Short-term Effects of the Neonatal Behavioral Assessment Scale-based Intervention for Infants with Developmental Disabilities

RYUICHI KUSAKA, RPT1), SHOHEI OHGI, RPT, PhD2), HIROTAKA GIMA, RPT3), TETSUYA FUJIMOTO, DE4)

1)Department of Physical Therapy, Undergraduate School of Health Sciences, Bukkyo University: 96 Kitahananobou-Murasakino, Kitaku, Kyoto 603-8301, Japan. TEL +81 75-491-2141, E-mail: kusaka@bukkyo-u.ac.jp
2)Department of Rehabilitation Sciences, Seirei Christopher University
3)Department of Rehabilitation, Nagasaki University Hospital
4)Interdisciplinary Graduate School of Science and Technology, Shinshu University

Abstract. Early intervention planning for infants with disabilities has conventionally been centered on the infants’ disabilities, rather than the family’s adjustment. This study investigates the effectiveness of an Neonatal Behavioral Assessment Scale (NBAS)-based intervention for infants with disabilities, in enhancing infant neurobehavioral organization, maternal self-efficacy, and mother-infant interaction. A time series design was used, with the intervention trial consisting of a two-week observation at baseline and intervention periods. Subjects were 15 infants with disabilities and their mothers. The NBAS, Lack of Confidence in Caregiving (LCC) items of the Mother and Baby Scale, and the Nursing Child Assessment Teaching Scale (NCATS), were used to assess neonatal neurobehaviors, maternal self-efficacy, and the quality of mother-infant interaction respectively, at 3 time points: at intake, pre-intervention, and post-intervention. Intervention sessions were performed 6–8 times, 30 minutes per session, during the intervention period. The NBAS, LCC, and NCAST scores were significantly improved post-intervention. The NBAS-based intervention has beneficial effects on neonatal neurobehavorial organization and the quality of mother-infant interaction skills and maternal self-efficacy, in infants with developmental disabilities. Attunement of mothers to their infants’ behaviors early on in life may promote a positive cycle of interaction between parents and infants.

Key words: NBAS-based intervention, Infants with disabilities, Neurobehavioral organization, Maternal self-efficacy, Mother-infant interaction

INTRODUCTION

Parents who have infants with developmental disabilities are known to have more difficulties in interacting with, and handling their babies1–5). In at-risk groups, it is especially important for parents to be able to adapt their parenting styles based on the infant’s behavioral repertoire and the severity of the infant’s symptoms6–12). Previous studies have demonstrated that interventions aimed at enhancing parental recognition of, and adaptation to, their infant’s behavioral cues, have positive effects on infant developmental outcome and parental adjustment13–16). For example, an early “family-centered intervention” based on the NBAS (Neonatal...
Behavioral Assessment scale), designed to facilitate the development of the infants by fostering parenting skills and improving parental recognition of their infants’ abilities, was used in healthy newborn and premature infants. The intervention groups had improved infant-mother interaction and infant developmental outcome. In a randomized trial with low birth weight infants affected by cerebral injuries, an NBAS-based intervention combined with physical and occupational therapies, was used, with follow up to 6 months corrected age. The intervention group had improved neonatal neurobehavioral development, as well as reduced maternal stress and anxiety.

Children with physical disabilities are at increased risk of problems in the parent-child relationship, and parents of such children experience elevated levels of depression, stress and anxiety. Ohgi et al. suggested that infants with developmental disabilities are more prone towards disorganization in the neonatal-behavioral systems, manifesting as problems with central nervous system irritation or depression, physiological disorganization, depressed reflexes activity, dysfunctions in motor control, poor behavioral state control (e.g. irritability, lability in change of state), and difficulties with appropriate adjustment to environmental stimuli (e.g. hypo- or hyper-sensitivity). In account of these challenges to the dyadic relationship in infants with physical disabilities, it may be helpful to provide parents with guidance on the infants’ behavioral repertoire, rather than to focus on the child’s disabilities.

The aim of this study was to examine the effects of an NBAS-based intervention trial for infants with disabilities, on infants’ neurobehavior, maternal self-efficacy and mother-infant interaction.

