
Longitudinal Relationship Between Maternal Depression and Infant Temperament in a Japanese Population

▼
Masumi Sugawara and Toshinori Kitamura

National Institute of Mental Health, Japan

▼
Mari Aoki Toda

Hokkaido University of Education

▼
Satoru Shima

Tokyo Keizai University

To investigate the relationship between maternal depression and infant temperament in a Japanese population, a prospective questionnaire survey was administered in the postpartum period. Postnatal depression was assessed by Zung's (1965) Self-Rating Depression Scale on two occasions (5 days and 12 months after delivery). At 6 months and 18 months after birth, infant temperament was assessed using the Revised Infant Temperament Questionnaire (RITQ; Carey & McDevitt, 1978) and the Toddler Temperament Scale (TTS; Fullward, McDevitt, & Carey, 1984), respectively. Of the five temperamental dimensions of the RITQ and TTS, "rhythmicity" and "attention span and persistence" showed reciprocal relationships with postnatal depression. Unidirectional effects of maternal depression on infant temperament were found for "frustration tolerance" and "fear of strangers and strange situations." © 1999 John Wiley & Sons, Inc. *J Clin Psychol* 55: 869-880, 1999.

This study was partly supported by a grant from the Toyota Foundation (86-II-081), a grant for nervous and mental disorders from the Ministry of Health and Welfare, Japan (3A-6), and a grant-in-aid for scientific research from the Ministry of Health and Welfare (Assessment of the Mother and Child Health Care System). The authors thank Drs. S. Hayashi and K. Sakakura, Department of Obstetrics and Gynecology, and Dr. T. Shikano, Department of Neuropsychiatry, and other members of Kawasaki Municipal Hospital, Kawasaki, Japan. Thanks are also extended to Professor T. Takuma, Tokyo Kokusai University.

Correspondence concerning this article should be addressed to Masumi Sugawara, Chief, Section of Family Study, Department of Sociocultural Environmental Research, National Institute of Mental Health, NCNP, 1-7-3, Konodai, Ichikawa 272, Japan.

Since Rutter's original paper in 1966, there have been several studies on the effects of parental mental illness on child development. Maternal depression has received much attention because of its association with a wide range of adverse outcomes in terms of children's development and behavior (Beardslee, Bemporad, Keller, & Klerman, 1983; Dodge, 1990; Downey & Coyne, 1990; Zahn-Waxler, 1995). Some studies have indicated that more than 60% of the offspring (aged 8 or older) of depressed mothers experience diagnosable mental disorders (Hammen et al., 1987; Sugawara, Mukai, Toda, Shima, & Kitamura, 1996).

Psychiatric studies have shown a relatively high prevalence of maternal depression in the postpartum period (Paffenbarger, 1961; Pitt, 1968). Approximately 10% of mothers are clinically depressed in the postnatal period (for discussion see O'Hara & Zekoski, 1988). In our previous study (Shima, Kitamura, Aoki, Sugawara, & Sakakura, 1988), 9.3% of Japanese mothers were found to suffer from depression based on the Research Diagnostic Criteria (RDC; Spitzer, Endicott, & Robins, 1978). Consequently, a large number of children are exposed to maternal depression from very early life. There is an urgent need to clarify the effects of postnatal depression on infant development and the mechanisms that exist from the early postpartum period.

Previous studies have focused on infant-depressed mother interaction (e.g., Cohn, Campbell, Matias, & Hopkins, 1990; Davenport, Zahn-Waxler, Adland, & Mayfield, 1984; Field, 1984; Field, Healy, Goldstein, & Guthertz, 1990; Livingood, Dean, & Smith, 1983; Pickens & Field, 1993) or infant attachment to a depressed mother (Lyons-Ruth, Connell, & Grunebaum, 1990; Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985; Teti, Gelfand, Messinger, & Isabella, 1995). Although these studies have revealed the negative effects of maternal depression on infant development, the child's own contribution to the negative outcomes should not be passed over (Mayberry & Affonso, 1993). Assessing the child's behavioral characteristics, therefore, is needed not only as a dependent variable but also as independent or mediating variables in the area of studies about the effects of maternal depression on child development. In the present study, we attempted both evaluations of infant temperamental characteristics and maternal depression longitudinally to understand the mutual effects.

The fact that infant temperamental difficulty could precipitate maternal depression has been shown in some previous studies. Cutrona and Troutman (1986) examined maternal depression, measured by the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), in pregnancy and at 3 months after delivery, as well as infant temperament assessed by the Revised Infant Temperament Questionnaire (RITQ; Carey, & McDevitt, 1978) at 3 months old ($N = 55$). From path analysis, they found that the infant's temperamental difficulty affected postpartum depression, both directly and indirectly, through the mediation of poor parenting self-efficacy. This was supported by the report of Hopkins, Campbell, and Marcus (1987), who found that although stresses connected with life events or social support were not related to the emergence of postpartum depression, they were related to infant temperament, measured by the Infant Characteristics Questionnaire (ICQ; Bates, Freeland, & Launsbury, 1979), at 7 to 11 weeks after birth (more difficult, more unadaptable, more unpredictable).

