Child Development, November/December 2004, Volume 75, Number 6, Pages 1774–1791

Parenting Stress, Infant Emotion Regulation, Maternal Sensitivity, and the Cognitive Development of Triplets: A Model for Parent and Child Influences in a Unique Ecology

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To examine the development of triplets, 23 sets of triplets were matched with 23 sets of twins and 23 singletons ($N = 138$). Maternal sensitivity was observed at newborn, 3, 6, and 12 months, and infants' cognitive and symbolic skills at 1 year. Triplets received lower maternal sensitivity across infancy and exhibited poorer cognitive competencies compared with singletons and twins. The most medically compromised triplet showed the lowest regulation, received lower maternal sensitivity, and demonstrated the weakest outcomes compared with siblings. Structural modeling charted three levels of influence on cognitive outcomes: direct, indirect, and contextual. The triplet ecology provides a context for assessing the relations among infant inborn dispositions, the rearing environment, and the role of exclusive parenting in development.

Although the absolute numbers of triplets and higher order multiples born yearly may be relatively small, triplets are the most rapidly growing birth population. Rates of triplet births in the United States have increased by tenfold since the 1980s, and the same growth rates are reported in other industrial countries, such as England, France, Belgium, Holland, and Australia (Blickstein & Keith, 2003; Blondel & Kaminski, 2002; Lipitz et al., 1989; Pons, Charlemaine, Dubreuil, Papiernik, & Frydman, 1998; Salat-Baroux & Antoine, 1996; Santema, Bourdrez, & Wallenburg, 1995; Vervliet et al., 1989; Yuval et al., 1995). With the assistance of modern technology, substantially more triplet pregnancies in the last decade have ended in three live births (Barr, Poggi, & Keszler, 2003). Still, little information is available on the developmental course of triplets. In particular, the differential relationships emerging between parents and each of their infants and their impact on the infants' cognitive development have rarely been examined in comprehensive, longitudinal studies.

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This study was supported by a grant from the Israel Science Foundation (01/945) and by the Irving B. Harris Foundation. We thank Vered Bar-On, Hagit Kahn, Dorit Vardiel, and Zehava Rosenthal for collecting and coding the data, and the parents and children who participated in the study.

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Apart from the need to chart the development of a growing birth population, the triplet condition offers a unique window into fundamental issues in development. Development under abnormal conditions creates a special context for the study of normative processes (Cicchetti & Lynch, 1993). Under conditions of high stress, components of the parenting system cohere and the interdependence among parenting experiences, interactive behavior, infant dispositions, and developmental outcomes tends to increase, highlighting the links between the determinants of parenting and developmental outcomes (Belsky, 1984, 1998; Cicchetti & Cohen, 1995). Specifically, the triplet situation provides a new angle on two central topics in developmental research: the ongoing relations between infant dispositions and the rearing environment, and the role of exclusive parenting in development. With regard to the first topic, in a typical family, infants enter the family one by one and each child encounters a different family ecology (van IJzendoorn et al., 2000). A triplet birth creates a situation where three infants are raised in the same environment and their own dispositions are the differentiating factors. Given that each infant's dispositions interact with the environment in a specific way, over time a unique rearing ecology is created for each child. Assessing the links among the infant's inborn dispositions, the parenting they elicit, and their combined effects on development may inform ecological and transactional models on normative and at-risk development (Bronfenbrenner, 1977; Sameroff, 1997).

As to the role of exclusive parenting, conditions in which more than one infant is the target of the

 0009-3920/2004/7506-0011

attachment process may pose a risk to the development of the mother–infant relationship (Anderson & Anderson, 1990; Theroux, 1989). Mothers of twins were found to show lower levels of affect attunement (Szajnberg, Skrinjaric, & Morre, 1989) and to develop preference to one child immediately after birth (Minde, Corter, Goldberg, & Jeffers, 1990). A triplet birth, which is significantly more stressful than the birth of twins, creates an ecology of limited parental resources and high parenting stress, where the exclusive parenting available for each child is markedly reduced (Sandbank, 1999). Because parenting is built on an initial period of total parental involvement with the child, complete attention to the infant's state and signals, and absorption in marking the child's day-by-day development (Feldman, Weller, Leckman, Kvint, & Eidelman, 1999; Leckman et al., 1999), a triplet birth may compromise the mother's ability to provide sensitive mothering to each infant. According to attachment theory, maternal sensitivity is the foundation on which the infant's cognitive and symbolic development rests (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969) and it is thus likely that disruptions to the formation of maternal sensitivity may interfere with the development of cognitive competencies. Assessing the development of maternal sensitivity within the triplet ecology and evaluating its effects on infants' cognitive outcomes may shed further light on the role of exclusive parenting in infant development.

The central hypothesis guiding the present study was that a triplet birth in itself constitutes a specific risk condition for infant development. This risk is independent of the degree of prematurity or infant medical risk and is related in part to the triplet ecology, which is marked by high parenting stress and potential disruptions to maternal sensitivity. Over time, such risks are likely to interfere with infant development. It was further suggested that although a triplet birth may pose a general risk to development, the inborn dispositions of each child would influence the type of parenting he or she receives, leading to differential cognitive outcomes. Finally, we used the triplet condition as a unique context to examine direct and indirect paths between components of the parenting system and developmental outcomes. We proposed and tested a theoretical model (Figure 1) that considers three levels of influence on cognitive outcomes: (a) direct, (b) indirect, and (c) contextual. These levels address factors that (a) directly affect cognitive growth, (b) shape cognitive outcomes through their impact on the development of maternal sensitivity, and (c) contribute

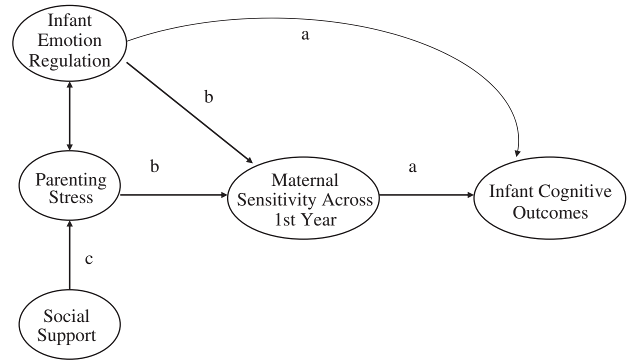

Figure 1. A model for the individual and contextual influences on infants' cognitive development in a high-risk population. Three levels of influence are proposed. Level a refers to direct influences on cognitive outcomes and includes maternal sensitivity and the infant's inborn emotion regulation capacities. Level b refers to indirect influences, which are mediated through their impact on maternal sensitivity, and includes parenting stress and infant emotion regulation. Level c indicates contextual influences, which affect cognitive development by increasing or reducing parenting stress, thereby indirectly affecting cognitive outcomes.

to increasing or reducing parenting stress, thereby affecting maternal sensitivity and, through it, cognitive outcomes.

Parenting Stress and the Development of Mother–Infant Relationship in Triplets

High parenting stress is among the central features of the triplet ecology. A triplet pregnancy poses a tremendous challenge to the mother and the need to provide basic care for three young infants is physically and psychologically exhausting (Albrecht & Tomich, 1996). The high levels of stress, fatigue, marital difficulties, and guilt reported by mothers of triplets contribute to their feeling of incompetence and to their reported difficulties in forming a special relationship with each of the children (Akerman, 1999; Garel & Blondel, 1992, 1995; Leonard, 1998). Furthermore, the fact that triplets are typically looked on as a strange, almost mythical phenomenon (Beit-Hallahmi & Paluszny, 1974; Scheinfeld, 1967) often limits the parents' quest for help from family or community members. In a recent survey, mothers raising multiple birth infants considered social stigma and parenting stress as the domains of most serious concern (Ellison & Hall, 2003).