METHODS

Participants
Mother-infant dyads were recruited from the neonatal intensive care unit of the Nagasaki University Hospital, Japan. Recruitment was between April 2003 and December 2004. Inclusion criteria were: 1) singleton birth, 2) cranial abnormality: cystic periventricular leukomalacia (PVL) and intraventricular haemorrhage (IVH) as shown by ultrasound, 3) asphyxia (Apgar Score at 5 min; 3 ≥, 4) congenital malformation, 5) chromosomal aberration, 6) other developmental disease (e.g.; congenital multiple arthrogryposis) and 7) consent of parents to participate in the research. A total of 168 infants were hospitalized in the NICU during the study period. Of these, fifteen infants (8.9%) met the aforementioned inclusion criteria over this study period.

Procedure
This trial was based on a time series design, consisting of a two-week observation phase (baseline) followed by interventions, to examine the efficacy of the NBAS-based intervention on infants’ neurobehavior, maternal self-efficacy and mother-infant interaction. As soon as each infant could tolerate handling outside the incubator their families were recruited. Infants’ neurobehavior, maternal self-efficacy and mother-infant interaction style were assessed at 3 time points: at intake, pre-intervention, and post-intervention. All participating families gave their informed consent. This study protocol was approved by the Ethics Committee of the Nagasaki University and Seirei Christopher College.

NBAS-based intervention
During the observation period, infants and their mothers received traditional care from nursing staff during their hospitalization and after discharge. The NBAS-based intervention method was designed to facilitate mother-infant interaction. It was performed by the infant specialist, who asked the parent to observe baby during the demonstration of the NBAS examination. Then, the infant specialist commented on, and discussed the baby’s behavior (e.g. infants’ strengths and weaknesses, attempts at self-regulation, transitions in behavioral states), provided guidance on how to read and support infants’ coping strategies, and demonstrated to parents the mode of intervention that the infant would benefit from. It was designed to optimize caregiving interactions by enhancing the mothers’ adjustment to their infants’ behavior. This program had the following aims: 1) to enable the mother to appreciate her baby’s specific behavioral characteristics; 2) to sensitize her to the baby’s cues, especially those that signal stimulus overload, distress, and readiness for interaction; 3) to teach her to respond appropriately to those cues in order to facilitate mutually satisfying interactions; 4) to adapt the immediate physical and sensory
environment to the infant’s thresholds for stimulation (e.g.; handling, positioning, swaddling, protection from light, noise, overstimulation etc); 5) to share with parents concerns about the baby’s future development; and 6) to promote a positive collaborative relationship between the clinician which will continue the care of the infant and family. This NBAS-based intervention session was performed 6–8 times, about 30 minutes per session during the intervention period prior to discharge from hospital.

**Outcome measures**

**Neurobehavioral examination**

Infants’ neurobehavioral functioning was assessed with the Neonatal Behavioral Assessment Scale (NBAS)\(^1\). The NBAS scores were reduced to seven clusters: 1) Habituation, 2) Orientation, 3) Motor Performance, 4) Range of State, 5) State Regulation, 6) Autonomic Stability and 7) Reflexes, in accordance with the data reduction scheme described by Lester et al. Individual item scores were re-coded and the cluster scores were calculated. The supplemental NBAS items were included in the corresponding cluster (for example, the supplemental item “Quality of alert responsiveness” was included in the Orientation cluster). Higher NBAS cluster scores indicated a better behavioral response, except for the Reflexes cluster, in which higher scores indicated more abnormal responses. The NBAS administration was recorded on video, and was independently coded by a blinded NBAS-certified examiner.

**Maternal self-efficacy**

To evaluate maternal self-efficacy, the mothers were asked questions based on the “Lack of Confidence in Caregiving” (LCC) items of the Mother and Baby Scale\(^2\). The 13 items, LCC scale provides a quick check as to whether or not a mother feels confident in dealing with her baby (Appendix). As shown in the appendix, each item was rated on a six-point Likert scale ranging from 0 (not at all) to 5 (Very Often/Very much). This scale is scored by totaling the individual items scores (some items need inversion), with lower scores indicating lower confidence.

