Risk and Regulation: A Longitudinal Perspective on Parenting, Psychosocial Risk, and the Development of Emotion Regulation from Infancy to Preschool

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ABSTRACT

Risk and Regulation: A Longitudinal Perspective on Parenting, Psychosocial Risk, and the Development of Emotion Regulation from Infancy to Preschool

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The early development of emotion regulation behaviours is predictive of lifelong socioemotional functioning and risk of psychopathology. Traditional developmental models of emotion regulation tend to categorize early regulatory strategies as "adaptive" or "maladaptive," with the assumption that certain strategies are superior to others. This is in contrast to recent research in adult emotion regulation, which contends that the benefits of any given strategy vary across individuals and situations (Bonanno & Burton, 2013).

In the current set of studies, observational coding systems were used to capture the range of regulatory behaviours employed across early development in contexts of both normative interaction with mothers and brief periods of mild distress. Rather than categorizing regulatory behaviours as helpful or unhelpful, strategies were examined individually (Study 1) or in co-occurring behavioural patterns (Study 2) to understand their associations with risk and protective factors, including positive and negative parenting behaviours (Studies 1 and 2), maternal depression (Study 1), and child temperament (Study 2).

Study 1 included a sample of depressed and non-depressed mothers and their four-month-old infants (N=35). Infant emotion regulation and maternal sensitivity and hostility were observationally coded during the Still-Face procedure. Results indicated that maternal sensitivity moderated the association between maternal depression and infant emotion regulation during the Still-Face period, such that maternal depressive symptoms negatively predicted infant gaze aversion when sensitivity was low and positively predicted gaze aversion when sensitivity was

high. Maternal hostility did not moderate the association during either the Normal or Still-Face periods but did have a direct effect on emotion regulation during the Still-Face period. Higher maternal hostility was associated with increased self-soothing and decreased gaze aversion. Results suggest that parenting both mitigates the effects of maternal depression and directly impacts regulatory behaviour use.

In Study 2, mother-infant dyads (N=167) were followed at four time points from infancy to preschool (6 months, 12 months, 18 months, 4.5 years). Emotion regulation behaviours were observationally coded during periods of mild distress at each time point, as well as during normative dyadic interaction periods as a comparison point. Latent profile analyses were used to identify patterns of co-occurring behaviours. The associations of the identified profiles with parenting (maternal sensitivity, non-hostility) and, at one time point, child temperament (emotionality, sociability) were explored. For a subset of the sample, the longitudinal associations between regulatory profiles and socioemotional outcomes (emotion regulation, depression, anxiety, aggression) in middle childhood (9-12 years) were also tested. Results indicated that more optimal parenting (higher sensitivity and non-hostility) was associated with more complex profiles of regulation during periods of induced mild distress, and that such profiles were predictive of positive socioemotional outcomes in later childhood. Findings suggest that attaining a diverse repertoire of regulatory behaviours in early life may be as important as the specific behaviours used.

The present dissertation makes an important contribution to the emotion regulation literature by considering the function and adaptiveness of a variety of regulatory behaviours, challenging current conceptualizations that behaviours fall into categories of “adaptive” or maladaptive,” and including risk and protective factors at multiple levels of influence, including

parenting, child characteristics, and maternal mental health. Findings from both studies suggest that aspects of regulatory flexibility may be emerging in early life, such that infants are adjusting their behaviours to meet situational demands, and that this flexibility may promote healthy socioemotional development. Results have implications for the design of early intervention to prevent future difficulties with dysregulation.

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“To err is human. To err repeatedly is research.”

- @AcademicsSay, May 7 2015

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Contributions of Authors

The current dissertation consists of two manuscripts:

Study 1 (see Chapter 2)

Atkinson, N. H., Stack, D. M., De France, K., & Field, T. M. Maternal depression and infant emotion regulation: Moderation by maternal sensitivity and hostility.

Study 2 (see Chapter 4)

Atkinson, N.H., Stack, D. M., & Serbin, L. A. Emerging repertoires of regulatory behaviour: Identifying profiles of emotion regulation in early life.

My supervisor, Dr. Dale M. Stack, and I are responsible for the conceptualization of the research presented in both studies of this dissertation. The data used in Study 1 were collected by Dr. Tiffany Field's research staff at the Touch Research Institute, University of Miami School of Medicine. The data used in Study 2 were collected from two sources. The low-risk full-term and very low birthweight (VLBW)/preterm dyads were collected in conjunction with the Neonatal Follow-Up Unit at a large teaching hospital by research staff in Dr. Stack's Infant and Child Studies Laboratory. The psychosocially at-risk participants were initially recruited through the Concordia Longitudinal Research Project (Concordia Project), under the direction of Drs. Jane Ledingham and Alex E. Schwartzman. The project is currently under the direction of Drs. Lisa A. Serbin and Dale M. Stack of Concordia University.

Infant behavioural observational coding for both studies was completed by me in Dr. Stack's Infant and Child Studies Laboratory, with some assistance from undergraduates. Following the reliability and observational coding that I conducted, I completed data entry and cleaning procedures using statistical software. With guidance and input from Dr. Stack, I formulated the research questions, hypotheses, and analyses plans. Dr. Kalee De France, former post-doctoral researcher in Drs. Stack and Serbin laboratories, provided guidance on planning and executing analyses. I wrote all components of this dissertation. Dr. Stack provided feedback at every step, including revisions and edits to the text.

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Chapter 1: General Introduction

In the first few years of life, children are tasked with learning to independently regulate their vast array of emotions. At birth, armed only with a few rudimentary self-soothing skills, infants are almost entirely reliant on their caregivers to help regulate their distress (Ostlund et al., 2017; Schore, 2015; Thomas et al., 2017). By age 4 or 5, children possess multiple strategies for self-regulation and are relatively able to manage their emotional states with minimal assistance from caregivers (Halligan et al., 2013). Emotion regulation encompasses the "behaviours, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions" (Calkins & Hill, 2007, p. 229). When effective strategies are developed in early life, it is predictive of more complex positive social behaviours, including social competence, positive relationships with others, popularity with peers, empathy, sympathy, and academic success (Leerkes et al., 2009; Penela et al., 2015), and may protect against internalizing and externalizing problems throughout childhood (Kim et al., 2014). Children who do not develop effective independent regulation strategies are at increased risk of socioemotional and behavioural problems (Crespo et al., 2017; Di Maggio et al., 2016) and future psychopathology (Rawana et al., 2014).

Development of Emotion Regulation

Although developmental changes in emotion regulation continue across the lifespan, the most dramatic gains occur in the first few years of life (Halligan et al., 2013). This development is driven by both environmental and biological factors. Infants are born with certain innate, primitive forms of emotion regulation, such as approach-withdrawal responses to pleasant or aversive stimuli and self-soothing strategies such as sucking and stroking (Stifter & Augustine, 2019; Thompson & Goodman, 2010). There is some evidence that these strategies are effective in reducing distress, but this may only be the case in the absence of parent involvement

(Crockenberg & Leerkes, 2004). For the most part, regulation in early infancy is dyadic: infants communicate their emotional states to their parents using facial, vocal, and behavioural cues, and parents act to regulate their infants' emotions by interpreting and responding to their needs, and by reciprocating and reinforcing their reactions (Thomas et al., 2017). This creates an ongoing cycle of emotion socialization in which parents reinforce or inhibit infant regulation, promoting the development of independent regulation strategies in the infant (Granat et al., 2017).

Biological influences are at work simultaneously. Starting at approximately six months, maturation in infants' brains allows for the development of more deliberate, cognitive regulation strategies. Attentional control is one of the first emotion regulation abilities to develop: at six months, infants are able to use orienting and sustained attention to actively disengage from stressful stimuli and focus on more positive or neutral stimuli (Crockenberg & Leerkes, 2004; Thomas et al., 2017). Infants' emotional repertoires continue to increase as they begin to use more intentional strategies such as manipulation of objects (Feldman, 2009). During the second year of life, executive control abilities allow for the control of emotional arousal and reactivity (Rueda et al. 2013), while coordinated motor and language skills allow for an increased ability to communicate effectively with others (Calkins & Hill, 2007). In the preschool years, children develop more autonomous approaches to regulation, including behavioural (changing situational antecedents, removing stimuli from view) and cognitive (attention regulation, cognitive reappraisal) strategies (Sala et al., 2014).

Although research has generally pointed to infancy and toddlerhood as a period of transition from dyadic regulation by a parent or caregiver to independent regulation by the infant (e.g., Ostlund et al., 2017; Thomas et al., 2017; Thompson & Goodman, 2010), there is evidence that, as infants become more adept at self-regulation, they are also increasingly able to use their

parents to aid in regulation. During the first year of life, infants become more aware that their parents' behaviour may assist them in regulating emotion, and thus more skilled at social signalling to elicit this assistance (Calkins & Hill, 2007). The second year of life brings major changes to toddlers' social and communication abilities, including the increased ability and motivation for joint attention (Akhtar & Martinez-Sussmann, 2007). Recent work from our own laboratory has suggested that dyadic regulation strategies increase, rather than decrease, across the first year and a half of life (Atkinson et al., 2021). It may be that, rather than replacing dyadic strategies with independent ones, infants are increasing the repertoire of regulatory behaviours used across situations.

This is in keeping with the Mutual Regulation Model, which posits that infants are simultaneously regulating their own internal emotional states, and their engagement with the external environment (Tronick & Beeghly, 2011). Infants use self-directed regulatory strategies to modify their internal emotional states, and other-directed strategies to shape their caregivers' behaviour and alter their environment. Through these processes, caregiver-infant dyads develop a coordinated, mutually regulated communicative system in which infants' regulatory capacities are bolstered by their parents. This in turn contributes to their emerging ability to regulate independently.

The idea that infants are developing a repertoire of regulatory strategies is also consistent with theories of regulatory flexibility (e.g., Bonanno & Burton, 2013; Hollenstein et al., 2013), although such models were developed in the context of adult emotion regulation. While traditional research emphasizes the effectiveness or utility of specific regulatory behaviours, models of regulatory flexibility posit that the benefits of any emotion regulation strategy vary across individuals and situations (Aldao, 2013; Bonanno et al., 2004). Bonanno and Burton's

(2013) theory of regulatory flexibility includes three components: (1) a diverse repertoire of regulatory strategies, (2) sensitivity to context, and (3) responsiveness to feedback. Thus, the growing abilities of infants to use a variety of regulation behaviours and to selectively implement these behaviours based on context and on feedback from parents may represent the early stages of regulatory flexibility.

Parenting and Infant Emotion Regulation

Both theory and empirical studies point to parent-child interaction quality as a major influence on children's developing emotion regulation (Halligan et al., 2013; Tronick & Beeghly, 2011). Maternal sensitivity, defined as the ability to accurately recognize and respond to infant cues in a timely, accurate, and warm manner (Ainsworth et al., 1974), has received particular attention in the emotion regulation literature beginning as early as the 1990s (e.g., Calkins & Johnson, 1998; van den Boom, 1994). Maternal sensitivity has been linked to better regulation of emotions throughout childhood (Crockenberg & Leerkes, 2004). Infants of higher sensitivity parents exhibit slower increases in distress reactivity, use more regulatory behaviours, and demonstrate distinct patterns of physiological reactivity and regulation (Braungart-Rieker et al., 2010; Conradt & Ablow, 2010; Frick et al., 2018). Sensitive parenting may act as a buffer against certain risk factors that could otherwise jeopardize healthy socioemotional development, including temperamental negativity (Crockenberg & Leerkes, 2006; Penela et al., 2015) and in utero exposure to maternal stress (Thomas et al., 2017). Caregiver interactions characterized by maternal sensitivity also promote development of the vagal system, which in turn enables infants to engage in self-regulation (Porges & Furman, 2011). Thus, maternal sensitivity appears to

promote the development of adaptive emotion regulation via multiple pathways.[1]

The adverse effects of negative parenting on the development of emotion regulation behaviour have received significantly less attention in the literature. However, parenting behaviours such as maternal hostility, defined as the anger, criticism, negativity, and disapproval directed toward a child (Sellers et al., 2014), may be detrimental to regulatory development (Hentges et al., 2020; Rose et al., 2018). Maternal hostility impacts both the physiological and behavioural regulation of the infant during mother-infant interactions (Calkins et al., 1998; Morris et al., 2002), and is associated with increased negative affect on the part of the infant (Lyons-Ruth et al., 1996) as well as increased difficulty in regulating distress (Little & Carter, 2005). Hostile parenting is predictive of emotion regulation difficulties into adolescence (Sarıtaş et al., 2013; Shaw & Starr, 2019), as well as internalizing and externalizing problems throughout childhood (Morris et al., 2002; Rose et al., 2018). Although less well-studied than positive parenting, maternal hostility may represent one mechanism by which parenting impacts the development of regulatory behaviour.

Dyads may be at increased risk of suboptimal parenting behaviour and the subsequent impairment of regulatory development when a parent's ability to support infant emotion regulation is impeded. This is the case with maternal depression, which has been shown to negatively impact mother-infant interactions. Depressed mothers may be less consistent in their interactive behaviour, display restricted affect, and have difficulty maintaining physical closeness with their infants (Feldman et al., 2009; Priel et al., 2019). In many studies, maternal depression has been linked to lower maternal sensitivity (Bernard et al., 2018) and increased

[1] Although interactions with all caregivers are important in the development of emotion regulation behaviours, the current studies were part of ongoing research projects with a focus on mother-infant interactions; thus, exclusively maternal parenting behaviours were measured.

maternal hostility (Lovejoy et al., 2000). Infants of depressed mothers demonstrate higher levels of negative emotionality and less goal-directed regulatory behaviour (Feldman et al., 2009; Skotheim et al., 2013). These infants are at increased risk of experiencing deficits in emotion regulation throughout childhood (Kujawa et al., 2014; van der Waerden et al., 2015) and have a higher lifetime risk of psychopathology (Goodman et al., 2011; Gotlib et al., 2020). Although some models contend that sub-optimal parenting may be a mechanism by which maternal depressive symptoms impede infant emotion regulation (Feldman et al., 2009), there is also evidence that many depressed mothers are able to compensate for their symptoms when it comes to parenting (Bernard et al., 2018; Turney, 2011). High maternal sensitivity may buffer the negative effects of maternal distress (Thomas et al., 2017), suggesting that parenting may moderate the effects of maternal depression on emotional development.

Infant Characteristics and Emotion Regulation Development

In keeping with bidirectional models of child development (e.g., Bell, 1968; Belsky, 1984), innate child characteristics also impact both regulatory development and the dyadic context in which it occurs. Child temperament, defined as the “constitutionally-based individual differences in emotional, motor, and attentional reactivity and self-regulation" (Rothbart & Bates, 1998, p.109), exerts a strong influence on the development of emotion regulation. According to the National Research Council and Institute of Medicine, “the task of learning how to manage one’s emotions … is a different challenge for children with different temperaments” (2000, p.114). Temperament has been shown to impact both regulatory strategy use and more distal indicators of dysregulation such as behaviour problems (Calkins, 2004).

In particular, temperamental negative emotionality, or the tendency to react with high levels of negative affect (Santucci et al., 2008), is associated with less effective regulatory

strategies (e.g., physical behaviours such as kicking or stomping rather than distraction or goal-directed behaviour; Calkins & Johnson, 1998; Calkins et al., 2002). Children with a predisposition toward experiencing negative emotions may also be less successful in their use of cognitive strategies to regulate distress (Morris et al., 2011). In addition to these proximal indicators, negative emotionality is associated with distal indicators of dysregulation, including internalizing and externalizing problems in later childhood (Eisenberg et al., 2003; Marakovitz et al., 2011; Oldehinkel et al., 2004). Further, there is evidence to suggest that temperamental negativity interacts with parenting, such that suboptimal parenting practices may have a more detrimental impact on emotion regulation in children with higher levels of negative emotionality than on those with lower levels (Morris et al., 2002).

Temperamental sociability is defined as the tendency to affiliate with and prefer the company of others (Buss & Plomin, 1984). The association between low levels of sociability and reduced emotion regulation capability is well-established in adulthood (Eisenberg et al., 1995). In early life, temperamental sociability has been shown to impact emotion regulation both directly through strategy use (Dollar & Stifter, 2012) and indirectly by eliciting more positive parenting behaviours (Kiff et al., 2011; Oddi et al., 2013). Temperamental sociability thus appears to have positive implications for emotion regulation throughout the lifespan.

Measurement Issues in Emotion Regulation Research

Although there is considerable evidence linking parent and child characteristics to the early development of emotion regulation, challenges in the measurement of emotion regulation have complicated the interpretation of these findings. Measures of emotion regulation in early life often produce a unitary score, either by summing ratings in the case of parent- and observer-report measures (e.g., Carter et al., 1999; Shield & Cicchetti, 1997), or by tallying behaviours in

the case of observational coding (e.g., Feldman et al., 2009; Halligan et al., 2013). By using a single score, these measures convey the assumption that *more regulation is better regulation*. However, greater use of regulatory behaviours may represent different processes on the part of the infant, not all of which are adaptive. For example, greater regulation may indicate that a child is overly regulated or using ineffective strategies (Bridges et al., 2004). The use of a single score may also obscure the complexities of early regulation and the increasing variety of strategies by which children regulate their emotions as they age. When the focus is on quantity, we risk losing valuable qualitative information about the development of emotion regulation.

When studies do examine regulatory behaviours separately, there is often an underlying assumption that behaviours fall into categories of "adaptive" or "maladaptive." This is not unlike the historical distinction between reappraisal and suppression in the adult emotion regulation literature (Gross, 1998a). In developmental studies, a common distinction is between dyadic regulatory behaviours, in which infants rely on the regulatory support of their caregivers, and independent behaviours, in which infants use self-soothing strategies to regulate their arousal. Early reliance on a caregiver's support for regulation is considered not only normative, but adaptive (Diener et al., 2002; Granat et al., 2017). Infants are observed to use increased independent strategies largely in contexts where their caregiver is less responsive to their cues, such as in the case of maternal depression (Khoury et al., 2016; Manian & Bornstein, 2009). Given this distinction, dyadic regulatory behaviours are often considered the more functional (and the more effective) strategy (Diener et al., 2002). However, it may be adaptive for infants to use independent strategies (despite their relative ineffectiveness) in situations when their caregiver is not available to them (Atkinson et al., 2021; Miller et al., 2002) or when their past experiences have taught them that their caregiver is not consistently responsive (Kim et al., 2014;

Manian & Bornstein, 2009). Thus, it is not only the effectiveness of a given regulatory behaviour that determines its functionality, but also the context, both in terms of the immediate situational demands and the infant's developmental history.

Models of regulatory flexibility, or interactionist models, also contend that context is key: these models posit that the benefits of regulatory behaviour vary across individuals and situations, such that the adaptiveness of a given strategy is dependent on both individual and contextual factors (Bonanno & Burton, 2013; Hollenstein et al., 2013). Rather than emphasizing the effectiveness of a given strategy, these models stress the importance of a flexible approach to regulation (Aldao, 2013; Sheppes & Gross, 2012). Although interactionist models have yet to be integrated into the developmental emotion regulation literature, there is evidence that regulatory flexibility, or the ability to vary regulatory behaviour to meet situational demands, is an adaptive approach in early life as well (Myruski & Dennis-Tiwary, 2021). Bonanno and Burton's (2013) model was developed in the context of adult emotion regulation, but their principles of regulatory flexibility (diverse repertoire of regulatory behaviours, sensitivity to context, responsiveness to feedback) likely apply to developmental research as well. Throughout early life, both environmental and biological factors contribute to the development of a growing repertoire of regulatory strategies on the part of the infant (Halligan et al., 2013). As this occurs, infants are simultaneously learning to selectively use strategies based on both immediate context and feedback from caregivers. Recent research from our own laboratory suggests that infants adjust the regulatory strategies used during different interaction periods (Atkinson et al., 2021). Further, what infants learn about the responsiveness of their caregivers may alter the regulatory behaviours they gravitate towards in future interactions (Miller at al., 2002). Thus, a complete

understanding of early emotion regulation may require insight into the regulatory behaviours used, the context(s) in which they occur, and the effect of the feedback provided by caregivers.

The Current Studies

The present set of studies was designed to challenge current approaches to the study of early emotion regulation by using observational coding systems to identify specific regulatory behaviours used by infants in different contexts and their association with risk and protective factors. By examining the breadth of behaviours used and by considering context (both immediate and delayed), our approach differed from traditional views in which more regulatory behaviour is assumed to be better or certain behaviours are viewed as more adaptive than others. Further, each of the two studies included both positive and negative parenting behaviours, allowing for the examination of the differential impact of these behaviours on the early development and use of regulatory behaviours. These studies were guided by the Mutual Regulation Model (Tronick & Gianino, 1986), which posits that infants are simultaneously regulating their own internal emotional states and their external environments, including the behaviours of their caregivers, and by Bonanno and Burton's (2013) model of regulatory flexibility, which posits that successful regulation requires a diverse repertoire of behaviours, sensitivity to context, and responsiveness to feedback.

In Study 1, we aimed to examine both positive (maternal sensitivity) and negative (maternal hostility) parenting behaviours as moderators of the association between maternal depressive symptoms and infant emotion regulation behaviours. A sample of depressed and non-depressed mothers and their four-month-old infants were observed during the Still-Face paradigm (Tronick et al., 1978), enabling us to observe infant behaviour during both normative dyadic interaction and a mildly distress-inducing task in which mothers were not available to

assist with regulation. We hypothesized that parenting behaviours would differentially impact the regulatory behaviours used by infants in different contexts, illustrating the effect of both immediate context and prior learning on strategy use.

In Study 2, our goal was to explore the development of regulatory flexibility by identifying profiles of regulatory behaviour used across early development. By expanding our focus beyond the examination of individual regulatory behaviours, we aimed to gain deeper insight into the breadth of strategies used by infants and the adaptiveness of varied strategy use. In this longitudinal study, we used age-appropriate observational coding systems at four age points from six months to four years. We then tested the association of these profiles with parenting behaviours and child temperament. For a subset of the sample, we were also able to test the associations of the identified profiles with indices of adjustment at a fifth time point in middle childhood. We hypothesized that profiles marked by a greater variety of behaviours were indicative of greater regulatory flexibility and would thus be associated with better outcomes in later development.

This set of studies represents a departure from the traditional conceptualization of early emotion regulation. By including factors at multiple levels of influence, including contextual, parent-driven, and child-driven, we were able to capture a more nuanced picture of emotion regulation and the factors involved in its development. By using observational coding systems and considering profiles of regulatory behaviour, we were able to consider the flexibility of infants in their deployment of regulatory behaviour. Finally, by testing the associations between early regulation and later outcomes, we were able to test the adaptiveness of flexible regulation. This approach allowed us to examine early regulatory behaviours in context and in relation to

each other rather than in isolation, potentially allowing for greater insight into the development of emotion regulation and its impact in later life.

Chapter 2: Dissertation Study 1

Maternal depression and infant emotion regulation: Moderation by maternal sensitivity and hostility

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Abstract

The development of emotion regulation behaviours begins in the context of caregiver-infant interactions. Maternal depression may impede these interactions, leading to negative socioemotional outcomes. Maternal depression is linked to both an absence of positive parenting behaviours (e.g., sensitivity) and increased negative parenting behaviours (e.g., hostility); however, the majority of research has focused on positive parenting as the mechanism by which depressive symptoms inhibit healthy emotional development, while little is known about the impact of negative parenting behaviours. The current study examined both positive (sensitivity) and negative (hostility) parenting behaviours as moderators of the association between maternal depressive symptoms and infant emotion regulation behaviours. Parental sensitivity and hostility and infant emotion regulation were observationally coded during the Still-Face procedure when infants were four months of age. Maternal sensitivity significantly moderated the association between maternal depression and infant emotion regulation during the Still-Face period. Maternal depressive symptoms negatively predicted gaze aversion when sensitivity was low, and positively predicted gaze aversion when sensitivity was high. Maternal hostility did not significantly moderate the association between maternal depression and infant emotion regulation during either period but did have a significant direct effect on emotion regulation during the Still-Face period: higher maternal hostility was associated with increased self-soothing and decreased gaze aversion. Infants appear to be deploying different strategies based on their experience of their caregivers, which may have implications for long-term development.

Introduction

Early emotion regulation behaviours set the stage for lifelong socioemotional development (Thomas et al., 2017). This development begins in the context of caregiver-infant interactions. In early life, infants communicate their emotional states to their caregivers through vocal, facial, and behavioural cues, while caregivers interpret these cues and respond to infant needs (Thomas et al., 2017). It is through this ongoing exchange that infants begin to develop an understanding of their emotional states and, gradually, the ability to independently regulate them (Granat et al., 2017; Kiel & Kalomiris, 2015). These emotion regulation abilities are defined as "the behaviours, skills, and strategies, whether conscious or unconscious, automatic or effortful, that serve to modulate, inhibit, and enhance emotional experiences and expressions" (Calkins & Hill, 2007, p.229), and include both internal and external processes (Granat et al., 2017).

The Mutual Regulation Model (Tronick & Gianino, 1986) posits that infants engage these processes to simultaneously regulate their own internal emotional states and their engagement with the external environment. They engage in self-directed regulatory strategies, intended to modify internal states, and other-directed strategies, intended to regulate parent behaviour. Through these simultaneous processes, parent-infant dyads develop a coordinated communicative system in which infants' limited regulatory capabilities are bolstered by their parents, gradually leading to increased independence. Thus, it is through dyadic regulation that infants begin to develop the independent emotion regulation behaviours that they will carry throughout development (Conradt & Ablow, 2010; Granat et al., 2017).

Under ideal circumstances, parents' contingent and appropriate responses help to modulate infant distress while simultaneously supporting the development of independent regulation behaviours (Behrendt et al., 2019). Through this process, infants transition from

exclusive reliance on innate, primitive forms of emotion regulation, including rudimentary self-soothing behaviours such as sucking and stroking, to incorporating more deliberate, cognitive strategies such as distraction and attention allocation (Kopp, 1982, 1989; Fox & Calkins, 2003). Infants also become more adept at seeking the regulation aid that is needed from their caregivers (Atkinson et al., 2021; Calkins & Hill, 2007). When an effective repertoire of behaviours is attained, it is predictive of social and academic success (Leerkes et al., 2009; Penela et al., 2015), as well as adjustment and well-being in adulthood (Penela et al., 2015). However, when parents have difficulty supporting the early development of emotion regulation, infants may fail to develop effective strategies, potentially leading to socioemotional (Di Maggio et al., 2016) and behavioural (Crespo et al., 2017; Hill et al., 2006) problems, and to risk of psychopathology (Aldao et al., 2010; Rawana et al., 2014). Parental difficulty in supporting effective child emotion regulation may represent one mechanism by which maternal psychopathology, particularly maternal postpartum depression, leads to negative outcomes for offspring (Feldman et al., 2009; Ostlund et al., 2017).