The high parenting stress in families raising triplets may compromise the development of maternal sensitivity. Mothers describe spending most of their time in caring for the infants' physical needs (Akerman, 1999; Sandbank, 1999), complain of having no energy to form a unique emotional bond with each child (Bryan, 1992), and report emotional distancing from their infants (Garel & Blondel, 1992). Maternal differentiation among siblings—an index of exclusive parenting—is described as lower in triplets compared with twins (Booting, MacFarlane, & Price, 1990). Generally, parenting stress is a risk factor for optimal parenting, associated with reduced maternal sensitivity and negative child outcomes (Crnic & Low, 2002; Darke & Goldberg, 1994). Parenting stress is also related to infant dispositions, and higher stress has been reported among parents of less regulated infants (Papousek & von Hofacker, 1998). On the other hand, contextual determinants, in particular, social support, have been shown to buffer the effects of parenting stress on maternal interactive behavior (Crnic, Ragozin, Greenberg, Robinson, & Basham, 1983), thus reducing its potential negative impact on developmental outcomes.

Maternal Sensitivity and the Development of Cognitive Competencies

Infant cognitive competencies are built on the mother's careful introduction of new experiences, scaffolding of emerging skills, and provision of opportunities for the practice of developing capacities, in addition to global warmth and positive approach (Messer, 1994; Nelson, 1985; Vygotsky, 1978; Wachs & Gruen, 1982). Maternal sensitivity is defined as the mother's responsiveness to the infant's age-appropriate growth needs and takes a different form as infants mature. Although the mother's global sensitivity is central across childhood, each ''biobehavioral transition'' (Emde, Gaensbauer, & Harmon, 1976) introduces a new context for social interactions and requires a new set of maternal behaviors. In the newborn period, a maternal style marked by positive affect, ''motherese'' vocalization, affectionate touch, and adaptation to infant momentary alertness has been shown to promote cognitive skills (Feldman & Eidelman, 2003; Feldman, Eidelman, Sirota, & Weller, 2002). By 3 months, infants enter the face-to-face stage (Stern, 1985) and the mother's acknowledgment of the infant's social initiation and give-and-take reciprocity are conducive for cognitive growth (Feldman & Greenbaum, 1997; Feldman, Greenbaum, Yirmiya & Mayes, 1996). At 6 months, infants begin to develop shared attention, and the exploration of novel objects becomes the focus of dyadic play (Landry, 1986; Ruff, 1986). The mother's joint manipulation of objects with the infant supports exploratory skills and contributes to cognitive development (Feldman, Weller, Sirota, & Eidelman, 2002; Kopp & Vaughn, 1982).

Toward the end of the 1st year, the emergence of symbolic thought is expressed through the infant's first words, gestures, and rudimentary symbolic play (Bretherton & Bates, 1984). Symbolic play begins with simple acts of decontextualization around self or other and develops across the 2nd year into more complex scenarios, which combine, organize, or serially structure a set of simple acts into a coherent whole (Fein, 1981; Tamis-LeMonda & Bornstein, 1991). Infants' symbolic competence develops at the ''zone of proximal development'' (Vytotsky, 1978) and requires the adult's sensitive elaboration of the child's acts into a shared meaning. At 1 year, infants begin to shift from predominantly functional play to play that includes simple symbolic expressions (Fenson & Ramsay, 1980; McCune, 1995). At this point, the mother's sensitive attunement to moment-by-moment shifts in symbolic complexity affords a context for the mastery of symbols (Fiese, 1990; Melstein-Damast, Tamis-LeMonda, & Bornstein, 1996; Slade, 1987). Thus, the mother's age-appropriate behaviors across infancy—sensitivity to shifts in newborn's state, reciprocity in support of the infant's budding social involvement, joint manual practice of first exploratory attempts, and careful facilitation of the toddler's symbolic expression—mark the maternal sensitive style and support the development of cognitive competencies. With three infants at once and high parenting stress, the mother's capacity to focus on the growth needs of each child is likely to decrease, placing triplets at a higher risk for optimal cognitive growth.

Cognitive Development in Triplets

Few studies have examined the cognitive development of triplets. Triplets are often born prematurely (Martin et al., 2002), and prematurity is a risk factor for cognitive delays (Wolke, 1998). Gutbrod, Wolke, Soehne, Ohrt, and Riegel (2000) found differences in the cognitive functioning of singletons and infants born in a multiple birth at 5 months but not at 20 months. Similarly, Tymms and Preedy (1998) found no differences in the school readiness of singletons and a group comprising twins and triplets at 6 years. Garel, Salobir, Lelong, and Blondel (2001) examined the cognitive skills of 11 triplet sets at 7 years and found that triplets scored lower than singletons on all subtests, but differences did not reach statistical significance. Akerman (1995) examined the cognitive functioning of 17 Swedish triplet sets ages 4 to 8 years and found that triplets scored lower than the average for the Swedish population. Comparisons between triplets and premature singletons showed a slight delay for triplets in most domains, in addition to a significant delay in the personal and social domains, and triplets born small for gestational age (SGA) scored lower than their siblings. In a longitudinal evaluation of one quintuplet, two quadruplets, and two triplets, Krall and Feinstein (1991) found that multiple-birth infants functioned at the low end of the normative spectrum and that birth weight was a major determinant in the attainment of cognitive milestones. Thus, although the aforementioned studies did not compare triplets with singletons and twins, the data suggest that triplets as a group function less optimally but that other factors related to medical risk affect the performance of individual children. As to the links between maternal sensitivity and cognitive outcomes, few studies examined the parent–infant relationship in triplets, and we are aware of no study that examined the associations between mother–infant interactions and cognitive development in triplets. (Data on socioemotional developmental outcomes from our longitudinal work on parent–infant relationships in triplets are reported in Feldman & Eidelman, 2004). However, researchers on the triplet condition (Booting et al, 1990; Bryan, 1992; Goshen-Gottstein, 1980) emphasize the negative impact of a rearing situation wherein children must compete for parental attention, affection, and stimulation on the development of cognitive competencies.

The Present Study

In sum, the present study aimed to pioneer the study of triplets, in particular the relationships among the determinants of parenting (Belsky, 1984), the development of maternal sensitivity across the 1st year, and the infants' cognitive and symbolic outcomes at 1 year. We included two control groups to the triplet group—singletons and twins—and the three groups were matched for demographic and medical conditions. This experimental design enabled the assessment of the unique effects of a triplet birth on child outcomes, above and beyond those of multiple birth. Infants' emotion regulation was tested at the newborn period with the Neonatal Behavior Assessment Scale (NBAS; Brazelton, 1973) and the family's social support networks were documented. Mothers and fathers' parenting stress was assessed at 3 months. Mother–infant interactions were observed at newborn, 3, 6, and 12 months, periods that follow biobehavioral transitions. Infant in the mother's arms in the newborn period, face-to-face interaction at 3 months, a toy session at 6 months, and symbolic play at 12 months were selected as the age-appropriate contexts for the study of maternal sensitivity, and both global and microanalytic measures were applied.

No group differences were expected in initial conditions: infant inborn dispositions and family social support. At 3 months, parents of triplets were expected to report significantly higher parenting stress. Maternal sensitivity was expected to be lower in families raising triplets at each time point, and triplets were expected to show poorer cognitive outcomes compared with singletons and twins. In line with the transactional model, the determinants of parenting were hypothesized to be interrelated (Belsky, 1984; Sameroff, 1997), with higher inborn regulation, lower parenting stress, and higher social support associated with higher maternal sensitivity and better cognitive outcomes. To examine the ongoing relations between infant inborn dispositions and the rearing environment, between-sibling differences were examined. The most medically compromised triplet at birth was expected to show the lowest emotion regulation, to elicit the least sensitive mothering, and to demonstrate the poorest cognitive outcomes compared with the siblings.

