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Prenatal and postnatal intimate partner violence, depression, and infant-mother touch

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ABSTRACT

Touch is a primary form of communication for mother-infant dyads in the infant's first year of life. Stressors such as intimate partner violence (IPV) and maternal depression experienced during the perinatal period may interfere with mother-infant touch via prenatal programming of the stress response and disrupted parenting. Mother-infant touch research typically focuses on maternal touch, while research on infant touch is limited. However, research suggests that infants sometimes lead interactive behavior, with mothers responding and adapting to their infants. Therefore, the aim of the present study was to examine the effects of IPV and maternal depression on infant-led touch interactions and maternal touch responses. Touch behaviors were coded in 174 mother-infant dyads while they engaged in a free play. ANCOVA analyses indicated that male infants with pre- or postnatal IPV exposure initiated more negative touch (e.g., hitting, kicking, pushing) with their mothers than female or nonexposed male infants. IPV did not predict differences in maternal touch responses to infants, while postpartum depressive symptoms were associated with maternal decreased touch responsiveness to male infant touch. The results suggest that male infant touch behavior is particularly susceptible to prenatal or postnatal exposure to IPV. Importantly, aggressive behavior in early childhood predicts more aggressive behavior across time, and these early negative touch behaviors may be indicative of the beginning of a trajectory of increased physical aggression into childhood, adolescence, and adulthood. Moreover, the results support extant findings that prenatal life is a sensitive period for postnatal development, including postnatal socially interactive behavior. Finally, depressed mothers of male infants exhibited decreased touch responsiveness, suggesting that depression may alter maternal interpretation of male infant cues, resulting in maternal withdrawal.

1. Introduction

Within the context of the mother-infant relationship, infants begin to learn self-regulation, develop expectations of others' behavior, and engage in dynamic back-and-forth interactions with their mothers (Beebe, Lachmann, & Jaffe, 1997; for review see Fonagy, 2010; Hertenstein, 2002). While this interactive behavior between infants and their mothers is mutually responsive and bidirectional, it is also asymmetrical (Beebe *et al.* 2016; Chow, Haltigan, & Messinger, 2010). Within any specific interaction, an infant's behavior likely shapes maternal behavior to a greater degree than vice versa (Beebe et al., 2016). This asymmetry in influence

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(seen in emotional, physiological, and behavioral indicators) is considered optimal in early infancy because it can initiate maternal attunement to the infant's states, responsive parenting, and regulatory behavior (e.g., Feldman, 2006). During infancy, particularly when the infant is pre-verbal, touch is an important form of interactive behavior between mother and infant (e.g., Hertenstein, 2002). Mothers use touch to respond to infant needs, communicate safety, and teach infants how to regulate and care for themselves (e.g., Ciaunica & Crucianelli, 2019). Though infants touch their mothers less than vice versa, infants increasingly initiate touch interactions by one year of age to communicate their needs and internal states to their mothers (Hertenstein, 2002; Ferber, Feldman, & Makhoul, 2008; Kaye & Fogel, 1980). However, infant-mother interactive touch behavior may be disrupted by risk factors, such as maternal depression or intimate partner violence (IPV) that interfere with mother-infant contact, self-regulatory behavior, and the psychological or physiological perception of touch (e.g., D'Andrea, Pole, DePierro, Freed & Wallace, 2013; Feldman, Keren, Gross-Rozval, & Tyano, 2004; Herrera, Reissland, & Shepherd, 2004).

Despite the detrimental effects of IPV and depression on infant-mother interactive *behavior*, research is limited on their effects on infant-mother *touch*. Understanding the context within which touch is occurring is likely important for understanding the implications of individual differences in touch behavior (Gliga, Farroni, & Cascio, 2019). In addition, maternal touch has often been examined independently of infant touch (noted by Crucianelli *et al.* 2019). Such a coding scheme makes it unclear which member of the dyad initiated the touch interaction. As previously noted, one-year-old infants also initiate touch behavior, which can shape maternal interactive behavior, though this is understudied (e.g., Beebe et al., 2016). In addition, by one year of age, infants exposed to IPV already display behavioral and interactive changes reflective of trauma symptoms (Bogat, DeJonghe, Levendosky, Davidson, & von Eye, 2006). Therefore, the aim of this study was to better understand infant-mother touch and whether risk factors, such as IPV and maternal depression, during pregnancy and postpartum are associated with differences in infant touching of the mother and the subsequent maternal touch response to the infant during an infant-initiated touch interaction.

1.1. Touch within the infant-mother relationship

Infant-mother touch is an important, though under-researched (see Botero, Langley, & Venta, 2020), component of the early caregiving relationship, particularly when the attachment system is activated and the infant perceives a threat and turns to the mother (or other primary caregiver) for security (Bowlby, 1969/1982; Hertenstein, 2002). During infancy, the child is entirely dependent on primary caregivers for safety, care, and regulation. A caregiver's ability to perceive the infant's mental state and conceptualize the infant's thoughts and feelings (i.e., mind-mindedness) helps the caregiver to respond in a way that is attuned to the infant. Attuned and consistent caregiver responding in turn shapes the infant's attachment style and expectations of care in close relationships throughout the lifespan (Bowlby, 1969/1982; Meins, Fernyhough, Fradley, & Tuckey, 2001). Caregivers are limited in how they can communicate safety and promote regulation in infants due to the infant's immature cognitive and emotional developmental state (Brazelton & Cramer, 1990; Hertenstein, 2002; Stack, 2001). However, the infant can use touch to help caregivers organize their behavior to be responsive to the infant's needs (Ferber et al., 2008; Kaye & Fogel, 1980). Infant-mother touch is a dynamic process that involves mutual influence and co-regulation (Hertenstein, 2002). During an interaction, mother and infant continuously adjust to one another, with mothers adjusting more to their infants than infants to their mothers (Beebe et al., 2016; Fogel & Garvey, 2007). How they adjust is informed by maternal and infant states, prior behaviors, the immediate context, a mother's ability to mentalize her infant, and the expectations developed within the context of the infant-mother relationship (e.g., Brzozowska, Longo, Mareschal, Wiesemann, & Gliga, 2021; Crucianelli et al., 2019; Cohn & Tronick, 1989). For touch specifically, prior infant-mother touch interactions create patterns and expectations that continue to be shaped by experience and infant development. Despite evidence to suggest a significant role for the influence of infant behavior on maternal behavior, research has typically focused on maternal touch of the infant and the implications of this touch for infants, rather than on infant touch of the mother and the implications of this touch for mothers.