Although infant temperamental difficulty can be a stressor of postpartum depression, as shown in these previous studies, the infant's own temperament may be affected by maternal depression in early infancy. It is therefore reasonable to expect that the relationship between the two might be not only unidirectional but also reciprocal. Using a behavioral rating assessment during the Bayley Developmental Test (Bayley, 1969) in the laboratory at 2 months after birth, Whiffen and Gotlib (1989) found that infants of depressed mothers ($n = 25$) exhibited significantly more negative emotions and less tolerance to

stress than infants of control mothers ($n = 25$). They also measured the maternal impression of infant care and reported that depressed mothers found this care more difficult. This observational study indicated a significant relationship between postpartum depression and early infant behavioral characteristics, although the causal relationship has been unclear. To clarify the mutual effect of the two, longitudinal assessments from the early postpartum period are needed. In the present study, we assessed twice both maternal depression (5 days and 12 months postpartum) and infant temperament (6 months and 18 months after birth) to test a model of the reciprocal (bilateral) effects of maternal depression and infant temperament.

Method

Participants

For a prospective study of maternal depression in pregnancy and the postpartum period (Kitamura, Shima, Sugawara, & Toda, 1996), a total of 1,329 women who attended an antenatal clinic in the obstetrics department of a general hospital in Kawasaki, an industrial city in Japan, participated in a questionnaire survey. Women who were at more than 12 weeks' gestation were excluded, but no other exclusion criteria were applied. The participants ranged in age from 17 to 42 years, with a mean of 27.9 years ($SD = 4.2$). For 48.3% of these women, the pregnancy was their first. The registration of the original participants was completed from August 1984 to February 1986.

Although these initial participants ($N = 1,329$) were not sampled randomly, their demographic features did not deviate from those of the Japanese population as a whole: whereas 44.9% of the husbands and 36.0% of the women in our sample had graduated from university or college, 43.0% of men and 32.4% of women Japanese contemporaries are graduates of university or college (Ministry of Education, 1993). The mean annual income of this sample also was similar to that of working Japanese populations (Ministry of Finance, 1984, 1985).

A set of questionnaires was administered four times after delivery: 5 days (during hospitalization for delivery, the general length of admission in Japan is from 5 to 7 days), 6 months, 12 months, and 18 months after delivery. For administration of 6, 12, and 18 months, the questionnaires were sent and returned by mail. The numbers of participants followed up were 1,108 at 5 days after delivery, 821 at 6 months, 723 at 12 months, and 615 at 18 months. A large part of the sample attrition was due to change of address. A series of attrition analyses (chi-squared and t -test on mean scores) comparing the 714 women who dropped out of the study at 18 months with the 615 who remained in it revealed no relationships between attrition and age ($p = .78$), annual income ($p = .41$), sex of child ($p = .12$), or total depression score (the Zung Self-Rating Depression Scale; Zung, 1965) in early pregnancy when the participants were enrolled ($p = .92$). However, women who dropped out of the study up to 18 months were more likely to have lower educational attainment ($p < .01$) than those who remained.

Measures

Self-Rating Depression Scale (SDS). The Zung Self-Rating Depression Scale (SDS; Zung, 1965) was used to measure the severity of depression at both 5 days and 12 months after delivery. The total number of SDS items was 20; they were rated on a scale that included *never* (0), *sometimes* (1), *often* (2), and *almost all the time* (3). The maximum total score was 60; higher scores indicated greater depression.

The validity of the Japanese version of the SDS has been studied by Kitamura, Shima, Sugawara, and Toda (1994) using a subpopulation of 120 taken from the present participants. These 120 mothers were interviewed using the Schedule for Affective Disorders and Schizophrenia (SADS; Spitzer & Endicott, 1978) and diagnosed using the Research Diagnostic Criteria (RDC; Spitzer et al., 1978). The interviews were distributed four times—in early and late pregnancy and 5 days and 1 month after the child was born. The SDS sufficiently identified cases of depressive disorders throughout these periods.