**Nursing Child Assessment Teaching Scale (NCATS)**

The Nursing Child Assessment Teaching Scale (NCATS) was used to assess dyadic parent-infant interactions\(^3\). The NCATS is a 73-item, binary scale that measures caregiver and child contributions to the dyadic relationship in caregiver/parent-child interaction. The caregiver/parent-child interaction is observed while the caregiver gets the child to carry out a standardized, developmentally appropriate task. Yields consist of a caregiver total score, subscales for the caregiver score are: sensitivity to cues, response to distress, social-emotional growth fostering, and cognitive growth fostering. The NCATS episode was recorded on video. The tapes were randomly scored by a certified NCAST scorer, who achieved 90% inter-rater reliability on the NCAST certifying program.

**Statistical analysis**

Comparisons of each outcome measure at the three assessment time points were based on analysis of variance (ANOVA). The ANOVAs were followed by Tukey’s honestly significant difference adjustment for multiple comparisons. Pearson’s correlation coefficient was used to study the relationship between the NBAS cluster scores and the NCAST maternal scores. P values less than 0.05 (two-tailed tests) were regarded as statistically significant. The statistical software SPSS (version 12.0J) was used for statistical analysis.

**RESULTS**

**Background**

The characteristics of the study infants and those of their mothers are presented in Table 1. There were 15 infants with the following disabilities: 6 cystic periventricular leukomalacia (2 infants with intraventricular hemorrhage), 3 chromosomal anomalies, 3 birth asphyxia (1 infant with hydrops fetalis), 1 holoprosencephaly, 1 congenital multiple arthrogryposis, 1 Russell-Silver syndrome. Average gestational age at intake was 38.7 weeks for premature infants and 45.8 weeks for full-term infants. With regards to social factors of parents, there were no single mothers and no fathers who were out of work. Six mothers had other children, 3 were living with grandparent(s) and all mothers had educational levels at or above high school.

**The NBAS cluster scores**

Table 2 shows the NBAS cluster scores at each...
assessment period. At baseline, all NBAS cluster scores showed no significant difference between intake and pre-intervention. Post-intervention Orientation and State Regulation cluster scores were significantly improved. Mean differences (post-intervention minus pre-intervention) were 0.79 (Standard Error (SE) 0.28, p<0.05) for Orientation cluster and 1.01 (SE: 0.30, p<0.05) for State Regulation cluster. Individual items on the NBAS yielded significant improvements on the Animate Visual Orientation, Auditory and Visual-Auditory Orientation scores and on the Alertness, Cuddliness, Self-quieting, Cost of Attention, General Irritability scores.

Maternal self-efficacy

The LCC scores at each assessment period are shown in Table 3. At baseline, all LCC subscale and total scores showed no significant differences between intake and pre-intervention. Post-intervention subscale “I have felt confident about looking after my baby”, and total LCC scores were significantly improved. Each mean difference were 0.60 (SE 0.18, p<0.05), and 4.00 (SE 1.13, p<0.05).

The NCATS scores

Table 4 shows the NCATS scores at each assessment period. At baseline, all NCATS subscale and total scores showed no significant differences between intake and pre-intervention. The NCATS Caregiver Total and Subscale scores, Sensitivity to cues and Social-Emotional Growth Fostering, were significantly improved post-intervention. Mean differences were 2.00 (SE 0.52, p<0.01) for Sensitivity to cues, 1.40 (SE 0.47, p<0.05) for Social-Emotional Growth Fostering, and 6.33 (SE 1.54, p<0.01) for total score.

Correlations between the NBAS cluster and the NCATS scores

The mean difference of Orientation cluster scores were significantly positively correlated with the mean difference of the NCAST Caregiver Total, Response to Distress and Social-Emotional Growth Fostering scores (Spearman correlation coefficients: r=0.63 (p<0.01), r=0.53 (p<0.05), r=0.50 (p<0.05), respectively). The mean difference of State Regulation cluster scores were significantly positively correlated with the mean