Between 5 months and 1 year of age, infants learn to initiate touch, understand reciprocity in touch, and develop expectations about whether and how their needs will be met when they touch their mother (Cohn & Tronick, 1989; Feldman, 2010; Kaye, 1982; Moszkowski, Stack, & Chiarella, 2009; Tronick et al., 1978). The limited research suggests that infant touch has implications for both infants and their mothers. Infant touch, including self-touch, is associated with the development of infant self-regulation (Murray & Trevarthen, 1985; Toda & Fogel, 1993; Weinberg & Tronick, 1994). Infants engage in more self-touch when emotionally dysregulated, such as when their mothers are disengaged or emotionally unavailable (Weinberg & Tronick, 1996). The goal of self-touch may be two-fold – engaging in self-soothing touch to manage distress and eliciting maternal caregiving behavior by alerting a mother to her infant's inner state (Moszkowski et al., 2009; Tronick, 1989; Gianino & Tronick, 1988). Infant touch of the mother may also cue the mother to the infant's need for attention or regulation. In addition, infant touch may affect maternal biology to promote caretaking behavior. Infant touch during breastfeeding (i.e., hand stimulation and sucking behavior) or during an interaction, for example, increases maternal oxytocin production and release, which is associated with increased maternal bonding (Feldman, Gordon & Zagoory-Sharon, 2011; Matthiesen, Ransjö-Arvidson, Nissen, & Uvnäs-Moberg, 2001).

Research on infant-mother touch suggests that mothers typically touch their infants most during the first six months of the infant's life, when touch is one of the primary ways a mother can communicate with her infant and modulate the infant's arousal (Hertenstein, 2002; Kaye & Fogel, 1980; Stern, 1985; Tronick, 1995). As a mother perceives changes in her infant's needs across infancy, she may adjust the quality and quantity of her touch in response (e.g., Crucianelli et al., 2019; Field, Vega-Lahr, Goldstein, & Scafidi, 1987; Jean, Stack, & Fogel, 2009). Over the second six months of life, mothers continue to adjust their touch in response to the infant's increased independence, with maternal touch decreasing and dyadic reciprocity increasing (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983; Ferber *et al.* 2008; Field et al., 1987). A critical component of attachment is how sensitive and appropriately responsive a mother is to her infant's cues. Indeed, infants of mothers who are attuned to their infant's mental state are more likely to demonstrate

secure attachment (Meins et al., 2001).

How infant and mother touch one another may depend on multiple factors, such as the context, the purpose of the touch (e.g., getting the other's attention, feeding, or seeking/providing comfort), maternal and infant health (e.g., Herrera et al., 2004; Harrison & Woods, 1991; Mantis & Stack, 2018), maternal attunement to the infant (e.g., Crucianelli et al., 2019), and infant sex. Research has found that mothers use certain types of touch more with their infant sons (e.g., stimulating touch) or their infant daughters (e.g., instrumental touch) (Feldman & Eidelman, 2004). Research has not demonstrated sex differences with regard to how infants touch their mother, although research does suggest that male infants may be more reactive and respond with more "conflict behavior" (i.e., anger, resisting physical contact) than female infants when mothers consistently do not respond adequately to their attachment needs (Lyons-Ruth, Bronfman & Parsons, 1999; Moszkowski & Stack, 2007).

1.2. Perinatal IPV, maternal depression, and infant touch

IPV is a common stressor among adult women (O'Leary, 1999), particularly during the peripartum period (e.g., Finnbogadóttir & Dykes, 2016; Gazmararian *et al.* 2000). Approximately 33% of women report experiencing IPV during pregnancy and 1 year postpartum (Charles and Perreira, 2007). Therefore, mothers and their infants may be exposed to violence during periods that are critical for the developing infant-mother relationship. Exposure to IPV is associated with detrimental effects to mothers (e.g., mental health, bonding, parenting behaviors) and infants (e.g., mental health, psychosocial development, attachment, self-regulation; Bogat et al., 2006; Kessler, Molnar, Feurer, & Appelbaum, 2001; Leung & Slep, 2006; Levendosky, Leahy, Bogat, Davidson, & von Eye, 2006).

Maternal experience of stress during pregnancy, when fetal brains are undergoing rapid development, is associated with differences in infant social-emotional, cognitive, and behavioral outcomes postnatally (Kingston, Tough, & Whitfield, 2012; Monk, Spicer, & Champagne, 2012; Zhang *et al.* 2018). Prenatal exposure to maternal stress can result in epigenetic and developmental changes to a fetus (for review, see Hicks, Swales, Garcia, Driver, & Davis, 2019). These changes may be evident postnatally in physiological, behavioral (though touch has not specifically been examined), and emotion regulation differences, particularly in response to stress (Hicks *et al.* 2019). In the postnatal period, these early differences may, in turn, influence the child's developmental trajectory beyond infancy (for review, see Van den Bergh et al., 2017). The effects of prenatal stress on infant outcomes, such as social-emotional development, may differ by infant sex (e.g., Gerardin et al., 2011; Khashan et al., 2011).

Postnatal exposure to IPV has been associated with numerous problematic infant outcomes, including increased risk of insecure attachment by age 1 (Levendosky, Bogat, Huth-Bocks, Rosenblum, & von Eye, 2011) and greater difficulty with emotion regulation, externalizing behavior, withdrawal, and regression (for reviews, see Mueller & Tronick, 2019; Tailor & Letourneau, 2012). It is unclear whether postnatal IPV exposure predicts differences in infant touch behavior, though we might expect less touch overall (withdrawal) or more negative touch behavior (dysregulation, externalizing behavior, modeling).

Another risk factor for infants in the postnatal period is maternal depression, which is associated with infant insecure attachment (Campbell *et al.* 2004) and increased affective reactivity, particularly among boys (Beeghly et al., 2017; Carter, Mayes, & Pajer, 1990; Weinberg, Tronick, Cohn, & Olson, 1999), as well as cognitive and psychomotor deficits (Cornish et al., 2006). Moszkowski and colleagues (2009) assessed infant touch during a Still Face procedure and found that infants of depressed mothers used more reactive self-touch behaviors (e.g., pulling/grabbing/patting) and touch of surrounding objects during the Still Face portion, whereas infants of mothers who were not depressed used more soothing types of touch on themselves during the same time period. This difference suggests that maternal depression is associated with changes to infant touch of the self when distressed, although it is not yet known whether maternal depression would predict differences in the infant's touch of the mother.

