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War trauma and infant motor, cognitive, and socioemotional development: Maternal mental health and dyadic interaction as explanatory processes☆

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ABSTRACT

Background: Taking care of infants in conditions of war is highly demanding and a few studies reveal the negative impact of war trauma on maternal and infant well-being. Yet, little is known regarding the influence of trauma on infant development and the potential explanatory mechanisms. First, the present study examines how mothers' prenatal exposure to traumatic war events is associated with infant cognitive, motor, and socioemotional development. Second, it analyses the mediating roles of maternal postpartum mental health problems, quality of dyadic mother-infant interaction, and earlier infant development (at six months) in the association between prenatal traumatic war events and infants' developmental skills at 18 months.

Method: This prospective three-wave study involved 502 Palestinian pregnant females in their first trimester during the 2014 Gaza War and participated at delivery (T1) and when the child was six (T2;$N = 392$) and eighteen (T3; $N = 386$) months of age. Mothers reported their exposure to traumatic war events (human and material losses, horrors, and threat to life) at T1 and T2, and researchers photo-documented the extent of destruction at T1. Mothers reported infants' language, fine- and gross-motor, and socioemotional skills at T2 and researchers tested infants' motor, cognitive-language and socioemotional skills using the Bayley Scales of Infant development (BSID-II) at T3. Mothers reported their mental health problems (symptoms of post-traumatic stress disorder [PTSD], depression and somatization) at T2 and T3 as well as dyadic interaction quality (the emotional availability self-report, [EA-SR] brief) at T2.

Results: First, the structural equation model (SEM) on direct effects indicated, in contrast to our hypotheses, that maternal prenatal exposure to traumatic war events did not associate with infants' developmental skills at T2 and predicted higher level of developmental skills at T3. Second, as hypothesized, we found two negative underlying mechanisms (paths) between high exposure and low levels of motor, cognitive-language, and socioemotional skills at T3: (1) through increased maternal mental health problems at T2, which then were associated with problems at T3, and (2) through increased maternal mental health problems at T2, which then were associated with a low quality of mother-infant-interaction and low level of infant developmental skills at T2.

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Conclusion: Improving maternal mental health and encouraging close and positive dyadic interaction can be critical for infant sensorimotor, cognitive, and socioemotional development in war conditions.

1. Introduction

Development is intensive and miraculous during the first years of life: an infant creates a unique dyadic interaction with the caregiver; learns apt ways of attention and coordination; improves in grasping objects, crawling, and walking; and develops sophisticated methods of communication, ultimately mastering language. During the first months, infants are dependent on the caregiver for nurturing, movement, and stress regulation; subsequently, they can take initiatives, express own preferences, regulate themselves, and communicate multiple emotions (Holodynski & Friedlmeier, 2006; Piek, 2006). According to Stern (1985), parental—particularly maternal—mental health and quality of mother-infant dyadic interaction form the proximal early environment for infant development. Ample research confirms that good maternal mental health and secure dyadic interaction create conditions that enhance optimal cognitive, sensorimotor, and socioemotional child development (Letourneau, Dennis, Cosic, & Linder, 2017; Poobalan et al., 2007; Rocha, dos Santos Silva, dos Santos, & Dusing, 2019). Instead, maternal depression, stress, family violence, and environmental insecurity can create a severe risk for optimal development (Cook, Ayers, & Horsch, 2018; Graignic-Philippe, Dayan, Chokron, Jacquet, & Tordjman, 2014).

The developmental environment is very harsh and inhuman for mothers and infants living in conditions of war and military violence. Since the last decennium, as many as 250 million children under five years of life live in countries affected by armed conflict (Save the Children, 2014), and 65 million war-affected people have been forced to seek safety as refugees and asylum seekers, including a large number of families with small children (UN High Commission for Refugees, 2016). The mothers and infants who participated in the present study live in conditions of military violence and recurrent wars in the context of Israel-Palestinian conflict and a large number represent third-generation refugees from historical Palestine (Robson, 2017). The mothers were pregnant during the 2014 Gaza War (The Operation of Resolute Cliff in the Israeli military terms) that lasted 54 days, accompanied with an almost complete curfew and daily air, sea, and land shelling and bombing. The war casualties were approximately 2000 deaths, 11,000 wounded, and 100,000 displaced civilians (United Nations Office for the Coordination of Humanitarian Affairs, OCHA, 2016; UN Human Rights Council, 2014). Israeli troops used modern weaponry containing toxicants (e.g. Barium) and teratogen (Tungsten) and carcinogen (Arsenic) heavy metals, thereby causing severe stress to parents who were scared of the impacts of these materials on their children (Manduca, Diab, Qouta, Albarqouni, & Punamäki, 2017).

It is well-known that pregnant women, caregivers, and their infants are particularly vulnerable in life-endangering conditions of war (Glover, O'Connor, & O'Donnell, 2010; Kaitz, Levy, Ebstein, Faraone, & Mankuta, 2009), but there is scarce knowledge regarding the impact of maternal prenatal exposure to war trauma on infant development. The theory of fetal programming states that maternal stress during pregnancy can induce pervasive and long-lasting effects on the development of the fetal nervous system and, ultimately, on the child's behavior (Del Giudice, 2012; Field, 2011, 2017; Glover et al., 2018). These effects include the development of increased stress responsivity and mental health problems, as well as alterations in cognitive and sensorimotor development from infancy to adolescence (Ibanez et al., 2015; Kingston, Tough, & Whitfield, 2012; Van den Bergh et al., 2017; Zijlmans, Riksen-Walraven, & de Weerth, 2015). Importantly, the principal fetal programming effects can be regarded as reflecting adaptive developmental plasticity: the developing fetus considers maternal stress hormones as valuable information regarding the state of the external world and matches its phenotype to the predicted environment (Del Giudice, 2012). In war conditions, expecting mothers are likely to experience increased stress provoked by numerous war-related traumatic events.

Therefore, the current study examines how maternal exposure to traumatic war events in pregnancy may impact an infant's motor, cognitive-language, and socioemotional skills, and whether maternal mental health and dyadic interaction as cornerstones of early developmental environment can mediate the impact.

1.1. Maternal exposure to trauma and child development

Research on pregnant women exposed to natural disasters provides valuable information regarding the trauma impacting child development. Prospective studies after ice storms (Laplante et al., 2004; Laplante, Brunet, Schmitz, Ciampi, & King, 2008), hurricanes (Nomura et al., 2019), and floods (King et al., 2015; Moss et al., 2017) evidence multiple negative consequences. For example, a prospective study on 58 infants confirmed that high maternal prenatal stress from Canadian ice storms predicted lower cognitive and language skills among toddlers (Laplante et al., 2004), and poorer general intelligence and symbolic play functioning, and difficult temperament among preschoolers (Laplante et al., 2008; Laplante, Zelazo, Brunei, & King, 2007).

Research on mothers who were pregnant during the 9/11 terrorist attack in the United States indicates newborn markers of subsequent cognitive developmental problems and certain compromises in infant and toddler emotional development. In a sample of 102 infants of mothers with post-traumatic stress disorder (PTSD), almost half (46 %) of the newborns had non-normative (longer) gestational age and greater head circumferences (Engel, Berkowitz, Wolff, & Yehuda, 2005) and showed distress to novelty (Brand, Engel, Canfield, & Yehuda, 2006). Further studies also found lower birth weight and reduced height in infants born to mothers in vicinity of the terrorist attack (Berkowitz et al., 2003; Lederman et al., 2008). Finally, toddlers of prenatally exposed mothers who suffered PTSD and depression showed high levels of emotional and behavioral problems (Chemtob et al., 2014; Landrigan et al., 2008).

Although a majority of studies have reported negative impact of maternal prenatal trauma exposure and particularly subsequent stress and mental health problems on infant and child development, a few studies show non-existing or even positive trauma impact. As an example, the Queensland Flood Study ($N = 131$) found that maternal prenatal stress did not predict problems in cognitive or language development in 30-month old toddlers (Austin et al., 2017). A few studies on prenatal stress of less life-threatening nature—such as daily stressors or pregnancy-specific stress—have found positive or curvilinear effects, thereby suggesting that mild-to-moderate exposure to stress during pregnancy might predict more advanced infant developmental skills, particularly in the domain of motor development (DiPietro, Novak, Costigan, Atella, & Reusing, 2006; Karam et al., 2016). In line with these results, the stress acceleration hypothesis proposes that early neural maturation can be accelerated in adverse conditions to enhance short-term survival (Callaghan & Tottenham, 2016). Yet, we were unable to find research on mothers' prenatal exposure to war events—such as life threat or human and material losses—thereby predicting infant motor, cognitive, language, or socioemotional development.

1.2. War trauma and maternal mental health

Research confirms that war and military violence negatively influence civilian mental health, which manifests in increased PTSD, depression, anxiety, and dissociative symptoms (Charlson et al., 2019; Morina, Stam, Pollet, & Priebe, 2018). There is research on war trauma impacting maternal pre- and postnatal mental health among survivors of terrorist attacks, refugee families, and, to a certain extent, also among mothers living in conditions of war and military violence. A systematic review of the 9/11 terrorist attack showed a substantial increase in PTSD symptoms among pregnant mothers who were living in vicinity of the attacks (Harville, Xiong, & Buekens, 2010). Further, high pre- and postnatal distress and depressive symptoms were reported among these mothers (Chemtob et al., 2010; Landrigan et al., 2010).

With regard to refugees and immigrants, a meta-analysis (40 studies; $N = 10\,123$) found that a third of refugee women from low- and middle-income countries suffered from clinically significant depression in pre- and postnatal periods (Fellmeth, Fazel, & Plugge, 2018). Thus, the proportion is approximately double compared to the general prevalence of major depression during the pregnancy (13 %–16 %) and in the postpartum period (7%–9%), with women in lower income countries suffering a higher burden of perinatal depression than women in middle- or high-income countries (Figueiredo & Conde, 2011; Gavin et al., 2005; Gelaye, Rondon, Araya, & Williams, 2016; Woody, Ferrari, Siskind, Whiteford, & Harris, 2017).

Canadian studies confirmed that refugee and immigrant women were at 2–3 times higher risk of postnatal depression than natives (Davey, Tough, Adair, & Benzies, 2011; Stewart, Gagnon, Saucier, Wahoush, & Dougherty, 2008). Importantly, personal exposure to traumatic war events, particularly violence and threat to life, severely deteriorate women's pre- and postnatal mental health. As an example, female refugees and asylum-seekers suffered from more severe depression, somatization, and anxiety symptoms (37 % and 42 % respectively) as compared to immigrants (21 %) who were not exposed to war trauma (Gagnon et al., 2013). A rare study among families living in conditions of war and military violence, a Palestinian prospective study evidenced that women exposed to extremely traumatic events, such as human and material losses and threat to life, showed higher levels of PTSD, anxiety, and depressive symptoms both during pregnancy and postpartum, as compared to women exposed to lower levels (Punamäki, Isosävi, Qouta, Kuittinen, & Diab, 2017).

1.3. Maternal trauma and dyadic interaction

Understanding the impact of maternal trauma on parenting originates from attachment literature that posits that an unresolved trauma comprehensively influences mothers' behavior, emotions, thinking and social relations, including the early mother-infant interaction (Main & Hesse, 1990). Trauma is transmitted to children through parental frightening behavior and frightened responses (Main & Hesse, 1990) as well as through breakdown of mutual emotion- and stress-regulation strategies (Crittenden, 2006). This is particularly devastating to infants who are highly dependent on caregiver's help (Crugnola et al., 2013).