Infant temperament. Infant temperament was assessed twice by questionnaire—at 6 months and 18 months after birth. The ratings were completed by the mothers. The Japanese version (Sato, 1983) of the Revised Infant Temperament Questionnaire (RITQ; Carey & McDevitt, 1978) and the Japanese version (Sato, 1984) of the Toddler Temperament Scale (TTS; Fullward et al., 1984) were used. The total number of RITQ items was 95 and TTS items was 97; they were rated on a 6-point scale ranging from 1 (*hardly at all*) to 6 (*almost all of the time*). The RITQ was answered by 817 participants at 6 months and the TTS by 615 at 18 months.

Although the RITQ and TTS originally contained nine subscales (activity level, rhythmicity, approach/withdrawal, adaptability, intensity of reaction, threshold of responsiveness, quality of mood, distractibility, and attention span and persistence), it was not possible to confirm the validity of these nine temperament dimensions among a Japanese population (Sugawara, Shima, Toda, Sato, & Kitamura, 1994). In the present study, therefore, five of seven factor scores of the RITQ and TTS extracted in our study of a Japanese population (Sugawara et al. 1994) were used as indices of infant temperament (Table 1). These five factors—fear of strangers and strange situations, frustration tolerance, rhythmicity, attention span and persistence, and audio-visual sensitivity—were extracted using both the RITQ and TTS correspondingly (see Table 1). The factor structures of the RITQ

Table 1
Factor Analysis of the RITQ ($N = 817$) and the TTS ($N = 615$) of the Japanese Versions

Factors	Sample items
Fear of strangers and strange situations	•Reaction to strangers •Adjusts to new place in 10 min. (–) ¹
Frustration tolerance	•Accepts nail-cutting without protest (–) •Tolerates having to wait (–)
Rhythmicity	•Wants to sleep at the same times •Has feeding (or meals) at the same times each day
Attention span and persistence	•Plays with toys (or parents) for under 1 min. (–) •Plays with favorite toys for over 10 min.
Audio-visual sensitivity	•Looks at someone passing by and stops playing •Stops eating (or drinking) when hears sound
Sensitivity to food ²	•Accepts new food promptly (–) •Takes any food, unaware of differences (–)
Tactile sensitivity ²	•Can be calmed when diaper is soiled (–) •Moves when diaper is wet
Intensity of reaction ³	•Reacts strongly when frustrated •Screams or cries when play goes wrong

Note. ¹(–): Reversal items

²These two factors formed one factor in the TTS (Sensitivity: food and tactile)

³This factor appeared only in the TTS

and TTS in the present study were similar to those obtained in the Australian Temperament Project (Prior, Sanson, & Oberklaid, 1989; Sanson, Prior, Garino, Oberklaid, & Sewell, 1987; $N = 2,443$).

Design of Statistical Analyses

To examine the mutual effects between infant temperament and postnatal depression longitudinally, we administered a series of path analyses of the sequential variables for early postnatal depression, five aspects of early infant temperament at 6 months (fear of strangers and strange situations, rhythmicity, frustration tolerance, attention span and persistence, and audio-visual sensitivity), late postnatal depression, and infant temperament at 18 months (same as at 6 months).

Results

Effects of Demographic Characteristics

Preliminary analyses were conducted to examine whether the demographic characteristics of age, annual family income, and educational attainment were significant predictors of postnatal depression. None of the demographic variables were significantly associated with SDS score at either assessment point (5 days and 12 months postpartum, significance level .09 ~ .27). Therefore, none were included in subsequent analyses.

Path Analyses Between Postnatal Depression and Infant Temperament

The variables used in the path analyses were (a) Time 1: maternal depression at 5 days after delivery (total scores of the SDS); (b) Time 2: five dimensions of infant temperament assessed by the RITQ (fear of strangers and strange situations, rhythmicity, frustration tolerance, audio-visual sensitivity, and attention span and persistence); (c) Time 3: maternal depression at 12 months after delivery (total scores of the SDS); and (d) Time 4: five dimensions of infant temperament assessed by the TTS (same as Time 2). The bivariate correlations among these variables are shown in Table 2. Moderate longitudinal correlations were observed between maternal depression at 5 days and at 12 months ($r = .57, p < .01$), and also among infant temperament, which was assessed twice (at 6 months and 18 months): ($r = .27, p < .01$) for fear of strangers and strange situations, ($r = .48, p < .01$) for rhythmicity, $r = .34, p < .01$ for frustration tolerance, ($r = .26, p < .01$) for audio-visual sensitivity, and ($r = .28, p < .01$) for attention span and persistence.

Different patterns of paths emerged for five infant temperamental dimensions, respectively. With regard to rhythmicity, all of the paths were statistically significant except from Time 1 (maternal depression at 5 days postpartum) to Time 4 (infant rhythmicity at 18 months; see Figure 1). This model accounted for 33.1% of the variance in maternal depression at 12 months (Time 3) and 26.5% of the variance in infant rhythmicity at 18 months (Time 4; Time 3: $R^2 = .58, F(1,502) = 126.23, p < .000$; Time 4: $R^2 = .52, F(3,351) = 43.44, p < .000$).