Maternal Depression and Infant Emotion Regulation

The peripartum period, which includes the time shortly before, during, and immediately after giving birth, represents a time of increased risk for depression (O'Hara & McCabe, 2013). Between 12-18% of women experience clinically significant symptoms of depression during pregnancy or the early postpartum period (Woody et al., 2017), and one in nine children are exposed to maternal depression in their first year of life (Bernard et al., 2018). These children are at increased risk of negative socioemotional outcomes throughout development, including biased processing of emotional information in childhood (Joormann et al., 2007), higher levels of irritability and fear in adolescence (Rice et al., 2017), and higher lifetime risk of

psychopathology (Goodman et al., 2011; Gotlib et al., 2020). As early as infancy, offspring demonstrate decreased sensitivity to social cues, higher levels of negative emotionality, and less goal-directed regulatory strategies (Feldman et al., 2009; Skotheim et al., 2013). When a mother's capacity to offer a regulatory framework to her infant is disrupted by depressive symptoms, it may limit the infant's ability to transition from the relatively ineffective behaviours of infancy to more active coping strategies (Tronick & Gianino, 1986), leading to deficits in emotion recognition and regulation that persist into childhood (Kujawa et al., 2014; van der Waerden et al., 2015).

The negative effects of maternal depression on offspring have often been linked to disturbed mother-infant interactions (Field, 2010). Most of this research has focused on maternal sensitivity, defined as the degree to which mothers perceive and respond promptly and appropriately to their infants' signals and communications (Ainsworth et al., 1974). Depressed mothers tend to display less consistent interactive behaviour, a restricted range of affective expression, and to have more difficulty maintaining physical closeness to their infants as compared to non-depressed mothers (Feldman et al., 2009; Priel et al., 2019). Their interactions with their infants are often less attuned (Behrendt et al., 2019; Lovejoy et al., 2000), and marked by fewer engaging behaviours such as smiling, vocalizing, and gameplaying (Field et al., 2006). When maternal sensitivity is high, it may buffer the effects of maternal distress on emotional development (Thomas et al., 2017).

In infancy, high maternal sensitivity is predictive of increased regulatory behaviour and longer latency to distress (Frick et al., 2018). Maternal sensitivity is associated with better emotion regulation throughout childhood, which in turn allows for greater social competence and success with peers (Crockenberg & Leerkes, 2004; Leerkes et al., 2009). Low maternal

sensitivity is predictive of children's externalizing problems, anxiety, and aggression, among other adverse social, emotional, and cognitive outcomes (Bradley & Corwyn, 2008; Bouvette-Turcot et al., 2017; Campbell et al., 2010; Deans, 2020).

Although the importance of maternal sensitivity is well-established, the impact of negative parenting behaviours has been relatively neglected in the field. However, results from one meta-analysis suggest that maternal depression is more strongly linked with negative parenting behaviours, such as hostility, as compared to an absence of positive behaviours, such as disengaged or insensitive parenting (Lovejoy et al., 2000). Evidence suggests that maternal depression has distinct associations with parenting hostility and warmth, and that both mediate the association between maternal depression and childhood psychopathology (Sellers et al., 2014). Parenting in the context of depression is thus characterized not only by an absence of positive behaviours, but also by the presence of negative behaviours which may have a detrimental impact on child development. Hostile parenting behaviours have been linked to adverse outcomes throughout childhood, including behaviour problems (Giallo et al., 2013), internalizing and externalizing symptoms (Edwards & Hans, 2015; Morris et al., 2002), and aggression (Stover et al., 2016).

Maternal hostility may impede socioemotional development through its impact on child emotion regulation (Hentges et al., 2020; Rose et al., 2018). Maternal hostility is associated with increased negative affect during mother-infant interactions (Lyons-Ruth, 1996), and has been shown to impact both physiological and behavioural regulation on the part of the infant (Calkins et al., 1998; Morris et al., 2002). Hostile parenting continues to predict emotion regulation difficulties into adolescence (Sarıtaş et al., 2013; Shaw & Starr, 2019) and may have long-term effects in terms of risk of psychopathology (Maughan et al., 1995; Sturge-Apple et al., 2006).

Measurement Issues in Emotion Regulation

In addition to the relative neglect of negative parenting behaviours, another issue in the study of infant emotion regulation has been its measurement. Measures of infant emotion regulation often treat emotion regulation as a unitary construct. In studies that do include multiple behaviours, they are often summed, or categorized as "adaptive" or "maladaptive" (e.g., Feldman et al., 2009; Khoury et al., 2016). These approaches risk obscuring the complexity of regulation and the flexibility of infants in developing and selecting varying regulatory strategies (Bridges et al., 2004).

In recent years, the adult literature has shifted from delineating the effects of specific regulatory strategies (e.g., reappraisal versus suppression) to a broader focus on regulatory flexibility (English & Eldesouky, 2020). Current theories posit that the utility of strategies is dependent on context, and thus successful emotion regulation is characterized by flexible adjustment (Aldao et al., 2015; Bonanno & Burton, 2013). Bridges et al. (2004) argue that all emotion regulation is adaptive, and that dysregulation may occur when emotion regulation styles are not sufficiently flexible to meet environmental demands. An exclusive focus on the utility of discrete strategies may fail to capture social and extrinsic factors and the flexibility they require (Myruski & Dennis-Tiwary, 2021).

Although such theories have yet to gain traction in the infant literature, there is evidence that similar ideas hold true. For example, in early infancy, dyadic regulatory strategies are more effective in regulating distress than the rudimentary self-soothing skills possessed by young infants (Diener et al., 2002; Khoury et al., 2016). However, when a caregiver is not immediately available, it may be adaptive for infants to transition to independent strategies. Prior research has shown that infants do vary their regulatory behaviours according to situational demands and the

availability of their caregiver (Atkinson et al., 2021; Miller et al., 2002). When infants are habitually denied responses from their parents, or when these responses are inappropriate or ineffective, relying on independent strategies may represent an adaptive compensation (Kim et al., 2014; Manian & Bornstein, 2009).

This may be the case in instances of an experimentally induced lack of responsiveness as well. Results from several studies have shown that infants of depressed mothers fail to demonstrate the typical "still-face (SF) effect," which consists of increased gaze aversion, less smiling, and more negative affect (Field, 2002; Field et al., 2007; Mesman et al., 2009). However, other studies have found little to no difference in the behavioural responses of infants of depressed mothers (Stanley et al., 2004; Weinberg et al., 2008). Infants' responses to the paradigm may be dependent on their prior experience of their caregiver, such that differences in parenting behaviours may explain these contradictory findings.

The Current Study

The current study used an observational coding system to capture the range of regulatory behaviours employed by infants. We used the SF paradigm, consisting of normal, SF, and reunion periods (Tronick et al., 1978), to observe infant behaviours during both naturalistic interactions with their mothers and a period of induced mild distress in which they were required to regulate independently. Our overarching goal was to examine both positive (sensitivity) and negative (hostility) parenting behaviours as moderators of the association between maternal depressive symptoms and infant emotion regulation behaviours. We anticipated that maternal sensitivity and hostility would differentially impact the association with infant emotion regulation behaviours, with sensitivity acting as a buffer for the effects of maternal depression and hostility heightening its effects.

We hypothesized that, during the normal interaction period, maternal sensitivity would moderate the association between maternal depressive symptoms and dyadic regulatory behaviours, such that higher levels of depressive symptoms would predict decreased use of dyadic behaviours for infants whose mothers were low on maternal sensitivity. These infants may be more accustomed to inconsistent responsiveness from their mothers and may have learned not to rely on them for regulatory support (Manian & Bornstein, 2009). During the SF period, we hypothesized that maternal sensitivity would moderate the effects of maternal depressive symptoms on gaze aversion, such that depressive symptoms would negatively predict gaze aversion for infants whose mothers had low maternal sensitivity, but not for infants whose mothers demonstrated high sensitivity. This is in keeping with our hypothesis that differences in parenting behaviour may be responsible for the mixed findings regarding the SF effect in infants of depressed mothers (e.g., Field et al., 2007; Graham et al., 2018). Infants of depressed mothers may demonstrate the usual SF effect if their mothers demonstrate high sensitivity but may be less distressed by the SF period if their mothers show low sensitivity.

Given the lack of research on the association between maternal hostility and infant emotion regulation behaviours, our analyses in this domain were largely exploratory. During the normal interaction periods, we hypothesized that maternal hostility would moderate the association between maternal depressive symptoms and infant self-soothing and gaze aversion, such that depressive symptoms would be positively associated with these independent regulatory behaviours in infants whose mothers demonstrated high maternal hostility. Maternal hostility is associated with increased negative affect during mother-infant interactions (Lyons-Ruth, 1996); infants may cope by using independent regulatory strategies. During the SF period, we hypothesized that maternal hostility would moderate the association between maternal depressive

symptoms and self-soothing, such that depressive symptoms would be positively associated with self-soothing behaviour for infants whose mothers showed higher levels of maternal hostility. Self-soothing behaviours involve innate behaviours such as mouthing and touch and are generally considered less effective than strategies requiring attention allocation, such as distraction (Fox & Calkins, 2003; Tronick & Gianino, 1986). Prior research has shown that increased maternal hostility is associated with greater difficulty in emotion regulation on the part of the infant during a frustration task (Little & Carter, 2005); this difficulty may be reflected in the use of less effective strategies.

The current study adds to a robust and important literature in several meaningful ways. The study was designed to capture a richer picture of infant regulation by using an observational coding system, including different contextual demands, and isolating the effects of different parenting behaviours. We believe this is a first step in moving beyond the concept of "adaptive" and "maladaptive" regulation towards an understanding of the development of regulatory flexibility. By specifically addressing the role of both positive and negative parenting behaviours, we aimed to increase insight into the risk associated with maternal depression, as well as the protective effects of positive parenting.

Methods

Participants

Videotaped interactions in the current study were from the Field et al. (2007) study. This study was conducted in accordance with the ethical standards of the American Psychological Association, with written informed consent obtained from a parent or guardian for each child before any assessment or data collection. All procedures were approved by the Institutional Review Board at the University of Miami School of Medicine.

Forty-six mothers were recruited prenatally through ultrasound clinics at the University of Miami School of Medicine in Miami, Florida, USA. When infants were four months old, mother-infant dyads were video recorded undergoing both a Separation and a SF procedure. For the purposes of the present study, only dyads who completed the SF procedure were included in analyses. Five dyads did not complete the SF procedure due to mothers not complying with instructions (n = 4) or excessive infant distress/irritability following the first procedure (n = 1). Of the remaining participants, six additional dyads were excluded from the present analyses due to an obstructed view of the infant in the videotape (n = 3), mothers not following instructions (n = 2), or excessive infant crying or distress (n = 1). The final sample consisted of 35 dyads (17 females, 18 males). Mothers' ages ranged from 18 to 37 years (M = 24.44, SD = 5.48) and infant ages ranged from 11 to 19 weeks (M = 16.87, SD = 1.44). Mothers were of lower socioeconomic status, as measured by the Hollingshead Index (M = 3.76, SD = 0.94) and self-identified as 49% Hispanic, 43% Black, and 8% White. Based on questionnaire measures, 13 mothers were classified as having high levels of depressive symptoms.

Procedure

Mother-infant dyads participated in video recorded testing at the Touch Research Institute at the University of Miami School of Medicine. Infants were securely fastened in an infant seat on a table at eye-level to their mothers. Two cameras were positioned on tripods to capture the mother and infant simultaneously.

After the mothers completed demographic and self-report questionnaires, they participated in two mildly distress-inducing paradigms with their infants. The first of these, the Separation Procedure (Field et al., 1986), was not used for the current analyses; for a full description, see Field et al. (2007). The second paradigm, the SF procedure (Tronick et al.,

1978), consists of two 90-second normal interaction periods (normal, reunion-normal), in which mothers are instructed to interact with their infant as they normally would, separated by a 90-second perturbed (SF) interaction period, during which mothers are asked to maintain a neutral facial expression and gaze at their infants but refrain from interacting with them. During the SF period, mothers are unresponsive and emotionally unavailable to their infants. Mothers were informed that they were free to terminate at any point if desired (n = 0), and testing was terminated if infants fretted for longer than 50% of the interaction period (n = 1).

Apparatus

Mother-infant interactions were filmed using two video cameras. A split screen generator was used to enable observation of both individuals simultaneously. Infants were securely fastened in an infant seat without toys or pacifiers. Observational coding of videos was completed using Mangold INTERACT (version 14.3.7), a software system used for behavioural research.

Measures

Maternal depression. Maternal depression was measured using the Center for Epidemiological Studies Depression Scale (CES-D; Radloff et al., 1977). This self-report questionnaire consists of 20 items rated on a four-point scale from “rarely” to “most of the time” and is designed to measure the number of depressive symptoms (e.g., depressed mood, feelings of hopelessness or worthlessness, etc.) experienced by the mother during the past week. The CES-D has been shown to be a reliable and valid measure of depression (Roberts, 1980; Yang et al., 2015) and to have a high internal consistency in other samples. Although maternal depression scores were treated as a continuous variable in our analyses, a cut-off score of 16 is considered to indicate clinically significant depressive symptoms. Using this cut-off score, 13 of the mothers in

our sample were considered depressed.

Maternal parenting behaviours. Maternal sensitivity and hostility were observationally coded using the Emotional Availability Scales (2nd ed., Biringen et al., 1988; 1993). Emotional availability is a construct that captures the emotional openness and connection between parent and child (Pipp-Siegel & Biringen, 1998). It includes both parent and child scales; however, for the purposes of the current study, and in the interest of parsimony, only parental sensitivity and hostility were included as these constructs have known associations with infant emotion regulation (e.g., Behrendt et al., 2019; Hentges et al., 2020). Parental sensitivity measures the contingency and appropriateness of parent responses. Parental hostility measures impatience, anger, or concealed hostility. Global ratings for each scale were assigned by observing maternal behaviour during the normal interaction periods, when mothers and infants were interacting naturally. Maternal sensitivity was coded on a nine-point scale, ranging from 1 (highly insensitive) to 9 (highly sensitive). Maternal hostility was rated on a five-point scale, ranging from 1 (non-hostile) to 5 (overtly hostile). Coding was carried out by trained coders who were blind to the study hypotheses and maternal depression scores. Intraclass correlation coefficients for the EA scales ranged from 0.84-0.97.

Infant emotion regulation behaviours. Emotion regulation behaviours were coded using the Infant Self-Regulation Scheme (ISRS; Millman et al., 2007). This system was adapted from the Infant Regulatory Scoring System (IRSS; Tronick & Weinberg, 1996), and has been used for observational coding of infant behaviour in a number of studies (e.g., Atkinson et al., 2021; August et al., 2017; Jean & Stack, 2012). The system includes the following categories: self-comfort regulatory, self-comfort exploratory, attention-seeking, escape, gaze aversion, and bidirectional exchange, which are coded on a second-by-second basis and later summed to create

a proportion for each interaction period. Thirty percent of the sample was double coded by an undergraduate student who was blind to the study's hypotheses and maternal depression scores. Brief operational definitions and kappa values for each behaviour are presented in Table 1.

Results

Data Preparation and Descriptive Statistics

Emotion regulation behaviours were transformed into percent durations to obtain the percentage of time infants engaged in each behaviour during each interaction period. Attention-seeking and escape behaviours were removed from analyses as these behaviours had means below 5% across periods. For the remaining behaviours, univariate outliers were identified as cases with standardized scores exceeding 3.29 and brought in to the value of the next score plus or minus one according to the method outlined by Tabachnick and Fidell (2013). The result of Little's MCAR test was nonsignificant ($c^2 = 45.232$, $df = 53$, $p = 0.767$); therefore, data can be assumed to be missing completely at random.

The goal of the study was to examine infant emotion regulation behaviours during a period of normative interaction and a period of maternal unavailability. Both the normal and reunion-normal periods represent interactions where the mother is available to her infant and may elicit similar emotion regulation behaviours on the part of the infant (e.g., Jean & Stack, 2012). In order to limit total analyses and reduce the chance of a Type 1 error, a one-way repeated measures MANOVA was conducted in IBM SPSS (v.22) to test for differences in emotion regulation behaviours between the normal and reunion-normal periods. As there were no significant differences, $F(4, 30) = 2.579$, $p = .057$, analyses were run using the normal and SF periods, but not the reunion-normal period.

Descriptive statistics for the study variables are presented in Table 2. Given that there

were no significant bivariate correlations between the planned control variables (maternal age, maternal education, SES) and any of the outcome variables, and in order to preserve power, the control variables were not included in the final models. Correlations between the included variables are presented in Table 3. Moderation analyses were conducted using MPlus (v.8). The model was tested using a robust maximum likelihood (MLR) estimator to account for non-normality in the data. A conservative *p*-value of 0.01 was used to determine statistical significance given the number of models.

Moderation Analyses

The moderating effects of maternal sensitivity and hostility were tested using a series of multiple regression analyses. Maternal sensitivity and hostility were tested in separate models to avoid potential multicollinearity problems created by the high negative correlation between scales. One set of models was run for each period (normal and SF), and separate models were run for each infant emotion regulation behaviour, resulting in 14 models. The independent variable (maternal depressive symptoms) and the moderator variables (maternal sensitivity, hostility) were converted to standardized scores prior to the analyses. Interaction terms were generated by creating the product of the maternal depressive symptoms and the moderator. Significant interaction effects were investigated using the Johnson-Neyman technique (Bauer & Curran, 2005; Johnson & Neyman, 1936), which allows for identification of the range of moderator values in which the association between the predictor and outcome is significant. All models were just identified and indicated good fit to the data ($X^2 = 0.00$, $p < 0.001$; CFI = 1.00; TLI = 1.00; RMSEA = 0.00; SRMR = 0.00).

Maternal Sensitivity

The first set of models tested maternal sensitivity as a moderator of the association between maternal depressive symptoms and infant emotion regulation behaviours (self-comforting, exploratory, gaze aversion, bidirectional exchange) during a normal interaction period. There were no significant main effects of maternal sensitivity or maternal depression and no significant interaction effects on any of the emotion regulation behaviours.

The second set of models tested maternal sensitivity as a moderator during the SF period. Emotion regulation behaviours included self-comforting, exploratory, and gaze aversion. Bidirectional exchange was not included in SF models as this category of behaviour is not possible during the SF period, when mothers are instructed not to interact with their infants. Maternal sensitivity and maternal depression were not significant predictors of any of the emotion regulation behaviours. The interaction term was a significant predictor of gaze aversion ($b = 0.519$, $p = 0.003$). The model explained an estimated 33.3% of the variance of gaze aversion. Inspection of the Johnson-Neyman plot demonstrated that the effect of maternal depression on gaze aversion was nonsignificant for values of maternal sensitivity between -0.9 *SD* and 0.4 *SD* from the mean. For values of maternal sensitivity below this range, depression negatively predicted gaze aversion; for values above this range, depression positively predicted gaze aversion (Figure 1). To illustrate this effect, the regression of gaze aversion on depression was plotted at 1 *SD* below the mean, at the mean, and at 1 *SD* above the mean (Figure 2).

Maternal Hostility

The third set of models tested maternal hostility as a moderator during the normal interaction period and included the following emotion regulation behaviours: self-comforting, exploratory, gaze aversion, bidirectional exchange. Results indicated that neither of the

independent variables nor the interaction term were significant predictors of the emotion regulation behaviours.

In the final set of models, maternal hostility was tested as a moderator during the SF period. The following emotion regulation behaviours were included: self-comforting, exploratory, gaze aversion. Maternal hostility positively predicted self-comforting (b = 0.359, p = 0.005) and negatively predicted gaze aversion (b = -0.303, p = 0.008). Maternal depression and the interaction terms were not significant predictors of any of the emotion regulation behaviours. The models explained 12.7% of the variance in self-comforting behaviour and 14.1% of the variance in gaze aversion, respectively.

Discussion

The current study aimed to examine positive and negative parenting behaviours as moderators of the association between maternal depression and early emotion regulation behaviours. By observationally coding infant behaviours during two interaction contexts, we were able to capture a snapshot of early dyadic and independent regulation. As hypothesized, maternal sensitivity and hostility differentially predicted the emotion regulation behaviours used by infants in periods of normal interaction and periods of mild induced distress.

Maternal sensitivity

Maternal sensitivity did not moderate the association between maternal depressive symptoms and infant emotion regulation behaviours during the normal period. This was contrary to our hypothesis that higher levels of depressive symptoms would predict decreased use of dyadic behaviours when mothers showed low levels of maternal sensitivity, and to prior studies which suggest that the impact of maternal depression on social behaviours may vary according to maternal sensitivity levels (Campbell et al., 2007; Feldman et al., 2009). It may be that our

results are due to the lack of variance in sensitivity observed in our sample. The mean of maternal sensitivity in our sample was relatively high (6.26), which maps onto what is often termed "good enough" parenting. Such interactions are generally positive but may lack the synchrony seen in dyads with more optimal sensitivity (Biringen et al., 2014). Although high levels of positive parenting behaviour are not generally expected in mothers with significant depressive symptoms, past studies do suggest that many mothers are able to override their depressive symptoms when it comes to parenting (Bernard et al., 2018; Turney, 2011). It is possible that the lack of variance in maternal sensitivity prevented us from detecting interaction effects. It may also be that, at the high levels of sensitivity observed, the impact of maternal depression on emotion regulation behaviours is less pronounced than at lower levels of sensitivity. Future studies should test this moderation with a greater range of sensitivity.

During the SF period, our hypothesis that maternal depressive symptoms would negatively predict gaze aversion for dyads with low maternal sensitivity was supported. Given that increased gaze aversion is a key behavioural change demonstrated by most infants during the SF procedure, our findings offer important insight as to whether infants of depressed mothers experience the classic SF effect. Past studies have yielded inconsistent results in this regard (e.g., Manian & Bornstein, 2009; Weinberg et al., 2008). Our results suggest that parenting behaviour may be one possible explanation for these contradictory findings. As suggested by Field et al. (2007), the SF procedure may be less distressing to infants of depressed mothers, who may be more accustomed to a lack of responsiveness or flattened affect on the part of their mothers. However, this may not be the case when mothers habitually display sensitive responding despite their depressive symptomatology. Thus, infants of depressed mothers may display an atypical

response to the SF period only when they have previous experience with this type of maternal behaviour, and not in cases of higher maternal sensitivity.

A related possibility is that infants of depressed mothers are using different regulatory strategies when faced with maternal non-responsiveness. Graham et al. (2018) found that infants of depressed mothers display greater positive affect during the SF period as compared to infants of non-depressed mothers; they suggested that these infants may be amplifying their positive attachment signals in an effort to reengage maternal attention. As with Field et al.'s (2007) contention, these differences may be attributable to greater familiarity with maternal non-responsiveness. When mothers are inconsistently responsive, infants may develop strategies for reengaging maternal support, including upregulating positive signalling and downgrading negative affect. Indeed, there is evidence that infant negativity is predictive of reduced maternal responsiveness in depressed mothers (Newland et al., 2016; Tester-Jones et al., 2015), suggesting that positive communicative and attachment signals may be an effective strategy on the infants' part. When maternal sensitivity is high, these signals may not be needed to engage maternal attention. Thus, infants with little experience of maternal non-responsiveness may rely more on strategies such as gaze aversion, while infants who have experienced chronic low sensitivity may engage different strategies intended to elicit maternal responsiveness. Further research is needed on the full spectrum of SF effect behaviours to confirm whether maternal sensitivity can explain differential responses to the SF paradigm in infants of depressed mothers.

Our moderation analyses also indicated that, for dyads with high maternal sensitivity, maternal depressive symptoms positively predicted infant gaze aversion. Gaze aversion is considered a normative response to the SF paradigm (Mesman et al., 2009); as such, a positive association with maternal depressive symptoms is unexpected. It is possible that our findings are

the result of some additional pathway by which maternal depression impacts emotion regulation behaviours. Infant temperament is one possible mechanism. One study found that when 12- and 18-month infants were high in temperamental negative affectivity, they looked at their mothers less during a frustration task when she scored highly on a global measure of emotional availability; for infants with lower temperamental negativity, the association was reversed (Kim et al., 2014). The authors concluded that infants with higher negative affectivity provide more opportunities for their parents to aid in independent regulation; when parents are emotionally available, these infants may learn to regulate their own frustration rather than relying exclusively on their parent (Kim et al., 2014). Given the positive association between maternal depression and infant temperamental negativity (Britton, 2011; McGrath et al., 2008), it is possible that a similar phenomenon was occurring in our sample. It is also possible that gaze aversion is serving a different function for these infants and is not a marker of distress. For example, an increased use of gaze aversion may indicate that the infant is distracted by some aspect of the environment. Since maternal depressive symptoms are predictive of household chaos (Hur et al., 2015), it is possible that these infants are averting their gaze simply because there is more to look at in their environment. Further research is needed to replicate our finding and explore potential moderators.

Maternal hostility

The next objective was to test the moderating effect of maternal hostility on the association between maternal depressive symptoms and infant emotion regulation behaviours. Although prior research has demonstrated an association between maternal depression and parenting hostility (Hentges et al., 2020; Lovejoy et al., 2000), to our knowledge our study was the first to directly test parenting hostility as a moderator of the association between maternal

depression and infant emotion regulation. Our results indicated that parenting hostility did not moderate the association between maternal depression and infant emotion regulation behaviours during either interaction period, but did have a direct association with infant emotion regulation behaviours during the SF period. It is possible that maternal depression and parenting hostility, though related, have separate and distinct effects on the development of emotion regulation. However, our findings in this domain should be interpreted with caution given the nature of our sample. Although our sample can be considered higher risk as compared to many studies (i.e., lower SES, high levels of depressive symptoms), we observed relatively low levels of maternal hostility. This may be due to our non-clinical sample, the young age of the infants, or the nature of the experimental paradigm. Although even small differences in parenting hostility may have real-world significance in terms of child development (Lam et al., 2018; Sellers et al., 2014; Stack et al., 2012), the limited variance in our sample may have prevented us from detecting existing interactions. Future research should test this moderation in a higher risk sample or use a more demanding interaction task to create more opportunity for frustration and maternal hostility.

Regarding direct effects, maternal hostility positively predicted self-comforting and negatively predicted gaze aversion during the SF period. When mothers have higher levels of hostility, infants appear to be using more rudimentary self-soothing strategies and less attention allocation. This is consistent with prior work, which found that maternal hostility predicted increased use of regulatory types of touch on the part of the infant during the SF period (Moszkowski et al., 2009). Prior research has demonstrated that greater maternal hostility is associated with infant difficulty in regulating distress during an emotional challenge (Little & Carter, 2005). It is possible that the increased self-soothing observed in our sample reflects this

difficulty: infants may be reverting to strategies such as touch when they are unable to successfully regulate their distress. It is also possible that infants whose mothers have higher hostility have not had the same opportunity to increase their repertoire of regulatory strategies, and are thus limited to the use of innate or more rudimentary behaviours. Future research should test the developmental trajectories of behaviours used by infants and their association with parenting characteristics.

Limitations and future directions

Along with several important contributions, including use of an observational coding system, inclusion of different contexts, and examination of positive and negative parenting effects, there are a number of limitations to the current study. First, our sample size was relatively small. Although small samples are typical of observational infant studies, especially those focused on higher-risk or more vulnerable populations, our sample size may have limited our ability to detect interaction effects. It is possible that, although we were able to detect interactions in one of our regression models, other existing associations may have been missed due to being underpowered. Future studies should aim to test these associations using larger samples.