Van Ee, Kleber, and Mooren (2012) showed that refugee mothers who suffered from PTSD symptoms were more insensitive, non-structured, and hostile toward their infants, who in turn were less responsive and involved in the dyadic interaction. Further, maternal PTSD was directly associated with infants' insecure and disorganized attachment style, the latter being a particularly high developmental risk (Van Ee, Kleber, Jongmans, Mooren, & Out, 2016). An Israeli interview study revealed that mothers exposed to a terrorist attack during pregnancy perceived themselves as damaged, inadequate to provide safety to the infant, and overwhelmed by feelings of guilt (Levy, 2006). Prenatal exposure to traumatic war events interfered with mothers' bonding with the fetus and future baby, thereby predicting difficulties in the creation of dyadic mother-infant interaction (Kaitz et al., 2009). An interview study identified dysfunctional representations among Palestinian mothers, involving—for example—high fear of their children's safety and idealization of their own dyadic endurance (Isosävi, Kuittinen, Quota, Diab, & Punamäki, 2020). Exposure to high level of traumatic war events was not associated with the mother's representations, but their severe PTSD symptoms increased dysfunctional representations. Similarly, another Palestinian study did not find a direct association between exposure traumatic war events and poor quality of mother-infant interaction, but the impact was instead mediated trough insecure maternal-fetus attachment, low family support, and severe maternal pre- and postnatal mental health problems (Punamäki et al., 2017).

1.4. Maternal mental health, dyadic interaction, and infant development

Extant research evidences that mothers who suffer from mental health problems, such as depression or anxiety, have difficulties in bonding with their infants (Edhborg, Lundh, Seimyr, & Widström, 2003; Muzik et al., 2013). Compared to mothers without mental

health problems, they are less likely to touch their infant and to show sensitive, warm, and positive interactions (Feldman et al., 2009). Anxious mothers tend to overstimulate and be intrusive or irritable in their dyadic interaction (Seymour, Giallo, Cooklin, & Dunning, 2015), and depressive mothers are often insensitive and withdrawn with their babies (Cluxton-Keller & Bruce, 2017). The infants of depressed and anxious mothers appear to be more tense and difficult to soothe (Agrati et al., 2015; McGrath, Records, & Rice, 2008) as well as are at increased risk of stress dysregulation (Letourneau, Watson, Duffett-Leger, Hegadoren, & Tryphonopoulos, 2011).

Subsequently, children of depressed mothers are at heightened risk for behavioral and emotional problems (Dietz, Jennings, Kelley, & Marshall, 2009; Cooklin, Giallo, D'Esposito, Crawford, & Nicholson, 2013) and compromised development of motor, cognitive, and language skills (Aoyagi et al., 2019; Grace, Evindar, & Stewart, 2003; Kingston, McDonald, Austin, & Tough, 2015; Mirhosseini et al., 2015). The withdrawal, unpredictability, and irritation that characterize depressive and anxious mothering can interfere with infants' ability and willingness to explore their environment and share and learn from novel experiences, which can pose a risk for optimal language and intellectual development. Importantly, positive mother-infant interaction, involving maternal responsiveness and dyadic shared pleasure can comprehensively enhance infant development (Milgrom, Westley, & Gemmill, 2004). However, we do not know whether maternal mental health and mother-infant interaction play similar roles in the context of military conflict and traumatic war experiences.

1.5. Research aims

This prospective study followed Palestinian mother-infant dyads from the time of delivery (T1) to when the infant is six (T2) and eighteen (T3) months old. Mothers were exposed to traumatic war events when they were in the first trimester of their pregnancy during the 2014 Gaza War. Our aim was to understand the impact of traumatic war events and potential trauma-induced changes in maternal mental health and dyadic interaction on infant development. The schematic model of the study hypotheses is presented in Fig. 1.

Our first research task was to examine how maternal prenatal exposure to traumatic war events predicts infant development. We hypothesized that higher prenatal exposure to war trauma, measured as maternal reports of war-time destruction, human losses, witnessing horrors, and threat to life are associated with lower levels of infant motor, cognitive-language, and socioemotional developmental skills at six (T2) and eighteen (T3) months of age. Second, we tested the mediating roles of maternal postpartum mental health problems, quality of dyadic mother-infant interaction, and early infant development (at six months) in the association between prenatal traumatic war events and the developmental skills of infants at 18 months of age. According to our mediation hypothesis, high exposure to traumatic war events is associated with high levels of maternal PTSD, depressive and somatization symptoms at T2 and T3, low-quality mother-infant interaction (low closeness and scaffolding and high distance) at T2, and low developmental skills at six months, which in turn is associated with low levels of development of infant motor, cognitive-language, and socioemotional skills at 18 months.

2. Method

2.1. Participants and procedure

The participants were 502 Palestinian women recruited at their delivery in maternity units in three governmental and one private

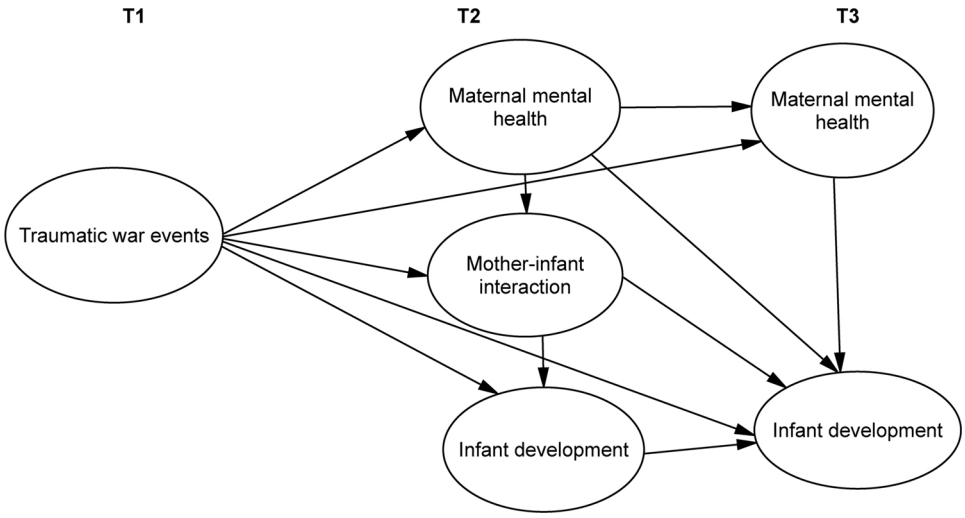

Fig. 1. Conceptual model of maternal mental health problems and poor dyadic mother-infant -interaction quality mediating the impact of traumatic war events on infant sensorimotor and cognitive development.

hospitals in the Gaza Strip (T1). When infants were six months, 392 mothers participated (T2), and 386 continued at 18 months (T3).

The T1 assessment was conducted between January to March 2015. The participants were representative of the four main regions of the Gaza Strip: North ($n = 100$), Middle ($n = 100$), and South ($n = 100$), and Gaza City ($n = 202$). The inclusion criteria were that they were pregnant and in their first trimester during the 2014 Gaza War. One midwife in each hospital registered all deliveries during her work shift and obtained written informed consent from participants.

The T2 assessment was conducted from June to October 2015, when the infants were about six months old ($M = 6.18$; $SD = 0.41$), and the T3 assessment was conducted from August to November 2016 when they were about 18 months old ($M = 18.10$; $SD = 0.56$). Ten fieldworkers with bachelor's degrees in social work, health sciences or psychology and former interview experiences visited mother-infant -dyads in their homes or their location after displacement. Fieldworkers attended a comprehensive training on the research tasks, ethics, and procedures, and two Palestinian members of the research team supervised the fieldwork through supervisory meetings. The interviews lasted for an average of 90 min. The infants received small presents for their participation. The study was approved by the Palestinian Health Research Council and the Helsinki Committee for Ethical Approval. Further, the Research Board in the Islamic University of Gaza, Palestine, reviewed and approved the research tools and procedures.

The number of participants who dropped out between T1 and T2 was 110 (22 %). The reasons were lost home addresses due to displacements and shelled homes ($n = 90$), death of the baby ($n = 13$), and withdrawal for family reasons ($n = 7$). The dropout was related to shorter gestation ($t = 2.50$, $p = 0.01$) and poorer newborn health ($t = 57.65$, $p = 0.0001$), but was not related to infants' gender and birthweight or age, employment, and education of the mother. The women without addresses were from Gaza City, where one large neighborhood was completely destroyed and all families were displaced, and were living currently with relatives or in tents provided by the United Nations (UN). Due to the military siege and international economic boycott, Palestinians were not allowed to import rebuilding materials such as cent or metals (Manduca et al., 2017; UN-Human Rights Council, 2014). The drop-out rate between T2 and T3 was only five mothers, one due to death of the child and others to missing current address.

2.2. Measures

2.2.1. Demographic and obstetric information (T1)

Standard European and US birth register information was collected at birth by the mid-wives in maternity units, including birthweight, length of gestation, mode of delivery, newborn health, and the need of an intensive care unit (NICU). Mothers also reported their own and spouse's working status (working at home or are professionals; are unemployed or employed or entrepreneurs), family size, and parental age.

2.2.2. Traumatic war events (T1 and T2)

At T1, mothers responded to five questions regarding their exposure to the 2014 war: whether their own house was bombed, their neighboring house was bombed, whether they were inside their home at the time of the shelling/attack, whether they were displaced afterwards, and whether they found spent ammunitions inside their dwelling (*yes* = 1; *no* = 0). Researchers verified the proximal exposure to military attacks by photo documenting the degree of home destruction (available from the corresponding author).

In T2, traumatic war events were assessed by a scale of 22 traumatic war events, based on scales used during earlier wars and military offensives on the Gaza Strip (Punamäki et al., 2017), and updated by events typical to the 2014 Gaza War (like being under curfew with dead bodies in the house). Seven events probed death and losses (e.g., death and injury of family members, seeing friend killed), nine probed witnessing horrifying scenes (e.g., seeing deaths, explosions, and bombing, experiencing threats and massacres, and hearing injured screaming), and six probed threats to life (e.g., fleeing for life due shelling/bombing, near miss of death, separation from family). The mothers reported whether they had been exposed to these events during the 2014 Gaza War (*yes* = 1; *no* = 0). A factor analysis with varimax rotation was conducted for both T1 and T2 traumatic war events to check their dimensionality. The results explained 46.38 % of their variation, thereby conforming dimensions of material destruction, death, and losses, witnessing horrors, and threats to life, and these scores were used to create a latent variable in the SEM analysis (the five events documented during T1 loaded in factors of material destruction and threat to life).

2.2.3. PTSD symptoms (T2 and T3)

During T2, the 16-item scale of PTSD symptoms, obtained from the Harvard Trauma Questionnaire (HTQ; Mollica et al., 1992), was applied. The HTQ covers intrusive, avoidance, and hypervigilance symptoms. Using a four-point scale, ranging from 1 (*Not at all*) to 4 (*Severely*), the mothers estimated how much they suffered from the described symptoms during the previous month. A sum variable was constructed with a Cronbach's α value of 0.91. A cut-off score of 2.06 was calculated from an averaged sum variable to indicate clinically significant PTSD (Oruc et al., 2009).

During T3, PTSD symptoms were measured using a nine-item National Stressful Events Survey PTSD Short Scale (NSESSS-PTSD) (LeBeau et al., 2014). It is based on the DSM-5 diagnostic criteria and encompasses the dimensions of intrusion, avoidance, and hypervigilance as well as negative cognitive-affective responses. The mothers estimated, on a five-point scale, the extent to which they had suffered the symptoms and affective states during the previous month 0 (*Not at all*) to 4 (*Extremely*). A sum score was constructed with Cronbach's α value of 0.94. A cut-off score of 24 was calculated from a sum variable to indicate clinically significant PTSD (LeBeau et al., 2014). The reason for changing the PTSD symptom scale was the criticism of the HTQ not being updated for DSM-5.

2.2.4. Depressive symptoms (T2 and T3)

The Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden, & Sagovsky, 1987) was applied to measure depressive symptoms.

The EPDS consists of 10 items that assess negative feelings, thoughts, and behaviors—such as sadness, fear, self-blame, and sleeping problems. Using a four-point scale, ranging from 0 (indicating that the symptom was not present) to 3 (indicating high symptom presence), the mothers estimated whether and to what extent they had suffered from the described symptoms during the last two weeks. Sum variables were constructed and Cronbach's α values were 0.82 at T2 and 0.83 at T3. A cut-off score of $\geq$12 of sum variables indicated clinically significant depression (Ghubash, Abou-Saleh, & Daradkeh, 1997).