A reciprocal relationship between maternal depression and infant attention span and persistence was observed until 12 months after delivery. This model accounted for 31.0% of maternal depression at 12 months (Time 3; $R^2 = .56, F(2,490) = 111.25, p < .000$; see Figure 2).

Table 2
Simple Correlation Among All Variables (Pearson's *r*)

	T1	T2					T3
		a	b	c	d	e	
T1: Depression at 5 days	—	—	—	—	—	—	—
T2: Temperament at 6 months							
a. Fear of strangers & situations	.07	—	—	—	—	—	—
b. Rhythmicity	-.17**	—	—	—	—	—	—
c. Frustration tolerance	-.15**	—	—	—	—	—	—
d. Audio-visual sensitivity	-.00	—	—	—	—	—	—
e. Persistence	-.14**	—	—	—	—	—	—
T3: Depression at 12 months	.57**	.09*	-.26**	-.12**	.03	-.15**	—
T4: Temperament at 18 months							
a. Fear of strangers & situations	.00	.27**	—	—	—	—	.15**
b. Rhythmicity	-.29**	.01	.48**	—	—	—	-.31**
c. Frustration tolerance	-.09	-.05	.16**	.34**	—	—	-.12**
d. Audio-visual sensitivity	-.03	-.08	-.06	-.11*	.26**	—	-.08
e. Persistence	-.11*	-.09	.14**	.14**	.12**	.28**	-.12**

Note. T1: Time 1, T2: Time 2, T3: Time 3, T4: Time 4; * = $p < .05$, ** = $p < .01$.

Frustration tolerance and fear of strangers and strange situations were affected by maternal depression unilaterally. Early maternal depression (Time 1: 5 days after delivery) was correlated negatively with frustration tolerance at Time 2 (6 months; see Figure 3), and late maternal depression (Time 2: 12 months) was related positively to fear of strangers and strange situations in late infancy (18 months; see Figure 4). No significant path was observed between audio-visual sensitivity and maternal depression.

Discussion

The purpose of this study was to investigate the relationship between infant temperament and postnatal depression longitudinally. From a series of path analyses of the sequential variables among postnatal depression assessed at two points after delivery (5 days and 12

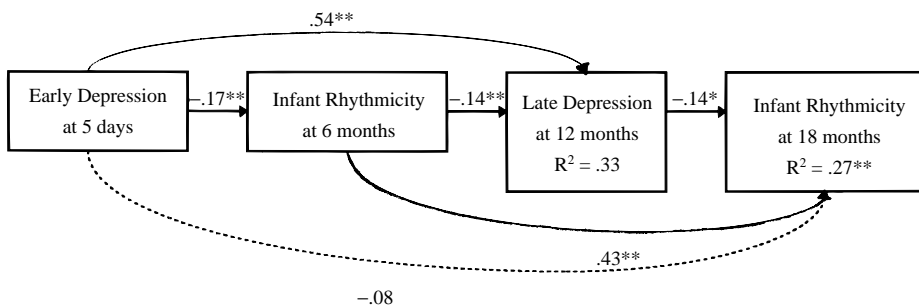


Figure 1. Path analysis of relationship between maternal depression and infant temperament: (Rhythmicity). Early Depression and Late Depression refer to maternal depression.
** $p < .01$. Dotted arrows denote nonsignificant coefficient.

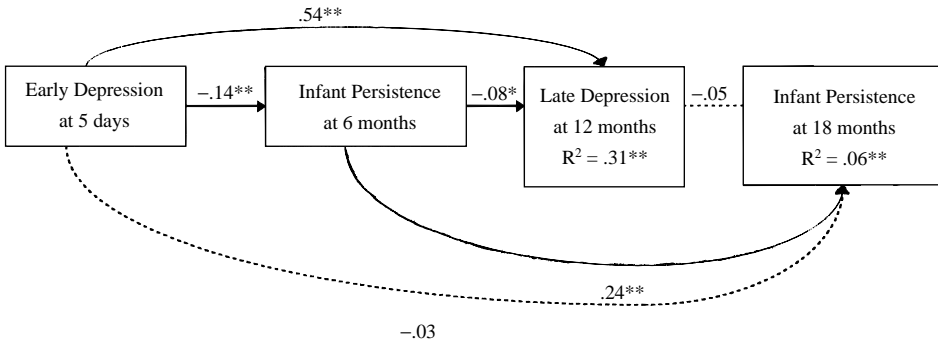


Figure 2. Path analysis of relationship between maternal depression and infant temperament: Attention span and persistence (Persistence). Early Depression and Late Depression refer to maternal depression. $**p < .01$. Dotted arrows denote nonsignificant coefficient.

months) and infant temperament also assessed twice (6 months and 18 months), two patterns of the relationships, that is, reciprocal and unilateral, were found.

