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MATERNAL CORTISOL AS A MEDIATOR OF PRENATAL STRESS AND INFANT REGULATION DEVELOPMENT

presented by

Shallimar M. Jones

has been accepted towards fulfillment
of the requirements for the

Doctoral degree in Psychology

Major Professor's Signature

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Date

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MATERNAL CORTISOL AS A MEDIATOR OF PRENATAL STRESS AND INFANT REGULATION DEVELOPMENT

by

Shallimar M. Jones

A DISSERTATION

Submitted to
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ABSTRACT

MATERNAL CORTISOL AS A MEDIATOR OF PRENATAL STRESS AND INFANT REGULATION DEVELOPMENT

By

Shallimar M. Jones

Maternal experience of stress during pregnancy can have a lasting impact on infant regulation development. Research suggests that the Hypothalamic Adrenal (HPA) axis transmits maternal stress to the fetus and that these effects can be observed in infant regulatory behaviors such as temperament and sleep patterns. However, examining prenatal maternal cortisol as a mediator of prenatal maternal stress and infant regulation has not been observed in human populations. Therefore, the present study investigated this relationship using a prospective design with a community sample of 92 participants in the 3rd trimester of their pregnancies. Participants were interviewed a second time when the infants were 3 months old. A.M. and P.M. salivary maternal cortisol and self report measures for prenatal stress (depression, anxiety, life stress, daily hassles, and perceived stress) and pregnancy related conditions were examined at Time 1. At Time 2, self report measures of postnatal stress (depression, anxiety, life stress, daily hassles, and perceived stress), general health, infant sleep and temperament with the Infant Behavior Scale were completed. Hierarchical Linear Regression controlling for postnatal stress, showed that cortisol was not a significant mediator. However, prenatal stress did predict aspects of infant regulation. Specifically, mental stress predicted infant activity (beta = -.24, $p<.05$) and sleep (beta = .40, $p<.05$) and life stress predicted attention (beta = -.24, $p<.05$). Postnatal analyses (controlling for prenatal stress) showed that, perceived stress experienced by the mother directly (beta = .21, $p<.05$) and indirectly through parenting

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effects (beta = -.24, $p<.05$) attention. Implications from this study not only highlight the need for further research on the role of cortisol as a mediator of prenatal stress and infant regulation, but also the need to incorporate these findings into clinical and physical assessments for earlier identification of pregnant women whose children may be at risk for possible negative developmental consequences.

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INTRODUCTION

The purpose of this study is to examine the relationship between psychosocial and physiological measures of stress during pregnancy and early infant regulation behavior (i.e. infant temperament and sleeping pattern) in humans. The idea that maternal emotions can influence infant regulation development has long been accepted (Feirreira, 1965). The most extensive examination of this issue has been conducted in animals. Research in animals has demonstrated that offspring exposed to prenatal stress in the form of unpredictable noise, (Schneider, 1992), motor restriction (Deminiere et al., 1992), or crowding (Dahlof, Hard, & Larsson, 1978) of the mother went on to exhibit fearful behaviors, decreased exploration of novel environments, learning difficulties, and problems with physical and motor development during infancy and into adulthood (Meek, Burda, & Paster, 2000; Schneider et al., 1992, Grimm & Frieder, 1987; Weinstock, Matlinda, Maor, Rosen, & McEwen, 1992). Many researchers believe that the effects of prenatal stress on infant regulation are mediated by the physiological stress response of the maternal hypothalamic-pituitary-adrenal (HPA) axis (Barbazanges, Piazza, le Moal, & Macccari, 1996; Weinstock, 1997).

One of the hormones involved in the stress response is cortisol. Research in animals has demonstrated a relationship between maternal stress and increased circulating corticosterone (cortisol in humans) within the mother (Arishima, Nakama, Morikawa, Hashimoto, & Eguchi, 1977; Zarrow, Philpott, & Denenberg, 1970) and within the fetus (Gitau, Cameron, Fisk, & Glover, 1998; Stewart, Rogerson, & Manson, 1995). Research has shown that rats exposed to prenatal stress display greater and prolonged elevation of adrenal hormones as adults (Clarke, Wittwer, Abbott, &

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Schneider, 1994; Fride, Dan, Feldon, Halevy, & Weinstock, 1986). This is problematic because many researchers believe that prenatal exposure to stress may permanently alter the neural circuitry of a developing organism (Benes, 2000; Meaney et al., 1996), leaving it more vulnerable for future emotional dysregulation, psychopathology, and a host of other difficulties during later development (Meyer et al., 2001). In fact, research has demonstrated that chronic exposure to stress and the circulating hormone cortisol, has been associated with a variety of physical problems including cardiovascular diseases, immuno-suppression, insulin resistance, and neuro-degenerative diseases (McEuwen & Sapolsky, 1995; Meaney 1996) as well as psychological problems such as excessive fear, anxiety, and depression in both humans and animals (Meyer, Chrousos, & Gold, 2001).

The postnatal environment also affects the development of an organism. Specifically, the effect of prenatal stress on subsequent infant physiology and behavioral development has also been shown to be impacted by postnatal maternal care. Work with rodents has demonstrated that high levels of maternal care may mediate the expression of fearfulness and circulating corticosterone in their offspring (Caldji, Tannenbaum, Sharma, Francis, Plotsky, & Meany, 1998; Lui et al. 1997; Sapolsky, 1997). Unfortunately, most of these studies did not consider the influence of the prenatal environment. Using a cross fostering design to examine prenatal stress, Maccari, Piazza, Kabbaj, Barbazanges, Simon and Le Moal (1995) found that the effects of prenatal stress environment could be influenced by postnatal parenting.

There is some evidence that a parallel relationship between prenatal stress and infant development may be true in the human population as well. Unlike animals where the idea of stress is easily operationalized, this is not so easily accomplished in the human

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population. Stress during pregnancy has been conceptualized as the experience of life events or daily hassles (DaCosta, Brender, & Larouche, 1998; Zuckerman, Amaro, Bauchner, & Cabral, 1989), psychological distress such as anxiety (Hobel, Dunkel-Schetter, Roeshc, Castro, & Arora, 1999), perceived stress (Sable & Wilkinson, 2000), or as a combination of all of these (Lobel, Dunkel-Schetter, & Scrimshaw, 1992). In addition, most studies on humans either examine stress during pregnancy and its relationship to early infant birth outcomes or they examine stress during the postnatal period. Studies conducted on the impact of prenatal stress on birth outcomes have documented that prenatal stressors are related to birth outcomes such as preterm delivery, decreased head circumference, pregnancy complications, or lower birth weight (Lou et al., 1994; Dunkel-Schetter, 1998; Paarlberg, Bingerhoets, Passchieir, Dekker, & van Geijn, 1999). Research in the postnatal period has also demonstrated an effect of postnatal stressors of the mother on infant motor and emotional development (Meijier, 1985; Warren, Gunnar, Kagan, Anders, Simmens, Rones, Wease, et al., 2003).

Currently, there is only a small body of literature that prospectively examines the connection between prenatal stress and infant development. One of the few prospective studies in this area, conducted by Huizink, de Medina, Mulder, Visser, and Buitelaar (2002), found that prenatal stress in the form of perceived stress and pregnancy anxiety was related to difficult infant behavior and attention regulation at 3 and 8 months. In addition, work by de Weerth, van Hees, and Buitelaar (2003) has demonstrated that mothers with high levels of cortisol during pregnancy not only delivered sooner than low cortisol mothers, but their infants also displayed more crying, fussing, and negative facial expressions. Unfortunately, these studies did not consider the influence of postnatal

stress. Therefore it is difficult to determine if the effects of prenatal stress significantly contribute to later infant development over and above postnatal stress. One study that did control for postnatal anxiety, found that maternal anxiety during pregnancy predicted later behavioral and emotional problems in children 4 years of age (O'Connor, Heron, Golding, Beveridge, & Glover, year). However this study did not account for postnatal parenting behavior which, in addition to stress, has also been shown to be an important predictor of infant development in both humans and infants (Teicher, Andersen, Polcari, Anderson, Navalta, & Kim, 2003).

Given the delicate nature of a developing fetus, prenatal exposure to stress through circulating hormones can be detrimental to subsequent development. Therefore, the purpose of this study is to examine the relationship between prenatal stress and infant regulation development. In order to account for postnatal variables, postnatal stress and parenting will also be accounted for.

Stress During Pregnancy in Animals

The idea that stress during pregnancy can impact fetal development, has long been established (Ferreira, 1965). Most of the early studies examining stress began in the 1970s. The term "stress" has been defined in a number of ways. The two oldest definitions of stress are rooted in the biological model and the engineering model. In the biological model, the main idea was to identify biologically-based reactions that could be generalized from individually taxing situations (Selye, 1956). In the engineering model, however, stress refers to an applied external force that when present, exceeds the carrying capacity of the material (Smith, 1987). Stress research in animals uses a combination of

these definitions by examining the effects of externally induced stressors and their effects on the biological and social development of an organism.

To induce stress in animals, pregnant mothers (mostly rodent or nonhuman primates) have been subjected to a variety of stressors that have ranged from painful to less painful. For example, with rodents some researchers have used crowding (Dahlof et al., 1978), repetitive tail shocks (Takahashi, Haglin, & Kalin, 1992), saline injections (Peters, 1990), or restraint (Herrenkohl & Whitney, 1976; Herrenhol, 1976; Deminiere et al., 1992) as stressors. While other researchers examining nonhuman primates have used noise (Schneider, 1992) or social stress such as removing a pregnant animal from its home cage and placing it in a new unfamiliar environment (Schneider & Coe, 1993).

Research in this area has demonstrated that the type of stressor can have differential outcomes on later development. Velazquez-Moctezuma et al. (1993) used four different prenatal stress (PS) conditions in rodents and found that restraint and sleep deprivation were correlated with later sexual behavior in males, while immersion in cold water was not. Other researchers have also found differential patterns in the type of PS and later offspring outcomes. For example, Takahashi et al. (1990) found that random electric shock was associated with fewer vocalizations, while Williams et al. (1998) found that restraint was associated with more vocalizations in rodents.

The timing of the stressor may also be a factor in many PS conditions. In a study of PS examining rodents during the beginning, middle, and end of pregnancy, it was found that later adult exploration was highly associated with PS in the early part of pregnancy (Suchecki & Neto, 1991). Other studies with nonhuman primates have shown

that PS administered across gestation rather than mid-gestational stress was related to later neuromotor development (Schneider & Coe, 1993).

Although stressors differ in severity and timing, overall PS has been associated with negative birth outcomes and early developmental delays as well as later adult developmental delays in motor, learning, emotional, and neurological development in animals. Currently most studies examining PS typically focus on later adult animal outcomes rather than early developmental effects of PS. Research on early development has shown that rhesus monkeys exposed to early PS had lower birth weight than non PS monkeys (Schneider et al., 1999). In rodents, Meek et al. (2000) found that when pregnant mice were randomly exposed to handling, noise, increased temperatures, or light for 45 minutes during the last week of pregnancy, a variety of early developmental indices were disturbed in the offspring. Specifically, they found that stressed pups were initially smaller than non stressed pups, had fewer teeth at birth, and were less likely to rotate at 3 days than non-stressed pups.

PS has also been associated with delayed motor development in animals. For example, Drago, Di Leo, and Giardina, (1999) found that rats exposed to PS exhibited delayed neonatal sensorimotor reflexes. Meek et al. (2000) reported that PS rats were less likely to climb, respond to tail pulling, or demonstrate clinging in the first week of life. Other studies have found that infant PS squirrel monkeys demonstrated poorer muscle tone, coordination, self-feeding, and response speeds than non PS monkeys. These results are consistent with other research on adult rodents that demonstrate continued motor delays (Grimm & Frieder, 1987; Lambert, Kinsley, Jones, Klien, Peretti, & Stewart, 1995). This pattern has also been observed in nonhuman primates as well.

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Specifically, Schneider (1992b) reported that at 6 months, squirrel monkeys demonstrated lower levels of gross motor behavior than non PS monkeys.

In addition to delayed motor development, cognition is also affected by PS. Research shows that adult rats exposed to PS have difficulty learning new tasks such as water mazes or reversal of previously learned discrimination tasks (Arnsten, 2000; de Quervain, Roozendaal, & McGaugh, 1998; Grim & Frieder, 1987; Meek et al., 2000; Thompson et al., 1962). In one of the earliest studies on this topic, Thompson et al. (1962) reported that PS rodents demonstrated a higher number of errors and needed more time to complete mazes than non PS rats. Grim and Frieder (1987) reported that PS rats learned mazes at a slower rate than non PS rats. In nonhuman primates, Schneider (1992c) observed that PS monkeys took longer to locate partially obstructed objects than non PS monkeys.

Other studies have documented disturbed emotional responses (or anxiety-like symptoms) in animals exposed to PS as well. According to Weinstock (2001), observation of rats exposed to an unfamiliar peer revealed that 30% of PS rats initiated contact compared to 90% of controls. Other studies have demonstrated increased startle responses, increased defecation, freezing, decreased ultra-sonic vocalizations, and altered sleep patterns in rats (Fride et al., 1986; Fride & Weinstock, 1984; Takahashi, Haglin, & Kalin, 1992). In nonhuman primates exposed to PS, abnormal social behavior has also been observed. Specifically, at 2 years of age, PS rhesus monkeys displayed fewer incidents of exploration in novel environments, reduced play, and increased clinging behaviors when placed in unfamiliar environments as compared to controls (Coe,

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Animals exposed to PS also exhibit a variety of neurological deficits. Coe et al. (2003) examined PS in a sample of rhesus monkeys. The researchers exposed pregnant monkeys to daily stress for 25% of their 24 week gestation period. PS during early and late gestation resulted in inhibited cell growth of the dentate gyrus and decreased hippocampal volume in both PS conditions. This is important for several reasons. First, the dentate gyrus is responsible for the generation of new cells (Gould & Tanapat, 1999; Altman & Bayer, 1990; Bayer, 1980). It is formed during gestation and continues to develop postnatally (Gould & Tanapat, 1999; Altman & Bayer, 1990; Bayer, 1980), so a reduction of this structure early on could effect subsequent cell growth. Second, the hippocampus is involved in episodic and declarative memory, spatial learning, and is also involved in the stress response (McEwen, Margarinos, & Reagan, 2002). Therefore a reduction of this structure could explain some of the cognitive deficits exhibited by these animals. Further, because many believe that the stress response system mediates the relationship between PS and later development (Dodic et al., 2002; Maccari, Darnaudery, Morley-Fletcher, Zuena, Cinque, & Van Reeth, 2003; Owen, Andrews, & Matthews, 2005; Nyirenda & Seckl, 1998; van den Bergh, Mulder, Mennes, & Glover, 2005; Wadhwa et al., 2001), disruption of this structure may affect the effectiveness of the stress response.

HPA Axis

When an organism encounters stressful stimuli, the Hypothalamic Adrenal Pituitary (HPA) axis responds. The first system that responds is the sympathetic nervous

system (Kalat, 1998; Korte, 2001). Here the "fight or flight" system is activated and the body immediately responds with an increase of catecholamines such as cortisol, which are hormones that elevate blood sugar and metabolism to aid in an increased fuel supply needed to respond to the situation (Kalat, 1998; Korte, 2001). As a part of this system, the HPA axis is also activated. This system is slower than the sympathetic system and involves the release of glucocorticoids (GC) which serve as the end product of the negative feedback loop which inhibits the stress response (Francis & Meaney, 1999; Meaney et al 1996; Vazquez, 1998; Weinstock, 2001).

In the HPA pathway, the paraventricular nucleus of the hypothalamus responds to external stressors by releasing corticotropin releasing hormones (CRH) and arginine vasopressin (AVP) to signal the anterior pituitary gland to secrete adrenocorticotropic hormone (ACTH) (Francis et al., 1996; Francis & Meaney, 1999; Meaney et al., 1996; Vazquez, 1998; Weinstock, 2001). In the bloodstream, this hormone ultimately stimulates the adrenal cortex to release the steroid hormones GC. GCs are most commonly in the form of corticosterone in rodents (or cortisol in humans and nonhuman primates). They serve to mobilize energy via increasing circulating glucose levels and also act on areas of the brain such as the hippocampus and amygdala to affect learning and memory (Francis et al., 1996; Francis & Meaney, 1999; Meaney et al., 1996; Owen et al., 2005; Vazquez, 1998; Weinstock, 2001). Although the mobilization of energy constitutes an important coping mechanism, prolonged exposure to high levels of corticosterone hormones leads to cardiovascular diseases, neuronal death, decreased immune response, as well as inhibited growth and reproduction in the long term because energy is being directed to other parts of the body (McEuwen & Sapolsky, 1995; Tsigos

& Chrousos, 2002; Vazquez, 1998; Weinstock, 2001). Accordingly, in order to be effective, the stress response system must be kept under strong regulation by rapidly responding to stimuli and quickly returning to baseline (Huznik, 2004; Vazquez, 1998; Weinstock, 2001).

The response of the stress system is regulated by a negative feedback system (Francis et al., 1996; Francis & Meaney, 1999; Huznik, 2004; Meaney et al., 1996; Vazquez, 1998; Weinstock, 2001) involving circulating levels of GCs (Korte, 2002; Huznik et al., 2004; Ratka, Sutano, Bloemers, & De Kloet, 1989; Ruel & De Kloet, 1985; Vazquez, 1998). GCs bind to two types of receptors: mineralcorticoid (MR) receptors or glucocorticoid receptors (GR). They are each located in the hippocampus, septum, and amygdala (Korte, 2002; Maccari et al., 2003; Mastorakos & Ilias, 2003; Ratka et al., 1989; Ruel & De Kloet, 1985; Vazquez, 1998; Weinstock, 2001). However, GRs are also located in other parts of the brain, with the highest concentration in the hypothalamus, hippocampus, and pituitary (Korte, 2002; Maccari et al., 2003; Mastorakos & Ilias, 2003; Ratka et al., 1989; Ruel & De Kloet, 1985; Vazquez, 1998). GCs bind mostly to MRs in basal conditions, whereas during times of stress and circadian peak, GCs mostly bind to GRs (Korte, 2002; Maccari et al., 2003; Mastorakos & Ilias, 2003; Ratka et al., 1989; Ruel & De Kloet, 1985; Vazquez, 1998). Regardless, both MRs and GRs respond to levels of circulating GCs by inhibiting the release of CRH in the HPA axis at its source, namely, the hypothalamus. Given this position, GCs and GRs are "part of a complex signaling system between the external environment, the brain, and the periphery" (Huznik et al., 2004, p. 121) which help to regulate the stress system.

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pregnancy, there are some major distinctions from the non-pregnancy state. The major difference is that during pregnancy the circulating levels of CRH are estimated to be at least 2-10 times higher than non-pregnancy levels (Huznik et al., 2004). One of the reasons for this increased level is that unlike non-pregnancy states, during pregnancy the placenta, deciduas, and fetal membranes also produce CRH (Huznik et al., 2004; Grino et al., 1987; Mastorakos & Ilias, 2003; Owen et al., 2005; Petraglia et al., 1996; Smith, 1999; van den Bergh et al., 2005). Although CRH produced by the placenta is chemically synonymous to hypothalamic CRH, it is not regulated by the negative feedback loop as in the normal HPA axis (Majzoub & Karalis, 1999; Challis, Matthews, van Meir, & Rameriez, 1995). Instead, the production and regulation of CRH during pregnancy operates in more of a positive feedback system (Majzoub & Karalis, 1999; Challis et al, 1995).

There are several aspects to the positive feedback system; namely, the mother, fetus, and the placenta each interact with one another to produce stress hormones. Specifically, although the placenta individually produces CRH, maternal CRH production also serves to potentiate placental production of CRH (Huizink, 2004; Kofman, 2002; Linton et al., 1993; Mastorakos & Ilias, 2003). This in turn, increases both maternal and fetal levels of corticosterone (cortisol in humans and primates). Fetal CRH is also influenced by the production of placental CRH. Placental CRH, stimulates the fetal HPA axis and thereby potentiates its production of cortisol. This serves to increase placental CRH as well. Since placental CRH crosses both the maternal and fetal stress systems, it serves to potentiate circulating levels of CRH and cortisol on both sides. This results in a state of hypercortisolism that persists from around the 8th week of pregnancy and

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eventually peaks during the third trimester in preparation for birth in humans (Huizink et al., 2004; Korte, 2002; Mastorakos & Ilias, 2003; Owen et al., 2005; Smith, 1999; van den Bergh, 2005).

Fortunately, all the circulating cortisol from the mother does not reach the fetus due to the presence of 11 β-hydroxy-steriod-dehydrogenase type 2 (11βHDS2) (Schoof, Frobenius, Kirshbaum, Repp, Kneer et al., 2001; Seckl, 1997). Located in the placenta, 11βHDS2 metabolizes some maternal cortisol. However, 11βHDS2 can have large variations between placentas (Welber, Seckl, & Holmes, 2001), so fetal exposure to maternal cortisol can also vary. Nonetheless, even with 11βHDS2, maternal cortisol has been shown to account for 33 – 40% of the variation in fetal cortisol (Gitau et al., 1998; 2001; 2003).

HPA and Offspring Development

Researchers examining this relationship have found that maternal stress hormones mediate offspring stress responses. For example, Barbazanges et al. (1996) performed an adrenalectomy and blocked corticosterone secretion in rodents. They then compared the offspring of mothers exposed to PS with an intact stress system to mothers with blocked corticosterone secretion. Results showed that when the pups were exposed to restraint stress, pups of mothers with an intact system demonstrated an overall 30 to 70% reduction of MRs and GRs (respectively) at 21 and 90 days of age. They also exhibited higher basal levels of circulating corticosterone and a longer activation of corticosterone secretion than the blocked condition. Oddly, the pups in the blocked condition did not display a reaction to stress. However, when pregnant mothers with the blocked corticosterone system were injected with corticosterone, results were comparable to those

with the intact system. This suggests that the presence of maternal corticosterone is essential for the development of the offspring stress response. However, overexposure to corticosterone can actually be detrimental to fetal and later adult development (Korte, 2002).

Weinstock et al. (1992) found that when pregnant rodent moms were exposed to PS, their offspring had fewer GRs than non-PS rodents. In fact, in PS rats, the basal level of corticosterone was 3x higher than in non-PS rats. This could be due in part to the decreased GRs. In addition, they also engaged in more defecation and wall seeking when placed in an open field test. Fride et al. (1986) found that the effects of PS persist over time. When adult rats were repeatedly exposed to stress, corticosterone in non PS rats ceased to rise after the 4^{th} exposure, but corticosterone continued to rise until the 8^{th} exposure in PS rats. They also found that PS rats displayed initially higher releases of corticosterone than non PS rats. Research has also shown that rats exposed to PS also have higher morning basal levels of corticosterone than non PS rats (Weinstock, 1997).

Similar results have also been found in humans and non-human primates. However unlike rodents, human and non-human primate fetuses are afforded some protection from maternal stress hormones. Specifically, the enzyme 11 β-hydroxysteroid dehydrogenase (located in the placenta), binds to maternal cortisol and renders it inactive (Huizink, 2004; Linton et al., 1993; Kofman, 2002; Mastorakos & Ilias, 2003; Suda et al., 1988). In spite of this protection, there is still a strong linear relationship between maternal and fetal cortisol (Gitau, Cameron, Fisk, & Glover, 1998), suggesting that a significant amount of unaltered maternal cortisol continues to cross the placental barrier.

Considering that brain development in humans and non-human primates occurs

mostly in-utero (Matthews, 2000), PS can have lasting effects on fetal development. Work with rhesus monkeys has demonstrated that monkeys exposed to PS had higher basal levels of cortisol than non PS monkeys (Clarke & Schneider, 1993). Other research reported that at 4-years-of-age rhesus monkeys exposed to PS displayed enhanced ACTH activity, but not cortisol activity in baseline or activation levels (Clarke, Wittwer, Abbott, & Schneider, 1997). The physiological effects of stress have also been examined in monkeys by externally administering ACTH during mid-gestation for a period of 14 days (Schneider, Coes, & Lubach, 1992). This resulted in delayed motor development, increased irritability, and shorter attention spans of 2-week-old infants. Other studies found that baseline cortisol and ACTH were normal at 8 months but were elevated at 18 months in PS monkeys (Clarke et al., 1994; Schneider et al., 1998). Overall, the literature suggests that PS has a significant impact on later development in both rodents and non-human primates. Unfortunately most of these studies do not address the postnatal environment; namely, they fail to address the impact of parenting behaviors on infant development.

Postnatal Stress and Parenting Offspring

Research has shown that stimulation during infancy has an enduring impact on long term development in both humans and animals (Pfeifer, Rotundo, Myers, & Denenberg, 1976). In his early studies of this effect in rats, Seymour Levine (1957) found that when pups were removed from their nest and mildly shocked they exhibited, as adults, lower levels ACTH. These animals also showed a greater ability to rapidly habituate to novel situations (Levine 1960; Levine & Broadhurst, 1963; Levine, Hallmeyer, Kara, & Denenberg 1966; Williams & Wells 1970;), were less susceptible to

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autoimmune diseases, and lived longer than non-manipulated rats (Levine, 1962). Even as infants, the stimulated pups opened their eyes earlier, achieved motor coordination sooner, and weighed more than the control group (Levine, 1960). Interestingly, these effects were similar to those reported earlier by Wieninger (1954), who, instead of using physical stress, "gentled" the pups by stroking them with the hand every day. The effects that Levine observed were paradoxical because stimulation that was intended to be painful and stressful, and which was hypothesized to produce negative long term effects, instead, produced positive effects (see Pfeifer et al., 1976).

One of the first explanations of how early stimulation may affect subsequent development was proposed by Levine (1962) and is now known as the "direct action hypothesis." He reported that, in one of his control groups, removing a pup from the nest without further treatment showed the same beneficial effects on adult stress regulation as that seen in the removal-plus-shocking group, and that, by comparison, it was the undisturbed group which showed deficits. From these findings, he proposed that early exposure to "noxious chronic stimulation" (including the stress of maternal separation), modified the development of physiological systems that affect stress regulation in adulthood (Bell et al., 1970). Although a direct effect of stimulation on the pups certainly occurs, this hypothesis did not explain how aversive stimulation and non-aversive stimulation could produce the same beneficial outcomes (Bell et al., 1970).

While conducting similar experiments, later research found that handling not only disrupted the pups, but the mother as well (Bruno, Blass, Amin, 1982; Levine, 1967; Levine & Mullins, 1966; Bell et al, 1970; Smotherman & Bell, 1980; Smotherman, Brown, & Levine, 1977; Pfeifer et al 1976). On this basis, it was proposed that the

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disruption caused by "the experimental stimulation of pups directly affects maternal behavior and indirectly produces long-lasting effects on the behavior and physiology of pups" (Smotherman, 1980, p. 169). This statement situates maternal behavior as the primary mediating factor of handling effects, not the direct experience of handling on the pups themselves.