2.2.5. Somatization symptoms (T2 and T3)

Somatization symptoms were assessed using the 12-item somatization-subscale of the Symptom Checklist-90 (SCL-90) (Derogatis, Lippman, & Covi, 1973). The items describe psychosomatic complaints, such as pains in the heart or chest, faintness, dizziness or muscle soreness. Using a five-point scale, ranging from 1 (*not at all*) to 5 (*very much*), the mothers estimated the extent to which they had suffered from each symptom during the last week. Sum variables were constructed with Cronbach's α values being 0.77 at T2 and 0.89 at T3.

2.2.6. Infant-mother interaction (T2)

The 28-item short version of the EA-SR Brief (Emotional Availability-Short Report; Biringen, Matheny, Bretherton, Renouf, & Sherman, 2000; Biringen, Vliegen, Bijttebier, & Cluckers, 2002) was used to evaluate the quality of infant-mother interaction at six months. First, the questionnaire depicts *close and positive dyadic interactions* (10 items, e.g., "My baby likes to be with me the most of the time"; "My baby seems to light up when she/he sees me"; "I am usually in a good mood when with my baby"); second, *distant and hard to soothe dyadic relationships* (10 items, e.g., "My baby is "cranky" most of the time"; "My baby doesn't seem to notice when I come back into the room"; "It is hard to soothe my baby and he (or she) seems to be distressed a lot"); and, third *emotional scaffolding* (8 items–e.g., "I try to see things from my baby's perspective"). Using a five-point scale ranging from 1 (*not at all*) to 5 (*completely*), the mothers estimated the extent to which the descriptions fit themselves and their baby. The EA-SR Brief self-report has been found to correlate significantly with EA observation scales; for example, correlations ranged from 0.37 to 0.44 ($p < 0.0016$, N = 84) between close and positive dyadic interaction with six observation scales (sensitivity, structuring, non-hostility, non-intrusiveness, responsiveness, and initiation) (Vliegen, Luyten, & Biringen, 2009).

Further, since the EA-SR-Brief has not been validated in Middle Eastern samples, we ran a confirmatory factor analysis (CFA) to confirm the three-dimensionality in the present sample. Averaged sum variables were constructed, but reliability analyses revealed satisfactory internal consistency only for close and positive ($\alpha = 0.71$) and, to a certain extent, for distant and negative ($\alpha = 0.65$) dimensions, but not for scaffolding ($\alpha = 0.51$).

2.2.7. Infant developmental skills at six months (T2)

A 48-item questionnaire, based on the Minnesota Child Development Inventory (MCDI) (Kopparthi et al., 1991), was applied to assess the infants' fine- and gross-motor development, vocalizations and utterances, as well as socioemotional development at six months. The items reflect increasingly demanding skills. The 15-item scale for *fine-motor development* begins with "Baby keeps both hands tightly clenched" and "Baby grabs the parent's finger strongly when it touches the baby's palm" and ends with "Baby can beat/hit/bang two blocks or other toys several times against each other" and "Pincer grip: The baby can grab small items by using her/his fingertips and by flexing the thumb and the index finger." Further, seven items of the fine motor skills were visualized in addition to the verbal descriptions provided. The 10-item scale for *gross-motor development* begins with "Raises head to the height of five centimeters, at least, and keeps it up about three seconds" and "Can roll from her/his stomach on to her/his back without help" and ends with "Can pull her/himself to stand independently, for example, through seeking support by her/his hand against the wall or bed." The 10-item scale for *language skills* began with "Baby's vocalization begins to resemble utterances–for example, ala and ila" and "Baby voices/utterances are continuous across one respiratory cycle (breathes in and out)" and ends with "Baby produces utterances that sound as real words—for example, expressions such as umm, abu (mother, father)." Finally, the 13-item scale for *socioemotional development* begins with "The baby makes eye contact" and "She/he smiles similarly to both the parents and stranger/visitors in the house" and ends with "She/he is attending the play of 'giving and taking'." Using a three-point scale, mothers estimated whether the infant had performed the task (1 = *not observed*; 2 = *observed once or occasionally*; 3 = *observed many times, routinely*). The MCDI has been validated and corresponds with the Bayley Sensory Motor Skills scale for 8- to 16-month old infants in North American (Kopparthi et al., 1991) and Egyptian (Baheree, 2013) samples. The current 48-item scale has been validated for the evaluation of early communication, language, and sensorimotor development among Finnish children (Lyytinen, Ahonen, Eklund, & Lyytinen, 2000) and a 15-item short version was found to be reliable and valid in the Palestinian Infant Study (Punamäki et al., 2017). Sum scores were calculated for fine-motor ($\alpha = 0.72$), gross-motor ($\alpha = 0.75$), language ($\alpha = 0.72$), and socioemotional development ($\alpha = 0.61$).

2.2.8. Infant developmental skills at 18 months (T3)

The skills were assessed by using three scales of the 50-item Arabic version of the Bayley Scales of Infant Development, BSID-III (Al Behairi, 2013): *motor development* (11 items, e.g., "Sitting without support," "Reaching objects with a goal-directed attempt"); *cognitive-language development* (22 items, e.g., "Looking at the pictures in the book," "Building a tower of two cubes or more," "Imitating words"), reflecting increasingly advanced skills; and *socioemotional development that* incorporates capacity to use a range of emotions, experiences, and expressions in social engagements (17 items, e.g., "Is responsive to people," "Soothability when upset," "Trust in others without fear"). A psychologist assessed the 18-month old infants individually for their motor and cognitive-language skills and observed and interviewed the mother for socioemotional development. Each task performed by an infant was scored on a scale (*yes* = 1, succeeded, performed; or *no* = 0, did not perform) in accordance with the specified performance standards of each task. Sum

variables were calculated for the three development domains, and Cronbach's α values were 0.80 for cognitive-language, 0.84 for motor development, and 0.89 for social-emotional scales.

2.2.9. Translation

All measures were taken in Arabic. The HTQ (Salo, Qouta, & Punamäki, 2005), EPDS, and a part of T2 developmental skills scales (Isosävi et al., 2017) and EA-SR short scale (Punamaki et al., 2017) were translated and validated in earlier studies conducted among Arab speaking adults. The traumatic war events and BSID-III were originally in Arabic. A bilingual researcher translated additional items of the T2 developmental skills and T3 PTSD scale from English to Arabic and another conducted a back translation to check for accuracy.

Table 1
Demographic Background, Obstetric and Newborn Characteristics at Birth at T1 (%).

	Participants[a]	
	%	N
Mother's age (years)		
16–20	14.5	73
21–30	62.9	316
31–40	21.1	106
41−52	1.4	7
Number of children		
Expecting first child	26.5	133
1–3	53.0	268
4–6	17.0	85
7–10	3.5	18
Mother's education		
No formal education	1.6	8
Elementary and secondary school	24.9	125
Gymnasium	33.9	170
College and Polytechnic	31.5	158
University	8.2	41
Mother employment		
Works at home	88.8	446
Worker or entrepreneur	0.2	1
Blue collar	9.3	46
High professional	0.6	3
Student	1.2	6
Type of residence		
Urban area	48.9	244
Village	18.6	93
Refugee camp	32.5	162
Child's sex		
Girl	50.4	253
Boy	49.6	249
Gestational age (weeks)		
< 37	4.2	20
37	11.3	54
38−42	84.5	404
Birth weight (gr)		
< 2500	4.5	21
2500–3499	54.1	252
3500–4499	39.7	185
> 4500	1.7	8
Newborn health		
Excellent	51.1	256
Good	45.5	228
Health problems[b]	2.6	13
Child death	0.8	4
Birth defect		
ICD 10 diagnosis	5.2	26
Not defect	94.8	476
Type of delivery		
Normal vaginal	86.8	435
Caesarean	13.2	66

[a] Participant numbers ranges between 466 (birth weight) and 502 differed due to missing responses.
[b] Combines reasonable and severe problems (severe n = 2).

Table 2
Means and Standard Deviations of Research Variables at T2 and T3 according to Child Gender and Total Sample.

	T2 (Child 6 months)							T3 (Child 18 months)						
	Girls		Boys		Total [a]			Girls		Boys		Total [a]		
	M	SD	M	SD	Minu-mum [d]	Maxi-mum [d]	Range	M	SD	M	SD	Minu-mum [d]	Maxi-mum [d]	Range
Maternal mental health														
PTSD symptoms[b]	31.77	8.99	31.76	9.80	16.00	59.00	43	16.30	9.56	16.00	8.59	0	36.00	36
Depressive symptoms	18.19	5.61	17.77	6.12	10.00	38.00	28	19.73	6.32	18.81	5.62	10.00	38.00	28
Somatization symptoms	29.16	10.79	28.96	10.73	13.00	60.00	47	29.16	10.79	28.96	10.73	13.00	60.00	47
Mother-infant -interaction														
Close and positive	4.29	.48	4.31	.45	1.33	5.00	3.67							
Distant and negative	2.28	.54	2.34	.60	1.00	4.64	3.64							
Scaffolding	3.37	.61	3.48	.62	1.80	5.00	3.20							
Infant development [c]														
Fine-motor skills	36.28	5.37	35.48	4.58	15.00	45.00	30							
Gross-motor/Motor skills	23.78	4.20	23.36	3.74	12.00	22.00	10	9.22	2.51	9.36	2.20	0	11.00	11
Language skills /Cognitive-language	21.73	4.28	21.64	3.90	10.00	30.00	20	19.31	2.59	19.28	2.43	2.00	21.00	19
Socioemotional skills	33.39	3.18	32.85	3.02	13.00	39.00	26	80.48	15.95	80.09	15.17	37.00	112.00	75

[a] N = 392 at T2 and N = 386 at T3.
[b] The questionnaire of PTSD was different at T2 (based on DSM-IV) and T3 (based on DSM5).
[c] Assessment tools were different at T2 (Based on mothers' reports) and T3 (Based on Baley II testing).
[d] These are the actual values based on this data (not theoretical).

2.3. Statistical analyses

The descriptive statistical analysis and computation of sum variables were conducted using SPSS 25.0. The distributions of demographic variables and traumatic war events are presented as percentages and correlations among study variables as the Pearson Cross Product method. In order to answer the two research questions, an SEM with latent variables was applied, using Amos SEM (Amos 24.0 software; SPSS Framework Version).

Fig. 1 presents the hypothesized SEM model with direct and indirect effects that was constructed to analyze (a) how maternal prenatal exposure to traumatic war events would predict infant motor, cognitive-language, and socioemotional development at six (T2) and eighteen (T3) months and (b) whether maternal mental health problems, quality of mother-infant dyadic interaction, and earlier infant developmental skills (6 months) would mediate the association between traumatic war events and infants' developmental skills at 18 months of age.

The measurement models of the latent variables were first tested with the maximum likelihood (ML) method to confirm the validity of constructs and to learn about their dimensionality. In the SEM model, the exogenous variable was the latent construct of traumatic war events (four manifest variables: material destruction, death and loss, witnessing horrors, and threat to life). Four endogenous latent variables were the two sets of maternal mental health in T2 and T3 (three manifest variables: PTSD, depressive, and somatization symptoms at both assessments), mother-infant interaction in T2 (three manifest variables: close and positive, distant and negative, and scaffolding interaction), and infant developmental skills at six months, T2 (four manifest variables: fine-motor, gross-motor, language, and socioemotional skills). Further, the outcome latent variable was infant developmental skills at 18 months (three manifest variables: motor, cognitive-language, and socioemotional skills). Error terms were allowed to correlate within manifest variables of an latent constructs. Based on modification indices the following correlations were included in the SEM model: witnessing horrors with threat to life, witnessing horrors with death and loss in traumatic war events; PTSD symptoms with depressive symptoms at T2 and T3, close and positive and scaffolding in mother-infant interaction, and fine-motor with socioemotional in infant development at T2. In addition, the number of children and gestational age were included as covariants in the SEM model, the former for statistical reasons (correlated with both dependent and independent variable) and the latter for developmental importance in terms of motor development.

