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## Developmental delay in communication among toddlers and its relationship to caregiving behavior among violence-exposed, posttraumatically stressed mothers

Author links open overlay panel, R. Torrisi<sup>a</sup>, E. Arnautovic<sup>a</sup>, V.C. Pointet Perizzolo<sup>a</sup>, M. Vital<sup>a</sup>, A. Manini<sup>a</sup>, F. Suardi<sup>a</sup>, M. Gex-Fabry<sup>b</sup>, S. Rusconi Serpa<sup>a</sup>, D.S. Schechter<sup>bc</sup>

<sup>a</sup>Child and Adolescent Psychiatry Service, Geneva University Hospitals, Geneva, Switzerland

<sup>b</sup>Department of Psychiatry, University of Geneva Faculty of Medicine, Geneva, Switzerland

<sup>c</sup>Department of Child and Adolescent Psychiatry, New York Langone University School of Medicine, New York, NY, USA

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### Abstract (208 words)

**Objectives:** This study aimed to understand if maternal interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) is associated with delayed language development among very young children (“toddlers”).

**Methods:** Data were collected from 61 mothers and toddlers (ages 12-42 months, mean age=25.6 months SD=8.70). Child expressive and receptive language development was assessed by the Ages and Stages Questionnaire (ASQ) communication subscale (ASQCS) that measures language acquisition. Observed maternal caregiving behavior was coded from videos of 10-minute free-play interactions via the CARE-Index. Correlations, Mann-Whitney tests, and multiple linear regression were performed.

**Results:** There was no significant association between maternal IPV-PTSD severity and the ASQCS.

Maternal IPV-PTSD severity was associated with continuous maternal behavior variables (i.e. sensitive and controlling behavior on the CARE-Index) across the entire sample and regardless of child gender. Maternal sensitivity was positively and significantly associated with the ASQCS. Controlling behavior was negatively and significantly associated with the ASQCS.

**Conclusions:** Results are consistent with the literature that while maternal IPV-PTSD severity is not associated with child language delays, the quality of maternal interactive behavior is associated both with child language development and with maternal IPV-PTSD severity. Further study is needed to understand if the level of child language development contributes to intergenerational risk or resilience for relational violence and/or victimization.

**Keywords:** violence, post-traumatic stress disorder (PTSD), language development, maternal behavior, infancy and early childhood, parenting

**Highlights:**

1. There was no relationship found between maternal interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) and maternally reported level of child language development at ages 12-42 months
2. Observed maternal behavior on the CARE-Index was associated with the maternally reported level of child language development
3. Observed maternal caregiving behavior was associated with maternal IPV-PTSD severity however across genders

**What this paper adds to the literature:**

No prior study has examined the association between maternal IPV-PTSD, maternal caregiving behavior, and early childhood language development. This paper thus adds to the literature the understanding that while no relationship between maternal IPV-PTSD and a maternally reported measure of child language development among toddlers, the nature of maternal caregiving behavior is significantly associated both with child language development and with maternal IPV-PTSD severity.

## 1.0 Introduction

Violence against women is a major public health problem with lifelong consequences. When the perpetrator of violence is a romantic partner and/or father of the child, repercussions for the victim and the child-witness are particularly devastating. Interpersonal violence (IPV i.e. physical and/or sexual abuse or assault and/or domestic violence exposure) exposure is often associated with psychiatric sequelae (i.e. depression, anxiety, post-traumatic stress disorder (PTSD), dissociation, aggressive behavior in the context of later conduct disorder, and suicidality) – (for a review, see Ellsberg, Jansen, Heise, Watts, & Garcia-Moreno, 2008). Moreover, the prevalence rate of PTSD associated with IPV has been noted to be as high as 63.8% of female victims in at least one study within a high-risk population (Golding, 1999). Women with pre-existing psychiatric disorders, furthermore, show a high prevalence and an increased risk of being a victim of domestic violence with their new intimate partner (Trevillion, Oram, Feder, & Howard, 2012) and consequently, to be exposed further to IPV during their pregnancy. The latter increases the risk for IPV-related morbidity and *mortality* for both the expectant mother and the fetus, then baby (Gunter, 2007).

It has been shown that the severity and frequency of exposure to violence fluctuates during the childbearing period. For example, violence tends to increase during the first six months of pregnancy and to decrease during the last trimester (Macy, Martin, Kupper, Casanueva, & Guo, 2007). Despite this reported temporary decrease of violence, studies have estimated that approximately the 8.7% to 20% of women are victims of violence during the 3rd semester of their pregnancy (Saltzman, Johnson, Gilbert, & Goodwin, 2003) with higher rates of pregnancy complications, such as preeclampsia, placenta previa, gestational diabetes (Abdollahi, Abhari, Delavar, & Charati, 2015; Flach et al., 2011) and fetal death (Bacchus, Mezey, & Bewley, 2004; Jasinski, 2004; Seng, 2002). This cycle of violence is associated with adverse consequences for the neonate (i.e. preterm birth, low infant birth weight ; Paarlberg, Vingerhoets, Passchier, Dekker, & Van Geijn, 1995 ; Paarlberg et al., 1999) and its development. Maternal prenatal stress and the higher associated risk for depressive disorders and anxiety (Beydoun, Beydoun, Kaufman, Lo, & Zonderman, 2012) have been associated with unhealthy maternal coping and with dysfunctional mother-child interaction strategies that in turn adversely influence child development (Davis, Glynn, Waffarn, & Sandman, 2011; Grace, Bulsara, Robinson, & Hands, 2016).