The maternal mediation hypothesis emphasizes the fact that stressed pups bring a different set of stimulation cues to the nurturing context that affects maternal behavior. Specifically, it was found that upon return to the nest, pups emit increased ultrasonic vocalizations (Bell et al, 1970; Bruno et al., 1982; Hofer, 1987; Smotherman et al., 1970; Smotherman & Bell, 1980) to which the mother responds by increasing pup-directed behaviors such as nursing, nest building, licking, and grooming (Bell et al., 1970; Levine, 1960). It was further demonstrated that brief handling (removal of pups from nest) also had a constant effect on mother-pup interactions that lasted throughout the neonatal period (Bruno et al., 1970; Francis & Meaney, 1999; Levine, 1960; Levine & Mullins, 1966). As measured by increased CORT levels, studies have shown that handling stresses not only the pups, but the dams a well. This increased stress is also reflected in maternal grooming behavior. Specifically, mothers of handled and non-handled pups spend relatively the same amount of time on the nest (Francis & Meaney, 1999; Smotherman & Bell, 1980), however, only the dams in the handled groups spent the most time licking and grooming their pups (Francis & Meaney, 1999; Smotherman, 1982). On the other hand, extended periods of handing have been related to depression like symptoms in dams where they engage in less pup grooming, more anxious behavior in novel environments, less aggression in intruder tests, and fewer escape behavior (Boccia &

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Changes in maternal behavior have also been related to direct (non pup elicited) stimuli. For example, when CORT was added to the drinking water of lactating dams, it was positively related to maternal licking and grooming behavior (Rees, Pansear, Steiner, & Fleming, 2004, 2006). Other work has directly exposed lactating dams to intruder odor which not only increases maternal CORT but grooming behavior as well (Moles,Rizzi, & D'Amato, 1994). Although studies of these offspring are not presently available in the literatures, one can assume (based on what is known about maternal behavior and offspring development) that these offspring experience the same benefits as other offspring in the handled condition. In sum, this shows that stress can impact offspring by direct exposure and indirectly via the dam.

While the maternal mediation hypothesis solved many questions, other questions remained concerning the physiological mediation of the same effects. On this issue, Meaney et al. (1992) determined that the receipt of increased maternal care causes an increase in the GR receptor mRNA in the hippocampus via the release of serotonin induced in this area by maternal handling and licking. This physiological change was deemed crucially important because, as previously mentioned, GRs are directly involved in the negative feedback loop that regulates the activity of the HPA axis.

Overall, these results show that parenting can mediate the relationship between external stress and infant development. Unfortunately, most of the studies in this area are restricted to rodents. This is problematic because unlike humans and non-human primates, the rodent brain is only about 12% of its adult weight at birth (Clancy et al., 2001). Therefore most of these effects cannot be generalized to other animal populations

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where the majority of brain development occurs in utero. In fact, since postnatal days 12-14 are most comparable to near-term fetal development in humans (Clancey et al., 2001), it may be that the maternal mediation hypothesis model is a better predictor of PS rather than postnatal stress in human and non-human primate populations. In addition, most of these studies do not take the prenatal environment into account when examining postnatal stress. Therefore, without considering both environments, the picture of stress and infant development is not complete.

Prenatal Stress and Parenting Offspring

There is some research to suggest that the postnatal environment can moderate abnormal emotional reactivity seen in PS animals (Meaney et al., 1989; Wakshlak & Weinstock, 1990). Most of the work in this area has been conducted on rodents. Maccari, Piazza, Kabbaj, Barbazanges, Simon and Le Moal (1995) examined the effects of prenatal stress and parenting behavior in a cross fostering design. The researchers placed PS rat pups with adopted mothers shortly after birth and compared them to pups raised by the biological mother. They found that the adopted mothers displayed more maternal behavior in the form of licking and grooming than biological mothers. Consistent with the previous reports of maternal behavior, the adopted pups also showed a decreased response of HPA activity than non-adopted pups. Other research has shown similar results. Lordi, Patin, Protais, Meillier, and Caston (2000) found that rats exposed to PS and then raised in an enriched environment had less anxiety in stressful and basal conditions than PS rats in non-enriched environments. One reason for the difference between adopted and non-adopted environments may be the effect that PS has on postnatal maternal behavior. Specifically, Darnaudery, Buee, Biltart, and Maccari (2004)

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found that mothers exposed to chronic stress during pregnancy displayed more freezing and anxiety-like behaviors than non-stressed mothers. Unfortunately, maternal behavior was not observed in this study. Therefore it may be that stress during pregnancy not only alters fetal development, but it may have a lasting impact on postnatal maternal behavior. Given this, it may be that postnatal parenting behaviors can serve to either attenuate or potentiate the effects of PS.

Stress in Humans

Unfortunately stress in the human population cannot be as easily defined as it is in the animal population. Defining stress based on the biological (Selye, 1956) or the engineering model (Smith, 1987) fails to consider the multidimensionality of stressors in humans (Lazarus, 1991; Wheaton, 1999). Researchers have defined stress in humans according to external events, internal events, or as a combination of both (Aldwin, 1994; Lazarus & Folkman, 1984; Pearlin & Schooler, 1978).

When stress is considered as an external event it typically refers to the occurrence of a particular stressor (Aldwin, 1994; Lazarus & Folkman, 1984; Pearlin & Schooler, 1978). A stressful life event (or stressor) is defined as "a condition of threat, or structural constraint that, by its very occurrence or existence, calls into question the operating integrity of the organism" (Wheaton, 1999, p. 281). Stressors can be events such as the death of a loved one, daily hassles, or domestic violence (Pearlin et al. 1981; Taylor, Repetti, & Seeman, 1997; Wheaton, 1999). Depending upon the severity and/or the occurrence of the stressor, it is classified as either a discrete, chronic, or traumatic life event (Pearlin et al., 1981; Wheaton, 1999).

A discrete stressor is described as an event that has a clear termination but may or

may not possess a definite beginning (Wheaton, 1999). An example of a discrete stressor would be the final day of work at a job an individual did not like. There may or may not have been a set point at which the person began to despise the job, but the last day signifies a clear termination of the stressor.

A chronic stressor on the other hand is defined by three criteria. Similar to a discrete stressor, the first condition of a chronic stressor is that it does not necessarily have a set beginning (Wheaton, 1999). Rather a chronic stressor leaves "the individual feeling as if there is a problem but little understanding as to how it developed" (p. 283). The second condition is that the stressor(s) be continuous in the sense that it occurs within the "daily roles or activities" (p. 283) experienced in the normal life of an individual. Finally, unlike discrete stressors which have a set ending, chronic stressors can continue indefinitely. An example of a chronic stressor would be poverty (Ennis et al., 2000; Pearlin et al. 1981). A person living in poverty may or may not know how they came to be poor, but due to their condition they are faced with various stressors that impact their daily life. Some of the stressors they face are associated with dwelling in high crime neighborhoods, poor health care, fewer access to resources, lack of employment opportunities, and other daily strains associated with this position (Ennis et al., 2000; McLoyd, 1998).

The final category of stressors is referred to as traumatic events. Although events in this category can occur as either discrete or continuous events, this category is separate because of the severity of the event. Due to the magnitude of the stressor, traumatic events are "thought to have greater potential for long-term impacts than most other stressors" (Wheaton, 1999, p. 285). An example of a traumatic event would be physical

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abuse. If a woman experiences physical abuse once, this would be considered a discrete traumatic stressor. However if she experiences physical abuse repeatedly over time, this would be considered a continuous traumatic stressor. According to Wheaton, continuous traumatic stressors are thought to be the "single most virulent form of stressful experience" (p. 286).

Internal events or the strain placed upon an individual are also considered to be stressors (Aldwin, 1994; Lazarus, 1983; Lazarus & Folkman, 1985; Pearlin & Schooler, 1978). The internal state of the organism can refer to the perception of stressfulness of an event or the emotional state of the organism. For example, although the occurrence of an event can be stressful, it also depends on how stressful an individual perceives the event. Consider the death of a close relative. Generally many would think that this would be stressful for a person to endure. However, what if the person never knew the relative or what if they did not like them at all? In this case, the death of their relative may not be a negative stressor at all, instead they may even be happy that the person died.

Another type of internal stressor is emotional distress. According to Lazarus (1983), the state of depression or anxiety leads to certain cognitive appraisals of events. For example, the state of depression or anxiety sets a person on cue to selectively take in and perceive stimuli in a negative or threatening way (Beck, 1998). This constant intake of negative or threatening information eventually strains the organism and becomes harmful over time (Selye, 1974).

The transaction between internal and external events is also considered to be an essential aspect of stress. According to Lazarus and Folkman (1984) stress is the "person environment-transaction." Specifically in the transactional model it is theorized that

stress is the balance between the occurrence of the event, how the event is appraised, and how one emotionally responds to or views the event.

Each of these types of stress are plausible indicators of stress for humans. However, none of these definitions considers stress within the context of the HPA axis. As previously mentioned, the HPA axis is aroused when an organism *perceives* a stimulus to be threatening (Kalat, 1998; Korte, 2001). Given this, it seems that it is not necessarily the occurrence of an event that matters; rather it is also how the person responds to the event that leads to activity of the HPA axis. Therefore, it may be that the best definition of stress considers all of these events as in the Lazarus and Folkman (1984) model, but instead focuses on the perception of stressfulness of discrete, chronic, or traumatic events rather than simply relying on their occurrence. Further, given that the perception of the event is influenced by mental stress such as anxiety and depression, it would also seem that this construct is important to include in a physiological definition of stress as well. Unfortunately though, this definition of stress which focuses on the general stress perception, stress appraisal of life events or daily hassles and mental stress has not been widely explored in research within this population. Instead, the more traditional definitions of stress (individually examining depression, anxiety, life events or daily hassles) have been used to examine the impact of PS on fetal, birth, early infant, and adult outcomes using both retrospective and prospective designs.

Prenatal Stress and Fetal Outcomes. A variety of stressors during pregnancy have been found to correlate with a variety of fetal responses. For example, Van den Bergh (1990) examined anxiety during the 37th and 40th weeks of pregnancy. She also measured fetal motor responses via ultrasound. Results showed a significant association between

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high levels of anxiety and fetal movement. Unfortunately, this study had a small sample size (N=30) and used a self reporting format without controlling for pregnancy complications, therefore these results have several confounders and may not generalize to the larger population. Groome, Swiber, Bentz, Holland, and Atterbury (1995) also examined anxiety in a sample of pregnant women and fetal behavior through an ultrasound. Unlike Van den Bergh (1990), they found that mothers who were high in anxiety had fetuses who exhibited fewer body movements and more sleep than other fetuses.

Other research has examined PS and fetal heart rate. Monk, Fifer, Myers, Sloan, Trien, and Hurtado (2000) examined anxiety during the 3rd trimester and fetal responses in 20 women. Using the Stroop color-word task to induce stress, the investigators examined the effect of PS on maternal and fetal heart rate. When examined as a whole there was no connection between maternal anxiety and fetal heart rate. However, when the sample was split into high and low anxiety, the fetuses of mothers in the high anxiety group exhibited significantly higher heart rates when presented with the Stroop test. Though with the low sample size this study may not have been able to replicated. DiPeietro, Costigan, and Gurewitsch (2003) found similar results when they examined women at 24 and 36 weeks at gestation. Results showed that induced maternal stress from the Stroop color-word task was associated with increased variability in fetal heart rate and suppression of motor activity. Although it did not control for other confounders such as income or other health related outcomes, this study performed baseline and manipulation measures of fetal movement on 137 women. Overall, these studies exhibit a

connection between the maternal experience of stress during pregnancy and its impact on fetal behaviors.

Prenatal Stress and Birth Outcomes. PS has been most widely studied in regards to birth outcomes. In this literature, stress is conceptualized as the occurrence of a stressor (DaCosta, Brender, & Larouche, 1998; Hedgaard, Henriksen, Scher, Hatch, & Sabroe, 1996; Hobel, Dunkel-Schetter, Roesch, Castro, & Arora, 1999; Wadhwa, Sandman, Porto, Dunkel-Schetter, & Garite, 1993), the perception of a stressor (Sable & Wilkinson, 2000), how one emotionally responds to stress (Hobel et al., 1999; Killingsworth, Rini, Dunkel-Schetter, Sandman, & Wadhwa, 1999; Wadhwa et al., 1993), or a multidimensional concept that includes all of the above (Lobel, Dunkel-Schetter, & Scrimshaw, 1992; Huznik et al., 2003).

The examination of life events during pregnancy and its association with birth outcomes is one of the most common approaches used in this area. Most approaches rely on the total number of life events experienced during a set time (Lobel, 1993). There are some reports that demonstrate a relationship between these stressors and birth outcomes (Brandt & Neilson, 1992; Gunter, 1963; Newton, Webster, Binu, Maskrey, & Phillips, 1979; Suarez, Cardarelli, & Hendricks, 2003) while other reports do not support this finding (Aurelius et al., 1984; Ching & Newton, 1983; Hedegaard et al., 1996; Mutale, Creed, Maresh, & Hunt, 1991; Obel, Hedegaard, Henriksen, Secher, & Olsen, 2003). For example, Paarlberg et al. (1999) found that daily hassles experienced during the 1st trimester were associated with low birth weight. Newton and Hunt (1984) examined total life events during the third trimester and found that they were related to preterm delivery as well. In another study, Brandt and Nielson (1992) examined the impact of chronic

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work stress during pregnancy and birth outcomes. They found that these women were at risk for lower birth weight, spontaneous abortion, as well as stillbirth.

Traumatic stress also has an impact on birth outcomes. Glynn, Wadhwa, Dunkel-Schetter, Chicz-DeMet, and Sandman (2000) found that the traumatic stress of experiencing an earthquake during pregnancy was associated with shorter gestational length. Specifically, women who experienced the earthquake early in pregnancy were more likely to deliver premature than late gestation exposure. Other research by Hansen, Lou, and Olsen (2000) found that women who experienced the death of an older child during the 1st trimester of pregnancy, were more likely to have children with cranial malformations.

Some studies, though, have found contradictory results. Hedegaard et al. (1996) used a prospective design with a Danish sample to examine stressful life events during the 16th and 30th week of pregnancy and preterm delivery. They found that the experience of life events was not associated with preterm delivery. Obel et al. (2003) also examined a Danish population of 4638 pregnant women. They found that life events were not associated with decreased head circumference at birth. Given the location of this population it is possible that these studies may not generalize to other countries. Overall, the literature is very much divided on the impact of life event stress and birth outcomes. One possibility for this may be flaws in the studies that impact their ability to detect significant associations. These studies each examine different types of stressors and birth outcomes, so the results do not generalize to all life events or outcomes. It is possible that certain life events (i.e., discrete, chronic, or traumatic stressors) are each individually associated with specific types of birth outcomes.

How a stressor is perceived also has an impact on birth outcomes. For example, although Hedegaard et al. (1996) did not find an association between the occurrence of life events and birth outcomes, they did find that individual appraisal of the event was associated with risk for preterm delivery. However, since this was a self-report design rather than a combined standardized interview and self-report methodology, it is difficult to determine if the same results would have been produced. Sable and Wilkinson (2000) used a retrospective design to examine perceived stress during pregnancy. They found that women who perceived that stress occurred during most of their pregnancy were 1.5 times more likely to deliver very low birth weight babies than other mothers who did not.

There is also a body of literature that examines the relationship between emotional state of the mother and birth outcomes. In general, depression is the most frequently reported mental health problem for women (Weisman, Bruce, Leaf, Florio, & Holzer, 1991; Kessler, McGonagle, Zhao, Nelson, Hughes, Eshleman, et al., 1994). The estimated lifetime prevalence for depression in women is between 10.2% (Weisman et al., 1991) and 21.3% (Kessler et al., 1994). During pregnancy though, roughly 25 - 30% of women display elevated symptoms of depression (Klein & Essex, 1994/1995). Hoffman and Hatch (2000) assessed depression in each trimester of pregnancy for a sample of women. They found that in poor women, depression during the 28th week of pregnancy was associated with decreased birth weight and may be related to restricted fetal growth. Within 24 hours of birth, studies have shown that babies born to depressed mothers show less activity, less endurance, longer time to habituate to visual stimuli, and more irritability than babies of non-depressed mothers (Abrams, Field, Scafidi, & Prodromidis, 1995; Field, 1995; Hernandez-Reif, Field, Diego, & Largie, 2002).

Anxiety however, is the most widely examined emotional state during pregnancy. Rini, Dunkel-Schetter, Wadhwa, and Sandman (1999) examined the combined contribution of pregnancy-related anxiety and state-trait anxiety during the 22nd to 28th week of pregnancy on 230 Hispanic and White women. They found that women who experienced higher anxiety during pregnancy were more likely to experience preterm delivery than women with lower anxiety. Wadhwa et al. (1993) sampled women who were between the 22nd and 28th week of pregnancy. They found that anxiety was associated with gestational age and preterm delivery. Unlike most studies both of these used an ethically diverse primarily low income population. Although both examined birth records and used self-report, neither study controlled for income differences within their population. This is important because low income women may not have access to services like other women, this in turn could impact their delivery complications. Other studies that examined anxiety during pregnancy also found a relationship with birth outcomes. For example Dayan et al. (2002) examined anxiety during the 20-28th weeks of pregnancy. They found that anxiety was related to preterm labor. Pagel et al. (1990) found that anxiety during pregnancy was related to 5 minute APGAR scores but not to 1 minute scores or birth weight.

Based on the Lazarus and Folkman (1984) theory, some researchers have used a multidimensional conceptualization of stress to examine its relationship to birth outcomes. Lobel et al. (1992) used the combined standardized score of number of life events, total life event distress, anxiety, and general perceived stress during pregnancy to represent the latent stress variable. They found that although the number of life events was not related to birth outcomes, life event distress, anxiety, and general perceived stress

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was significantly related to low birth weight and preterm delivery. Wadhwa et al. (1993) used a similar technique and combined daily hassles, chronic stress, and perceived stress into one score. The results revealed that the combined life events score was related to low birth weight. However, these results were correlational and therefore, did not take other confounding variables into consideration. Recent work by Dole, Savitz, Picciotto, Siega-Riz, McMahon and Buekens (2003) also examined anxiety, life events, and general perceived stress during the 24th and 29th week of pregnancy. They found that women who experienced anxiety were more likely to deliver prematurely. In addition women who experienced anxiety and high perceived stress were also at risk for preterm delivery. Overall these studies show that PS is related to delivery complications.

Prenatal Stress and Infant Outcomes. PS is also associated with infant and child development. For instance, Allen, Lewinson, and Seeley (1998) examined the infants of mothers who experienced emotional difficulties during pregnancy. These infants were almost 2.5 times more likely to exhibit disruptive disorders than other infants. Currently there are a few studies that have examined PS and infant outcomes using a prospective design. Van den Bergh (1990) examined anxiety during late pregnancy and later infant temperament. Results demonstrated that anxiety during pregnancy was significantly correlated with difficult temperament at 10 weeks and again at 7 months. Anxiety during the last trimester of pregnancy and infant behavior at 1 year and again at 2 years, revealed similar results (Brouwers, van Baar, & Pop, 2001). After accounting for income, smoking and alcohol use, and depression during pregnancy, prenatal anxiety was related to poor attention and reactivity at 1 year of age. PS accounted for 22% of the variance in decreased mental development at 2 years of age. Huizink et al. (2002) examined a

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combined measure of PS as a predictor of infant temperament at 3 and 8 months. After accounting for pre and postnatal depression, they found that prenatal anxiety accounted for 3.8% of the variance in attention regulation in 3 month old infants. Perceived stress accounted for 8% of the variance in difficult behavior at 3 months. The prenatal anxiety and perceived stress together accounted for 5% of the variance in attention at 8 months. O'Connor, Heron, Golding, and Glover (2002) also examined anxiety during the last trimester of pregnancy in almost 8,000 women. Controlling for pregnancy and delivery complications and alcohol and smoking, they found that children of mother's in the top 15% of anxiety at 18 or 32 weeks were at least 2 to 3 more likely to emotional or behavioral problems that were more that 2 standard deviations above the mean. The data here shows that the effects of PS also extend to into infancy.

Prenatal Stress and Childhood and Adolescent Outcomes. Unfortunately the majority of the studies that have examined PS and later child outcomes are conducted using a retrospective design. The impact of prenatal stress is also present in later childhood. For example, Laucht, Esser, Baving, Gerhold, Hoesch, Ihle, Steigleider et al. (2000), examined later child development in 8 year olds and found that mothers exposed to psychosocial stress during pregnancy had children who experienced a higher number of attentional difficulties than other mothers. McIntosh, Mulkins, and Dean (1995) found similar results. Specifically, mothers of children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) experienced more psychological stress during pregnancy than mothers of children without ADHD. Notably this study was conducted using survey data from a retrospective report, which by its nature has many biases.

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These findings also extend to older children. O'Connor et al. (2003) (using the same analysis format as previously stated), found that high levels of maternal PS and maternal prenatal anxiety levels, predicted parent reported inattention and hyperactivity in boys, conduct problems in girls, and behavior/emotional difficulties in both boys and girls, up to age six years. Using the same sample, O'Connor (2005) also found that prenatal anxiety predicted behavior difficulties in pre-adolescent children. In 14-15 year old children, van den Bergh et al. (2005) used a prospective design and reported that children of mothers who had high prenatal stress at 12 to 22 weeks displayed more impulsivity on cognitive tasks at age 14-15 years than children without prenatal stress exposure. Overall, these studies provide evidence that the emotional state of the mother significantly contributes to infant and later child development.

Prenatal Stress and Adult Outcomes. There is a growing body of literature that attributes prenatal stress in humans to later adult development. One of the key studies on this topic utilized a retrospective design to associate prenatal famine with later affective disorders in adults (Brown, Van Os, Driessens, Hoek, & Susser, 2000; Van Os & Selten, 1998). Based on a cohort that was exposed to the Dutch famine, the researchers found that individuals exposed during the second and third trimester of pregnancy were more likely to develop affective disorders than non-exposed individuals or those exposed during the first trimester. The major limitation of these studies is that they each employ a retrospective design. Although there are many issues associated with retrospective designs, one significant drawback is that "a significant correlation between life events and birth outcomes may indicate merely that adverse birth outcomes cause increased reporting of life events" (Lobel, 1993, p 234). In addition, the results may be a function

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of famine rather than stress *per se*. Nonetheless, these studies provide some evidence (albeit weak at best) that stress experienced by the mother during pregnancy also affects the child. This now raises the question of how psychosocial stress experienced by the mother is transmitted to the baby.

Stress and the HPA in humans

Since PS has been linked to problems with emotional and attention regulation in infancy (de Weerth et la., 2003; Dunkel-Schetter, 1998; Huizink et al., 2002; Lou et al., 1994; Meijier, 1985; Mohler, Parzer, Brunner, Wiebel, & Resch,, 2006; O'Connor et al., 2002; Paarlberg et al., 1999), childhood (Brouwers et al., 2001; Laucht et. Al., 200; McIntosh et al., 1995; O'Connor et al., 2005) adolescence (O'Connor et al., 2003; 2005; van den Bergh et al., 2005) and in adulthood (Brown et al, 2000; Van Os et al., 1998), the areas responsible for this behavior and therefore, most likely to be impacted by cortisol is the limbic system.

The limbic system holds among other structures, the amygdala, hippocampus and hypothalamus (Campbell, Mitchell, & Reece, 1997; Elliot, 1999; Shaffer, 1999, Weinstock, 2001). It works in emotional regulation, attention, and memory. As previously mentioned, GC receptors are located within various brain structures (Korte, 2002; Maccari et al., 2003; Mastorakos & Ilias, 2003; Ratka et al., 1989; Ruel & De Kloet, 1985; Vazquez, 1998; Weinstock, 2001), but the highest concentration is in the hypothalamus, hippocampus, and pituitary (Korte, 2002; Maccari et al., 2003; Mastorakos & Ilias, 2003; Ratka et al., 1989; Ruel & De Kloet, 1985; Vazquez, 1998). In the animal literature, there have been documented associations between decreased GC receptors in the amygdala and hippocampus and prenatal corticosterone exposure (Korte,

2002; Francis et al., 1996; Francis & Meaney, 1999; Maccari et al., 2003; Mastorakos & Ilias, 2003; Meaney et al., 1996; Owen et al., 2005; Tsigos & Chrousos, 2002;Vazquez, 1998; Weinstock, 2001). At present, there are no published comparable studies to demonstrate this reduction in the human fetus. So an alternate way to assess this possibility, is by examining the rate of fetal brain development in animals as compared to humans.

The development of the fetal rat brain is similar to a developing human fetal brain up to days 22-23 in the rat and weeks 16-17 (late 1st and early 2nd trimester) for a human (Bayer, Altman, Russo, & Zhang, 1993). In the rat brain, the hypothalamus, hippocampus, and amygdala are structurally formed from day 13 to 19 (Bayer et al., 1993; Weinstock, 2001). In humans however, these areas are structurally developed from week 5 to 19. However, refinement of these structures (i.e. development of dentate granule cells of the hippocampus) is not completed until week 32 (mid 3rd trimester). By the 7th month, most cell migration and differentiation has occurred (Bush, Lou, & Posner, 2000; Paus, 2001; Bourgeois, 1997; Levitt, Reinoso, & Jones, 1998; Rakic, 2002; Weaver, la Plante, Weaver, Parent, Sharma, Diorio et al., 2001). Afterwards mylenation and synaptic development of the cells continues into adolescence. So depending on the timing of exposure, cortisol can alter the development of early structural components of the fetus, the development of more refined imbedded structures, or the mylenation process. However, continued exposure to stress could impact all of these areas. So the published reports of difficulties with attention and emotional regulation in infancy and into adolescence following PS (Brouwers et al., 2001; de Weerth et al., 2003; Dunkel-Schetter, 1998; Huizink et al., 2002; Laucht et. al., 2000; Lou et al., 1994; McIntosh et

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al., 1995; Meijier, 1985; O'Connor et al., 2002; 2003;2005; van den Bergh et al., 2005), is likely mediated by prenatal stress hormone exposure to these parts of the fetal brain.

As previously mentioned, research in animals has documented that the experience of stress is associated with the arousal of the HPA axis (Barbazanges et al.,1996; Korte, 2002; Schneider, Coes, & Lubach, 1992; Sapolsky, 1997; Weinstock et al., 1992). This has also been documented in pregnant women as well. For example, Wadhwa, Dunekl-Schetter, Chicz-DeMet, Porto, and Sandman (1996) examined the association between HPA activity and stress in a sample of pregnant women. Using the multidimensional approach to stress discussed earlier, researchers recruited pregnant women at or before 28 weeks of gestation and assessed life events, perceived stress, chronic stress, daily hassles, social support, pregnancy anxiety, and personality during their prenatal visit between the 28^{th} and 30^{th} week of gestation. In addition, hormonal levels of ACTH and cortisol were also assessed. Data analysis showed that perceived stress was significantly correlated with ACTH ($r = .44$). Multiple regressions (controlling for demographic and personality variables) that combined the stress and social support variables predicted 36% of the variance in ACTH and 13% in cortisol. However, when time of blood draw was added, these variables accounted for 22% of the variance in cortisol. It important to note that pregnancy and delivery complications were not taken into account in these analyses, and therefore may be confounds to the results.