To test the direct effects, the latent variables of infant developmental skills at T2 and T3 were regressed on the latent variable of traumatic war events. Testing the mediation hypothesis proceeded in three stages: (1) The four endogenous latent variables (maternal mental health at T2 and T3, dyadic interaction at T2, and infant developmental skills at T2) were regressed on the exogenous latent variable of traumatic war events. (2) The latent outcome variable of infants' developmental skills at T3 was regressed on the four endogenous variables and on the exogenous latent variable traumatic war events.

Two conditions indicate the mediation or indirect effects between traumatic war events and infants' developmental skills in T3 (through maternal mental health in T2 and T3, dyadic interaction in T2, and infant development at T2): (1) statistically significant paths (β-values) between the exogenous, endogenous, and outcome variables, and (2) significant indirect effects, indicated by unstandardized b-values with confidence intervals (CI) excluding zero. The AMOS-program was used to calculate the indirect effect by using a ML method that obtains estimates of the parameters and produces bias-corrected bootstrap CIs to construct both direct and indirect effects (MacKinnon, Lockwood, & Williams, 2004). For the bootstrap procedure, the three-wave data was completed by regression-based multiple imputation technique (because the procedure is based on complete data). The actual SEM testing of hypotheses is based on available original data of 392 at T2.

The criteria for model fitness were non-significant χ^2-value, comparative fit index (CFI), and Tucker-Lewis index (TLI) above 0.90, and the root mean square error of approximation (RMSEA) was below 0.06 (Bentler, 2007).

3. Results

3.1. Descriptive results

Table 1 presents the demographic and obstetric data collected in T1. The average age of the mothers was 26 years of age ($SD = 6.0$ years). A third of mothers had gymnasium or college (34 %) or polytechnic (32 %) level of education and only 2% had no formal education. Further, a majority of mothers currently worked at home (89 %) and the remainder worked as blue collar staff, such as teachers or nurses (9.3 %).

The sample consisted of an equal number of boys and girls. With regard to obstetric data, the average duration of gestation was 39.23 weeks ($SD = 1.77$ weeks) and birthweight 3348.38 g (SD =527.96 g). The prevalence of preterm delivery (< 37 weeks) was 4%, low birth weight (< 2.500 g) 4.5 %, and birth defects 5.2 %. All babies were born alive, although one died within a few minutes after birth and four died in the first six months (reasons not available).

Table 2 presents the statistics associated with the study variables according to child gender in T2 and T3. T-tests showed that there were no gender differences (available from the authors). With regard to the severity of the mothers' mental health problems, 31.1 % had clinically significant PTSD at T2 and 20.5 % at T3; moreover, 21.5 % suffered clinically significant depression at T2, and 27.2 % at T3.

Mothers' prenatal exposure to traumatic war events during the 2014 Gaza War was relatively high. Almost two-thirds (63.9 %) had experienced shelling and bombing in their neighborhood, approximately one-thirds (32.7 %) had their home destroyed, and one-thirds (35.4 %) were inside the house when bombed. In mothers' own reports, the most common events were related to witnessing horrors, such as massacres (50.6 %), heavy explosions and burning (63.6 %), or hearing wounded people scream (47.4 %). Approximately half

Table 3
Pearson's Product Moment Correlations between Traumatic War Events, Maternal Mental Health at T2 [a], Mother-perceived Emotional Availability at T2 [a], and Infant Development at T3 [b].

	Traumatic war events (T1and T2)				Maternal mental health (T2)			Mother-infant interaction (T2)			Infant development (T3)		
	1.	2.	3	4.	5.	6.	7.	8.	9.	10.	11.	12	13
Traumatic war events (T1& T2) N = 392													
1.Material destruction													
2. Death and losses	.12*												
3. Witnessing horrors	.27***	.17*											
4. Life-threat	.34***	.28***	.27***										
Mental health problems (T2) N = 392													
5. PTSD symptoms	.25***	.25***	.31***	.20***									
6. Depressive symptoms	.04**	.13*	.03	.05	.51***								
7. Somatization	.09*	.15**	.17**	.09*	.64***	.61***							
Mother-infant-interaction (T2) N = 392													
8. Close and positive	−.04	−.01	.11*	−.01	−.05	−.17**	−.23***						
9. Distant and negative	.07+	.07+	−.18***	.06	.19***	.35***	.19***	−.14**					
10.Scaffolding	−.04	.03	−.06	−.07+	−.03	−.01	−.09+	−.19***	.06				
Infant development (T3) N = 386													
11. Motor	−.04	−.03	.20***	.10	−.03	−.17**	−.12**	.31***	−.24***	.08			
12.Cognitive-language	−.02	−.03	.16**	−.10*	−.01	−.19***	−.13*	.16**	−.15**	.01	.63***		
13. Socio-emotional	−.09+	−.03	−.01	−.08	−.09+	−.07	−.03	.07	−.07	.05	.42***	.51***	

Notes: + p < .10, * p < .05, ** p < .01, *** p < .001; The significances are based on one-tailed correlations between traumatic war events and other study variables, and on two-tailed correlations between all other variables [a] N = 392 at T2; Maternal mental health and mother-infant -interaction is reported only from T2 assessment due to the lack of space; the T3 correlations are reported in the text; [b] N = 386 at T3.

of the mothers reported life-threatening experiences, such as not finding safe place to hide from shelling and bombing (50.8 %), soldiers attacking family (51.0 %), or near- missing death (53.1 %). Death (6.9 %) and injury (12.1 %) of family members were less common traumatic war events.

Table 3 presents the correlations among traumatic war events, maternal mental health problems at T2, mother-infant interaction quality at T2, and infant developmental skills at T3 (correlations of maternal mental health problems at T3 and infant developmental skills at T2 are not reported due to lack of space). All four indicators of traumatic war events were significantly positively correlated with PTSD and somatization symptoms, but only material destruction and death and losses were correlated with depressive symptoms. Instead, only witnessing horrors correlated significantly with the quality of mother-infant dyadic interaction; however, somewhat unexpectedly, as correlation was positive with close and positive interaction and negative with distant and negative interaction. All indicators of maternal mental health problems correlated positively with distant and negative mother-infant interaction, but only depressive and somatization symptoms negatively with close and positive interaction. With regard to traumatic war events, only witnessing horrors was correlating significantly and, unexpectedly, positively with a high level of infant motor and cognitive-language skills at T3. Further, maternal depressive and somatization symptoms (but not PTSD symptoms) were negatively correlated with infants' motor and cognitive-language skills at T3. Close and positive mother-infant interaction correlated positively and distant and negative interactions correlated negatively with infants' motor and cognitive-language skills at T3.

Of background variables, the number of children correlated positively with material destruction of war events ($r = 0.13$, $p = 0.003$, $n = 495$) and negatively with infants' developmental skills at T3 (motor, $r = -0.15$, $p = 0.004$, $n = 346$; cognitive-language, $r = -0.12$, $p = 0.021$, $n = 348$; and socioemotional $r = -0.12$, $p = 0.027$, $n = 354$). Higher gestation age correlated positively with infant motor skills at T3 ($r = 0.13$, $p = 0.008$, $n = 354$), but not with other developmental skills. Further, none of the traumatic war events correlated significantly with gestational age, but material destruction was negatively correlated with optimal newborn status ($r = -0.13$, $p = 0.003$, $n = 495$). Child gender, newborn health, birth weight, or mother's education or work status were not correlating with developmental skills at T3.

3.2. Measurement models of latent variables

Table 4 presents the measurement models of the latent constructs of traumatic war events, maternal mental health, mother-infant interaction quality, and infants' developmental skills. The measurement models were part of the final SEM model with direct and

Table 4
Measurement Models: Loading Estimates of Manifest Variables of Traumatic War Events, Maternal Mental Health, Mother-Infant Interaction, and Infant Development for Corresponding Latent Constructs of the Structural Equation Model (SEM).

Manifest variables for latent constructs	Unstd β	SE	Std β	Critical ratio/t-tests
Traumatic war events T1 and T2				
Material destruction	1.00[b]		.42	
Death and losses	0.29	.10	.22	2.84**
Witnessing horrors	0.81	.18	.62	4.39****
Life-threat	0.52	.13	.40	3.86****
Maternal mental health problems at T2				
PTSD-symptoms	1.00		.90	
Depressive symptoms	0.92	.06	.82	15.00****
Somatization symptoms	1.04	.09	.72	11.97****
Maternal mental health problems at T3 [a]				
PTSD-symptoms	1.00	.	.61	
Depressive symptoms	0.82	.09	.84	9.52****
Somatization symptoms	1.78	.77	.62	6.11****
Mother-infant interaction quality at T2				
Close and positive	1.00		.23	
Distant and negative	−3.09	1.19	−.69	−2.599**
Scaffolding	0.17	.32	.04	0.52
Infant developmental skills at T2				
Fine-motor	1.00		.73	
Gross-motor	0.94	.06	.71	15.54****
Language	0.76	.05	.72	15.75****
Socioemotional	2.58	.13	.91	19.35****
Infant developmental skills at T3				
Motor	1.00		.81	
Cognitive and language	1.07	.08	.83	12.84****
Socioemotional	4.97	.45	.62	11.06****
Model indices[b]				
$\chi^2 = 393.51$, df = 153, $p = .0001$; CFI = .91; TLI = .91; NFI = .91; RMSEA = .057 [90% CI: .050–.064]				

Notes: ****$p < .0001$, ***$p < .001$, * $p < .05$.

[a] N = 511 at T1, N = 392 at T2 and N = 386 at T3.

[b] In the Unstandardized estimate (β) StdE (Unstandardized estimate) and critical ratio (t-values) refer to parameters fixed to 1 in the measurement model; [c]The measurement models are from the final tested SEM model, thus the model indices are the same as in Table 4.

indirect paths, which showed good fit indices, CFI = 0.91, TLI = 0.91, RMSEA = 0.057 [90 % CI: 0.050–0.064], although χ^2 (393.51, df = 151, p = 0.0001) was significant, as is often the case in large samples (Hu & Bentler, 1999). All manifest variables loaded significantly on the constructed latent variables, except scaffolding in mother-infant interaction. Moreover, the estimation loadings of death and losses (β = 0.22) and close and positive mother-infant interaction (β = 0.23) were unacceptably low, although they were statistically significant. They were all included in the analysis for conceptual and technical reasons (each latent variable had at least three manifest variables).

3.3. Impact of traumatic war events on infant development

The SEM model testing simultaneous direct and indirect paths predicting the infant developmental skills at 18 months indicated adequate goodness-of-fit (see fit indices in Tables 4 and 5). With regard to the first research question, Table 5 illustrates that, against the hypothesis, high maternal prenatal exposure to traumatic war events was not significantly associated with fine-motor, motor, language, and socioemotional infant developmental skills at six months (T2). Further, in contrast to the hypothesis, traumatic war events were associated with higher motor, cognitive-language, and socioemotional developmental skills at 18 months (T3).

3.4. Mediating roles of maternal mental health and dyadic interaction

The results revealed two negative mediating paths from prenatal traumatic war events to infants' developmental skills at 18 months, both through maternal mental health problems. First, as hypothesized, high prenatal exposure to traumatic war events was associated with a higher level of maternal mental health problems at T2 (β = 0.35, t = 4.96, p = 0.0001), which then—through maternal mental health problems at T3 (β = 0.60, t = 7.86, p = 0.0001)—was associated with low level of infant developmental skills at 18 months (β = -0.20, t = -2.24, p = 0.023). Traumatic war events were not directly associated with maternal mental health at T3.