### 1.1 Maternal interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) and parenting

Maternal IPV-PTSD itself has been shown across studies to interfere with the maternal capacity to provide sensitive caregiving to her preschool-age child (Chemtob, Gudiño, & Laraque, 2013; Lyons-Ruth & Block, 1996; Schechter et al., 2015). It has also been shown that maternal IPV-PTSD symptom severity is moderately and significantly related to the degree of hostile, intrusive (i.e. controlling) maternal behavior during laboratory-based observations (Lyons-Ruth & Block, 1996; Schechter et al., 2015). Disturbances in caregiving behavior during early childhood have been associated with parental difficulties with mutual emotion regulation and age-appropriate limit-setting. These parenting difficulties in turn have been associated with delayed and/or maladaptive development of self-

regulation of emotion during the preschool years, particularly when compounded by direct violence at the hands of one or more caregivers towards the young child. The latter, has been linked to a greater risk for development of subsequent oppositional-defiant and conduct disorder, auto-aggressive behavior and other psychopathology that may well contribute to the intergenerational transmission of violence and related trauma (Lyons-Ruth, Bureau, Holmes, Easterbrooks, & Brooks, 2013; Petitclerc, Boivin, Dionne, Zoccolillo, & Tremblay, 2009; Tremblay et al., 2005).

According to DeJonghe, von Eye, Bogat, and Levendosky (2011), multiple studies have supported that parental IPV often leads to poor child social-emotional and other mental and physical health outcomes. One mechanism by which this is thought to occur involves the effects of IPV on maternal self-regulation of emotion and arousal during routine stressful parent-child interactions, that in turn, affect the infant's developing ability to self-regulate in the absence of predictable, responsive caregiving as she attends to her own self-regulation (Crockenberg, Leerkes, & Lekka, 2007; DeJonghe et al., 2011; Samuelson & Cashman, 2008).

During the first years of life, the child clearly depends on his mother within the context of their attachment relationship. However, if the mother herself does not feel secure and thus expends much of her psychic energy in maintaining a state of hypervigilance to potential attack, she cannot be sufficiently available emotionally in order to read and respond to her child's emotional communication as is necessary for the child's social-emotional and cognitive development. Traumatized parents thus often report greater parental stress, which in turn mediates effects on their caregiving behavior (Pereira et al., 2012). Such parents, as supported translationally in rodent, primate and other human studies, carry physiologic and related epigenetic traces of altered adaptation to anticipated high-stress environments particularly as related to the HPA-Axis and related epigenetics, which in turn can confer risk and/or protective factors across generations (Coplan et al., 2017; Murgatroyd, Wu, Bockmühl, & Spengler, 2010). Studies with the same sample that provided the data for the present study have reported 1) dysregulation of circadian rhythms in IPV-PTSD affected mothers compared to non-PTSD controls and, consistent with this finding, 2) decreased methylation of the glucocorticoid receptor gene *NR3c1* significantly associated with maternal IPV-PTSD severity and its biological correlates. This particular epigenetic signature study echoed another study of veterans with PTSD (Yehuda et al., 2015). This study found less methylation of the *NR3c1*-1F promoter in peripheral blood mononuclear cells of combat veterans with PTSD compared with combat-exposed veterans who did not develop PTSD.

Of additional interest, the aforementioned study of traumatized mothers showed decreased *NR3c1* methylation was also significantly associated with decreased maternal medial prefrontal cortical activity and increased parahippocampal activity in response to seeing silent videos of mother-child separation versus play (Schechter et al., 2015). That latter "cortical-limbic dysregulation" in a previous study of a different sample had, moreover, corresponded to experiencing greater subjective stress in IPV-PTSD mothers versus non-PTSD controls watching separation vs. play video excerpts (Schechter et al., 2012).

Maternal response to child emotional communication in the wake of IPV-PTSD related psychobiological and specifically cortical-limbic dysregulation as described above has also been noted to involve difficulty in discerning child emotions, with frequent misappraisal and poorly measured and timed response, contributing to decreased maternal sensitivity as noted in multiple studies (Bailey, DeOliveira, Wolfe, Evans, & Hartwick, 2012; Pillhofer et al., 2015; Schechter et al., 2005;

Schechter et al., 2015). Of course, in families involving parents with histories of IPV, children are at greater risk to be exposed directly to inter-parental violence and to maltreatment (Howell, Barnes, Miller, & Graham-Bermann, 2016). In response to such direct threat, children (ages 4-12 years) have been found to display increased hypervigilance and increased distress, irritability, and aggression, dysregulation of sleep and delayed development (Davies et al., 2002; Sylvestre, Bussi res, & Bouchard, 2016; Udo, Sharps, Bronner, & Hossain, 2016).