1.3. Peripartum IPV, maternal depression, and maternal touch responses

Maternal IPV and depression would not only be expected to affect how infants touch their mothers, but also the reverse. A mother may integrate her experience of IPV into her beliefs about her infant, herself as a mother, and her ability to meet the infant's needs. Women who experience IPV during pregnancy are more likely to perceive their unborn children in emotionally removed or dysregulated ways, rather than in a thoughtful, sensitive, and/or accepting way (Huth-Bocks, Levendosky, Theran, & Bogat, 2004). These perceptions during pregnancy predict postpartum parenting behavior (Dayton, Levendosky, Davidson, & Bogat, 2010), suggesting that IPV experienced during pregnancy continues to affect maternal parenting into the postpartum period (Theran, Levendosky, Bogat, & Huth-Bocks, 2005). Although research on the effect of IPV on maternal touch behavior is limited, examinations of parenting behavior more broadly have shown that women who experience IPV postpartum are at greater risk of engaging in negative parenting behaviors, including inappropriate discipline, intrusive parenting, and more authoritarian parenting (e.g., Boeckel, Blasco-Ros, Grassi-Oliveira, & Martinez, 2014; Holden & Ritchie, 1991; Levendosky et al., 2006; McElwain & Volling, 1999). Moreover, IPV may be associated with alterations in maternal responsiveness to a child's cues due to differences in how cues are interpreted. Bernstein and colleagues (2019) found that IPV-exposed mothers were at greater risk of reading their child's facial expression as fearful, which the authors posited may affect how mother and child subsequently interact. Thus, IPV during pregnancy or postpartum may shape how mothers perceive and respond to their infants, which may also be evident in maternal touch responses.

Maternal depression is also associated with changes in maternal caregiving. Extant research suggests that pregnancy depression predicts postpartum parenting, primarily by reducing maternal sensitivity to infant cues, resulting in lower quality interactions (Pearson, Cooper, Penton-Voak, Lightman, & Evans, 2010; Pearson, Lightman & Evans, 2011). In fact, depressive symptoms during pregnancy are associated with a greater reduction in maternal responsiveness to infant cues than postpartum depressive symptoms (Flykt, Kanninen, Sinkkonen, & Punamäki, 2010).

In the postpartum period, mothers with depression may also be less sensitive and more rejecting in response to their infants, and use more intrusive, over-stimulating, and developmentally inappropriate touch (Campbell, Cohn, & Meyers, 1995; Cohn & Tronick, 1989; Fergus, Pickens, & Schmidt, 1998; Herrera et al., 2004; Lovejoy, Graczyk, O'Hare & Neuman, 2000; Murray, Fiori-Cowley, Hooper, & Cooper, 1996). Mothers with depression may also use less playful touch than nondepressed mothers and decrease their overall touch of the infant following a stressor (e.g., Still Face; Mantis, Mercuri, Stack, & Field, 2019). Mismatched and developmentally inappropriate maternal touch behaviors can elicit withdrawal, conflict behaviors, frustration, and anxiety in infants and young children (e.g., Apter-Levy, Feldman, Vakart, Ebstein, & Feldman, 2013), likely leading to less infant touch overall or more aggressive child touch.

1.4. Study aims

The present study aimed to understand infant-to-mother touch and subsequent maternal touch responses in the context of risk – specifically risk associated with IPV and depression. We expected that maternal risk factors would be associated with differences in how infants touch their mothers and how mothers respond to being touched by their infants, such as increased negative touch and fewer touches overall. In addition, given research that suggests that there may be infant sex differences in the effect of risk on infant-mother interactive behavior, infant sex was also included in the analyses.

2. Method

2.1. Participants

This study used data collected as part of a larger longitudinal study on the effect of IPV on women and their children from pregnancy to age 10. Participants were recruited during pregnancy from four counties in the mid-Michigan area. They were over-sampled for exposure to IPV, which was defined as episodes of physical, sexual, or psychological violence in the past year. IPV-exposed women and non-exposed women were matched on demographic characteristics. The larger study involved 10 waves of data collection, and mothers were financially compensated for their participation. All procedures were approved by the university Institutional Review Board (IRB). The current study used data from assessments conducted during pregnancy and when the children were one year old.

Two hundred and six pregnant women were enrolled in the larger study and interviewed during the last trimester of pregnancy. At one year postpartum, 189 of the original participants were contacted and interviewed. Of the 189 dyads, 15 had missing interaction videos due to loss of custody, living out of state, or technical problems during the interview. Therefore, 174 mothers and their one-year-old infants were included in the final sample of this study. The diversity of the participants was reflective of the population in the areas in which the women were recruited: 63% of the women identified as White, 25% as Black, 5% as Latina, and 7% as other ethnic/racial backgrounds. With regard to marital status, 44% were single, 44% were married, and 12% were separated, divorced, or widowed. With regard to education, 38% had a high school education or less, 42% had some college, 14% had an AA/BA/BS degree or some graduate school, and 6% had a graduate degree. Their monthly incomes ranged from $267 to $10,000, with a median household income of $1600 per month.

2.2. Procedures

Women were first screened over the phone for eligibility. To be included in the study, they needed to be (1) in the last trimester of pregnancy; (2) between 18 and 40 years old; (3) English speakers; and (4) in a romantic relationship for at least 6 weeks during the pregnancy. Data for this study came from two waves of the larger study. Women were first assessed during their third trimester of pregnancy and again when their children were 12 months of age. They were administered various questionnaires described below. At the 12 month assessment, mothers and infants then participated in a 12-minute videotaped free play episode. Mothers were instructed to interact with their infants as they normally would at home, including feeding or changing if need be. The room contained two chairs, a box of age-appropriate toys, anything mothers brought with them (e.g., toys, food, or diapers) and strategically placed mirrors to assist with viewing the interaction. Research assistants operated the video camera, which was not visible to participants, and they also observed the interaction from behind a two-way mirror. Measures.

2.2.1. Intimate partner violence

To assess IPV, women completed the *Severity of Violence against Women Scales* (SVAWS; Marshall, 1992) at both in-person interviews. The SVAWS is a 46-item measure that assesses psychological, physical, and sexual violence, that occurred during the relevant time period (i.e., during pregnancy or during the first postpartum year), on a four-point scale ranging from "Never" to "Many Times" (pregnancy coefficient alpha =0.94, postpartum coefficient alpha =0.95). Examples of items include "punched you" and "destroyed something belonging to you". A dichotomous variable was created, with mothers categorized as having experienced IPV if they endorsed items 9 or above, which assess moderate to severe IPV, at each time period (e.g., Bogat et al., 2006). To improve accuracy in reporting IPV, women were given an event history calendar (Yoshihama, Gillespie, Hammock, Belli, & Tolman, 2005). Fifty-six mothers (32.2%) reported experiencing pregnancy IPV and 44 mothers (25.3%) reported experiencing postpartum IPV.

2.2.2. Maternal depression

To assess pre- and postpartum maternal depression, women completed the *Beck Depression Inventory* (BDI; Beck, Ward, Mendelson, Mock & Erbaugh, 1961). The BDI is a 21-item scale that assesses depressive symptoms over the prior 2 weeks (pregnancy coefficient

alpha =0.86, postpartum coefficient alpha =0.86). Examples of symptoms assessed are guilt and suicidality. A dichotomous variable was created, with mothers categorized as having depression if they were at or above the recommended clinical cutoff of 10 (10 yields good sensitivity and specificity; Norris, Gallagher, Wilson, & Winograd, 1987). Eighty-three mothers (47.7%) reported clinically significant pregnancy depressive symptoms and 35 mothers (20.1%) reported clinically significant postpartum depressive symptoms.