PS stress hormones and fetal development. Using the animal literature as a model, it is now believed that the HPA axis serves to mediate the relationship between maternal stress and infant development in humans as well (Dodic et al., 2002; Huznik et al., 2004; Maccari et al., 2003; Matthews, 2000; Nyirenda & Seckl, 1998; Owen et al.,

2005; Sapolsky, 1997; Wadhwa et al., 2001). Gitau and Glover (2003) examined the acute stress caused by intrauterine needling on maternal and fetal CRH concentrations during gestational age 17 to 38. They found that maternal and fetal levels of CRH were significantly correlated with each other. Other work by Gitau et al. (1998) also found a linear relationship between maternal and fetal cortisol. In fact, maternal cortisol in this sample accounted for 40% of the variance in fetal concentrations.

As discussed previously, the presence of CRH during pregnancy serves two main functions. One function is its role in the stress response feedback loop (Majzoub & Karalis, 1999; Challis et al., 1995). It also functions as a natural process that assists with the timing of delivery (Korte, 2002; Lockwood, 1999; Majzoub & Karalis, 1999; Mastorakos & Ilias, 2003; Owen et al., 2005; Petraglia et al., 1992; Sandman et al., 2002; Smith, 1999; van den Bergh, 2005). Specifically, levels of cortisol gradually rise across pregnancy and eventually peak during the third trimester in preparation for parturition. Although there are many benefits to this natural rise in cortisol, one of its functions is to initiate lung maturation of the fetus (Haram, Mortensen, & Wollen, 2003). The importance of this process is most easily seen in women at risk for preterm delivery.

Women who are between 23 and 34 weeks of gestation and at risk for preterm delivery are typically given 2 doses of 12mg betamethasone or 6mg dexamethasone (a synthetic stress hormone) to help facilitate fetal lung development and prevent respiratory distress syndrome (RDS) (Haram et al., 2003). However as seen in other research where high levels of stress hormones are related to neuronal deficits in animals (Barbazanges et al., 1996; Korte, 2002; Schneider et al., 1992; Weinstock et al., 1992), too much dexamethasone can result in marked atrophy of hippocampal cells (Uno et al., 1994) as

well as decreased birth weight and head circumference in newborns (French, Hagan, Evans, Godfrey, & Newnham, 1999).

Given its influence on delivery, it is not surprising that high CRH levels during gestation are also correlated with an increased risk of preterm delivery (Glynn, Wadhwa, & Sandman, 2000; Mastorakos & Ilias, 2003; Ruiz, Fullerton, Brown, & Dudley, 2002; Smith, 1999; Wadhwa et al., 1996; Welber & Seckl, 2001). For example, Wadhwa et al. (1998) examined CRH of women who were between 28 and 30 weeks of gestation. Results demonstrated a significant negative relationship between CRH and gestation length. In addition, CRH was positively correlated to preterm delivery (r=.48). Hobel et al. (1999) also examined CRH during pregnancy. They focused on CRH, cortisol, and ACTH levels between 3 time periods: 18 to 20, 28 to 30, and 36 to 38 weeks of gestation. In addition, researchers also included self report measures of perceived stress and anxiety. Women with high CRH and ACTH levels across all three time periods were more likely to experience preterm delivery than women who did not. Cortisol at 18 to 20 weeks and 28 to 30 weeks was also related to preterm delivery. Analyses also revealed that maternal stress at 18 to 20 weeks of gestation accounted for a significant amount of variance in CRH levels at 28 to 30 weeks of gestation.

Prenatal stress hormones and infant development. Stress hormones during pregnancy also affect fetal and infant development as well. Sandman et al. (1998) examined CRH concentrations in mothers and their fetuses between the 31st and 32nd week of gestation. Results showed that fetuses of mothers with high concentrations of CRH did not respond to a novel stimulus repeated over time. According to the researchers, the "dishabituated response" of the fetus to the stimulus implies that CRH

has a direct influence on learning and memory associated with the parahippocampal region of the brain. There is also some evidence that this carries over into infancy and childhood as well.

Ponirakis, Susman, and Stiftler (1996) examined morning salivary cortisol during pregnancy and infant outcomes in a sample of adolescent women. Researchers assessed the women at 16 weeks of gestation, at 32-34 weeks of gestation, 24 hours after birth, and at 4 weeks postpartum. Data analysis revealed that women with overall higher levels of cortisol during pregnancy delivered infants who were more likely to need resuscitation at delivery. However, only maternal cortisol during early pregnancy (16 weeks gestation) was a significant predictor of lower infant APGAR scores at 1 and 5 minutes. de Weerth et al. (2003) also examined maternal cortisol during pregnancy. Infant temperament was assessed across postnatal week 1 through 20 using videotaped bathing sessions; temperament questionnaires were also completed during weeks 7 and 18. Mothers were divided into high and low cortisol groups based on a prenatal assessment conducted at 36 weeks of gestation. Mothers in the high cortisol group were more likely to deliver early as well as have infants who displayed more crying, fussing, and negative facial expressions than mothers in the low cortisol group. Obel et al. (2005) examined life stress and cortisol during early, mid, and late pregnancy. Results showed that evening cortisol levels of women with more than one life stressor were 27% higher than women without one life stressor.

Psychological stress, hormones, and infant outcomes. Other researchers have also included measures of maternal psychological stress and hormones in their analysis. For example, Lundy et al. (1999) examined depression with a clinical structured interview

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and cortisol using urine in a sample of pregnant women. They found that depressed mothers not only had higher cortisol levels (average: 400.05ng/mg depressed vs 269.17ng/mg non-depressed) but their full term newborn infants also exhibited high cortisol levels (average: 562.07ng/mg vs 348.20ng/mg) as well. Further analysis of the infants also revealed that infants of depressed mothers, compared to those without depressed mothers, were more withdrawn, had more abnormal reflexes, and more difficulty orienting to new objects. Field, Diego, Dieter, Hernandez-Reif, Schanberg, Kuhn et al. (2001) compared nondepressed mothers with withdrawn or intrusive mothers on their prenatal cortisol, dopamine levels, and on neonatal outcomes in full term infants. Results showed that compared to non-depressed mothers, withdrawn mothers had higher cortisol levels during pregnancy and their newborns also had higher cortisol levels and the most asymmetrical EEG patterns. Newborns of depressed mothers also had lower scores on the Brazelton infant development scale.

Other researchers have examined the relationship between anxiety and hormones on infant development. For example, Vaughn, Bradley, Joffe, Seifer, and Barglow (1987) examined anxiety and maternal hormones during pregnancy and infant temperament at 4 months. Unlike the previous studies, investigators found that ACTH measured during the 3rd trimester was not related to later infant temperament. However, anxiety during pregnancy was significantly correlated with difficult infant temperament at 4 months.

Field, Diego, Hernandez-Reif, Scanber, Kuhn, Yando, and Bendell (2003) examined anxiety and comorbid depression in addition to urinary hormonal levels during the second trimester in a sample of women with self-report and observer data. They

found that women who reported high anxiety also experienced high levels of depression. Results also showed that compared to fetuses of low anxious mothers, high anxious mothers were significantly more active and had smaller abdominal circumferences. Mothers with high anxiety also had high norepinephrine and low dopamine levels during pregnancy, there were no significant differences in cortisol. Their newborns had significantly low vagal tone and levels of dopamine and serotonin but no differences in cortisol. A sleep assessment, demonstrated that these infants also spent more time in deep sleep and less time in quiet and alert states. Given the occurrence of prenatal of stress, it stands to reason that these stressors may continue into the postnatal period, also affecting infant development. Unfortunately these studies did not consider the possible confound of the postnatal environment on infant development.

Postnatal Stress in Humans

Research has shown that postnatal emotional stress experienced by the caregiver significantly contributes to infant and child development (Field, 1998; Shaw, Vondra, Hommerding, & Keenan, 1994; Weissman, Prusoff, Gammon, 1984; Lyons-Ruth, Wolfe, & Lyubchick, 2000). One of the earliest studies on this topic examined 8 month old infants of anxious mothers (Davids, Holden, & Gray, 1963). Using the Bayley Scales of Infant Development, they found that infants of highly anxious mothers were more likely to have lower scores on the Bayley than low anxious mothers. Other studies have extended these findings. Specifically, infants of anxious women are more likely to be irritable, sleep poorly, be more active, and be less responsive than infants of mothers with low anxiety (Farber, Vaughn, & Egeland, 1981; Warren, Gunnar, Kagan, Anders, Simmens, Rones et al., 2003; Ferriera, 1960). Observational studies of infants of

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depressed mothers have documented that at 3 months these infants display fewer facial expressions, cry less, display fewer head orientations towards stimuli, and are more fussy than infants of nondepressed mothers (Martinez, Malphrus, Field, Pickens, Yando, Bendell et al., 1997).

Emotional stress can also occur with other types of stressors to affect the infant as well. For example, Righetti-Veltema, Conne-Perreard, Bosquet, and Manzano (2002) examined postpartum depression and interactions between mothers and their 3 month old infants. Depressed mothers experienced more negative life events, more professional and financial restrictions, and overall had more worries since the birth of their infant. Infants of depressed mothers cried more and had increased difficulty with eating and sleeping and had fewer vocalizations than infants of nondepressed mothers. In addition, the depressed mothers also reported less positive feelings about their infant. Based on the caregiver experience of postnatal stress, it may be that his/her parenting behavior is also compromised.

Parenting and Postnatal Stress

As discussed in the animal models, one of the mechanisms thought to mediate postnatal stress is parenting behavior. Ideally, parenting behavior is the exchange of interactions between the mother and the child. When babies cry, receptive mothers tend to respond by feeding, changing, or soothing the child. Problems arise when the mother is not responsive. In this case, when a mother does not respond to her child's crying, the child is unable to regulate his/her system (Hofer, 1987). Unlike the prenatal literature, most of the research on postnatal stress and parenting focuses on maternal depression.

According to McFarland and Sanders (2003), the children of depressed mothers

are exposed to a different parenting environment than those of nondepressed mothers. Specifically, the environment these children experience is "characterized by lack of responsiveness, higher levels of negative affect, and poor supervision" (p 41). Research has shown that depressed mothers tend to have either a withdrawn or intrusive interaction style (Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Field, 1986; Tronick & Field, 1986). One explanation for the restrictive parenting of depressed mothers may be their inability to tolerate excessive activity (Cohn et al., 1986). There are many studies that have supported this idea. For example, Martinez et al. (1997) reported that depressed mothers demonstrated fewer facial expressions and a lower interaction rating regardless of whether or not they were interacting with their own infant or an infant of a nondepressed woman. Fleming, Ruble, Flett, and Shaul (1988) reported that depressed mothers were less inclined to respond to their infant's vocalizing than nondepressed mothers. One of the seminal studies conducted in this area was carried out by Field (1984). In this study, depressed and nondepressed women were recruited at the time of delivery and followed up 3 months later with their infants. The researcher used a "depressed" interaction where the mother pretended to be depressed and then a reunion where normal affect was restored to examine how this simulation affected depressed and nondepressed dyads. Results showed that across interactions, infants of nondepressed mothers displayed more positive facial expressions, fewer negative expressions, more vocalizations, and protesting than infants of depressed mothers. In addition, unlike nondepressed mothers, the behavior of the depressed mothers in the interactions did not change. These results suggest that the infants of depressed mothers are accustomed to the depressive behavior of their mother and therefore do not react in an otherwise anxiety-

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Unlike the previous studies, that only examined depression, recently some studies have begun to examine parenting in other stressful states as well. Assel, Landry, Swank, Steelman, Miller-Loncar, and Smith (2002) used a combined emotional stress score (depression, anxiety, and anger) to assess emotional stress and parenting in 3 year old children. Analysis showed that mothers who experienced higher levels of stress were less warm and flexible in their interactions with their children. Interestingly, this study also found that mild levels of emotional stress also affected parental sensitivity to their children's needs.

Warren et al. (2003) examined the infants of mothers with panic disorder. Based on two samples of infants at 4 months and at 14 months, researchers examined parenting behaviors, cortisol, infant sleep, and infant temperament. They found that the infants of mothers with panic disorder did not show more reactivity, behavioral inhibition, or ambivalent attachment. Instead they found that these infants exhibited higher cortisol levels and more disturbed sleep compared to infants of non-panic disorder mothers. Panic disorder mothers were also less sensitive to their infants than non-panic disorder mothers. Together these studies show that both high and low levels of maternal psychological stress can impact parenting and child behavior and physiology.

Prenatal stress, hormones and later outcomes.

To date there are only a handful of studies that have examined PS, maternal physiology, and infant development while considering the postnatal environment. Huizink et al. (2003) examined prenatal stress in early, mid, and late gestation in a sample of healthy term infants and assessed infant development up at 3 and 8 months.

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Rationale

They found that after controlling for postnatal depression and perceived stress, high levels of pregnancy anxiety predicted lower mental and motor development among 8-month-old infants. They also found that daily hassles in early pregnancy were related to lower mental development scores on the Bayley at 8 months. This study also assessed the influence of maternal physiology. Specifically, prenatal maternal salivary cortisol in late pregnancy displayed an inverse relationship with motor and mental development scores at 3 months. Guitteling, de Weerth, & Buitelaar (2004) using the same sample as Huizink (2003), found that 4 to 6 year old children who were exposed to high levels of morning cortisol had higher levels of cortisol after vaccination than other children. Unfortunately these studies did not consider parenting behaviors that, as previously mentioned, do influence infant outcomes.

Susman, Schmeelk, Ponirakis, and Gariepy (2001) conducted a longitudinal study examining prenatal stress, postnatal stress, concurrent stress, physiology, and parenting among 3-year-old children. They found that the children of women who experienced low levels of hormones (cortisol, testosterone, and estradiol) during pregnancy, displayed more verbal and nonverbal aggression than children of mothers in the high group. Unfortunately this study did not individually distinguish between the hormones so it is difficult to determine how they may independently impact later child development. Another limitation of this study is that the influence of the postnatal environment was not controlled in the analyses for PS. Therefore, these results should be interpreted with caution, because they are confounded with the influence of either the pre or postnatal environment.

Rationale for the Present Study

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The purpose of this dissertation is to examine maternal cortisol as a mediator of the relationship between PS experienced by the mother and infant regulation development at 3 months. Over the past decades many researchers have speculated and found support for the idea that maternal experience of stress during pregnancy can have a lasting impact on infant development (de Weerth et al., 2003; Dunkel-Schetter, 1998; Huizink et al., 2002; Lou et al., 1994; Meijier, 1985; Paarlberg et al., 1999). Only recently though have researchers identified the mechanism that may be responsible for the transmission of maternal stress during pregnancy to the infant (Gitau et al., 1998; Stewart et al., 1995).

According to the animal literature, the theorized mechanism is the maternal HPA axis. Specifically, it is the maternal experience of stress and the subsequent arousal of the HPA system that mediates the relationship between PS and offspring development (Barbazanges et al., 1996; Clark et al., 1997; Mastorakos et al., 2003; Schneider et al., 1992; Weinstock, 1997). Although work with animals does not directly overlap with human development, it does provide a solid basis for extrapolating the same model to humans. Researchers have documented a possible direct relationship between maternal cortisol during pregnancy and the fetus, infant birth outcomes and a relationship between cortisol at delivery (French et al., 1999; Gitau et al., 2001;Glynn et al., 2000; Haram et al., 2003; Wadhwa et al., 1996; Wadhwa et al., 2001) and later infant developmental outcomes as well (de Weerth et al., 2003; Field et al., 2001 & 2003; Huizink et al., 2002; Lundy et al., 1999; O'Connor et al., 2004; Ponirakis et al., 1996; Sandman et al., 1998). A relationship between maternal stress hormones and maternal stress has also been identified (Arishima et al., 1977; Zarrow et al., 1970). Given the relationship among

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these variables and what is already known in the animal literature, it seems logical that the maternal HPA axis may also mediate the relationship between maternal psychosocial stress during pregnancy and infant outcomes (Dodic et al., 2002; Huznik et al., 2004; Maccari et al., 2003; Matthews, 2000; Nyirenda & Seckl, 1998; Sapolsky, 1997; Wadhwa et al., 2001). Unfortunately, the mediational role of the HPA axis has yet to be examined within humans. In addition, most extant studies suffer from methodological problems. For example, they often do not specify what times of the day cortisol was collected. This is important because cortisol fluctuates based on a diurnal pattern where peak levels occur in the morning. So depending on the time, the ability to detect significant observable levels may vary.

Another important consideration is the postnatal environment. Research has shown that postnatal stress experienced by the caregiver significantly contributes to infant and child development (Davids et al., 1963; Farber et al., 1981; Field et al., 1998; Lyons-Ruth et al., 2000; Shaw et al., 1994; Weissman et al., 1984; Warren et al, 2003). In addition, postnatal parenting behaviors can also be compromised by caregiver stress (Hofer, 1987). This in turn can lead to dysregulation in infant regulatory behaviors (Field, 1984; Warren et al., 2003). Therefore considering the contribution of these variables in the context of prenatal stress and infant regulation is essential.

The majority of work in the area of PS omitted the HPA component and focused primarily on maternal stress during pregnancy or how stress during pregnancy influenced delivery outcomes. Further, very few studies have gone beyond assessing delivery outcomes to examine the lasting effects of PS on later infant development. The handful of studies that have extended beyond this time frame are typically retrospective and

correlational--methodologies which have inherent limitations. Therefore a critical analysis of the maternal HPA axis as a mediator of PS and infant regulation development is essential.

Another difficulty in this research is the multiple and imprecise definitions of stress employed. In animal studies, the stressors are easily operationalized and examined. Stress in humans, however, is harder to define. Stress has been defined as the occurrence of external events such as life events or daily hassles or as internal events such as perception of stress or emotional distress. However, given the complex multidimensional nature of humans, stress does not consist of just one type of stressor, rather stress is the combination of many individual events or states that a person deems or perceives to be stressful (Lazarus & Folkman, 1984). The perception of stress is the pivotal factor influencing transmission of mental stress to physical stress and the HPA axis. It is *not* the occurrence of an event that produces a physiological reaction, rather it is how a person perceives the event that matters (Kalat, 1998; Korte, 2001).

Overall, there appears to be several gaps in the current literature on the mediational role of the HPA axis on PS and infant regulation. To address these gaps, the purpose of this dissertation is to further the literature by examining PS and infant regulation at 3 months examining maternal cortisol during pregnancy as a mediator. Because cortisol is highest during the last trimester of pregnancy (Huizink et al., 2004; Korte, 2002; Mastorakos & Ilias, 2003; Smith, 1999) and since this time period is thought to be the most predictive of infant outcomes (Obel, Hedegaard, Henriksen, Secher, Olsen, & Levine, 2005), women between 30 and 35 weeks of pregnancy will be examined.

The 3 month assessment of infant regulation was chosen for two primary reasons.

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For infants the time between 2 and 4 months is referred to as the "first biobehavioral shift" (Emde, Gaensbaurer, & Harmon, 1976) because this is when changes in sleep pattern, attention, and irritability emerge (see Barr, 1990; Berg & Berg, 1987). Specifically, adult circadian rhythms emerge between 8 and 10 weeks of age (Castro, Elias, Martinelli, Antonini, Santiago, & Moreira, 2000; Hanna, Jett, Laird, Mandel, LaFranchi, & Reynolds, 1997; Jett, Samuels, McDaniel, Benda, LaFranchi, Reynolds, & Hanna, 1997; Riad-Fahmy, Read, & Walker, 1983; Rokicki, Forest, Loras, Bonner, & Bertrand, 1990). Therefore, infant regulation will be measured by infant temperament (to assess irritability and attention) and infant sleep patterns. In addition, this study will examine the diurnal pattern of maternal cortisol.

To this end, the present study used a prospective design to examine pregnant women in the last trimester of pregnancy and assessed how maternal cortisol mediates the relationship between high versus low PS and infant temperament and sleep development at 3 months. In addition, to clarify the nature of this relationship, the influence of postnatal stress and parenting were also considered.

Hypotheses:

a. PS will have a direct effect on infant regulation.
b. PS will have a direct effect on cortisol.
    1. Cortisol examination using A.M. and P.M. values will be viewed as exploratory in nature so specific hypotheses are not provided.
c. Cortisol will have a direct effect on infant regulation.
d. Cortisol will mediate PS and infant regulation.
e. PS have a direct effect on postnatal stress.

f. P

g. P

h. P

i. P

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f. Postnatal maternal stress will have a direct effect on infant regulation.

g. Postnatal maternal stress will have a direct effect on parenting competency.

h. Parenting competency will have a direct effect on infant regulation.

i. Parenting competency will mediate postnatal maternal stress and infant regulation.

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METHOD

Participants

At time 1, participants were 92 women ranging in age from 18 to 39 (M=26, SD=5.3) and between 27 and 36 weeks of gestation (M=33, SD=1.89) at the time of interview. Fifty-eight percent of the sample was single never married and forty-two percent was married or divorced. Fifty percent of women were White, 29% were Black, 8% of women were Latina, and the remaining 13% of women were Native American, Asian/Pacific Islander, or Multi-racial. The median monthly income was $2,036 and ranged from $0 to $8,000. Eighty-two percent of women were at least high school educated. Twenty percent of women smoked during pregnancy. The average level of A.M. salivary cortisol was 12.22 nmol/L (SD 7.78) with a range of .00 to 36.14 nmol/L. The average P.M. salivary cortisol was 7.95 nmol/L (SD 7.43) with a range of 1.10 to 65.11 nmol/L. See Table 1 for details.

At time 2 when the infants were 3 months, seventy-one percent or a total of 65 participants returned for the study. The average age of the infant at the interview was 3.9 months ranging from 2.1 to 7.3 months (corrected for prematurity). Forty-nine percent of infants were boys and fifty-one percent were girls. Twenty-eight percent of children were Black, 34% were Caucasian, 27% were bi-racial, 4% were multi-racial, and the remaining 4% were Asian and Latino. The average age of gestation at delivery was 39 weeks (range: 26-42). The average weight at birth was 7lbs. 9oz., ranging from 4lbs. 14oz. to 10lbs. 9ozs. Ninety-one percent of births were considered full-term (37 to 42 weeks), 13% (N=8) were considered moderately premature (between 32 and 36 weeks), and 2% (N=1) were considered extremely premature (before 28 weeks). There was an

average of 4 health risk factors during pregnancy (i.e., diabetes, HIV, cancer, smoking, etc). See Table 2 for details of the sample at T1 and T2 and procedures section for details of the recruitment.

Measures

Demographics. A 22 item demographic questionnaire assessing ethnicity, marital status, family income, occupation, and participant education was administered during pregnancy. See Appendix A for a copy of the measure.

Maternal Health. Adapted from Bogat and Levendosky (1999), this is a 35-item health questionnaire that assesses various chronic health conditions as well as pregnancy-related health conditions. This measure was administered during pregnancy. For example, participants are asked to answer with yes "1" or no "2" if they "have ever been diagnosed by a medical professional" with HIV, cancer, or gestational diabetes. See Appendix B for a copy of the measure.

Physical Health Symptomatology (Cohen & Hoberman, 1983). This is a modified version of the Cohen-Hoberman Inventory of Physical Symptoms. This 19-item questionnaire assesses physical symptoms such as fatigue, coughing, muscle, or sleep problems related to stress. This measure was administered during pregnancy to assess physical health before and during pregnancy and postnatally to assess symptoms not accounted for in the last month of pregnancy and postnatal symptoms. Each statement is answered on a 5 point scale ranging from 0 "never" to 4 "3 or more times a week." The scale was modified to assess symptoms before, during and after pregnancy. Scores were summed and can range from 0 to 76, the reported reliability of this scale .92. The reliability for this sample was .90 at T1 and T2. See Appendix C for a copy of this

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Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20 item scale that is used to measure symptoms of depression during the past week. Symptoms that are assessed in this questionnaire include guilty feelings, hopelessness, changes in appetite, or sleep disturbances. This measure was administered both pre and postnatally. Participants are asked to rate statements of how they have felt during the past week. Examples of statements include "I felt depressed" or "I thought my life had been a failure." Each statement is ranked on a 4 point scale from 1 "Rarely or none" to 4 "Most or all the time." The results are then summed. Scores were summed and can range from 0 to 60 the reported reliability of this scale was .95. The reliability for the current sample was .80 at T1 and .79 at T2. See Appendix D for a copy of the measure.

State-Trait Anxiety Inventory (STAI; Spielberger, Grousch, & Lushene, 1970). The STAI is a 40-item inventory used to assess symptoms of state and trait anxiety. This measure was administered both pre and postnatally. The scale has 2 subscales: state and trait anxiety. The state anxiety scale measures transient anxiety at the time of administration. The trait anxiety subscale measures stable anxiety. Examples of items include "I feel nervous" and "I am calm." Participants are asked to rate the intensity of their anxiety on a scale from 1 "Not at All" to 4 "Very Much so." Scores were summed and can range from 40 to 160, the reported reliability for this scale was .90. The reliability for this sample was .95 at T1 and .93 at T2. See Appendix E.

Perceived Stress Scale (PSS; Cohen, Kamark, & Mermelstein, 1983). The PSS is a 13-item scale used to measure the degree of stressfulness of events in the last month.

This measure was administered both pre and postnatally. This scale is designed to measure how unpredictable, uncontrollable, and overwhelming daily events are to the individual. Examples of items include "How often have you felt confident about your ability to handle personal problems" and "How often have you been upset because of something unexpected happening?" Participants are asked to rate these items on a 5-point scale ranging from "never" to "very often." Scores were summed and can range from 13 to 52. The reported reliability for this scale is .94. The reliability for this sample was 61 at T1 and .63 at T2. See Appendix F for a copy of the measure.

Life Experiences Survey (LES: Sarason, Johnson, & Siegel, 1978). This is an adapted version of the original 49-item measure of life events. Items related to males, becoming pregnant, or having an abortion were omitted in prenatal administration. Becoming pregnant and having an abortion were included in the postnatal administration. Participants are asked to indicate the time period in which the event occurred and then rate the stressfulness of the event on their life. Examples of life experiences include "divorce," "death of close family member," and "new job." Participants are asked to rate the impact of the event on a 4-point scale -3 "extremely negative" to 0 "no impact." Scores of stress were summed and can range from 0 to 60; the reported reliability coefficient for the scale is .63. The reliability for this scale was .70 at T1 and T2. See Appendix G.

Daily Hassles Questionnaire (DHQ: DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982). This is an adapted version of the original 117-item scale that assesses daily stressors. This measure was administered both pre and postnatally. Items related to becoming pregnant were omitted for T1. Participants are asked to indicate daily hassles

such as "concerns about job security" or "not enough money for food" that have occurred in the last month. They are then asked to rate the severity of the stressor from 0 "No Impact" to 3 "Extremely Severe." Scores are summed and can range from 0 to 342. The reported reliability coefficient for the scale was .98. The reliability obtained from this sample was .93 at T1 and .98 at T2. See Appendix H.

Birth, pregnancy, and delivery questionnaire (Bogat & Levendosky, 1998; Spencer & Coe, 1999). This 39-item questionnaire was adapted from the original scales and asks questions about chronic health conditions diagnosed in the last weeks of pregnancy, delivery complications, and child health at 3 months. Women answer questions that inquire about chronic health conditions in the mother during the last weeks of pregnancy, length of delivery, and current child health with a yes or no. See Appendix I.