Finally, structural modeling was used to test the theoretical model on the embedded nature of infants' cognitive development (Figure 1). Three levels of influence on cognitive outcomes were hypothesized: direct, indirect, and contextual. Maternal sensitivity was expected to show stability across the 1st year and to have a direct impact on cognitive growth. Infant emotion regulation at birth was expected to have both a direct effect on cognitive skills and an indirect effect, mediated by its influence on maternal sensitivity. Parenting stress was expected to exert an indirect effect on cognitive outcomes, mediated by its impact on maternal sensitivity. Finally, social support was expected to have neither a direct nor indirect effect on cognitive development but to have a contextual effect on parenting by reducing parenting stress, thereby indirectly affecting maternal sensitivity and, through it, the infant's cognitive outcomes.

Method

Participants

Participants included 138 infants born in the maternity ward of a tertiary care medical center in Jerusalem. These included 23 consecutive sets of triplets born in the hospital during the study period. Following the recruitment of a triplet set, we matched this set with a set of twins and a singleton infant from the same hospital nursery. Triplets, twins, and singletons were matched on the following medical variables: birthweight (matched to the average of the triplet set), gestational age, medical risk, and a similar proportion of Small for Gestational Age (SGA)/Appropriate for Gestational Age (AGA) infants and male–female ratio in the three groups. The three groups were matched for the following demographic variables: maternal age, maternal education, paternal age, and paternal education. Exclusion criteria included: mothers younger than 20 years old, unemployed parents, infant intraventricular hemorrhage (IVH) Grades III or IV (i.e., large bleeding in the brain ventricles with extension into the brain parenchyma), infant perinatal asphyxia, or infant metabolic or genetic disease. Table 1 shows demographic and medical information for singletons, twins, and triplets, and it reveals no significant differences between groups.

All families were considered middle class by Israeli standards (Harlap, Davis, Grower, & Prywes, 1977). All mothers were on maternity leave for the first 3 months of the infant's life, in accordance with the Israeli maternity leave policy. When infants were 6 months old, approximately two thirds of the mothers returned to full- or part-time employment, with no group differences in the proportion of employed mothers or the ratio of full- to part-time employment. No group differences were found in the number of older siblings or in the mother's self-reported social support networks. Mothers also rated the degree of father participation in household and child care responsibilities (for families with children), and no group differences were detected.

All mothers of triplets born in the neonatal nursery during the study period agreed to participate in the study. All families of triplets were included except for three families in which one or two of the children died immediately after birth or one child did not meet inclusion criteria because of IVH. In the singleton group, three mothers refused participation, and in the twin group, two mothers refused participation because of inconvenience or father refusal. The study received the approval of the Institutional Review Board in the hospital, and all mothers signed an informed consent form.

Follow-up observations were conducted for all infants with the following exceptions: one triplet set and one singleton at 3 months, one twin set and one singleton at 12 months, and one triplet set and one twin set at 12 months. These missed visits resulted from scheduling difficulties, and none of the families stopped participation in the study.

Procedure

Infants and families were observed in the postpartum period and at 3, 6, and 12 months of age (corrected age for infants born below 36 weeks GA). Parent–infant interactions were conducted separately with each infant, and cognitive assessment was conducted individually for each child. In families of triplets, more than one visit was often scheduled and mothers were encouraged to terminate the session if they felt they or the infants needed a second visit. The order of filming was randomized among siblings. Within each session, mother–infant interactions were followed by infant testing to minimize maternal fatigue and to avoid back-to-back interactions with several children. The newborn observation was conducted before discharge from the hospital, the 3-month assessment took place in the

Table 1
Demographic Information

	Singletons		Twins		Triplets	
	M	*SD*	*M*	*SD*	*M*	*SD*
Birth weight (grams)	1638.26	445.48	1658.22	495.5	1660.14	417.33
Gestational age (weeks)	32.10	2.76	32.57	2.97	32.22	2.52
Medical risk (CRIB)	1.63	2.45	1.30	1.90	1.43	2.19
Mother age (years)	27.84	5.46	28.55	6.03	29.25	4.68
Mother education (years)	14.56	2.42	14.21	1.47	14.01	2.33
Father age (years)	30.08	5.95	31.93	7.59	32.06	5.01
Father education (years)	13.50	3.01	13.93	2.56	14.15	2.95
Male or female (% male)	53.8%		57.4%		55.1%	
No. of children	1.53	1.20	1.65	1.32	1.07	0.86
SGA ratio	8.7%		9.0%		8.6%	

Note. CRIB = Clinical Risk Index for Babies; SGA = small for gestational age.

family's home, and the 6- and 12-month assessments were conducted at a developmental laboratory, to enable the evaluation of cross-setting consistency in maternal and infant behavior.

Newborn

Infant emotion regulation. A day or two before discharge from the hospital (at 37 weeks GA for infant born prematurely) infants were examined with the NBAS (Brazelton, 1973) by a trained neonatologist. The NBAS is a well-established test of newborns' neurobehavioral maturation that has been used in studies of term and preterm neonates (Brazelton, 1990). Items were grouped into six clusters according to Lester's (1984) classification. Two factors were used in the present study as indexes of the infant's inborn emotion regulation capacities: the Range of State cluster, which includes peak of excitement, rapidity of buildup, irritability, and lability of state; and the Regulation of State cluster, which includes cuddliness, consolability, self-quieting, and hand to mouth. The Range of State and Regulation of State clusters were averaged into the Infant Emotion Regulation composite ($\alpha = .71$).

Mother–newborn interaction. Mothers and infants were videotaped in a 10-min session of free interaction before discharge from the hospital. Mothers were videotaped in a secluded room in the nursery and were asked to interact freely with the infant for 10 min. Infants born prematurely were videotaped at 37 weeks GA.

Mother–infant interaction at 3 months. Mothers and infants were videotaped in a 5-min free-play session at home. Instructions were: "Play with your child as you normally do." No toys were provided but some mothers used the infant's own toys.

Mother–infant toy exploration at 6 months. Mothers were given a basket with age-appropriate toys and were asked to play with the infant using these toys. Approximately 10 min of dyadic toy play were videotaped in a split-screen technique, which showed both mother's and infant's faces.

Infant cognitive development at 12 months. Infant cognitive development was assessed by a trained psychologist with the Bayley Scale of Infant Development–2nd edition (Bayley II; Bayley, 1993). The Bayley II yields two scores: a Mental Development Index (MDI) and a Psychomotor Developmental Index (PDI).

Symbolic play at 12 months. Ten minutes of mother–child play with a set of predetermined toys were videotaped. Toys were selected on the basis of previous research (Feldman & Greenbaum, 1997; McCune, 1995; Tamis-LeMonda & Bornstein, 1991) and included: doll and accessories, bottle, diaper, comb, a bath, tea set (cups, plates, spoons, forks, pitcher), soft animals, telephones, sunglasses, mirror, small handbag, car, ball, small plastic animals, and small wooden cubes.