Our smaller sample size also prevented the inclusion of measures of infant characteristics, such as a measure of temperament or the infant dimension of the EA scales. Including an infant measure may have provided insight into the bidirectional nature of parent-child interactions and the impact of both members of the dyad on emotion regulation behaviours. Future studies should examine the interactive effects of maternal and infant characteristics on the use of specific emotion regulation behaviours.

Another limitation is the relatively short observation time used to code the EA scales. The predictive validity of the EA scales improves with increased observation time (Biringen et al., 2005). This may be due in part to the impact of social desirability on mothers' behaviour, which may decrease over more prolonged observation periods. However, longer observation times are difficult with very young infants. Past studies have used the EA scales to examine parenting behaviour in shorter interaction periods, including laboratory procedures such as the SF paradigm (e.g., Carter et al., 1998; Korja & McMahon, 2021; Moszkowski et al., 2009).

A common limitation in developmental research is the inclusion of mothers but not fathers. Future studies should examine the impact of paternal depression and parenting behaviours on infant emotion regulation. Finally, although our sample may be considered at-risk in many respects (high rates of depressive symptomatology, lower SES), one should be cautious about generalizing findings to other vulnerable populations. Future studies should seek to replicate our findings with different populations, including clinical samples and samples with higher rates of suboptimal parenting.

Implications and conclusions

Our findings provide a number of interesting contributions to the literature. First, by examining the specific emotion regulation behaviours used by infants in two contexts, we gained increased insight into *how* infants are regulating rather than simply *whether* they are. The behaviours attained in infancy are predictive of lifelong regulatory success (Penela et al., 2015), and thus understanding the context in which certain behaviours develop (or fail to develop) is key to understanding healthy socioemotional development.

Our inclusion of both positive and negative parenting behaviours enabled a more nuanced understanding of the risk associated with maternal depression. In our study, maternal sensitivity

buffered the effects of maternal depressive symptoms during a period of maternal unavailability, such that infants of higher sensitivity mothers displayed a normative distress response regardless of maternal depression status. When maternal sensitivity is low, infants appear to be habituating to decreased responsiveness and reacting differently to maternal non-responsiveness. This acclimatization may represent an adaptive response on the part of the infant (Khoury et al., 2016; Kim et al., 2014).

Our findings also provide insight into the importance of negative parenting behaviours. Although there is evidence that maternal depression is more strongly linked to the presence of negative parenting behaviours than the absence of positive characteristics (Lovejoy et al., 2000), relatively little research has focused on the role of negative parenting behaviours in the development of emotion regulation. In our study, maternal hostility did not moderate the effects of maternal depressive symptoms on infant regulatory behaviour. Our interaction period was brief and relatively undemanding, and it is possible that we did not observe high enough levels of hostility to capture an interaction. However, our results do suggest that maternal hostility directly impacts the emotion regulation behaviours used by infants during challenging interaction tasks. Infants of mothers showing higher levels of hostility relied more on rudimentary self-soothing skills rather than using strategies that are considered more sophisticated. It is possible that maternal hostility is interfering with infants' learning of new strategies, which may explain past findings regarding the association between maternal hostility and difficulty regulating (Lyons-Ruth, 1996). If this is the case, it may have serious repercussions for the emotional development of these infants.

In recent years, there has been increased focus on screening for maternal depression and difficulties in the mother-infant relationship during pediatric well-baby visits (Bernard et al.,

2018). Several parenting interventions targeting maternal sensitivity in depressed mothers have yielded promising results (Deans, 2020; Kersten-Alvarez et al., 2011); however, negative parenting behaviours have been relatively neglected. Consistent with past research (e.g., Hentges et al., 2020; Lovejoy et al., 2000), results from the current study suggest that parenting hostility may be an important target for intervention given its unique association with emotion regulation. More direct targeting of hostility could potentially improve not only dyadic interaction, but also emotion regulation trajectories.

Taken together, our findings provide a more nuanced understanding of the socioemotional risk associated with maternal depression. Using an observational coding system allowed us to capture the breadth of regulatory behaviours used by infants. By including both positive and negative parenting behaviours, we delineated the potentially harmful effects of suboptimal parenting. Finally, rather than focusing on the adaptiveness of discrete strategies, we were able to take into account social and contextual factors which shape early emotion regulation. This more complex view of early regulation is crucial to our understanding of healthy socioemotional development, and to the early identification and treatment of at-risk dyads.

Table 1.

Brief operational definitions for Infant Self-Regulation Scheme (ISRS; Millman et al., 2007) and inter-rater agreement.

Emotion regulation behaviour	Operational definition	Kappa
Self-comfort regulatory	Using touch or self to independently self-regulate. Infant's gaze must be directed away from self or object. e.g., Mouthing, rubbing body, pulling clothes.	0.85
Self-comfort exploratory	Using environment to independently self-regulate. Infant's gaze is directed toward the object of interest. e.g., Exploring chair with hands, playing with clothes or chair's belt.	0.78
Attention-seeking	Trying to get mother's attention when mother is not interacting with child. e.g., Reaching for mother, vocalizing insistently.	0.82
Escape	Attempting to get out of chair or distance self from mother. e.g., Twisting in chair, arching body away from mother.	0.79
Gaze aversion	Looking away from mother. e.g., Not interested in interacting with mother, attention elsewhere.	0.80
Bidirectional exchange	Regulating by engaging with mother. e.g., Cooperative play, joint attention.	0.86

Table 2.

Descriptive statistics.

	Range	*M*	*SD*
Maternal depression	0 - 31	12.97	7.72
Maternal sensitivity	1 - 9	6.26	2.02
Maternal hostility	1 – 2.5	1.15	0.36
Self- comforting (Normal)	0 - 75.52	19.49	21.88
Self- comforting (Still-face)	2.22 – 94.40	51.02	24.49
Exploratory (Normal)	0 – 41.09	6.96	12.25
Exploratory (Still-face)	0 – 69.97	16.25	20.87
Gaze aversion (Normal)	3.33 – 87.74	33.07	22.79
Gaze aversion (Still-face)	0 – 65.53	18.72	18.01
Bidirectional exchange (Normal)	2.22 – 83.30	37.94	24.11

Table 3.

Correlations between study variables.

	1	2	3	4	5	6	7	8	9	10
1. Maternal depression	1									
2. Maternal sensitivity	-0.21	1								
3. Maternal hostility	0.18	-0.57**	1							
4. Self- comforting (Normal)	0.02	-0.26	0.09	1						
5. Self- comforting (Still-face)	-0.13	-0.19	0.30	0.19	1					
6. Exploratory (Normal)	0.22	0.33	0.22	0.42*	0.02	1				
7. Exploratory (Still-face)	0.18	0.80	-0.13	0.03	-0.50**	0.33	1			
8. Gaze aversion (Normal)	0.11	0.18	0.07	-0.54**	-0.04	0.40*	-0.17	1		
9. Gaze aversion (Still-face)	0.06	0.29	-0.25	-0.30	-0.51**	-0.39*	-0.32	.24	1	
10. Bidirectional exchange (Normal)	-0.22	0.21	-0.10	-0.57**	-0.12	-0.55**	-0.07	-0.22	0.23	1

Note. * $p < 0.05$, ** $p < 0.01$, two-tailed.

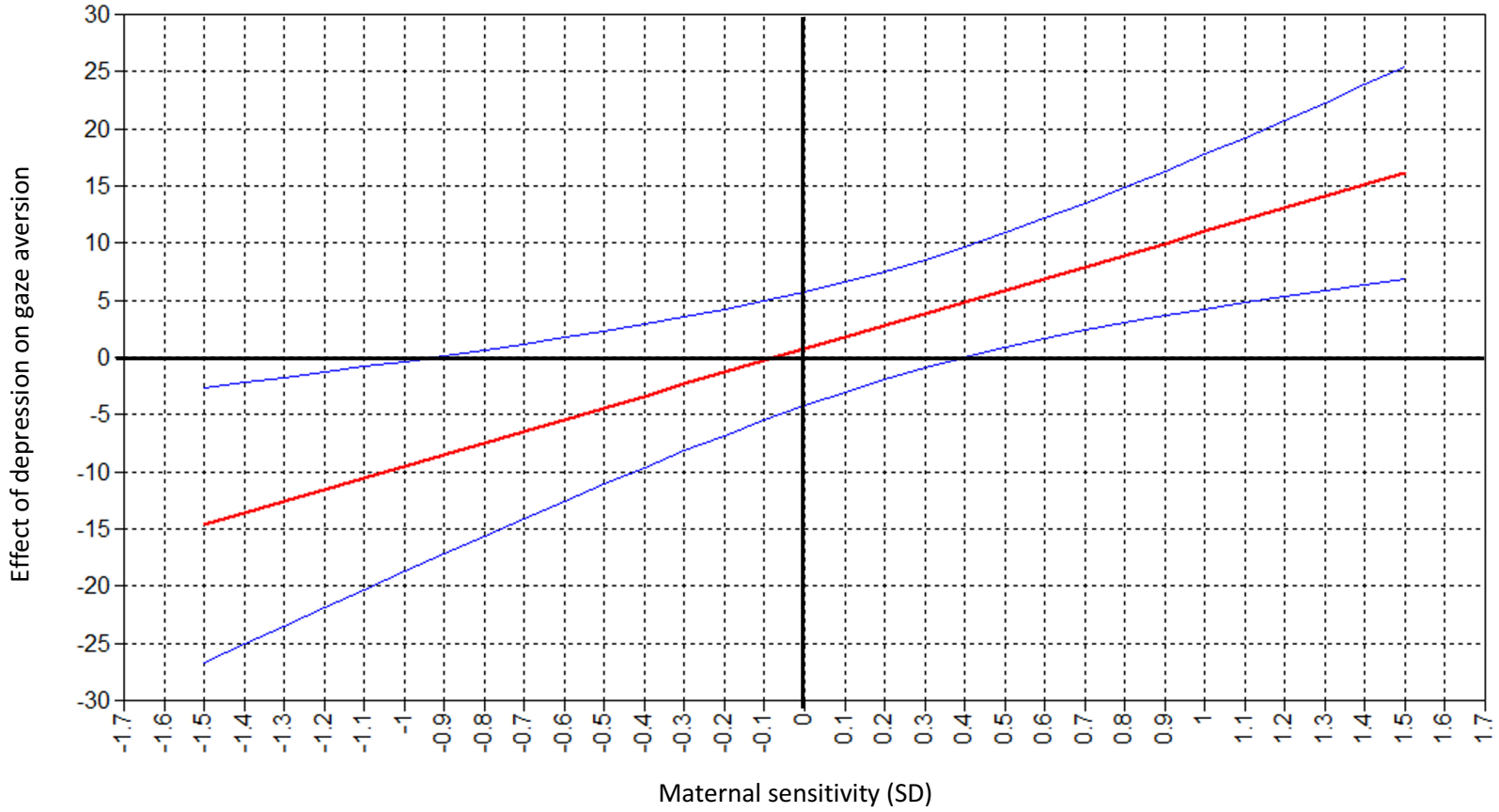

Figure 1. Johnson-Neyman loop plot depicting the effect of maternal depression on the proportion of gaze aversion used during the SF period at different values of maternal sensitivity. The red line represents the adjusted effect of depression on gaze aversion. Blue lines represent 95% confidence intervals.

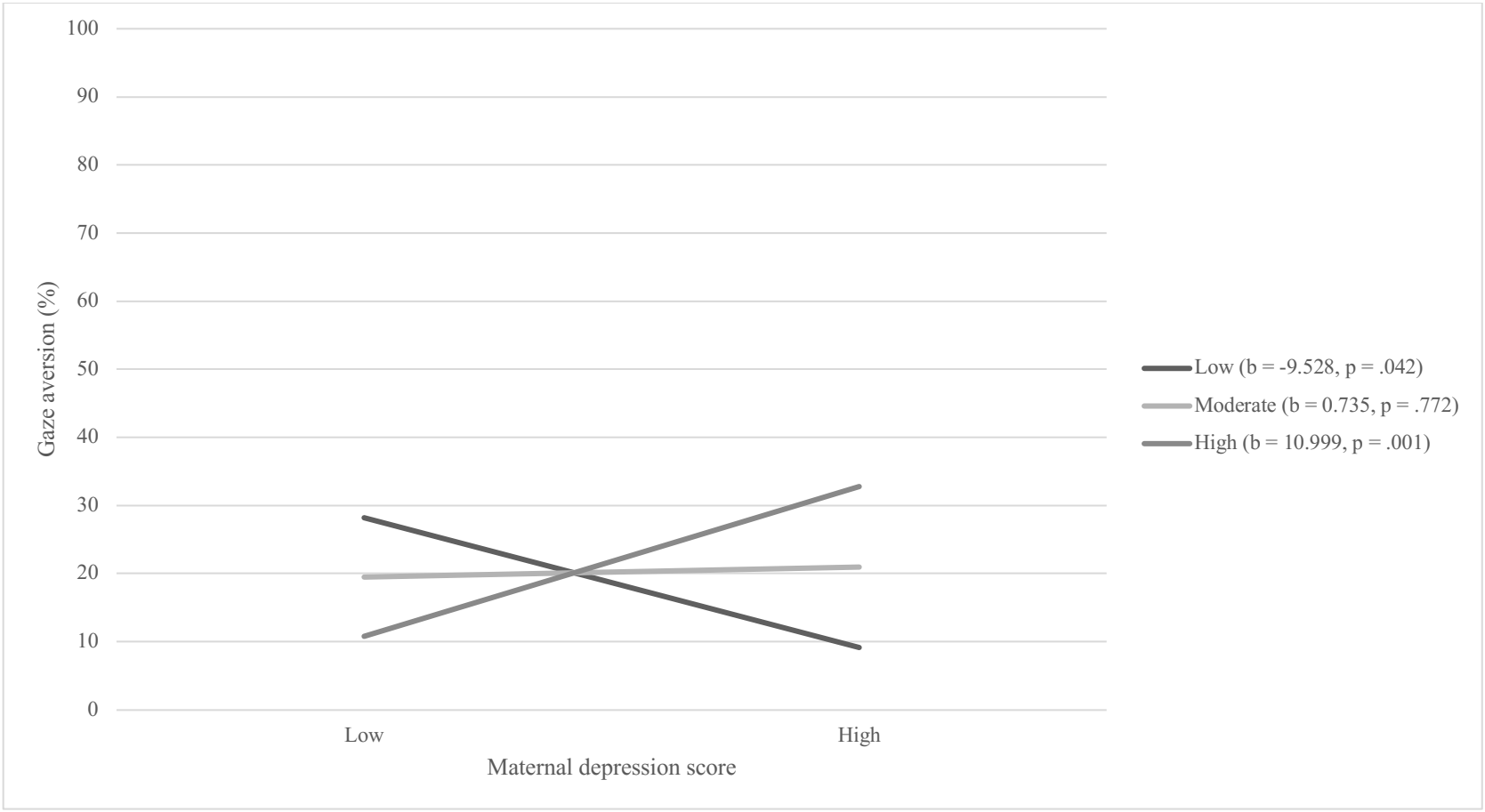

Figure 2. Association between maternal depression score and use of gaze aversion during the SF period for low (-1 *SD*), moderate (mean), and high (+1 *SD*) levels of maternal sensitivity.

Chapter 3: Transition Statement between Study 1 and Study 2

Results from Study 1 indicated that both positive and negative parenting behaviours play a role in the emotion regulation behaviours used by infants during normative interactions and during periods of mild distress. Specifically, maternal sensitivity moderated the association between maternal depression and infant regulatory behaviours during both interaction periods, suggesting that the interaction of maternal mental health and suboptimal parenting behaviour may play an important role in the early development of emotion regulation. Although maternal hostility was not a significant moderator in our models, it did directly predict the emotion regulation behaviours used by infants during a perturbed interaction period. This finding indicates that negative parenting may have a distinct effect on emotion regulation, over and above the effects of maternal depression.

These results suggest that the regulatory behaviours used by infants are impacted by their experiences with their caregivers. Although traditional approaches would hold that suboptimal parenting leads to poorer regulation on the part of the infant (Diener et al., 2002), there is also evidence that parenting behaviours may impact which strategies are most adaptive (Miller et al., 2002). Thus, rather than being indicative of poorer regulation, our results may suggest that infants are adjusting their approach to regulation based on situational demands.

Study 1 offered a more nuanced understanding of regulatory behaviours in the context of dyadic mother-infant relationships; however, it did not directly capture regulatory flexibility. In Study 2, we examined not only the specific regulatory behaviours used by infants, but also their co-occurrence, in order to gain a sense of the behavioural repertoires used in early life. Possession of a variety of regulation strategies is necessary for regulatory flexibility (Bonanno &

Burton, 2013). This method allowed us to identify profiles of emotion regulation that occur across early development, deepening our understanding of the function of not only individual behaviours, but of behavioural repertoires. Given the dyadic nature of the development of emotion regulation, we included infant-driven factors in addition to parenting behaviours in order to consider the effects of both interaction partners. Generally, we hypothesized that positive parenting behaviours and less negative/more social infant temperament would promote a more flexible approach to regulation, marked by a more varied use of strategies, and that these flexible approaches would in turn predict adaptive outcomes in later childhood. This study was designed to enable us to gain more insight into the development and adaptiveness of regulatory flexibility in early life.

Chapter 4: Dissertation Study 2

Emerging repertoires of regulatory behaviour: Identifying profiles of emotion regulation in early life

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Abstract

While adult emotion regulation literature has transitioned from its focus on comparing regulatory behaviours to an emphasis on regulatory flexibility, developmental literature continues to measure emotion regulation as a unitary construct or to label behaviours as "adaptive" or "maladaptive." The current study aimed to explore the emergence of a repertoire of regulatory behaviours, a key facet of regulatory flexibility, by identifying profiles of regulatory behaviours at four time points from infancy to preschool (six months, twelve months, eighteen months, and four years). To understand the development of this repertoire, we explored the associations of these profiles with parenting behaviours (sensitivity, non-hostility) and, at the final timepoint, child temperament (emotionality, sociability). For a subset of the sample for which data were available at a fifth time point in middle childhood (9-12 years), we tested the longitudinal association of profiles of regulatory behaviour at each time point with positive and negative socioemotional outcomes (emotion regulation, social skills, and internalizing and externalizing problems). Emotion regulation behaviours and parenting were observationally coded at each time point during periods of induced mild distress wherein mothers were not emotionally available to their infants. Distinct profiles of regulation were identified at each time point. Findings indicated that positive parenting may promote complex profiles of regulation and that such profiles are associated with positive socioemotional outcomes in later childhood. Temperament was not as predictive of regulatory profiles as hypothesized. This study adds to the literature by challenging current models of emotion regulation development and testing principles of regulatory flexibility in young children.

Introduction

Traditional emotion regulation research has emphasized the balance of "adaptive" versus "maladaptive" regulatory strategies, with the inherent assumption that adaptive strategies are more effective, less taxing, and lead to better outcomes than maladaptive behaviours (Aldao & Nolen-Hoeksema, 2010; Gross, 1998a). In recent years, research in adult emotion regulation has strayed from this approach in favour of interactionist models that stress the importance of regulatory flexibility (Bonanno & Burton, 2013; Hollenstein et al., 2013). These models are based on evidence that the benefits of any emotion regulation behaviour will vary across individuals and situations, and thus the most adaptive approach to regulation is one that is flexible (Aldao, 2013; Bonanno et al., 2004; Sheppes & Gross, 2012). Despite these changes in the adult literature, such models are only just beginning to be applied in research with children (e.g., Myruski & Dennis-Tawari, 2021).

In studies of infants and young children, emotion regulation is often measured as a unitary construct. Many parent- and observer-report measures are designed to provide a single score representing regulatory capability (e.g., Carter et al., 1999; Shields & Cicchetti, 1997). In other cases, observed regulatory behaviours are tallied or summed (e.g., Feldman et al., 2009; Halligan et al., 2013). Not only do such methods risk missing the intricacies of infant regulatory behaviour, they also suggest a framework in which more regulation is better regulation (Bridges et al., 2004). In reality, increased use of regulatory behaviour may have different meanings: for example, that a child is using ineffective strategies, that they are overly regulated, or that they are appropriately using all available strategies to face an emotional challenge (Bridges et al., 2004). By focusing exclusively on *how much* a child regulates, we may lose important information about *how* the child regulates.

A final measurement challenge in developmental research on emotion regulation is that many studies adhere to the notion that certain behaviours are better than others, and thus successful regulation is dependent on use of the "right" regulatory behaviours. In the adult literature, Bonanno and Burton (2013) term this concept "the fallacy of uniform efficacy," which refers to the tendency of researchers to assume that particular regulatory strategies are consistently either beneficial or maladaptive. Their model of regulatory flexibility posits that successful regulation consists of a diverse repertoire of regulatory strategies, sensitivity to context, and responsiveness to feedback.

In the developmental literature, many studies draw a distinction between the value of dyadic regulation, in which infants and young children are reliant on their caregivers for regulatory support, and independent regulatory behaviour, in which infants and young children rely on themselves or their environment to manage their emotions. Dyadic regulation is generally considered to be the more adaptive strategy in early life given its effectiveness in regulating distress (Diener et al., 2002; Khoury et al., 2016). By contrast, independent regulatory behaviours have been shown to have the adverse effect of increasing negative affect in some contexts (Diener et al., 2002); these behaviours are generally considered ineffective and therefore less adaptive. However, research has shown that dyadic regulation is not consistently the most effective strategy. For example, it may be beneficial for infants to rely on independent strategies when their caregiver is not available to them (Atkinson et al., 2021; Miller et al., 2002) or when they have learned from past experiences that their caregiver is not always responsive to their needs (Kim et al., 2014; Manian & Bornstein, 2009). Consistent with Bonanno and Burton's (2013) model of regulatory flexibility, this suggests that the most effective option for infants may be to evaluate the contextual demands and select a regulatory strategy accordingly.

According to Bonanno and Burton's (2013) model, a key element of regulatory flexibility is possession of a wide repertoire of regulatory behaviours. Throughout early development, children develop the range of strategies which will enable flexibility in later life (Kopp, 1989). Infants are born with rudimentary self-soothing skills, such as self-touch and mouthing (Thompson & Goodman, 2010). In the first years of life, they develop cognitive strategies allowing them to shift their attention or use distraction (Fox & Calkins, 2003; Feldman, 2009). Simultaneously, they become more adept at social signaling to elicit caregiver support in regulation (Calkins & Hill, 2007). During the preschool period, children's increased exposure to peers grants them new information about their own and others' emotions, as well as situational and social factors that influence the social appropriateness of emotional expression (Kopp, 1989; Myruski & Dennis-Tawari, 2021). With the development of more regulatory behaviours and increased awareness of contextual cues, children may become more adept at flexibly adjusting their strategies to meet changing demands. Previous research from our laboratory suggests that infants vary their use of regulatory behaviours in line with the availability of their caregiver as early as six months (Atkinson et al., 2021).

Attaining effective regulatory strategies is predictive of positive socioemotional functioning throughout the lifespan (Thomas et al., 2017). Adaptive emotion regulation may protect against internalizing and externalizing problems throughout childhood (Penela et al., 2015), as well as predicting lifelong regulatory abilities and well-being and healthy adjustment in adulthood (Parker & Asher, 1987; Penela et al., 2015). By contrast, a lack of effective emotion regulation skills during early development is predictive of later aggressive behaviours, as well as symptoms of depression and anxiety (Bowie, 2010; Degnan et al., 2008). The early development of regulatory processes thus has implications for long-term functioning.

Parenting and Emotion Regulation

Early regulatory development occurs in the context of caregiver-child interactions (Thompson, 1994). It is through parental assistance in regulation that infants develop the ability to understand and regulate their emotions (Granat et al., 2017; Kiel & Kalomiris, 2015). Maternal sensitivity has received particular attention in the emotion regulation literature. Sensitivity, defined as the degree to which mothers perceive and respond appropriately to their infants' signals and communications (Ainsworth et al., 1974), is positively associated with quality of emotion regulation throughout childhood (Leerkes et al., 2009). Infants of mothers with higher sensitivity show longer latency to distress, increased use of regulatory behaviour, and greater use of attentional and behavioural regulation strategies (Frick et al., 2017). Maternal sensitivity may also act as a buffer against the effects of innate risk factors, such as temperament. Crockenberg and Leerkes (2006) found that infants with high reactivity were less likely to have difficulty regulating their distress when their mothers were highly sensitive. Similarly, maternal sensitivity has been shown to moderate the association between temperamental negativity and the use of avoidant regulatory strategies in six-month-old infants (Thomas et al., 2017).

Although significantly less studied, negative parenting behaviours also play a role in the early development of regulatory abilities. Maternal hostility, which includes anger, criticism, negativity, and disapproval directed toward a child (Sellers et al., 2014), is posited to impede the development of healthy regulatory abilities in the child (Hentges et al., 2020; Rose et al., 2018). Indeed, this may represent the mechanism by which hostile parenting behaviours lead to poor adjustment in childhood, including internalizing and externalizing problems (Morris et al., 2002; Rose et al., 2018). In Study 1, we found that maternal hostility was directly associated with the regulatory abilities used by six-month-old infants during a mildly distressing Still-Face task, with

higher hostility predicting increased self-soothing behaviours and decreased distraction behaviours. Given that distraction behaviours are mastered later in development (Fox & Calkins, 2003; Feldman, 2009), it may be that this differential strategy use reflects a more restricted repertoire of emotion regulation behaviours in infants of mothers showing more hostility.

Temperament and Emotion Regulation

Although emotion regulation develops in the context of parent-child interactions, there is evidence that the innate characteristics of the child play a role in shaping this development. Child temperament, defined as the "constitutionally-based individual differences in emotional, motor, and attentional reactivity and self-regulation" (Rothbart & Bates, 1998, p.109), has been shown to impact both proximal indices of regulation, including regulatory strategy use, and distal indices, such as behaviour problems (Calkins, 2004). Temperamental negative emotionality, or the tendency to react with high levels of negative affect, is predictive of both immediate regulatory behaviour and long-term regulatory impairment (Santucci et al., 2008). Calkins and Johnson (1998) found that infants with higher distress responses to frustration tasks were more likely to engage in aggressive behaviours, rather than using distraction or goal-directed coping strategies. Similarly, Calkins et al. (2002) found that infants who were easily frustrated were more likely to engage in physical responses to frustration, such as kicking and banging, and displayed less distraction, more scanning of the environment, and more orienting toward their mothers than did less easily frustrated infants. Braungart-Rieker and Stifter (1996) examined the longitudinal association between frustration reactivity at five months and emotion regulation at 10 months. They found that high levels of frustration reactivity at five months were associated with the use of fewer emotion regulation behaviours at 10 months. These associations persist into childhood: Santucci et al. (2008) found that children aged 4-7 years with higher levels of

negative affectivity were more likely to focus on the obstacle in a frustration task rather than engaging in distraction, passive waiting, comfort-seeking, or goal-directed behaviour. High levels of negative emotionality have also been found to predict childhood outcomes associated with poor regulatory abilities, including internalizing and externalizing problems (Eisenberg et al., 2003; Marakovitz et al., 2011; Oldehinkel et al., 2004).