Table 1. Participants

<table>
<thead>
<tr>
<th>Sex (male / Female)</th>
<th>10</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age (week)</td>
<td>33.3 (5.1)</td>
<td>32 (25–42)*</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>1,936 (1,069.2)</td>
<td>1473 (900–4515)*</td>
</tr>
<tr>
<td>Maternal age (year)</td>
<td>30.7 (4.2)</td>
<td>32 (22–38)*</td>
</tr>
<tr>
<td>Maternal education** (years)</td>
<td>13.9 (1.5)</td>
<td>14 (12–16)*</td>
</tr>
<tr>
<td>Single mother No. (%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Siblings No. (%)</td>
<td>6 (38.5)</td>
<td></td>
</tr>
</tbody>
</table>

†: average (standard deviation, range)
*: median (range)
**: over the elementary school

Table 2. NBAS

| Intake Pre-intervention Post-intervention Mean difference Mean difference |
|-------------------|-----------------|-----------------|-----------------|-----------------|
| Habituation | 6.83 (0.16) | 7.01 (0.15) | 7.26 (0.10) | 0.18 (0.20) | 0.25 (0.20) |
| Orientation | 5.19 (0.19) | 5.25 (0.19) | 6.03 (0.21) | 0.05 (0.28) | 0.79 (0.28)* |
| Motor | 4.17 (0.13) | 4.30 (0.13) | 4.55 (0.13) | 0.13 (0.18) | 0.24 (0.18) |
| State Range | 4.05 (0.18) | 4.19 (0.16) | 4.67 (0.14) | 0.14 (0.23) | 0.47 (0.23) |
| State Regulation | 4.49 (0.21) | 4.49 (0.22) | 5.51 (0.21) | 0.01 (0.30) | 1.01 (0.30)** |
| Autonomic Stability | 6.65 (0.12) | 7.00 (0.10) | 7.31 (0.08) | 0.35 (0.14) | 0.31 (0.14) |
| Reflexes | 4.00 (0.36) | 4.77 (0.41) | 4.69 (0.38) | 0.77 (0.55) | −0.08 (0.56) |

Average (standard error)
*: p<0.05, **: p<0.01
difference of the NCAST Caregiver Total and Social-Emotional Growth Fostering scores (Spearman correlation coefficients: r=0.67 (p<0.01), r=0.62 (p<0.01)).

**DISCUSSION**

The findings suggest the NBAS-based intervention has beneficial effects on neonatal neurobehavioral organization and the quality of mother-infant interaction skills, in infants with developmental disabilities.

The results of the NBAS showed that the Orientation and State Regulation clusters were significantly improved post-intervention. The infants improved their abilities to: 1) be less irritable and fussy, 2) have a higher capacity for maintaining stable state organization in the face of increasing levels of stimulation; 3) have a higher capability for state-regulation in their ability to move when crying, and 4) have less stress behavior. It is therefore likely that the improved behavioral characteristics would have a positive modifying influence on the interactions between the infants and their parents.

Maternal self-efficacy by the LCC also showed significant improvement post-intervention. This suggests that the NBAS-based intervention may have positive effects in helping mothers modify their caregiving or parenting practices to better