2.2.3. Demographic risk

Given the potential effect of demographic risk on maternal parenting behaviors such as touch (e.g., through increased maternal stress, reduced resources, and systemic inequity; e.g., Aber, Jones, & Cohen, 2000; Angley, Divney, Magriples, & Kershaw, 2015), demographic risk was controlled in the analyses. Participants provided information regarding their race, marital status, education, and income (assessed via Medicaid status). Each of these variables were coded dichotomously with a score of "1" indicating risk (i.e., nonwhite, single, below high school education, or low income). Risk variables were summed to create a 0–4 total risk score. Previous research has supported the use of cumulative risk scores over the use of individual risk variables (Sameroff, Seifer, Baldwin, & Baldwin, 1993).

2.2.4. Touch

Touch was coded during the middle 8 min of the 12-minute free play to allow time for the dyad to transition into and out of the task. Research suggests that coding the middle subsection of an interaction can be as reliable and valid as coding the entire interaction (e.g., Hirschmann, Kastner-Koller, Deimann, Schmelzer, & Pietschnig, 2018) and is a widely used approach (e.g., Brzozowska et al., 2021). Infant touch behaviors were coded at five-second intervals (e.g., Karger, 1979; Stack & Muir, 1992) to describe the purpose of the touch. Only infant-initiated touch interactions were coded; if mothers touched their infants first, this was considered to be a mother-initiated touch interaction and was not included in the present study. Infant touch codes were adapted from Jean and Stack's Functions of Touch Scale (2009) and are presented in Table 1. These were affectionate (defined as touch used to seek comfort, establish a connection, communicate positive feelings, show caring, or play), instrumental (defined as goal-directed touch to take care of physical needs), accidental/passive (defined as touch with no explicit purpose, occurring accidentally or in the course of another behavior, or using little to no active muscle engagement or movement), negative (defined as touch that causes harm/pain, is insensitive or cold, or done in frustration), and no touch (defined as not initiating a touch behavior). Each time infant-initiated touch occurred and was coded, mothers received a code for their touch response to the infant touch. Maternal touch behaviors were only coded as touch responses if they were timely (i.e., within several seconds; Van Egeren, Barratt, & Roach, 2001) and appeared related to the infant's initial touch. Touch responses were coded as positive/neutral [defined as responding with an affectionate or playful touch, or a touch that is neutral in emotional valence (e.g., when the infant uses the mother to go from seated to standing, and the mother responds by helping the infant to stand)], negative (defined as responding with a harsh, hurtful, or avoidant touch), and no touch (defined as not responding with a touch behavior). Each type of touch purpose or touch response code was then summed to create a total score for each type of touch. The sum scores indicated how many five-second intervals contained each type of infant-initiated touch and maternal touch response.

2.3. Touch coding and reliability

The videos were viewed through a program created for the study that stopped the video at the end of each five-second interval to allow the coders to record their codes in Qualtrics. Infant-mother touch videos were coded by the first author and three trained undergraduate coders, who were trained to reliability by the first author. The undergraduate coders were blind to the study hypotheses, IPV exposure status, and maternal depression. The first author was blind to the IPV exposure status and maternal depression. Each

Table 1
Touch category descriptions.

Infant touch initiation	Description
Affectionate	Touch to seek comfort, establish a connection, communicate positive feelings, show caring, play • E.g., infant strokes mothers face
Instrumental	Goal-directed touch to take care of physical needs or complete an action • E.g., infant places hands on mother to push self into a standing position
Accidental/Passive	Touch with no explicit purpose, occurring accidentally or in the course of another behavior, or using little to no active muscle engagement or movement • E.g., infant reaches for a toy and touches mother accidentally
Negative	Touch that causes harm/pain, is insensitive or cold, or done in frustration • E.g., infant pushes mother away
No Touch	No touch behavior initiated
Maternal touch response	Description
Positive/Neutral	Responding with an affectionate or playful touch, or a touch that is neutral in emotional valence • E.g., after infant climbs into mother's lap, mother rubs infant's back
Negative	Responding with a harsh, hurtful, or avoidant touch • E.g., after infant touches mother, mother pushes infant away
No Touch	Not responding with a touch behavior after infant initiates touch

coder (undergraduate and the author) coded approximately 25% of the videos. The first author double-coded an additional 15% of the videos chosen at random to assess interrater reliability. Reliability was assessed throughout the coding process, to ensure that coders remained reliable and did not drift. Discrepancies were discussed and resolved by the coders during meetings. Cohen's kappa (Cohen, 1960) was used to calculate reliability. This calculation takes the probability of chance agreement into account and has been used by prior research on infant-mother touch with similar methods (multiple observations per minute, several qualitative streams).

The results suggest acceptable agreement across all infant touch initiation codes. Cohen's kappa for infant affectionate touch was.74 (good), infant instrumental touch was.74 (good), infant passive touch was.59 (moderate), and infant negative touch was.89 (very good). Results also suggested acceptable agreement across maternal touch response codes, except for negative maternal touch responses, which almost never occurred in the double-coded videos and therefore could not be assessed for agreement. Cohen's kappa for maternal positive/neutral touch response was.58 (moderate) and maternal no touch response was.62 (good). As negative maternal touch responses were rare, the overall incidence was assessed across the 174 mothers. Four mothers responded with negative touch once and two mothers responded with negative touch twice across the interactions. Given the low incidence rate, this variable was removed from the analyses.

3. Results

3.1. Data analytic approach

There were no missing data in the 174 dyads. The analyses were conducted using SPSS Version 28. The dichotomous categorical IPV and depression variables were effect coded. Analysis of covariance (ANCOVA) examined differences in touch behavior as a function of pregnancy and postpartum IPV and depression and infant biological sex, with demographic risk included as a covariate. Correlations, means, and standard deviations for the study variables are in Tables 2 and 3. Cell means and F tests are presented in Tables 4 and 5, and estimated marginal means controlling for demographic risk for the significant effects are presented in the text.

3.1.1. Infant touch initiation

Pregnancy and postnatal IPV and pregnancy or postnatal depression did not predict infant use of affectionate, instrumental, passive or no touch behavior. In addition, there were no significant effects for depression predicting touch behavior. Thus, we focus primarily on the IPV results for negative touch behavior presented in Table 4. There was a significant main effect of infant sex on infant use of negative touch behavior such that male infants were more likely to use negative touch toward their mothers (M =0.73, SD =0.17) than were female infants (M =0.23, SD =0.16). The main effect of prenatal IPV was not statistically significant although the means were in the expected direction with IPV (exposed M =0.67, SD =0.21, IPV not exposed M =0.29, SD =0.14). The interaction between prenatal IPV and infant sex was not statistically significant, F(1174) = 3.13, p = .08.