Children's levels of sociability, defined as the tendency to affiliate with others and to prefer the company of others (Buss & Plomin, 1984), may also impact their regulatory abilities. Dollar and Stifter (2012) found that the adaptiveness of a given emotion regulation strategy may be dependent on sociability. In their study, high levels of distraction and self-soothing during a frustration task were associated with lower levels of parent-rated social competence, but only for children who were more sociable. High levels of sociability may also elicit different parenting behaviour: infants whose temperaments are "easier," that is more sociable and easy-to-soothe, are more likely to experience warm and responsive parenting, whereas infants with more "difficult" temperaments are likely to elicit higher levels of parenting stress and harsh parenting (Kiff et al., 2011; Oddi et al., 2013). Thus, child temperament may influence the development of emotion regulation behaviours both directly and indirectly via parenting.

Taken together, although there is a great deal of research regarding the importance of early emotion regulation and the factors involved in its development, such studies generally follow a model of emotion regulation in which more is considered better. This is in stark contrast to the adult literature, which emphasizes the importance of regulatory flexibility. According to Bonanno and Burton's (2013) model, regulatory flexibility requires a repertoire of behaviours, context sensitivity, and responsiveness to feedback. Although such models are rarely applied in the developmental literature, it is likely that these same principles apply to children, such that

mastering and using a selection of regulatory behaviours has a positive impact on socioemotional development.

Current Study

In keeping with the principles of regulatory flexibility, the central aim of the current study was to examine the development and use of a repertoire of emotion regulation behaviours across early development. Our objectives were to: (1) identify profiles of regulatory behaviours used in infancy and early childhood, (2) test the association of these profiles with parenting behaviours and child temperament, and (3) examine whether these profiles predict positive and negative socioemotional outcomes. We used age-appropriate observational coding systems to capture the specific behaviours used at four age points from infancy to preschool (6 months, 12 months, 18 months, and 4.5 years). Behaviours were coded during periods where the mother was unavailable to her child (still-face and interference periods). These periods permit the examination of independent regulation during a mildly distressing experience and mimic the everyday experience of young children, whose caregivers are juggling competing demands and may not always be available to them. Periods of normal dyadic interaction were also coded as a comparison point. These periods elicit high levels of dyadic regulation and were expected to be characterized by less diverse regulation patterns and be less influenced by factors like parenting and temperament.

We identified profiles of behaviours during each period at each time point and tested the associations of these profiles to parenting behaviours (maternal sensitivity and non-hostility) and, at the last time point, child temperament (emotionality and sociability). We hypothesized that positive social behaviours, including higher levels of maternal sensitivity, maternal non-hostility, and child sociability, would promote more complex patterns of regulation (i.e., those that include

a variety of behaviours), while negative social behaviours such as child negative emotionality would impede the development of flexibility. Positive mother-infant interactions may promote the learning of a variety of strategies in the infant, leading to increased regulatory flexibility at every age, while factors impeding mother-infant interactions may limit this growth. We hypothesized that this would not be the case during periods of normative dyadic interaction, when there is no induced distress which requires regulating and when dyadic regulation is elicited by the situational demands.

Finally, for a subset of our sample in which data were available at a fifth time point in middle childhood, we tested the longitudinal association of these profiles with indices of adjustment, including measures of emotion regulation, social competence, and internalizing and externalizing problems. We hypothesized that more complex regulatory profiles during the perturbed interaction periods would be associated with positive socioemotional developmental outcomes in middle childhood. Infants who possess and use a greater repertoire of regulatory behaviours may be better equipped to respond to emotional challenges throughout development. We hypothesized that this would not be the case for complex regulatory profiles during the periods of maternal availability.

The current study adds to an important literature by testing the principles of regulatory flexibility in early life, as well as the adaptive function of this early flexibility. This approach represents a departure from the traditional conceptualization of early emotion regulation, in which behaviours are either summed or labeled as adaptive or maladaptive, and has theoretical implications for the ongoing study of early emotion regulation. Clinically, a more nuanced understanding of early regulatory flexibility may aid in the identification of at-risk children and in the development of targeted interventions.

Methods

Participants

Participants were drawn from two longitudinal studies and consisted of three distinct groups. Participants drawn from the *Mother-Infant Interactions* (MII) study included mothers and their full-term (FT; *n* = 48) or very-low-birthweight/preterm (VLBW/PT; *n* = 63) infants. Participants from the *Concordia Longitudinal Research Project* (Concordia Project; n = 56) are a subset of a prospective, intergenerational study that began in 1976; the current sample consists of the offspring of the original participants (Serbin et al., 1998; Stack et al., 2017). A total of 167 dyads participated in at least one time point; due to attrition, technical difficulties, damage to videos, and procedural issues, not all dyads had data available at all time points. All dyads were tested in their homes when infants were 6 months (Time 1; mean age = 5.64 months (0.56); *n* = 134), 12 months (Time 2; mean age = 12.08 months (0.53); *n* = 116), 18 months (Time 3; mean age = 18.15 months (0.59); *n* = 116), and 4.5 years (Time 4; mean age = 56.97 months (6.79); *n* = 108) of age. Dyads from the Concordia Project underwent additional testing in middle childhood (9-12 years; mean age = 10.85 years (0.94); *n* = 37).

MII sample. Mother-infant dyads were recruited from a major community hospital in Montreal, Quebec. Mothers received a letter outlining the research and were subsequently contacted by telephone and asked to participate. Inclusion criteria for the FT infants included a birthweight of at least 2750 g (6 lbs), a gestation period of 37-41 weeks, and an uncomplicated medical history. VLBW/PT infants were screened for medical status variables by a nurse during their follow up visit at between three and four months of age. Criteria for inclusion in the VLBW/PT group included a birthweight of between 800-1500 g (1.76 – 3.30 lbs) and a gestation period of 26-32 weeks. Exclusion criteria included: infants who suffered from any medical

illnesses, syndromes, or complications; infants who had been diagnosed with congenital abnormalities; infants who had experienced prolonged and/or repeated hospitalizations since the neonatal period; and mothers at psychological risk due to a history of inadequate prenatal care, drug abuse, or mental illness. Mothers self-identified as 69.4% White, 13.5% Black, 8.1% Hispanic, 4.5% Asian, and 4.5% Middle Eastern. 43.2% had a university degree, 22.5% had graduated Cégep (a public junior college attended between high school and university in the Quebec education system), 27.0% had secondary school education, and 7.2% had not completed secondary school. Their ages ranged from 17-44 (M = 31.55, SD = 5.41).

Concordia Project sample. Concordia Project participants were originally recruited from low SES neighbourhoods in Montreal, Quebec between 1976-1978 (Schwartzman et al., 1985; Stack et al., 2017). The initial sample consisted of 1770 French-speaking children attending primary school. Since this time, many of the original participants have become parents, and they and their children have participated in multiple follow-ups in varying cohorts over time. The current sample represents the second generation of the study and consists of some of the offspring of original participants and their mothers. Mothers all self-identified as White; 23.2% had university degrees, 30.4% had Cégep degrees, 35.7% had graduated secondary school, and 10.7% had not completed secondary school. Mothers' ages ranged from 20-36 (M = 29.16, SD = 3.35).

Between-Sample Heterogeneity

Given that participants were drawn from different samples, there are likely to be differences in emotion regulation behaviours observed across groups. Preterm infants may be more likely to have difficulty with independent regulation than full-term infants (Wolf et al., 2002). Similarly, dyads in the Concordia Project sample may be at higher risk for socioemotional

difficulties due to parents' histories of disadvantage and maladaptive interaction patterns (Stack et al., 2012). The heterogeneity of the combined sample may represent an advantage in terms of generalizability, as the aggregated sample is more likely to be representative of the population than each individual sample. To ensure that the heterogeneity between samples did not influence our results, group differences in emotion regulation behaviours were examined and group was included as a control in our models. These procedures are detailed in the results section.

Procedure

Mother-infant dyads participated in home visits when infants were 6 months, 12 months, 18 months, and 4.5 years of age. At the beginning of each visit, informed consent was obtained by research staff from the mother for herself and her child.

At Time 1, dyads participated in the Still-Face (SF) procedure (Tronick et al., 1978), which consists of two two-minute normal interaction periods (normal, reunion-normal) in which mothers were instructed to interact with their infants as they normally would, separated by a two-minute perturbed (SF) interaction period in which mothers were instructed to maintain a neutral facial expression and gaze at their infant without interacting with them. Testing was interrupted if infants fretted for 20 seconds or more, or if mothers wished to stop for any reason (n = 0). The SF period was the focus of the current study. The initial normal period was included as a comparison.

At Times 2, 3, and 4, the observational tasks used for the study included three-minute interference periods wherein dyads were positioned on a mat on the floor with a set of standardized toys and mothers were asked to complete questionnaires while their child played close by and in close view. They received no explicit instructions about how to react to their children's bids for attention. The interference task was designed to mimic the competing

demands experienced by mothers in their daily life and has been used in past studies (August et al., 2017; Pereira et al., 2012). A three-minute free play period, in which mothers were instructed to play with their children as they normally would, was included as a comparison. At all three time points, these tasks were part of a longer series of interaction periods. At Times 2 and 3, this included a three-minute puzzle task and an additional three-minute free play period. At Time 4, this included an eight-minute puzzle task, a two-minute clean-up task, and an additional two-minute free play period.

Participants in the Concordia Project study underwent testing at an additional time point. In middle childhood (9-12 years), children, parents, and teachers completed a series of measures of child socio-emotional development.

Measures

Demographic information

Mothers completed the Demographic Information Questionnaire (DIQ) at each time point. This measure has been used reliably to collect socio-demographic information in past studies from our laboratory (e.g., Briscoe et al., 2019; Enns et al., 2016).

Emotion regulation behaviours

Emotion regulation was observationally coded at Times 1-4 using age-appropriate, systematic coding systems. At Time 1, emotion regulation was coded using the Infant Self-Regulation Scheme (ISRS; Millman et al., 2007). This system was adapted from the Infant Regulatory Scoring System (Tronick & Weinberg, 1996), and captures the following infant behaviours: self-comfort regulatory, self-comfort exploratory, attention-seeking, escape, gaze aversion, and bidirectional exchange. At Times 2 and 3, the Toddler Self-Regulation System (TSRS; Atkinson & Stack, 2017) was used, which includes the following behaviours: self-

comfort regulatory, self-comfort exploratory, attention-seeking, escape, dyadic exchange, over-activity, and independent play. At Time 4, emotion regulation was coded using an adapted version of the Preschool Self-Regulatory Scheme (PSRS; August & Stack, 2010). This coding system was modified for continuity with coding systems used at the previous time points: negative and positive attention-seeking were combined into a single behaviour, and prosocial behaviour was divided into cooperation and independent play. Behaviours included: self-comfort regulatory, attention-seeking, escape, cooperation, independent play, over-activity, non-compliance, and fretting. Between 20-30% of videos for each time point were double-coded by undergraduates who were blind to the study's hypotheses. Brief definitions and kappa statistics for all coded behaviours are presented in Table 1.

Maternal parenting characteristics

Maternal sensitivity and non-hostility were observationally coded at Times 1-4 using the Emotional Availability Scales (3rd ed., Biringen et al., 2000). These scales were designed to capture the "emotional responsiveness and attunement" of a dyad (Emde, 1980, p. 80). They include both parent and child scales; however, only maternal sensitivity and non-hostility were included in the current study due to their known associations with early emotion regulation (e.g., Behrendt et al., 2019; Hentges et al., 2020). In the third edition of the EA scales, the hostility scale was renamed non-hostility and scoring was reversed; scoring of the scale is otherwise largely unchanged. Maternal sensitivity, which involves the contingency and appropriateness of parent responses, was coded on a nine-point scale, ranging from 1 (highly insensitive) to 9 (highly sensitive). Maternal non-hostility, which refers to the absence of impatience, anger, or concealed hostility, was rated on a five-point scale, ranging from 1 (overtly hostile) to 5 (non-hostile). Global ratings for each scale were assigned after observing maternal behaviour during

the normal interaction periods at each time point.

Child temperament

At Time 4, mothers completed the Emotionality Activity Sociability Scale (EAS-2; Buss & Plomin, 1986). This child temperament measure comprises four subscales, however only the emotionality and sociability subscales were included in the present study. These subscales were selected due to their associations with both proximal and distal indices of regulation (e.g., Calkins, 2004; Dollar & Stifter, 2012). Emotionality measures negative mood reactivity, and includes the tendency for the child to show anxiety, sadness, anger, and irritability. Sociability is defined as a tendency to affiliate with others and reflects the child's preference for the company of others over being alone. Each item on the 20-item scale is rated from 1 (my child's behaviour is never like this) to 5 (my child's behaviour is always like this). Previous research has demonstrated that this measure has good test-retest reliability and internal consistency (e.g., Anthony et al., 2002; Bould et al., 2013).

Child socioemotional outcomes

Socioemotional outcomes were measured at a subsequent time point (Time 5) in middle childhood, but only for participants in the Concordia Project sample.

Emotion regulation. Child emotion regulation was measured using the emotion regulation subscale of the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997). This measure was completed by mothers and consists of 24-items that tap into affective stability, intensity, valence, and situational appropriateness. The emotion regulation subscale is focused on expression of emotions, empathy, and emotional self-awareness, with higher scores indicating higher adaptive regulatory processes. The measure also consists of an emotional lability/negativity subscale, not used in the current study, which assesses anger dysregulation and

mood lability. The emotion regulation subscale was selected for the current study as a more direct assessment of regulatory abilities. Past studies have confirmed the reliability and predictive validity of the two subscales (Esmailian et al., 2016; Shafietabar et al., 2020).

Social skills. Social skills were measured using the Social Skills Rating System – Student Form (SSRS; Gresham & Elliot, 1990). This is a self-report scale (child-reported) designed to capture a global assessment of social and problem behaviours. Research has provided support for the reliability and validity of the total score, but not the subscale scores (Diperna & Volpe, 2005); as such, the total scores were used in the analyses.

Psychological/behavioural difficulties. The Child Behavior Checklist/6-18 (CBCL; Achenbach & Rescorla, 2001) was used to tap into psychological and behavioural difficulties. The parent report form was used for this study, in which mothers rate child behaviours over the past six months on a three-point scale, with higher scores indicating more behavioural problems. We included the anxious/depressed, withdrawn/depressed, and aggressive behaviour subscales to tap into difficulties with anxiety, depression, and aggression. These difficulties are characterized by deficits in emotion regulation and are often considered distal indices of ineffective regulation (Eisenberg et al., 2003; Marakovitz et al., 2011; Oldehinkel et al., 2004). The empirically derived syndrome scales were used rather than the rationally-derived *DSM* scales, as there is evidence that the *DSM*-oriented scales do not display greater correspondence with diagnoses or increase clinical utility above the syndrome scales (Ebesutani et al., 2010). Notably the CBCL is a broad band measure and is not a diagnostic tool.

Results

Data preparation and descriptive statistics

At each time point, emotion regulation behaviours were transformed into percent

durations to obtain the percentage of time infants engaged in each behaviour during each interaction period. Univariate outliers were identified as cases with standardized scores exceeding 3.29 and brought in according to the method outlined by Tabachnick and Fidell (2013). The result of Little's MCAR test was nonsignificant ($c^2 = 675.505$, $df = 672$, $p = 0.455$); therefore, data can be assumed to be missing completely at random. Behaviours were excluded from analysis if they had means below 5% across both interaction periods for a given time point. This included attention-seeking and escape at Time 1, escape and over-activity at Time 2, self-comfort regulatory, escape, and over-activity at Time 3, and escape, over-activity, non-compliance, and fretting at Time 4. Attention-seeking was also removed from the Time 3 free-play models, as this behaviour did not occur across all infants. Descriptive statistics are presented in Table 2 and correlations between parenting and child characteristics are presented in Table 3.

Analysis across samples

Because the sample was comprised of three groups (FT, VLBW/PT, Concordia Project), the three subsamples were tested on the emotion regulation behaviours used at all time points to test their comparability. Two-way mixed (group x interaction period) MANOVAs were carried out at each time point. At Time 1, there were significant group differences for self-comfort regulatory, $F(2, 130) = 6.584$, $p = 0.002$, and gaze aversion, $F(2, 130) = 3.4080$, $p = 0.036$. Post-hoc analyses revealed that infants from the Concordia Project sample used higher levels of self-comfort regulatory than both other groups, and lower levels of gaze aversion than the VLBW/PT infants. At Time 2, group differences were significant for independent play, $F(2, 112) = 19.909$, $p < .001$. Infants from the Concordia Project used less independent play than did infants in the other samples. There were no significant group or interaction effects at Time 3. At Time 4, there was a significant group effect on self-comfort regulatory, $F(2, 101) = 3.980$, $p = 0.022$. FT

infants used higher levels of self-comfort regulatory than the VLBW/PT infants. Given these significant differences, group was included as a control variable in all of the models. Group differences were not unexpected given the nature of the samples. Both prematurity and parental histories of disadvantage may be associated with socioemotional issues, including difficulties with emotion regulation (Stack et al., 2012; Wolf et al., 2002). The small size of each individual sample (N = 48, 63, 56) precluded further exploration of between-group variations.

Latent profile analyses

Latent profile analyses were conducted separately for the SF/interference and the normal/free-play periods at each time point. Time points were estimated separately given the developmental changes in regulatory behaviours occurring across this period (e.g., Kopp, 1989). Models including 1-5 profiles were estimated for each period using the robust Maximum Likelihood (MLR) estimator.

Several indicators may be used in selecting the optimal number of latent profiles in the data. Lower values on the Akaike Information Criterion (AIC), the Consistent AIC (CAIC), the Bayesian Information Criterion (BIC), and the sample-adjusted BIC (ABIC) suggest a better-fitting model. The entropy indicates the precision with which cases are classified into profiles, with values closer to 1 indicating a better fit. The Lo, Mendell, and Rubin likelihood ratio test (LMR) and the Bootstrap Likelihood Ratio Test (BLRT) compare a *k*-profile with a *k*-1 profile model; a significant *p*-value indicates that the *k*-profile model should be retained over the *k*-1 profile model. Simulation studies have contrasted the accuracy of these indicators in correctly identifying the number of latent classes as a function of different study design conditions; these studies generally converge on the use of the CAIC, BIC, ABIC, and BLRT in model selection (e.g., Morgan, 2015; Nylund et al., 2007; Peugh & Fan, 2013). By contrast, the entropy, AIC,

and LMR are less reliable indicators and may be impacted by factors such as sample size, heterogeneity of sample, number of latent classes, and number of indicators (Nylund et al., 2007; Peugh & Fan, 2013; Wang et al., 2017). Diallo et al. (2017) suggest that the ABIC and BLRT perform better in conditions of low entropy (e.g., ≤ 0.500), whereas the CAIC and BIC perform better in cases of high entropy (e.g., ≥ 0.800).

In the current study, the entropy levels of alternative solutions for all models were consistently high. For this reason, the CAIC and the BIC were prioritized when determining the optimal number of profiles. To ensure theoretical conformity, the underlying profiles of each model were examined to ensure that they were meaningfully distinct, interpretable, and contained a sufficient proportion of participants (> 5%; Ferguson et al., 2020). Model retention decisions were based on fit indices, specifically the CAIC, BIC, ABIC, and BLRT, and interpretive consideration of the models. The fit indices for the alternative solutions estimated for all periods are reported in Table 4. Indices are not reported for the five-profile solutions for Time 1 Normal period, Time 2 Free play period, Time 2 Interference period, Time 3 Free play period, and Time 4 Interference period, as these models did not converge.

Following model retention, multinomial logistic regressions were used to test the association between the predictor variables and the probability of membership in each of the profiles in the final LPA solution. At all time points, parenting behaviours (sensitivity, non-hostility) were included as covariates. At Time 4, child emotionality and sociability were also included. Occupational prestige, which assesses family financial status based on the occupations of adult members (Nock & Rossi, 1979), was used as a proxy for socioeconomic status; maternal and paternal scores were measured at each time point and included as controls in all models. Maternal age at birth was also included as a control variable given that both younger and older

maternal age have been found to negatively impact emotional development (Du et al., 2022; Moreno-Giménez et al., 2022).

We selected the profile of infants who used a variety of regulatory strategies as the comparison group for each model. These mixed regulatory profiles were hypothesized to represent flexible styles of regulation; by using these profiles as the comparison group, we were able to contrast them against less flexible profiles of regulation. Although we were most interested in regulatory flexibility during the perturbed interaction periods, which may elicit mild distress and promote the use of independent regulatory behaviours, we included the normal periods to enable comparisons. As such, only brief descriptions of retained solutions are provided for the normal periods. Tables for these periods are in the supplemental materials. Group was included as a control variable in all models but was not predictive of profile membership in any of the perturbed interaction periods.

Time 1

The four-profile solution was retained for the Time 1 SF period. Although the entropy was slightly higher for the two-profile solution, the entropy values for all solutions were above the recommended threshold (< 0.80). Inspection of the solutions showed that the third and fourth profiles were qualitatively distinct, whereas adding a fifth profile resulted in the arbitrary division of one existing profile into two smaller profiles. Classification probabilities for the retained solution are presented in Table 5, and the identified profiles and associated covariate analyses are presented in Tables 6.

The first profile (33.6%) included infants who relied largely on self-comfort regulatory behaviours; this group is labelled “self-soothing.” Profile 2 (13.4%) was distinct in that infants used high levels of self-comfort exploratory. This profile was labelled “exploration.” Profile 3

(17.2%) included infants who used high levels of gaze aversion and was labelled "distraction." Finally, the fourth profile (35.8%) was characterized by moderate levels of all three strategies. This group was labelled "mixed regulation."

Profile 4 was used as the reference category for comparison. As compared to this group, maternal sensitivity negatively predicted membership in Profile 2 ("exploration;" b = -1.058, p = 004). No significant associations were detected for Profiles 1 and 3.

A four-profile solution was retained for the Time 1 Normal period (38.8% dyadic, 13.4% self-soothing, 31.3% distraction, 16.4% mixed regulation). No significant associations with covariates were detected for any of the profiles as compared to the reference category (Profile 4).

Time 2

The three-profile model was retained for the Time 2 Interference period based on interpretive considerations. Inspection of the solutions showed that the addition of the third profile resulted in qualitatively distinct profiles, whereas adding a fourth profile resulted in two profiles that differed only quantitatively. Classification probabilities are presented in Table 7, and the profiles and covariate analysis are presented in Table 8. Profile 1 (11.3%) differed from other profiles in higher use of self-comfort regulatory; this profile was labelled "self-soothing." Infants in the second profile (79.1%) used a combination of independent play, self-comfort exploratory, and attention-seeking; this profile was labelled "mixed regulation." The final profile (9.6%) was comprised of infants who used a variety of strategies, including dyadic exchange. Given that dyadic regulation is relatively rare during the interference period, this profile was labelled "mixed-dyadic."

Profile 2 was used as the reference group for the covariate analysis. The initial model generated an error regarding the regression of Profile 3 on maternal non-hostility. Inspection of

the data showed that all dyads in this profile had a score of 5; this lack of variance is likely responsible for the model failing to converge. The association between Profile 3 and maternal non-hostility was removed from the model. As compared to Profile 2, membership in Profile 1 ("self-soothing") was negatively predicted by maternal non-hostility (b = - 0.840, p = 0.031). No other significant associations were detected.

The four-profile solution was retained for the Time 2 free-play period (13.7% self-soothing, 56.0% dyadic, 12.9% mixed regulation, 17.2% independent). Attention-seeking was removed from the model as it generated an error due to its low variance. Profile 3 was used as the reference group for comparison. As compared to this profile, there were no significant associations with any of the covariates.

Time 3

The four-profile solution for the Time 3 Interference period was retained. Classification probabilities are presented in Table 9, and profile results are presented in Table 10. Profile 1 (14.9%) was comprised of infants who used high amounts of attention-seeking and moderate amounts of independent play; this profile was labelled "attention-seeking." Infants in profile 2 (7.9%) used a variety of strategies, including high levels of dyadic exchange. This profile was labelled "mixed-dyadic" given that use of dyadic behaviours is relatively unexpected during the interference period. Infants in the third profile (58.8%) used high levels of independent play and low levels of all other behaviours; this profile was labelled "independent." The fourth profile (18.4%) was characterized by moderate levels of self-comfort exploratory and independent play; this profile was referred to as "mixed regulation."

Profile 4 was used as the reference group. As compared to this group, membership in the first profile ("attention-seeking") was predicted by higher maternal sensitivity (b = 0.856, p =

.014) and lower maternal non-hostility (b = -1.660, p = 0.026). Membership in the mixed-dyadic profile was positively predicted by maternal age (b = 0.190, p = .025).

In the Time 3 free-play models, attention-seeking was removed as this behaviour did not occur at all across all dyads. The association between Profile 3 and maternal non-hostility was removed due to the lack of variance in this group. The three-profile solution was retained (81.9% dyadic, 6.9% mixed regulation, 11.2% independent). The second profile was used as the reference category. No significant associations with the covariates were detected.

Time 4

The four-profile solution for the Time 4 Interference period was retained. Classification probabilities are presented in Table 11 and profile results are presented in Table 12. Profile 1 (55.8%) contained infants who used high levels of independent play and was labelled "independent." The second profile (16.3%) was characterized by higher levels of attention-seeking than the other profiles; it was labelled "attention-seeking." Profile 3 (11.5%) was characterized by a mix of all four behaviours and was labelled "mixed regulation." The final profile (16.3%) comprised infants who used higher levels of self-comfort regulatory; it was labelled "self-soothing."

The third profile was used as the reference group for comparisons. An error was generated for the association of non-hostility with Profile 2. Inspection of the data showed that all non-hostility scores in this group equaled 5; this association was removed from the model. As compared to Profile 3, membership in Profile 4 ("self-soothing") was negatively associated with maternal sensitivity (b = -1.972, p = 0.015) and child sociability (b = -0.286, p = 0.034).

The four-profile solution for the Time 4 free-play period was retained (10.2% independent, 5.6% mixed-attention-seeking, 20.4% self-soothing, 63.9% dyadic). Profile 2 was used as the reference category. No significant associations were detected.

Longitudinal associations

For our final objective, a subset of our sample (i.e., the Concordia Project participants) were used to regress the outcome variables in middle childhood (anxiety, depression, aggression, social skills, and emotion regulation) on the probability of membership in each profile at Times 1-4. Standardized model results are reported.

Time 1

During the SF period, probability of membership in Profile 1 ("self-soothing") negatively predicted anxiety (b = -0.318, $p < 0.001$) and aggression (b = -0.292, p = 0.001). No significant associations were detected between profile membership in the Time 1 Normal period and any of the outcome variables in middle childhood.

Time 2

During the Time 2 interference period, probability of membership in Profile 2 ("mixed regulation") negatively predicted depression (b = -0.252, p = 0.025) and probability of membership in Profile 3 ("mixed-dyadic") negatively predicted social skills *(*b = -0.256, p = 0.020). Probability of membership in Profile 3 ("exploration") during the Normal period negatively predicted anxiety (b = -0.216, p = 0.008), depression (b = -0.419, $p < 0.001$), and aggression (b = -0.228, p = 0.024) in middle childhood.