Infant Care Scale (ICS: Frotman & Owen, 1989). The ICS is a 52-item scale that measures maternal perception of efficacy regarding caring for their infant. Participants are asked about knowledge of infant health, diet, and safety. Participants are asked to rate their confidence in each item on a 5-point scale ranging from 1 "very little" to 5 "quite a lot." Scores were summed and range from 52 to 260, the reported reliability of this scale is .98. The reliability of the scale for this sample was .96. See Appendix J.

Infant Behavior Questionnaire (IBQ; Rothbart, 1981). The IBQ is a 94-item measure of infant temperament. The scale consists of 6 subscales: soothability, activity level, distress to limitations, duration of orienting (attention), distress and latency to approach, and smiling and laughter. Example of items include "during sleep how often does your baby toss about in the crib" or "when face was washed how often did the baby

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fuss or cry." Participants were asked to rate items on a 7 point scale ranging from 1 "Never" to 7 "Always." Reported reliability for this scale ranges from .72 to .85. The reliability of the 6 subscales for this sample ranged from .16 to .80. Since the reliability of the soothability scale was .49 and the reliability of the distress and latency to approach scale was .16 they were omitted from all analyses. This includes the following items: 9, 10, 11, 30, 33, 35, 42, 44, 45, 46, 50, 54, 61, 75, 76, 77, 79, 83, 84, 86, 88, 89, 90, 94). See Appendix K.

Cortisol. During the prenatal period, two saliva samples (one morning and one afternoon) were obtained from the women in one 24-hour period. Each participant was instructed not to eat or drink 20 minutes before providing the sample. The time of saliva collection was recorded for each sample. The first saliva sample was provided individually by the woman 20 minutes after awakening in the morning on the scheduled day of the interview. The second sample was obtained 20 minutes after the afternoon interview began between the hours of 3:30 P.M. and 6:00 P.M.

Participants were asked to chew on the end of a straw or chew Trident gum for 1 minute to stimulate saliva flow. Using a straw, women dispensed a volume of 0.5 -1.0ml of saliva into a container. Morning samples were refrigerated until the afternoon interview. Both samples were then frozen at (-20°C) in a locked freezer and then analyzed in duplicate using standard assay procedures discussed by Salimetrics, Inc. (Pennsylvania State University) at Michigan State University. (See Appendix L for instructions).

Infant Sleep (IS; Jones, 2004). This is a measure of infant regulation designed to assess the most typical sleeping patterns of infants. Participants are asked to think about

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the most recent and typical 24-hour period of sleep for their infant. Then, based on 1-hour time blocks over a 24-hour period, participants are asked to report whether their infant was asleep or awake during a given block. Infants between 10 and 12 weeks of age (3 months) can be expected to sleep on average for 14 hours a day with 5 consecutive hours occurring at night (Mayoclinic Staff, 2006). Therefore, sleep was defined based on total consecutive night sleep from 7 p.m. to 7 a.m. So each consecutive hour of sleep was totaled to obtain one score for total consecutive night sleep from 7PM to 7AM.was obtained (See Appendix M).

Procedure

A total of 92 women were interviewed during the 3rd trimester of their pregnancy (T1), and 64 women returned for a second interview conducted when the infant was 3 months old (T2).

Recruitment. Participants were recruited for the study through referral and fliers placed at local OB/GYN offices, health department prenatal clinics, and other places that offer pregnancy services. (See Appendix N). Women who were interested in participating in the study were screened over the telephone for week of gestation during pregnancy, health, and experience of domestic violence. (See Appendix N). Women were excluded from the study if they were not singleton pregnancies, not between the ages of 18 and 40, if they occasionally or often smoked or used other substances during pregnancy, if they had health conditions that could negatively affect pregnancy, if they experienced severe domestic violence, or if they had limited knowledge of the English language. After meeting criteria and if she agreed to participate in the study, an interview date and time were scheduled for the 1st interview. At this time, each woman was

assigned a subject number, which was kept separate from her identifying information. The day before the scheduled interview at T1, women were contacted and personally provided with a saliva sample collection packet. At this time, instructions regarding sample collection were reviewed (See Appendix O) and any questions were addressed. At the time of the scheduled afternoon interview, each woman was given a consent form (See Appendix P). Women were also asked for recontact information for the Time 2 interview (See Appendix Q). Recontact people were individuals who would know where to locate the participant if she could not be located directly by the researcher. This information was also kept in a separate locked file cabinet.

Cortisol samples were stored in a locked freezer and, upon analysis, the samples were destroyed and the information obtained from the analysis was stored in a locked file cabinet identified only by subject number. The assays were carried out in three runs using reagents from the same lot. For each run the instrument was calibrated according to the manufacturer's instructions. Commercially prepared high, medium and low controls were included in each run. The interrun Coefficients of Variability (CV's) for the controls were as follows: for the low control, 6.5%, for the medium control, 3.9%, and for the high control, 6.8%. A single assay was performed on each sample and control since the intrarun assay CV's on this machine are reported by the manufacturer to be less than 5%. All the samples had values within the reportable range and in terms of absolute.

Approximately, one week after the reported due date, participants were contacted to confirm each infant's date of birth, weight, length, and head circumference. Participants were then contacted 11 weeks after the due date to schedule an interview for the 2nd assessment. The second assessment took place in the 3rd month postpartum

between weeks 12 and 16. Four attempts were made to reach each participant at the initial postnatal contact and for the 2nd interview at 3 months. If these attempts were unsuccessful within 1 week, a letter was sent to the woman's home requesting her to contact the office to set up an appointment. If participants could not be reached within the 2nd week, the recontact people were contacted either by phone or letter to reach the participant.

Data Collection and Data Entry. Ten undergraduates were trained to administer both interviews. Each interviewer underwent 3 weeks of training to become competent and reliable in interview procedures and troubleshooting through role-playing, shadowing interviews, and other techniques. In addition, after training, each interviewer attended a weekly meeting to address any concerns or problems experienced during interviews. Each interviewer received Independent Study credits in exchange for their participation.

The above criteria also applied to the 3 undergraduates trained in data entry. Data was double entered and each undergraduate maintained an average of 98% reliability on data entry. Data was then correlated to check for any inconsistencies and data was cleaned to 100% accuracy.

RESULTS

Initial Data Construction

Imputation. All data analysis was conducted on SPSS version 14. Participants were 92 women in their 3rd trimester of pregnancy. Due to 30% subject attrition at T2 (N=27 participants were missing) data imputation using the Hot Deck method (LISREL; Joreskog & Sorbom, 2001) was utilized to estimate data. [The hot deck method of imputation identifies the participants that most closely match the subjects with missing

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data and estimates the missing data based on the responses of the non-missing participants.] All missing scores were imputed using the information obtained during T1 data collection such as: demographic information, weeks pregnant, total stress, total mental health, or perceived stress. To ensure consistency between imputed and non-imputed data, t-tests were used to determine sample differences. There were no significant differences across the imputed variables. See Table 2 for details.

Variable Construction. Cortisol was evaluated by examining concentrations in the A.M. and P.M.

Pregnancy risk factors were calculated based on the initial screen and Maternal Health During Pregnancy questionnaire. One point was assigned to each risk factor such as smoking and alcohol usage (from the screen), or health conditions such as pre-eclampsia or anemia occurring during pregnancy (items 3-28 from the maternal health questionnaire. These items were summed to produce total pregnancy risk factors. The average number of risk factors was 4.03 (SD: 3.06; range: 0 to 14).

Stress during pregnancy was defined based on the Lazarus and Folkman (1984) transactional theory that emphasizes stress perception. Specifically, depression, anxiety, the perception of stressfulness of daily hassles and life events, and overall perceived stress are each combined to form one indicator of stress. To construct these predictor variables, all stress measures (perceived stress, depression, anxiety, life event stress, and daily hassles stress) were correlated to determine if they could be collapsed into one variable. Correlations for T1 revealed that depression and anxiety were moderately correlated $r = .53$, $p<.01$. Life event stress and daily hassles were also moderately correlated $r = .51$, $p<.01$. However perceived stress was not substantially correlated to

other variables so it was analyzed alone. Depression and anxiety did not have a substantial correlation with either life stress or daily hassles. This pattern was replicated with T2 data as well. See Table 5 for details.

Next, to assure an unbiased combination of the measures, T-scores for each individual scale were computed. T-scores for depression and anxiety were combined to form the scale "mental stress." T-scores for life events and daily hassles were combined to form the "life stress" scale.

To further support using combined scales, factor analyses were conducted with the mental stress and life stress variables. Given the low occurrence of daily hassles and life events, a factor analysis was not performed on this data. The factor analysis for mental stress using maximum likelihood extraction was not able to converge when rotated using varimax rotation. Problems like this are associated with data colinearity (Neil Schmitt, personal communication, 2007). Thus, using a combined measure of depression and anxiety as supported by the correlations, was warranted.

Preliminary Data Analysis. The above correlations of variables revealed that outcome infant IBQ variables and predictor variables were weakly intercorrelated at best. Therefore, each was treated as an independent predictor or dependent variable. Due to this, all analyses were conducted using Hierarchical Linear Regression.

To determine covariates, a MANOVA was conducted with all possible covariates predicting each outcome variable. This includes the following predictors: income, education, delivery complications, risk factors during pregnancy (smoking, drinking, alcohol consumption, or health risks), and corrected age of infant. Results showed that only age of baby and pregnancy risk factors were significant predictors so they were used

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A separate MANOVA was conducted using time of cortisol sample as a predictor for cortisol concentration. Results demonstrate that cortisol sample collection times were not significant predictors of cortisol concentration so they were omitted from all analyses.

In addition, based on personal communication from Salimetrics (2006), it was possible that the cortisol values obtained for the study were not accurate due to a change in the Trident Gum formula. According to Salimetrics in 2006, Trident was "no longer recommended as a method of saliva stimulation." In addition, since Salimetrics has no established norms for cortisol during pregnancy (personal communication, 2007), no correction formula is available. So to address this the following procedure was performed. Initial study supplies were purchased in mid-late 2004 (when Trident was still considered an acceptable form of saliva collection) and were approximately enough supplies to cover the first half of participants. The serial numbers of gum packages were not available to analyze for time of purchase and thereby serve as a control. Therefore the sample was split in half to assess the possible confound of Trident on the assay of cortisol. The first half represented the early participants or group 1 (N=46) and the second half represented the later participants or group 2 (N=46). Since the variables were not normally distributed, they were transformed with rank transformation. Next, using ANOVA, the groups were compared across AM and PM cortisol concentrations. There were no significant differences across groups in AM cortisol (p= *n.s.;* Group 1 M = 13.4 nmol/L and Group 2 M = 11.0 nmol/L) or in PM cortisol (p= *.05;* Group 1 M = 8.12 nmol/L and Group 2 M = 6.5 nmol/L).

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of sample collection assay techniques, and time of gestation cortisol ranged to 0.5 nmol/L to 50.5nmol/L (Buckwalter et al., 1999; de Weerth & Buitelaar, 2005; Guettling et al., 2004; Huizink et al., 2003; Paoletti et al., 2005; O'Connor et al., 2005, Obel et al., 2005; Wadwa et al., 1996). However when these studies were examined based on gestation (women between 28 to 37 weeks), method of collection (salivary), and time (A.M. versus P.M.), and varying assay methods, the AM cortisol concentration this current study are within the reported values (de Weerth et al., 2004; Huzink et al., 2003; Guetteling et al., 2004; O'Connor et al., 2005; Paoletti et al., 2005). Specifically morning cortisol for these studies ranged from .75nmol/L to 50.5nmol/L (de Weerth et al., 2004; Huzink et al., 2003; Guetteling et al., 2004; O'Connor et al., 2005; Paoletti et al., 2005) and morning samples for this study for the whole sample ranged from 0.0 to 36.14 nmol/L. However, the afternoon concentrations were not within reported ranges. Reported afternoon cortisol ranged from .50nmol/L to 10.3nmol/L (de Weerth et al., 2004; O'Connor et al., 2005) and afternoon cortisol of the whole sample of the present study ranged from 1.1 nmol/L to 27.31 nmol/L. Though, given the small comparison group and differences in assay methods for the afternoon concentrations, it's likely that these data are within acceptable limits. Especially since they are within the overall non-differentiated reported values of 0.5 nmol/L to 50.5nmol/L (Buckwalter et al., 1999; de Weerth & Buitelaar, 2005; Guettling et al., 2004; Huizink et al., 2003; Paoletti et al., 2005; O'Connor et al., 2005, Obel et al., 2005; Wadwa et al., 1996). However, these data should still be interpreted with caution.

Hierarchical Linear Regression was utilized in all analyses. In the first step, maternal risk factors during pregnancy, corrected age of infant, and T2 stress (for T1

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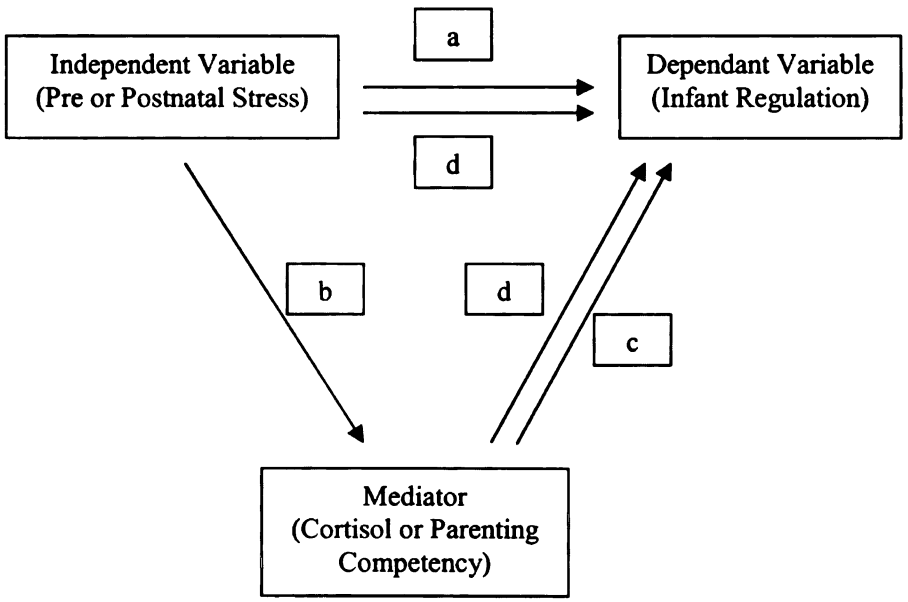
analyses) or T1 stress (for T2 analyses) were used as covariates. Afterwards, the steps outlined in the Baron and Kenny (1986) method of mediation were used. Specifically, a mediator was identified as significant based on several criteria: (1) If the independent variable (pre or postnatal stress) predicts the dependent variable (infant regulation) (a), (2) if the independent variable predicts the mediator (cortisol [am and pm separately] or parenting competency) (b), (3) if the mediator predicts the outcome variable (c), (4) and if the path between the independent variable and dependent variable becomes insignificant with the addition of the mediator (d). See Figure 1. These analyses were completed separately based on type of pre or postnatal stress, time of cortisol collection, and for each IBQ scale and infant sleep.

Figure 1

Mediator Model



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Frequency analysis. Frequency analysis of variables revealed that all variables were normally distributed except income and cortisol. Rank transformations were performed on income and cortisol variables to ensure normal distribution.

Correlations of all variables. Correlations of variables demonstrated significant relationships between T1 life stress, pregnancy risk, and delivery complications. T1 mental stress was also correlated with pregnancy risk. T1 perceived stress was not correlated with any covariate or outcome variables. T2 life stress was correlated with infant activity. T2 mental stress was correlated with parenting competency and delivery complications. T2 perceived stress was correlated with P.M. cortisol and infant duration of orienting. See Table 6 for more details.

Hypothesis A: PS will have a direct effect on infant regulation

Mental Stress and infant regulation. In most cases mental stress was not a significant predictor of infant regulation (distress to limitations: beta = -.03, *p*= n.s.; smiling: beta = .12, *p*=n.s.; duration of orienting: -.09, *p*=n.s.; consecutive sleep (beta = .04, $p<.05$.). However mental stress had a significant main effect for activity (beta = -2.40, $p<.05$). See Tables 6 to 10 for details.

Life Stress and infant regulation. Life stress as a significant predictor of infant regulation was not significant for the following: activity: beta = -.08, *p*=n.s.; distress to limitations: beta = .14, *p*= n.s.; smiling: beta = -.02 *p*=n.s.; duration of orienting: beta = -.19, $p<.05$; consecutive sleep: beta = -.20, *p*=n.s. See Tables 11 to 15 for details.

Perceived stress and infant regulation. Perceived stress was not significant in any condition (activity: beta = -.19, *p*=n.s.; distress to limitations: beta = .03, *p*= n.s.; smiling:

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beta = .22, *p*=n.s.; duration of orienting: beta = .04, *p*=n.s.; consecutive sleep: beta= -.06, *p*= n.s.). See Tables 16 to 20 for details.

Hypothesis B: PS will have a direct effect on cortisol.

Stress and A.M. cortisol. Stress was not a significant predictor of A.M. cortisol: mental stress: beta= -.09, *p*=n.s.; life stress: beta = .07, *p*=n.s.; perceived stress: beta = .12, *p=n.s.* See Tables 21 to 23 for details.

Stress and P.M. cortisol. Stress was not a significant predictor of A.M. cortisol: mental stress: beta= -.18, *p*=n.s.; life stress: beta = -.16, *p=n.s.;* perceived stress: beta = .12, *p=n.s* . Life stress was a significant predictor of morning cortisol (beta = -.11, *p=.05).* See Tables 24 to 25 for details.

Hypothesis C: Cortisol will have a direct effect on infant regulation

A.M. Cortisol and infant regulation. This hypothesis was not supported for any outcome (activity: beta = .09, *p*=n.s., distress to limitations: beta = .08; smiling: beta = -.02, *p*=n.s.; duration of orienting: beta = .08, *p=n.s*; consecutive sleep: beta = -.13, *p*=n.s). See Tables 26 to 30 for details

P.M. Cortisol and infant regulation. This hypothesis was not supported for any outcome (activity: beta = .14, *p*=n.s., distress to limitations: beta = .06; smiling: beta = .03, *p*=n.s.; duration of orienting: beta = .07, *p=n.s*; consecutive sleep: beta = -.00, *p*=n.s). See Tables 31 to 35 for details.

Hypothesis D: Cortisol will mediate PS and infant regulation

A.M. Cortisol was not a significant mediator for any stress condition and any infant outcome. P.M. Cortisol was also not a mediator. See Tables 36 to 68 for details

Hypothesis E: PS will have a direct effect on postnatal stress

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Prenatal mental stress was a significant predictor of postnatal mental stress (beta = .37, $p<.05$). Prenatal life stress predicted postnatal life stress (beta = .30, $p<.05$). Prenatal perceived stress also predicted postnatal perceived stress (beta = .52, $p<.05$). These results demonstrate that prenatal stress does predict postnatal stress. See Tables 69 to 71 for details.

Hypothesis F: Postnatal maternal stress will have a direct effect on infant regulation

Mental stress and infant regulation. Mental stress was not a significant predictor for activity (beta= .04, *p=n.s.*), distress to limitations (beta=.08, *p=n.s.*), smiling (beta= .05, *p=n.s.*), duration of orienting (beta= -.02, *p=n.s.*), sleep (beta=.23, *p=n.s.*). See Tables 72 to 76 for details.

Life stress and infant regulation. Life distress was not a significant predictor for: distress to limitations (beta= -.14, *p=n.s.*), smiling (beta= .03, *p*=n.s.), duration of orienting (beta= .07, *p=n.s.*), (beta=.08, *p=n.s)*. It was significant for sleep (beta= .23, *p*=n.s.) and activity (beta= .30, $p<.05$). See Tables 77 to 81 for details.

Perceived stress and infant regulation. Perceived distress was not a significant predictor for activity (beta= -.19, *p=n.s.*), distress to limitations (beta=.04, *p=n.s.)*,smiling (beta= -.04, *p=n.s.*), sleep (beta=-.09, *p=n.s)*. It was significant for duration of orienting (beta= -.26, *p=n.s.*). See Tables 82 to 86 for details.

Hypothesis G: Postnatal maternal stress will have a direct effect on parenting competency.

Mental stress was a significant predictor for parenting competency (beta=-.35, *p<.05.)*. Life stress (beta= .04, *p*=n.s.) and perceived stress (beta= -.07, *p*=n.s.) were not significant predictors of parenting competency. See Tables 87 to 89 for details

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Hypothesis H: Parenting competency will have a direct effect on infant regulation

Parenting competency was not a significant predictor for activity (beta= -.07, *p=n.s.*), distress to limitations (beta=-.15, *p=n.s.),* smiling (beta= .17, *p=n.s.*), sleep (beta=.23, *p=n.s.).* It was significant for duration of orienting (beta= .24, *p<.05*). See Tables 90 to 94 for details

Hypothesis I: Parenting competency will mediate postnatal maternal stress and infant regulation

Parenting competency was not a significant mediator for postnatal mental stress, life stress or perceived stress and infant regulation. See Tables 95 to 109 for details.

DISCUSSION

Early researchers demonstrated that maternal experience of prenatal stress predicts infant outcomes (Abrams et al.; 1995, Field, 1995; Hernandez-Reif et al., 2002; Rini et al., 1999, Sable & Wilkinson, 2000; Wadhwa et al., 1993). Prenatal maternal stress hormones, such as cortisol, have been shown to be related to infant outcomes as well (de Weerth et al., 2003; Field et al., 2001 & 2003; Huizink et al., 2002; Lundy et al., 1999; Mohler, Parzer, Brunner, Wiebel, Resch, 2006; O'Connor et al., 2004; Ponirakis et al., 1996; Sandman et al., 1998). Based on animal research, it seems likely that stress hormones would also mediate the relationship between prenatal maternal stress and infant outcomes in humans (Dodic et al., 2002; Huznik et al., 2004; Maccari et al., 2003; Matthews, 2000; Nyirenda & Seckl, 1998; Sapolsky, 1997; Wadhwa et al., 2001). Unfortunately to date, there are no known studies in humans that examine cortisol as a *mediator* of PS and infant regulation. Therefore, the purpose of this study was to examine prenatal maternal cortisol was a mediator of maternal experience of stress during

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pregnancy and infant regulation development at 3 months. It was hypothesized that (a) PS will have a direct effect on cortisol (b) cortisol will have a direct effect on infant regulation (c) cortisol will mediate PS and infant regulation (d) PS have a direct effect on postnatal stress (e) postnatal maternal stress will have a direct effect on infant regulation. Given the possible postnatal environmental contributions on infant regulation the following was also hypothesized: (f) PS have a direct effect on postnatal stress (g) postnatal maternal stress will have a direct effect on parenting competency (h) parenting competency will have a direct effect on infant regulation (i) Parenting competency will mediate postnatal maternal stress and infant regulation.

Results for both mediation hypotheses were not supported due to insignificance in supporting analyses. However there was some support for PS as a predictor of infant regulation even after controlling for the postnatal environment. This was also found for postnatal stress after controlling for the prenatal environment. Results are discussed below.

Prenatal cortisol was not related to PS or infant regulation. Thereby it was not a significant mediator for any measure of PS and infant regulation. At first glance these results are a departure from the literature regarding cortisol. First, unlike this study, other research has found prenatal cortisol to be a significant predictor of infant regulation (de Weerth et al., 2003; Lundy et al., 1999; Field et al., 2001; Huizink et al., 2003; Vaughn et al., 1987). One explanation for the insignificant results for cortisol might be related to the complications surrounding cortisol collection in the present study. Before providing cortisol samples, women were instructed (per instructions from Salimetrics, 2004) to chew sugarless Trident gum if they had difficulty generating a saliva sample.

Unfortunately unbeknownst to the researcher, Trident changed their formula at some point during 2005, and according to Salimetrics in 2006 (personal communication, 2006), Trident was "no longer recommended as a method of saliva stimulation." Due to this change, according to Salimetrics, "it is impossible to determine if this impacted the sample collection and if so, to what degree the sample collection was altered." This may also explain why cortisol at both time collections was not significantly correlated to predictor or outcome variables.

Even with possible sample contamination, the values of cortisol are reasonably within the reported values. However, there is still the complication that most studies that examine cortisol during pregnancy are often devoid of information regarding the time of cortisol collection. Further, studies also vary based on their method of stress hormone collection. Some researchers examined blood serum, CRH or ACTH, and still others salivary cortisol. Although each of these methods of collection, especially blood and serum, are highly correlated (Lightman & Everitt, 1986), differences across methodologies still exist and therein make it difficult to draw comparisons across studies.

Another complication is that each study uses a different methodology to examine infant regulation. Some use maternal report, observer data, or a combination of both. There are no standards for examining infant outcomes. The limited number of studies to use as a comparison and the use of maternal report in this study further complicate this issue and provide more support for the lack of findings for cortisol. It may be that this relationship exists only within certain measures of infant regulation. As a further complication, maternal report may be biased and therefore, not the most accurate reflection of infant behavior.

Even with this, the possibility cannot be overlooked that cortisol may *not* mediate the relationship of PS and infant regulation. It may be some other factor that can account for the transmission. One possibility is the placenta. It may be that placental function is likely the most accurate assessment of *actual* cortisol exposure from the mother to the fetus. Since the functioning of 11βHDS2 varies by placenta (Welber, Seckl, & Holmes, 2001), this enzyme may the regulator of stress hormone transmission in humans. So examining women with high and low 11βHDS2 functioning in comparison to maternal circulating cortisol and fetal cortisol may prove to be a better method of examining cortisol as a mediator of maternal stress and infant outcomes.

Another possibility may be that other stress hormones are better indicators of mediation since they occur earlier in the stress hormone cycle. Specifically, CRH or ACTH, have been documented across a variety of study methodologies (unlike cortisol) to predict fetal and early infant outcomes (Glynn, Wadhwa, & Sandman, 2000; Mastorakos & Ilias, 2003; Ruiz, Fullerton, Brown, & Dudley, 2002; Smith, 1999; Wadhwa et al., 1996; Welber & Seckl, 2001). They have also been shown to have a relationship with PS (Hobel et al., 1999; Sandman et al., 1998; Wadwa et al., 1996). Given this, these variables should be thoroughly examined as possible mediators.

The possibility also exists that this relationship may be driven by genetics rather than environment. Young and colleagues (2006) examined salivary cortisol in a sample of children with one depressed parent. Children of currently depressed parents did not experience depression individually, but did have elevated levels of cortisol that were highly correlated to their parent's levels. They suggest that there is a possible genetic and environmental effect on child cortisol. Unfortunately only one published study has

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examined maternal personality variables within a prospective prenatal design. They found that even with controlling for personality, PS still impacted infant outcomes (Wadwa et al., 1996). Parenting control? With that aside, it still seems unlikely that genetics drives this relationship. For example, it is documented that fetal exposure to toxic teratogens can alter fetal and infant development (Elliot, 1999; Bercovici, 2005; Ginzel, Maritz, Neuberger, Pauly, et al., 2007; Huzinik & Mulder, 2006; Mancinetti, Binetti, Ceccanti, 2007; Schroeder, 1987). These effects are not genetically driven but based upon the noxious exposure to the toxin. Since prolonged stress exposure has been documented to predict cardio-vascular difficulties, exacerbate the course of some illnesses, and lead to some neurological deficits (Hassan, York, Li, Li, & Sheps, 2007; McEuwen & Sapolsky, 1995; Meyer et al., 2001; Meaney 1996; Neilson, Strandberg, Gronbeck, Schnohr, & Zhang, 2007) stress too, can be considered a toxin after prolonged exposure. So, prenatal exposure to stress *may* be separate from any genetic contribution. However, there is a paucity of research to account for this so further examination of this is necessary.