Second, maternal mental health problems at T2 were also associated with a low quality of mother-infant interaction (β = -0.68, t = -3.35, p = 0.0001), which then was associated with a low level of infant developmental skills at T3 both directly (β = 0.12, t = 1.98, p = 0.048) and via infant developmental skills at T2 (β = -0.17, t = 2.35, p = 0.020). The association between T2 and T3 developmental skills was significant (β = 0.33, t = 5.10, p = 0.0001).

Against our hypothesis, there was also a positive path from prenatal exposure to traumatic war events into infant developmental skills at T3, mediated via the quality mother-infant interaction. High exposure to traumatic war events was associated with high quality of mother-infant interaction quality at T2 (β = 0.57, t = 2.99, p = 0.002), which then was associated with high level of infant developmental skills at T3 both directly and indirectly via high infant developmental skills at T2 (for β-values, see text above, Fig. 2 and

Table 5
Structural Equation Model (SEM) Mediating Paths between Traumatic War Events and Infant Development: Parameter Estimates (Coefficients) and Model Fit Indices.

	Unstandardized estimates	S.E.	Standardized estimates	Critical ratio
Direct path				
Traumatic war events -> Infants' developmental skills T3	0.38	.18	.14	2.06*
Paths from the predictor to mediators				
Traumatic war events -> Maternal mental health problemsT2	0.24	.05	.35	4.96****
Traumatic war events -> Maternal mental health problemsT3	0.02	.05	.03	0.41
Traumatic war events -> Quality of mother-infant -interaction T2	0.10	.04	.59	2.99**
Traumatic war events -> Infants' developmental skills T2	0.14	.27	.03	0.50
Sequential paths between mediators				
Maternal mental health problems T2 -> Maternal mental health problems T3	0.68	.09	.60	7.86****
Maternal mental health problems T2 -> Quality of mother-infant -interaction T2	−0.17	.05	−.68	−3.35****
Quality of mother-infant -interaction T2 -> Infants' developmental skills T2	3.93	1.67	−.17	−2.35*
Paths between mediators and outcome				
Maternal mental health problems T3 -> Infants' developmental skills T3	−0.46	.20	−.20	−2.24*
Quality of mother-infant -interaction T2 -> Infants developmental skills T3	2.53	1.28	.12	1.98*
Infants' developmental skills T2 -> Infants' developmental skills T3	0.16	.04	.33	5.10****
Covariant: Gestation age -> Infant development T3	0.06	.05	.05	1.36
Covariant: Number of children -> Infant development T3	−0.13	.04	−.22	−2.84**
Indirect paths between predictors, mediators and outcome [a]				
Traumatic War events -> Maternal mental health problems T2 -> Maternal mental health problems T3/ Quality of mother-infant interaction T2 -> Infants' developmental skills T2 -> Infants' developmental skills T3	.16	.44		CI[-.282;.899] p = .314
Maternal mental health problems T2 -> Maternal mental health problems T3 / Quality of mother-infant interaction T2 -> Infants' developmental skills T2 -> Infants' developmental skills T3	−.88	.49		CI[-1.68;.−.136] p = .014
Model fit indices				
χ^2 = 393.51, df = 153, p = .0001; CFI = .91; TLI = .91; NFI = .91; RMSEA = .057 [90% CI: .050–.064]				

Note: *p < .05, ***p < .001. [a] The values of are from imputated data (missing values replaced for Bootstrap testing); other analyses/path testing with non-imputed data.

Table 4).

As revealed by the SEM results in Table 5, the bootstrap procedure found the entire indirect/mediating model to be non-significant ($b = 0.16$; CI's included zero; $p = 0.314$). The AMOS program does not allow testing the significance of separate single mediators, but we tested the significance of the mediating model from maternal mental health problems at T2 to infant developmental skills at T3 (through mental health problems at T3, dyadic interaction at T2, and developmental skills at T2), which turned out to be significant ($b = 0.88$, CI's excluding zero; $p = 0.014$).

4. Discussion

The present study aimed to understand the underlying mechanisms that explain the impact of maternal prenatal exposure to trauma on infant development in conditions of war and military violence. The results revealed both negative and positive impacts of war trauma, with the latter being unexpected. Traumatic war events in pregnancy increased maternal mental health problems at six months, which then were associated with lower levels of infants' cognitive, motor and socioemotional developmental skills at 18 months through subsequent augmented mental health problems. In other words, the early maternal mental health problems were associated with low quality of mother-infant interaction, which then compromised infant development at 18 months, both directly and through earlier low infant developmental skills at six months.

Importantly, the positive path from traumatic war experiences to enhanced infant developmental skills suggests that trauma-exposed mothers may intensify their efforts to maintain protective and loving interaction with their vulnerable infants, which may then be reflected in good infant developmental skills at 18 months. Modelling specified that mediating paths from maternal mental health problems to developmental skills were statistically significant, which accords with earlier research emphasizing the importance of maternal responses—particularly PTSD—to the trauma (Engel et al., 2005; Landrigan et al., 2008). The results contribute to general research on prenatal stress and infant well-being, the role of early interactional environment, and human rights issues of mothers and infants in war conditions.

4.1. Mental health, dyadic interaction, and infant development in war

Our results on mothers and infants in war conditions concur with research on child development in peaceful countries in two ways. First, pre- and postpartum maternal mental health problems pose a risk for normal infant intellectual, motor, cognitive, and language development (Grace et al., 2003; Kingston et al., 2015). There is abundant research on postpartum depression and our findings add that postpartum PTSD and somatization symptoms are also harmful for infant development. Second, high-quality mother-infant interaction—conceptualized by attachment security (Crittenden, 2006; Main & Hesse, 1990) or emotional availability (Biringen, 2000)—is associated with favorable infant development, including intellectual, motor, cognitive, and language achievements (Rocha et al.,

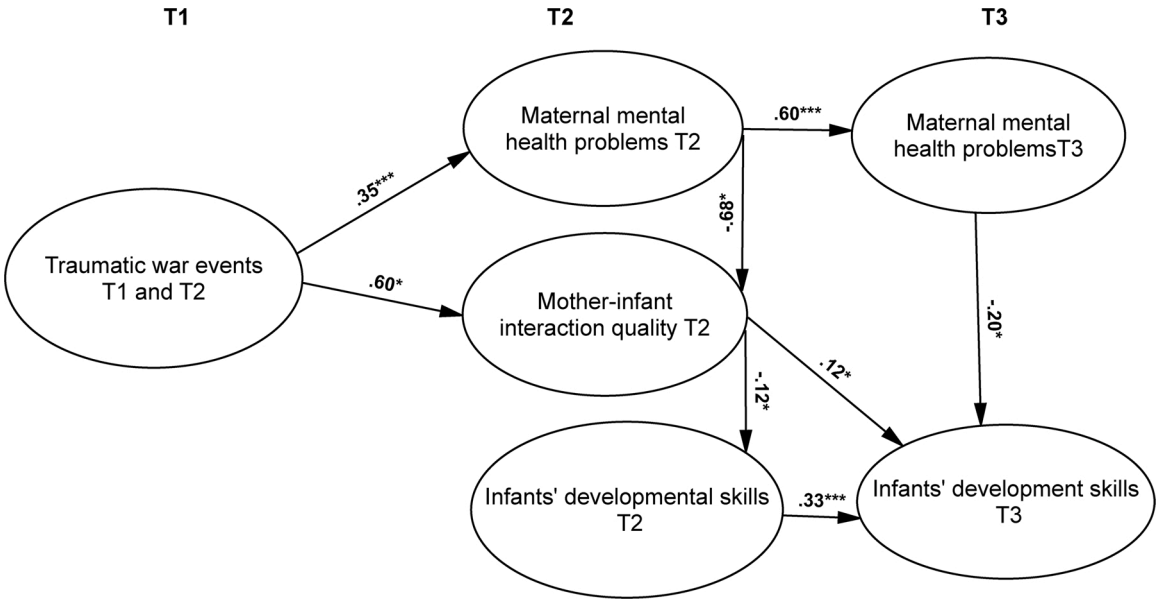

Fig. 2. Structural equation model (SEM) mediators between prenatal maternal exposure to traumatic war events and infant developmental skills. *Note.* $N = 392$. T1 = 1st trimester during the War on Gaza 2014 (mother-reported and researcher documented at deliver and mothers updated when infant was six-month; T2 = Infant is six months old; T3 = Infant is 18 months old.
Only significant paths with standardized β-coefficients are shown; ****$p < .0001$; ***$p < .001$; **$p < .01$; *$p < .05$. Error terms and correlations and correlated residuals/error terms are omitted for clarity reason. Only first-order latent variables are shown, and their manifest variables and fixed estimates are presented in Table 4.

2019). Our findings confirmed the importance of high-quality dyadic interaction in associating and predicting the development of optimal developmental skills among infants in war times.

Traumatic war events can severely threaten pre- and postnatal maternal mental health, which is presented in women who live in conditions of war and military violence (Punamäki et al., 2017; Taubman-Ben-Ari, Rabinowitz, Feldman, & Vaturi, 2001), are exposed to terrorist attacks (Pulcino et al., 2003), and have fled from war as refugees (Fellmeth, Fazel, & Plugge, 2017). Our prospective findings among Palestinian mothers specify that exposure to traumatic war experiences were associated with high levels of PTSD, depressive, and somatization symptoms at six months, but not anymore when infants were 18 months of age. Yet, the trauma exposure indirectly predicted subsequent mental health problems, which are mediated through a high level of earlier postpartum mental health problems. Prospective studies on maternal mental health in war conditions are lacking, but general follow-ups among trauma survivors confirm the trend of attuning the severity of PTSD with time (Bisson, Cosgrove, Lewis, & Robert, 2015).

Our findings concur with research among survivors of terrorist attacks and refugees (Kaitz et al., 2009; Muzik et al., 2013; Van Ee et al., 2016) in that severe maternal mental health problems interfered with optimal mother-infant dyadic interaction by decreasing close and positive interaction and increasing distant and negative interaction. Importantly, however, prenatal maternal exposure to traumatic war events alone directly predicted good dyadic interaction; the quality deteriorated only indirectly in case the trauma-exposed mothers suffered from mental health problems. The earlier research on war and disasters did not focus on the role of mothers' personal exposure to traumatic experiences but rather analyzed their responses to trauma in the form of PTSD (Chemtob et al., 2014; Landrigan et al., 2008) or subjective stress (Laplante et al., 2004, 2008). Our findings contribute to the research that emphasizes the importance of understanding the unique ways that mothers have of responding to traumatic events, as they potentially either attune or accelerate the impact of trauma on child well-being and development (Freud & Burlingham, 1943; Oni, Harville, Xiong, & Buekens, 2015).

Literature suggests that maternal mental health and sensitivity and emotional availability in the dyadic interaction between mother and infant are crucial fine-attuning mechanisms in promoting infant development in general and particularly in buffering against overwhelming stress reactions (Gunnar & Donzella, 2002). Optimal dyadic interaction further promotes infants' behavioral and hormonal synchronization with maternal regulatory processes (Feldman, 2012). In turn, these early regulatory mechanisms boost infants' developmental skills of attention, memory, and learning (Holodynski & Friedlmeier, 2006). International organizations work determinedly to protect women and children from war trauma and to heal those who are traumatized (e.g., Child Defense International, Save the Children, and UNICFF). Our results suggest that these interventions must include therapeutic elements to enhance positive dyadic interaction and maternal mental health in addition to the essential protection of human rights and socioeconomic assistance.

4.2. War and infant development

The positive indirect link between war trauma and infant developmental skills at 18 months contradicts studies on prenatal maternal trauma during natural disasters that indicate negative influences on children's intellectual, language, and socioemotional development (Laplante et al., 2004; Moss et al., 2017; Nomura et al., 2019). Further, the correlation analysis indicated that traumatic war events—particularly witnessing horrific scenes—was associated with a higher level of infant motor and cognitive-language skills. We may speculate that these prenatal experiences may drastically change the fetal hormonal environment to accelerate mobility. A few parents commented that our unexpected finding with regard to "war training" of motor skills with habitual Palestinian humor:

We and our parents spent the childhood in national uprisings, Intifadas against the Israeli military occupation. We run all our lives, as the Palestinian children fought with stones against the occupation soldiers. Maybe the running started in the womb.