Time 3

During the Time 3 interference period, probability of membership in Profile 1 ("attention-seeking") was positively associated with social skills (b = 0.330, p = 0.041) and

emotion regulation (b = 0.431, p < 0.001), membership is Profile 2 ("mixed-dyadic") positively predicted depression (b = 0.260, p = 0.022) and negatively predicted emotion regulation *(*b = -0.377, p = 0.025), membership in Profile 3 ("independent") was negatively associated with emotion regulation (b = -0.354, p = 0.038), and membership in Profile 4 ("mixed regulation") was negatively associated with anxiety (b = -0.240, p = 0.022) and aggression (b = -0.310, p = 0.001) in middle childhood. During the free-play period, probability of membership in Profile 1 ("dyadic") positively predicted anxiety (b = 0.246, p = 0.029) and aggression (b = 0.237, p = 0.031) and negatively predicted social skills (b = -0.358, p = 0.004) in middle childhood. Probability of membership in Profile 2 ("mixed regulation") positively predicted social skills (b = 0.255, p = 0.035). Membership in Profile 3 ("independent") negatively predicted anxiety (b = -0.143, p = 0.042) and aggression (b = -0.142, p = 0.044) and positively predicted social skills (b = 0.265, p = 0.037).

Time 4

During the Time 4 interference period, probability of membership in Profile 2 ("attention-seeking") negatively predicted social skills (b = -0.540, p < 0.001) and membership in Profile 3 ("mixed regulation") positively predicted social skills (b = 0.197, p = 0.043). During the free-play period, probability of membership in Profile 1("independent") was negatively associated with depression (b = -0.406, p < 0.001) and positively associated with social skills (b = 0.502, p < 0.001) and emotion regulation (b = 0.266, p = 0.001).

Discussion

The present study aimed to extend prior research on the early development of emotion regulation using an approach highlighting regulatory flexibility. In line with Bonanno and Burton's (2013) theory, we sought to explore the early emergence of the repertoire of behaviours

needed for flexible regulation, as well as its implications for socioemotional development. Our objectives were to: (1) identify profiles of regulatory behaviours across time points, (2) explore the association of these profiles with positive and negative interaction behaviours on the part of both parents and infants, and (3) test their longitudinal prediction of children's socioemotional functioning. Past studies have focused on the individual behaviours used by infants and young children rather than on the importance of a growing repertoire of strategies and the regulatory flexibility this enables.

Profiles of emotion regulation

The first objective of the current study was to identify profiles of regulatory behaviour used at each time point. As hypothesized, our results revealed distinct profiles of behaviours at each time point. Similar profiles emerged across ages, including profiles characterized by dyadic or attention-seeking strategies, profiles characterized by self-soothing or independent strategies, and profiles characterized by mixed regulatory strategies. This suggests that, for some infants, the ability to use a wide variety of regulatory behaviours is developed in very early life. In line with Bonanno and Burton's (2013) theory, this may represent one key component of regulatory flexibility. However, it is worth noting that a wide repertoire of strategies is not necessarily indicative of effective regulation. In some cases, shifting between strategies may represent a disorganized approach on the part of the infant, wherein they are ineffectually enacting strategies at random due to their difficulty with regulation. Future studies should examine the emergence of the other components of flexibility, including sensitivity to context and responsiveness to feedback (Bonanno & Burton, 2013). In the current study, these constructs were partially captured by infants' differential behaviour use in contexts of dyadic interaction versus in periods of potential mild distress in which their mothers were not available to them. Consistent with prior

research (Atkinson et al., 2021), our findings suggest that infants at all time points did adjust their regulatory behaviour use according to situational demands.

Association with parent and child factors

For our second research objective, we tested the associations of the identified profiles with positive and negative interaction behaviours, including parenting and infant temperament. We hypothesized that, during the perturbed interaction periods, higher levels of maternal sensitivity and non-hostility would promote profiles of behaviour characterized by a greater variety of regulatory behaviour, such that other profiles would be negatively associated with positive parenting behaviours as compared to the mixed regulation profile. Our hypotheses were partially supported. As compared to the mixed regulatory profiles, maternal sensitivity was negatively associated with the exploration profile at six months and with the self-soothing profile at four years. It may be that these infants are more reliant on a single strategy as they have had less opportunity to learn a more varied approach through sensitive dyadic interactions. This may be especially evident at four years, given that self-soothing behaviours are considered rudimentary and appear very early in development (Kopp, 1989). Children who continue to rely on these strategies in their preschool years may have developed fewer alternative strategies than their peers. Contrary to expectations, maternal sensitivity also positively predicted membership in the attention-seeking profile at 18 months. It may be that infants of highly sensitive mothers are less accustomed to non-responsiveness on the part of their mothers, and thus may be more likely to bid for attention during interaction periods where mothers are not available.

As compared to the mixed regulatory profiles, maternal non-hostility negatively predicted membership in the self-soothing profile at 12 months and in the attention-seeking profile at 18 months. This is consistent with findings that maternal hostility is associated with difficulty

regulating (Little & Carter, 2005). Infants may be more likely to rely heavily on rudimentary self-soothing strategies or on eliciting help from a caregiver if they are having difficulty with self-regulation.

Taken together, our findings suggest that positive parenting behaviours do play a role in the regulatory profiles of infants and may promote complex patterns of regulation. However, significant differences in parenting behaviours were not observed between many of the identified profiles across all four ages. It is likely that the observed parenting behaviours are not the only mechanism by which regulatory flexibility emerges. Although regulatory behaviour largely develops in the context of caregiver-infant interactions, other aspects of the interaction, including modeling of emotion regulation and emotion socialization, may play an important role in this development (Morris et al., 2007). Future studies should test alternative parenting behaviours as potential mechanisms for the development of regulatory flexibility.

As hypothesized, parenting behaviours did not predict membership in any of the profiles during the normal interaction periods as compared to the mixed profile. These periods are designed to elicit dyadic interaction and rarely elicit distress, thus do not necessarily require flexible regulatory approaches.

Child temperament was only measured at the final time point. We hypothesized that, during the perturbed interaction period, child sociability would negatively predict membership in other profiles as compared to the mixed regulatory profile, while child negative emotionality would positively predict membership in other profiles. Our findings indicated that child sociability only negatively predicted membership in the self-soothing profile as compared to the mixed profile. This is in keeping with our hypothesis that children who are more social have had more opportunity to learn alternative strategies from caregivers and interaction partners and are

thus less likely to use high levels of self-soothing behaviours and more likely to use a wider range of strategies. Contrary to hypotheses, child negative emotionality did not predict membership in any profile as compared to the mixed regulatory profile. As hypothesized, neither temperament measure predicted profile membership during the normal interaction period.

Overall, child temperament was not as predictive of regulatory profiles as we hypothesized. This is in contrast to past studies which have shown that both negative emotionality and sociability were associated with regulatory strategy use (Calkins et al., 2002; Dollar & Stifter, 2012). In these studies, emotion regulation was measured in the context of frustration tasks. It is possible that the effect of temperament is more pronounced in situations that elicit high levels of frustration, as opposed to the mild distress that may have been elicited in the current study. It may also be that, compared to the other factors influencing regulatory behaviour, including parent behaviours, socialization, and contextual demands, child temperament plays a relatively limited role in determining the use of regulatory strategies in a given situation. Even so, our findings suggest that temperament does play a role in the regulatory behaviours used during periods of mild distress.

The control variables were, for the most part, not significantly associated with membership in regulatory profiles at any age. However, at Time 3, maternal age positively predicted membership in the mixed-dyadic profile. Findings are mixed regarding the impact of maternal age on emotion regulation, with some studies identifying younger maternal age as a risk factor (Farley et al., 2021) and others pointing to the adverse outcomes associated with older maternal age (Moreno-Giménez et al., 2021). The range of maternal age at birth in the current study was 17-44, suggesting the presence of both younger and older mothers in our sample. Testing the positive and negative effects of maternal age was beyond the scope of the current

study. Future research should explore the effects of young and old maternal age on the development of regulatory flexibility using samples at both extremes.

Associations with indices of socioemotional adjustment

We hypothesized that, at all time points, complex profiles of regulation during the perturbed interaction periods would be associated with positive indices of socioemotional development, such as lower depression, anxiety, and aggression, and higher social skills and emotion regulation. This hypothesis was partially supported. At 12 months, the mixed profile of regulation was negatively associated with depression; at 18 months, this profile was negatively associated with anxiety and aggression; and at 4.5 years, this profile positively predicted social skills. The association of mixed regulatory profiles with adaptive outcomes in later development suggests that, as predicted, such profiles may represent adaptive precursors to regulatory flexibility. Infants who develop a wide range of regulatory strategies may be better regulated in later development and be at less risk of developing socioemotional difficulties. This positive association did not hold true for the six-month time point. At this age, the self-soothing profile was predictive of reduced anxiety and aggression in middle childhood. It may be that, at this early stage of development, prior to the development of a more extensive regulatory repertoire, the use of such strategies represents an adaptive response when faced with caregiver unavailability.

These analyses also yielded an unexpected finding. The profile of mixed-dyadic regulation was associated with negative middle-childhood outcomes at both 12 and 18 months. Like the infants with mixed regulatory profiles, these infants used a variety of regulatory behaviours; however, they also engaged in higher levels of dyadic regulation. Given that the interference period was designed to limit mothers' availability to their infants, it may be that this

group of infants represents those who required more support in regulating. However, our findings also indicate that, at 18 months, the profile of attention-seeking was associated with positive outcomes. It is likely that seeking parent support when the parent is distracted is adaptive in some contexts and not in others. For example, seeking caregiver assistance when emotions are overwhelming likely represents an adaptive strategy, whereas an overreliance on caregivers may represent difficulty with independent regulation. Future research should seek to clarify the nature of this association by measuring emotion regulation in different contexts to elicit different behaviours, or by tapping into the quality of the mother-infant relationship by including measures such as attachment style.

We also hypothesized that the association between mixed regulatory profiles and adaptive outcomes would not be present during the normal interaction periods, which are designed to promote dyadic interaction and are thus dominated by dyadic regulatory strategies. However, at 12 and 18 months, mixed regulatory profiles during the normal period were associated with positive outcomes in middle childhood. At 12 months, this profile was negatively associated with anxiety, depression, and aggression. At 18 months, this profile positively predicted social skills. At these ages, varied regulatory behaviours appear to predict regulatory success, even when a caregiver is available. This may lend further support to theories of regulatory flexibility and suggest that use of a repertoire of strategies in early life is predictive of regulatory success. Future studies should explicitly use periods of maternal availability and unavailability to contrast the range of strategies used by infants in and outside of interactions with their caregivers.

Limitations and future directions

In addition to the contributions of the current study, including the application of a

regulatory flexibility approach to understanding early emotion regulation, use of observational coding systems, and a longitudinal design, there are some limitations. First, although the focus of the current study was the emergence of a repertoire of regulation behaviours, it did not fully capture the construct of regulatory flexibility given that sensitivity to context and responsiveness to feedback were not measured. A wide variety of regulatory behaviours is not sufficient to enable regulatory flexibility and may in some cases be indicative of a disorganized approach to regulation. Our findings suggest that the use of a variety of regulatory behaviours in early life is predictive of positive socioemotional outcomes. Future research should include other key elements of regulatory flexibility to gain a full sense of its emergence and impact in early life.

Second, our sample size was relatively small, particularly for the longitudinal analyses undertaken for the final objective. Small samples are not unusual in observational studies, especially those with a longitudinal component. In order to increase our sample size, we combined participants from two different samples. Although this likely increased the generalizability of our findings, it also introduced heterogeneity into our sample due to the different risk factors involved in each group. Given that a similar approach has not previously been taken to study the development of emotion regulation, our analyses may be considered exploratory and require replication. Future studies should use larger samples to confirm the identified profiles and their longitudinal association with indices of adjustment, as well as explicitly test the association of regulatory profiles with different risk factors such as premature birth and parent histories of socioemotional problems and disadvantage.

A third limitation of the current study was the inclusion of mothers but not fathers or other caregivers. Given that regulatory behaviours may be learned in interactions with various caregivers, future research should examine whether paternal parenting behaviours (or those of

other caregivers) differentially impact infant emotion regulation. During the preschool period, peers may also play a role in shaping socioemotional development (Kopp, 1989; Myruski & Dennis-Tawari, 2021). Future research should include peer influences in the development of regulatory flexibility.

A strength of the current study was the inclusion of both parent and child variables; however, child temperament was only included at the final time point. Future studies should aim to include child temperament at earlier time points to effectively capture the input of both interaction partners in regulatory development. An observational measure of child affect might also be included in future studies to enable assessment of the effectiveness of regulatory patterns, potentially offering insight into the short-term effects of each profile of regulation.

The interaction periods used to code both emotion regulation behaviours and parenting behaviours were relatively short. Although we were able to identify distinct profiles of regulatory behaviours during each period, a longer observation time may have allowed for more variety in the observed profiles. In terms of parenting behaviours, there is evidence that the predictive validity of the EA scales improves with longer observation times (Biringen et al., 2005). However, the EA scales have commonly been used during shorter interaction periods, including laboratory paradigms such as the SF and interference periods (e.g., Carter et al., 1998; Korja & McMahon, 2021; Moszkowski et al., 2009). Future studies should also explore regulatory strategy use in other contexts, including tasks that elicit more conflict and frustration, to elicit a greater range of behaviours, as well as using alternative methods, such as time-sampling, to capture a larger snapshot of the regulatory process.

Finally, although the longitudinal design of the current study was a major strength, it was limited to infancy and early childhood. Emotional development is a lifelong process (Rawana et

al., 2014) and behaviours developed in early life have repercussions well into adulthood (Penela et al., 2015). Future studies should seek to extend the current study by including time points in later childhood, adolescence, and adulthood in order to capture the ongoing development of emotion regulation and its impact on socioemotional outcomes beyond early life.

Implications and conclusions

The current study was unlike others in the field in its focus on regulatory profiles and the development of a repertoire of regulation behaviours, as opposed to the traditional emphasis on identifying "adaptive" and "maladaptive" behaviours. Our approach is more consistent with the adult emotion regulation literature, which stresses the importance of regulatory flexibility (Bonanno & Burton, 2013; Hollenstein et al., 2013). Indeed, results from the current study demonstrated that as early as six months, infants differ in the variety of strategies used. This pattern was consistent across time points, with some infants engaging in a wide variety of strategies within a relatively short timeframe, and others relying largely on one or two behaviours. This may suggest that, even at this very young age, infants are developing the repertoire of strategies which will enable regulatory flexibility in later life (Bonanno & Burton, 2013).

Our findings also provide insight into the impact of parent and child characteristics on the development of regulatory flexibility. Prior research suggests that emotion regulation develops in the context of parent-child interactions, such that positive and negative parenting behaviours may shape the regulatory behaviours used by infants (Hentges et al., 2020; Leerkes et al., 2009). Infant temperament has also been shown to shape the development of regulatory processes (Calkins, 2004). In our study, although both parenting behaviours and infant temperament were associated with regulatory profiles, they did not reliably predict membership in the mixed profile

of regulation. Our results may suggest that an alternative mechanism is involved in the development of regulatory flexibility, including other parenting behaviours such as modeling of emotion regulation and emotion socialization. Future studies should explore alternative mechanisms which promote the development of regulatory flexibility in early life in order to provide further insight into socioemotional development, and potentially offer new directions for intervention.

Finally, by testing the association between profiles of mixed regulation and socioemotional outcomes in middle childhood, we were able to assess the adaptive function and long-term effects of early repertoires of regulatory behaviour. At three of the four ages tested, profiles of mixed regulation during the interference period were associated with positive outcomes in middle childhood. At two ages, mixed regulation was also predictive of positive outcomes when measured during periods of caregiver-infant interaction. This suggests that at these ages, the use of varied behaviours is an adaptive regulatory approach. The adaptiveness of a varied profile is consistent with the adult literature, which suggests that the adaptiveness of any given emotion regulation behaviour varies across individuals and situations; it is the ability to respond flexibly that is associated with regulatory success (Aldao, 2013; Bonanno et al., 2004; Sheppes & Gross, 2012).

From a clinical perspective, our findings point to the utility of early interventions that explicitly teach a wide range of regulatory skills to young children. Emotion regulation behaviours are generally learned in the context of caregiver-infant interactions; however, when these interactions are sub-optimal, infants risk developing less effective regulatory behaviours (Granat et al., 2017; Kiel & Kalomiris, 2015). Deficits in emotion regulation are associated with internalizing and externalizing problems, as well as psychopathology across the lifespan (Bowie,

2010; Degnan et al., 2008). Early interventions that promote regulatory flexibility by teaching varied regulatory skills could prevent future difficulties and promote healthy socioemotional development.

Taken together, our results suggest that some aspects of regulatory flexibility may be developing at a very young age, and that this flexibility may be predictive of socioemotional functioning and wellbeing later in development. This viewpoint, although consistent with recent adult theories of emotion regulation, runs contrary to the traditional approach to understanding the development of emotion regulation yet offers new directions and possible avenues for early intervention. By examining emotion regulation behaviour as a shifting pattern of behaviours rather than one static ability, we may gain a more nuanced understanding of regulatory ability, and of socioemotional development more broadly.

Table 1.

Brief definitions and inter-rater agreement for emotion regulation behaviours.

Behaviour	Definition	Time 1 kappa	Time 2 kappa	Time 3 kappa	Time 4 kappa
Self-comfort regulatory	Using touch or self to independently self-regulate. Infant's gaze must be directed away from self or object. E.g., mouthing, rubbing body, pulling clothes.	0.84	0.84	0.76	0.75
Self-comfort exploratory	Using environment to independently self-regulate. Infant's gaze is directed toward the object of interest. E.g., exploring chair with hands, playing with clothes or chair's belt.	0.80	0.77	0.74	-
Attention-seeking	Trying to get mother's attention when mother is not interacting with child. E.g., reaching for mother, vocalizing insistently.	0.75	0.87	0.83	0.84
Escape	Attempting to get out of chair or distance self from mother. E.g., twisting in chair, arching body away from mother.	0.80	0.71	0.71	0.87
Gaze aversion	Looking away from mother. E.g., not interested in interacting with mother, attention elsewhere.	0.81	-	-	-
Bidirectional exchange/ Dyadic exchange/ Cooperation	Regulating by engaging with mother. E.g., cooperative play, joint attention.	0.88	0.76	0.76	0.88
Over-activity	Displaying heightened activity. E.g., flailing arms, kicking, bouncing	-	0.81	0.76	0.79

Independent play	Engaging in a task alone, without the help or involvement of mother. E.g., parallel play, solitary play	-	0.77	0.73	0.86
Non-compliance	Resisting or ignoring mother's requests. E.g., yelling 'no,' pretending not to hear mother	-	-	-	0.90
Fretting	Overt displeasure or upset. E.g., whining, frowning, pouting.	-	-	-	0.79

Table 2.

Means and standard deviations for study variables.

	Time 1		Time 2		Time 3		Time 4	
	Normal	Still-face	Normal	Interference	Free-play	Interference	Free-play	Interference
Self-comfort regulatory	15.37 (17.64)	41.78 (22.41)	6.29 (11.83)	5.59 (9.87)	1.59 (4.03)	3.06 (5.50)	10.72 (9.05)	18.45 (14.41)
Self-comfort exploratory	3.49 (5.83)	15.08 (18.28)	5.53 (8.61)	11.00 (11.05)	5.06 (7.31)	10.80 (12.73)	-	-
Attention-seeking	0.26 (1.53)	1.90 (3.53)	0.02 (0.13)	12.59 (14.80)	0.00 (0.00)	13.87 (17.37)	1.40 (3.32)	10.45 (8.98)
Escape	0.09 (0.45)	1.93 (4.13)	1.68 (4.09)	0.61 (1.84)	3.21 (8.08)	1.31 (3.22)	0.62 (1.56)	1.44 (3.38)
Bidirectional/ Dyadic/ Cooperation	43.61 (24.67)	-	48.64 (30.20)	1.41 (3.10)	60.88 (33.67)	1.42 (3.39)	74.03 (19.19)	3.06 (5.50)
Gaze aversion	35.00 (23.08)	31.40 (21.79)	-	-	-	-	-	-
Independent play	-	-	15.08 (19.04)	39.78 (28.95)	13.70 (23.32)	49.27 (27.34)	10.66 (13.10)	53.29 (20.35)
Over-activity	-		1.21 (2.66)	1.22 (2.66)	0.75 (1.96)	0.84 (1.90)	0.32 (0.85)	0.35 (1.08)
Non-compliance	-	-	-	-	-	-	0.07 (0.50)	0.35(2.07)
Fretting	-	-	-	-	-	-	0.02 (0.16)	0.96 (3.82)
Maternal sensitivity	7.67 (1.02)	-	7.42 (1.05)	-	7.08 (1.14)	-	7.44 (0.85)	-
Maternal non-hostility	4.90 (0.37)	-	4.89 (0.44)	-	4.88 (0.48)	-	4.88 (0.34)	-
Child emotionality							11.83 (3.72)	
Child sociability							17.25 (3.65)	
Maternal prestige	422.14 (145.48)	-	388.13 (162.68)	-	390.29 (153.85)	-	390.71 (153.21)	-
Paternal prestige	422.14 (145.48)	-	423.42 (166.30)	-	434.03 (156.00)	-	463.86 (154.02)	-

Maternal age at birth	30.33 (4.95)	-	-	-	-	-	-	-

Table 3.

Stability and intercorrelations between parent and child characteristics.

		1	2	3	4	5	6	7	8	9	10
Age											
6	1. Sensitivity	1									
	2. Nonhostility	.57**	1								
12	3. Sensitivity	.15	.04	1							
	4. Nonhostility	.34**	.29**	-.09	1						
18	5. Sensitivity	.49**	.21**	.21*	.54**	1					
	6. Nonhostility	.34**	.35**	-.13	.72**	.43**	1				
4.5	7. Sensitivity	.32**	.14	.35**	-.16	.36**	-.02	1			
	8. Nonhostility	.17	.13	.12	.06	.14	.21*	.34**	1		
	9. Emotionality	.17	.13	-.22*	.09	.06	.16	-.08	.19*	1	
	10. Sociability	-.05	-.14	-.10	.04	-.05	-.07	-.04	.08	.05	1

Note. * $p < 0.05$, ** $p < 0.01$, two-tailed.

Table 4.

Class enumeration.

Model	Log likelihood	AIC	CAIC	BIC	ABIC	Entropy	Smallest Class %	LMR	BLRT
Time 1, Still-face period (n = 134)									
1	-1984.940	3985.880	4002.824	4010.824	3985.495				
2	-1742.875	3507.750	3528.626	3539.626	3504.831	0.969	14.2	< 0.001	< 0.001
3	-1687.825	3407.650	3538.015	3454.015	3403.404	0.907	14.2	0.0067	< 0.001
4	-1659.441	3360.881	3400.736	3421.736	3355.308	0.883	13.4	0.0012	< 0.001
5	-1644.098	3340.197	3389.450	3415.540	3333.296	0.878	13.4	0.3873	< 0.001
Time 1, Normal period (n = 134)									
1	-2426.789	4873.579	4914.759	4904.759	4873.097				
2	-2187.570	4403.140	4457.710	4443.710	4399.425	0.901	18.7	0.0255	< 0.001
3	-2138.985	4317.970	4395.927	4375.927	4312.662	0.850	14.9	0.1970	< 0.001
4	-2095.254	4242.509	4343.853	4317.853	4235.608	0.889	13.4	0.1738	< 0.001
Time 2, Interference period (n = 115)									
1	-2376.969	4777.938	4827.354	4815.354	4777.360				
2	-2108.223	4250.446	4314.109	4297.109	4243.376	0.999	11.3	0.002	< 0.001
3	-2056.343	4160.685	4250.564	4226.564	4150.704	0.988	9.6	0.087	< 0.001
4	-2024.499	4110.998	4226.091	4196.091	4098.106	0.915	8.9	0.090	< 0.001
Time 2, Free-play period (n = 116)									
1	-2126.900	4273.800	4314.980	4304.980	4273.318				
2	-1879.681	3787.362	3839.913	3825.913	3781.659	0.973	12.9	0.0889	< 0.001
3	-1829.412	3698.825	3773.896	3753.896	3690.677	0.970	12.1	0.0029	< 0.001
4	-1786.292	3624.584	3722.992	3696.177	3613.992	0.948	13.3	0.1330	< 0.001
Time 3, Interference period (n = 114)									
1	-1973.848	3967.697	4008.876	3998.876	3967.215				
2	-1707.394	3442.787	3495.094	3481.094	3436.845	0.998	7.9	0.0074	< 0.001
3	-1655.602	3351.203	3425.927	3405.927	3342.714	0.970	7.9	0.0042	< 0.001
4	-1608.743	3269.486	3366.627	3340.627	3258.450	0.956	7.9	0.0047	< 0.001

5	-1579.709	3223.418	3342.976	3310.976	3209.835	0.950	7.9	0.6240	< 0.001
Time 3, Free-play period (n = 116))									
1	-1693.408	3402.817	3435.761	3427.761	3402.532				
2	-14.28.404	2878.808	2920.097	2909.097	2874.327	0.976	11.2	0.003	< 0.001
3	-1388.865	2809.731	2869.788	2853.788	2803.213	0.981	6.9	0.001	< 0.001
4	-1344.421	2730.843	2809.668	2788.668	2722.288	0.960	6.9	0.240	< 0.001
Time 4, Interference period (n = 104)									
1	-1781.683	3583.366	3624.546	3614.546	3582.885				
2	-1536.628	3101.256	3152.278	3138.278	3094.052	0.986	8.8	0.0399	< .001
3	-1515.516	3071.033	3143.921	3123.921	3060.741	0.916	11.5	0.1085	< .001
4	-1488.873	3124.745	3072.500	3098.500	3016.365	0.902	11.5	0.2405	< .001
Time 4, Free-play period (n = 108)									
1	-1772.679	3565.357	3606.537	3596.537	3564.876				
2	-1499.975	3027.950	3076.500	3065.500	3021.264	1.000	5.6	0.0133	< .001
3	-1446.505	2933.009	3006.652	2986.652	2923.458	0.970	5.6	0.1644	< .001
4	-1409.742	2871.484	2967.219	2941.219	2859.067	0.941	5.6	0.2894	< .001
5	-1391.032	2846.065	2963.893	2931.893	2830.783	0.941	4.6	0.4528	< .001

Note: AIC = Akaike information criterion; CAIC = constant AIC; BIC = Bayesian information criterion; ABIC = sample size adjusted BIC; LMR = *p*-value associated with the adjusted Lo–Mendell–Rubin likelihood ratio test; BLRT = *p*-value associated with the bootstrap likelihood ratio test

Table 5.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 1 Still-Face period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.935	0.000	0.000	0.065
Profile 2	0.001	0.979	0.000	0.019
Profile 3	0.000	0.000	0.969	0.031
Profile 4	0.068	0.000	0.030	0.901

Table 6.

Four-profile model results for the Time 1 Still-Face period.

	Profile 1 Self-soothing (n = 45)	Profile 2 Exploration (n = 18)	Profile 3 Distraction (n = 23)	Profile 4 Mixed regulation (n = 48)
Self-comfort regulatory	66.87 (11.33)	24.40 (11.55)	17.10 (10.77)	36.59 (12.39)
Self-comfort exploratory	9.67 (10.99)	54.27 (8.99)	2.17 (3.72)	11.64 (9.32)
Gaze aversion	14.52 (8.68)	17.22 (11.28)	70.04 (9.88)	34.02 (9.75)
Maternal prestige	0.004	0.000	-0.001	
Paternal prestige	-0.005	-0.003	-0.005	
Maternal age at birth	0.061	0.030	0.143	
Maternal sensitivity	-0.272	-1.058**	-0.709	
Maternal non-hostility	0.627	2.167	1.428	

Note: Values below the table break are from covariate analysis, with Profile 4 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Table 7.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 2 Interference period.