### **1.2 Maternal IPV-PTSD, interactive behavior, and child language development: possible effects?**

Children's efforts to adapt to a maladaptive situation such as by hypervigilance and/or avoidance, numbing and dissociative symptoms may impede their psychological investment in more complex, integrative developmental processes as well as inhibit their flexibility to adapt to novel relationships and situations. In sum, formative development within social-emotional and cognitive domains may be impaired both by virtue of a primary attachment relationship between the infant and a traumatized caregiver who, due to posttraumatic psychopathology (i.e. PTSD, depression) is insufficiently available for mutual emotion regulation, joint attention and shared intersubjectivity (Schechter et al., 2010). Development in these domains can further be impaired by direct exposure to IPV (Udo et al., 2016). One particular domain of development which has been associated with both delay and pathology given direct exposure to domestic violence is that of speech and language (Cobos-Cali, Ladera, Perea, & Garc a, 2017; Sylvestre et al., 2016; Udo et al., 2016). The acquisition of language is the result of interconnected biological, genetic and environmental factors (Smith Deutsch & Tyler Chowduri, 2009; Vargha-Khadem, Gadian, Copp, & Mishkin, 2005). It is argued that without emotional stimuli and sufficient joint attention, children will lack adequate motivation for communication and speech and consequently the rate and success of speech and language acquisition may be reduced (Gregl, Kirigin, Su eska Liguti , & Bila , 2014). Emotional interaction and joint attention with parents and caregivers, which motivates learning speech and language, is therefore necessary for early speech and language development (Adamson, Bakeman, Deckner, & Ronski, 2009). Specific delays in receptive and expressive language set up very early in developmental process and became apparent within the first years of the child life (Allen & Oliver, 1982; Culp et al., 1991; or Naughton et al., 2013 for a review). Specifically, exposure to IPV has been associated with poor consolidation of phonological coding and poor symbolization (Cobos-Cali et al., 2017).

In terms of the impact of maternal psychopathology on early language development, maternal depression has been shown to have an adverse effect on the development of expressive language (Kaplan, Danko, Everhart, Diaz, Asherin, Vogeli, & Fekri, 2014). These studies did not take into account maternal trauma history. The literature suggests some evidence that maternal depression affects the language development of the child (Abdollahi, Reza Abhari, & Zarghami, 2017). Most of the studies focused on adult children of parents exposed to major stressors, and did not examine whether the parents themselves experienced mental disturbances (Van EE, Kleber, & Mooren, 2012).

### **1.3 Maternal caregiving behavior in the context of maternal psychopathology and the effects on language development**

The literature consistently reports that depressed mothers from birth tend to feed, cradle, and touch their infants less than non-depressed mothers despite that their babies cry just as often and intensely as babies of non-depressed controls (Esposito et al., 2017). Yet one assumes that there are

individual differences likely in caregiving behavior within a given context of parental psychopathology. One study that has demonstrated this involved substance-abusing mothers in which, initially it appeared that maternal substance abuse was associated with poorer development of expressive language (Siqueland, Haabrekke, & Wentzel-Larsen, 2014). Yet once socio-economic factors, maternal age, education, and single-parent status were covaried, the effect of maternal substance abuse became relatively insignificant. However, hostile-intrusive maternal interactive behavior did remain predictive of language delay in that sample, showing individual differences that may be related to the individual mother's attachment history, temperament and individual child factors that trigger certain behaviors in vulnerable mothers. Several studies have suggested that maternal psychopathology such as depression, PTSD, or borderline personality disorder can adversely impact maternal sensitive caregiving behavior, which in turn can mediate the effects of maternal psychopathology, attachment history and other variables that take origin from within and without the dyad on child developmental outcomes such as language development, acquisition of self-regulation of emotion and arousal, and risk for subsequent child psychopathology (Stein, Lehtonen, Harvey, Nicol-Harper, & Craske, 2009; Schechter et al., 2008; Lyons-Ruth et al., 2013).

### **1.4 Hypotheses**

To our knowledge, no prior study has examined the association between maternal PTSD that is linked to interpersonal violence, maternal caregiving behavior, and early childhood language development. We therefore aimed to investigate these potential associations and test the following hypotheses:

- (1) The diagnosis and severity of traumatized mothers' PTSD would be significantly associated delayed child language development on a developmental screening measure.
- (2) Maternal caregiving behavior characterized by decreased sensitivity to child emotional communication in the context of maternal PTSD would be associated with delayed child language development

## **2.0 Maternal and Methods**

### **2.1 Participants and Procedures**

The study protocol was approved by the institutional review board of the University of Geneva Hospitals.

Inclusion and exclusion criteria were as follows: Biological mothers were included in the study if they had lived with their child for the majority of the child's life since birth. Due to physiologic measurements taken, women who were pregnant or breast-feeding were not accepted into the study. Children were included in the study if they were 12-42 months of age at the time of scheduled mother-child behavioral observations mothers were excluded if they were actively substance abusing or psychotic. Mothers and children were excluded from the study if they were physically and/or mentally impaired in such a way that would interfere with the ability to participate in laboratory tasks (i.e. cognitive, sensory, and motor impairments).