The correlation analyses revealed trauma and outcome specificity, as only witnessing horrors was associated with higher motor and cognitive language skills, whereas threat to life was associated with lower cognitive-language skills. None of the traumatic war events correlated significantly with socioemotional skills, although a trend was found toward high trauma with a low level of these skills.

A few earlier studies suggested that prenatal stress ranging from mild to moderate could improve infant motor development (DiPietro et al., 2006; Karam et al., 2016; Laplante et al., 2008). Further, Karam et al. (2016) indicated that maternal distress in pregnancy predicted the beneficial impact on infant motor development, whereas postpartum distress predicted problems in motor and sensorimotor development. Laplante et al. (2008) found a U-shaped association between prenatal stress and infant development and stated that moderate disaster stress was beneficial for children's motor development, whereas severe prenatal stress had an opposite impact.

The stress acceleration hypothesis, which states that early exposure to stress may lead to accelerated neural maturation to enhance short-term survival (Callaghan & Tottenham, 2016), may provide one explanation of these findings. In line with the hypothesis, fetuses of mothers undergoing prenatal stress show more motor activity and increased heart rates compared to the fetuses of more relaxed mothers (Field, 2017). These behavioral alterations may reflect unpredictability and high demands for prenatal programming in the fetus, who subsequently grows to be better prepared and physically "trained" to survive in stressful postnatal environments. Such programming may take place, for example, through increased maternal stress hormones that impact fetal stress regulatory systems and neural development (Tobon, Stransky, Ross, & Stevens, 2016). Although a few consequences of the accelerated prenatal development due to mild or moderate stress exposure may be beneficial in terms of earlier motor development, disadvantages are more expected. Importantly, the pregnant Palestinian mothers in our study were exposed to toxic traumatic stress, involving threat-to-life, witnessing horrors, and material and human losses.

The disaster studies also specify that the timing of stress and trauma in pregnancy plays an important role in the intellectual development of infants, with the first trimester being the most vulnerable time (King & Laplante, 2005). The participating Palestinian

mothers faced major war trauma in their first trimester and, thus, the timing cannot explain the unexpected result of direct positive associations of trauma with infant motor and cognitive development.

4.3. Can trauma bring anything good?

In addition to the fetal programming (Glover et al., 2018) and stress acceleration hypotheses (Callaghan & Tottenham, 2016), research on resilience and post-traumatic growth might be helpful for understanding the direct link between war trauma and positive mother-infant interaction and advanced motor and cognitive infant development. Resilient war survivors can maintain their rewarding social relationships, optimistic future prospects and good everyday functioning; they can even blossom and learn from trauma (Bonanno, 2004; Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014). Those showing posttraumatic growth can interpret traumatic experiences as spiritual enlightenment, increased sense of social affiliation, and crystallization of meaning of life and own aspirations (Calhoun, Cann, Tedeschi, & McMillan, 2000). Both phenomena indicate that resourceful trauma survivors do not only manage to "keep the head above water" but also invest extra efforts to reach balance or gain compensatory strengths from hardships and adversities. The secret of resilience involves apt temperament, such as novelty-seeking, ability to provide and ask for help and social support, philosophical, ideological, and religious awareness to find meaning in trauma, as well as repertoires of multilevel processing and integration of trauma on cognitive, emotional, social, and physiological levels (Masten, 2010; Punamäki, 2014). A Palestinian study found that high post-traumatic growth could enable mothers to protect the emotional development of their infants from the negative impact of severe war trauma (Diab, Qouta, Isosävi, Kuittinen, & Punamäki, 2017).

We could not find studies on resilience among expecting or caring mothers who live in traumatic conditions. Yet, our findings suggest that traumatic war events can intensify mothers' efforts to protect their infants by creating positive interactions involving closeness, joy, and intimacy. This can be conceptualized as life-span salient resilience, as transition to parenthood is a decisive period for the dyad. Analogously, research in peaceful conditions provide evidence that certain infant-related stressors or even hardships, such as low birth weight (LBW) and developmental deficits, can intensify a mother's efforts to provide compensatory and sensitive care in order to enhance optimal child development. Mothers of pre-term infants indicate a high quality of emotional availability involving sensitive structuring and positive emotions (Korja, Latva, & Lehtonen, 2012), and mothers with infertility history indicate a high level of positive parenting and immunity to stressful events (Repokari et al., 2006). The present study suggests that exposure to war trauma may have caused similar, maybe evolutionary or universally significant, phenomenon of additional investments made by mothers for taking care of their vulnerable and precious offspring in highly dangerous environment. Yet, importantly, our mediating analyses specify that this intensified maternal care was only possible among mothers who did not suffer from mental health problems.

Trauma research suggests that the type of trauma is of importance for mental health consequences, but research is scarce for the effect of trauma on infant development. Survivors of interpersonal violence, particularly of early-life abuse and neglect, show more severe mental health symptoms than those of natural disasters or wars (Sezgin & Punamäki, 2019; McMillan & Asmundson, 2016). In this context, a Palestinian study confirmed that maternal interpersonal abuse had more negative impact than war trauma (2008/09 Gaza War) on infants' emotional development, which was indicated by emotional dysregulation and negative affectivity (Isosävi et al., 2017). We may further speculate that war trauma can involve certain social, collective, and ideological benefits that are not present in natural disasters, such as floods and ice storms, which may explain a few differences between our findings of positive links and severely negative impact of natural disasters on infant development. It is probably that mothers with infants are given particularly strong social support, encouragement, and even admiration in war conditions related to the Palestinian national struggle for independence and end of military siege. The reasons for the importance of trauma type are related to unique meanings that survivors give to their painful experiences, social support or rejection they receive, and degree of betrayal of their basic trust or core beliefs that they experience (Calhoun et al., 2000; Punamäki, 2014).

4.4. Strengths and limitations

A prospective research setting and reasonable sample size are the strengths of the current study. The limitations are the use of a mother's self-reports on mental health and mother-infant dyadic interaction as well as infant cognitive and sensorimotor development at six months of age. Clinical interviews would be more reliable in assessing maternal PTSD as well as depressive and somatization symptoms than self-reports that are biased and vulnerable to social desirability (Pawlby, Sharp, Hay, & O'Keane, 2008). Using video-recorded material and the emotional availability scoring system (Biringen, 2000) would have provided more objective information regarding the nuances of dyadic interaction. Again, it is possible that social desirability and values of good mothering lead to biased self-reports of mother-infant interaction toward more positive and caring levels. When children were 18 months of age, we utilized an Arabic Bayley testing battery as a more preferable tool to assess developmental skills. Finally, our measures of traumatic war events at T1 and T2 are disproportionate as in the event of delivery in maternity care (T1) we could only include five questions regarding material losses and threat-to-life in the midwifes' obstetric standards, while visiting mothers and infants in their homes or shelters (T2) it was possible to inquire about 22 possible traumatic war experiences.

Future research must pay attention to the use of appropriate methodology with regard to maternal mental health, mother-infant interaction and infant development. Further, subsequent research could focus more specifically on the risk and resilience-promoting factors within families living in war conditions.

5. Conclusions

Human rights organizations like Save the Children warn that expecting mothers, fetuses, and infants are particularly vulnerable to traumatic war experiences. The core experience in war is threat-to-life, experienced in near misses, witnessing others dying, and fearing for the safety of children and family. The concern regarding human rights become urgent in the light of the contemporary knowledge of the long-term impact of maternal pre- and postnatal stress on human development (2017, Field, 2011; Clover et al., 2010; 2018). Thus, mothers and their infants in war conditions need tailored help in order to prevent maternal mental health problems interfering with the protecting dyadic interactions and further human development.

CRediT authorship contribution statement

Samir R. Qouta: Conceptualization, Investigation, Data curation, Writing - original draft. **Mervi Vänskä:** Writing - original draft. **Safwat Y. Diab:** Investigation, Writing - original draft. **Raija-Leena Punamäki:** Conceptualization, Supervision, Writing - review & editing.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.infbeh.2021.101532.

References

Agrati, D., Browne, D., Jonas, W., Meaney, M., Atkinson, L., Steiner, M., & Fleming, A. (2015). Maternal anxiety from pregnancy to two years postpartum: Transactional patterns of maternal early adversity and child temperament. *Archives of Women's Mental Health, 18*, 693–705. https://doi.org/10.1007/s00737-014-0491-y.

Aoyagi, S., Takei, N., Nishimura, T., Nomura, Y., Tsuchiya, K., & Stojanovik, V. (2019). Association of late-onset postpartum depression of mothers with expressive language development during infancy and early childhood: The HBC study. *Peer J—The Journal of Life and Environmental Sciences, 7*(3), Article e6566. https://doi.org/10.7717/peerj.6566.

Austin, M. P., Christl, B., McMahon, C., Kildea, S., Reilly, N., Yin, C., … King, S. (2017). Moderating effects of maternal emotional availability on language and cognitive development in toddlers of mothers exposed to a natural disaster in pregnancy: The QF2011 Queensland Flood Study. *Infant Behavior & Development, 49*, 296–309. https://doi.org/10.1016/j.infbeh.2017.10.005.

Baheree, A. R. (2013). *Standardization of bayley scales of infant development Cairo: El Nahda el massriah* (fourth edition). (In Arabic).

Berkowitz, G. S., Wolff, M. S., Janevic, T. M., Holzman, I. R., Yehuda, R., & Landrigan, P. J. (2003). The World Trade Center disaster and intrauterine growth restriction. *JAMA the Journal of the American Medical Association, 290*(5), 595–596. https://doi.org/10.1001/jama.290.5.595-b.

Biringen, Z. (2000). Emotional availability: Conceptualization and research findings. *The American Journal of Orthopsychiatry, 70*(1), 104–114.

Biringen, Z., Matheny, A., Bretherton, I., Renouf, A., & Sherman, M. (2000). Maternal representation of the self as parent: Connections with maternal sensitivity and maternal structuring. *Attachment & Human Development, 2*(2), 218–232.

Biringen, Z., Vliegen, N., Bijttebier, P., & Cluckers, G. (2002). *The emotional availability self- report*. Retrieved from http://www.emotionalavailability.com.

Bisson, J. I., Cosgrove, S., Lewis, C., & Robert, N. P. (2015). Post-traumatic stress disorder. *BMJ (Clinical Research Ed), 351*, h6161. https://doi.org/10.1136/bmj.h6161.

Bonanno, G. A. (2004). Loss, trauma, and human resilience—have we underestimated the human capacity to thrive after extremely aversive events? *The American Psychologist, 59*(1), 20–28. https://doi.org/10.1037/0003-066x.59.1.20.

Brand, S. R., Engel, S. M., Canfield, R. L., & Yehuda, R. (2006). The effect of maternal PTSD following in utero trauma exposure on behavior and temperament in the 9-month-old infant. *Annals of the New York Academy of Science, 1071*, 454–458. https://doi.org/10.1196/annals.1364.041.

Calhoun, L. G., Cann, A., Tedeschi, R. G., & McMillan, J. (2000). A correlational test of the relationship between posttraumatic growth, religion, and cognitive processing. *Journal of Traumatic Stress, 13*(3), 521–527. https://doi.org/10.1023/A:1007745627077.

Callaghan, B. L., & Tottenham, N. (2016). The stress acceleration hypothesis: Effects of early-life adversity on emotion circuits and behavior. *Current Opinion in Behavioral Sciences, 7*, 76–81. https://doi.org/10.1016/j.cobeha.2015.11.018.

Charlson, F., van Ommeren, M., Flaxman, A., Cornett, J., Whiteford, H., & Saxena, S. (2019). New WHO prevalence estimates of mental disorders in conflict settings: A systematic review and meta-analysis. *Lancet, 394*(10194), 240–248. https://doi.org/10.1016/S0140-6736(19)30934-1.