For postnatal IPV exposure, there was a main effect of postnatal IPV exposure on negative touch, such that exposed infants engaged in more negative touch behavior (M =0.91, SD =0.23) than infants who were not exposed to IPV postnatally (M =0.31, SD =0.15). In addition, there was a significant infant sex by postnatal IPV interaction associated with infant use of negative touch behavior. A simple slopes analysis was run to estimate separate postnatal IPV effects depending on infant sex. The results, which are presented in Fig. 1, indicated that male infants of mothers with postnatal IPV engaged in more negative touch with their mothers (M = 1.61, SD =0.37) than did male infants of mothers without postnatal IPV (M =0.36, SD =0.21, $F(1, 174) = 10.29$, $p < 0.05$). This pattern was not found in female infants.

Given that the interaction between infant sex and pregnancy IPV when predicting infant use of negative touch trended toward significance ($F(1, 174) = 3.13$, $p = 0.08$), an exploratory follow-up analysis examined whether the same pattern seen with infant sex and postnatal IPV would also be seen with infant sex and pregnancy IPV. Results suggested that male infants exposed to pregnancy IPV engaged in over 3 times more negative touch than non-exposed male infants ($F(1, 174) = 4.72$, $p < 0.05$). Again, this pattern was not demonstrated in female infants.

Table 2
Correlations and Means for Infant Touch.

	1	2	3	4	5	6	7	8	9	10	11
1. Pregnancy IPV	–										
2. Postpartum IPV	.24 * *	–									
3. Pregnancy Depression	.33 * *	.06	–								
4. Postpartum Depression	.16 *	.12	.46 * *	–							
5. Dem Risk	.32 * *	.08	.16 *	.07	–						
6. Infant Biological Sex	-0.15 *	-0.17 *	-0.13	-0.03	-0.02	–					
7. Affectionate Touch	.02	.00	-0.04	-0.08	.03	-0.08	–				
8. Instrumental Touch	-0.07	.08	.05	.17 *	-0.01	.04	.40 * *	–			
9. Passive Touch	.04	-0.11	.00	-0.09	.00	.01	.32 * *	.28 * *	–		
10. Negative Touch	.08	.02	.07	.09	.06	.09	.05	.07	.11	–	
11. No Touch	-0.02	.06	-0.01	.05	.00	.00	-0.64 * *	-0.55 * *	-0.90 * *	-0.19 *	–
Mean	3.59	2.87	10.22	5.70	1.53		2.29	2.33	9.10	.37	82.53
SD	8.73	8.53	6.94	5.54	1.20		5.54	4.00	13.18	1.45	16.60

Note. * indicates p is significant at < 0.05, * * indicates p is significant at < 0.001

Table 3
Correlations and Means for Maternal Touch Response to Infant Touch.

	1	2	3	4	5	6	7	8	9
1. Pregnancy IPV	–								
2. Postpartum IPV	.24 * *	–							
3. Pregnancy Depression	.33 * *	.06	–						
4. Postpartum Depression	.16 *	.12	.46 * *	–					
5. Dem Risk	.32 * *	.08	.16 *	.07	–				
6. Baby Biological Sex	-0.15 *	-0.17 *	-0.13	-0.03	-0.02	–			
7. Positive/Neutral Touch Response	.03	-0.06	-0.01	-0.05	-0.01	-0.02	–		
8. Negative Touch Response	-0.03	-0.06	.02	-0.07	.07	-0.09	.23 * *	–	
9. No Touch Response	-0.06	-0.02	.08	.09	.16 *	.19 *	.11	.08	–
Mean	3.59	2.87	10.22	5.70	1.53		12.09	.05	1.98
SD	8.73	8.53	6.94	5.54	1.20		17.60	.26	2.04

Note. * indicates p is significant at < 0.05, ** indicates p is significant at < 0.001.

Table 4
Table of Infant Negative Touch.

		Male Infants		Female Infants		Sex Main Effect	IPV Exposure Main Effect	Depression Main Effect	IPV by Sex Interaction	Depression by Sex Interaction
Prenatal Exposure		Exposed	Unexposed	Exposed	Unexposed	*F*	*F*	*F*	*F*	*F*
IPV	*M*	1.15	.32	.20	.26	4.61 *	2.14	.89	3.13 +	.55
	SD	.31	.18	.26	.20					
Depression	*M*	.93	.53	.25	.20					
	SD	.23	.25	.21	.24					
Postnatal Exposure										
IPV	*M*	1.61	.36	.20	.27	6.55 *	5.31 *	.28	6.72 *	.14
	SD	.37	.21	.28	.22					
Depression	*M*	1.11	.87	.26	.21					
	SD	.37	.21	.33	.19					

Note. *p < 0.05, **p < 0.01, +p < 0.10. All F tests had numerator df = 1, denominator df = 174.

Table 5
Table of maternal no-touch response.

		Male Infants		Female Infants		Sex Main Effect	IPV Exposure Main Effect	Depression Main Effect	IPV by Sex Interaction	Depression by Sex Interaction
Prenatal Exposure		Exposed	Unexposed	Exposed	Unexposed	*F*	*F*	*F*	*F*	*F*
IPV	*M*	2.51	2.41	1.13	1.87	8.92 *	.79	4.34 *	1.46	2.43
	SD	.43	.26	.36	.28					
Depression	*M*	3.05	1.88	1.58	1.41					
	SD	.32	.35	.30	.33					
Postnatal Exposure										
IPV	*M*	2.83	3.04	.94	1.85	14.91 * *	2.60	6.60 *	1.02	8.33 *
	SD	.50	.29	.38	.30					
Depression	*M*	3.93	1.94	1.34	1.45					
	SD	.50	.29	.44	.25					

Note. *p < 0.05, **p < 0.01. All F tests had numerator df = 1, denominator df = 174.

3.1.2. Maternal touch response

There were no significant main effects of pregnancy and postpartum IPV, pregnancy and postpartum depression, or infant sex on positive maternal touch responses. There was a significant main effect of demographic risk ($F(1, 174) = 4.90$, $p < .05$), infant sex (female infants M = 1.39, SD =0.26, male infants M = 2.94, SD =0.31), pregnancy depression (no depression M = 1.64, SD =0.24, depression M = 2.31, SD =0.22), and postpartum depression (no depression M = 1.70, SD =0.19, depression M = 2.63, SD =0.33)) on the mothers lack of a touch response to her infant's initiation of touch. That is, mothers with infant boys, higher demographic risk, pregnancy depression, or postpartum depression were more likely to not respond with touch to infant touch behavior.