Sixty-one mothers and their children were recruited by flyers<sup>1</sup> posted at the University of Geneva Hospitals and Faculties of Medicine and Psychology as well as at community centers, daycares, school including domestic violence agencies and shelters. Of all the 61 mothers who responded to the flyer, none were screened out based on our exclusion criteria. Following informed consent and assessment, we excluded 4 mothers from the present analyses because they were found to have a PTSD diagnosis or clinically significant (i.e. subthreshold) symptoms related to non-IPV related life-events (i.e. medical-surgical events and car accidents) when our focus was on the effects of IPV-PTSD. Forty-one mothers had PTSD symptoms, with the “A-Criterion” of the DSM-IV-TR related to IPV, among whom 24 met criteria for DSM- IV-TR diagnosis and 17 had clinically significant symptoms that were below the threshold for full-diagnosis. Thus, 61 French-speaking mothers (ages 18-45 years) and children participated (ages 12-42 months) including 41 mothers and children in the PTSD case-group and 20 mothers and children in the non-PTSD group. Fathers and other romantic partners of mothers were not seen in the study given concerns over safety and maintenance of trust for women who had experienced partner violence. Thus data about fathers were obtained by maternal report rather than from the fathers themselves.

Within 1 month after the screening visit, participants completed 2 videotaped visits over the ensuing 1-2 months period Figure 1 show the sequence of the screening. 1<sup>st</sup> and 2<sup>nd</sup> visits separated by 1-2 weeks. During the screening visit, following informed consent, mothers were given a socio-demographic and life-events interview followed by several self-report questionnaires. During the following visit, mothers were interviewed without their child presence, with a focus on the mother’s mental representations of her child and relationship with her child, an elaboration of her traumatic life-events, followed by structured diagnostic interviews and series of dimensional measures. Then, 1-2 weeks later mothers were asked to bring their child to the lab for a parent-child interaction procedure (Zeanah, Larrieu, Heller, & Vallier, 2000) followed by administration of measures focusing on the child’s life events, psychopathology, and social-emotional development. Salivary samples were taken for measurement of cortisol and DNA extraction for analyses that are not discussed in this paper. After each visit, mothers received 50 Swiss francs along with a small book or toy for their child.

-----insert figure 1-----

## 2.2 Measures

### *Socio-Demographic Variables*

During the screening session we conducted an interview with the mothers using the Geneva Socio-demographic Questionnaire (GSQ ; Sancho Rossignol et al., 2010) which was adapted from the Structured Clinical Interview for the DSM-IV (First, Spitzer, Gibbon, & Williams, 1995) and developed for the present study in order to obtain a detailed overview of the parents’ socioeconomic status, characteristics and history of the mother-partner relationships, and exposure to stressful life-events (i.e. interpersonal violence, substance abuse, economic difficulties, immigration, and physical and mental health problems and interventions, and child protective and judicial services involvement).

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<sup>1</sup> The text of the flyer read as follows: “Do you have a child ages 12-42 months? Do you have questions about his/her development, behavior, on your life with your child that is not always easy? If you would like, you can participate in a study on the effects of stress (routine life events, family conflicts, illnesses, violence or abuse) on your life and on your relationship with your child. If so, call us at the following number.”



The family socio-economic status (SES) was calculated using the Largo Index (Largo et al., 1989), which is well validated SES index used in pediatric research in Switzerland that takes into account both parental educational attainment and occupational status.

### *IPV and Other Traumatic Life-Events*

History of experience of traumatic events during childhood was assessed via the Brief Physical and Sexual Abuse Questionnaire (BPSAQ ; Marshall et al., 1998), and supplemented for other events during adulthood with the Traumatic Life Events Questionnaire (TLEQ). The TLEQ assesses 22 life events that could fulfill the “A-Criterion” for the DSM-IV diagnosis. The TLEQ show stability and convergent validity across various studies and minority populations (Kubany et al., 2000). Twelve items that asked for the same events as the BPSAQ were eliminated from the TLEQ. Scoring of the BPSAQ was undertaken as described in a previous paper of our research group (Schechter et al., 2005). The severity of physical violence of the mother’s partner and herself in the context of her adult romantic relationship was measured via the Conflicts Tactics Scale 2 Shirt Version (CTS2 ; Straus & Douglas, 2004). This well validated measure consists of 20 items that ask about tactics used by the subject’s partner and herself in order to resolve relational conflict including physical aggression along a 7-point scale.

### *Maternal psychopathology*

During an initial videotaped interview IPV-exposed and non-IPV-exposed mothers underwent a variety of psychometrics including the Clinician administered PTSD scale (CAPS ; Blake et al., 1995) to assess lifetime PTSD and Post-traumatic Symptom Checklist-Short Version (PCL-S) additionally to assess current PTSD symptoms (Weathers, Keane, & Davidson, 2001). Subjects on both measures with no IPV and no PTSD symptoms were coded as having the minimum score of 16. Subjects with IPV exposure but with no PTSD symptoms were coded as having 17. For categorical analyses, mothers met criteria for violence-related PTSD if their A-criterion trauma was of a violent nature (i.e. due to child physical or sexual abuse or family violence exposure and/or adult physical or sexual assault), and if CAPS score was at or above 55 and the PCL-S score was at or above 40 (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). Subjects that were subthreshold for diagnosis yet with significant clinical symptoms such that they were included in the IPV-PTSD groups were those who had a CAPS life time score of 55 or above, and current score of 30 or above (rather than 40 as required for full-diagnosis).