Chemtob, C. M., Nomura, Y., Rajendran, K., Yehuda, R., Schwartz, D., & Abramovitz, R. (2010). Impact of maternal posttraumatic stress disorder and depression following exposure to the September 11 attacks on preschool children's behavior. *Child Development, 81*(4), 1129–1141.

Cluxton-Keller, F., & Bruce, M. L. (2017). Clinical effectiveness of family therapeutic interventions in the prevention and treatment of perinatal depression: A systematic review and meta-analysis. *PloS One*. https://doi.org/10.1371/journal.pone.0198730. June 14, 2018.

Cook, N., Ayers, S., & Horsch, A. (2018). Maternal posttraumatic stress disorder during the perinatal period and child outcomes: A systematic review. *Journal of Affective Disorders, 225*, 18–31. https://doi.org/10.1016/j.jad.2017.07.045.

Cooklin, A. R., Giallo, R., D'Esposito, F., Crawford, S., & Nicholson, J. M. (2013). Postpartum maternal separation anxiety, overprotective parenting, and children's social-emotional well-being: Longitudinal evidence from an Australian cohort. *Journal of Family Psychology, 27*, 618–628. https://doi.org/10.1037/a0033332.

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry, 150*(6), 782–786.

Crittenden, P. M. (2006). A dynamic-maturational model of attachment. *The Australian and New Zealand Journal of Family Therapy, 27*(2), 105–115.

Crugnola, C. R., Gazzotti, S., Spinelli, M., Ierardi, E., Caprin, C., & Albizzati, A. (2013). Maternal attachment influences mother–infant styles of regulation and play with objects at nine months. *Attachment & Human Development, 15*(2), 107–131. https://doi.org/10.1080/14616734.2013.745712.

Davey, H. L., Tough, S. C., Adair, C. E., & Benzies, K. M. (2011). Risk factors for sub-clinical and major postpartum depression among a community cohort of Canadian women. *Maternal and Child Health Journal, 15*(7), 866–875. https://doi.org/10.1007/s10995-008-0314-8.

Del Giudice, M. (2012). Fetal programming by maternal stress: Insights from a conflict perspective. *Psychoneuroendocrinology, 37*(10), 1614–1629. https://doi.org/10.1016/j.psyneuen.2012.05.014.

Diab, S. Y., Qouta, S. R., Isosävi, S., Kuittinen, S., & Punamäki, R. L. (2017). The protective role of maternal posttraumatic growth and cognitive trauma processing among Palestinian mothers and infants. *Infant Behavior & Development*. https://doi.org/10.1016/j.infbeh.2017.05.008, 4.10.2016.

Dietz, L. J., Jennings, K. D., Kelley, S. A., & Marshall, M. (2009). Maternal depression, paternal psychopathology, and toddlers' behavior problems. *Journal of Clinical Child and Adolescent Psychology : the Official Journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53, 38*, 48–61. https://doi.org/10.1080/15374410802575362.

DiPietro, J. A., Novak, M. F., Costigan, K. A., Atella, L. D., & Reusing, S. P. (2006). Maternal psychological distress during pregnancy in relation to child development at age two. *Child Development, 77*(3), 573–587.

Edhborg, M., Lundh, W., Seimyr, L., & Widström, A. M. (2003). The parent-child relationship in the context of maternal depressive mood. *Archives of Women's Mental Health, 6*, 211–216. https://doi.org/10.1007/s00737-003-0020-x.

Feldman, R. (2012). Oxytocin and social affiliation in humans. *Hormones and Behavior, 61*, 380–391. https://doi.org/10.1016/j.yhbeh.2012.01.008.

Feldman, R., Granat, A., Pariente, C., Kanety, H., Kuint, J., & Gilboa-Schechtman, E. (2009). Maternal depression and anxiety across the postpartum year and infant social engagement, fear regulation, and stress reactivity. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*, 919–927. https://doi.org/10.1097/CHI.0b013e3181b21651.

Fellmeth, G., Fazel, M., & Plugge, E. (2017). Migration and perinatal mental health in women from low-and middle-income countries: A systematic review and meta-analysis. *BJOG: An International Journal of Obstetrics & Gynecology, 124*(5), 742–752. https://doi.org/10.1111/1471-0528.14184.

Field, T. (2011). Prenatal depression effects on early development: A review. *Infant Behavior & Development, 34*(1), 1–14. https://doi.org/10.1016/j.infbeh.2010.09.008.

Field, T. (2017). Prenatal anxiety effects: A review. *Infant Behavior & Development, 49*, 120–128. https://doi.org/10.1016/j.infbeh.2017.08.008.

Figueiredo, B., & Conde, A. (2011). Anxiety and depression in women and men from early pregnancy to 3-months postpartum. *Archives of Women's Mental Health, 14*, 247–255. https://doi.org/10.1007/s00737-011-0217-3.

Freud, A., & Burlingham, D. (1943). *Children and war*. London: Medical War Books.

Gagnon, A. J., Dougherty, G., Wahoush, O., Saucier, J.-F., Dennis, C. L., Stanger, E., & Stewart, D. E. (2013). International migration to Canada: the post-birth health of mothers and infants by immigration class. *Social Science & Medicine, 76*, 197–207.

Gavin, I., Gaynes, N., Lohr, N., Meltzer-Brody, N., Gartlehner, N., & Swinson, N. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics and Gynecology, 106*(5, Part 1), 1071–1083. https://doi.org/10.1097/01.AOG.0000183597.31630.db.

Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry, 3*(10), 973–982. https://doi.org/10.1016/S2215-0366(16)30284-X.

Ghubash, R., Abou-Saleh, M. T., & Daradkeh, T. K. (1997). The validity of the Arabic Edinburgh postnatal depression scale. *Social Psychiatry and Psychiatric Epidemiology, 32*(8), 474–476.

Glover, V., O'Connor, T., & O'Donnell, K. (2010). Prenatal stress and the programming of the HPA axis. *Neuroscience and Biobehavioral Reviews, 35*(1), 17–22. https://doi.org/10.1016/j.neubiorev. 2009.11.008.

Glover, V., O'Donnell, K., O'Connor, T., Fisher, J., Doyle, C., & Cicchetti, D. (2018). Prenatal maternal stress, fetal programming, and mechanisms underlying later psychopathology. A global perspective. *Development and Psychopathology, 30*(3), 843–854.

Grace, S. L., Evindar, A., & Stewart, D. E. (2003). The effect of postpartum depression on child cognitive development and behavior: A review and critical analysis of the literature. *Archives of Women's Mental Health, 6*(4). https://doi.org/10.1007/s00737-003-0024-6, 263-227.

Graignic-Philippe, R., Dayan, J., Chokron, S., Jacquet, A., & Tordjman, S. (2014). Effects of prenatal stress on fetal and child development: A critical literature review. *Neuroscience and Biobehavioral Reviews, 43*, 137–162. https://doi.org/10.1016/j.neubiorev.2014.03.022.

Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology, 27*(1-2), 199–220. https://doi.org/10.1016/s0306-4530(01)00045-2.

Harville, E., Xiong, X., & Buekens, P. (2010). Disasters and perinatal health: A systematic review. *Obstetrical & Gynecological Survey, 65*(11), 713–728. https://doi.org/10.1097/OGX.0b013e31820eddbe.

Holodynski, M., & Friedlmeier, W. (2006). *Development of emotions and emotion regulation*. New York: Springer Science & Business Media.

Ibanez, G., Bernard, J., Rondet, C., Peyre, H., Forhan, A., Kaminski, M., … Tsuchiya, K. (2015). Effects of antenatal maternal depression and anxiety on children's early cognitive development: A prospective cohort study. *PloS One, 10*(8), Article e0135849. https://doi.org/10.1371/journal.pone.0135849.

Isosävi, S., Diab, S. Y., Kangaslampi, S., Qouta, S., Kankaanpää, S., Puura, K., & Punamäki, R. (2017). Maternal trauma affects prenatal mental health and infant stress regulation among Palestanian dyads. *Infant Mental Health Journal, 38*(5), 617–633. https://doi.org/10.1002/imhj.21658.

Isosävi, S., Kuittinen, S., Quota, S., Diab, S., & Punamäki, R.-L. (2020). Caregiving representations in war conditions: Associations with maternal trauma, mental health, and mother-infant interaction. *Infant Mental Health Journal*. https://doi.org/10.1002/imhj.21841.

Kaitz, M., Levy, M., Ebstein, R., Faraone, S. V., & Mankuta, D. (2009). The intergenerational effects of trauma from terror: A real possibility. *Infant Mental Health Journal, 30*(2), 158–179. https://doi.org/10.1002/imhj.20209.

Karam, F., Sheehy, O., Huneau, M. C., Chambers, C., Fraser, W. D., Johnson, D., … St-André, M. (2016). Impact of maternal prenatal and parental postnatal stress on one-year-old child development: Results from the OTIS antidepressants in pregnancy study. *Archives of Women's Mental Health, 19*(5), 835–843. https://doi.org/10.1007/s00737-016-0624-0626.

King, S., & Laplante, D. (2005). The effects of prenatal maternal stress on children's cognitive development: Project Ice Storm. *Stress, 8*(1), 35–46. https://doi.org/10.1080/10253890500108391.

King, S., Kildea, S., Austin, M. P., Brunet, A., Cobham, V. E., Dawson, P. A., … McIntyre, H. D. (2015). QF2011: A protocol to study the effects of the Queensland flood on pregnant women, their pregnancies, and their children's early development. *BMC Pregnancy and Childbirth, 15*(1), 109. https://doi.org/10.1186/s12884-015-0539-7.

Kingston, D., McDonald, S., Austin, M. P., & Tough, S. (2015). Association between prenatal and postnatal psychological distress and toddler cognitive development: A systematic review. *PloS One, 10*(5), Article e0126929.

Kingston, D., Tough, S., & Whitfield, H. (2012). Prenatal and postpartum maternal psychological distress and infant development: A systematic review. *Child Psychiatry and Human Development, 43*(5), 683–714. https://doi.org/10.1007/s10578-012-0291-4.

Kopparthi, R.1, McDermott, C., Sheftel, D., Lenke, M. C., Getz, M., & Frey, M. (1991). The Minnesota Child Development Inventory: Validity and reliability for assessing development in infancy. *Journal of Developmental and Behavioral Pediatrics : JDBP, 2*(4), 217–222.

Korja, R., Latva, R., & Lehtonen, L. (2012). The effects of preterm birth on mother–infant interaction and attachment during the infant's first two years. *Acta Obstetricia et Gynecologica Scandinavica, 91*(2), 164–173. https://doi.org/10.1111/j.1600-0412.2011.01304.x.

Landrigan, P. J., Forman, J., Galvez, M., Newman, B., Engel, S. M., & Chemtob, C. (2008). Impact of September 11 World Trade Center disaster on children and pregnant women. *Mount Sinai Journal of Medicine A Journal of Translational and Personalized Medicine, 75*(2), 129–134.

Laplante, D. P., Barr, R. G., Brunet, A., Galbaud, G., Du Fort, M., Meaney, L., Saucier, J. F., … King, S. (2004). Stress during pregnancy affects general intellectual and language functioning in human toddlers. *Pediatric Research, 56*(3), 400–410. https://doi.org/10.1203/01.PDR.0000136281.34035.44.

Laplante, D., Brunet, A., Schmitz, N., Ciampi, A., & King, S. (2008). Project Ice Storm: Prenatal maternal stress affects cognitive and linguistic functioning in 5 1/2-year-old children. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(9), 1063–1072. https://doi.org/10.1097/CHI.0b013e31817eec80.

Laplante, D. P., Zelazo, P. R., Brunei, A., & King, S. (2007). Functional play at 2 years of age: Effects of prenatal maternal stress. *Infancy, 12*(1), 69–93. https://doi.org/10.1111/j.1532-7078.2007.tb00234.x.