There was a significant infant sex by postpartum depression interaction when predicting no touch behavior (see Table 5). A follow-up simple slopes analysis was run to estimate separate effects of postpartum depression depending on infant sex. The results, which are presented in Fig. 2, demonstrated that mothers with postpartum depression were more likely than mothers without postpartum depression to not show a touch response after their infant boys touched them ($F(1, 174) = 14.03$, $p < 0.001$). This pattern was not

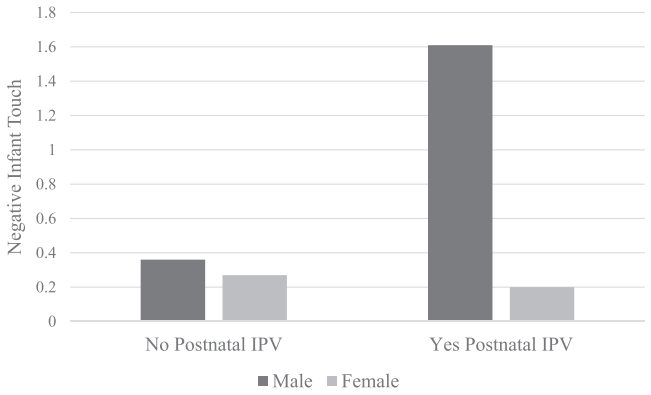

Fig. 1. Infant use of negative touch.

found in mothers of girls.

3.1.3. Follow-up analyses

Follow-up multilevel modeling analyses were run to examine whether there were patterns of specific infant touch initiation types and specific maternal touch responses that varied as a function of pregnancy IPV, postnatal IPV, pregnancy depression, and postnatal depression. In these analyses, the dyad was treated as the upper-level unit, and the individual was treated as the lower level unit. Three types of fixed effects models were run. These models included an IPV variable from either the pregnancy or postnatal period, a depression variable likewise measured pre- or postnatally, a categorical infant touch variable (1 = affectionate touch, 2 = instrumental touch, 3 = passive touch, 4 = negative touch), and a categorical maternal touch response variable (1 = no touch response, 2 = positive/neutral touch response, 3 = negative touch response). Frequencies of specific touch-response combinations were modeled as the interaction between these two variables. Three-way interactions between IPV (or depression), infant touch initiation, and maternal touch response were also included to test for differences in effects as a function of IPV or depression. In addition, four-way interactions were run to test for differences as a function of infant sex.

There was a significant relationship between infant touch type and maternal touch response ($F(6, 1870) = 15.09$, $p < 0.001$), with maternal no touch response typically following infant use of passive touch (M = 1.67, SD =0.39), and not infant use of affectionate (M =0.12, SD =0.39), instrumental (M =0.14, SD =0.39) or negative touch (M =0.10, SD =0.39). Maternal positive touch response was associated with infant use of affectionate (M = 2.67, SD =0.39), instrumental (M = 2.11, SD =0.39), or passive touch (M = 6.91, SD =0.39), and not with negative touch (M =0.33, SD =0.39). As noted previously, negative maternal touch response was not included in the analyses due to a low incidence rate. There were no significant three-way interactions between infant touch initiation, maternal touch response, and pregnancy or postnatal IPV or depression (pregnancy IPV: $F(6, 1870) = 0.60$, $p > 0.05$; pregnancy depression: $F(6, 1870) = 1.11$, $p > 0.05$; postnatal IPV: $F(6, 1870) = 0.27$, $p > 0.05$; and postnatal depression: $F(6, 1870) = 0.53$, $p > 0.05$). There were no significant four-way interactions between infant touch initiation, maternal touch response, pregnancy or postnatal IPV or depression and infant sex (with pregnancy IPV: $F(12, 997) = 0.45$, $p > 0.05$; with pregnancy depression: $F(12, 997) = 1.07$, $p > .05$; with postnatal IPV: $F(12, 997) = 0.68$, $p > 0.05$; and with postnatal depression: $F(12, 997) = 0.30$, $p > 0.05$).

4. Discussion

In the present study, factors that have been established as predictors of caregiving and child outcomes – IPV and maternal

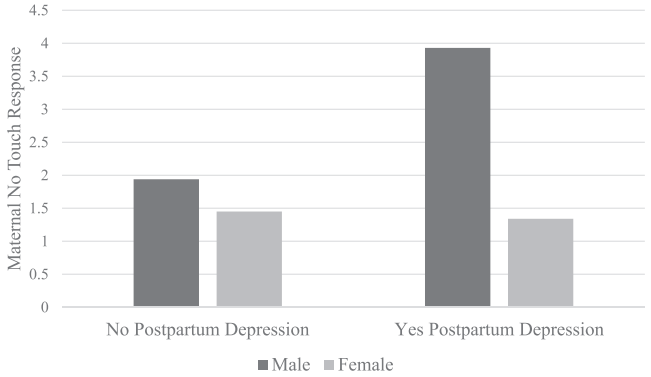

Fig. 2. Maternal use of no touch response to infant touch.

depression – were examined as predictors of infant-initiated touch behavior. Notably, exposure to prenatal or postnatal IPV predicted increased negative touch behavior, such as hitting, kicking, and pushing, by male infants only. The sex-specific effects suggest several possible pathways through which IPV could result in differences in touch by baby boys. The effect may be due to exposure. For the pregnancy period, exposure to maternal stress hormones *in utero* may have resulted in prenatal programming and more negative emotionality or reactive behavior postpartum. For the postpartum period, exposure to the IPV itself may have resulted in increased stress and dysregulation.

As noted previously, prenatal exposure to maternal stress can result in prenatal programming of the fetus, which may be evident in developmental differences in the postnatal period (for review, see Hicks et al., 2019). Though research has found sex-specific differences in how maternal stress affects child outcomes, the results are mixed as to whether male offspring or female offspring are at greater risk of negative outcomes. Gerardin and colleagues (2011), for example, found that maternal pregnancy depression (a proxy for stress) predicted greater difficulty in "regulation of states" for newborn male infants relative to female infants, and increased anxiety in those same male infants at 1 year of age. The early assessment within several days of birth allowed the authors to postulate that the sex effects were due to the pregnancy environment and not due to differences in parenting behavior or the postpartum environment. Similarly, Khashan et al. (2011) and Fineberg et al. (2016) also found that prenatal stress was associated with greater risk for poor outcomes (increased risk for affective disorders and increased risk for schizophrenia, respectively) in males but not in females. Other research has found females to be at greater risk, suggesting that further research is necessary to understand the discrepancy (for review, see Sutherland & Brunwasser, 2018).