Although prenatal cortisol was not a significant predictor, PS did predict decreased infant regulation. Specifically mental stress predicted infant activity. This finding is consistent with previous reports of maternal stress impacting infant regulation (Brouwers et al., 2001; Huizink, 2002; O'Connor et al., 2003; van den Bergh, 1990). Notably, unlike other studies, this study also extends the impact of PS to nighttime infant sleep.

Specifically, results demonstrated no effect for infant sleep. This is different from other reports of the newborns of high anxiety mothers (Field, Diego, Hernandez-Reif,

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Schanberg, Kuhn,Yando, et al., 2003). Researchers found that these newborns experienced increased deep sleep, cried less, and were quieter and less active than low anxiety-exposed newborns. Although the sample in the current study is older, it is possible that a more in-depth analysis of infant sleep (i.e. using sleep journals or monitors) may yield similar findings. Especially since these methods of data collection are more likely to be accurate descriptions of infant sleeping patterns.

Interestingly, unlike mental stress, life stress and perceived stress were not a significant predictors for infant regulation in this study. This is actually a departure from the documented reports. Close examination of the literature demonstrates that in most published studies, perceived stress accounted for more variance in infant regulation than did other stressors (Buitelaar et al., 2003; Huizink et al., 2002).

One possible explanation for this finding is that there are a limited number of studies that prospectively examine PS and infant regulation. Within these studies, they differ on the actual methods of data collection of infant regulation. Some studies examine infant regulation using the Bayley for motor and performance measures (de Weerth et al., 2003). Other researchers measure regulation using cardiac vagal tone (Ponirakis et al., 1998), primarily use outside observers to assess temperament and motor activity (Browers, 2001; Field, 1985), primarily use maternal report to assess temperament and activity (Vaughn, 1987), or with they use a combination of maternal and observer report to obtain data about regulation (Huizink et al., 2002, 2003; Van den Bergh, 1990, 1992). Given the variety of methodologies of data collection, generalizing across these studies is difficult. In addition, it is notable that a vast majority of studies published in this area are from one foreign sample population. Unique aspects of that sample such as location,

cultural values, access to healthcare, or other variables may not overlap completely with other U.S. based samples.

Results regarding the postnatal mediation hypothesis were not significant. However, postnatal life stress was positively related to nighttime sleep and activity. Perceived stress on the other hand, was negatively related to duration of orienting. Life stress involved everyday tasks or events that occur. If a mom is experiencing higher levels of these stressors, it may take a more active infant to elicit her attention and more care. This in turn may increase their sleep at night. Perceived stress is different because it is how a woman generally views her world. She may feel more overwhelmed and may be more subdued in her interactions with her infant. This in turn may lead to decreased infant attention to particular stimuli. Either way, it seems that stress has some impact on infant behavior.

Based upon the findings of this study, it is puzzling why prenatal mental stress predicted infant outcomes, but prenatal life stress and perceived stress did not. Further, it is also puzzling why the findings were not replicated in the postnatal period. As predicted, prenatal stress predicted postnatal stress. Also correlations showed that T1 stress variables were significantly correlated to corresponding T2 stress variables. Therefore, it would seem logical that what is significant prenatally, would also be significant postnatally as well. But this was not shown in this study. One possible explanation is that certain stressors may be more salient during pregnancy and vice versa. A pregnant woman may be more susceptible to particular stressors during this time simply as a function of the bodily changes and hormonal changes that occur. Due to the growing baby, she may find it harder to complete daily tasks such as cleaning or picking

up simple objects. She may also have stopped working and thereby have few social contacts or experience decreased outlets for recreation due to fatigue. Hormonally, rapid increases in the natural hormones that prepare for birth may also alter her sense of self. Although many of these stressors are present after the birth of the baby, they may become more global in nature. So feeling stressed in general or feeling like there is less time or that you unable to control important aspects of life may be more salient at this time. With the demands of a new baby, a woman may not "have time" to reflect on feelings of depression but may actually *feel* stressed in general, or have feelings that things are piling up.

Interestingly, only mental stress predicted parenting competency. Specifically as mental stress increased parenting competency decreased. This makes sense. As a mother is more stressed, her parenting suffers and she feels less unsure about her caretaking abilities. It's possible that mental stress may be more taxing since it directly affects an individual's sense of self. Thereby it may impact an individual's perception of their parenting skills in a more direct manner than perceived or life stress.

It should be noted that there are several limitations to the present study. As mentioned earlier possible sample contamination, methodological differences in cortisol collection as compared to other studies, sample, and data collection may impact the ability of this study to generalize to larger populations. For example, there are only a handful of studies in this area, and most are based on non-U.S. populations and come from higher SES backgrounds. This aspect alone may alter the ability of this study to compare to those populations. Also, given that this study is based on a primarily lower income population, there may be other contributory factors that women may be

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experiencing related to economics (such as: access to healthcare, unsafe neighborhoods, or poor nutrition) which may also impact the generalizability of the results. Future studies should examine other protective factors such as social support, spirituality, or other stressors such as neighborhood location, racism or domestic violence to help gain a better understanding of the role of PS on infant development. Lastly, this study was based primarily on maternal report so the possible confound of rater bias may have impacted some of the results as well.

Overall this study highlights the need for further research on PS, cortisol, and infant development. Although the role of cortisol *may* have been compromised in this study, this does not diminish the possibility that cortisol may hold a significant role in the transmission of stress from mother to child. A broader examination of possible sources to understand the transmission of stress is essential given the impact PS has been shown to have in infant, child and adolescent development.

In addition, to date there is a paucity of published studies of PS and infant sleep development. This study provides the first look at these variables within the context of a mediator model. Future studies should include this in their analysis to help determine what, if any relationship PS and cortisol have on the developing sleep patterns of infants.

Finally, since studies are beginning to demonstrate that PS has a lasting impact on later childhood and adolescent behavior (Allen et al., 1998; Laucht et al., 2000; McIntosh et al., 1995; O'Connor et al., 2002; 2003; 2005; van den Bergh et al., 2005), early identification and interventions may attenuate the later effects on child development. Identifying pregnant mothers at high risk for experiencing stressors, could greatly reduce the detrimental effects that PS have on infants' social, emotional, physiological and brain

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development. Therefore, physicians and clinicians should include inquiries of PS in their assessments of pregnant women and aid them in establishing and integrating healthy forms of stress reduction in their lives. Lastly, there are no established norms for levels of cortisol during pregnancy. More research is needed to determine specific criteria for identifying high cortisol during pregnancy. A simple saliva swab could also aid in identifying women at risk and help prevent related future infant, childhood, adolescent, and adult health and psychological complications.

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APPENDICES

Appendix A: Demographics

Subject # _____
Date of Interview _____
Name of Interviewer_____

Pregnancy Interview
Demographic Questionnaire

1. What is your date of birth: __ / __ / __
(mo) (dy) (yr)

2. How many weeks are you in your pregnancy?_____

3. What is your baby's due date: __ / __ / __
(mo) (dy) (yr)

4. How many biological children do you currently have? _____

5. How many people, including yourself, live in your household? _____
(If participant is living in a shelter, questions 7 & 8 refer to household composition before moving into shelter.)

3. Please list these: (Write in specific relationship to mother. Be specific—is the person (for ex.) a husband, stepfather, biological child, foster child, or partner's child?)

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

7. Choose the one that best describes your current marital/relationship status (choose only one):

(a) single, never married

(b) married bb) For how long? _____ (in months)

I separated cc) For how long? _____ (in months)

(d) divorced dd) For how long? _____ (in months)

(e) widowed ee) For how long? _____ (in months)

If (a) is circled: Are you currently in a relationship? YES NO
If NO, were you in a relationship that lasted at least
6 weeks during your current pregnancy? YES NO

8. First name of your current partner **or** the partner you were with for at least 6 weeks during your pregnancy:_____

9. Are you currently living with your partner? YES NO

10. Is your partner the father of your baby? YES NO

11. If no, what is your current relationship with the father of your baby? (Circle one)
1 = spouse
2 = ex-spouse
3 = partner
4 = ex-partner
5 = friend
6 = acquaintance
7 = stranger
8 = other Please specify: _____

12. What is your racial or ethnic group?
    1 = Native American
    2 = Asian American/Pacific Islander
    3 = Black, African American
    4 = Latino, Hispanic, Chicano
    5 = Biracial (mixed): Specify_____
    6 = Caucasian, White
    7 = Other: _____

13. What is the baby's father's racial or ethnic group?
    1 = Native American
    2 = Asian American/Pacific Islander
    3 = Black, African American
    4 = Latino, Hispanic, Chicano
    5 = Biracial (mixed): Specify_____
    6 = Caucasian, White
    7 = Other: _____

14. What is the highest level of education you have completed? (Circle one)
    1 = grades 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, GED **(circle specific grade)**
    2 = trade school
    3 = some college
    4 = AA degree
    5 = BA/BS
    6 = some grad school
    7 = graduate degree such as MA, Ph.D., Law, or MD?

15. Do you currently work outside the home? YES NO

If NO, did you work outside the home during the last year? YES NO

16. If YES to either part of Question 18, what is/was your occupation?_____

19. If yes to Question 18, what is his/her occupation? _____
(Please be specific)

20. What is your total family income per month (estimate)? _____

21. Do you currently receive services from . . . ?

a. WIC.....	**YES**	**NO**
b. TANF (formerly AFDC).....	**YES**	**NO**
c. Protective Services.....	**YES**	**NO**
d. Food Stamps.....	**YES**	**NO**
e. Medicaid.....	**YES**	**NO**
f. SSI (Disability).....	**YES**	**NO**
g. FIA cash assistance/grant.....	**YES**	**NO**
h. Any child related programs (e.g., 0-3; Mother-Infant Program; Head Start)?.....	**YES**	**NO**

3. Are you currently residing in homeless shelter or a shelter for battered women?
   # days in shelter?_____
   YES **NO**

Appendix B: Maternal Health

MATERNAL HEALTH

1) In general would you say that your health is excellent, very good, good, fair, or poor?

3. In what month of your pregnancy did you receive prenatal care?

2a. 1 2 3 4 5 6 7 8 9 (circle one)

2b. How many visits did you have with the doctor or midwife during your pregnancy? _____ visits

3) During your pregnancy are you excessively tired?.....YES NO

4) During your pregnancy have you experienced bleeding?.....YES NO

5) During your pregnancy have you been on bed rest?.....YES NO

Have you ever been diagnosed by a health professional with any of the following health conditions during your pregnancy?

		Before you were pregnant			While you were pregnant		
6	High blood pressure (hypertension)	Yes	No	Don't know	Yes	No	Don't know
7	Asthma	Yes	No	Don't know	Yes	No	Don't know
8	Allergies	Yes	No	Don't know	Yes	No	Don't know
9	Sickle Cell disease	Yes	No	Don't know	Yes	No	Don't know
10	Diabetes	Yes	No	Don't know	Yes	No	Don't know
11	Epilepsy	Yes	No	Don't know	Yes	No	Don't know
12	Anemia	Yes	No	Don't know	Yes	No	Don't know
13	Migraines	Yes	No	Don't know	Yes	No	Don't know
14	Heart disease	Yes	No	Don't know	Yes	No	Don't know
15	High Cholesterol	Yes	No	Don't know	Yes	No	Don't know
16	AIDS	Yes	No	Don't know	Yes	No	Don't know
17	Hepatitis	Yes	No	Don't know	Yes	No	Don't know
18	Herpes	Yes	No	Don't know	Yes	No	Don't know
19	Cancer	Yes	No	Don't know	Yes	No	Don't know
20	Thyroid disease	Yes	No	Don't know	Yes	No	Don't know
21	Menstrual irregularities	Yes	No	Don't know	Yes	No	Don't know
22	Albumin or protein in your urine	Yes	No	Don't know	Yes	No	Don't know
23	Toxemia	Yes	No	Don't know	Yes	No	Don't know
24							
25	Influenza or the flu				Yes	No	Don't know
26	Other conditions? (please specify)				Yes	No	Don't know

_____

27 What kind of medicine?_____

During what month of pregnancy did you take it?_____

28	Have you been pregnant before?	Yes	No
29	Have you ever had a miscarriage?	Yes	No
30	Have you ever delivered still born?	Yes	No
31	Have you ever had an abortion?	Yes	No
32	Have you ever delivered prematurely?	Yes	No

Appendix C: Physical Health Symptoms

Physical Health Symptoms

Now I have a list of specific symptoms and would like you to answer how much you have experienced these.

0	1	2	3	4
NEVER	**Once a month or less**	**2-3 times a month**	**Once or twice a week**	**3 or more times a week**

	pregnancy?	Before you became pregnant?
1. Sleep problems (can't fall asleep, wake up in the middle of the night or early in the morning)	_____/	_____/
2. Back pain	_____/	_____/
3. Faintness	_____/	_____/
4. Constant fatigue	_____/	_____/
5. Headache	_____/	_____/
6. Nausea and/or vomiting	_____/	_____/
7. Acid stomach or indigestion	_____/	_____/
8. Stomach pain	_____/	_____/
9. Hands trembling	_____/	_____/
10. Heart pounding or racing	_____/	_____/
11. Poor appetite	_____/	_____/
12. Feeling weak all over	_____/	_____/
13. Feeling low in energy	_____/	_____/
14. Muscle tension or soreness	_____/	_____/
15. Severe aches and pains	_____/	_____/
16. Constant coughing	_____/	_____/
17. Heavy chest cold	_____/	_____/
18. Trouble breathing or shortness of breath	_____/	_____/
19. Pain or tightness in chest	_____/	_____/

Appendix D: Center for Epidemiological Studies Depression Scale

CES-D

We would like to know about your feelings ***during the past week.*** For each of the following statements please consider how often you have felt this way.

Answer Key	
0 =	Rarely or none of the time (less than 1 day)
1 =	Some or a little of the time (1-2 days)
2 =	Occasional or a moderate amount of time (3-4 days)
3 =	Most or all of the time (5-7 days)

1. I was bothered by things that usually don't bother me.	0 1 2 3
2. I did not feel like eating; my appetite was poor.	0 1 2 3
3. I felt that I could not shake off the blues even with help from family.	0 1 2 3
4. I felt that I was just as good as other people.	0 1 2 3
5. I had trouble keeping my mind on what I was doing.	0 1 2 3
6. I felt depressed.	0 1 2 3
7. I felt that everything I did was an effort.	0 1 2 3
8. I felt hopeful about the future.	0 1 2 3
9. I thought my life had been a failure.	0 1 2 3
10. I felt fearful	0 1 2 3
11. My sleep was restless	0 1 2 3
12. I was happy.	0 1 2 3
13. I talked less than usual	0 1 2 3
14. I felt lonely	0 1 2 3
15. People were unfriendly	0 1 2 3
16. I enjoyed life	0 1 2 3
17. I had crying spells	0 1 2 3
18. I felt sad	0 1 2 3
19. I felt that people disliked me	0 1 2 3
20. I could not get "going."	0 1 2 3

Appendix E: State-Trait Anxiety Inventory

STAI Y-1

A number of statements which people have used to describe themselves are given below. Read each statement and indicate how you feel *right* now, that is *at this moment.* There are no right or wrong answers. Do not spend too much time on any one statement but give the best answer which seems to describe your present feelings best

Not at all	Somewhat	Moderately So	Very Much So
1	2	3	4

1. I feel calm.....	1	2	3	4
2. I am secure.....	1	2	3	4
3. I am tense.....	1	2	3	4
4. I feel strained.....	1	2	3	4
5. I feel at ease.....	1	2	3	4
6. I feel upset.....	1	2	3	4
7. I am presently worrying over possible misfortunes.....	1	2	3	4
8. I feel satisfied.....	1	2	3	4
9. I feel frightened.....	1	2	3	4
10. I feel comfortable.....	1	2	3	4
11. I feel self confident.....	1	2	3	4
12. I feel nervous.....	1	2	3	4
13. I am jittery.....	1	2	3	4
14. I feel indecisive.....	1	2	3	4
15. I am relaxed.....	1	2	3	4
16. I feel content.....	1	2	3	4
17. I am worried.....	1	2	3	4
18. I feel confused.....	1	2	3	4
19. I feel steady.....	1	2	3	4
20. I feel pleasant.....	1	2	3	4

STAI Y-2

A number of statements which people have used to describe themselves are given below. Read each statement and indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the best answer which seems to describe your present feelings best

Not at all	Somewhat	Moderately So	Very Much So
1	2	3	4

21. I feel pleasant.....	1	2	3	4
22. I feel nervous and restless.....	1	2	3	4
23. I feel satisfied with myself.....	1	2	3	4
24. I wish I could be as happy as other seem to be.....	1	2	3	4
25. I feel like a failure.....	1	2	3	4
26. I feel rested.....	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them...	1	2	3	4
29. I worry too much over something that really doesn't matter.....	1	2	3	4
30. I am happy.....	1	2	3	4
31. I have disturbing thoughts.....	1	2	3	4
32. I lack self confidence.....	1	2	3	4
33. I feel secure.....	1	2	3	4
34. I make decisions easily.....	1	2	3	4
35. I feel inadequate.....	1	2	3	4
36. I am content.....	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me...	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person.....	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests.....	1	2	3	4

Appendix F: Perceived Stress Scale

PSS

Sometimes when people are stressed they can feel upset while others do not. ***In the last month*** how often have you had these feelings?

Answer Key	
0 =	Never
1 =	Once or twice
2 =	Several Times
3 =	Often
4 =	Very Often

1. How often have you been upset because of something that happened unexpectedly?	1 2 3 4
2. How often have you felt that you were unable to control the important things in your life?	1 2 3 4
3. How often have you felt nervous and "stressed?"	1 2 3 4
4. How often have you dealt successfully with irritating life hassles?	1 2 3 4
5. How often have you felt confident about your ability to handle your personal problems?	1 2 3 4
6. How often have you felt that things were going your way?	1 2 3 4
7. How often have you found that you could not cope with all the things that you had to do?	1 2 3 4
8. How often have you been able to control irritation in your life?	1 2 3 4
9. How often have you felt that you were on top of things?	1 2 3 4
10. How often have you been angered because of things that happened that were outside of your control?	1 2 3 4
11. How often have you found yourself thinking about things that you have to accomplish?	1 2 3 4
12. How often have you been able to control the way you spend your time?	1 2 3 4
13. How often have you felt difficulties were piling up so high that you could not overcome them?	1 2 3 4

Appendix G: Life Experiences Survey

LES

Listed below are a number of events that sometimes bring about change in the lives of those who experience them. Please check those events that you have experienced since you were pregnant and indicate the time period during which they happened. **Be sure that all check marks are directly across from the items they correspond to.**

Also, for each item checked below, *please indicate whether you viewed the event as having a positive or negative impact on your life* at the time it occurred. A rating of -3 would indicate an extremely negative impact. A rating of 0 suggests no impact either positive or negative. A rating of +3 would indicate an extremely positive impact. Check NA if the event did not happen to you in the last year.

	NA	During pregnancy	Extremely negative	Moderately negative	Somewhat negative
1. Marriage			-3	-2	-1
2. Detention in jail or comparable institution			-3	-2	-1
3. Death of a spouse/partner			-3	-2	-1
4. Major change in sleeping habits (much more or much less sleep)			-3	-2	-1
5. Death of close family member			-3	-2	-1
a. mother			-3	-2	-1
b. father			-3	-2	-1
c. brother			-3	-2	-1
d. sister			-3	-2	-1
e. grandmother			-3	-2	-1
f. grandfather			-3	-2	-1
g. spouse/partner			-3	-2	-1
h. child			-3	-2	-1
3. other (specify) _____			-3	-2	-1
6. Major change in eating habits (eating much more or much less food)			-3	-2	-1
7. Foreclosure on mortgage or loan			-3	-2	-1
8. Death of close friend			-3	-2	-1
9. Outstanding personal achievement			-3	-2	-1
10. Minor law violations (traffic tickets, disturbing the peace, etc.)			-3	-2	-1
11. Pregnancy			-3	-2	-1
12. Changed work situation (different work responsibility, major change in working conditions, working hours, etc.)			-3	-2	-1
13. New job			-3	-2	-1

	NA	During pregnancy	Extremely negative	Moderately negative	Somewhat negative
14. Serious illness or injury of close family member			-3	-2	-1
a. mother			-3	-2	-1
b. father			-3	-2	-1
c. brother			-3	-2	-1
d. sister			-3	-2	-1
e. grandmother			-3	-2	-1
f. grandfather			-3	-2	-1
g. spouse/partner			-3	-2	-1
h. child in study			-3	-2	-1
i. other child			-3	-2	-1
j. other (specify) _____			-3	-2	-1
15. Sexual difficulties			-3	-2	-1
16. Trouble with employer (for example, in danger of losing job, being suspended, demoted, etc.)			-3	-2	-1
17. Trouble with in-laws or partner's family			-3	-2	-1
18. Major change in financial status (a lot better off or a lot worse off)			-3	-2	-1
19. Major change in closeness of family members (a lot more close or a lot less close)			-3	-2	-1
20. Gaining a new family member (through birth, adoption, family member moving in, etc.)			-3	-2	-1
21. Change of residence			-3	-2	-1
22. Marital separation (due to conflict)			-3	-2	-1
23. Major change in church activities (increased or decreased attendance)			-3	-2	-1
24. Marital reconciliation			-3	-2	-1
25. Major change in number of arguments with spouse/partner (a lot more or a lot less arguments)			-3	-2	-1
26. Change in spouse/partner's work (loss of job, beginning new job, retirement, etc.)			-3	-2	-1
27. Major change in usual type and/or amount of recreation			-3	-2	-1
28. Borrowing more than $10,000 (buying home, business, etc)			-3	-2	-1
29. Borrowing less than $10,000 (buying car, TV, getting school loan, etc.)			-3	-2	-1
30. Being fired from job			-3	-2	-1

	NA	During pregnancy	Extremely negative	Moderately negative	Somewhat negative
31. Having abortion			-3	-2	-1
32. Major personal illness or injury			-3	-2	-1
33. Major change in social activities, e.g., parties, movies, visiting (increased or decreased participation)			-3	-2	-1
34. Major change in living conditions of family (building new home, remodeling, deterioration of home, neighborhood, etc.)			-3	-2	-1
35. Divorce			-3	-2	-1
36. Serious injury or illness of close friend			-3	-2	-1
37. Retirement from work			-3	-2	-1
38. Son or daughter leaving home (due to marriage, college, etc.)			-3	-2	-1
39. Ending of formal schooling			-3	-2	-1
40. Separation from spouse/partner (due to work, travel, etc.)			-3	-2	-1
41. Engagement			-3	-2	-1
42. Breaking up with boyfriend/girlfriend			-3	-2	-1
43. Leaving home for the first time			-3	-2	-1
44. Reconciliation with boyfriend/girlfriend			-3	-2	-1
Other recent experiences which have had an impact on your life. List and rate					
47.			-3	-2	-1
48.			-3	-2	-1
49.			-3	-2	-1

Appendix H: Daily Hassles Questionnaire

DHS

Hassles are irritants that can range from minor annoyance to fairly major pressures, problems, or difficulties. They can occur few or many times. Listed below are some hassles that people feel. *First circle the hassles that have happened in the past month.* Then loos at the numbers on the right of the items you circled. Indicate by circling 1, 2, or 3 how SEVERE each of the *circled* hassles has been for you in the past month.

1= somewhat severe 2 = Moderately severe 3= Extremely severe

1	Misplacing or losing things	1	2	3	x 23	Non-family members living in your home	1	2	3
2	Troublesome neighbors	1	2	3	x 24	Care for pet	1	2	3
3	Social obligations	1	2	3	x 25	Planning meals	1	2	3
4	Inconsiderate smokers	1	2	3	x 26	Concerned about the meaning of life	1	2	3
5	Troubling thoughts about your future	1	2	3	x 27	Trouble relaxing	1	2	3
6	Thoughts about death	1	2	3	x 28	Problems getting along with fellow workers	1	2	3
7	Health of a family member	1	2	3	x 29	Customers or clients give you a hard time	1	2	3
8	Not enough money for clothing	1	2	3	x 30	Home maintenance (inside)	1	2	3
9	Not enough money for housing	1	2	3	x 31	Concerns about job security	1	2	3
10	Concerns about owing money	1	2	3	x 32	Laid-off our out of work	1	2	3
11	Concerns about getting credit	1	2	3	x 33	Don't like fellow workers	1	2	3
12	Concerns about money for emergencies	1	2	3	x 34	Not enough money for basic needs	1	2	3
13	Someone owes you money	1	2	3	x 35	Not enough money for food	1	2	3
14	Financial responsibility for someone who doesn't live with you	1	2	3	x 36	Too many interruptions	1	2	3
15	Cutting down on electricity, water, etc	1	2	3	x 37	Unexpected company	1	2	3
16	Smoking too much	1	2	3	x 38	Too much time on hands	1	2	3
17	Use of alcohol	1	2	3	x 39	Having to wait	1	2	3
18	Personal use of drugs	1	2	3	x 40	Concerns about accidents	1	2	3
19	Too many responsibilities	1	2	3	x 41	Being lonely	1	2	3
20	Decisions about having children	1	2	3	x 42	Not enough money for health care	1	2	3
21	Fear of confrontation	1	2	3	x 43	Declining physical abilities	1	2	3
22	Financial security	1	2	3	x 44	Being exploited	1	2	3
45	Silly practical mistakes	1	2	3	x 73	Concerns about bodily functions	1	2	3
46	Inability to express yourself	1	2	3	x 74	Rising prices of common goods	1	2	3
47	Physical illness	1	2	3	x 75	Not getting enough rest	1	2	3
48	Self effects of medication	1	2	3	x 76	Not getting enough sleep	1	2	3
49	Concerns about medical treatment	1	2	3	x 77	Problems with aging parents	1	2	3
50	Physical appearance	1	2	3	x 78	Problems with your children	1	2	3
51	Fear of rejection	1	2	3	x 79	Problems with persons younger than yourself	1	2	3
52	Difficulties with getting pregnant	1	2	3	x 80	Problems with your partner	1	2	3
53	Sexual problems that result from physical problems	1	2	3	x 81	Difficulties seeing or hearing	1	2	3

54	Sexual problems other than those above	1	2	3	x	82	Overloaded with family responsibilities	1	2	3
55	Concerns about health in general	1	2	3	x	83	Too many things to do	1	2	3
56	Not seeing enough people	1	2	3	x	84	Unchallenging work	1	2	3
57	Friends or relatives too far away	1	2	3	x	85	Concerns about meeting standards	1	2	3
58	Preparing meals	1	2	3	x	86	Financial dealings with friends or acquaintances	1	2	3
59	Wasting time	1	2	3	x	87	Job dissatisfactions	1	2	3
60	Auto maintenance	1	2	3	x	88	Worries about decisions to change jobs	1	2	3
61	Filling out forms	1	2	3	x	89	Trouble with reading, writing, or spelling	1	2	3
62	Neighborhood deterioration	1	2	3	x	90	Too many meetings	1	2	3
63	Financing children's education	1	2	3	x	91	Problems with divorce or separation	1	2	3
64	Problems with employees	1	2	3	x	92	Transportation problems	1	2	3
65	Problems on job due to being a woman	1	2	3	x	93	Not enough money for transportation	1	2	3
66	Trouble with math skills	1	2	3	x	94	Not enough money for entertainment and recreation	1	2	3
67	Gossip	1	2	3	x	95	Shopping	1	2	3
68	Legal problems	1	2	3	x	96	Prejudice and discrimination from others	1	2	3
69	Concerns about weight	1	2	3	x	97	Property, investments, or taxes	1	2	3
70	Not enough time to do the things you need to do	1	2	3	x	98	Not enough time for entertainment and recreation	1	2	3
71	Television	1	2	3	x	99	Yardwork or outside home maintenance	1	2	3
72	Not enough personal energy	1	2	3	x	100	Concerns about news events	1	2	3
101	Concerns about inner conflicts	1	2	3	x	111	Noise	1	2	3
102	Feel conflicted over what to do	1	2	3	x	112	Crime	1	2	3
103	Regrets over past decisions	1	2	3	x	113	Traffic	1	2	3
104	Menstrual problems	1	2	3	x	114	Pollution	1	2	3
105	The weather	1	2	3	x	115	Have we missed anything?	1	2	3
106	Nightmares	1	2	3	x					
107	Concerns about getting ahead	1	2	3	x					
108	Hassles from boss or supervisor	1	2	3	x					
109	Difficulties with friends	1	2	3	x					
110	Not enough family time	1	2	3	x					

Appendix I: Birth, pregnancy, and delivery questionnaire

Birth, Pregnancy, and Delivery Questionnaire

The first questions I want to ask you concern your health during your pregnancy as well as the birth and delivery of your baby.