	Profile 1	Profile 2	Profile 3
Profile 1	1.000	0.000	0.000
Profile 2	0.000	0.997	0.003
Profile 3	0.000	0.013	0.987

Table 8.

Retained three-profile model results and coefficients for the Time 2 Interference period.

	Profile 1 Self-soothing (*n* = 13)	Profile 2 Mixed regulation (*n* = 91)	Profile 3 Mixed-dyadic (*n* = 11)
Self-comfort regulatory	30.92 (6.83)	2.44 (3.48)	1.77 (2.21)
Self-comfort exploratory	8.49 (8.86)	10.27 (10.72)	20.06 (12.61)
Dyadic exchange	1.96 (2.78)	0.36 (1.06)	9.47 (2.83)
Independent play	34.51 (25.74)	42.00 (29.85)	27.62 (22.25)
Attention-seeking	13.10 (11.88)	12.94 (15.64)	9.09 (10.52)
Maternal prestige	0.000		0.001
Paternal prestige	0.001		-0.001
Maternal age at birth	-0.034		-0.154
Maternal sensitivity	-0.143		0.333
Maternal non-hostility	-0.840*		-

Note: Values below the table break are from covariate analysis, with Profile 3 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Table 9.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 3 Interference period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.973	0.000	0.024	0.003
Profile 2	0.000	1.000	0.000	0.000
Profile 3	0.009	0.001	0.983	0.007
Profile 4	0.002	0.000	0.034	0.964

Table 10.

Retained four-profile model results and coefficients for the Time 3 Interference period.

	Profile 1 Attention-seeking (n = 17)	Profile 2 Mixed-dyadic (n = 9)	Profile 3 Independent (n = 67)	Profile 4 Mixed regulation (n = 21)
Self-comfort exploratory	5.73 (6.87)	6.60 (7.55)	5.63 (5.58)	33.21 (10.28)
Attention-seeking	49.10 (12.36)	10.09 (9.55)	7.23 (7.37)	8.19 (11.11)
Dyadic exchange	0.47 (1.11)	11.87 (1.89)	0.37 (1.27)	1.02 (1.84)
Independent play	19.78 (11.43)	43.19 (24.04)	65.53 (20.0)	23.88 (15.52)
Maternal prestige	-0.003	0.001	-0.002	
Paternal prestige	0.000	-0.003	0.001	
Maternal age at birth	0.190	0.233*	0.131	
Maternal sensitivity	0.856*	0.051	-0.023	
Maternal non-hostility	-1.660*	-1.444	-0.907	

Note: Values below the table break are from covariate analysis, with Profile 4 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Table 11.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 4 Interference period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.968	0.014	0.000	0.018
Profile 2	0.096	0.888	0.003	0.014
Profile 3	0.000	0.002	0.998	0.000
Profile 4	0.063	0.006	0.002	0.929

Table 12.

Retained four-profile model results and coefficients for the Time 4 Interference period.

	Profile 1 Independent (*n* = 58)	Profile 2 Attention-seeking (*n* =17)	Profile 3 Mixed regulation (*n* = 12)	Profile 4 Self-soothing (*n* = 17)
Self-comfort regulatory	12.84 (8.34)	16.60 (10.10)	12.96 (10.74)	43.34 (10.43)
Attention-seeking	7.39 (5.56)	25.50 (5.80)	11.27 (9.14)	5.27 (3.74)
Independent play	66.08 (14.83)	37.53 (14.51)	35.12 (17.85)	38.24 (10.42)
Cooperation	1.24 (2.01)	2.49 (2.78)	16.39 (5.09)	0.46 (1.31)
Maternal prestige	-0.002	0.001		0.002
Paternal prestige	-0.002	-0.007		0.001
Maternal age at birth	0.022	0.056		-0.147
Maternal sensitivity	-0.093	-0.360		-1.972*
Maternal non-hostility	-0.618	-		0.533
Child emotionality	-0.112	-0.111		-0.307
Child sociability	0.073	0.086		-0.286*

Note: Values below the table break are from covariate analysis, with Profile 3 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

General Discussion

The present set of studies was designed to extend current knowledge of early emotion regulation by including factors at multiple levels of influence (including parent-, child-, and context-driven), using observational coding systems to capture the complexities of regulatory behaviour, and examining the implications of early regulatory flexibility. By exploring an alternative approach to understanding the development of emotion regulation, we aimed to challenge traditional approaches and shed light on the complexities of early regulatory behaviour.

One strength of the current set of studies is the inclusion of predictive factors at multiple levels of influence. There is ample evidence that the development of emotion regulation behaviours is shaped by parenting behaviours (Granat et al., 2017), child characteristics (Calkins, 2004), and contextual factors such as parental mental health (Feldman et al., 2009); however, it is commonplace for studies to focus on one level of influence rather than their interaction. Further, when considering parenting factors, the focus largely tends to be on positive parenting behaviour, most notably sensitivity. Recent evidence suggests that negative parenting behaviour, including parental hostility, may have a distinct and detrimental impact on the development of regulatory behaviour (Hentges et al., 2020; Rose et al., 2018).

In the current set of studies, we included measures of parenting (sensitivity, hostility), child characteristics (temperament), and family context (maternal depression). In Study 1, we aimed to examine the interaction of parenting and depression using a moderation model. Our results indicated that parenting moderated the effects of maternal depression on infant emotion regulation during both a normative interaction period and a period of mild distress. Understanding how these factors interact provides us with more insight into the detrimental

effects of maternal depression and the potentially protective effects of positive parenting. In Study 2, we examined the impact of both parenting behaviours and child temperament on regulatory profiles. Factors at both levels were associated with the identified profiles, suggesting that parenting and temperament may influence the type and variety of strategies used by infants throughout development.

In each of the studies, we included both positive and negative parenting behaviours. Our results supported prior findings that negative parenting behaviours may have a distinct impact on regulatory behaviours. In Study 1, maternal hostility directly impacted infants' use of self-soothing behaviours during the perturbed interaction period. In Study 2, maternal non-hostility negatively predicted membership in regulatory profiles characterized by self-soothing at 12 months of age and by attention-seeking at 18 months of age. This suggests that, despite receiving relatively little attention in the literature as compared to positive parenting behaviours, maternal hostility may play an important role in the development and use of emotion regulation behaviours in early life.

The current set of studies also aimed to challenge traditional approaches to early emotion regulation, which often treat regulation as a unitary construct (e.g., Carter et al., 1999; Shields & Cicchetti, 1997), prioritize quantity of regulation over quality (e.g., Feldman et al., 2009; Halligan et al., 2013), or categorize behaviours as either adaptive or maladaptive (e.g., Diener et al., 2002). Not only do such approaches risk obscuring the intricacies of regulatory behaviour used across early development, but they also fail to consider how contextual and individual factors might impact the adaptiveness of a given regulatory behaviour (Bridges et al., 2004; Myruski & Dennis-Tiwary, 2021).

In our studies, we used observational coding systems to capture the breadth of strategies used by infants in varying contexts (e.g., in normal interaction periods and during periods of potential mild distress). Rather than categorizing the observed behaviours as adaptive or maladaptive, we considered how individual and contextual factors, including temperament, parenting, and parent mental health, might impact their utility and adaptiveness. Finally, we identified profiles of regulation across early life in order to assess the emergence of regulatory flexibility and its impact on socioemotional functioning in later life.

Our findings suggest that, from a very young age, infants are altering their use of regulatory behaviours to meet situational demands, both in terms of the immediate context and their prior experience with caregivers. Further, across age groups, infants differ in the extent to which they vary their regulatory behaviour, with some infants relying primarily on one or two strategies and others engaging in a breadth of behaviours across a relatively short interaction period. Although there are many possible interpretations, it may be that these findings represent the early emergence of regulatory flexibility. This hypothesis is strengthened by our findings that profiles marked by varied regulatory behaviours were associated with positive outcomes in later childhood. This may suggest that, as is the case with adults, possessing and using multiple regulatory strategies is adaptive in early life.

Our findings are in line with both the Mutual Regulation Model (Tronick & Beeghly, 2011) and Bonanno and Burton's (2013) theory of regulatory flexibility. Infants in both studies engaged in a range of regulatory strategies targeting both their internal states and, through the use of attention-seeking and dyadic regulation, their caregivers' behaviour. This breadth of regulatory behaviour also suggests that, even at these young ages, infants are developing the repertoire of regulatory behaviours needed for regulatory flexibility. In Study 2, this breadth was

associated with positive socioemotional outcomes in later childhood at three of the four timepoints measured. Further, by including contextual and parent factors, we observed how infants' regulatory behaviours are shaped both by their immediate demands and by their historical relationships with caregivers. Infants' ability to shift their regulatory strategy use according to these factors may represent the early stages of regulatory flexibility and may set the stage for successful regulation in later life.

Limitations and Future Directions

Despite these important contributions (inclusion of factors at multiple levels of influence, use of observational coding systems, and examination of the implications of early regulatory flexibility), there are limitations to the current set of studies. First, the observation periods used for coding emotion regulation and parenting behaviours were relatively short, allowing for only a snapshot of the behaviours that occur in daily life. Although this is relatively common in observational research, it may limit the generalizability of the current findings. The current studies included two interaction contexts at each observation point in order to capture periods of naturalistic dyadic interaction and periods of caregiver unavailability; future studies should examine regulatory behaviour during other contexts or use time-sampling to capture behaviours over a longer period of time.

The longitudinal design of Study 2 represents a major strength, allowing for identification of regulatory profiles at different stages across early development. However, the lack of consistency between interaction periods at Time 1 (SF) versus the remaining times (interference task) precludes direct comparison between timepoints. Both the SF paradigm and the interference task represent interactions in which the mother is physically present but emotionally unavailable to her infant, eliciting some distress and the need for independent regulation. Many

of the differences between the periods are reflective of the developmental changes occurring in infants (e.g., sitting on a mat versus being constrained in an infant seat), however this discrepancy prevents the direct comparison of regulatory behaviours at different timepoints. Although this was not the goal of this study, future studies should seek to examine change in regulatory profiles over time using more uniform interaction periods.

A common shortcoming in developmental literature shared by the current set of studies is the lack of fathers or other caregivers. Future research should examine whether the parenting behaviour of other caregivers differentially impacts emotion regulation behaviour. Both studies also had relatively small sample sizes, limiting both the power of our analyses and the generalizability of our findings. Future studies should seek to replicate our results with larger sample sizes.

Finally, one goal of the current studies was to explore the early emergence of regulatory flexibility by examining the impact of individual and contextual factors on regulatory strategy use and by identifying profiles of regulatory behaviour. Our findings suggest that infants may be demonstrating aspects of regulatory flexibility from a young age, and that this flexibility may be associated with adaptive outcomes in later childhood. However, regulatory flexibility was not explicitly measured in our studies, and thus no definitive conclusions can be reached. Future studies should seek to more explicitly capture the construct of regulatory flexibility in early life, such as by including all three facets of flexibility included in Bonanno and Burton's (2013) model. By more concretely operationalizing this construct in early life, we may be able to better understand its emergence and its implications for socioemotional development.

Theoretical and Clinical Implications

The current set of studies represents a divergence from traditional approaches to studying the development of emotion regulation. Taken together, results from our studies suggest that early emotion regulation cannot adequately be captured by unitary measures or by dividing behaviours into “adaptive” and “maladaptive” categories. It may be that the models of regulatory flexibility used in the adult literature (e.g., Bonanno & Burton, 2013; Hollenstein et al., 2013) are a better fit for understanding early regulatory processes, such that the adaptiveness of a given strategy is dependent on both individual and contextual factors and the most effective approach to regulation is one that is flexible. If this is the case, future models should seek to adapt adult interactionist models and emphasize the development of a flexible approach to regulation.

From a clinical standpoint, the results of the current studies have numerous implications for intervention. First, our findings regarding the interaction of maternal depression and parenting behaviours provide further evidence that parenting can heighten or mitigate the risks associated with maternal depression. Many existing parenting interventions for depressed mothers have proven effective (e.g., Deans, 2020; Kersten-Alvarez et al., 2011); such interventions may also aid in the development of healthy regulatory abilities. Although these interventions largely target positive parenting behaviours, the results of the current set of studies suggest that negative parenting behaviours may be equally important for the development of emotion regulation, regardless of maternal depression status. Hostility may be an important target for future interventions aiming to promote healthy socioemotional development.

Our findings also suggest that the early development of a wide range of regulatory behaviours is associated with healthy developmental outcomes. Given that deficits in emotion regulation underlie many forms of psychopathology (Rawana et al., 2014; Weissman et al., 2019), our results may have important implications for intervention. Early interventions could

aim to promote flexible approaches to regulation by explicitly teaching regulatory skills to young children or helping parents to model effective regulation; this has the potential to protect against internalizing and externalizing problems and promote healthy socioemotional development. Many therapeutic interventions for adults, including Dialectical Behaviour Therapy (Linehan, 1993), target deficits in emotion regulation abilities. Promoting these crucial skills in early life may help in preventing disorders characterized by poor emotion regulation.

General Conclusions

The present set of studies provided an in-depth exploration of the development of emotion regulation behaviours in early life, their use in different contexts, and the impact of parent- and child- influences. Taken together, results from these studies deepen our understanding of the risks associated with maternal depression, the importance of both positive and negative parenting behaviours, and the influence of child temperament. Further, by using observational coding measures and by identifying not only specific behaviours but also profiles of behaviours, these studies contribute to our understanding of regulatory flexibility in early life and its long-term implications. Our findings challenge traditional conceptualizations of early emotion regulation, which prioritize quantity over quality and hold certain behaviours as more adaptive than others, and are more in line with the adult literature, which favours flexibility and adaptability. Clinically, these findings suggest new potential areas for intervention, including the inclusion of negative parenting behaviours and the explicit targeting of emotion regulation deficits in early life. Overall, these studies demonstrate the complexity of regulatory behaviour in early life, a complexity that may not be adequately captured by current models. By shifting our perspective, we may gain a more nuanced understanding of early emotion regulation and its implications for fostering healthy development.

References

Achenbach, T. M., & Rescorla, L. A. (2001). *Child behavior checklist for ages 6-18* (pp. 6-10). Burlington, VT: University of Vermont.

Ainsworth, M. D., Bell, S. M., & Stayton, D. J. (1974). Infant-mother attachment and social development: Socialization as a product of reciprocal responsiveness to signals. In M. P. M. Richards (Ed.), *The integration of a child into a social world* (pp. 99-135). Cambridge University Press.

Akhtar, N., & Martínez-Sussmann, C. (2007). Intentional Communication. In C. A. Brownell & C. B. Kopp (Eds.), *Socioemotional development in the toddler years: Transitions & transformations* (pp. 201- 220). The Guilford Press

Aldao, A. (2013). The future of emotion regulation research: Capturing context. *Perspectives on Psychological Science*, *8*(2), 155-172. https://doi.org/10.1177/1745691612459518

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*(2), 217-237. https://doi.org/10.1016/j.cpr.2009.11.004

Aldao, A., Sheppes, G., & Gross, J. J. (2015). Emotion regulation flexibility. *Cognitive Therapy and Research*, *39*(3), 263-278. https://doi.org/10.1007/s10608-014-9662-4

Anthony, J. L., Lonigan, C. J., Hooe, E. S., & Phillips, B. M. (2002). An affect-based, hierarchical model of temperament and its relations with internalizing symptomatology. *Journal of Clinical Child and Adolescent Psychology*, *31*(4), 480-490. https://doi.org/10.1207/S15374424JCCP3104_7

Atkinson, N. H., Jean, A. D., & Stack, D. M. (2021). Emotion regulation from infancy to toddlerhood: Individual and group trajectories of full-term and very-low-birthweight preterm infants. *Infancy*, *26*(4), 570-595. https://doi.org/10.1111/infa.12405

Atkinson, N., & Stack, D. M. (2017). *Toddler Self-Regulatory System*. Unpublished document, Concordia University, Montreal, Quebec, Canada.

August, E. G., & Stack, D. M. (2010). *Preschooler Self-Regulatory Scheme*. Unpublished document, Concordia University, Montreal, Quebec, Canada.

August, E. G., Stack, D. M., Martin-Storey, A., Serbin, L. A., Ledingham, J., & Schwartzman, A. E. (2017). Emotion regulation in at-risk preschoolers: Longitudinal associations and influences of maternal histories of risk. *Infant and Child Development, 26*(1), Article e1954. https://doi.org/10.1002/icd.1954

Bauer, D. J., & Curran, P. J. (2005). Probing interactions in fixed and multilevel regression: Inferential and graphical techniques. *Multivariate Behavioral Research*, *40*(3), 373-400. https://doi.org/10.1207/s15327906mbr4003_5

Behrendt, H. F., Scharke, W., Herpertz-Dahlmann, B., Konrad, K., & Firk, C. (2019). Like mother, like child? Maternal determinants of children's early social-emotional development. *Infant Mental Health journal*, *40*(2), 234-247. https://doi.org/10.1002/imhj.21765

Bell, R. Q. (1968). A reinterpretation of the direction of effects in studies of socialization. *Psychological Review, 75*(2), 81–95. https://doi.org/10.1037/h0025583

Belsky, J. (1984). The determinants of parenting: A process model. *Child Development, 55*(1), 83–96. https://doi.org/10.1111/j.1467-8624.1984.tb00275.x.

Bernard, K., Nissim, G., Vaccaro, S., Harris, J. L., & Lindhiem, O. (2018). Association between maternal depression and maternal sensitivity from birth to 12 months: A meta-analysis. *Attachment & Human Development*, *20*(6), 578-599. https://doi.org/10.1080/14616734.2018.1430839

Biringen, Z., Damon, J., Grigg, W., Mone, J., Pipp-Siegel, S., Skillern, S., & Stratton, J. (2005). Emotional availability: Differential predictions to infant attachment and kindergarten adjustment based on observation time and context. *Infant Mental Health Journal*, *26*(4), 295-308. https://doi.org/10.1002/imhj.20054

Biringen, Z., Derscheid, D., Vliegen, N., Closson, L., & Easterbrooks, M. A. (2014). Emotional availability (EA): Theoretical background, empirical research using the EA Scales, and clinical applications. *Developmental Review*, *34*(2), 114-167. https://doi.org/10.1016/j.dr.2014.01.002

Biringen, Z., Robinson, J. L., & Emde, R. N. (1988). *The Emotional Availability Scales*. Centre for Excellence in Emotional Availability. www.emotionalavailability.com

Biringen, Z., Robinson, J. L., & Emde, R. N. (1993). *Emotional Availability Scales: Infancy to early childhood version*. Centre for Excellence in Emotional Availability. www.emotionalavailability.com

Biringen, Z., Robinson, J. L., & Emde, R. N. (2000). Appendix B: The emotional availability scales (3rd ed.; An abridged infancy/early childhood version). *Attachment & Human Development*, *2*(2), 256-270. https://doi.org/10.1080/14616730050085626

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science*, *8*(6), 591-612. https://doi.org/10.1177/1745691613504116

Bonanno, G. A., Papa, A., Lalande, K., Westphal, M., & Coifman, K. (2004). The importance of being flexible: The ability to both enhance and suppress emotional expression predicts long-term adjustment. *Psychological Science*, *15*(7), 482-487. https://doi.org/10.1111/j.0956-7976.2004.00705.x

Bould, H., Joinson, C., Sterne, J., & Araya, R. (2013). The emotionality activity sociability temperament survey: Factor analysis and temporal stability in a longitudinal cohort. *Personality and Individual Differences, 54*(5), 628-633. https://doi.org/10.1016/j.paid.2012.11.010

Bouvette-Turcot, A. A., Bernier, A., & Leblanc, É. (2017). Maternal psychosocial maladjustment and child internalizing symptoms: Investigating the modulating role of maternal sensitivity. *Journal of Abnormal Child Psychology*, *45*(1), 157-170. https://doi.org/10.1007/s10802-016-0154-8.

Bowie, B. H. (2010). Emotion regulation related to children's future externalizing and internalizing behaviors. *Journal of Child and Adolescent Psychiatric Nursing*, *23*(2), 74-83. https://doi.org/10.1111/j.1744-6171.2010.00226.x

Bradley, R. H., & Corwyn, R. F. (2008). Infant temperament, parenting, and externalizing behavior in first grade: A test of the differential susceptibility hypothesis. *Journal of Child Psychology and Psychiatry*, *49*(2), 124-131. https://doi.org/10.1111/j.1469-7610.2007.01829.x

Braungart-Rieker, J. M., Hill-Soderlund, A. L., & Karrass, J. (2010). Fear and anger reactivity trajectories from 4 to 16 months: The roles of temperament, regulation, and maternal sensitivity. *Developmental Psychology*, *46*(4), 791-804. https://doi.org/10.1037/a0019673

Braungart-Rieker, J. M., & Stifter, C. A. (1996). Infants' responses to frustrating situations: Continuity and change in reactivity and regulation. *Child Development*, *67*(4), 1767-1779. https://doi.org/10.2307/1131730

Bridges, L. J., Denham, S. A., & Ganiban, J. M. (2004). Definitional issues in emotion regulation research. *Child Development*, *75*(2), 340-345. https://doi.org/10.1111/j.1467-

8624.2004.00675.x

Briscoe, C., Stack, D. M., Dickson, D. J., & Serbin, L. A. (2019). Maternal emotion socialization mediates the relationship between maternal and adolescent negative emotionality. *Journal of Youth and Adolescence*, *48*(3), 495-509. https://doi.org/10.1007/s10964-018-0945-z

Britton, J. R. (2011). Infant temperament and maternal anxiety and depressed mood in the early postpartum period. *Women & Health*, *51*(1), 55-71. https://doi.org/10.1080/03630242.2011.540741

Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Lawrence Erlbaum Associates.

Buss, A. H., & Plomin, R. (1986). The EAS approach to temperament. In R. Plomin & J. Dunn (Eds.), The study of temperament: Changes, continuities, and challenges (pp. 67–79). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Calkins, S. D. (2004). Temperament and emotional regulation: Multiple models of early development. In M. Beauregard (Ed.), *Consciousness, emotional self-regulation, and the brain: Advances in consciousness research* (pp. 35-60). John Benjamins Publishing Company. https://doi.org/10.1075/aicr.54.04cal

Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. J. Gross (Ed.), *Handbook of Emotion Regulation* (pp. 606–615). Guilford Press.

Calkins, S. D., & Johnson, M. C. (1998). Toddler regulation of distress to frustrating events: Temperamental and maternal correlates. *Infant Behavior and Development*, *21*(3), 379-395. https://doi.org/10.1016/S0163-6383(98)90015-7

Calkins, S. D., Dedmon, S. E., Gill, K. L., Lomax, L. E., & Johnson, L. M. (2002). Frustration in

infancy: Implications for emotion regulation, physiological processes, and temperament. *Infancy*, *3*(2), 175-197. https://doi.org/10.1207/S15327078IN0302_4

Calkins, S. D., Smith, C. L., Gill, K. L., & Johnson, M. C. (1998). Maternal interactive style across contexts: Relations to emotional, behavioral and physiological regulation during toddlerhood. *Social Development*, *7*(3), 350-369. https://doi.org/10.1111/1467-9507.00072

Campbell, S. B., Matestic, P., von Stauffenberg, C., Mohan, R., & Kirchner, T. (2007). Trajectories of maternal depressive symptoms, maternal sensitivity, and children's functioning at school entry. *Developmental Psychology*, *43*(5), 1202-1215. https://doi.org/10.1037/0012-1649.43.5.1202

Campbell, S. B., Spieker, S., Vandergrift, N., Belsky, J., Burchinal, M., & NICHD Early Child Care Research Network. (2010). Predictors and sequelae of trajectories of physical aggression in school-age boys and girls. *Development and Psychopathology, 22*(1), 133-150. https://doi.org/10.1017/S0954579409990319

Carter, A. S., Little, C. B., & Garrity-Rokous, F. (1998). Adapting the emotional availability scales for 4-month old infant-mother dyads: Associations with molecular coding and maternal psychopathology. *Infant Behavior and Development*, *21*, 25. https://doi.org/10.1016/S0163-6383(98)91240-1

Carter, A. S., Little, C., Briggs-Gowan, M. J., & Kogan, N. (1999). The infant–toddler social and emotional assessment (ITSEA): Comparing parent ratings to laboratory observations of task mastery, emotion regulation, coping behaviors, and attachment status. *Infant Mental Health Journal*, *20*(4), 375-392. https://doi.org/10.1002/(SICI)1097-0355(199924)20:4<375::AID-IMHJ2>3.0.CO;2-P

Conradt, E., & Ablow, J. (2010). Infant physiological response to the still-face paradigm:

Contributions of maternal sensitivity and infants' early regulatory behavior. *Infant Behavior and Development*, *33*(3), 251–265. https://doi.org/10.1016/j.infbeh.2010.01.001

Crespo, L. M., Trentacosta, C. J., Aikins, D., & Wargo-Aikins, J. (2017). Maternal emotion regulation and children's behavior problems: The mediating role of child emotion regulation. *Journal of Child and Family Studies*, *26*, 2797-2809. https://doi.org/10.1007/s10826-017-0791-8

Crockenberg, S. C., & Leerkes, E. M. (2004). Infant and maternal behaviors regulate infant reactivity to novelty at 6 months. *Developmental Psychology*, *40*(6), 1123-1132. https://doi.org/10.1037/0012-1649.40.6.1123

Crockenberg, S. C., & Leerkes, E. M. (2006). Infant and maternal behavior moderate reactivity to novelty to predict anxious behavior at 2.5 years. *Development and Psychopathology*, **18**(1), 17–34.