### *Maternal Behavior*

Maternal Sensitivity was measured via structured behavioral observations during 5 min of mother-child play. Two blind raters who were psychologists trained to reliability on the CARE-Index (Crittenden, 2006) coded the maternal and child behaviors. For the coding of maternal sensitivity, the coding procedure focused these raters’ attention on seven aspects of maternal behavior some of which assess affect (facial expression, vocal expression, position and body contact, expression of affection) with other assessing “cognition”, i.e., temporal order and interpersonal contingency (pacing of turns, control of the activity, and developmental appropriateness of the activity). Each aspect of behavior was evaluated separately. The score was then summed to generate the maternal sensitivity scale score. This scale score has a range from 0 to 14, with zero sensitivity being dangerously insensitive, 7 being normally sensitive, and 14 being outstandingly sensitive. The CARE-

Index also provides two additional scales: Controlling (i.e. intrusive) and Unresponsive (i.e. avoidant and withdrawing) maternal behavior that are coded using a similar scale-score to that of maternal sensitivity (Crittenden & Bonvillian, 1984). Inter-rater reliability was excellent for all three scales (ICC= .86). The Infant and Toddler versions of the CARE-Index are well validated (Farnfield, Hautamäki, Nørbech, & Sahhar, 2010; Küster, Fegert, & Ziegenhain, 2010).

### *Child Assessment*

Child communication was assessed via Ages and Stages Questionnaire ASQ-3 (Squires & Bricker, 2009). ASQ is an assessment tool that helps parents provide information about the developmental status of their young child across five developmental areas: communication, gross motor, fine motor, problem solving, and personal-social. The assessment tool is available in 21 versions to allow measurement of development for the ages of 2 to 60 months (Squires & Bricker, 2009). Only the communication dimension concerns our hypothesis. The accuracy of ASQ as brief parent report measures were significantly correlated with direct individual language assessment (Sachse, Suchodoletz, & Waldemar, 2008). It suggests that the parent language report is a valid and efficient tool for assessing productive language abilities.

## **2.3 Data analysis**

Group comparisons (IPV-PTSD vs non-PTSD-Control) proceeded with chi square tests for categorical variables and Mann-Whitney for continuous variables (Tables 1 and 2). Associations of continuous measures (e.g. maternal PTSD severity reported as the CAPS score, degree of maternal sensitivity and language development measured by the ASQ score) were analysed using Spearman correlation coefficients. Multiple linear regressions were then used to investigate influences of severity of traumatized mothers (CAPS) and maternal sensitivity (CARE-Index) on the development of the language of the child (ASQCS). All analyses were performed using SPSS versions 19 and 24 (IBM, Armonk NY, USA). Significance level was set at .05 (two-tailed tests).

## **3.0 Results**

### **3.1 Sample characteristics**

The data of sixty-one mothers and their children were analysed; twenty mothers of which constituted the non-PTSD (“control”) group, while forty-one, belonged to the IPV-PTSD group. As shown in Table 1 median of maternal age was 35 years for the control group, and was of 28 years for the IPV-PTSD group, difference in maternal age between groups was not significant ( $p = .143$ ). Median of children age was 30 months among controls, and also 30 months in the IPV-PTSD group, with no significant group-differences ( $p=.703$ ) at the time of the parent-child interaction visit during which maternal sensitivity was measured. Even if an unequal number of girls and boys participated in the study (23 girls and 38 boys), boys and girls were relatively equally distributed in each group, 65% of the control group were boys, while 39% of the IPV-PTSD group were girls, no significant group difference was found with respect to group gender-composition ( $p=.761$ ).

-----insert table 1 – socio-demographic characteristics-----

Group difference in degree of maternal education, while not reaching significance, showed a slight trend showing IPV-PTSD mothers to have a lower mean level of education (Median (Mdn)=28,  $U=293.5$ ,  $p=.083$ ). More significant group differences were apparent concerning socio-economic status: Mothers with IPV-PTSD were socio-economically disadvantaged compared to controls (Mdn=34,  $U=235.0$ ,  $p=.012$ ). Marital status was significantly different between groups ( $\chi^2 = 9.130$ ,  $df=1$ ,  $p=.003$ ): 43.5% of IPV-PTSD mothers were married, while as many as 56.50% were married in the control group.

### 3.2 Maternal life-events and related psychopathology

As shown in the second section of Table 1 (Mother's traumatic events), exposure to violence of mothers was rigorously analysed. Differences between IPV-PTSD versus control mothers revealed that the former showed a significantly higher comorbidity of adult experience of IPV, primarily partner violence, with other forms of violent trauma and maltreatment throughout childhood and adulthood as one might expect. Childhood events were reported as violent and traumatic by mothers on the BPSAQ (Marshall et al., 1998) across groups: 82% of the IPV-PTSD mothers were witness of domestic violence during their childhood ( $p=.019$ ), while 21% were victim of intrafamilial sexual abuses ( $p=.041$ ), 33% suffered physical violence as child ( $p=.077$ ). As adult 56.4 % of IPV-PTSD mothers suffered of physical ( $p=.063$ ) and 17.5% of sexual abuses.