Reciprocal relationships were observed for two temperament dimensions: rhythmicity and attention span and persistence. Maternal depression in the early postpartum period was found to be related to early infant low rhythmicity, which was itself related to postnatal depression; late postnatal depression was then related to low infant rhythmicity in the later stages. This suggests that the relationship between maternal depression and infant rhythmicity is not unidirectional but bidirectional; they form a vicious circle over time. A similar relationship was found for attention span and persistence until 12 months after delivery. Hammen, Burge, and Stansbury (1990) reported similar results from a longitudinal study of older children (aged 8 to 16) and their mothers over a 6-month period. Children’s problem behavior 6 months later was linked to both poor maternal functioning (including depression) and child characteristics, emphasizing a reciprocal relationship between maternal functioning and child characteristics.

With regard to rhythmicity, some previous studies (Cutrona & Troutman, 1986; Hopkins et al., 1987) have indicated that infant temperament difficulty, including irregularity of daily behavior, was a risk factor for maternal depression. A baby’s unexpected demands

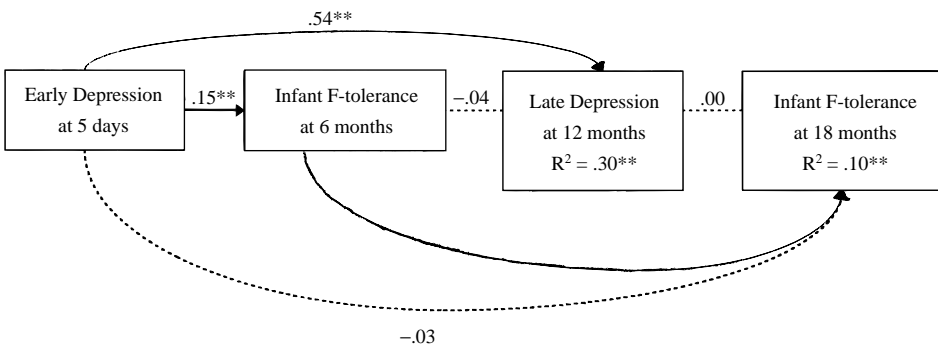


Figure 3. Path analysis of relationship between maternal depression and infant temperament: Frustration tolerance (F-tolerance). Early Depression and Late Depression refer to maternal depression. $**p < .01$. Dotted arrows denote nonsignificant coefficient.

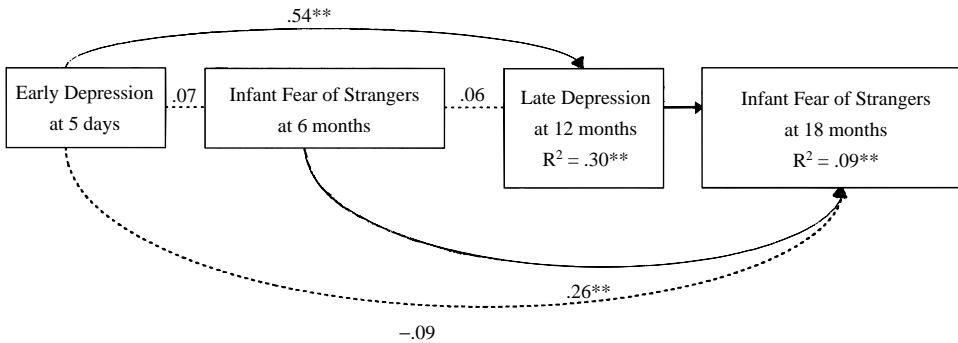


Figure 4. Path analysis of relationship between maternal depression and infant temperament: Fear of strangers and strange situations (Fear of Strangers). Early Depression and Late Depression refer to maternal depression.

** $p < .01$. Dotted arrows denote nonsignificant coefficient.

for feeding or alternations in the wake-sleep or excretion pattern may disrupt the mother's daily activities, such as interruption of sleep during the night and of household and leisure activities during the day. This appears to support the contention that women with less social support are more likely to suffer from postnatal depression (Paykel, Emms, Flecher, & Rassaby, 1980) because such women have to, for example, cope alone with the baby's irregular demands for feeding or diaper-changing. Moreover, failure to arrange a rhythmical daily life for the baby may lead to deterioration of maternal self-efficacy, thus precipitating postnatal depression (Cutrona & Troutman, 1986). On the other hand, confusion in the mother's daily life over matters such as sleep, loss of appetite, or negative emotional expression due to depression might affect the infant's life rhythms. Future studies will be needed to clarify the mechanisms of these correlations in terms of the different factors associated with maternal depressive symptoms (Sugawara, Sakamoto, Kitamura, Toda, & Shima, 1999) such as somatic (sleep disturbance, decreased appetite, etc.), affective (depressed affect, crying spells, irritability, etc.), or cognitive (confusion, psychomotor retardation, etc.).