Measures

Infant medical risk. To evaluate the degree of infant medical risk, the Clinical Risk Index for Babies (CRIB) score (International Neonatal Network, 1993) was used. The CRIB is a measure of neonatal risk for premature infants that has been shown a better predictor of mortality and morbidity than birth weight alone. The CRIB consists of six sections, and scores within each section are predetermined as follows: (a) birth weight ($>1{,}350$ g $= 0$; 851–1350 g $= 1$; 701–850 g $= 4$; <700 g $= 7$); (b) gestational age (>24 weeks $= 0$; <24 weeks $= 1$); (c) congenital malformation (non $= 0$; not life threatening $= 1$; acutely life threatening $= 3$); (d) maximum base excess (acid) in first 12 hr ($<7 = 0$; $7–9.9 = 1$; $10–14.9 = 2$; $>15 = 3$); (e) minimum F_IO_2, fractional percentage of inspired oxygen ($<0.4 = 0$; $0.41–0.6 = 2$; $0.61–0.90 = 3$; $0.91–1.00 = 4$); (f) maximum F_IO_2 in first 12 hr ($<0.4 = 0$; $0.41–0.8 = 1$; $0.81–0.90 = 3$; $0.91–1.00 = 5$). Scores are summed to create the total CRIB score; higher scores indicate greater medical risk.

Social support. Upon discharge from the hospital, mothers completed two measures of social support. The Social Support Scale (Cutrona, 1984) is a 12-item instrument that examines the parent's perception of support availability in different domains (e.g., attachment, guidance, reassurance of worth), with good reliability and validity. In the second measure, (Crockenberg & Litman, 1990), mothers listed names of people who give them support within nested circles, which marks the frequency of contact. The final score was derived from weighing each contact by the frequency of contact and summing across contacts. The two social support scales were correlated ($r = .52$, $p < .001$) and their standardized scores were averaged into a social support composite ($\alpha = .68$).

Parenting stress. At 3 months, mothers and fathers each completed the short form of the Parenting Stress Index (PSI; Abidin, 1990). The PSI is a 36-item questionnaire that measures the relative magnitude of stress in the parent–child system. It has been widely used and is reported to have high internal consistency and good test–retest reliability (Button, Pianta, & Marvin, 2001; Deater-Deckard & Scarr, 1996). The PSI Short Form yields three scores that are summed to create a total score. The first scale, parenting distress, considers the parent's depression, sense of isolation, and limitations imposed by the parental role. The second scale, parent–child dysfunctional interaction, considers the affective quality of the parent–child relationship in light of the parent's expectation. The third scale, difficult child, addresses the parent perception of child difficulty in relation to the parent's expectations from the child. Mothers' and fathers' total PSI scores were correlated ($r = .69$, $p < .001$) and were averaged into a parenting stress composite ($\alpha = .73$). The decision to combine the mothers' and fathers' scores was made in light of the high correlations between the two scores and to assess the global magnitude of stress in the parenting system.

Coding

To minimize coders' awareness of infant group membership, interactions of all infants at each age were transferred to continuous tapes, twins and triplets were not placed successively, and tapes were randomly divided among coders. Coding at each age was performed by different teams of coders. Before data analysis, order effects between twins and triplets videotaped in a single session were examined and no order effects were found. We also checked differences in the level of reliability among the three groups and no differences were found.

Mother–newborn interactions. Microanalysis of mother–newborn interaction was conducted using the Coding Interaction Behavior Manual–Newborn (CIB; Feldman, 1998), which has been validated in research of neonates (Feldman & Eidelman, 2003; Feldman, Eidelman, et al., 2002; Keren, Feldman, Eidelman, Sirota, & Lester, 2003). Four maternal behavioral categories and one infant category are coded and codes within each category are mutually exclusive. For each 10-s epoch, the coder selects one behavior in each category. Two graduate students in psychology coded the videotapes and training continued until 85% agreement was achieved in all categories.

Categories and codes included in each category were as follows: (a) maternal gaze: to infant's face, to infant's body, to object, gaze aversion; (b) maternal affect: positive, negative, neutral; (c) maternal talk: no talk, talk to infant, sing, mothereese; (d) maternal touch: no touch, functional touch (wipe infant mouth), affectionate touch (mother touch infant with clear positive affect and no functional purpose), hug, cradle, and stimulate; and (e) infant state: fuss, cry, alert scanning, gaze aversion, and sleep. In addition, two global codes were rated on a scale of 1 (*low*) to 5 (*high*): maternal adaptation and maternal intrusiveness. Reliability was conducted for 20 mother–infant dyads; reliability averaged 93% ($\kappa = .82$). All codes were transformed to z scores and were subjected to a principal component factor analysis with varimax rotation. The first factor had an eigenvalue of 3.84, explained 16.73% of the variance, and had high loading ($> .50$) for maternal positive affect, maternal affectionate touch, motherese vocalization, and maternal adaptation. The variables with high loading on the first factor were averaged into the maternal sensitivity composite in the newborn period.

Mother–infant interaction at 3 months. Interactions were coded with the CIB (Feldman, 1998). The CIB is a global rating system including 42 codes rated on a 5-point scale that has been validated in studies of healthy and at-risk dyads across ages and cultural backgrounds (Feldman, 2000; Feldman, Greenbaum, Mayes, & Erlich, 1997; Feldman & Klein, 2003; Feldman, Masalha, & Nadam, 2001; Feldman, Weller, Eidelman, & Sirota, 2003; Feldman, Weller, Sirota, & Eidelman, 2002). Maternal sensitivity at 3 months included the following codes: maternal acknowledgment of infant signals, positive vocalization, adaptation to infant states, resourcefulness, fluent and rhythmic dyadic style, and give-and-take reciprocity. These codes were transformed to z scores and averaged to form the mother sensitivity composite at 3 months ($\alpha = .89$). Coders were trained to 90% agreement on all categories. Interrater reliability was computed on 25 interactions and reliability averaged 94% (range = 87% to 98%), intraclass $r = .93$ (range = .88 to .98).

Toy exploration at 6 months. Microanalysis of the toy exploration session was conducted using a computerized system (Noldus Co., Waggeniggen, The Netherlands). Several categories of mother and child behavior were coded, and codes within each category were mutually exclusive. The following codes were used for the mother: (a) mother gaze: to object (other than the object of shared attention), to partner, gaze aversion, shared attention; (b) mother affect: positive, neutral, negative, and social disengagement; and (c) mother toy presentation: does not present toy to infant, hands toy to infant, demonstrates the use of toy, physically manipulates the infant's hands, takes away toy, and manipulates toy with the infant. Reliability was examined for 25 infants and mothers. Reliability for all behaviors exceeded 88% and mean reliability was 93% ($\kappa = .83$). All maternal codes were transformed to z scores and were subjected to a principal component factor analysis with varimax rotation. The first factor had an eigenvalue of 3.65, explained 16.54% of the variance, and had high loading (>.50) for maternal positive affect, shared attention, and joint manipulation, and negative loading for maternal gaze aversion, negative affect, and no play. The variables with high loading on the first factor were averaged into the maternal sensitivity composite at 6 months.

Symbolic play at 12 months. Symbolic play was coded separately for mother and child in 5-s frames along eight hierarchical levels of symbolization, in line with previous research (Feldman & Greenbaum, 1997; Tamis-LeMonda & Bornstein, 1991). Play levels included (a) three presymbolic levels: no play, object manipulation (e.g., touching), and functional play (use of toy in its intended way, e.g., moving a car on floor); (b) two simple symbolic levels: self-pretend (pretend involves only self, e.g., sleeping, combing hair) and other pretend (including others in pretend play, e.g., feeding a doll); (c) and three complex symbolic levels: combinatorial pretend (combining several play schemes into a single act, e.g., feeding doll and then putting it to sleep), hierarchical pretend (a single act expresses a hierarchical scheme, e.g., a child plans ahead and fits objects to predetermined roles), and substitutional pretend (child substitutes one object for another in a deliberate fashion, e.g., stick instead of car). The proportion of time the infant spent in each play level was computed and three composites were created: functional play (manipulation + functional), simple symbolic play (self pretend + other pretend), and complex symbolic play (combinatorial, hierarchical, and substitutional pretend). The infant's simple symbolic play provides a measure of the age-appropriate level of symbolic representation (Tamis-LeMonda & Bornstein, 1991) and was used as an index of symbolic skills at 1 year. Mother's play was coded for each 5-s frame for the degree of maternal sensitivity. Maternal sensitivity included five aspects: (a) mother's positive affect; (b) warm and clear vocalization; (c) constant gaze toward infant or object of joint attention; (d) sensitive facilitation of infant play level in terms of extension, elaboration, naming, or placing the child's symbolic output in context; and (e) infant-led interaction. Two coders, who did not participate in the previous coding, were trained to 85% reliability on all codes. Reliability was conducted for 25 mother–infant dyads and reliability averaged 92% ($\kappa = .81$). The proportion of frames the mother showed a sensitive facilitation of the child's play was transferred into z scores and used to index maternal sensitivity at 12 months.