Deans, C. L. (2020) Maternal sensitivity, its relationship with child outcomes, and interventions that address it: A systematic literature review. *Early Child Development and Care, 190*(2), 252-275, https://doi.org/10.1080/03004430.2018.1465415

Degnan, K. A., Calkins, S. D., Keane, S. P., & Hill-Soderlund, A. L. (2008). Profiles of disruptive behavior across early childhood: Contributions of frustration reactivity, physiological regulation, and maternal behavior. *Child Development*, *79*(5), 1357-1376. https:;//doi.org/10.1111/j.1467-8624.2008.01193.x

Di Maggio, R., Zappulla, C., & Pace, U. (2016). The relationship between emotion knowledge, emotion regulation and adjustment in preschoolers: A mediation model. *Journal of Child and Family Studies*, *25*, 2626-2635. https://doi.org/10.1007/s10826-016-0409-6

Diallo, T. M., Morin, A. J., & Lu, H. (2017). The impact of total and partial inclusion or

exclusion of active and inactive time invariant covariates in growth mixture models. *Psychological Methods*, *22*(1), 166-190. https://doi.org/10.1037/met0000084

Diener, M. L., Mangelsdorf, S. C., McHale, J. L., & Frosch, C. A. (2002). Infants' behavioral strategies for emotion regulation with fathers and mothers: Associations with emotional expressions and attachment quality. *Infancy*, *3*(2), 153-174. https://doi.org/10.1207/S15327078IN0302_3

Diperna, J. C., & Volpe, R. J. (2005). Self-report on the social skills rating system: Analysis of reliability and validity for an elementary sample. *Psychology in the Schools*, *42*(4), 345-354. https://doi.org/10.1002/pits.20095

Dollar, J. M., & Stifter, C. A. (2012). Temperamental surgency and emotion regulation as predictors of childhood social competence. *Journal of Experimental Child Psychology*, *112*(2), 178-194. https://doi.org/10.1016/j.jecp.2012.02.004

Du, J., Rolls, E. T., Gong, W., Cao, M., Vatansever, D., Zhang, J., Kang, J., Cheng, W., & Feng, J. (2022). Association between parental age, brain structure, and behavioral and cognitive problems in children. *Molecular Psychiatry*, *27*(2), 967-975. https://doi.org/10.1038/s41380-021-01325-5

Ebesutani, C., Bernstein, A., Nakamura, B. J., Chorpita, B. F., Higa-McMillan, C. K., Weisz, J. R., & Research Network on Youth Mental Health. (2010). Concurrent validity of the Child Behavior Checklist DSM-oriented scales: Correspondence with DSM diagnoses and comparison to syndrome scales. *Journal of Psychopathology and Behavioral Assessment*, *32*(3), 373-384. https://doi.org/10.1007/s10862-009-9174-9

Edwards, R. C., & Hans, S. L. (2015). Infant risk factors associated with internalizing, externalizing, and co-occurring behavior problems in young children. *Developmental*

Psychology, 51(4), 489-499. https://doi.org/10.1037/a0038800

Eisenberg, N., Fabes, R. A., Murphy, B., Maszk, P., Smith, M., & Karbon, M. (1995). The role of emotionality and regulation in children's social functioning: A longitudinal study. *Child development*, *66*(5), 1360-1384. https://doi.org/10.2307/1131652

Eisenberg, N., Valiente, C., Morris, A. S., Fabes, R. A., Cumberland, A., Reiser, M., Gershoff, E. T., Shepard, S. A., & Losoya, S. (2003). Longitudinal relations among parental emotional expressivity, children's regulation, and quality of socioemotional functioning. *Developmental Psychology, 39*(1), 3–19. https://doi.org/10.1037/0012-1649.39.1.3

Emde, R. N. (1980). Emotional availability: A reciprocal reward system for infants and parents with implications for prevention of psychosocial disorders. In P. M. Taylor (Ed.), *Parent–infant relationships* (pp. 87–115). Grune & Stratton.

English, T., & Eldesouky, L. (2020). We're not alone: Understanding the social consequences of intrinsic emotion regulation. *Emotion*, *20*(1), 43-47. https://doi.org/10.1037/emo0000661

Enns, L. N., Barrieau, L. E., Stack, D. M., Serbin, L. A., Ledingham, J. E., & Schwartzman, A. E. (2016). Verbal and nonverbal communication in at-risk mother-child dyads: Implications for relationship quality and developing positive social behaviours in middle-childhood. *European Journal of Developmental Psychology*, *13*(1), 1-19. https://doi.org/10.1080/17405629.2015.1049153

Esmailian N, Dehghani M., Fallah S. (2016). Evaluating the psychometric features of emotion regulation checklist (ERC) in children and adolescents. *Journal of Clinical Psychology Achievements, 2*(1). 15-34. https://doi.org/10.22055/jacp.2017.18725.1023

Farley, L., Oliver, B. R., & Pike, A. (2021). A multilevel approach to understanding the

determinants of maternal harsh parenting: the importance of maternal age and perceived partner support. *Journal of Child and Family Studies*, *30*(8), 1871-1880.

Feldman, R., Granat, A. D. I., 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 & Adolescent Psychiatry*, *48*(9), 919-927. https://doi.org/10.1097/CHI.0b013e3181b21651

Ferguson, S. L., G. Moore, E. W., & Hull, D. M. (2020). Finding latent groups in observed data: A primer on latent profile analysis in Mplus for applied researchers. *International Journal of Behavioral Development*, *44*(5), 458-468. https://doi.org/10.1177/0165025419881721

Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: A review. *Infant Behavior and Development*, *33*(1), 1-6. https://doi.org/10.1016/j.infbeh.2009.10.005

Field, T. M. (2002). Early interactions between infants and their postpartum depressed mothers. *Infant Behavior & Development, 25*(1), 25-29. https://doi.org/10.1016/S0163-6383(02)00089-9

Field, T., Diego, M., & Hernandez-Reif, M. (2006). Prenatal depression effects on the fetus and newborn: A review. *Infant Behavior and Development*, *29*(3), 445-455. https://doi.org/10.1016/j.infbeh.2006.03.003

Field, T., Hernandez-Reif, M., Diego, M., Feijo, L., Vera, Y., Gil, K., & Sanders, C. (2007). Still-face and separation effects on depressed mother-infant interactions. *Infant Mental Health Journal*, *28*(3), 314-323. https://doi.org/10.1002/imhj.20138

Field, T., Vega-Lahr, N., Scafidi, F., & Goldstein, S. (1986). Effects of maternal unavailability

on mother-infant interactions. *Infant Behavior and Development*, *9*(4), 473-478. https://doi.org/10.1016/0163-6383(86)90019-6

Fox, N. A., & Calkins, S. D. (2003). The development of self-control of emotion: Intrinsic and extrinsic influences. *Motivation and Emotion*, *27*(1), 7-26. https://doi.org/10.1023/A:1023622324898

Frick, M. A., Forslund, T., Fransson, M., Johansson, M., Bohlin, G., & Brocki, K. C. (2018). The role of sustained attention, maternal sensitivity, and infant temperament in the development of early self-regulation. *British Journal of Psychology*, *109*(2), 277-298. https://doi.org/10.1111/bjop.12266

Giallo, R., Cooklin, A., Wade, C., D'Esposito, F., & Nicholson, J. M. (2013). Maternal postnatal mental health and later emotional–behavioural development of children: The mediating role of parenting behaviour. *Childcare, Health and Development*, *40*(3), 327-336. https://doi.org/10.1111/cch.12028

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical Child and Family Psychology Review*, *14*(1), 1-27. https://doi.org/10.1007/s10567-010-0080-1

Gotlib, I. H., Goodman, S. H., & Humphreys, K. L. (2020). Studying the intergenerational transmission of risk for depression: Current status and future directions. *Current Directions in Psychological Science*, *29*(2), 174-179. https://doi.org/10.1177/0963721420901590

Graham, K. A., Blissett, J., Antoniou, E. E., Zeegers, M. P., & McCleery, J. P. (2018). Effects of maternal depression in the Still-Face Paradigm: A meta-analysis. *Infant Behavior and Development*, *50*, 154-164. https://doi.org/10.1016/j.infbeh.2017.12.001

Granat, A., Gadassi, R., Gilboa-Schechtman, E., & Feldman, R. (2017). Maternal depression and anxiety, social synchrony, and infant regulation of negative and positive emotions. *Emotion*, *17*(1), 11-27. https://doi.org/10.1037/emo0000204

Gresham, F. M., & Elliot, S. N. (1990). *Social skills rating system*. PsycTESTS.

Gross, J. J. (1998a). Antecedent-and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, *74*(1), 224-237. https://doi.org/10.1037//0022-3514.74.1.224

Gross, J. J. (1998b). The emerging field of emotion regulation: An integrative review. *Review of General Psychology*, *2*(3), 271-299. https://doi.org/10.1037/1089-2680.2.3.271

Halligan, S. L., Cooper, P. J., Fearon, P., Wheeler, S. L., Crosby, M., & Murray, L. (2013). The longitudinal development of emotion regulation capacities in children at risk for externalizing disorders. *Development and Psychopathology*, *25*(2), 391-406. https://doi.org/10.1017/S0954579412001137

Hentges, R. F., Graham, S. A., Fearon, P., Tough, S., & Madigan, S. (2020). The chronicity and timing of prenatal and antenatal maternal depression and anxiety on child outcomes at age 5. *Depression and Anxiety*, *37*(6), 576-586. https://doi.org/10.1002/da.23039

Hill, A. L., Degnan, K. A., Calkins, S. D., & Keane, S. P. (2006). Profiles of externalizing behavior problems for boys and girls across preschool: The roles of emotion regulation and inattention. *Developmental Psychology*, *42*(5), 913-928. https://doi.org/10.1037/0012-1649.42.5.913

Hollenstein, T., Lichtwarck-Aschoff, A., & Potworowski, G. (2013). A model of socioemotional flexibility at three time scales. *Emotion Review*, *5*(4), 397-405. https://doi.org/10.1177/1754073913484181

Hur, E., Buettner, C. K., & Jeon, L. (2015). Parental depressive symptoms and children's school-readiness: The indirect effect of household chaos. *Journal of Child and Family Studies*, *24*(11), 3462-3473. https://doi.org/10.1007/s10826-015-0147-1

Jean, A. D. L., & Stack, D. M. (2012). Full-term and very-low-birth-weight preterm infants' self-regulating behaviors during a Still-Face interaction: Influences of maternal touch. *Infant Behavior and Development*, *35*(4), 779–791. https://doi.org/10.1016/j.infbeh.2012.07.023

Johnson, P. O., & Neyman, J. (1936). Tests of certain linear hypotheses and their application to some educational problems. In J. Neyman & E. S. Pearson (Eds.), *Statistical Research Memoirs* (pp. 57-93). University College Press.

Joormann, J., Talbot, L., & Gotlib, I. H. (2007). Biased processing of emotional information in girls at risk for depression. *Journal of Abnormal Psychology*, *116*(1), 135-143. https://doi.org/10.1037/0021-843X.116.1.135

Kersten-Alvarez, L. E., Hosman, C. M., Riksen-Walraven, J. M., Van Doesum, K. T., & Hoefnagels, C. (2011). Which preventive interventions effectively enhance depressed mothers' sensitivity? A meta-analysis. *Infant Mental Health Journal*, *32*(3), 362-376. https://doi.org/10.1002/imhj.20301

Khoury, J. E., Gonzalez, A., Levitan, R., Masellis, M., Basile, V., & Atkinson, L. (2016). Infant emotion regulation strategy moderates relations between self-reported maternal depressive symptoms and infant HPA activity. *Infant and Child Development, 25*(1), 64–83. https://doi.org/10.1002/icd.1916

Kiel, E. J., & Kalomiris, A. E. (2015). Current themes in understanding children's emotion regulation as developing from within the parent-child relationship. *Current Opinion in Psychology*, *3*, 11–16. https://doi.org/10.1016/j.copsyc.2015.01.006

Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology Review*, *14*(3), 251-301. https://doi.org/10.1007/s10567-011-0093-4

Kim, B. R., Stifter, C. A., Philbrook, L. E., & Teti, D. M. (2014). Infant emotion regulation: Relations to bedtime emotional availability, attachment security, and temperament. *Infant Behavior and Development*, *37*(4), 480-490. https://doi.org/10.1016/j.infbeh.2014.06.006

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental psychology*, *18*(2), 199-214. https://doi.org/10.1037/0012-1649.18.2.199

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology*, *25*(3), 343-354. https://doi.org/10.1037/0012-1649.25.3.343

Korja, R., & McMahon, C. (2021). Maternal prenatal mood problems and lower maternal emotional availability associated with lower quality of child's emotional availability and higher negative affect during still-face procedure. *Infancy*, *26*(6), 901-919. https://doi.org/10.1111/infa.12428

Kujawa, A., Proudfit, G. H., & Klein, D. N. (2014). Neural reactivity to rewards and losses in offspring of mothers and fathers with histories of depressive and anxiety disorders. *Journal of Abnormal Psychology*, *123*(2), 287-297. https://doi.org/10.1037/a0036285

Lam, C. B., Chung, K. K. H., & Li, X. (2018). Parental warmth and hostility and child executive function problems: A longitudinal study of Chinese families. *Frontiers in Psychology*, *9*, Article 1063. https;//doi.org/10.3389/fpsyg.2018.01063

Leerkes, E. M., Blankson, A. N., & O'Brien, M. (2009). Differential effects of maternal

sensitivity to infant distress and nondistress on social-emotional functioning. *Child Development*, *80*(3), 762-775. https://doi.org/10.1111/j.1467-8624.2009.01296.x

Linehan, M. M. (1993). *Cognitive behavioural therapy of borderline personality disorder*. Guilford Press.

Little, C., & Carter, A. S. (2005). Negative emotional reactivity and regulation in 12-month-olds following emotional challenge: Contributions of maternal–infant emotional availability in a low-income sample. *Infant Mental Health Journal*, *26*(4), 354-368. https://doi.org/10.1002/imhj.20055

Lovejoy, M. C., Graczyk, P. A., O'Hare, E., & Neuman, G. (2000). Maternal depression and parenting behavior: A meta-analytic review. *Clinical Psychology Review*, *20*(5), 561-592. https://doi.org/10.1016/s0272-7358(98)00100-7

Lyons-Ruth, K. (1996). Attachment relationships among children with aggressive behavior problems: the role of disorganized early attachment patterns. *Journal of Consulting and Clinical Psychology*, *64*(1), 64-73. https://doi.org/10.1037//0022-006x.64.1.64

Manian, N., & Bornstein, M. H. (2009). Dynamics of emotion regulation in infants of clinically depressed and nondepressed mothers. *Journal of Child Psychology and Psychiatry*, *50*(11), 1410–1418. https://doi.org/10.1111/j.1469-7610.2009.02166.x

Marakovitz, S. E., Wagmiller, R. L., Mian, N. D., Briggs-Gowan, M. J., & Carter, A. S. (2011). Lost toy? Monsters under the bed? Contributions of temperament and family factors to early internalizing problems in boys and girls. *Journal of Clinical Child & Adolescent Psychology*, *40*(2), 233-244. https://doi.org/10.1080/15374416.2011.546036

Maughan, B., Pickles, A., & Quinton, D. (1995). Parental hostility, childhood behavior, and adult social functioning. In J. McCord (Ed.), *Coercion and punishment in long-term perspectives*

(pp. 34-58). Cambridge University Press. https://doi.org/10.1017/CBO9780511527906.003

McGrath, J. M., Records, K., & Rice, M. (2008). Maternal depression and infant temperament characteristics. *Infant behavior and development*, *31*(1), 71-80. https://doi.org/10.1016/j.infbeh.2007.07.001

Mesman, J., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). The many faces of the Still-Face Paradigm: A review and meta-analysis. *Developmental review*, *29*(2), 120-162. https://doi.org/10.1016/j.dr.2009.02.001

Miller, A. L., McDonough, S. C., Rosenblum, K. L., & Sameroff, A. J. (2002). Emotion regulation in context: Situational effects on infant and caregiver behavior. *Infancy*, *3*(4), 403-433. https://doi.org/10.1207/S15327078IN0304_01

Millman, T. P., Jean, A., & Stack, D. M. (2007). *Infant Self-Regulation Scheme (ISRS)*. *[Unpublished undergraduate thesis].* Concordia University.

Moreno-Giménez, A., Campos-Berga, L., Nowak, A., Sahuquillo-Leal, R., D'Ocon, A., Hervás, D., Navalón, P., Vento, M., & García-Blanco, A. (2022). Impact of maternal age on infants' emotional regulation and psychomotor development. *Psychological Medicine*, *52*(15), 3708-3719. https://doi.org/10.1017/S0033291721000568

Morgan, G. B. (2015). Mixed mode latent class analysis: An examination of fit index performance for classification. *Structural Equation Modeling, 22*(1), 76–86. https://doi.org/10.1080/10705511.2014.935751

Morris, A. S., Silk, J. S., Morris, M. D., Steinberg, L., Aucoin, K. J., & Keyes, A. W. (2011). The influence of mother–child emotion regulation strategies on children's expression of anger and sadness. *Developmental psychology*, *47*(1), 213-225. https://doi.org/10.1037/a0021021

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social development*, *16*(2), 361-388. https://doi.org/10.1111/j.1467-9507.2007.00389.x

Morris, A. S., Silk, J. S., Steinberg, L., Sessa, F. M., Avenevoli, S., & Essex, M. J. (2002). Temperamental vulnerability and negative parenting as interacting predictors of child adjustment. *Journal of Marriage and Family*, *64*(2), 461-471. https://doi.org/10.1111/j.1741-3737.2002.00461.x

Moszkowski, R. J., Stack, D. M., & Chiarella, S. S. (2009). Infant touch with gaze and affective behaviors during mother–infant still-face interactions: Co-occurrence and functions of touch. *Infant Behavior and Development*, *32*(4), 392-403. https://doi/org/10.1016/j.infbeh.2009.06.006

Myruski, S., Dennis-Tiwary, T. (2021). Biological signatures of emotion regulation flexibility in children: Parenting context and links with child adjustment. *Cognitive, Affective, & Behavioral Neuroscience, 21*, 805–821. https://doi.org/10.3758/s13415-021-00888-8

National Research Council and Institute of Medicine. (2000). From neurons to neighborhoods: The science of early childhood development. In J. P. Shonkoff, & D. A. Phillips (Eds.), *Board on children, youth, and families, commission on behavioral and social sciences and education*. National Academy Press. https://doi.org/10.17226/9824

Newland, R. P., Parade, S. H., Dickstein, S., & Seifer, R. (2016). The association between maternal depression and sensitivity: Child-directed effects on parenting during infancy. *Infant Behavior and Development*, *45*(Pt A), 47-50. https://doi.org/10.1016/j.infbeh.2016.09.001

Nock, S. L., & Rossi, P. H. (1979). Household types and social standing. *Social Forces*, *57*(4),

1325-1345. https://doi.org/10.2307/2577273

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural equation modeling: A multidisciplinary Journal*, *14*(4), 535-569. https://doi.org/10.1080/10705510701575396

Oddi, K. B., Murdock, K. W., Vadnais, S., Bridgett, D. J., & Gartstein, M. A. (2013). Maternal and infant temperament characteristics as contributors to parenting stress in the first year postpartum. *Infant and Child Development*, *22*(6), 553-579. https://doi.org/10.1002/icd.1813

O'Hara, M. W., & McCabe, J. E. (2013). Postpartum depression: Current status and future directions. *Annual Review of Clinical Psychology*, *9*, 379-407. https://doi.org/10.1146/annurev-clinpsy-050212-185612

Oldehinkel, A. J., Hartman, C. A., De Winter, A. F., Veenstra, R., & Ormel, J. (2004). Temperament profiles associated with internalizing and externalizing problems in preadolescence. *Development and Psychopathology*, *16*(2), 421-440. https://doi.org/10.1017/s0954579404044591

Ostlund, B. D., Measelle, J. R., Laurent, H. K., Conradt, E., & Ablow, J. C. (2017). Shaping emotion regulation: Attunement, symptomatology, and stress recovery within mother-infant dyads. *Developmental Psychobiology, 59*(1), 15–25. https://doi.org/10.1002/dev.21448

Parker, J. G., & Asher, S. R. (1987). Peer relations and later personal adjustment: Are low-accepted children at risk? *Psychological Bulletin, 102*(3), 357–389. https://doi.org/10.1037/0033-2909.102.3.357

Penela, E. C., Walker, O. L., Degnan, K. A., Fox, N. A., & Henderson, H. A. (2015). Early behavioral inhibition and emotion regulation: Pathways toward social competence in middle childhood. *Child Development*, *86*(4), 1227-1240. https://doi.org/10.1111/cdev.12384

Pereira, J., Vickers, K., Atkinson, L., Gonzalez, A., Wekerle, C., & Levitan, R. (2012). Parenting stress mediates between maternal maltreatment history and maternal sensitivity in a community sample. *Child abuse & neglect*, *36*(5), 433-437.

Peugh, J., & Fan, X. (2013). Modeling unobserved heterogeneity using latent profile analysis: A Monte Carlo simulation. *Structural Equation Modeling, 20*(4), 616–639. https://doi.org/10.1080/10705511.2013.824780

Pipp-Siegel, S., & Biringen, Z. (1998). Assessing the quality of relationships between parents and children: The emotional availability scales. *The Volta Review*, *100*(5), 237-249.

Porges, S. W., & Furman, S. A. (2011). The early development of the autonomic nervous system provides a neural platform for social behaviour: A polyvagal perspective. *Infant and child development*, *20*(1), 106-118.

Priel, A., Djalovski, A., Zagoory-Sharon, O., & Feldman, R. (2019). Maternal depression impacts child psychopathology across the first decade of life: Oxytocin and synchrony as markers of resilience. *Journal of Child Psychology and Psychiatry*, *60*(1), 30-42. https://doi.org/10.1111/jcpp.12880

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385-401. https://doi.org/10.1177/014662167700100306

Rawana, J. S., Flett, G. L., McPhie, M. L., Nguyen, H. T., & Norwood, S. J. (2014).

Developmental trends in emotion regulation: A systematic review with implications for community mental health. *Canadian Journal of Community Mental Health*, *33*(1), 31-44. https://doi/org/10.7870/cjcmh-2014-004

Rice, F., Sellers, R., Hammerton, G., Eyre, O., Bevan-Jones, R., Thapar, A. K., Collishaw, S., Harold, G. T., & Thapar, A. (2017). Antecedents of new-onset major depressive disorder in children and adolescents at high familial risk. *JAMA psychiatry, 74*(2), 153–160. https://doi.org/10.1001/jamapsychiatry.2016.3140

Roberts, R. E. (1980). Reliability of the CES-D scale in different ethnic contexts. *Psychiatry Research*, *2*(2), 125-134. https://doi/org/10.1016/0165-1781(80)90069-4

Rose, J., Roman, N., Mwaba, K., & Ismail, K. (2018). The relationship between parenting and internalizing behaviours of children: A systematic review. *Early Child Development and Care*, *188*(10), 1468-1486. https://doi.org/10.1080/03004430.2016.1269762

Rothbart, M. K., & Bates, J. E. (1998). Temperament. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology: Social, emotional and personality development* (pp. 105-176). John Wiley & Sons.

Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2013). Attentional control and self-regulation. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 284-299). Guilford Press.

Sala, M. N., Pons, F., & Molina, P. (2014). Emotion regulation strategies in preschool children. *British Journal of Developmental Psychology, 32*(4), 440 – 453. http://doi.org/10.1111/bjdp.12055

Santucci, A. K., Silk, J. S., Shaw, D. S., Gentzler, A., Fox, N. A., & Kovacs, M. (2008). Vagal tone and temperament as predictors of emotion regulation strategies in young

children. *Developmental Psychobiology*, *50*(3), 205-216. https://doi.org/10.1002/dev.20283

Sarıtaş, D., Grusec, J. E., & Gençöz, T. (2013). Warm and harsh parenting as mediators of the relation between maternal and adolescent emotion regulation. *Journal of Adolescence*, *36*(6), 1093-1101. https:doi.org/10.1016/j.adolescence.2013.08.015

Schore, A. N. (2015). *Affect regulation and the origin of the self: The neurobiology of emotional development*. Routledge.

Schwartzman, A. E., Ledingham, J. E., & Serbin, L. A. (1985). Identification of children at risk for adult schizophrenia: A longitudinal study. *Applied Psychology, 34*(3), 363-379. https://doi.org/10.1111/j.1464-0597.1985.tb01333.x

Sellers, R., Harold, G. T., Elam, K., Rhoades, K. A., Potter, R., Mars, B., Craddock, N., Thapar, A., & Collishaw, S. (2014). Maternal depression and co-occurring antisocial behaviour: Testing maternal hostility and warmth as mediators of risk for offspring psychopathology. *Journal of Child Psychology and Psychiatry*, *55*(2), 112-120. https://doi.org/10.1111/jcpp.12111

Serbin, L. A., Cooperman, J. M., Peters, P. L., Lehoux, P. M., Stack, D. M., & Schwartzman, A. E. (1998). Intergenerational transfer of psychosocial risk in women with childhood histories of aggression, withdrawal, or aggression and withdrawal. *Developmental Psychology*, *34*(6), 1246-1262. https://doi.org/ 10.1037//0012-1649.34.6.1246

Shafietabar, M., Akbari Chermahini, S., & Molaei Yasavoli, M. (2020). Factorial structure and psychometric properties of the emotion regulation checklist–parent form. *Journal of Child Mental Health*, *7*(3), 80-95. https://doi.org/10.52547/jcmh.7.3.8

Shaw, Z.A., Starr, L.R. (2019). Intergenerational transmission of emotion dysregulation: The role of authoritarian parenting style and family chronic stress. *Journal of Child & Family*

Studies, 28(12), 3508–3518. https://doi.org/10.1007/s10826-019-01534-1

Sheppes, G., & Gross, J. J. (2012). Emotion regulation effectiveness: What works when. In H. Tennen, J. Suls, & I. B. Weiner (Eds.), *Handbook of psychology: Personality and social psychology* (pp. 391–405). John Wiley & Sons.

Shields, A., & Cicchetti, D. (1997). Emotion regulation among school-age children: the development and validation of a new criterion Q-sort scale. *Developmental Psychology*, *33*(6), 906-916. https://doi.org/10.1037/0012-1649.33.6.906

Skotheim, S., Braarud, H. C., Høie, K., Markhus, M. W., Malde, M. K., Graff, I. E., Berle, J. Ø., & Stormark, K. M. (2013). Subclinical levels of maternal depression and infant sensitivity to social contingency. *Infant Behavior and Development*, *36*(3), 419-426. https://doi.org/10.1016/j.infbeh.2013.03.009

Stack, D. M., Serbin, L. A., Girouard, N., Enns, L. N., Bentley, V. M., Ledingham, J. E., & Schwartzman, A. E. (2012). The quality of the mother–child relationship in high-risk dyads: Application of the Emotional Availability Scales in an intergenerational, longitudinal study. *Development and Psychopathology*, *24*(1), 93-105. https://doi.org/10.1017/S095457941100068X

Stack, D. M., Serbin, L. A., Matte-Gagné, C., Kingdon, D., Doiron, K., & Schwartzman, A. E. (2017). Development under adverse circumstances as a risk for psychopathology: An intergenerational study of children from disadvantaged high-risk backgrounds. In L. C. Centifanti & D. M. Williams (Eds), *Handbook of developmental psychopathology* (pp. 345–363). Wiley Blackwell. https://doi.org/10.1002/9781118554470.ch17

Stanley, C., Murray, L., & Stein, A. (2004). The effect of postnatal depression on mother–infant interaction, infant response to the still-face perturbation, and performance on an

instrumental learning task. *Development and psychopathology*, *16*(1), 1-18. https://doi.org/10.1017/s0954579404044384

Stifter, C., Augustine, M. (2019). Emotion Regulation. In V. LoBue, K. Pérez-Edgar, K.A. Buss (Eds) *Handbook of emotional development* (pp. 405-430). Springer nature Switzerland AG. https://doi.org/10.1007/978-3-030-17332-6_16

Stover, C. S., Zhou, Y., Kiselica, A., Leve, L. D., Neiderhiser, J. M., Shaw, D. S., Natsuaki, M. N., Scaramella, L. V., & Reiss, D. (2016). Marital hostility, hostile parenting, and child aggression: Associations from toddlerhood to school age. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*(3), 235–242. https://doi.org/10.1016/j.jaac.2015.12.008

Sturge-Apple, M. L., Davies, P. T., & Cummings, E. M. (2006). Impact of hostility and withdrawal in interparental conflict on parental emotional unavailability and children's adjustment difficulties. *Child Development*, *77*(6), 1623-1641. https://doi.org/10.1111/j.1467-8624.2006.00963.x

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson Education Inc.