It is possible that postpartum exposure to IPV may result in sex differences in how infants touch their mothers, with males and females exhibiting different signs of dysregulation when stressed (e.g., males engaging in more externalizing behaviors, such as negative touch, and females having more internalizing problems, such as anxiety) due to being raised in a periodically unpredictable and perhaps frightening environment. In households with IPV, male children exhibit more physically aggressive behavior than female children beginning at ages 1 – 1.5 years (Alink et al., 2006; Baillargeon et al., 2007). Interestingly, the magnitude of the effect increases through childhood and into adulthood (for review, see Archer, 2000; Côté, 2007), with adult males continuing to exhibit more physical aggression and adult females utilizing more relational aggression (Archer & Coyne, 2005). In addition, the use of more aggressive behavior in early childhood predicts a rising trajectory of aggressive behavior across time, and children who are exposed to risk factors during pregnancy and postpartum (such as demographic risk or family dysfunction) are at greater risk of this pattern of aggression (Tremblay et al., 2004). Furthermore, exposure to early adversity can exacerbate the sex effect, such that children engage in more sex-stereotypic types of aggression when dysregulated (e.g., Cullerton-Sen et al., 2008). Therefore, postpartum IPV exposure may increase physical aggression in the form of negative touch behavior among male infants when they become dysregulated. This tendency toward physically aggressive interactive behavior among risk-exposed males in infancy may be indicative of the beginning of a trajectory of increased physical aggression into childhood, adolescence, and adulthood.

The effect of IPV on infant touch may also be indirect. Maternal experience of IPV during pregnancy or postpartum may result in differences between how mothers parent their baby boys versus their baby girls. These differences in parenting may result in differences in infant emotion regulation and expression of negative emotions. In other words, touch differences may also be learned within the context of attachment relationships and may be more reflective of differences in how parents raise and socialize their male and female infants within the context of pregnancy and postpartum IPV (for review, see Tailor & Letourneau, 2012). From birth, parents respond to child behaviors in ways that socialize their baby girls and baby boys to engage in behaviors that conform to societal norms for gendered behavior (for girls, nurturing and deferent behavior; and for boys, dominant and aggressive behavior; Birns, Cascardi, & Meyer, 1994; Brody, 2000; Keenan & Shaw, 1997). This sex-role socialization may be particularly evident in homes with IPV, where parents tend to hold more sex-role stereotypic beliefs (Burge, 1981; Morris, 2009). Therefore, male infants in homes with IPV may receive feedback from their parents that promotes increased aggressive behavior which, in the present study, may be reflected in more negative infant-initiated touch than male infants in homes without IPV.

Contrary to expectations, pregnancy and postpartum maternal depression did not predict infant touch behavior during our free-play task. While research by Moszkowski and colleagues (2009) found that infants of depressed mothers used more reactive touch, this finding was in the context of the Still Face or during a brief physical separation from the mother. Therefore, these differences in touch were elicited during a stressful task in which mothers were either unavailable emotionally or physically, and these differences did not involve infant touch of the mother (rather, it was infant touch of self or object). Therefore, it may be that exposure to maternal pregnancy or postnatal depression predicts differences in infant touch behavior under conditions when the infant is stressed and dysregulated rather than during a typical play interaction.

The second aim of this research, which postulated that IPV and depression would predict differences in maternal touch responses to infant touch, was partially supported. Research suggests that IPV-exposed mothers may engage in more punitive, harsh parenting (e.g., Boeckel, Blasco-Ros, Grassi-Oliveira, & Martínez, 2014; Holden & Ritchie, 1991), perhaps as a result of their own emotional dysregulation, limited emotional resources, distorted perceptions of the child's behavior or more maladaptive parenting models (e.g., early parental attachment figures and later romantic attachment figures), which in turn could interfere with a mother's ability to understand the infant's internal state and meet the infant's need. The results of the present study do not provide support for alterations in maternal touch response behavior. Rather, mothers with pregnancy or postpartum IPV were similarly responsive to infant touch with positive and no-touch responses as the nonexposed mothers. It is notable that IPV-exposed mothers did not differ in their touch behaviors with their infants, particularly given that their infants were more likely to use negative touch. Thus, infant touch of many types seems to provide mothers with an unambiguous cue for caregiving behavior that elicits a similar maternal response even when the dyad has been exposed to IPV.

However, it is possible that the IPV-exposed mothers in the present sample engage in more negative parenting behaviors, but that

these behaviors were not captured within the interaction. That is, negative parenting behavior may not be touch-related (e.g., it may be verbal, gestural, or related to neglect), or it is touch-related but occurs infrequently or does not occur in response to infant touch. Another explanation may be that the present paradigm indirectly discouraged a full range of parenting behavior. Mothers were aware of being watched and recorded and may have avoided exhibiting behavior that could result in the researchers reporting child abuse. In addition, the setting – although potentially stressful for the infant because it was unfamiliar – may have been devoid of salient stressors for the mother (e.g., the abusive partner) that may make negative parenting behaviors more likely.

Depression was also expected to be associated with differences in maternal touch responses given research on more discordant parenting and touch responsiveness in depressed mothers. Our findings suggested differences in the amount of touch used by depressed mothers but not in the type of touch. In addition, the results suggested that mothers with postpartum depression were less responsive with touch to their infant boys than their infant girls. Tronick and Reck (2009) found that depressed mothers may struggle in particular with their baby boys, who may be more emotionally reactive, eliciting withdrawal or aggression in their mothers. The present findings suggest that withdrawal in depressed mothers may also be specifically evident in touch responsiveness to male infant-initiated contact. However, overall, depressed mothers did not significantly differ in their use of touch responses compared with their non-depressed counterparts.

Of note, the general demographic risk variable predicted differences in maternal touch responses, such that greater demographic risk was associated with more "no touch" responses to the infant's touch. It is possible that greater demographic risk is associated with decreased responsiveness in general or in touch specifically. Indeed, previous research has found that socioeconomic status (SES) is associated with parenting, such that low SES mothers may show less affection with their infants, vocalize less, and spend less time holding their infants in their lap (e.g., Piccinini et al., 2010; Roopnarine et al., 2005).

As IPV and depression did predict differences in infant-initiated touch behaviors and maternal touch responses, follow-up analyses were run to examine whether certain types of infant touch were associated with specific maternal touch responses, and whether IPV or depression and infant sex predicted differences in these infant-mother touch patterns. Results indicated that when mothers responded with no touch, it was typically preceded by infant use of passive touch, whereas when mothers responded with positive touch, it was typically preceded by infant use of affectionate, instrumental, or passive touch. Infant negative touch was not associated with a specific type of maternal touch response. These results suggest that mothers were generally responsive with touch when their infants initiated a touch interaction with an active type of touch (i.e., affectionate or instrumental). When mothers did not respond with touch, it was typically because the infant engaged in passive touch. Infant passive touch may have communicated that the infant was not currently seeking an active maternal touch response, or it may have been an ambiguous cue that sometimes elicited a maternal touch response and other times did not. IPV or depression in pregnancy or the postnatal period did not predict differences in infant-mother touch patterns. Infant sex also did not predict differences in infant-mother touch patterns. These results suggest that IPV or depression predicted greater use of certain types of infant touch behaviors and maternal touch responses, particularly among dyads with male infants; when examined together, however, patterns in how infants touched their mothers and the maternal touch responses they elicited did not significantly differ between risk-exposed and nonexposed dyads.