Results

We present the results in five sections. The first section reports differences in maternal sensitivity between groups at the four observation points (newborn, 3, 6, and 12 months). The second section examines differences related to multiple-birth status on parenting and infant variables. The third section presents bivariate correlations among the study variables. The fourth section includes hierarchical multiple regressions predicting cognitive and symbolic skills from parent and child factors. In the final section, structural equation modeling was used to test the theoretical model. Because of the nonindependence of observations when the same mother interacts with three infants, each analysis of variance (ANOVA) was computed twice, once using the entire sample ($n = 138$) and again using a random case from each triplet set and a random case from each twin set. This resulted in a sample with no nonindependence problems ($n = 69$). We report a finding as reliable only when the same results appear for the entire sample and for the randomly selected sample. Following the two analyses, we examined within-sibling differences between the sickest infant at birth and the sibling(s).

Maternal Sensitivity at Newborn, 3, 6, and 12 Months

A multivariate analysis of variance (MANOVA) with multiple-birth status and infant gender as the between-subject factors was computed for the four maternal sensitivity factors at newborn, 3, 6, and 12 months. A significant overall main effect was found for multiple birth, Wilks's $F(8, 246) = 3.38$, $p < .01$, effect size (ES) = .10, with no significant gender or interaction effects. Univariate ANOVAs with Scheffe's tests followed the MANOVA and are presented in Table 2. Examination of the randomly selected sample showed a similar overall main effect for multiple birth, Wilks's $F(8, 116) = 3.45$, $p < .01$, ES = .15, and univariate analyses showed differences in maternal sensitivity at all four observations.

As seen in Table 2, mothers of triplets showed lower levels of maternal sensitivity compared with mothers of singletons and twins at each observation across infancy. At the newborn and 12-month observation, no differences were found between mothers of singletons and twins. At 3 and 6 months, mothers of singletons scored higher than mothers of twins, and those mothers scored higher than mothers of triplets.

Comparisons of maternal sensitivity toward the sickest triplet and the healthier siblings revealed no between-sibling differences in maternal sensitivity at

Table 2
Maternal Sensitivity at Newborn, 3, 6, and 12 Months in Singletons, Twins, and Triplets

	Singletons	Twins	Triplets	Univariate F	ES
Newborn	.05	.01	− .44	3.17* a, b > c	.05
3 months	.24	.04	− .30	11.32** a > b > c	.14
6 months	.17	− .04	− .48	6.46** a > b > c	.09
12 months	.07	.03	− .45	3.78* a, b > c	.06

Note. Variables are standardized scores. ES = effect size; a = singletons; b = twins; c = triplets.
$^{*}p<.05$. $^{**}p<.01$.

the newborn stage or at 3 months. At 6 months, mothers were more sensitive to the healthier triplets than to the sicker child, $F(2, 20) = 3.97$, $p<.05$, ES = .07, and similar findings emerged at 12 months, with mothers showing greater sensitivity to the healthier infants, $F(2, 20) = 3.84$, $p<.05$, ES = .07. Mothers of twins were more sensitive to the healthier infant at 6 months only, $F(2, 21) = 4.02$, $p<.05$, ES = .08.

Parenting and Infant Development Variables in Singletons, Twins, and Triplets

Parenting stress and social support. Univariate ANOVA with multiple-birth status and infant gender as the between-subject factor on the parents' total PSI score indicated that parents of triplets experienced significantly more stress than parents of singletons and twins (Table 3). Similar findings emerged when mothers' and fathers' scores were computed separately. The mean PSI score for singletons fall within the average range reported by Abidin (1990; $M = 71$, $SD = 15.4$). The mean PSI score for triplets, however, fell above the 90th percentile, indicating substantial stress within the parenting system.

Examination of the three subscales of the PSI for mothers and fathers separately indicated that mothers of triplets scored higher on parenting distress, $F(2, 65) = 3.76$, $p<.05$, ES = .07, and on parent–child dysfunctional interactions, $F(2, 65) = 3.85$, $p<.05$, ES = .08, and fathers of triplets scored higher on parenting distress, $F(2, 65) = 4.06$, $p<.05$, ES = .10. No gender effects were found for parenting stress.

No differences related to multiple birth or gender were found in the family's social support.

Infant emotion regulation. No differences related to multiple birth or gender were found in the infant's emotion regulation in the newborn period. As expected, the sickest triplet showed significantly worse emotion regulation than the siblings, $F(1, 68) = 6.33$, $p<.05$, ES = .15, and similar findings emerged for the sicker twin, $F(1, 43) = 5.27$, $p<.05$, ES = .12.

Symbolic play. A MANOVA with multiple-birth status and infant gender as the between-subject factor computed for the three symbolic play clusters (functional, simple symbolic, complex symbolic) yielded a significant main effect for multiple birth, Wilks's $F(6, 250) = 2.77$, $p<.01$, ES = .07, and no gender effects. Univariate tests showed differences in simple symbolic play (Table 3); triplets displayed

Table 3
Self-Report Measures and Infant Developmental Factors in Singletons, Twins, and Triplets

	Singletons		Twins		Triplets			
	M	*SD*	*M*	*SD*	*M*	*SD*	Univariate F	ES
Social support[a]	− 0.05		0.02		0.07		0.88	
Parenting stress	67.50	12.13	79.22	13.33	98.12	14.32	7.31** a < b < c	.11
Infant emotion regulation[b]	6.20	1.24	5.92	1.16	5.86	1.04	0.57	
Infant symbolic play[c]	0.11	0.08	0.09	0.07	0.05	0.05	3.67* a, b > c	.06
Cognitive development-MDI	91.21	8.64	88.96	9.43	83.14	10.51	4.76**a, b > c	.07

Note. ES = effect size; a = singletons; b = twins; c = triplets; MDI = Mental Development Index.
[a]Numbers represent standardized scores.
[b]Average of the Range of State and Regulation of State clusters of the Neonatal Behavior Assessment Scale.
[c]Numbers represent proportion of time infant spent in simple symbolic acts.
$^{*}p<.05$. $^{**}p<.01$.

less simple symbolic play than did singletons and twins, with no differences between the other two groups. Similar results emerged for the randomly selected sample, Wilks's $F(4, 120) = 2.94$, $p < .01$, ES = .11, related to simple symbolic play.

Comparisons of the sickest triplet and the siblings revealed that the healthier infants showed more symbolic play than the sicker child, $F(2, 20) = 4.25$, $p < .05$, ES = .10. Longer latencies to the first symbolic act were found in the play of the sicker triplet ($M = 128.2$ s, $SD = 113.3$) compared with the siblings ($M = 101.4$s, $SD = 85.6$), $F(2, 20) = 3.95$, $p < .05$, ES = .09. Similar findings emerged for twins, with the sicker twin showing less symbolic play than the sibling, $F(2, 20) = 3.81$, $p < .05$, ES = .08.