Tester-Jones, M., O'Mahen, H., Watkins, E., & Karl, A. (2015). The impact of maternal characteristics, infant temperament and contextual factors on maternal responsiveness to infant. *Infant Behavior and Development*, *40*, 1-11. https://doi.org/10.1016/j.infbeh.2015.02.014

Thomas, J. C., Letourneau, N., Campbell, T. S., Tomfohr-Madsen, L., & Giesbrecht, G. F. (2017). Developmental origins of infant emotion regulation: Mediation by temperamental negativity and moderation by maternal sensitivity. *Developmental Psychology*, *53*(4), 611-

628. https://doi.org/10.1037/dev0000279

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development*, *59*(2-3), 25-52. https://doi.org/10.2307/1166137

Thompson, R. A., & Goodman, M. (2010). Development of emotion regulation: More than meets the eye. In A. M. Kring & D. M. Sloan (Eds.), *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment* (pp. 38–58). The Guilford Press.

Tronick, E., Als, H., Adamson, L., Wise, S., & Brazelton, T. B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child Psychiatry*, *17*(1), 1–13. https://doi.org/10.1016/S0002-7138(09)62273-1

Tronick, E., & Beeghly, M. (2011). Infants' meaning-making and the development of mental health problems. *American Psychologist*, *66*(2), 107-119. https://doi.org/10.1037/a0021631

Tronick, E., & Gianino, A. F. (1986). The transmission of maternal disturbance to the infant. *New Directions for Child Development*. *34,* 5-11. https://doi.org/10.1002/cd.23219863403

Tronick, E., & Weinberg, M. K. (1996). *The Infant Regulatory Scoring System (IRSS)*. [Unpublished document]. Children's Hospital/Harvard Medical School, Boston.

Turney, K. (2011). Labored love: Examining the link between maternal depression and parenting behaviors. *Social Science Research*, *40*(1), 399-415. https://doi.org/10.1016/j.ssresearch.2010.09.009

Van den Boom, D. C. (1994). The influence of temperament and mothering on attachment and exploration: An experimental manipulation of sensitive responsiveness among lower-class

mothers with irritable infants. *Child development*, *65*(5), 1457-1477. https://doi.org/10.2307/1131511

Van Der Waerden, J., Galéra, C., Larroque, B., Saurel-Cubizolles, M. J., Sutter-Dallay, A. L., Melchior, M., & EDEN Mother–Child Cohort Study Group. (2015). Maternal depression trajectories and children's behavior at age 5 years. *The Journal of Pediatrics*, *166*(6), 1440-1448. https://doi.org/10.1016/j.jpeds.2015.03.002

Wang, M. C., Deng, Q., Bi, X., Ye, H., & Yang, W. (2017). Performance of the entropy as an index of classification accuracy in latent profile analysis: A monte Carlo simulation study. *Acta Psychologica Sinica*, *49*(11), 1473-1482. https://doi.org/10.3724/SP.J.1041.2017.01473

Weinberg, M. K., Beeghly, M., Olson, K. L., & Tronick, E. (2008). Effects of maternal depression and panic disorder on mother–infant interactive behavior in the Face-to-Face Still-Face paradigm. *Infant Mental Health Journal*, *29*(5), 472-491. https://doi.org/10.1002/imhj.20193

Weissman, D. G., Bitran, D., Miller, A. B., Schaefer, J. D., Sheridan, M. A., & McLaughlin, K. A. (2019). Difficulties with emotion regulation as a transdiagnostic mechanism linking child maltreatment with the emergence of psychopathology. *Development and Psychopathology*, *31*(3), 899-915. https://doi.org/10.1017/S0954579419000348

Wolf, M. J., Koldewijn, K., Beelen, A., Smit, B., Hedlund, R., & De Groot, I. J. M. (2002). Neurobehavioral and developmental profile of very low birthweight preterm infants in early infancy. *Acta Paediatrica*, *91*(8), 930-938. https://doi.org/10.1080/080352502760148667

Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., & Harris, M. G. (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

Yang, L., Jia, C. X., & Qin, P. (2015). Reliability and validity of the Center for Epidemiologic Studies Depression Scale (CES-D) among suicide attempters and comparison residents in rural China. *BMC Psychiatry*, *15*, Article 76. https://doi.org/10.1186/s12888-015-0458-1

Appendix A: Consent Form for Study 1

Informed Consent
Preventing Depression in Infants

We are doing a study on how being depressed may affect your baby, the ways to reduce depression in mothers, and how to prevent it in infants. During your pregnancy, after your baby is born and during your baby's first two years of life, we will interview you and test your baby. The tests are strictly for our study and will be confidential.

During Pregnancy

If you agree to be in the study, between your 3rd and 9th month of pregnancy you will be asked to complete questions on alcohol and smoking and your general health during pregnancy. In addition, we will ask you some questions regarding your feelings of depression, anxiety, stress, anger, daily hassles and your attitudes and knowledge about being pregnant and raising children. These will take between 1-2 hours to complete. We will ask for a urine sample to look at different hormones. You will be asked if we can observe two of your ultrasounds and/or if you are interested in having your significant other or family member learn a pregnancy massage and provide twice weekly 20-minute massages during pregnancy. The massage may be a moderate or light pressure or you may be in a group that receives no massage. If you are in a massage group, and if you prefer, massage therapists can conduct your massages at the U.M. Touch Research Institutes. Ultrasound sessions will take place in the prenatal clinic during your second and third trimesters of pregnancy and will last approximately 25-50 minutes. In order to record how your baby moves inside you. Head, foot or hand massage at the ultrasound clinic will last 3 to 5 minutes and we will watch your baby for 4 minutes during the ultrasound to see how he/she moves.

After you give birth

Shortly after birth, a psychologist will test your baby's alertness, behaviour and physical activity and we will ask you how you feel. We will also videotape your baby and record the baby's heart rate. Heart rate will be recorded at the same time we collect brain wave information through electrodes (little round stickers) placed on your baby's chest. We will take recordings of you and your baby's brain waves to see if they are affected by your moods. For the brain wave test we will place a few sensors on your baby's head and a cap on your head. We will also place 3 sensors on your chest area, arm, or neck to record heart rate. This will not cause any discomfort. There are no risks to these procedures. These recording only take a few minutes. We will also record you and your baby during a feeding, ask you questions about breast feeding and we will ask for a sample of you and your baby's urine. This visit will take approximately 2-2½ hours. We may also show you how to massage your baby and ask you to do a bedtime massage every night.

During the first 6 months

Once a month, for the first 6-months of your baby's life, we will ask you to come back to our video lab where we will videotape you while you and your baby play together for about 5 minutes. One video camera will be focused on your baby's face and record your baby's expressions and another will be focused on your face and record your expressions. We will also videotape your baby's responses to a Raggedy Ann doll's face (at the 4-month visit), to another baby's face and your baby's own face in a mirror (at 5 months), and to an object (e.g., a star versus a round-shaped object at 6 months). We will erase the videotapes after we finish analyzing them. We will ask for another urine sample from you and your baby at one of these visits and ask you some questions about stress. When your baby is 6 months we will give him/her a developmental test and a physical examination.

We will pay $20.00 for each visit. If we find any medical problems we will refer you to a doctor, your records and results will be given a number instead of your name and will be kept confidential to the extent permitted by law. If you decide to take part in the study with your baby, we will ask you for permission to review your medical records at delivery and your baby's medical records at birth. The results of this study will be reported as group results to protect your identity. Your records may also be bound by the same provisions of confidentiality. The Department of Health and Human Services (DHHS) may review these research records.

Your participation is voluntary and if you do not want to be in the study, you can leave at any time and it will not hurt your treatment. Feel free to ask questions at any time. For questions regarding this study contact Dr. Tiffany Field at 305-243-6781. You will receive a copy of this consent form for your records. If you have any questions about your rights as a research subject you may contact Maria Arnold, IRB Director, University of Miami at 305-243-3195.

_____ _____

Signature of Mother Date

Appendix B: Consent Form for Study 2, 6 months, full-term and VLBW/PT groups

Consent Form
Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social exchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes. In the first part, my baby will be seated in an infant seat directly facing me. The procedure will consist of several interaction periods, each lasting two to three minutes in length, during which time I will be asked to interact in different ways with my baby. During some periods I will be asked to interact with my baby as I normally do, while in others I will be asked to pose a neutral, still facial expression and remain silent for a brief period. There will be brief breaks separating the interaction periods. In the second part, my baby and I will play together on a carpeted floor for approximately 8 minutes in a designated area, during which time I will be asked to play with my baby as I normally would at home. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be asked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest confidence and are not shown to others without my permission. I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential. I am also aware that I may be asked to participate again when my baby is 12 and 18 months of age.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-2424, ext. 7565), Dr. Lisa Serbin (848-2424, ext. 2255) or Dr. Alex Schwartzman (848-2424, ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Mrs. Laurie Berlin (340-8222, ext. 5833). She can be contacted should I have any questions regarding my rights as a research volunteer.

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby _____ to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of child: _____ Date:_____
Parent's signature: _____ Date:_____
Witness: _____ Date:_____

Appendix C: Consent Form for Study 2, 6 months, psychosocially at-risk group

"L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants"

Directeurs du projet:
- Dale M. Stack, Ph.D.
- Lisa A. Serbin. Ph.D.
- Alex E. Schwartzman, Ph.D.

FORMULAIRE DE CONSENTEMENT

Cette étude a pour but d'examiner le développement social des enfants et comment les parents et leurs jeunes enfants jouent ensemble. Je comprends que mon enfant participera à une séance d'observation de 60 minutes divisée en deux parties: Une première partie où mon enfant sera assis(e) dans un siège d'enfant me faisant face. Cette partie sera composée de plusieurs périodes de deux à trois minutes chacune. Durant certaine de ces périodes, je devrai demeurer silencieuse et conserver une expression faciale assez neutre lors de mes interactions avec mon enfant. La seconde partie sera une période de jeu libre où mon enfant et moi jouerons ensemble pour une période de huit minutes environ. A la fin de la séance d'observation, une rémunération totale de $15.00 me sera allouée. Chaque période d'observation sera séparée par une courte pause et les manipulations expérimentales ne sont aucunement dangereuses pour mon enfant. La séance entière sera filmée sur vidéo afin de permettre la cotation des réactions de mon enfant ultérieurement.

Je comprends que ma participation à cette étude est volontaire et que je peux y soustraire mon enfant en tout temps et cela, sans avoir à donner d'autres explications. Je comprends aussi que j'ai le droit d'exiger que le ruban magnétoscopique soit détruit. Je permets que les résultats obtenus soient publiés, sachant que mon nom et celui de mon enfant seront gardés confidentiels. Je comprends aussi que toutes les informations que nous fournissons, qu'elles soient écrites ou filmées, sont strictement confidentielles et qu'elles ne serviront qu'à des fins de recherche. Dans toutes les circonstances, je suis assuré(e) que l'anonymat sera conservé.

Comme le projet "L'individu dans son milieu" est à long terme, je comprends que je pourrais être appelé(e) dans l'avenir pour participer à d'autres étapes de ce projet. Je me réserve le droit de décider, à ce moment, de donner suite ou non à la demande de participation.

Je m'engage volontairement avec mon enfant, _____, à participer à cette étude. Dans l'éventualité où j'aurais des questions ou une plainte à formuler concernant cette étude, je pourrai m'adresser aux directeurs du projet: Dr. Dale Stack (848-7565), Dr. Lisa Serbin (848-2255) ou Dr. Alex Schwartzman (848-2251) du département de psychologie de l'Université Concordia.

Merci de votre coopération.

Signature:_____ Date:_____

Témoin: _____ Date:_____

Appendix D: Consent Form for Study 2, 12 and 18 months, full-term and VLBW/PT groups

Consent Form
Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social exchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes, divided into two main parts. The first part will consist of a period of free play in which my child and I will play together for approximately 15 minutes. The second part will also be a play period, but it will include a series of different activities lasting approximately three minutes for each activity. These observation periods will be separated by short pauses. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be asked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest of confidence and are not shown to others outside without my permission.

I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-2424, ext.7565), Dr. Lisa Serbin (848-2424, ext.2255) or Dr. Alex Schwartzman (848-2424 ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Lianne Brown (340-8222, ext. 5833). She can be contacted should I have any questions regarding my rights as a research volunteer.

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of child: _____ Date:

Parent's signature: _____ Date:

Witness: _____ Date:

(October 25, 1999)

Appendix E: Consent Form for Study 2, 12 and 18 months, psychosocially at-risk group

"L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants"
Directeurs du projet: - Dale M. Stack, Ph.D.
- Lisa A. Serbin. Ph.D.
- Alex E. Schwartzman, Ph.D.

FORMULAIRE DE CONSENTEMENT

Cette étude a pour but d'examiner le développement social des enfants et comment les parents et leurs jeunes enfants jouent ensemble. Je comprends que mon enfant participera à une séance d'observation de 60 minutes divisée en deux parties: Une première partie sera une période de jeu libre où mon enfant et moi jouerons ensemble pour une période de 15 minutes environ. La seconde partie sera également une période jeu, mais sera composée de différentes activités d'environ 3 minutes chacune. A la fin de la séance d'observation, une rémunération totale de $15.00 me sera allouée. Chaque période d'observation sera séparée par une courte pause et les manipulations expérimentales ne sont aucunement dangereuses pour mon enfant. La séance entière sera filmée sur vidéo afin de permettre la cotation des réactions de mon enfant ultérieurement.

Je comprends que ma participation à cette étude est volontaire et que je peux y soustraire mon enfant en tout temps et cela, sans avoir à donner d'autres explications. Je comprends aussi que j'ai le droit d'exiger que le ruban magnétoscopique soit détruit. Je permets que les résultats obtenus soient publiés, sachant que mon nom et celui de mon enfant seront gardés confidentiels. Je comprends aussi que toutes les informations que nous fournissons, qu'elles soient écrites ou filmées, sont strictement confidentielles et qu'elles ne serviront qu'à des fins de recherche. Dans toutes les circonstances, je suis assuré(e) que l'anonymat sera conservé.

Comme le projet "L'individu dans son milieu" est à long terme, je comprends que je pourrais être appelé(e) dans l'avenir pour participer à d'autres étapes de ce projet. Je me réserve le droit de décider, à ce moment, de donner suite ou non à la demande de participation.

Je m'engage volontairement avec mon enfant, _____, à participer à cette étude. Dans l'éventualité où j'aurais des questions ou une plainte à formuler concernant cette étude, je pourrai m'adresser aux directeurs du projet: Dr. Dale Stack (848-7565), Dr. Lisa Serbin (848-2255) ou Dr. Alex Schwartzman (848-2251) du département de psychologie de l'Université Concordia.

Merci de votre coopération.

Signature:_____ Date:_____

Témoin: _____ Date:_____

Appendix F: Consent Form for Study 2, 4.5 years, full-term and VLBW/PT groups

Consent Form
Mother-Infant Interactions

This study is designed to look at infants' responses during social interaction and to study the different types of interaction used by caregivers and their role in social exchange.

I understand that my baby and I will participate in a study lasting approximately 60 minutes, divided into two main parts. The first part will consist of a period of free play in which my child and I will play together for approximately 15 minutes. The second part will also be a play period, but it will include a series of different activities lasting approximately three minutes for each activity. These observation periods will be separated by short pauses. Under no circumstances will any manipulation be harmful to my baby. Finally, I will be asked to complete several brief questionnaires.

The entire session will be videotaped so that at a later point my baby's responses may be scored. However, these recordings are kept in the strictest of confidence and are not shown to others outside without my permission.

I understand that my participation in this study is totally voluntary. I know that I may withdraw at any time and for any reason. I also understand that I may request that the videotape recording of my baby be erased. In the event that the results of the study are published, my name and the name of my baby will be kept confidential.

In the event that I have any unanswered concerns or complaints about this study, I may express these to Dr. Dale Stack (848-2424, ext.7565), Dr. Lisa Serbin (848-2424, ext.2255) or Dr. Alex Schwartzman (848-2424 ext. 2251) of the Psychology Department at Concordia University. In addition, the patient representative of the Jewish General Hospital is Lianne Brown (340-8222, ext. 5833). She can be contacted should I have any questions regarding my rights as a research volunteer.

Thank you for your cooperation.

I, _____, do hereby give my consent for my baby to participate in a study conducted by Dr. Dale Stack at Concordia University, and with the cooperation of the Jewish General Hospital. A copy of this consent form has been given to me.

Parent's signature on behalf of child: _____Date:
Parent's signature: _____Date:
Witness: _____Date:

Appendix G: Consent Form for Study 2, 4.5 years, psychosocially at-risk group

"L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants"

Directeurs du projet: - Dale M. Stack, Ph.D., Lisa A. Serbin. Ph.D. et Alex E. Schwartzman, Ph.D.

FORMULAIRE DE CONSENTEMENT

Cette étude se propose d'analyser les interactions parent-enfant, ainsi que les différents modes d'interactions utilisés et les différentes trajectoires qu'emprunte le développement de l'enfant. En bout de ligne, nous nous attendons à ce que les informations recueillies par cette étude et celles qui vont suivre permettront la mise sur pied de programmes d'intervention préventive.

Je comprends que mon enfant et moi participeront à une session, d'une durée d'environ 2-3 heures, séparée en diverses parties. La première est une période de jeu libre pour mon enfant et moi d'une durée d'environ 15 minutes. La deuxième partie, elle, est aussi une période de jeu, mais avec casse-tête, qui dure environ 10 minutes. Ces deux périodes de jeu seront séparées par une pause. La troisième partie consiste en une évaluation cognitive de mon enfant pendant que je remplirai une série de questionnaires. Les chercheurs sont prêts à faire une deuxième visite, au besoin, pour terminer l'évaluation ou pour parler des résultats. Le processus d'évaluation ne sera en aucun cas néfaste pour mon enfant. A la fin de la séance d'observation, une rémunération totale de $20.00 me sera allouée. Chaque période d'observation sera séparée par une courte pause et les manipulations expérimentales ne sont aucunement dangereuses pour mon enfant. La séance entière sera filmée sur vidéo afin de permettre la cotation des réactions de mon enfant ultérieurement.

Je comprends que ma participation à cette étude est volontaire et que je peux y soustraire mon enfant en tout temps et cela, sans avoir à donner d'autres explications. Je comprends aussi que j'ai le droit d'exiger que le ruban magnétoscopique soit détruit. Je permets que les résultats obtenus soient publiés, sachant que mon nom et celui de mon enfant seront gardés confidentiels. Je comprends aussi que toutes les informations que nous fournissons, qu'elles soient écrites ou filmées, sont strictement confidentielles et qu'elles ne serviront qu'à des fins de recherche. Dans toutes les circonstances, je suis assuré(e) que l'anonymat sera conservé. Cependant, en accord avec la loi sur la protection de la jeunesse, toute information laissant croire à de l'abus physique ou sexuel doit être rapportée à l'Office de la protection de la jeunesse.

Comme le projet "L'individu dans son milieu" est à long terme, je comprends que je pourrais être appelé(e) dans l'avenir pour participer à d'autres étapes de ce projet. Je me réserve le droit de décider, à ce moment, de donner suite ou non à la demande de participation.

Je m'engage volontairement avec mon enfant, _____, à participer à cette étude. Dans l'éventualité où j'aurais des questions ou une plainte à formuler concernant cette étude, je pourrai m'adresser aux directeurs du projet: Dr. Dale Stack (848-7565), Dr. Lisa Serbin (848-2255) ou Dr. Alex Schwartzman (848-2251) du département de psychologie de l'Université Concordia.

Merci de votre coopération.

Signature du parent : _____ date : _____

Témoin : _____ date : _____

Appendix H: Consent Form for Study 2, 9-12 years, psychosocially at-risk group

«L'INDIVIDU DANS SON MILIEU: Les parents et leurs enfants»

Directeurs du projet: -Lisa A. Serbin, Ph.D.
-Dale M. Stack, Ph.D.

Numéro d'identification:
Formulaire de consentement

Je, soussigné(e), autorise les chercheurs du projet «L'individu dans son milieu» de l'université Concordia à rencontrer mon enfant à l'école, en deux sessions, durant la période de classe. Je comprends que mon enfant remplira des tests de fonctionnement intellectuel et académique ainsi que des questionnaires sur son comportement et son tempérament. J'autorise également les chercheurs à recueillir des informations sur la vie scolaire de mon enfant de la part de son professeur et à avoir une copie du dernier bulletin de l'année en cours. Finalement, lors d'une troisième visite, je consens à rencontrer les chercheurs de l'université Concordia à la maison avec mon enfant afin de remplir des questionnaires additionnels portant sur notre vie familiale et de recueillir des échantillons de salive sur moi-même, lors de la rencontre, et sur mon enfant, lors de la rencontre et pendant deux jours de la semaine. J'accepte aussi d'être filmé(e) avec mon enfant lors d'une session incluant un jeu et des discussions portant sur des résolutions de problèmes.

Je comprends que toute l'information recueillie demeurera confidentielle et qu'elle ne servira qu'à des fins de recherche. Cependant, si après évaluation des examens votre enfant requérait une attention spéciale, les chercheurs de l'université Concordia s'engagent à faire le suivi de la rencontre afin de référer les services nécessaires.

Dans l'éventualité où j'aurais des questions concernant cette recherche, je pourrai m'adresser soit à Julie Martin ou bien à Nadine Girouard au (514) 848-2424 extension 2254.

Nom: _____ Date:
EN LETTRES MOULÉES

Signature:

****

Nom de l'enseignant/e: _____
Année: _____
Nom du directeur/de la directrice: _____

Nom de l'école: _____
Numéro de téléphone: ( ) _____
code régional

Appendix I: Supplemental Tables for Study 2

Supplemental Table 1.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 1 Normal period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.953	0.012	0.030	0.005
Profile 2	0.023	0.928	0.033	0.016
Profile 3	0.050	0.009	0.911	0.030
Profile 4	0.002	0.000	0.030	0.968

Supplemental Table 2.

Retained four-profile model results and coefficients for the Time 1 Normal period.

	Profile 1 Dyadic (n = 52)	Profile 2 Self-soothing (n = 18)	Profile 3 Distraction (n = 42)	Profile 4 Mixed regulation (n = 22)
Self-comfort regulatory	8.78 (10.16)	51.38 (11.14)	7.64 (8.70)	16.26 (11.58)
Self-comfort exploratory	0.51 (1.38)	1.25 (1.72)	2.36 (3.08)	14.52 (5.81)
Gaze aversion	22.44 (12.17)	21.02 (14.46)	61.59 (15.89)	25.38 (16.84)
Bidirectional exchange	67.80 (13.57)	23.38 (16.21)	26.96 (13.44)	34.77 (20.05)
Maternal prestige		0.004	0.002	-0.003
Paternal prestige		-0.002	0.002	0.003
Maternal age at birth		-0.005	0.013	0.073
Maternal sensitivity		0.203	-1.163**	-0.590
Maternal non-hostility		0.938	2.234*	1.038

Note: Values below the table break are from covariate analysis, with Profile 1 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Supplemental Table 3.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 2 Free-play period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.955	0.044	0.000	0.001
Profile 2	0.004	0.982	0.008	0.005
Profile 3	0.000	0.004	0.994	0.002
Profile 4	0.000	0.075	0.000	0.925

Supplemental Table 4.

Retained four-profile model results and coefficients for the Time 2 Free-play period.

	Profile 1 Self-soothing (n = 16)	Profile 2 Dyadic (n = 65)	Profile 3 Exploration (n = 15)	Profile 4 Independent (n = 20)
Self-comfort regulatory	32.30 (11.01)	1.95 (3.55)	4.18 (7.09)	1.17 (2.66)
Self-comfort exploratory	2.80 (4.03)	2.52 (3.95)	24.78 (5.79)	3.07 (4.70)
Dyadic exchange	36.77 (23.19)	64.97 (26.10)	18.97 (18.67)	27.37 (18.56)
Independent play	10.17 (12.11)	6.72 (8.63)	10.22 (9.43)	49.81 (14.62)
Maternal prestige	0.000		0.001	0.000
Paternal prestige	-0.003		-0.002	0.000
Maternal age at birth	0.175		0.130*	-0.062
Maternal sensitivity	0.176		-0.262	0.230
Maternal non-hostility	-1.873		-0.724	-1.937

Note: Values below the table break are from covariate analysis, with Profile 2 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Supplemental Table 5.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 3 Free-play period.

	Profile 1	Profile 2	Profile 3
Profile 1	0.997	0.001	0.001
Profile 2	0.009	0.991	0.000
Profile 3	0.045	0.000	0.095

Supplemental Table 6.

Retained three-profile model results and coefficients for the Time 3 Free-play period.

	Profile 1 Dyadic (*n* = 95)	Profile 2 Mixed regulation (*n* = 8)	Profile 3 Independent (*n* = 13)
Self-comfort exploratory	3.31 (4.53)	25.52 (4.07)	5.28 (6.23)
Dyadic exchange	70.07 (28.55)	33.11 (27.94)	10.83 (11.23)
Independent play	6.77 (10.34)	1.95 (5.22)	71.48 (16.42)
Maternal prestige		-0.001	-0.005
Paternal prestige		-0.005	0.001
Maternal age at birth		0.022	-0.035
Maternal sensitivity		0.582	0.265
Maternal non-hostility		0.481	0.481

Note: Values below the table break are from covariate analysis, with Profile 3 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.

Supplemental Table 7.

Classification probabilities for the most likely latent class membership (column) by latent class (row) for the Time 4 Free-play period.

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	0.957	0.000	0.031	0.012
Profile 2	0.000	1.000	0.000	0.000
Profile 3	0.004	0.000	0.944	0.052
Profile 4	0.003	0.000	0.019	0.978

Supplemental Table 8.

Retained four-profile model results and coefficients for the Time 4 Free-play period.

	Profile 1 Independent (*n* =11)	Profile 2 Mixed-attention-seeking (*n* = 6)	Profile 3 Self-soothing (*n* = 22)	Profile 4 Dyadic (*n* = 69)
Self-comfort regulatory	10.17 (9.56)	9.37 (7.58)	24.25 (6.00)	6.60 (4.85)
Attention-seeking	1.88 (2.09)	13.79 (2.79)	0.51 (0.91)	0.52 (1.14)
Independent play	40.83 (7.08)	11.48 (17.36)	10.59 (9.10)	5.80 (6.61)
Cooperation	40.72 (16.96)	55.76 (17.78)	60.39 (9.43)	85.27 (9.45)
Maternal prestige	-0.002	0.001	0.003	
Paternal prestige	-0.001	-0.002	-0.003	
Maternal age at birth	-0.068	0.148	-0.034	
Maternal sensitivity	-0.997*	-1.366	0.108	
Maternal non-hostility	1.1331	0.543	0.725	
Child emotionality	-0.007	-0.138	-0.123	
Child sociability	-0.019	0.026	0.004	

Note: Values below the table break are from covariate analysis, with Profile 4 serving as the reference category. * $p < 0.05$, ** $p < 0.01$.