LeBeau, R., Mischel, E., Resnick, H., Kilpatrick, D., Friedman, M., & Craske, M. (2014). Dimensional assessment of posttraumatic stress disorder in DSM-5. *Psychiatry Research, 218*(1-2), 143–147. https://doi.org/10.1016/j.psychres.2014.03.032.

Lederman, S. A., Jones, R. L., Caldwell, K. L., Rauh, V., Sheets, S. E., Tang, D., & Perera, F. P. (2008). Relation between cord blood mercury levels and early child development in a World Trade Center cohort. *Environmental Health Perspectives, 116*(8), 1085–1091. https://doi.org/10.1289/ehp.10831.

Letourneau, N., Dennis, C., Cosic, N., & Linder, J. (2017). The effect of perinatal depression treatment for mothers on parenting and child development: A systematic review. *Depression and Anxiety, 34*(10), 928–966. https://doi.org/10.1002/da.22687.

Letourneau, N., Watson, B., Duffett-Leger, L., Hegadoren, K., & Tryphonopoulos, P. (2011). Cortisol patterns of depressed mothers and their infants are related to maternal–infant interactive behaviors. *Journal of Reproductive and Infant Psychology, 29*, 439–459. https://doi.org/10.1080/02646838.2011.649474.

Levy, M. (2006). Maternity in the wake of terrorism: Rebirth or retraumatization? *Journal of Prenatal & Perinatal Psychology & Health, 20*(3), 221–248.

Lyytinen, P., Ahonen, T., Eklund, K., & Lyytinen, H. (2000). *Assessment of vocal and motoric development in infancy*. Jyväskylä: Niilo Mäki Instituutti (in Finnish).

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99–128. https://doi.org/10.1207/s15327906mbr3901_4.

Manduca, P., Diab, S. Y., Qouta, S. R., Albarqouni, N. M. A., & Punamäki, R.-L. (2017). A cross sectional study of the relationship between the exposure of pregnant women to military attacks in 2014 in Gaza and the load of heavy metal contaminants in the hair of mothers and newborns. *British Medical Journal Open, 7*, e014–035. https://doi.org/10.1136/bmjopen-2016-014035.

McGrath, J. M., Records, K., & Rice, M. (2008). Maternal depression and infant temperament characteristics. *Infant Behavior & Development, 31*, 71–80. https://doi.org/10.1016/j.infbeh.2007.07.001.

Milgrom, J., Westley, D., & Gemmill, A. (2004). The mediating role of maternal responsiveness in some longer term effects of postnatal depression on infant development. *Infant Behavior & Development, 27*(4), 443–454. https://doi.org/10.1016/j.infbeh.2004.03.003.

Mirhosseini, H., Moosavipoor, S. A., Nazari, M. A., Dehghan, A., Mirhosseini, S., Bidaki, R., & Yazdian-anari, P. (2015). Cognitive behavioral development in children following maternal postpartum depression: A review article. *Electronic Physician, 7*, 1673–1679. https://doi.org/10.19082/1673.

Mollica, R. F., Caspi-Yavin, Y., Bollini, P., Truong, T., Tor, S., & Lavelle, J. (1992). The Harvard Trauma Questionnaire. Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *Journal of Nervous and Mental Disorders, 180*, 111–116. https://doi.org/10.1097/00005053-199202000-00008.

Morina, N., Stam, K., Pollet, T. V., & Priebe, S. (2018). Prevalence of depression and posttraumatic stress disorder in adult civilian survivors of war who stay in war-afflicted regions. A systematic review and meta-analysis of epidemiological studies. *Journal of Affective Disorders, 239*, 328–338. https://doi.org/10.1016/j.jad.2018.07.027.

Moss, K., Simcock, G., Cobham, V., Kildea, S., Elgbeili, G., Laplante, D., & King, S. (2017). A potential psychological mechanism linking disaster-related prenatal maternal stress with child cognitive and motor development at 16 months: The QF2011 Queensland flood study. *Developmental Psychology, 53*(4), 629–641. https://doi.org/10.1037/dev0000272.

Muzik, M., Bocknek, E., Broderick, A., Richardson, P., Rosenblum, K., Thelen, K., & Seng, J. (2013). Mother–Infant bonding impairment across the first six months postpartum: The primacy of psychopathology in women with childhood abuse and neglect histories. *Archives of Women's Mental Health, 16*(1), 29–38. https://doi.org/10.1007/s00737-012-0312-0.

Nomura, Y., Davey, K., Pehme, P., Finik, J., Glover, V., Zhang, W., … Ham, J. (2019). Influence of in utero exposure to maternal depression and natural disaster-related stress on infant temperament at 6 months: The children of Superstorm Sandy. *Infant Mental Health Journal, 40*(2), 204–216. https://doi.org/10.1002/imhj.21766.

OCHA. (2016). *Gaza: Two Years since the 2014 hostilities*. Retrieved 3.8.2016 from https://www.ochaopt.org/content/gaza-two-years-2014-hostilities-august-2016.

Oni, O., Harville, E., Xiong, X., & Buekens, P. (2015). Relationships among stress coping styles and pregnancy complications among women exposed to Hurricane Katrina. *Journal of Obstetric Gynecology and Neonatal Nursing, 44*(2), 256–267. https://doi.org/10.1111/1552-6909.12560.

Oruc, L., Kapetanovic, A., Pojskic, N., Miley, K., Forstbauer, S., Richard, F., … Henderson, D. C. (2009). Screening for PTSD and depression in Bosnia and Herzegovina: Validating the harvard trauma questionnaire and the hopkins symptom checklist. *International Journal of Culture and Mental Health, 1*(2), 105–116. https://doi.org/10.1080/17542860802456620.

Pawlby, S., Sharp, D., Hay, D., & O'Keane, V. (2008). Postnatal depression and child outcome at 11 years: The importance of accurate diagnosis. *Journal of Affective Disorders, 107*, 241–245. https://doi.org/10.1016/j.jad.2007.08.002.

Piek, J. P. (2006). *Infant motor development*. Champaign, IL: Human Kinetics.

Poobalan, A., Aucott, L., Ross, L., Smith, W., Helms, P., & Williams, J. (2007). Effects of treating postnatal depression on mother-infant interaction and child development: Systematic review. *The British Journal of Psychiatry : the Journal of Mental Science, 191*, 378–386.

Pulcino, T., Galea, S., Ahern, J., Resnick, H., Foley, M., & Vlahov, D. (2003). Posttraumatic stress in women after the September 11 terrorist attacks in New York City. *Journal of Women's Health, 12*(8), 809–820.

Punamäki, R. L. (2014). Mental health and development among children living in violent conditions: Underlying mechanisms for promoting peace. In P. Britto, J. F. Leckman, C. Panter–Brick, & R. Salah (Eds.), *Pathways to peace: The transformative power of children and families. Strüngmann Forum reports* (vol 15). Cambridge, MA: MIT Press. J Lupp, series ed.

Punamäki, R., Isosävi, S., Qouta, S. R., Kuittinen, S., & Diab, S. Y. (2017). War trauma and maternal–fetal attachment predicting maternal mental health, infant development, and dyadic interaction in Palestinian families. *Attachment & Human Development, 19*(5), 463–486. https://doi.org/10.1080/14616734.2017.1330833.

Repokari, L., Punamäki, R., Poikkeus, P., Tiitinen, A., Vilska, S., Unkila-Kallio, L., … Tulppala, M. (2006). Ante- and perinatal factors and child characteristics predicting parenting experience among formerly infertile couples during the child's first year: A controlled study. *Journal of Family Psychology, 20*(4), 670–679. https://doi.org/10.1037/0893-3200.20.4.670.

Robson, L. (2017). Refugees and the case for international authority in the Middle East: The league of nations and the united nations relief and works agency for palestinian refugees in the Near East Compared. *International Journal of Middle East Studies, 49*(4). https://doi.org/10.1017/S0020743817000629, 625-250.

Rocha, N., dos Santos Silva, F., dos Santos, M., & Dusing, S. (2019). Impact of mother–Infant interaction on development during the first year of life: A systematic review. *Journal of Child Health Care.* , Article 1367493519864742. https://doi.org/10.1177/1367493519864742.

Salo, J. A., Qouta, S., & Punamäki, R.-L. (2005). Adult attachment, posttraumatic growth and negative emotions among former political prisoners. *Anxiety, Stress, and Coping, 18*, 361–378. https://doi.org/10.1080/10615800500289524.

Save the Children. (2014). *State of the world's mothers 2014*. Retrieved from: http://www.savethechildren.org/atf/cf/%7B9def2ebe-10ae-432c-9bd0-df91d2eba74a%7D/SOWM_2014.PDF.

Seymour, M., Giallo, R., Cooklin, A., & Dunning, M. (2015). Maternal anxiety, risk factors, and parenting in the first post-natal year. *Child: Care, Health and Development, 41*, 314–323. https://doi.org/10.1111/cch.12178.

Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: Interdisciplinary perspectives. *European Journal of Psychotraumatology, 5*(1), 25338.

Stern, D. N. (1985). *The interpersonal world of the infant*. New York: Basic books.

Stewart, D. E., Gagnon, A., Saucier, J.-F., Wahoush, O., & Dougherty, G. (2008). Postpartum depression symptoms in newcomers. *The Canadian Journal of Psychiatry, 53*(2), 121–124. https://doi.org/10.1177/070674370805300208.

Taubman-Ben-Ari, O., Rabinowitz, J., Feldman, D., & Vaturi, R. (2001). Post-traumatic stress disorder in primary-care settings: Prevalence and physicians' detection. *Psychological Medicine, 31*(3), 555–560. https://doi.org/10.1017/S0033291701003658.

Tobon, A. L., Stransky, A. D., Ross, D., & Stevens, H. (2016). Effects of maternal prenatal stress: Mechanisms, implications, and novel therapeutic interventions. *Biological Psychiatry, 80*(11), e85–e87. https://doi.org/10.1016/j.biopsych.2016.09.011.

UN High Commission for Refugees. (2016). *Global trends, 2016*. https://www.unhcr.org/global-trends-2016-media.html?.

UN Human Rights Council. (2014). *The united nations independent commission of inquiry on the 2014 Gaza conflict*. Retrieved from: http://www.ohchr.org/EN/HRBodies/HRC/CoIGaza/Conflict/Pages/ReportCoIGaza.aspx.

Van den Bergh, B., van den Heuvel, M. I., Lahti, M., Braeken, M., de Rooij, S., Entringer, S., & Schwab, M. (2017). Prenatal developmental origins of behavior and mental health: The influence of maternal stress in pregnancy. *Neuroscience and Biobehavioral Reviews*. https://doi.org/10.1016/j.neubiorev.2017.07.003.

Van Ee, E., Kleber, R. J., & Mooren, T. T. (2012). War trauma lingers on: Associations between maternal posttraumatic stress disorder, parent-child interaction, and child development. *Infant Mental Health Journal, 33*(5), 459–468. https://doi.org/10.1002/imhj.21324.

Van Ee, E., Kleber, R. J., Jongmans, M. J., Mooren, T. T., & Out, D. (2016). Parental PTSD, adverse parenting, and child attachment in a refugee sample. *Attachment & Human Development, 18*(3), 273–291. https://doi.org/10.1080/14616734.2016.1148748.

Vliegen, N., Luyten, P., & Biringen, Z. (2009). A multimethod perspective on emotional availability in the postpartum period. *Parenting, Science and Practice, 9*(3-4), 228–243.

Woody, C., Ferrari, A., Siskind, D., Whiteford, H., & Harris, M. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *Journal of Affective Disorders, 219*, 86–92. https://doi.org/10.1016/j.jad.2017.05.003.

Zijlmans, M., Riksen-Walraven, J., & de Weerth, C. (2015). Associations between maternal prenatal cortisol concentrations and child outcomes: A systematic review. *Neuroscience and Biobehavioral Reviews, 53*, 1–24. https://doi.org/10.1016/j.neubiorev.2015.02.015.