Cognitive development. A MANOVA computed for the two Bayley indexes—MDI and PDI—revealed a significant overall effect for multiple birth, Wilks's $F(4, 252) = 2.58$, $p < .05$, ES = .06, and univariate tests (Table 3) indicated significant differences in MDI scores, which address infant perception, attention, categorization, and emerging inhibitory control skills. No differences related to multiple-birth status emerged for psychomotor development, possibly because groups were matched for medical risk, which is the central determinant in motor development, and no differences were found in PDI between the sickest triplet and the siblings. Similar main and univariate effects were found in the randomly selected sample, Wilks's $F(2, 124) = 3.21$, $p < .0$, ES = .14. The sickest triplet, but not the twin, received lower MDI scores ($M = 80.15$, $SD = 10.62$) than the siblings ($M = 85.11$, $SD = 9.95$), $F(2, 20) = 3.63$, $p < .05$, ES = .07. It thus appears that by 12 months of age the most medically compromised triplet is functioning at a significantly lower level than the siblings in the cognitive and symbolic domains. Within the triplet set, the gap between the highest and lowest MDI scores averaged 10.57 points ($SD = 8.55$) compared with 5.47 ($SD = 5.11$) between twins, $F(1, 43) = 5.35$, $p < .05$, ES = .15, indicating a greater variability in cognitive performance among triplets. No gender effects were found for cognitive development.

Correlations Among Study Variables

Correlations among the study variables were computed for the randomly selected sample ($n = 69$) and are presented in Table 4. As seen in the table, parenting stress was related to lower social support, less sensitive mothering at each time point, and lower infant symbolic competence at 12 months. Maternal sensitivity was individually stable across the 1st year and correlations were found among all four observations. Infant emotion regulation in the newborn period was related to higher maternal sensitivity at subsequent stages and to higher cognitive and symbolic skills. Maternal sensitivity at each observation was related to higher social support, infant symbolic play, and MDI scores. Social support at the newborn stage correlated with lower parenting stress, and cognitive and symbolic skills were interrelated. Examination of the intercorrelation matrix for each group separately showed no significant differences, and correlations of similar magnitude emerged when assessing the mothers' and fathers' PSI scores separately.

Predicting Cognitive and Symbolic Development

Two hierarchical multiple regressions were computed predicting infants' cognitive skills and symbolic play from child, family, and interactive factors

Table 4
Bivariate Correlations Among Study Variables

	2	3	4	5	6	7	8	9
1. Parenting stress (3 months)	$-.42^{**}$	$-.29^{*}$	$-.24$	$-.39^{*}$	$-.32^{*}$	$-.29^{*}$	$-.37^{*}$	$-.32^{*}$
2. Social support (newborn)		.05	.12	$.31^{*}$	$.35^{*}$	$.31^{*}$	.23	.18
3. Infant emotion regulation (newborn)			.22	$.34^{*}$	$.33^{*}$	$.29^{*}$	$.39^{**}$	$.36^{*}$
4. Mother sensitivity, newborn				$.45^{**}$	$.41^{**}$	$.37^{*}$	$.32^{*}$	$.35^{*}$
5. Mother sensitivity, 3 months					$.47^{**}$	$.40^{**}$	$.29^{*}$	.25
6. Mother sensitivity, 6 months						$.34^{*}$	$.32^{*}$	$.30^{*}$
7. Mother sensitivity, 12 months							$.39^{**}$	$.35^{*}$
8. Infant symbolic play								$.31^{*}$
9. Infant cognitive development								

Note. Data in this table represent results from a randomly selected sample. One case from each triplet and twin set was randomly selected. $^{*}p < .05$. $^{**}p < .01$.

across the 1st year. To address the issue of non-independence, regressions were computed on the randomly selected sample. Variables were entered in six blocks. In the first and second blocks, the infant's medical risk as indexed by the CRIB score and the infant's multiple-birth status were entered to partial out variance related to infant risk. The next three blocks addressed the determinants of parenting: infant emotion regulation, parenting stress, and social support. Finally, the average of the mother's sensitivity at the newborn, 3-, 6-, and 12-month observations ($\alpha = .78$) was entered in the sixth block. Results of the regression models are presented in Table 5.

As seen in Table 5, multiple-birth status, higher emotion regulation, lower parenting stress, and higher maternal sensitivity were each uniquely predictive of the infant's symbolic skills. Cognitive development was independently predicted by lower medical risk at birth, multiple-birth status, higher emotion regulation, and higher maternal sensitivity. Social support did not explain unique variance in cognitive or symbolic skills above and beyond parenting stress, suggesting that the impact of social support on cognitive outcomes is likely to be indirect.

Structural Modeling

Structural equation modeling was used to test the theoretical model (Figure 1) and examine the embedded influences of social support, parenting stress, infant emotion regulation, and maternal sensitivity on infants' cognitive outcomes. Analyses were computed with Amos 4 (Arbuckle & Wothke, 1999), using the maximum likelihood estimation method. Five indexes were used to assess the model fit to the data: The chi-square statistic and the goodness-of-fit index (GFI) examine the general fit of the model. The adjusted goodness-of-fit index (AGFI) considers the model's adaptiveness, taking into account the degrees of freedom, and the normed fit index (NFI) provides an index for the relations between the proposed model and an independence model that assumes no links between variables. The AGFI and NFI are considered as more conservative indexes of model fit. Finally, the root mean square error of approximation (RMSEA) addresses model parsimony. A nonsignificant chi-square; GFI, AGFI, and NFI of .90 or above; and RMSEA of .05 or less indicate a close fit to of the model to the data (Byrne, 2001; Jöreskog & Sörbom, 1984).

A confirmatory factor analysis was first applied to examine whether the four maternal sensitivity composites load on a single latent factor. The model provided an excellent fit to the data, $\chi^2(52) = 2.64$, $p = .26$, GFI = .99, AGFI = .98, NFI = .96, RMSEA = .04, indicating that the four maternal sensitivity constructs at the different ages are underlay by a single factor. These findings provide construct validity to the maternal sensitivity measures used in the present study.

Structural Model 1. Model 1 tested the hypothesis that the three determinants of parenting—infant emotion regulation, parenting stress, and social support—each exerts an influence on the latent construct of maternal sensitivity, and maternal sensitivity, in turn, affects the infant's cognitive outcomes. According to this model, proposing three levels of influence (direct, indirect, and contextual) on cognitive outcomes would not add to model parsimony. Links were charted from emotion regulation, parenting stress, and social support to the latent construct of maternal sensitivity and from this latent construct to the latent construct of infant cognitive outcomes, to which infant symbolic skills

Table 5
Predicting Cognitive and Symbolic Development in Singletons, Twins, and Triplets

	Symbolic play			Cognitive development		
	Beta	R^2 change	F change	Beta	R^2 change	F change
Medical risk (CRIB)	−.09	.02	1.12	−.25*	.04	3.86*
Multiple birth	−.24*	.05	3.89*	−.19	.06	4.37*
Infant emotion regulation	.35*	.10	9.43**	.26*	.06	4.74*
Parenting stress	−.27*	.08	5.26*	−.07	.02	1.36
Social support	.03	.00	0.21	.06	.01	0.68
Maternal sensitivity	.33*	.09	8.77**	.29*	.07	6.27*
R^2 total	.39, $F(6, 59) = 2.78$, $p < .05$			.35, $F(6, 59) = 3.40$, $p < .05$		

Note. Data in this table represent results from a randomly selected sample. One case from each triplet and twin set was entered into the regression. CRIB = Clinical Risk Index for Babies.
*$p < .05$.

and cognitive competence contributed. The model provided an acceptable, but not a good, fit to the data; $\chi^2(96) = 33.22$, $p = .02$, GFI = .94, AGFI = .87, NFI = .85, RMSEA = .077, with the chi-square statistic being significant and the RMSEA index above .05 (Byrne, 2001).