A similar explanation of the reciprocal relationship between maternal depression and attention span and persistence may be possible. As shown in Table 1, the items related to attention span and persistence are concerned with the time duration of play with toys and parents. If an infant shows a lack of concentration while playing with toys or parents, the duration of infant play is shortened, and maternal satisfaction in playing with the infant may decrease. These may be related to deterioration of the mother's self-efficacy of infant care, consequently precipitating maternal depression. Meanwhile, confusion in the mother's daily life or negative emotional expression due to depression may affect the infant's emotional stability, which may provide the background for the infant's concentration to play.

Both of two temperament dimensions of the emotional domain—fear of strangers and strange situations and frustration tolerance—were affected by postnatal depression unilaterally in the present study. Early frustration tolerance scores (at 6 months) were negatively correlated with maternal depression in the early postpartum period. This result was similar to that obtained by Whiffen and Gotlib (1989), who found that infants of depressed mothers exhibited significantly lower tolerance for stress at 2 months after birth than controls. This result and our present study suggest that infants of mothers who are depressed in the early postpartum period are more vulnerable to stress from early

infancy. However, no such negative relationship was found between maternal depression and infant frustration tolerance in late infancy. On the other hand, the relationship between fear of strangers and strange situations and maternal depression was apparent only in late infancy. At this time, when infant social behavior, including social cognition, is developing rapidly, maternal social withdrawal due to depression might increase the infant's fearfulness of strangers and strange situations. Thus, maternal depression may have different effects on infant temperament according to infant developmental stage.

These effects of postnatal depression on infant temperament may be interpreted in several ways. First, late infant behavioral characteristics may be affected through interactions with depressed mothers. Most research on behavioral interactions between depressed mothers and their infants has revealed negative behavioral outcomes, including negative affect expression by both mother and infant, less positive engagement, less responsiveness, etcetera (e.g., Campbell, Cohn, & Meyers, 1995; Field, 1984; Lyons-Ruth et al., 1990; Pickens & Field, 1993). Infants of depressed mothers may learn or imitate a poor interactional style or negative emotional expressions from the mother. Second, infants of depressed mothers may live in more adverse social circumstances than infants of nondepressed mothers. Depressed women have a high rate of marital conflict (Weissman, 1987) and divorce (Briscoe & Smith, 1973). Downey and Coyne (1990) pointed out that the association between parental depression and child problems may be spurious, in that both may be caused by preexisting conditions such as marital turmoil or family stress.

Alternatively, there may be a genetic influence on the association between maternal depression and infant temperament. Ge et al. (1996) reported that adopted children (age 12–18 years) whose biological parents had a substance use disorder or antisocial personality were significantly more likely to have antisocial/hostile behavior problems than control children even though they were adopted at birth. Such an association may be hypothesized in terms of the relationship between maternal depression and infant temperament. Parental personality or temperament characteristics also need to be examined as a possible mediating variable.

There are some limitations regarding the measurements used in this study that should be considered when interpreting the results. First, the assessment of infant temperament was obtained via the mothers' perceptions. The items of the RITQ and TTS were designed to obtain information about infant behavioral style as objectively as possible, but some subjectivity was unavoidable, as the data were based on the mothers' judgments. Richiters and Pellegrini (1989) examined the hypothesis that depressed mothers have distorted perceptions of their 9-year-old children's problems, using teachers' ratings as an independent criterion for evaluating the accuracy of the mothers' ratings. They found no evidence to indicate depression as an attenuator of mother-teacher agreement about children's behavioral problems. We are unaware of any systematic study of depressed mothers' judgments about infant temperament such as that of Richiters and Pellegrini (1989), but multiple assessments of infant behavioral styles will still be needed. These should include direct observation of infants that are limited to narrower situations, but assured of higher objectivity, and reports of caregivers on infants' daily behavior. These have a higher risk of subjectivity but will provide a wider source of information.

Second, we treated maternal depression as a continuous variable in this study. To find out if these results are applicable to depression at the clinical level, a replicative study using direct interviews and psychiatric diagnoses will be needed in the future.

With these limitations in mind, the finding of significant associations between postpartum depression and infant temperament, as well as their reciprocal relationships, underlines the importance of a longitudinal study of the relationship between a caregiver's mental health and illness and the personality development of children. Further consider-

ation needs to be given to the psychological and social factors surrounding depressed caregivers and infants, along with clarification of the structures of the relationships involved.