1. What is your baby's name? _____

2. What date was your baby born? _____ _____ _____
   Month Day Year

3. Is your baby a (circle one) **Boy or Girl?**

These next questions are about your health the last weeks of pregnancy and since your delivery

		Last weeks of pregnancy		
4	High blood pressure (hypertension)	Yes	No	Don't know
5	Asthma	Yes	No	Don't know
6	Allergies	Yes	No	Don't know
7	Sickle Cell disease	Yes	No	Don't know
8	Diabetes	Yes	No	Don't know
9	Epilepsy	Yes	No	Don't know
10	Anemia	Yes	No	Don't know
11	Migraines	Yes	No	Don't know
12	Heart disease	Yes	No	Don't know
13	High Cholesterol	Yes	No	Don't know
14	AIDS	Yes	No	Don't know
15	Hepatitis	Yes	No	Don't know
16	Herpes	Yes	No	Don't know
17	Cancer	Yes	No	Don't know
18	Thyroid disease	Yes	No	Don't know
19	Menstrual irregularities	Yes	No	Don't know
20	Albumin or protein in your urine	Yes	No	Don't know
21	Toxemia	Yes	No	Don't know

22 What kind of medicine?_____

During what month of pregnancy did you take it?_____

23	Rh or other blood group incompatibility	Yes	No	Don't know
24	Influenza or the flu	Yes	No	Don't know
25	Other conditions? (please specify)	Yes	No	Don't know

_____

26	Have you taken any over the counter or prescribed medication during your pregnancy?	Yes	No	Don't know

these conditions since delivery Yes No

a. IF yes, which ones (list # of condition above)_____

27. Were you diagnosed with any of

The next questions are about your delivery

28. Where was your baby delivered? (Check one)
_____Hospital
_____Home
_____Other (Please specify: _____)

29. How long was your labor? _____ hours

3. Was it a vaginal or caesarean birth? (Check one)
_____ Vaginal
_____ Caesarean

31. Was it a breech (bottom first) delivery? **YES NO**

32. Were you given anaesthetic for the delivery (e.g., an epidural or spinal?) **YES NO**

33. How many weeks pregnant were you when you delivered your baby? _____ weeks

34. What was your baby's birth weight? _____ (lbs.) _____ (ozs.)

35. What was your baby's birth length? _____ (inches)

36. What was your baby's APGAR score at 1 minute_____ 5 minutes?_____

37. After delivery, did you stay in the hospital because of health problems? **YES NO**
If YES, how many days? _____ days

38. After delivery, did the baby stay in the hospital because of health problems? **YES NO**
If YES, how many days? _____ days

3. Did your baby have any of the following complications during delivery or shortly after delivery?

39a.	Bleeding?	**YES**	**NO**
39c.	Poor feeding/sucking?	**YES**	**NO**
39d.	Seizures?	**YES**	**NO**
39e.	Cord around neck?	**YES**	**NO**
39f.	Infection?	**YES**	**NO**
39g.	Low blood sugar?	**YES**	**NO**
39h.	Trouble keeping a constant temperature?	**YES**	**NO**
39i.	Alcohol or drug withdrawal?	**YES**	**NO**
39j.	Heart problems?	**YES**	**NO**
39k.	Birth defects?	**YES**	**NO**
	(What were they?_____)		
39*l*.	Injured during birth?	**YES**	**NO**
	(How? _____)		

These next questions are about your baby's health now

3. Which of the following best describes your infant's overall state of health?

☐ **Very Healthy** ☐ **Healthy** ☐ **Not very healthy** ☐ **Unhealthy**

4) Has your child had any serious illnesses or health problems since birth that have required active medical treatment?
YES
NO

If yes can you please specify the illness_____

a) Are there any lasting problems?_____

b) Please circle one of the following:

Doubtful (as to full recovery or lasting problems)
Yes, full recovery
Yes, with persistent problems

5) Has your child been admitted to the hospital for **one night or more**, at any time since birth?
YES **NO**

a) If yes, how many times 1 time 2 times 3 or more times

c) What was the reason for the admission?_____

6) Does your child have any long standing illnesses, disabilities, or health problems? **YES** **NO**

7	Does your child breast feed?	**YES** **NO**
8	About how long in minutes does your baby suck?	_____
9	Does your child use a bottle?	**YES** **NO**
10	About how much does your baby take at one time?	_____ounces
11	On average, how many times a day does your child eat?	_____
12	How often does your baby feed?	Every _____ hours
14	How many weeks old was your baby when s/he was last measured?	_____ weeks
15	How much did your baby weigh at the last measurement?	____(lbs.)___(ozs.)
16	What was your baby's length at the last measurement?	_____ inches
17	How big around was your baby's head (head circumference) at the last measurement?	_____ inches

Appendix J: Infant Care Scale

ICS

How much confidence do you have about doing each of the behaviors listed below. There are no right or wrong answers.

Very Little ←----------→ Quite A Lot				
A	**B**	**C**	**D**	**E**

1	Knowing immunization schedules	27	Knowing what articles are safe to leave with your baby in the crib or baby seat
2	Knowing schedule for physical exam	28	Treating diaper rash
3	Recognizing signs of an ear infection	29	Burping your baby
4	Identifying diaper rash	30	Weighing your baby
5	Knowing when to get help from the clinic, emergency room, or doctor	31	Taking your baby's temperature
6	Recognizing teething	32	Changing a diaper
7	Knowing regular breathing sounds of babies	33	Relieving pain from teething
8	Recognizing congestion	34	Relieving congestion
9	Recognizing an allergic response	35	Giving your baby a liquid medication
10	Recognizing a croup	36	Relieving croup
11	Knowing expected weight gain patterns for an infant	37	Treating constipation
12	Recognizing constipation	38	Treating diarrhea
13	Recognizing diarrhea	39	Relieving gas pains
14	Recognizing gas pains	40	Establishing a sensible sleeping schedule
15	Knowing normal growth and development patterns	41	Soothing your crying baby
16	Knowing how much to feed your baby	42	Breast or bottle feeding your baby
17	Selecting the best formula	43	Spoon feeding your baby
18	Selecting baby foods	44	Preparing baby food
19	Planning a balanced diet for your baby	45	Introducing new food into baby's diet
20	Knowing how to use a baby bottle	46	Establishing a sensible feeding schedule
21	Identifying safety hazards in the house	47	Holding your baby
22	Choosing safe baby toys	48	Demonstrating a tonic neck reflex
23	Choosing safe baby furniture	49	Bathing your baby
24	Choosing safe baby clothes	50	Using a car seat
25	Knowing which medications are dangerous	51	Walking while holding your baby
26	Knowing safe positions for a baby after feeding		Playing with your baby

Appendix K: Infant Behavior Questionnaire

INSTRUCTIONS: Please read carefully before starting:
As you read each description of the baby's behavior below, please indicate how often the baby did this during the LAST WEEK (the past seven days) by circling one of the numbers in the left column. These numbers indicate how often you observed the behavior described during the last week.

(1) Never	(2) Very Rarely	(3) Less Than Half the Time	(4) About Half the Time	(5) More Than Half the Time	(6) Almost Always	(7) Always	(X) Does Not Apply

The "Does Not Apply" (X) column is used when you did not see the baby in the situation described during the last week. For example, if the situation mentions the baby having to wait for food or liquids and there was no time during the last week when the baby had to wait, circle the (X) column. "Does Not Apply" is different from "Never" (1). "Never" is used when you saw the baby in the situation, but the baby never engaged in the behavior listed during the last week. For example, if the baby did have to wait for food or liquids at least once but never cried loudly while waiting, circle the (1) column.

Please be sure to circle a number for every item.

Feeding

When having to wait for food or liquids during the last week, how often did the baby:

1 2 3 4 5 6 7 X.....(1) seem not bothered?
1 2 3 4 5 6 7 X.....(2) show mild fussing?
1 2 3 4 5 6 7 X.....(3) cry loudly?

During feeding, how often did the baby:

1 2 3 4 5 6 7 X.....(4) lie or sit quietly?
1 2 3 4 5 6 7 X.....(5) squirm or kick?

During feeding, how often did the baby:

1 2 3 4 5 6 7 X.....(6) wave arms?
1 2 3 4 5 6 7 X.....(7) fuss or cry when s/he had enough to eat?
1 2 3 4 5 6 7 X.....(8) fuss or cry when given a disliked food?

When given a new food or liquid, how often did the baby:

1 2 3 4 5 6 7 X.....(9) accept it immediately?
1 2 3 4 5 6 7 X.....(10) reject it by spitting out, closing mouth, etc.?
1 2 3 4 5 6 7 X.....(11) not accept it no matter how many times offered?

Sleeping

Before falling asleep at night during the last week, how often did the baby:

1 2 3 4 5 6 7 X.....(12) show no fussing or crying?

During sleep, how often did the baby:

1 2 3 4 5 6 7 X.....(13) toss about in the crib?
1 2 3 4 5 6 7 X.....(14) move from the middle to the end of the crib?
1 2 3 4 5 6 7 X.....(15) sleep in one position only?

After sleeping, how often did the baby:

1 2 3 4 5 6 7 X.....(16) fuss or cry immediately?
1 2 3 4 5 6 7 X.....(17) play quietly in the crib?
1 2 3 4 5 6 7 X.....(18) coo and vocalize for periods of 5 minutes or longer?
1 2 3 4 5 6 7 X.....(19) cry if someone doesn't come within a few minutes?

How often did the baby:

1 2 3 4 5 6 7 X.....(20)seem angry (crying and fussing) when you left her/him in the crib?

1 2 3 4 5 6 7 X . . . . . (21) seem contented when left in the crib?
1 2 3 4 5 6 7 X . . . . . (22) cry or fuss before going to sleep for naps?

Bathing and Dressing

When being dressed or undressed during the last week, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (23) wave her/his arms and kick?
1 2 3 4 5 6 7 X . . . . . (24) squirm and/or try to roll away?
1 2 3 4 5 6 7 X . . . . . (25) smile or laugh?

When put into the bath water, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (26) startle (gasps, throws out arms; stiffens body, etc.)?
1 2 3 4 5 6 7 X . . . . . (27) smile?
1 2 3 4 5 6 7 X . . . . . (28) laugh?
1 2 3 4 5 6 7 X . . . . . (29) have a surprised expression?
1 2 3 4 5 6 7 X . . . . . (30) splash or kick?
1 2 3 4 5 6 7 X . . . . . (31) turn body and/or squirm?

When face was washed, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (32) smile or laugh?
1 2 3 4 5 6 7 X . . . . . (33) fuss or cry?

When hair was washed, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (34) smile or laugh?
1 2 3 4 5 6 7 X . . . . . (35) fuss or cry?

Play

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . . . (36)look at pictures in books and/or magazines for 2-5 minutes at a time?

1 2 3 4 5 6 7 X . . . . . (37)look at pictures in books and/or magazines for 5 minutes or longer at a time?
1 2 3 4 5 6 7 X . . . . . (38)stare at a mobile, crib bumper or picture for 5 minutes or longer?
1 2 3 4 5 6 7 X . . . . . (39)play with one toy or object for 5-10 minutes?
1 2 3 4 5 6 7 X . . . . . (40)play with one toy or object for 10 minutes or longer?
1 2 3 4 5 6 7 X . . . . . (41)spend time just looking at playthings?
1 2 3 4 5 6 7 X . . . . . (42)repeat the same sounds over and over again?
1 2 3 4 5 6 7 X . . . . . (43)laugh aloud in play?
1 2 3 4 5 6 7 X . . . . . (44)smile or laugh when tickled?
1 2 3 4 5 6 7 X . . . . . (45)cry or show distress when tickled?
1 2 3 4 5 6 7 X . . . . . (46)repeat the same movement with an object for 2 minutes or longer (e.g., putting a block in a cup, kicking or hitting a mobile)?

When something the baby was playing with had to be removed, how often did s/he:

1 2 3 4 5 6 7 X . . . . . (47) cry or show distress for a time?
1 2 3 4 5 6 7 X . . . . . (48) cry or show distress for several minutes for longer?
1 2 3 4 5 6 7 X . . . . . (49) seem not bothered?

When tossed around playfully, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (50) smile?
1 2 3 4 5 6 7 X . . . . . (51) laugh?

During a peekaboo game, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (52) smile?
1 2 3 4 5 6 7 X . . . . . (53) laugh?

Daily Activities

How often during the last week did the baby:

1 2 3 4 5 6 7 X . . . . . (54)cry or show distress at a loud sound (blender, vacuum cleaner, etc.)?
1 2 3 4 5 6 7 X . . . . . (55)cry or show distress at a change in parents' appearance (glasses off, shower cap on, etc.)?
1 2 3 4 5 6 7 X . . . . . (56)when in a position to see the television set, look at it for 2 to 5 minutes at a time?
1 2 3 4 5 6 7 X . . . . . (57)when in a position to see the television set, look at it for 5 minutes or longer?
1 2 3 4 5 6 7 X . . . . . (58)protest being put in a confining place (infant seat, play pen, car seat, etc)?
1 2 3 4 5 6 7 X . . . . . (59)startle at a sudden change in body position (for example, when moved suddenly)?
1 2 3 4 5 6 7 X . . . . . (60)startle to a loud or sudden noise?
1 2 3 4 5 6 7 X . . . . . (61)cry after startling?

When being held, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (62) squirm, pull away, or kick?

When placed on his/her back, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (63) fuss or protest?
1 2 3 4 5 6 7 X . . . . . (64) smile or laugh?
1 2 3 4 5 6 7 X . . . . . (65) lie quietly?
1 2 3 4 5 6 7 X . . . . . (66) wave arms and kick?
1 2 3 4 5 6 7 X . . . . . (67) squirm and/or turn body?

When the baby wanted something, how often did s/he:

1 2 3 4 5 6 7 X . . . . . (68) become upset when s/he could not get what s/he wanted?
1 2 3 4 5 6 7 X . . . . . (69)have tantrums (crying, screaming, face red, etc.) when s/he did not get what s/he wanted?

When placed in an infant seat or car seat, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (70) wave arms and kick?
1 2 3 4 5 6 7 X . . . . . (71) squirm and turn body?
1 2 3 4 5 6 7 X . . . . . (72) lie or sit quietly?
1 2 3 4 5 6 7 X . . . . . (73) show distress at first; then quiet down?

When you returned from having been away and the baby was awake, how often did s/he:
1 2 3 4 5 6 7 X . . . . . (74) smile or laugh?

When introduced to a strange person, how often did the baby:
1 2 3 4 5 6 7 X . . . . . (75) cling to a parent?
1 2 3 4 5 6 7 X . . . . . (76) refuse to go to a stranger?
1 2 3 4 5 6 7 X . . . . . (77) hang back from the stranger?
1 2 3 4 5 6 7 X . . . . . (78) never "warm up" to the stranger?
1 2 3 4 5 6 7 X . . . . . (79) approach the stranger at once?
1 2 3 4 5 6 7 X . . . . . (80) smile or laugh?

When introduced to a dog or cat, how often did the baby:

1 2 3 4 5 6 7 X . . . . . (81) cry or show distress?
1 2 3 4 5 6 7 X . . . . . (82) smile or laugh?
1 2 3 4 5 6 7 X . . . . . (83) approach at once?

Soothing Techniques

Have you tried any of the following soothing techniques in the last two weeks? If so, how often did the method soothe the baby? Circle (X) if you did not try the technique during the LAST TWO WEEKS.

1 2 3 4 5 6 7 X . . . . . (84) rocking?
1 2 3 4 5 6 7 X . . . . . (85) holding?
1 2 3 4 5 6 7 X . . . . . (86) singing or talking?
1 2 3 4 5 6 7 X . . . . . (87) walking with the baby?
1 2 3 4 5 6 7 X . . . . . (88) giving the baby a toy?
1 2 3 4 5 6 7 X . . . . . (89) showing the baby something to look at?
1 2 3 4 5 6 7 X . . . . . (90) patting or gently rubbing some parts of the baby's body?
1 2 3 4 5 6 7 X . . . . . (91) offering food or liquid?
1 2 3 4 5 6 7 X . . . . . (92) offering baby her/his security object?
1 2 3 4 5 6 7 X . . . . . (93) changing baby's position?

1 2 3 4 5 6 7 X . . . . . (94) other (please specify) _____

Appendix L: Cortisol

Directions for Saliva Sample

Before You Take Your Saliva Sample Remember:

- Please take this sample as soon as you wake up in the morning and write down the time on the line below.

- Please do **not** eat or drink anything before taking this sample.

To Take Sample

- With the straw inside the collection tube, drool into the straw until the 1.0 mL line is reached. Be careful to no have "spit bubbles" at the top. The sample should be clear without bubbles.

- If you have trouble producing saliva, you can:

    - chew on the end of the straw
    - or chew the piece of gum enclosed to help stimulate the flow.

- When you are finished, place the sample in your refrigerator until your afternoon interview

Thank you so much for participating in the Pregnancy Stress Study!!!! If you have any questions please call us at 432-3825.

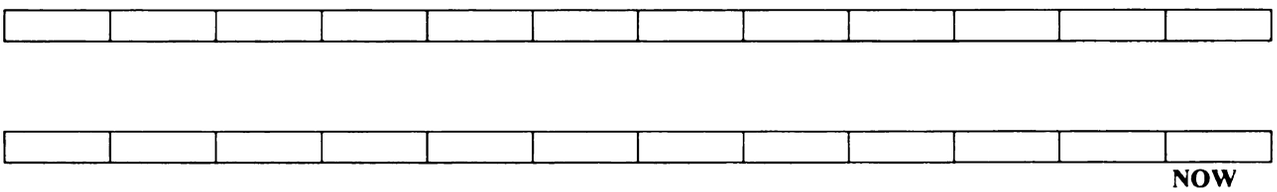
Time of Sample_____

Appendix M: Infant Sleep

IS

Please use the chart below to describe your infant's sleep pattern in the last 24 hours. If this was not a typical 24-hr period please describe the most typical pattern.

A= awake S= sleep



Appendix N: Fliers

ARE YOU PREGNANT?

YOU MAY BE ELIGIBLE TO PARTICIPATE IN A STUDY ABOUT
Maternal Stress During Pregnancy

!! $10.00 !!

We are looking for pregnant women between 30 and 34 weeks to participate in a research study at Michigan State University. You will be asked about experiences and feelings during pregnancy, perceptions of your infants, and recent life events.

- Interview can be done at MSU or at your home.
- You will be paid **$10.00** in cash.
- All information is kept completely confidential.

!! $10.00 !!

If you are interested or would like more information, please call **432-3825** and ask for

The Pregnancy Stress Study

Appendix O: Screen

SCREEN

1. How far along in weeks are you in your pregnancy?	
a. Was this verified by a doctor?	YES NO
2. Are you pregnant with more than one baby?	YES NO
3. About how many prenatal visits have you had?	
4. Have you been diagnosed with any fetal abnormalities?	YES NO
a. If yes, what kind of abnormalities?	
5. ***During this pregnancy*** did you drink alcoholic beverages?	YES NO
a. About how often did you drink (rarely, sometimes, often)?	
6. ***During this pregnancy*** did you use marijuana, crack cocaine, heroin, or other substances?	YES NO
3. About how often did you use these substances (rarely, sometimes, often)?	
7. ***During this pregnancy*** did you smoke cigarettes?	YES NO
a. About how often did you smoke (rarely, sometimes, often)?	
8. Did you take prescription medicine during this pregnancy?	YES NO
a. If yes please specify what kind and when	
9. Did you take over the counter medicine during this pregnancy	YES NO
a. If yes please specify what kind and when	
10. Have you been diagnosed with hypertension, diabetes, or any other health condition ***during this pregnancy***?	YES NO
a. If yes please specify?	
11. Were you diagnosed with any of these conditions before you were pregnant?	YES NO
12. Have you ever been diagnosed with a chronic disease such as sickle cell, cancer, or thyroid disease ***during this pregnancy***?	YES NO
13. Before this pregnancy?	YES NO
12. Have you been diagnosed with an STD such as herpes or HIV **during this pregnancy**?	YES NO
13. Before this pregnancy?	YES NO
14. Have you ever been punched, kicked, or beaten up by a romantic partner during this pregnancy?	YES NO

Appendix P: Consent Forms

Pregnancy and Stress Study

Consent Form – Time 1

This study is part of a survey of women in Michigan, some of whom may be stress during their pregnancy. We hope to learn about the types of stressors you may have faced during your pregnancy, how stressful they are to you, the strengths that you bring to your situation, your feelings, your perceptions of your child, and your relationships with others, including partners and friends, as well as how stress effects the physiology of pregnant women. We hope to use this information to help plan better programs for pregnant women experiencing stress during pregnancy.

If you decide to take part in the survey today, you will be asked questions about events that have happened to you in the last year, how you have been feeling recently, and your feelings about your child and the people in your life who provide support for you. You will also be asked to give a saliva sample to help us learn more about the biology of stress. However, nothing that we do will be painful or dangerous. The total interview will take about 1 hour. You will be paid $10 for your participation.

All information that you give us will be kept strictly confidential among the project staff. Your name or will not be on any questionnaires; an identification number will be put on them instead. All questionnaires and saliva samples will be kept in locked file cabinets in a locked office. All saliva samples will be stored in a locked freezer and destroyed after analysis. Your identity will not be revealed in any reports written about this study. We will summarize information from all study participants and will not report information about yourself or any individuals. Your privacy will be protected to the maximum extent allowable by law.

The only exception to full confidentiality is in the case of ongoing child abuse or neglect. If you indicate that child abuse or neglect is occurring in your household, we are required to make a report to Child Protective Services. We would inform you if we thought we needed to make such a report.

You have the right to refuse to answer any questions or to withdraw from this study at any point during the interview with no penalty or negative consequences. Your decision about whether to participate or not will not affect your relationship with any agencies or Michigan State University. If you have any questions, please ask us. If you have any questions about the study later, you can contact Dr. Anne Bogat or Shallimar Jones, M.A. at (517) 432-3825. If you have questions about your rights as a participant in this research study you may contact Dr. Peter Vasilenko at (517) 355-2180.

We may be interested in recontacting you when your child turns 3 months. At the end of the interview today, we will ask you to update the contact information that we have for you. Your participation today does not obligate you to participate in any future interviews.

I have read this form and agree to participate.

Signature of Participant	Print Name	Date
Witness		Date

Anne Bogat, Ph.D.
Michigan State University
Department of Psychology
East Lansing, MI 48824

Dr. Peter Vasilenko
202 Olds Hall
Michigan StateUniversity
East Lansing, MI 48824
UCHRIS@msu.edu

Shallimar Jones, M.A.
Department of Psychology
East Lansing, MI 48824

Pregnancy and Stress Study
Consent Form – Time 2

Thank your for participating in the first time period of the Pregnancy and Stress study. This is the second part of a survey of women in Michigan, some of whom may be stress during their pregnancy. We hope to learn about the types of stressors you may have faced during your pregnancy, how stressful they are to you, the strengths that you bring to your situation, your feelings, your child's development, and your relationships with others, including partners and friends, as well as how stress effects the physiology of pregnant women. In addition we are also interested in how stress during pregnancy may impact infants. We hope to use this information to help plan better programs for pregnant women experiencing stress during pregnancy.

If you decide to take part in the survey today, you will be asked questions about events that have happened to you in the last year, how you have been feeling recently, and your feelings about your child, their development, and the people in your life who provide support for you. Nothing that we do will be painful or dangerous. The total interview will take about 1 1/2 hours. You will be paid $15 for your participation.

All information that you give us will be kept strictly confidential among the project staff. Your name or will not be on any questionnaires; an identification number will be put on them instead. All questionnaires and will be kept in locked file cabinets in a locked office. Your identity will not be revealed in any reports written about this study. We will summarize information from all study participants and will not report information about yourself or any individuals. Your privacy will be protected to the maximum extent allowable by law.

The only exception to full confidentiality is in the case of ongoing child abuse or neglect. If you indicate that child abuse or neglect is occurring in your household, we are required to make a report to Child Protective Services. We would inform you if we thought we needed to make such a report.

You have the right to refuse to answer any questions or to withdraw from this study at any point during the interview with no penalty or negative consequences. Your decision about whether to participate or not will not affect your relationship with any agencies or Michigan State University. If you have any questions, please ask us. If you have any questions about the study later, you can contact Dr. Anne Bogat or Shallimar Jones, M.A. at (517) 432-3825. If you have questions about your rights as a participant in this research study you may contact Dr. Peter Vasilenko at (517) 355-2180.

I have read this form and agree to participate.

_____	_____	_____
Signature of Participant	Print Name	Date

_____	_____
Witness	Date

Anne Bogat, Ph.D.
Michigan State University
Department of Psychology
East Lansing, MI 48824

Shallimar Jones, M.A.
Department of Psychology
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Dr. Peter Vasilenko
202 Olds Hall
Michigan State University
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UCHRIS@msu.edu

Appendix Q: Recontact Information

RECONTACT INFORMATION

We would like permission to stay in contact with you throughout the 6 months. We will contact you after your delivery date to make sure we have your correct address and telephone number. Then 3 months after your baby is born, we will call to set up an interview to ask you similar questions and also about the birth as well as your child's health and development. Providing us with the following information does not obligate you to talk to us on the telephone or meet with us for the second visit.

Please list at least three people who will always know where you are, even if you were to move or relocate unexpectedly.