-----insert table 2-----

Table 2 shows group comparisons (Mann-Whitney) of IPV severity during adulthood in the current or most recent relationship with an intimate partner ( $p<.000$ ), as well as maternal psychopathology, parenting stress, and maternal behaviour as continuously rated on the CARE-Index, consistent with previously reported findings (Schechter, et al., 2015). Firstly, as expected we noted a significant difference between the IPV-PTSD group and non IPV-group with respect to maternal psychopathology: namely, depression as measured by the Beck Depression Inventory (BDI;  $p<.000$ ) and parenting stress as measured by Parental Stress Index the (PSI;  $p=.023$ ). Using the Clinician Administered PTSD Scale (CAPS), we found significant group differences between IPV-PTSD group and non-PTSD group with respect to the quality of maternal behaviour as measured by coding videotaped play-interactions using the CARE-INDEX for the following dimensions: sensitive ( $p=.002$ ), controlling ( $p=.026$ ), and a trend-level of significance unresponsive maternal behavior ( $p=.052$ ). Continuous analyses also yielded significant findings that the severity of maternal IPV-PTSD on the CAPS was associated with the quality of maternal behaviour as measured by coding videotaped play-interactions using the CARE-Index.

### 3.3 Associations with the maternally reported level of child language development

As shown on the last section of table 2, results did not support our first hypothesis that the diagnosis and severity of traumatized mothers PTSD would be significantly associated with a lower communication subscale score on the ASQ Communication Subscale Score (ASQCS) ( $p=.672$ ). We additionally examined if specific types of IPV life-events independently of PTSD might impact maternal behavior and/or the ASQCS score.

Mothers with histories of childhood physical abuse (PA), but not sexual abuse (SA) at this level of analysis, while less sensitive (PA  $r=-.32$ ,  $p=.019$ ; SA  $p>.5$ ), showed no difference from mothers without PA history on the ASQCS. Neither PA nor SA were associated significantly with more

controlling or unresponsive maternal care and neither were directly, significantly associated with child language development: PA  $p>.3$ ; SA  $p>.5$ . Concerning exposure to IPV during adulthood, the following aspects of the exposures were not significantly related with maternally reported level of child language development: a) Severity of IPV ( $p>.2$ ); b) duration and number of events of IPV ( $p>.5$ ) c) infant exposure to IPV on the Child Exposure to Violence Questionnaire was not significant ( $p>.3$ ).

-----Insert table 3-----

### 3.4 Associations with maternal behavior on the CARE-Index

While results did not support a direct link between maternal PTSD diagnosis or severity and child language development on the ASQCS, results did show that there was a significant correlation between the ASQSC and the quality of maternal behavior, which in turn was significantly associated with PTSD diagnosis and severity. As shown in table 3, the severity of the mother's PTSD, was negatively associated with sensitive maternal behavior ( $r = -.541, p = 0.000$ ) and positively associated with controlling maternal behavior ( $r = .447, p = .001$ ). Multiple linear regression were used to investigate maternal sensitivity (CARE-Index) as a function of ASQCS, with respect to sensitive and controlling, but not unresponsive behavior: for sensitive behavior:  $R^2$  is .505,  $F(2,17) 8.672$   $p = .003$ ;  $\beta$ -CAPS -.58, .003;  $\beta$  communication .42  $p = .046$ . For controlling behavior:  $R^2$  is .547,  $F(2,17) 7.612$   $p = .007$ ;  $\beta$ -CAPS .52,  $p = .009$ ;  $\beta$ -communication -.314,  $p = .038$ .

## 4.0 Discussion

The current paper investigated the association between mothers' IPV-PTSD diagnosis and symptom severity as associated with their young children's language development. Two hypotheses were tested: 1) the diagnosis and severity of traumatized mothers' PTSD would be significantly associated with delayed child language development 2) less sensitive maternal caregiving behavior in the context of maternal PTSD would be associated with delayed child language development.

### 4.1 Understanding the link between caregiving behavior and child language development despite no direct association between maternal IPV-PTSD and child language delays in this study

Neither maternal exposure to physical or sexual abuse or assault, nor related PTSD was associated with child developmental delay in language by maternal report on the ASQCS. One explanation of this finding is that language delay in young children has been associated most significantly with emotional and/or physical neglect and with maternal major depression, rather than with either violence exposure or maternal psychopathology more generally (Kocovska et al., 2012; Naughton et al., 2013; Sylvestre et al., 2016; Kawai et al., 2017). Of note, no papers to our knowledge have been written looking at maternal PTSD and child developmental language delay.

On the other hand, our results are not consistent with at least one other study that showed a significant increase in the odds of early childhood language delay to be associated with domestic violence exposure, albeit the study did not measure parental PTSD (Udo et al., 2016). And, while are child patients were by-and-large not physically or sexually abused, we know that many parents who are abusive have been abused and do suffer from related PTSD. Two studies have shown that their children were noted to have delayed language development and more specifically, delayed syntactic expression as related to child maltreatment (Eigsti & Cicchetti, 2004; Allen & Oliver, 1982). One factor which may explain diverging results is that of measurement of language development. The

three above cited studies looking at children who were either exposed to domestic violence or were maltreated, used clinical assessments of child language development. Our study relied on maternal report using the ASQSC, which may well be a significant limitation of our study.