In summary, the results of this study have several implications. First, male infants may be differently susceptible to the effects of risk on touch interactions with their mothers, leading to their greater use of negative touch. While some of the differential effects of risk on infant male and female touch behaviors may be attributable to differences in environment (e.g., parenting behavior), the fact that prenatal IPV exposure predicted differences in male but not in female touch behavior suggests that additional factors are at play, such as differential susceptibility to prenatal programming of their behavior by stress. Furthermore, the findings also underscore the value in examining stressors during the pregnancy period when studying infant interactive behavior and infant outcomes. The results may also provide support for the intergenerational transmission of violence in male children exposed to IPV, which may already be evident in interactive touch behaviors in infancy. The fact that IPV did not predict differences in maternal touch responses to infant touch suggests that infant touch may be an unambiguous cue that pulls for similar maternal touch behavior, regardless of IPV exposure. Maternal depression, however, may differ from IPV, perhaps by altering maternal perception of infant cues or by affecting the mother's beliefs as to whether she can meet her infant's needs. This finding provides support for the use of interventions that instruct depressed mothers on how to interact with and touch their infants, behaviors which are associated with improved parenting, decreased maternal depression, and increased infant positive affect (Field, 2010; Malphurs, Raag, Field, Pickens & Pelaez-Nogueras, 1996; Peláez-Nogueras, Field, Hossain & Pickens, 1996). This may be especially important as maternal touch may buffer the effect of maternal pregnancy and postpartum depression on infant social-emotional outcomes (Field, 2010; Sharp *et al.* 2012).

4.1. Limitations and future directions

The present study has several limitations, particularly with regard to measurement. Touch was examined in a lab setting rather than in a familiar environment for the mother and infant. The setting was new to both mother and infant, and mothers were aware of being videotaped and observed, which may have resulted in different behaviors than mother and infant might engage in at home. Previous research is mixed as to whether parenting is consistent across home and lab settings, with findings varying as a function of how parenting is assessed, the frequency of assessment, and maternal mental health (e.g., Bornstein *et al.* 2006; Pauli-Pott, 2008). Additionally, the measurement of IPV and depression relied on self-report data, which may be subject to socially desirable responding. Also, while touch was coded at 5-second intervals in the present study, research examining maternal or infant touch has often (though not exclusively; e.g., Karger, 1979; Stack & Miur, 1992) been coded second-by-second. While each type of infant-initiated touch and maternal touch response that occurred within a 5-second period was coded, the coding may have missed some of the infant-mother interactions that second-by-second coding would have revealed.

Future research should examine whether early differences in infant-mother touch predict later differences in the mother-child relationship or child outcomes. Understanding whether interactive differences observed at 1 year of age have implications for later functioning may provide additional information for better understanding how to develop and target interventions. Indeed, research suggests a connection between early adversity (such as prenatal maternal stress exposure or postnatal exposure to IPV or maternal depression) and emotion regulation difficulties in early childhood (e.g., Fong et al., 2019; Monk et al., 2012), which in turn predict aggressive behavior later in childhood (e.g., Crockenberg et al., 2008; Holmes, Yoon, & Berg, 2017).

Future research may also benefit from examining other components of the interaction, such as other interactive behaviors or attunement (e.g., Crucianelli et al., 2019), which may provide an expanded understanding of touch and the infant-mother relationship. For example, coding maternal and infant emotion and non-touch behavior or including maternal and infant physiological arousal throughout an interaction may provide insight into the relationship between risk, touch, and emotion regulation.

Lastly, there are sensitive periods for the effects of stressors on fetal and infant development, suggesting that a more precise understanding of the timing of maternal IPV and depression during pregnancy may be necessary for understanding how, why, and to what extent these stressors may affect infants overall and later infant-mother interactive behavior more specifically. Moreover, the timing of the stressors likely also has implications for how maternal parenting is affected, not only because how a mother thinks about herself and her child shifts across pregnancy, but also because of the physical, physiological, and neurocognitive changes that occur during pregnancy (e.g., Pearson et al., 2010; Pearson et al., 2009). Therefore, different aspects of later mothering (such as touch) may be more vulnerable at some points of the pregnancy compared to others. Further research is necessary to elucidate the role of timing in the effect of stressors on parenting more broadly, and touch specifically.

4.2. Conclusion

This study is a further contribution to the growing infant-mother touch literature. Overall, the findings demonstrated that prenatal and postnatal exposure to IPV predict differences in how male infants touch their mothers. Male infants may be more vulnerable to the effects of relational stressors on touch, potentially due to differences in parenting behavior, an increased sensitivity to prenatal effects of stress, or an increased sensitivity to the postnatal home environment. Alternatively, the results may also be reflective of a tendency towards externalizing behavior in response to prenatal or postnatal stress in male infants. Ultimately, the effect of IPV on male infant touch suggests a potential pathway through which IPV may exert more long-term effects on a child's interactive behavior and expectations of caregiving. This study also provides additional information about the effect of IPV and depression on maternal touch response behavior. While limited previous research suggested that IPV predicted differences in how mothers touch their infants, the present study suggests that when maternal touch behavior is preceded by infant touch behavior, the effect of IPV on maternal touch may be buffered. In depressed mothers of boys, however, infant touch may instead be a source of stress, resulting in decreased maternal touch responsiveness that may be indicative of maternal withdrawal. Of note, however, is that despite these differences in infant touch and maternal touch responsiveness, how mothers responded to specific types of infant touch did not differ significantly across dyads – maternal touch may have been similarly attuned (i.e., an active touch response to active infant touch; no response to passive or accidental infant touch) or misattuned (i.e., an active touch response to passive or accidental infant touch) across dyads, regardless of IPV, maternal depression, or infant sex.

CRediT authorship contribution statement

Nicola K. Bernard: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing, Formal analysis, Visualization. **G. Anne Bogat**: Supervision, Investigation, Data curation, Resources, Writing – review & editing, Funding acquisition. **Deborah A. Kashy**: Methodology, Formal analysis, Writing – review & editing, Supervision. **Joseph S. Lonstein**: Supervision, Writing – review & editing. **Alytia A. Levendosky**: Supervision, Conceptualization, Methodology, Investigation, Resources, Writing – review & editing.

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Conflict of interest

We have no conflicts of interest to disclose.

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