References

- Bates, J.E., Freeland, C.B., & Lounsbury, M.L. (1979). Measurement of infant difficultness. *Child Development*, 50, 794–803.
- Bayley, N. (1969). *Manual for Bayley Scales of Infant Development*. New York: Psychological Corporation.
- Beardslee, W.R., Bemporad, J., Keller, M.B., & Klerman, G.L. (1983). Children of parents with major affective disorder: A review. *American Journal of Psychiatry*, 140, 825–832.
- Beck, A.T., Ward, C.H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, 4, 561–571.
- Briscoe, C.W., & Smith, J.B. (1973). Depression and marital turmoil. *Archives of General Psychiatry*, 29, 811–817.
- Campbell, S.B., Cohn, J.F., & Meyers, T. (1995). Depression in first-time mothers: Mother-infant interaction and depression chronicity. *Developmental Psychology*, 31, 349–357.
- Carey, W.B., & McDevitt, S.C. (1978). Revision of Infant Temperament Questionnaire. *Pediatrics*, 61, 735–739.
- Cohn, J.F., Campbell, S.B., Matias, R., & Hopkins, J. (1990). Face to face interactions of postpartum depressed mother–infant pairs at two months. *Developmental Psychology*, 26, 185–193.
- Cutrona, C.E., & Troutman, B.R. (1986). Social support, infant temperament, and parenting self-efficacy: A mediational model of postpartum depression. *Child Development*, 57, 1507–1518.
- Davenport, Y.B., Zahn-Waxler, C., Adland, M.L., & Mayfield, A. (1984). Early child rearing practices in families with a manic-depressive parent. *American Journal of Psychiatry*, 142, 230–235.
- Dodge, K.A. (Ed.). (1990). Developmental psychopathology in children of depressed mothers [Special section]. *Developmental Psychology*, 26, 3–67.
- Downey, G., & Coyne, J. (1990). Children of depressed parents: An integrative review. *Psychological Bulletin*, 108, 50–76.
- Field, T. (1984). Early interactions between infants and their postpartum depressed mothers. *Infant Behavior and Development*, 7, 517–522.
- Field, T., Healy, B., Goldstein, S., & Guthertz, M. (1990). Behavior state matching and synchrony in mother-infant interactions of nondepressed versus depressed dyads. *Developmental Psychology*, 59, 1569–1579.
- Fullward, W., McDevitt, S.C., & Carey, W.B. (1984). Assessing temperament in one- to three-year-old children. *Journal of Pediatric Psychology*, 9, 205–217.
- Ge, X., Conger, R., Cardoret, R., Neiderhiser, J., Yates, W., Troughton, E., & Stewart, M. (1996). The developmental interface between nature and nurture: A mutual influence model of child antisocial behavior and parent behaviors. *Developmental Psychology*, 32, 574–589.
- Hammen, C., Gordon, D., Burge, D., Adrian, C., Jaenicke, C., & Hiroto, D. (1987). Maternal affective disorders, illness, and stress: Risk for children's psychopathology. *American Journal of Psychiatry*, 144, 736–741.
- Hammen, C., Burge, D., & Stansbury, K. (1990). Relationship of mother and child variables to child outcomes in a high-risk sample: A causal modeling analysis. *Developmental Psychology*, 26, 24–30.
- Hopkins, J., Campbell, S.B., & Marcus, M. (1987). Role of infant-related stressors in postpartum depression. *Journal of Abnormal Psychology*, 96, 237–241.
- Kitamura, T., Shima, S., Sugawara, M., & Toda, M.A. (1994). Temporal variation of validity of self-rating questionnaires: Repeated use of the General Health Questionnaire and Zung's Self-