That being said, while results did not support a direct link between maternal PTSD diagnosis or severity and child language development on the ASQCS, results did show that there was a significant correlation between the ASQSC and less sensitive, more controlling maternal behavior, which in turn was significantly associated with PTSD diagnosis and severity. And so, we have reason to believe that maternally reported child language development on the ASQCS provided enough of an indicator of child language development to show this association that makes clinical sense. It may also be that maternal behavior which likely has multifactorial determinants such as maternal attachment history, psychopathology and child responsiveness is a more sensitive environmental predictor of language delay than maternal IPV-PTSD alone. The latter point concerning child responsiveness merits further investigation. It is, indeed, possible that the negative correlation between controlling maternal behavior and the ASQCS may be reflective of a bidirectional process (i.e. in which the more difficulty the child has in communicating, the more controlling the mother's behavior becomes, this in an effort to manage her poorly communicative child).

Since maternal IPV-PTSD was not significantly associated with child language delay directly, we could not test whether maternal behavior might be a mediator of effects. Of note, maternal behavior in our linear regression analyses accounted for over 50% of the variance on the ASQSC. What might be some of the reasons why less sensitive and more controlling maternal behavior, rather than unresponsive neglectful behavior for example, might be significantly associated to less developed language?

Multiple studies have established that language skills are acquired through social interactions such as parent-child interactions, during which, parents are the dominant actors. The ability of parents to identify and respond to their child's needs has an impact on the quality of the relationship they build with their child. The latter influences child language development. Consistent with this perspective, Levendosky and her colleagues (2006) found that parenting behavior mediates the effects on IPV on infant's externalizing behaviors via reduced maternal warmth and sensitivity to infants (i.e. less appropriate and less well-timed recognition and response to child needs). Within this context, less sensitive parenting inhibits the early development of emotion regulation (Robinson et al., 2009; Supplee, Skuban, Shaw, & Prout, 2009) (Levendosky & Graham-Bermann, 2000, 2001; Levendosky, Leahy, Bogat, Davidson, & von Eye, 2006; Margolin, Gordis, Medina, & Oliver, 2003). Another study of a similar sample to that of the present paper sample found that maternal difficulty in identifying children's emotions had no significant relationship with the severity of IPV alone; but it was related to the individual's psychobiological response linked to IPV-PTSD (Schechter, et al, 2015). Van EE and her colleagues (2012) found that maternal posttraumatic stress symptoms do not directly affect infants' psychosocial functioning, but they do affect the quality of the dyadic interaction and therefore infants' psychosocial functioning. In fact, mother's emotional competence, interpreted as the ability to express and show feelings to their child are understood as a crucial social skills necessary for recognizing, interpreting and constructively responding to one's own emotions and the emotions of others (Gregl et al., 2014).

Consistent with the literature, our results showed that maternal caregiving behavior impacts child communication. Traumatized mothers suffer from PTSD symptoms that include reexperiencing avoidance and numbing, negative cognitions, and hyperarousal. These mothers may experience difficulties regulating their own arousal and consequently, experience difficulties modulating their infants' arousal (McDonagh-Coyle et al., 2001; Tull, Barrett, McMillan, & Roemer, 2007; Van der Kolk, 1996). Trauma related symptoms are associated with insensitive caregiving behavior such as increased hostile-intrusive behavior and poor limit-setting (Cohen, Hien, & Batchelder, 2008; Lyons-Ruth & Bloch, 1996; Schechter et al., 2010). In line with our findings, a recent review of research on the influence of PTSD on parent-child functioning in military and veteran families supported that PTSD symptoms were associated with increased distress avoidance (i.e. fear, wariness, non responsiveness or low empathy) in reaction to aversive behavior or affective distress of the child during an observed interaction between fathers and their children (Brockman et al., 2016).

Consistent with the literature, our results showed that maternal caregiving behavior impacts child communication. Traumatized mothers suffer from PTSD symptoms that include re-experiencing avoidance, and numbing, hyperarousal, and negative cognitions. These mothers may thus experience difficulties regulating their own emotion and arousal, and so consequently, experience difficulties modulating their infants' emotion and arousal (McDonagh-Coyle et al., 2001; Tull et al., 2007). When traumatized mothers' own children are too young to be able to regulate their own emotions, arousal, and aggression, and depend on them to do so, this demand, whether during play, or moreover during a stressful interaction that may result in a helpless, distress state, can in fact exacerbate maternal PTSD symptoms if not trigger them (Schechter, Kaminer, Grienberger, & Amat, 2003).

The particular measures that are used to code maternal-child interaction may highlight one or the other of these two aspects (i.e. free-play versus a stressful condition such as separation-reunion) by virtue of the focus of interactive behavior that each measure codes. For example, free-play behavior prior to any stressor is coded or weighted in the instance of the CARE-Index (Crittenden et al., 2006; Küster et al., 2010) that was used in this study, a measure which focuses on maternal sensitivity and yields two subscales that are reflective of insensitivity: controlling and unresponsive behavior. Alternatively, measures such as the Atypical Maternal Behavior Instrument (AMBIANCE; Lyons-Ruth, Bronfman, & Parsons, 1999; Schechter et al., 2008) and the Disconnected and Extremely Insensitive Parenting Scale (DIP; Out, Bakermans-kranenburg, & Van Ijzendoorn, 2009) weight more heavily parenting behavior in the face of separation-reunion stress, albeit each with their own specific focus: AMBIANCE being that of frightening/frightened behavior (FFB) according to Main and Hesse criteria (1990)—unlike the CARE-Index, with the addition of affective communication errors (i.e. incongruence between parental affective response and child affective communication). Whereas DIP, also uses the (FFB) criteria yet separates out these characteristics of the caregiving behavior from the degree of maternal sensitivity which is collapsed into the AMBIANCE score.