Structural Model 2. Model 2 examined the theoretical model outlined in Figure 1. A link between social support and parenting stress was proposed as the contextual influence. A link was added between parenting stress and infant emotion regulation, in light of research pointing to higher parenting stress among parents of dysregulated infants, and each of these factors was proposed as influencing the latent construct of maternal sensitivity. A link was charted between the latent construct of maternal sensitivity and the latent construct of cognitive outcomes. A direct link was added between infant emotion regulation at birth and cognitive outcomes, pointing to the effects of inborn regulatory capacities on cognitive development. The model provided a close fit to the data, $\chi^2(94) = 23.48$, $p = .13$, GFI = .96, AGFI = .91, NFI = .90, RMSEA = .04. This model was a significant improvement over model 1, $\Delta\chi^2(2) = 9.77$, $p < .01$. All paths were significant, supporting the theoretical model. Results of Structural Model 2 are presented in Figure 2.

Discussion

Results of this study, among the first to follow the development of triplets, suggest that a triplet birth constitutes an independent risk condition for infant development, even when triplets are matched to singletons and twins for medical and environmental conditions. A triplet birth creates a rearing ecology marked by high parenting stress and difficulties in providing exclusive parenting to each child, resulting in lower maternal sensitivity across infancy. Lower maternal sensitivity, in turn, interfered with the infants' cognitive and symbolic growth. Components of the parenting system—parenting stress, social support, infant inborn emotion regulation, and maternal sensitivity—were interrelated and affected the development of cognitive competencies. Between-sibling differences were observed, and the most medically compromised triplet received the lowest maternal sensitivity and showed the poorest outcomes. Structural modeling charted three levels of influences between components of the parenting

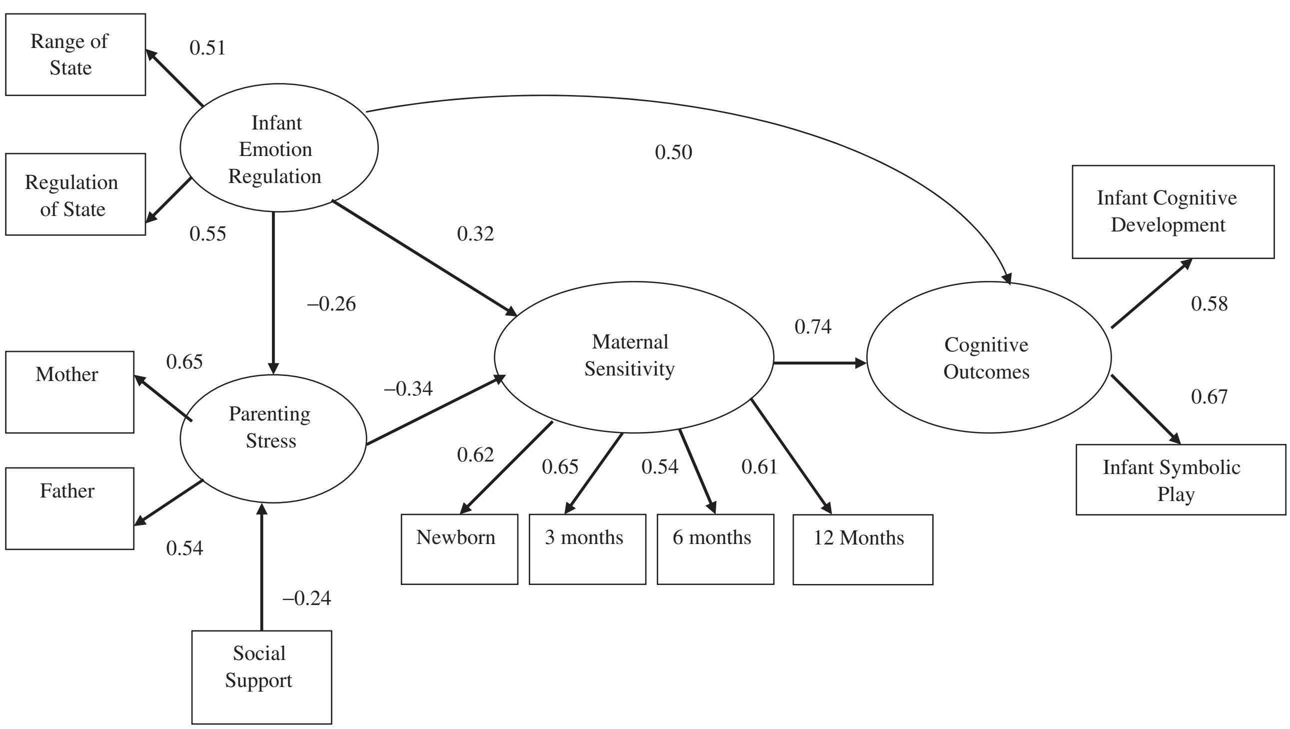

Figure 2. Model 2 standardized coefficients with direct paths from maternal sensitivity and infant emotion regulation to cognitive development, indirect paths from parenting stress and infant emotion outcomes to maternal sensitivity, and a contextual path from social support to parenting stress. A bidirectional path is included between parenting stress and infant emotion regulation. All path coefficients are significant at $p < .05$, $\chi^2(94) = 23.48$, $p = .13$, goodness-of-fit index = .96, adjusted goodness-of-fit index = .91, normed fit index = .90, root mean square error of approximation = .04.

system and cognitive outcomes. Direct, indirect, and contextual influences were described, with indirect influences being mediated through their impact on maternal sensitivity and contextual influences operating through their effect on the degree of parenting stress. Similar to models that used specific risk populations to investigate the development of infant in context, such as child maltreatment (Cichetti & Lynch, 1993), prematurity (Bendersky & Lewis, 1994), or environmental risk (Sroufe, 1996), the triplet condition was used here to address the relations of infant, caregiver, and developmental process in an ecology marked by a high needs-to-resources ratio. Important to note, however, that unlike other risk conditions, such as maternal depression or high environmental risk, no inherent risk was observed in the child or family's initial conditions. It is thus possible that as triplets grow, parenting stress decreases and the sibling relationship may provide some compensation for the lower level of exclusive parenting.

Two central issues were of interest in the context of the triplet ecology: the ongoing relations between infant dispositions and the rearing environment, and the role of exclusive parenting in development. Consistent with the predictions of the transactional model, the newborn's self-regulatory capacities—a construct addressing early indicators of reactivity and regulation such as irritability, peak of excitement, and consolability—shaped the development of parenting and child outcomes in a bidirectional fashion. Newborns' emotion regulation correlated with maternal sensitivity at each subsequent observation, and maternal sensitivity, in turn, predicted cognitive and symbolic development. The infant's inborn regulation also influenced the rearing environment by increasing or decreasing parenting stress, which affected the development of maternal sensitivity. It has been suggested that in ecologies marked by high stress, the interdependence between infant self-regulation and parental provision tends to increase. According to Belsky's (1998) notions on "differential susceptibilities to rearing environments" the infant's self-regulatory capacities determine the degree of dependence between parental behaviors and developmental outcomes. Children with poor self-regulation are more dependent on the sensitive handling of the environment to reach optimal development. Under the high stress of raising three infants, maternal investment in the infant who is less easy to handle or is a less rewarding social partner is likely to decrease, placing that child at an especially high risk for maladaptive development, even as compared with the siblings.