1st person:
Name (Relationship to you): _____

Address: _____

_____

Phone Number: _____

2nd Person
Name (Relationship to you): _____

_____

Address: _____

_____

Phone Number: _____

3rd Person
Name (Relationship to you): _____

Address: _____

_____

Phone Number: _____

1. Would you prefer: (circle one)

a) to be contacted directly?_____ OR
b) to be contacted through one of the 3 persons listed on the previous page?_____

If you would like to be contacted through the above-listed persons, we will call them and ask if we may call you directly. If we may not, we will send a note to you in care of the contact person.

3. If we or the people on the previous sheet lose contact with you, may we try finding you through your social security # or driver's license? YES NO

If yes, social security no. _____
driver's license no. _____

INTERVIEWER: Have participant sign 3 letters.

Check here when completed _____

TABLES AND FIGURES

Table 1

Demographic Description of Sample at T1 (N=92)

Variable	
Age	25.7 (5.3)
Income (median)	$2,036 (1736)
Education (percent)	--
Weeks pregnant	32.5 (1.89)
No High School	19%
High school, GED	24%
Trade School	26%
Associates	3%
B.A., B.S.	21%
Med/Grad/Law	8%
Ethnicity (percent)	--
White	50%
Black	29%
Latino	8%
Asian	3%
Native American	2%
Multi-racial	8%
Smoking	20%
Am cortisol nmol/L	12.22 (7.78)
Pm cortisol nmol/L	11.86 (7.43)

Table 2

Demographic Variables for T2 (N=65)

Variable Name	Mean
Sex	--
Male	49%
Female	51%
Ethnicity	--
Black	28%
White	34%
Asian	3%
Latino	1%
Bi-racial	27%
Multi-racial	4%
Gestation at delivery	39
Moderately premature	8(13%)
Extremely premature	1(2%)
Birth weight	7 lbs. 9 oz. (1.30)
Child age at interview (corrected for prematurity)	3.9 months (1.1)
Type of birth	--
Vaginal	80%
Caesarian	20%
Pregnancy Risk Factors	4 (3.01)

Table 3

Table of Means for Imputed vs. Non-Imputed Data

Demographic Characteristics	N=65 mean	N=27 mean
Age of mom (t1)	26	24
Age of child (t2)	3.9	4.1
Gestation (t2)	38	38
Birth weight (t2)	6.8	7.8
Number of bio children (t1)	.83	1.2
People in household (T1)	3.1	3.3
Income (T1)	2249	1524
Education (T1)	3.6	2.8
Maternal Health complications during pregnancy (T1)	4.4	4.6
Marriage	1.55	1.33
Study Variables of interest	N=65 mean	N=27 mean
Mental health (T1)	147	155
Stress (T1)	89	103
Perceived	35	36
Am cortisol (T1) nmol/L	13.01	10.32
Pm cortisol (T1) nmol/L	8.69	6.15
Mental health (T2)	152	144
Stress (T2)	100	99
Perceived (T2)	34	35
Activity (T2)	56	58
Distress to Limitations (T2)	54	59
Duration of Orienting (T2)	30	30
Smiling (T2)	65	61
Infant Care (T2)	221	222
Consecutive Sleep (T2)	6.76	6.80

(T1 = original non-imputed and all of T2 was imputed)

Table 4

Table of Combined Imputed and Non-imputed Data for Study Variables

Variable Name	Mean	SD	Range
Age of mom (t1)	25.68	5.32	18-38
Age of child (t2)	4.0	1.11	2.14-7.25
Gestation (t2)	38.75	5.60	26-42
Income (T1)	2036	1736	0-8,000
Pregnancy Risk Factors	4.03	3.01	0-14
T1 Depression	24.02	8.79	0-47
T1 Anxiety	78.11	22.12	44-139
T1 Life Events	20.61	12.68	2-60
T1 Daily Hassles	68.92	51.59	0-234
T2 Depression	19.5	7.48	0-42
T2 Anxiety	63.27	14.39	41-105
T2 Life Events	14.58	8.31	1-33
T2 Daily Hassles	51.41	4.26	42-58
Mental health (T1)	100	17.51	75-146
Stress (T1)	100.00	14.58	0-234
Perceived (T1)	35.63	4.86	16-47
Am cortisol (T1) nmol/L	12.22	7.78	0.00-36.14
Pm cortisol (T1) nmol/L	11.86	4.36	1.10-27.31
Mental health (T2)	100.00	23.68	100-209
Stress (T2)	100.00	6.25	77-131
Perceived (T2)	34.61	4.64	22-47
Parenting Competency (T2)	4.27	.54	2.90-4.96
Activity (T2)	56.6	13.66	25-84
Distress to Limitations (T2)	56.00	14.01	16-94
Duration of Orienting (T2)	30.34	8.44	11-51
Smiling (T2)	64.22	12.53	41-96
Consecutive Sleep (T2)	6.78	2.88	2-12

Table 5
Correlations of All Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
T1 Life (1)	1.00																	
T1 Mental (2)	.22*	1.00																
T1 Perc (3)	.08	.41**	1.00															
T2 Life (4)	.04	.04	.19	1.00														
T1 Mental (5)	-.10	.33**	.16	.06	1.00													
T2 Perc (6)	-.05	.09	.50**	.00	.10	1.00												
AM Cort (7)	.05	-.15	.04	-.09	-.12	.09	1.00											
PM Cort (8)	.00	-.19	-.11	.07	-.03	-.09	.06	1.00										
Parenting (9)	.23*	.11	.10	.07	-.23*	.02	.05	.03	1.00									
Baby Age (10)	-.15	-.01	-.09	-.05	.09	-.01	-.08	.12	.02	1.00								
Mom Age (11)	.37**	-.13	.15	.17	-.14	.17	.03	-.12	.05	-.10	1.00							
Income (12)	.06	-.14	.144	.19	.09	.18	.09	.06	-.07	.06	.46**	1.00						
Preg. Risk (13)	.05	.34**	.07	-.10	.02	.11	.01	-.02	.13	-.07	-.01	-.04	1.00					
Del. Comp (14)	.02	.04	-.03	.08	.19	-.02	-.19	.26*	-.04	.31**	.00	.27**	-.05	1.00				
Activity (15)	.05	-.12	-.19	.21*	.00	-.16	.03	.20	-.03	.24*	-.02	.08	.24*	.16	1.00			
Dist. to Lim (16)	-.05	.05	.07	-.09	.10	.08	.05	.07	-.12	-.09	-.13	-.06	.11	-.03	.22*	1.00		
Dur. of Orient. (17)	-.11	-.11	-.10	.01	-.12	-.24*	.08	.13	.20	-.06	.01	-.03	-.02	-.01	-.04	-.01	1.00	
Smiling (18)	.10	.17	.17	-.01	.05	.04	-.04	.05	.17	.18	-.10	-.02	.07	.07	.05	-.24*	.20	1.00
Sleep (19)	-.10	.07	-.05	.19	.17	-.12	-.22*	.06	-.03	.13	-.02	-.11	-.11	.04	-.13	-.29**	.02	.10

* $p < 0.05$ level (2-tailed). ** $p < 0.01$ level (2-tailed)

Table 6: Hypothesis A: Mental Stress Predicting Infant Activity

Step 1	β	SE β	Beta
Age of baby	3.84	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.84
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.00	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.44	1.51	.28**
Pregnancy risk factors	1.74	.45	.39**
T2 Perceived Stress	-.56	.27	-.19*
T2 Life Stress	.59	.20	.27**
T2 Mental Stress	.00	.06	.03
T1 Mental stress	-.14	.06	-.25*
Total for Step 2	$\Delta R^2 = .05$, $F(6,91)= 5.41$, $p<.01$		

Notes to table:

*p<.05, **p<.01

Table 7: Hypothesis A: Mental Stress Predicting Distress To Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.34	1.36	-.11
Pregnancy risk factors	.44	.53	.10
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.22	.24	-.10
T2 Mental Stress	.07	.07	.11
T1 Mental Stress	-.01	.07	-.03
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .65$, p=n.s.		

Notes to table:

*p<.05, **p<.01

Table 8: Hypothesis A: T1 Mental Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.10
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.03	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.05	1.21	.18
Pregnancy risk factors	.18	.47	.04
T2 Perceived Stress	.10	.29	.04
T2 Life Stress	.05	.21	.00
T2 Mental Stress	.04	.06	.01
T1 Mental Stress	.06	.06	.12
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .82$, p=*n.s.*		

Notes to table:

*p<.05, **p<.01

Table 9: Hypothesis A: Mental Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.09	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.44	.81	-.06
Pregnancy risk factors	.09	031	.32
T2 Perceived Stress	-.43	.19	-.24*
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.02	.04	-.05
T1 Mental Stress	-.03	.04	-.09
Total for Step 2	$\Delta R^2 = .01$, $F(6,91)= 1.09$, $p=n.s.$		

Notes to table:

*p<.05, **p<.01

Table 10: Hypothesis A: Mental Stress Predicting Consecutive Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.30	.27	.11
Pregnancy risk factors	-.07	.11	-.08
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.18
T2 Mental Stress	.02	.01	.16
Mental Stress	.00	.02	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 1.65$, p=*n.s.*		

Notes to table:

*p<.05, **p<.01

Table 11: Hypothesis A: T1 Life Stress Predicting Activity

Step 1	B	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.52	1.19	.29**
Pregnancy risk factors	1.40	.47	.35**
T2 Perceived Stress	-.51	.29	-.17
T2 Life Stress	.61	.22	.28**
T2 Mental Stress	-.01	.06	-.03
T1 Life Stress	-.06	.10	-.08
Total for Step 2	$\Delta R^2 = .00$, $F(4,91)= 4.23$, $p < .01$		

Notes to table:
*p<.05, **p<.01

Table 12: Hypothesis A: Life Stress Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.13	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.40	1.35	-.11
Pregnancy risk factors	.17	.54	.04
T2 Perceived Stress	.13	.33	.04
T2 Life Stress	-.30	.25	-.13
T2 Mental stress	.04	.07	.06
T1 Life Stress	.12	.11	.14
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .84$, p=*n.s.*		

Notes to table:

*p<.05, **p<.01

Table 13: Hypothesis A: Life Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.10	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.03	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.10	.29	.03
T2 Life Stress	.08	.22	.00
T2 Mental Stress	.02	.06	.04
Life Stress	-.01	.05	-.02
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .65$, p = *n.s.*		

Notes to table:

*p<.05, **p<.01

Table 14: Hypothesis A: T1 Life Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.09	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.37	.80	-.05
Pregnancy risk factors	.21	.32	.08
T2 Perceived Stress	-.40	.19	-.20
T2 Life Stress	.07	.15	.05
T2 Mental Stress	-.08	.04	-.02
T1 Life Stress	-.10	.07	-.19
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.41$ $p=$ n.s.		

Notes to table:
*p<.05, **p<.01

Table 15: Hypothesis A: T1 Life Stress Predicting Consecutive Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.07	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.32	.28	.13
Pregnancy risk factors	.01	.11	.03
T2 Perceived Stress	-.06	.06	-.09
T2 Life Stress	.11	.05	.22*
T2 Mental Stress	.03	.01	.24*
T1 Life Stress	-.04	.02	-.20
Total for Step 2	$\Delta R^2 = .03$, $F(6,91) = 2.14$ p= n.s.		

Notes to table:
*p<.05, **p<.01

Table 16: Hypothesis A: T1 Perceived Stress Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.50	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.27	1.18	.27**
Pregnancy risk factors	1.39	.43	.31**
T2 Perceived Stress	-.27	.32	-.09
T2 Life Stress	.64	.21	.30**
T2 Mental Stress	-.01	.06	-.02
T1 Perceived Stress	-.53	.32	-.19
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 4.76$ $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 17: Hypothesis A: T1 Perceived Stress Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.30	1.37	-.10
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.15	.37	.05
T2 Life Stress	-.24	.25	-.10
T2 Mental Stress	.06	.07	.10
T1 Perceived Stress	.07	.37	.03
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .65$ *p=n.s.*		

Notes to table:
*p<.05, **p<.01

Table 18: Hypothesis A: T1 Perceived Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.26	1.20	.20
Pregnancy risk factors	.32	.43	.08
T2 Perceived Stress	-.20	.33	-.07
T2 Life Stress	-.06	.22	-.03
T2 Mental Stress	.06	.06	.01
T1 Perceived Stress	.57	.32	.22
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.19$ $p=n.s.$		

Notes to table:
*p<.05, **p<.01

Table 19: Hypothesis A: T1 Perceived Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.09	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.14	.10
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.40	.81	-.05
Pregnancy risk factors	.07	.29	.00
T2 Perceived Stress	-.45	.22	-.25*
T2 Life Stress	.00	.15	.00
T2 Mental Stress	-.03	.04	-.08
T1 Perceived Stress	.06	.22	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = 1.01$ p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 20: Hypothesis A: T1 Perceived Stress Predicting Consecutive Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .10$		
Step 2			
Age of baby	.28	.27	.11
Pregnancy risk factors	-.06	.10	-.06
T2 Perceived Stress	-.06	.07	.10
T2 Life Stress	.09	.05	.18
T2 Mental Stress	.02	.01	.19
T1 Perceived Stress	-.03	.07	-.06
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 1.68$ p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 21: Hypothesis B: T1 Mental Stress Predicting A.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	.12	2.60	.00
Pregnancy risk factors	.24	.94	.03
T2 Perceived Stress	.18	.62	.03
T2 Life Stress	-.36	.46	-.09
T2 Mental Stress	-.14	.12	-.12
Total for Step 1	$\Delta R^2 = .03$		
Step 2			
Age of baby	.09	2.60	.00
Pregnancy risk factors	.50	1.00	.06
T2 Perceived Stress	.17	.62	.03
T2 Life Stress	-.35	.46	-.08
T2 Mental Stress	-.10	.13	-.09
T1 Mental Stress	-.09	.13	-.09
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .47$ p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 22: Hypothesis B: T1 Life Stress Predicting A.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	-.37	2.562	-.02
Pregnancy risk factors	.14	.94	.07
T2 Perceived Stress	.18	.61	.03
T2 Life Stress	-.60	.47	-.14
T2 Mental Stress	-.21	.18	-.13
Total for Step 1	$\Delta R^2 = .03$		
Step 2			
Age of baby	-.12	2.60	-.01
Pregnancy risk factors	.10	.94	.01
T2 Perceived Stress	.20	.62	.04
T2 Life Stress	-.62	.47	-.14
T2 Mental Stress	-.20	.18	-.12
T1 Life Stress	.20	.30	.07
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 1.05$ p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 23: Hypothesis B: T1 Perceived Stress Predicting A.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	.12	2.60	.01
Pregnancy risk factors	.24	.94	.03
T2 Perceived Stress	.18	.62	.03
T2 Life Stress	-.37	.46	-.09
T2 Mental Stress	-.14	.12	-.12
Total for Step 1	$\Delta R^2 = .03$		
Step 2			
Age of baby	.40	2.61	.02
Pregnancy risk factors	.22	.94	.03
T2 Perceived Stress	-.16	.71	-.03
T2 Life Stress	-.45	.47	-.11
T2 Mental Stress	-.16	.12	-.14
T1 Perceived Stress	.67	.70	.12
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .53$ p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 24: Hypothesis B: T1 Mental Stress Predicting P.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	1.95	2.56	.08
Pregnancy risk factors	-.07	.93	-.01
T2 Perceived Stress	-1.4	.61	-.20
T2 Life Stress	-.05	.45	-.01
T2 Mental Stress	-.06	.12	-.05
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	1.90	2.54	.08
Pregnancy risk factors	.45	.99	.05
T2 Perceived Stress	-1.17	.61	-.20
T2 Life Stress	-.03	.45	-.00
T2 Mental Stress	-.00	.13	.01
T1 Mental Stress	-.19	.13	-.18
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 1.14$; $p=n.s.$		

Notes to table:
*p<.05, **p<.01

Table 25: Hypothesis B: T1 Life Stress Predicting P.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	1.95	2.56	.08
Pregnancy risk factors	-.07	.93	-.01
T2 Perceived Stress	-1.4	.61	-.20
T2 Life Stress	-.05	.45	-.01
T2 Mental Stress	-.06	.12	-.05
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	2.10	2.56	.09
Pregnancy risk factors	.47	1.02	.05
T2 Perceived Stress	-1.01	.62	-.18
T2 Life Stress	.01	.47	.02
T2 Mental Stress	-.07	.13	-.01
T1 Life Stress	-.25	.21	-.16
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 1.01$; $p=n.s.$		

Notes to table:
*p<.05, **p<.01

Table 26: Hypothesis B: T1 Perceived Stress Predicting P.M. Cortisol

Step 1	β	SE β	Beta
Age of baby	1.95	2.56	.08
Pregnancy risk factors	-.07	.93	-.01
T2 Perceived Stress	-1.4	.61	-.20
T2 Life Stress	-.05	.45	-.01
T2 Mental Stress	-.06	.12	-.05
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	1.70	2.81	.07
Pregnancy risk factors	-.05	.93	-.01
T2 Perceived Stress	-.84	.71	-.15
T2 Life Stress	.03	.47	.01
T2 Mental Stress	-.03	.12	-.03
T1 Perceived Stress	-.60	.70	-.11
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .88$; p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 27: Hypothesis C: T1 A.M. Cortisol Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.35	.43	.30**
T2 Perceived Stress	-.55	.28	-.19
T2 Life Stress	.59	.21	.27**
T2 Mental Stress	-.02	.06	.04
A.M. Cortisol	.05	.05	.09
Total for Step 2	$\Delta R^2 = .01$, $F(6,91)= 4.37$; $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 28: Hypothesis C: T1 A.M. Cortisol Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.34	1.35	-.11
Pregnancy risk factors	.39	.49	.09
T2 Perceived Stress	.18	.32	.06
T2 Life Stress	-.21	.24	-.09
T2 Mental Stress	.06	.06	.11
A.M. Cortisol	.04	.06	.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .73$; $p = n.s.$		

Notes to table:
*p<.05, **p<.01

Table 29: Hypothesis C: T1 A.M. Cortisol Predicting Distress to Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.04
T2 Life Stress	.00	.22	.00
T2 Mental Stress	.02	.06	.04
A.M. Cortisol	-.01	.05	-.02
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .65$; $p =$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 30: Hypothesis C: T1 A.M. Cortisol Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.04	.19	-.23
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.43	.81	-.06
Pregnancy risk factors	.00	.29	.00
T2 Perceived Stress	-.43	.19	-.23
T2 Life Stress	.02	.14	.08
T2 Mental Stress	-.02	.04	-.07
A.M. Cortisol	.03	.03	.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91)= 1.10$; $p=$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 31: Hypothesis C: T1 A.M. Cortisol Predicting Consecutive Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	.08	.06	-.12
T2 Life Stress	.08	05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.29	.27	.11
Pregnancy risk factors	-.06	.10	-.06
T2 Perceived Stress	-.07	.06	-.12
T2 Life Stress	.07	.05	.16
T2 Mental Stress	.02	.01	.16
A.M. Cortisol	-.01	.01	-.13
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 1.91$; $p=$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 32: Hypothesis C: T1 P.M. Cortisol Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.19
T2 Life Stress	.57	.21	.26
T2 Mental Stress	-.31	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.34	1.18	.27
Pregnancy risk factors	1.37	.43	.31
T2 Perceived Stress	-.46	.29	-.16
T2 Life Stress	.58	.21	.26
T2 Mental Stress	-.03	.06	-.05
P.M. Cortisol	.07	.05	.14
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 4.62$; $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 33: Hypothesis C: T1 P.M. Cortisol Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.39	1.36	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.23	.33	.08
T2 Life Stress	-.22	.24	-.10
T2 Mental Stress	.06	.06	.11
P.M. Cortisol	.03	.06	.06
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .69$; $p =$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 34: Hypothesis C: T1 P.M. Cortisol Predicting Distress to Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.00	1.22	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.11	.29	.04
T2 Life Stress	.01	.22	.01
T2 Mental Stress	.03	.06	.05
P.M. Cortisol	.02	.05	.03
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .66$; $p =$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 35: Hypothesis C: T1 P.M. Cortisol Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.04	.19	-.23
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.67	.81	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.40	.20	-.22
T2 Life Stress	.02	.14	.01
T2 Mental Stress	-.03	.04	-.07
P.M. Cortisol	.02	.03	.07
Total for Step 2	$\Delta R^2 = .01$, $F(6,91)= 1.06$; $p=$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 36: Hypothesis C: T1 P.M. Cortisol Predicting Consecutive Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	.08	.06	-.12
T2 Life Stress	.08	05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.07	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
P.M. Cortisol	.00	.01	.00
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 1.64$; $p=$ *n.s.*		

Notes to table:
*p<.05, **p<.01

Table 37: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Mental Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.44	1.15	.28**
Pregnancy risk factors	1.72	.45	.39**
T2 Perceived Stress	-.57	.28	-.19*
T2 Life Stress	.60	.21	.28**
T2 Mental Stress	.02	.06	.04
A.M. Cortisol	.04	.05	.08
T1 Mental Stress	-.14	.06	-.25*
Total for Step 2	$\Delta R^2 = .06$, $F(6,91)= 4.71$ $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 38: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Life Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.51	1.19	.29**
Pregnancy risk factors	1.45	.18	.33**
T2 Perceived Stress	-.52	.29	-.18
T2 Life Stress	.62	.22	.28**
T2 Mental Stress	-.01	.06	-.03
A.M. Cortisol	.04	.05	.08
T1 Life Stress	-.05	.10	-.06
Total for Step 2	$\Delta R^2 = .01$, $F(6,91)= 3.74$ $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 39: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Perceived Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.24	1.18	.26**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.27	.32	-.09
T2 Life Stress	.67	.21	.31**
T2 Mental Stress	-.00	.06	-.01
A.M. Cortisol	.06	.05	.11
T1 Perceived Stress	-.57	.31	-.20
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 4.28$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 40: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Mental Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.34	1.36	-.11
Pregnancy risk factors	.42	.53	.09
T2 Perceived Stress	.18	.32	.06
T2 Life Stress	-.22	.24	-.09
T2 Mental Stress	.07	.07	.12
A.M. Cortisol	.04	.06	.08
T1 Mental Stress	-.01	.07	-.02
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .62$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 41: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Life Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.42	1.35	-.11
Pregnancy risk factors	.11	.54	.02
T2 Perceived Stress	.11	.33	.04
T2 Life Stress	-.29	.25	-.13
T2 Mental Stress	.04	.07	.07
A.M. Cortisol	.05	.06	.11
T1 Life Stress	.14	.11	.16
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .85$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 42: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Perceived Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.11
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.32	1.37	-.10
Pregnancy risk factors	.39	.50	.09
T2 Perceived Stress	.16	.37	.05
T2 Life Stress	-.22	.25	-.10
T2 Mental Stress	.06	.07	.11
A.M. Cortisol	.04	.06	.08
T1 Perceived Stress	.05	.37	.02
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .62$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 43: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Mental Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.05	1.21	.18
Pregnancy risk factors	.18	.47	.04
T2 Perceived Stress	.10	.29	.04
T2 Life Stress	.00	.22	.00
T2 Mental Stress	.00	.06	.01
A.M. Cortisol	-.00	.05	-.02
T1 Mental Stress	.06	.06	.12
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .69$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 44: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Life Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.13	1.21	.19
Pregnancy risk factors	.66	.48	.16
T2 Perceived Stress	.18	.29	.07
T2 Life Stress	.09	.22	.05
T2 Mental Stress	.05	.06	.10
A.M. Cortisol	-.03	.05	-.06
T1 Life Stress	.16	.10	-.21
Total for Step 2	$\Delta R^2 = .03$, $F(6,91) = .92$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 45: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Perceived Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.44	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.27	1.21	.20
Pregnancy risk factors	.32	.44	.08
T2 Perceived Stress	-.20	.33	-.07
T2 Life Stress	-.07	.22	-.04
T2 Mental Stress	.00	.06	.01
A.M. Cortisol	-.02	.05	-.04
T1 Perceived Stress	.58	.33	.23
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 1.03$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 46: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Mental Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.00	.29	.00
T2 Perceived Stress	-.42	.19	-.23
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.44	.81	-.06
Pregnancy risk factors	.08	.31	.03
T2 Perceived Stress	-.43	.19	-.24
T2 Life Stress	.03	.14	.02
T2 Mental Stress	-.01	.04	-.04
A.M. Cortisol	.02	.03	.07
T1 Mental Stress	-.03	.04	-.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .99$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 47: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Life Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.00	.29	.00
T2 Perceived Stress	-.42	.19	-.23
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.37	.80	-.05
Pregnancy risk factors	.19	.32	.07
T2 Perceived Stress	-.38	.19	-.21
T2 Life Stress	.07	.15	.06
T2 Mental Stress	-.00	.04	-.02
A.M. Cortisol	.02	.03	.05
T1 Life Stress	-.09	.07	-.18
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.23$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 48: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Perceived Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.00	.29	.00
T2 Perceived Stress	-.42	.19	-.23
T2 Life Stress	.01	.14	.01
T2 Mental Stress	-.03	.04	-.08
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.41	.82	-.05
Pregnancy risk factors	.00	.30	.00
T2 Perceived Stress	-.45	.22	-.25
T2 Life Stress	.02	.15	.01
T2 Mental Stress	-.03	.04	-.07
A.M. Cortisol	.02	.03	.08
T1 Perceived Stress	.05	.22	.03
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .93$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 49: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Mental Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.29	.27	.11
Pregnancy risk factors	-.07	.11	-.08
T2 Perceived Stress	-.07	.06	-.12
T2 Life Stress	.07	.05	.15
T2 Mental Stress	.02	.01	.15
A.M. Cortisol	-.01	.01	-.13
T1 Mental Stress	.00	.02	.03
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 1.63$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 50: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Life Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.32	.27	.13
Pregnancy risk factors	.03	.11	.03
T2 Perceived Stress	.05	.06	-.08
T2 Life Stress	.10	.05	.21
T2 Mental Stress	.03	.01	.23*
A.M. Cortisol	-.2	.01	-.16
T1 Life Stress	-.04	.02	-.24
Total for Step 2	$\Delta R^2 = .05$, $F(6,91)= 2.21$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 51: Hypothesis D: T1 A.M. Cortisol As A Mediator of T1 Perceived Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.06	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.28	.27	.11
Pregnancy risk factors	-.06	.10	-.06
T2 Perceived Stress	-.06	.07	-.10
T2 Life Stress	.08	.05	.16
T2 Mental Stress	.02	.01	.17
A.M. Cortisol	-.01	.01	-.12
T1 Life Stress	-.02	.07	-.04
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 1.63$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 52: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Mental Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.33	1.15	.27**
Pregnancy risk factors	1.72	.45	.39**
T2 Perceived Stress	-.50	.30	-.17
T2 Life Stress	.59	.20	.27**
T2 Mental Stress	.02	.06	.03
P.M. Cortisol	.06	.05	.11
T1 Mental Stress	-.13	.06	-.23**
Total for Step 2	$\Delta R^2 = .06$, $F(6,91)= 4.83$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 53: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Life Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.38	1.19	.28**
Pregnancy risk factors	1.47	.47	.33**
T2 Perceived Stress	-.44	.29	-.15
T2 Life Stress	.61	.22	.27**
T2 Mental Stress	-.02	.06	-.03
P.M. Cortisol	.07	.05	.14
T1 Life Stress	-.05	.10	-.06
Total for Step 2	$\Delta R^2 = .02$, $F(6,91)= 3.96$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 54: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Perceived Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.48	1.18	.28**
Pregnancy risk factors	1.37	.43	.31**
T2 Perceived Stress	-.54	.28	-.18
T2 Life Stress	.57	.21	.26**
T2 Mental Stress	-.03	.06	-.05
Total for Step 1	$\Delta R^2 = .23$		
Step 2			
Age of baby	3.15	1.18	.26**
Pregnancy risk factors	1.39	.42	.31**
T2 Perceived Stress	-.22	.32	-.08
T2 Life Stress	.65	.21	.29**
T2 Mental Stress	-.01	.06	-.20
P.M. Cortisol	.07	.05	.13
T1 Perceived Stress	-.49	.32	.17
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 4.37$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 55: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Mental Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.10
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.39	1.37	-.11
Pregnancy risk factors	.43	.53	.09
T2 Perceived Stress	.23	.33	.07
T2 Life Stress	-.22	.24	-10
T2 Mental Stress	.07	.07	.11
P.M. Cortisol	.03	.06	.06
T1 Mental Stress	-.01	.07	-.02
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .59$, $p < .05$.		