Maternal PTSD is often associated with caregiver insensitivity whether characterized by FFB, affective incongruence between parent and child, even after controlling for SES and maternal depression (Cohen et al., 2008; Lyons-Ruth & Block, 1996; Schechter et al., 2010; Schechter et al., 2015). In line with our findings, a recent review of research on the influence of PTSD on parent-child functioning in military and veteran families illustrated that PTSD symptoms were associated with increased distress avoidance (i.e. fear, wariness, non-responsiveness or low empathy) in reaction to aversive behavior

or affective distress of the child during an observed interaction between fathers and their children (Brockman et al., 2016).

#### **4.2 Alternative hypotheses to test in the future: Can relational difficulties and language delays exacerbate maternal IPV-PTSD symptoms?**

Consistent with the work of Creech and Misca (2017), higher levels of parent-child relationship problems are likely to amplify PTSD symptoms in both, particularly during times of stress. On the other hand, daily adaptation of the child to an expected harsh environment can cause a significant investment of psychic energy in order to maintain the multiple regulatory processes that a very young child must master by the age of 5 (Davies et al., 2002). Results of this specific adaptation to an insensitive and/or unpredictable caregiving environment can compromise children's subsequent social-emotional development and increase their risk both for psychopathology and perpetration of intergenerational transmission of violence and related difficulties (Wolfe, Crooks, Lee, McIntyre-Smith, & Jaffe, 2003). In response to a potentially life-threatening event such as a bout of IPV, children (4-12 year of age) display behaviors such as hypervigilance that are consistent with efforts to maintain survival, but at a cost (Davies et al., 2002).

We were able to show that mothers with IPV-PTSD are as we have pointed out psychobiologically dysregulated along several dimensions: behaviorally, physiologically, epigenetic and in terms of cortical-limbic neural activity levels in response to parenting stressors. These mothers tend to exhibit less sensitive and often more controlling behavior that is associated with expressive language delay. Of note, children with expressive language delays have been shown to be at greater risk for both internalizing and externalizing behaviors (Whitehouse, Robinson, & Zubrick, 2011).

Working backwards, in at least one prior study, children with expressive language delay tended to have mothers that had more difficulty with emotion regulation and emotional reactivity (i.e. having anxiety/depression) (Gregl et al., 2014). According to Vygotsky (1983), behavioral regulation is dependent on internalized speech which subsequently is linked to thought and reflection. Therefore, language development enables the transition from externally controlled behaviors toward behavior that children manage internally. According to Gregl and her colleagues (2014) a delay in language development results not only in delayed cognitive development, but in trouble with social adjustments, which in turn are undermined by IPV-PTSD symptomatology. It is therefore, essential in the context of language studies to consider systematically the relational and affective dimensions between the child and his parents (Gregl et al., 2014).

As for the epigenetic links to these relational and affective dimensions that might be operative in language delay in the instance, for example of autistic spectrum disorders, several gene candidates—have been mentioned which may also be relevant to the study of samples of traumatized parents and their children at high-risk for exposure to violence, maltreatment, and neglect: *OXTR*, *EN2* and *MECP2* (Loke, Hannan, & Craig, 2015). Further study of the epigenetic signatures of stress related genes in these samples in relation to language development should also be studied, such as that of the aforementioned glucocorticoid receptor *NR3c1* (Schechter et al., 2015).

#### **4.3 Limitations of the present study**

One limitation of this study was that it was not possible given the cross-sectional rather than its longitudinal nature to understand to what extent SES might have been a risk factor for maternal violence-exposure and PTSD, with the additional limitation that maternal violence-exposure and other life-events were measured retrospectively. Another possible limitation, as already mentioned above, was the use of the parent-report of the ASQ to measure child language development rather than a clinician rated measure. Even though the validity of the ASQCS is well established, and we did show an effect related to maternal caregiving behavior, a clinician-rated measure would have permitted a more complete and objective evaluation. Another possible limitation is that we measured maternal sensitivity only during play that preceded the separation-reunion laboratory stressor. A next step would be to compare interactions prior to laboratory stressors, such as during free-play, with interactions following separation/novelty exposure.

#### 4.4 Conclusion and clinical implications

Results are consistent with the literature that while maternal IPV-PTSD severity is not associated with child language delays, the quality of maternal interactive behavior is associated both with child language development and with maternal IPV-PTSD severity. Maternal sensitive behavior may vary based on the child's gender. The latter would require a larger sample to test. Further prospective study similarly is needed to understand if the level of child language development contributes to prosocial skills and thus to intergenerational risk or resilience for relational violence and/or victimization. Clinicians working with infants and young children should be attentive to parental life-event histories and in the case of IPV-affected parents, to observe interactive behavior and to assess child receptive and expressive language development in order to target these areas via evidence-based intervention, for example, involving video-feedback (Rusconi Serpa, Sancho Rossignol, & McDonough, 2009).

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