It is interesting that differential mothering toward the three children was detected in the second 6 months, not in the newborn or 3-month observations. These findings are consistent with the transactional perspective and support the notion that over time children create their own rearing ecology. It is also possible that during the second half year, when infants begin to engage in object manipulation and emerging symbolization, the child's contribution to the dyadic exchange increases and the infant's dispositions become central in shaping the nature of mothering. The effects of the mother's synchronous style during the second half year on child outcomes were found to be especially strong for less regulated infants (Feldman, Greenbaum, & Yrimiya, 1999). Because risk factors are both cumulative and interactive (Bendersky & Lewis, 1994), an infant born with low self-regulation who is also part of a triplet set is at a double risk and requires professional attention throughout infancy.

With regard to maternal sensitivity, the findings highlight both the stable and changing components of the mother's sensitive style and the contribution of each to infant development. Although the links between sensitive mothering and cognitive outcomes are well established, particularly among high-risk populations (Donovan & Leavitt, 1978; Ostfeld, Smith, Hiatt, & Hegyi, 2000; Stams, Juffer, & van IJzendoorn, 2002), most studies have examined maternal sensitivity at one time point and considered its global components, such as maternal warmth or positive affect. During the 1st year infants undergo several "biobehavioral transitions" (Emde et al., 1976), complete phase shifts that introduce new skills and require the reorganization of maternal behavior. In no other period in the child's life does the context of play change so dramatically as during the 1st year—from the mother's holding arms, to face-to-face reciprocity, to functional engagement with objects, to rudimentary symbolic activity. As seen, at each age, the construct of maternal sensitivity integrated the global and stable components of the maternal style, such as constant gaze, warm affect, and positive vocalizations, with age-specific components such as affectionate touch in the newborn period, reciprocity at 3 months, joint manipulation at 6 months, and facilitation of simple symbolic acts at 1 year. Each of these age-specific components has been shown to facilitate cognitive growth (Feldman & Eidelman, 2003; Feldman et al., 1996; Feldman, Eidelman, et al., 2002; Kopp & Vaughn, 1982; Slade, 1987), and the findings further support their central role in development. Furthermore, the confirmatory factor analysis supported the underlying communality of the four sensitivity constructs and validated the measures of maternal sensitivity used in the present study. In combination, the age-specific and global components describe the mother who is attuned to the infant's day-by-day development and can scaffold newly acquired skills in a reciprocal, nonintrusive manner while maintaining a consistent style that is familiar to her infant. In line with theoretical positions on the affective and relational basis of symbolic thought (Messer, 1994; Nelson, 1985; Vygotsky, 1978), the data underscore the role of mother–child reciprocal exchange around developmentally salient tasks in facilitating the infant's cognitive and symbolic growth.

Although mothers of triplets did not differ from mothers of twins and singletons in levels of initial anxiety, depression, and social support, and triplets as a group did not display poorer inborn regulation—suggesting there was no intrinsic risk in the parenting system—it is possible that the decrease in exclusive parenting that is inherent in the triplet situation interfered with the mother's ability to adapt to each child's individual development while providing global warmth and reciprocity. The decrease in the mother's global sensitivity is consistent with studies indicating that the burden of raising triplets often leads to maternal emotional distancing (Garel & Blondel, 1992). Thus, the role of exclusive parenting in development may be related to the mother's ability to provide synchronous parenting that is attuned to the emerging competencies, signals, and rhythms of an individual child. However, because no substantial disruption to the parenting system was detected in the triplet group, in terms of maternal or child factors, father involvement, or contextual support, the differences found in the 1st year may attenuate as children grow and the level of parenting stress decreases. In this respect, the triplet situation may constitute a transitory risk (Cicchetti & Lynch, 1993), with significant effects in early infancy and a later recovery. It is thus important to follow triplets into later childhood and adolescence and detect which factors differentiate families whose functioning improves following the initial stress from those who deteriorate over time.

The theoretical model specifies the hierarchy of the individual and contextual influences on infants' cognitive development. Although triplets as a group demonstrated poorer cognitive outcomes, the model underscores the complexity of the individual, maternal, familial, and social factors that shape the functioning of individual infants. Consistent with the ecological model (Bronfenbrenner, 1986), infant development was shaped by embedded systems of influence. The infant inborn self-regulatory capacities, indexing the biological level, had a direct influence on cognitive development. Biological dispositions, however, interact with the caregiving context, and the infant's inborn regulation was found to have an additional indirect influence on cognitive outcomes, mediated by its effect on maternal sensitivity. Parenting stress, an index of the microsystem and its needs-to-resources ratio, represents the next hierarchical level, and it had an indirect effect on cognitive outcome, mediated by the effects of stress on the development of maternal sensitivity. The next level of influence, the exosystem, addressing the immediate social context and its support of the young family, had neither direct nor indirect effects but exerted a contextual influence on cognitive outcomes. Close and supportive social networks reduced the level of parenting stress, which facilitated the development of maternal sensitivity. Higher sensitivity, in turn, had a direct effect on the infant's cognitive and symbolic growth. In this context, it is hypothesized that the macrosystem, the level of cultural values and customs not studied here, would exert both contextual and indirect effects on cognitive outcomes. The impact of culture on cognitive skills is likely to operate through the contextual level, as cultures affect the family's support networks (e.g., nuclear vs. extended family living arrangements), as well as through the indirect level, by shaping the definition and expression of maternal sensitivity.

In addition to specifying the embedded influences of the parenting system on infant development in the context of a high-risk population not previously studied, the theoretical model points to the direction of early intervention. A rearing ecology marked by high parenting stress—due to any parental, child, or contextual factors—compromises infant adaptation by decreasing the mother's age-appropriate sensitivity. The provision of physical and emotional support is likely to initiate cascading changes in the parenting system, improving parental experiences, interactive behaviors, and child outcomes. Thus, the findings have clear implications for social policy. Parenting stress in families raising triplets was found to be especially high. Both parents reported high levels of distress in the parenting role, and mothers considered the parent–child relationship to be developing inadequately. Providing social support on a federal or community level to families raising triplets is thus crucial to minimize the negative effects of parenting stress on infant development. The findings also point to the tremendous risk to the most medically compromised child among the triplet set. Parents should be informed about the development of triplets in general and the risks to the sickest infant in particular, and a close follow-up of that child is recommended.

Several limitations of the study should be mentioned. First, there was no information on fathers beyond the first 3 months. Because there were no group differences in father involvement, it is possible that fathers of triplets increase their involvement as infants grow and this may contribute to infant development or to the reduction of parenting stress. Second, the measure of parenting stress used here, although the most widely used instrument for the evaluation of stress in parenting, may be tapping other parenting issues, such as disturbed parent–child relationship or parental distress in addition to parenting stress. Third, the triplet ecology was not compared with the ecology of parents raising three small singleton infants. Although raising three infants simultaneously is not similar to raising three infants one after the other, issues of parenting stress and parental exclusivity may be important in such contexts as well. Finally, it is important to note that the effect sizes, albeit significant, were relatively small in magnitude.

The triplet situation—an area that has received little empirical attention—provides a natural paradigm to examine the ongoing relations between the infant's individuality and the parents' capacity to endorse that individuality in a rearing ecology where the number of children exceeds that of the parents. Future studies may continue to follow triplets beyond the infancy period. Because no initial risk was found in the parenting system, it is possible that the developmental lag found in the 1st year attenuates as children grow, and it is important to detect at what ages and in which families this initial risk improves or deteriorates. Similarly, the relationship among the siblings is a fascinating topic for future investigations, and research may address the potential buffering effect of the sibling group on child adaptation, especially at points of transition. The triplet situation offers a unique context to study the construction of the environment by the child and the exclusivity of the parent–child relationship. Future research may continue to elucidate the complexities of infant individuality as infants develop within a growing matrix of embedded proximal and distal influences.

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