Notes to table:
*p<.05, **p<.01

Table 56: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Life Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.10
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.49	1.36	-.12
Pregnancy risk factors	.15	.54	.03
T2 Perceived Stress	.17	.33	.06
T2 Life Stress	-.30	.25	-.13
T2 Mental Stress	.04	.07	.07
P.M. Cortisol	.04	.06	.08
T1 Life Stress	.13	.11	.15
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .78$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 57: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Perceived Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.33	1.35	-.10
Pregnancy risk factors	.40	.49	.09
T2 Perceived Stress	.19	.32	.06
T2 Life Stress	-.23	.24	-.10
T2 Mental Stress	.06	.06	.10
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.36	1.37	-.11
Pregnancy risk factors	.40	.50	.09
T2 Perceived Stress	.18	.38	.06
T2 Life Stress	-.24	.25	-.11
T2 Mental Stress	.06	.07	.10
P.M. Cortisol	.03	.06	.06
T1 Perceived Stress	.09	.37	.03
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .60$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 58: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Mental Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.044	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.00	1.21	.18
Pregnancy risk factors	.17	.47	.04
T2 Perceived Stress	.13	.30	.05
T2 Life Stress	.01	.22	.00
T2 Mental Stress	.00	.06	.01
P.M. Cortisol	.02	.05	.05
T1 Mental Stress	.06	.06	.13
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .72$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 59: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Life Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.044	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1 $\Delta R^2 = .04$			
Step 2			
Age of baby	2.10	1.21	.19
Pregnancy risk factors	.63	.48	.15
T2 Perceived Stress	.18	.30	.07
T2 Life Stress	.10	.22	.05
T2 Mental Stress	.05	.06	.10
P.M. Cortisol	.01	.05	.01
T1 Life Stress	-.15	.10	-.19
Total for Step 2 $\Delta R^2 = .03$, $F(6,91) = .88$, p=n.s.			

Notes to table:
*p<.05, **p<.01

Table 60: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Perceived Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.03	1.21	.18
Pregnancy risk factors	.34	.044	.08
T2 Perceived Stress	.09	.29	.03
T2 Life Stress	.01	.21	.01
T2 Mental Stress	.02	.06	.05
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.22	1.21	.20
Pregnancy risk factors	.32	.44	.08
T2 Perceived Stress	-.18	.33	-.07
T2 Life Stress	-.07	.22	-.03
T2 Mental Stress	.01	.06	.01
P.M. Cortisol	.02	.05	.05
T1 Perceived Stress	.59	.33	.23
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 1.04$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 61: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Mental Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.15	.01
T2 Mental Stress	-.03	.04	-.07
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.47	.81	-.06
Pregnancy risk factors	.08	.32	.03
T2 Perceived Stress	-.41	.20	-.22
T2 Life Stress	.02	.14	.01
T2 Mental Stress	-.02	.04	-.05
P.M. Cortisol	.02	.04	.06
T1 Mental Stress	-.03	.04	-.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .96$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 62: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Life Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.15	.01
T2 Mental Stress	-.03	.04	-.07
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.40	.81	-.05
Pregnancy risk factors	.20	.32	.07
T2 Perceived Stress	-.35	.20	-.20
T2 Life Stress	.07	.15	.05
T2 Mental Stress	-.01	.04	-.02
P.M. Cortisol	.01	.03	.05
T1 Life Stress	-.01	.07	-.18
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.22$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 63: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Perceived Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.43	.80	-.06
Pregnancy risk factors	.01	.29	.00
T2 Perceived Stress	-.42	.19	-.23*
T2 Life Stress	.01	.15	.01
T2 Mental Stress	-.03	.04	-.07
Total for Step 1	$\Delta R^2 = .07$		
Step 2			
Age of baby	-.44	.82	-.06
Pregnancy risk factors	.01	.30	.00
T2 Perceived Stress	-.44	.23	-.24
T2 Life Stress	.01	.15	.00
T2 Mental Stress	-.03	.04	-.08
P.M. Cortisol	.02	.03	.07
T1 Perceived Stress	.08	.22	.04
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .91$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 64: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Mental Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.61	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.29	.27	.11
Pregnancy risk factors	-.07	.11	-.08
T2 Perceived Stress	-.08	.07	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.16
P.M. Cortisol	.00	.01	.01
T1 Mental Stress	.00	.05	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = 1.40$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 65: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Life Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.61	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.33	.27	.13
Pregnancy risk factors	.01	.11	.01
T2 Perceived Stress	-.06	.07	-.10
T2 Life Stress	.11	.05	.22*
T2 Mental Stress	.03	.01	.24*
P.M. Cortisol	-.00	.01	-.02
T1 Life Stress	-.03	.02	-.21
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.82$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 66: Hypothesis D: T1 P.M. Cortisol As A Mediator of T1 Perceived Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.30	.27	.11
Pregnancy risk factors	-.61	.10	-.07
T2 Perceived Stress	-.08	.06	-.12
T2 Life Stress	.08	.05	.17
T2 Mental Stress	.02	.01	.18
Total for Step 1	$\Delta R^2 = .11$		
Step 2			
Age of baby	.28	.27	.11
Pregnancy risk factors	-.06	.10	-.06
T2 Perceived Stress	-.06	.08	-.10
T2 Life Stress	.08	.05	.18
T2 Mental Stress	.02	.01	.19
P.M. Cortisol	-.00	.01	-.00
T1 Perceived Stress	-.03	.08	-.06
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = 1.42$, p=n.s.		

Notes to table:
*p<.05, **p<.01

Table 67: Hypothesis E: T1 Mental Stress Predicting T2 Mental Stress

Step 1	β	SE β	Beta
Age of baby	3.16	2.25	.15
Pregnancy risk factors	.19	.83	.02
T2 Perceived Stress	.31	.54	.06
T2 Life Stress	.41	.40	.11
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	2.87	2.12	.14
Pregnancy risk factors	-.79	.83	-.10
T2 Perceived Stress	.31	.51	.06
T2 Life Stress	.38	.38	.08
T1 Mental Stress	.35	.10	.37**
Total for Step 2	$\Delta R^2 = .12$, $F(6,91)= 3.19$; $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 68: Hypothesis E: T1 Life Stress Predicts T2 Life Stress

Step 1	β	SE β	Beta
Age of baby	-.39	.60	-.07
Pregnancy risk factors	-.22	.22	-.11
T2 Perceived Stress	.00	.14	.00
T2 Mental Stress	.03	.03	.11
Total for Step 1	$\Delta R^2 = .03$		
Step 2			
Age of baby	-.43	.59	-.08
Pregnancy risk factors	-.44	.23	-.22
T2 Perceived Stress	-.06	.14	-.05
T2 Mental Stress	-.00	.03	.01
T1 Life Stress	.12	.05	.30**
Total for Step 2	$\Delta R^2 = .07$, $F(6,91)= 1.76$; p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 69: Hypothesis E: T1 Perceived Stress Predicts T2 Perceived Stress

Step 1	β	SE β	Beta
Age of baby	-.06	.45	-.01
Pregnancy risk factors	.16	.16	.11
T2 Life Stress	.00	.08	.00
T2 Mental Stress	.01	.02	.06
Total for Step 1	$\Delta R^2 = .02$		
Step 2			
Age of baby	.16	.39	.04
Pregnancy risk factors	.10	.14	.07
T2 Life Stress	-.07	.07	-.09
T2 Mental Stress	-.00	.02	-.04
T1 Perceived Stress	.49	.09	.52**
Total for Step 2	$\Delta R^2 = .25$, $F(6,91)= 6.11$; $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 70: Hypothesis F: T2 Mental Stress Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.07	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.03	1.23	.25*
Pregnancy risk factors	1.36	.49	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.07	.10	.08
T1 Mental Stress	-.12	.07	-.21
T2 Mental Stress	-.02	.06	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 3.27$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 71: Hypothesis F: T2 Mental Stress Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.35	-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.03	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.27	1.37	-.10
Pregnancy risk factors	.39	.55	.08
T1 Perceived Stress	.07	.34	.02
T1 Life Stress	.11	.11	.12
T1 Mental Stress	-.04	.08	-.08
T2 Mental Stress	.05	.07	.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .62$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 72: Hypothesis F: T2 Mental Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.38	1.17	.21*
Pregnancy risk factors	.55	.47	.13
T1 Perceived Stress	.55	.29	.21
T1 Life Stress	-.21	.10	*.27*
T1 Mental Stress	.06	.06	.12
T2 Mental Stress	.03	.06	.05
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .07$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 73: Hypothesis F: T2 Mental Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.40	.82	-.05
Pregnancy risk factors	.15	.33	.06
T1 Perceived Stress	-.06	.21	-.03
T1 Life Stress	-.11	.07	-.20
T1 Mental Stress	-.00	.05	-.00
T2 Mental Stress	-.01	.04	-.02
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .73$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 74: Hypothesis F: T2 Mental Stress Predicting Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.12	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	-.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.25	.27	.10
Pregnancy risk factors	-.08	.11	-.08
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.03	.02	-.17
T1 Mental Stress	.01	.02	.15
T2 Mental Stress	.03	.01	.23
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 1.41$, $p=n.s.$		

Notes to table:
*p<.05, **p<.01

Table 75: Hypothesis F: T2 Life Stress Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.07	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.31	1.16	.27**
Pregnancy risk factors	1.59	.47	.36**
T1 Perceived Stress	-.50	.29	-.18
T1 Life Stress	.01	.10	.01
T1 Mental Stress	-.09	.06	-.17
T2 Life Stress	.65	.22	.30**
Total for Step 2	$\Delta R^2 = .08$, $F(6,91)= 5.15$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 76: Hypothesis F: T2 Life Stress Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.35	-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.03	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.26	1.35	-.10
Pregnancy risk factors	.20	.55	.04
T1 Perceived Stress	.13	.34	.05
T1 Life Stress	.16	.11	.18
T1 Mental Stress	-.04	.07	-.07
T2 Life Stress	-.32	.25	-.14
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .81$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 77: Hypothesis F: T2 Life Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.47	1.16	.22*
Pregnancy risk factors	.54	.47	.13
T1 Perceived Stress	.55	.30	.21
T1 Life Stress	-.21	.10	-.27*
T1 Mental Stress	.07	.06	.14
T2 Life Stress	.06	.22	.03
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 2.00$, $p=n.s.$		

Notes to table:
*p<.05, **p<.01

Table 78: Hypothesis F: T2 Life Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	.37	.81	-.05
Pregnancy risk factors	.20	.33	.07
T1 Perceived Stress	-.08	.21	-.04
T1 Life Stress	-.11	.07	-.23
T1 Mental Stress	.00	.04	.00
T2 Life Stress	.09	.15	.07
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .78$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 79: Hypothesis F: T2 Life Stress Predicting Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.12	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	-.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.36	.27	.14
Pregnancy risk factors	-.06	.11	-.07
T1 Perceived Stress	-.06	.07	-.09
T1 Life Stress	-.03	.02	-.18
T1 Mental Stress	.02	.02	.21
T2 Life Stress	.11	.05	.23*
Total for Step 2	$\Delta R^2 = .05$, $F(6,91)= 1.64$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 80: Hypothesis F: T2 Perceived Stress Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.07	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.19	1.20	.26*
Pregnancy risk factors	1.44	.48	.32**
T1 Perceived Stress	-.09	.35	-.03
T1 Life Stress	.09	.10	.11
T1 Mental Stress	-.14	.07	-.25*
T2 Perceived Stress	.56	.34	-.19
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 3.79$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 81: Hypothesis F: T2 Perceived Stress Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.35	-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.03	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.18	1.36	-.09
Pregnancy risk factors	.30	.55	.07
T1 Perceived Stress	.00	.40	.00
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.03	.08	-.05
T2 Perceived Stress	.13	.39	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .56$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 82: Hypothesis F: T2 Perceived Stress Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.47	1.16	.21*
Pregnancy risk factors	.53	.47	.13
T1 Perceived Stress	.61	.34	.24
T1 Life Stress	-.20	.10	-.26*
T1 Mental Stress	.06	.06	.13
T2 Perceived Stress	-.09	.33	-.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 1.96$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 83: Hypothesis F: T2 Perceived Stress Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.33	.80	-.04
Pregnancy risk factors	.25	.32	.09
T1 Perceived Stress	.19	.23	.11
T1 Life Stress	-.09	.07	-.18
T1 Mental Stress	-.03	.04	-.08
T2 Perceived Stress	-.47	.23	-.26*
Total for Step 2	$\Delta R^2 = .05$, $F(6,91)= 1.50$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 84: Hypothesis F: T2 Perceived Stress Predicting Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.12	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	-.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.32	.28	.12
Pregnancy risk factors	-.10	.11	-.11
T1 Perceived Stress	-.01	.08	-.02
T1 Life Stress	-.02	.2	-.11
T1 Mental Stress	.02	.02	.19
T2 Perceived Stress	-.05	.08	-.09
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .96$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 85: Hypothesis G: T2 Mental Stress Predicting Parenting Competency

Step 1	β	SE β	Beta
Age of baby	.01	.05	.03
Pregnancy risk factors	.02	.02	.10
T1 Perceived Stress	.00	.01	.08
T1 Life Stress	.00	.00	.12
T1 Mental Stress	-.00	.00	-.04
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	.04	.05	.07
Pregnancy risk factors	.00	.02	.04
T1 Perceived Stress	.01	.01	.09
T1 Life Stress	.01	.00	.21
T1 Mental Stress	.01	.00	.05
T2 Mental Stress	-.01	.00	-.35**
Total for Step 2	$\Delta R^2 = .10$, $F(6,91)= 2.22$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 86: Hypothesis G: T2 Life Stress Predicting Parenting Competency

Step 1	β	SE β	Beta
Age of baby	.01	.05	.03
Pregnancy risk factors	.02	.02	.10
T1 Perceived Stress	.00	.01	.08
T1 Life Stress	.00	.00	.12
T1 Mental Stress	-.00	.00	-.04
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	.01	.05	.03
Pregnancy risk factors	.02	.02	.10
T1 Perceived Stress	.00	.01	.07
T1 Life Stress	.00	.00	.10
T1 Mental Stress	-.00	.00	-.04
T2 Life Stress	.00	.01	.04
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .54$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 87: Hypothesis G: T2 Perceived Stress Predicting Parenting Competency

Step 1	β	SE β	Beta
Age of baby	.01	.05	.03
Pregnancy risk factors	.02	.02	.10
T1 Perceived Stress	.00	.01	.08
T1 Life Stress	.00	.00	.12
T1 Mental Stress	-.00	.00	-.04
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	.01	.05	.03
Pregnancy risk factors	.01	.02	.10
T1 Perceived Stress	.01	.02	.11
T1 Life Stress	.00	.00	.12
T1 Mental Stress	-.00	.00	-.06
T2 Perceived Stress	-.01	.02	-.07
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .57$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 88: Hypothesis H: T2 Parenting Competency Predicting Activity

Step 1	β	SE β	Beta
Age of baby	3.01	1.21	.25*
Pregnancy risk factors	1.33	.18	.30*
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.08	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.11	1.21	.25*
Pregnancy risk factors	1.36	.49	.30*
T1 Perceived Stress	-.38	.31	-.13
T1 Life Stress	.08	.10	.10
T1 Mental Stress	-.11	.07	-.20
T2 Parenting Competency	-1.67	2.50	-.07
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 3.33$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 89: Hypothesis H: T2 Parenting Competency Predicting Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.35	-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.03	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.01	1.34	-.09
Pregnancy risk factors	.39	.54	.09
T1 Perceived Stress	.11	.34	.04
T1 Life Stress	.14	.11	.16
T1 Mental Stress	-.04	.07	-.06
T2 Parenting Competency	-3.88	2.76	-.15
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .88$, p=*n.s.*		

Notes to table:
*p<.05, **p<.01

Table 90: Hypothesis H: T2 Parenting Competency Predicting Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.93	1.14	.21*
Pregnancy risk factors	.45	.46	.11
T1 Perceived Stress	.52	.29	.20
T1 Life Stress	-.22	.09	-.28*
T1 Mental Stress	.07	.06	.14
T2 Parenting Competency	3.85	2.35	.17
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 2.47$, $p<.05$..		

Notes to table:
*p<.05, **p<.01

Table 91: Hypothesis H: T2 Parenting Competency Predicting Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.47	.79	-.06
Pregnancy risk factors	.10	.32	.04
T1 Perceived Stress	-.09	.20	-.05
T1 Life Stress	-.12	.06	-.24
T1 Mental Stress	.00	.04	.00
T2 Parenting Competency	3.72	1.63	.24*
Total for Step 2	$\Delta R^2 = .06$, $F(6,91)= 1.64$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 92: Hypothesis H: T2 Parenting Competency Predicting Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.12	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.31	.28	.12
Pregnancy risk factors	-.11	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.02
T1 Mental Stress	.03	.02	.21
T2 Parenting Competency	-.03	.57	-.01
Total for Step 2	$\Delta R^2 = .00$, $F(6,91) = .88$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 93: Hypothesis I: Parenting Competency Mediating T2 Mental Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.08	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.09	1.24	.25
Pregnancy risk factors	1.37	.49	.31
T1 Perceived Stress	-.38	.31	-.14
T1 Life Stress	.08	.10	.10
T1 Mental Stress	-.11	.07	-.21
T2 Parenting Competency	-1.56	2.67	-.06
T2 Mental Stress	.01	.07	.02
Total for Step 2	$\Delta R^2 = .00$, $F(6,91)= 2.83$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 94: Hypothesis I: Parenting Competency Mediating T2 Mental Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.34	.-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.32	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.14	1.34	-.09
Pregnancy risk factors	.41	.55	.09
T1 Perceived Stress	.11	.34	.04
T1 Life Stress	.13	.11	.15
T1 Mental Stress	-.04	.07	-.07
T2 Parenting Competency	-3.67	2.94	-.14
T2 Mental Stress	.02	.07	.03
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .76$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 95: Hypothesis I: Parenting Competency Mediating T2 Mental Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.21	1.12	.20
Pregnancy risk factors	.52	.46	.13
T1 Perceived Stress	.51	.29	.20
T1 Life Stress	-.24	.10	-.32*
T1 Mental Stress	.06	.06	.11
T2 Parenting Competency	4.70	2.48	.20
T2 Mental Stress	.07	.06	.12
Total for Step 2	$\Delta R^2 = .04$, $F(6,91)= 2.28$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 96: Hypothesis I: Parenting Competency Mediating T2 Mental Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.54	.80	-.07
Pregnancy risk factors	.13	.32	.05
T1 Perceived Stress	-.10	.20	-.06
T1 Life Stress	-.13	.07	-.26
T1 Mental Stress	-.01	.04	-.02
T2 Parenting Competency	4.07	1.72	.26*
T2 Mental Stress	.03	.04	.08
Total for Step 2	$\Delta R^2 = .06$, $F(6,91)= 1.45$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 97: Hypothesis I: Parenting Competency Mediating T2 Mental Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.11	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.24	.28	.09
Pregnancy risk factors	-.08	.12	-.09
T1 Perceived Stress	-.04	.07	-.08
T1 Life Stress	-.03	.02	-.18
T1 Mental Stress	.01	.02	.14
T2 Parenting Competency	.33	.60	.06
T2 Mental Stress	.03	02	.23
Total for Step 2	$\Delta R^2 = .04$, $F(6,91) = 1.24$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 98: Hypothesis I: Parenting Competency Mediating T2 Life Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.08	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.34	1.16	.27**
Pregnancy risk factors	1.62	.47	.36**
T1 Perceived Stress	-.49	.30	-.17
T1 Life Stress	.01	.10	.01
T1 Mental Stress	-.10	.06	-.18
T2 Parenting Competency	-1.97	2.39	-.08
T2 Life Stress	.66	.22	.30*
Total for Step 2	$\Delta R^2 = .09$, $F(6,91)= 4.50$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 99: Hypothesis I: Parenting Competency Mediating T2 Life Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.34	.-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.32	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.20	1.34	.10
Pregnancy risk factors	.27	.55	.06
T1 Perceived Stress	.16	.34	.06
T1 Life Stress	.17	.11	.20
T1 Mental Stress	-.04	.07	-.08
T2 Parenting Competency	-3.75	2.76	-.15
T2 Life Stress	-.30	.25	-.13
Total for Step 2	$\Delta R^2 = .04$, $F(6,91) = .97$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 100: Hypothesis I: Parenting Competency Mediating T2 Life Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.41	1.15	.21*
Pregnancy risk factors	.47	.17	.11
T1 Perceived Stress	..52	.29	.20
T1 Life Stress	-.22	.10	-.29
T1 Mental Stress	.07	.06	.15
T2 Parenting Competency	3.83	2.37	.17
T2 Life Stress	.05	.21	.02
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 2.10$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 101: Hypothesis I: Parenting Competency Mediating T2 Life Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.44	.80	-.06
Pregnancy risk factors	.13	.32	.05
T1 Perceived Stress	-.10	.20	-.06
T1 Life Stress	-.13	.07	-.25
T1 Mental Stress	.00	.04	.01
T2 Parenting Competency	3.68	1.63	.24*
T2 Life Stress	.08	.15	.06
Total for Step 2	$\Delta R^2 = .06$, $F(6,91)= 1.43$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 102: Hypothesis I: Parenting Competency Mediating T2 Life Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.11	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.40	.27	.14
Pregnancy risk factors	-.06	.11	-.07
T1 Perceived Stress	-.05	.07	-.90
T1 Life Stress	-.03	.02	-.18
T1 Mental Stress	.02	.02	.21
T2 Parenting Competency	-.06	.60	-.01
T2 Life Stress	.11	.05	.30*
Total for Step 2	$\Delta R^2 = .05$, $F(6,91)= 1.39$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 103: Hypothesis I: Parenting Competency Mediating T2 Perceived Stress and Activity

Step 1	β	SE β	Beta
Age of baby	3.09	1.21	.25*
Pregnancy risk factors	1.33	.48	.30**
T1 Perceived Stress	-.39	.31	-.14
T1 Life Stress	.08	.10	.09
T1 Mental Stress	-.11	.07	-.20
Total for Step 1	$\Delta R^2 = .19$		
Step 2			
Age of baby	3.22	1.20	.26*
Pregnancy risk factors	.147	.49	.33*
T1 Perceived Stress	-.07	.36	-.03
T1 Life Stress	.10	.10	.12
T1 Mental Stress	-.14	.07	-.26*
T2 Parenting Competency	-1.89	2.48	-.08
T2 Perceived Stress	.57	.34	-.18
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 3.32$, $p<.05$.		

Notes to table:
*p<.05, **p<.01

Table 104: Hypothesis I: Parenting Competency Mediating T2 Perceived Stress and Distress to Limitations

Step 1	β	SE β	Beta
Age of baby	-1.15	1.34	.-.09
Pregnancy risk factors	.33	.54	.07
T1 Perceived Stress	.08	.34	.03
T1 Life Stress	.12	.11	.14
T1 Mental Stress	-.32	.07	-.06
Total for Step 1	$\Delta R^2 = .04$		
Step 2			
Age of baby	-1.12	1.35	-.09
Pregnancy risk factors	.37	.55	.08
T1 Perceived Stress	.05	.40	.02
T1 Life Stress	.13	.11	.16
T1 Mental Stress	-.03	.08	-.05
T2 Parenting Competency	-3.84	2.89	-.15
T2 Perceive Stress	.10	.38	.03
Total for Step 2	$\Delta R^2 = .02$, $F(6,91) = .76$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01

Table 105: Hypothesis I: Parenting Competency Mediating T2 Perceived Stress and Smiling

Step 1	β	SE β	Beta
Age of baby	2.45	1.15	.22*
Pregnancy risk factors	.51	.46	.13
T1 Perceived Stress	.56	.29	.22
T1 Life Stress	-.20	.09	-.26*
T1 Mental Stress	.07	.06	.14
Total for Step 1	$\Delta R^2 = .12$		
Step 2			
Age of baby	2.41	1.15	.21*
Pregnancy risk factors	.46	.17	.11
T1 Perceived Stress	.56	.34	.22
T1 Life Stress	-.22	.09	-.28*
T1 Mental Stress	.07	.06	.14
T2 Parenting Competency	3.82	2.37	.17
T2 Perceived Stress	-.07	.33	-.02
Total for Step 2	$\Delta R^2 = .03$, $F(6,91)= 2.10$, $p=n.s.$.		

Notes to table:
*p<.05, **p<.01

Table 106: Hypothesis I: Parenting Competency Mediating T2 Perceived Stress and Duration of Orienting

Step 1	β	SE β	Beta
Age of baby	-.41	.81	-.06
Pregnancy risk factors	.16	.32	.06
T1 Perceived Stress	-.06	.20	-.03
T1 Life Stress	-.11	.07	-.21
T1 Mental Stress	-.00	.04	-.01
Total for Step 1	$\Delta R^2 = .05$		
Step 2			
Age of baby	-.39	.78	-.05
Pregnancy risk factors	.19	.31	.07
T1 Perceived Stress	.15	.23	.09
T1 Life Stress	-.11	.06	-.21
T1 Mental Stress	-.02	.04	-.06
T2 Parenting Competency	3.54	1.60	.23*
T2 Perceived Stress	-.45	.22	-.25*
Total for Step 2	$\Delta R^2 = .09$, $F(6,91)= 2.05$, $p<05$..		

Notes to table:
*p<.05, **p<.01

Table 107: Hypothesis H: Parenting Competency Mediating T2 Perceived Stress and Sleep

Step 1	β	SE β	Beta
Age of baby	.31	.28	.12
Pregnancy risk factors	-.11	.11	-.12
T1 Perceived Stress	-.04	.07	-.07
T1 Life Stress	-.02	.02	-.12
T1 Mental Stress	.03	.02	.21
Total for Step 1	$\Delta R^2 = .06$		
Step 2			
Age of baby	.32	.28	.12
Pregnancy risk factors	-.10	.11	-.11
T1 Perceived Stress	-.01	.08	-.02
T1 Life Stress	-.02	.02	-.11
T1 Mental Stress	-.02	.02	.19
T2 Parenting Competency	-.05	.57	-.01
T2 Perceived Stress	-.05	.08	-.08
Total for Step 2	$\Delta R^2 = .01$, $F(6,91) = .82$, p=*n.s.*.		

Notes to table:
*p<.05, **p<.01