- Rating Depression Scale among women during antenatal and postnatal periods. *Acta Psychiatrica Scandinavica*, 90, 446–450.
- Kitamura, T., Shima, S., Sugawara, M., & Toda, M.A. (1996). A psychosocial study of depression in early pregnancy. *British Journal of Psychiatry*, 168, 732–738.
- Livingood, A.B., Dean, P., & Smith, B.D. (1983). The depressed mother as a stimulation for her infant. *Journal of Clinical Psychology*, 39, 369–375.
- Lyons-Ruth, K., Connell, D.B., & Grunebaum, H.U. (1990). Infants at social risk: Maternal depression and family support service as mediators of infant development and security of attachment. *Child Development*, 61, 85–98.
- Mayberry, L.J., & Affonso, D.D. (1993). Infant temperament and postpartum depression: A review. *Health Care for Women International*, 14, 201–211.
- Ministry of Education (1993). *Basic Survey of Schools*. Tokyo: Japanese Government Printing Office.
- Ministry of Finance (1985). *White Paper on the Life of the People*. Tokyo: Japanese Government Printing Office.
- Ministry of Finance (1994). *White Paper on the Life of the People*. Tokyo: Japanese Government Printing Office.
- O'Hara, M., & Zekoski, M. (1988). Postpartum depression: A comprehensive review. In R. Kumar & I.F. Brockington (Eds.), *Motherhood and mental illness 2* (pp. 17–63). London: Wright.
- Paffenbarger, R.S. (1961). The picture puzzle of the postpartum psychoses. *Journal of Chronic Diseases*, 13, 161–173.
- Paykel, E.S., Emms, E.M., Flecher, J., & Rassaby, E.S. (1980). Life events and social support in puerperal depression. *British Journal of Psychiatry*, 136, 339–346.
- Pickens, J., & Field, T. (1993). Facial expressivity in infants of depressed mothers. *Developmental Psychology*, 29, 986–988.
- Pitt, B. (1968). A typical depression following childbirth. *British Journal of Psychiatry*, 114, 1325–1335.
- Prior, M., Sanson, A.V., & Oberklaid, F. (1989). The Australian Temperament Project. In J.E. Kohnstamm, J.E. Bates, & M.K. Rothbart (Eds.), *Temperament in childhood*. Chichester, England: John Wiley & Sons.
- Radke-Yarrow, M., Cummings, E.M., Kuczynski, L., & Chapman, M. (1985). Patterns of attachment in two- and three-year-olds in normal families and families with parental depression. *Child Development*, 36, 884–893.
- Richters, J., & Pellegrini, D. (1989). Depressed mothers' judgement about their children: An examination of depression-distortion hypothesis. *Child Development*, 60, 1068–1075.
- Rutter, M. (1966). *Children of sick parents: An environmental and psychiatric study*. Institute of Psychiatry Maudsley Monographs, 16. London: Oxford University Press.
- Sanson, A.V., Prior, M., Garino, F., Oberklaid, F., & Sewell, J. (1987). The structure of infant temperament: Factor analysis of the RITQ. *Infant Behavior and Development*, 10, 97–104.
- Sato, T. (1983). The Japanese version of the RITQ. Unpublished manuscript.
- Sato, T. (1984). The Japanese version of the TTS. Unpublished manuscript.
- Shima, S., Kitamura, T., Aoki, M., Sugawara, M., & Sakakura, K. (1988). Shussan ni tomonan seishin shyōgaino jūdan teki kenkyū. [A longitudinal study of mental disorders with child-bearing.] *Nihon Iji Shinpou*, 3344, 43–49.
- Spitzer, R.L., & Endicott, J. (1978). *Schedule for Affective Disorders and Schizophrenia (SADS)* (3rd ed.). New York: New York State Psychiatric Institute, Biometric Research.
- Spitzer, R.L., Endicott, J., & Robins, E. (1978). *Research Diagnostic Criteria (RDC) for a selected group of functional disorders*. New York: New York State Psychiatric Institute, Biometric Research.

- Sugawara, M., Shima, S., Toda, M.A., Sato, T., & Kitamura, T. (1994). Nyuyōjiki ni mirareru kōdō tokutyō. [Behavioral characteristics in early childhood: An investigation of RITQ and TTS (Japanese version).] *Japanese Journal of Educational Psychology*, 42, 315–323.
- Sugawara, M., Mukai, T., Toda, M.A., Shima, S., & Kitamura, T. (1996). Mental health of mother and child: 8-year follow-up study. Paper presented at the 60th meeting of the Association for Japanese Psychology.
- Sugawara, M., Sakamoto, S., Kitamura, T., Toda, M.A., & Shima, S. (in press). Structure of depressive symptoms in pregnancy and the postpartum period. *Journal of Affective Disorders*.
- Teti, D.M., Gelfand, D.M., Messinger, D.S., & Isabella, R. (1995). Maternal depression and the quality of early attachment: An examination of infants, preschoolers, and their mothers. *Developmental Psychology*, 31, 364–376.
- Weissman, M.M. (1987). Advances in psychiatric epidemiology: Rates and risks for major depression. *American Journal of Public Health*, 77, 445–451.
- Whiffen, V.E., & Gotlib, I.E. (1989). Infants of postpartum depressed mothers: Temperament and cognitive status. *Journal of Abnormal Psychology*, 98, 274–279.
- Zahn-Waxler, C. (Ed.). (1995). Parental depression and distress: Implications for development in infancy, childhood, and adolescence [Special section]. *Developmental Psychology*, 31, 347–436.
- Zung, W.W.K. (1965). A self-rating depression scale. *Archives of General Psychiatry*, 12, 63–70.