### Table 3. LCC (Lack of Confidence in Caregiving)

<table>
<thead>
<tr>
<th>Item</th>
<th>Intake (a)</th>
<th>Pre-intervention (b)</th>
<th>Post-intervention (c)</th>
<th>Mean difference (b–a)</th>
<th>Mean difference (c–b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It makes me insecure when my baby cries</td>
<td>3.00 (0.10)</td>
<td>2.80 (0.11)</td>
<td>3.13 (0.13)</td>
<td>–0.20 (0.16)</td>
<td>0.33 (0.16)</td>
</tr>
<tr>
<td>2. I have felt confident about looking after my baby</td>
<td>2.60 (0.13)</td>
<td>2.47 (0.13)</td>
<td>3.07 (0.12)</td>
<td>–0.13 (0.18)</td>
<td>0.60 (0.18)*</td>
</tr>
<tr>
<td>3. I have felt clumsy in caring for my baby</td>
<td>2.73 (0.15)</td>
<td>2.53 (0.13)</td>
<td>3.07 (0.12)</td>
<td>–0.20 (0.19)</td>
<td>0.53 (0.19)</td>
</tr>
<tr>
<td>4. I would have liked more advice about looking after my baby</td>
<td>2.47 (0.13)</td>
<td>2.53 (0.13)</td>
<td>2.53 (0.13)</td>
<td>0.07 (0.19)</td>
<td>0.00 (0.19)</td>
</tr>
<tr>
<td>5. Looking after my baby has been more difficult than I expected</td>
<td>2.60 (0.16)</td>
<td>2.53 (0.13)</td>
<td>2.87 (0.13)</td>
<td>–0.07 (0.20)</td>
<td>0.33 (0.20)</td>
</tr>
<tr>
<td>6. I have been feeling anxious about coping when my baby and I get home</td>
<td>2.40 (0.16)</td>
<td>2.27 (0.15)</td>
<td>2.60 (0.13)</td>
<td>–0.13 (0.21)</td>
<td>0.33 (0.21)</td>
</tr>
<tr>
<td>7. I think I have been coping all right with my baby</td>
<td>2.53 (0.17)</td>
<td>2.60 (0.13)</td>
<td>2.93 (0.15)</td>
<td>0.07 (0.21)</td>
<td>0.33 (0.21)</td>
</tr>
<tr>
<td>8. I have been afraid that I might drop my baby</td>
<td>3.47 (0.13)</td>
<td>3.40 (0.13)</td>
<td>3.53 (0.13)</td>
<td>–0.07 (0.19)</td>
<td>0.13 (0.19)</td>
</tr>
<tr>
<td>9. I have asked the nurse for help when my baby is unsettled</td>
<td>2.73 (0.12)</td>
<td>2.87 (0.10)</td>
<td>3.00 (0.14)</td>
<td>0.13 (0.17)</td>
<td>0.13 (0.17)</td>
</tr>
<tr>
<td>10. I have felt worried I might hurt my baby when handling her/him</td>
<td>3.27 (0.15)</td>
<td>3.13 (0.10)</td>
<td>3.47 (0.13)</td>
<td>–0.13 (0.18)</td>
<td>0.33 (0.18)</td>
</tr>
<tr>
<td>11. I have felt unsure whether I have been doing the right thing whilst looking after my baby</td>
<td>2.60 (0.13)</td>
<td>2.53 (0.13)</td>
<td>2.93 (0.12)</td>
<td>–0.07 (0.18)</td>
<td>0.40 (0.18)</td>
</tr>
<tr>
<td>12. I cope well with my baby when she/he is unsettled</td>
<td>2.67 (0.13)</td>
<td>2.73 (0.12)</td>
<td>2.93 (0.12)</td>
<td>0.07 (0.17)</td>
<td>0.20 (0.17)</td>
</tr>
<tr>
<td>13. I think I have been making a good job of being a mother</td>
<td>2.73 (0.12)</td>
<td>2.80 (0.11)</td>
<td>3.13 (0.17)</td>
<td>0.07 (0.19)</td>
<td>0.33 (0.19)</td>
</tr>
<tr>
<td><strong>Total Score</strong></td>
<td>35.80 (1.02)</td>
<td>35.20 (0.62)</td>
<td>39.20 (0.99)</td>
<td>–0.60 (1.27)</td>
<td>4.00 (1.13)*</td>
</tr>
</tbody>
</table>

Average (standard error)

*: p<0.05

Each item was rated on a six-point Likert scale ranging from 0 (not at all) to 5 (Very Often/Very much). This scale is scored by totaling the individual items scores (some items need inversion), higher scores indicated lower confidence.
adapt to their infants’ abilities. Mothers had a more positive perception of their parenting and childcare and judged their infants to be easier to care for. The changes in maternal attitude at this early phase of life may promote a positive cycle of interaction between parents and infants that may lead, albeit indirectly, to desirable long-term consequences. Dyadic parent-infant interactions were assessed using the Nursing Child Assessment Teaching Scale (NCATS) and showed improved Caregiver Total and Subscale scores (Sensitivity to Cues and Social-Emotional Growth Fostering) post-intervention. The Sensitivity to Cues subscale measures the caregiver/parent’s ability to recognize and respond to an infant’s cues. For example, caregiver/parent demonstrates sensitivity through their positioning to accurately read and respond to their child, and provides suitable stimulation (holding, moving, talking and looking at their infants). Improvement of this subscale shows possible maternal sensitization to the baby’s behavioral cues, affording appropriate responses to those cues. The Social-Emotional Growth Fostering subscale measures the affective domain and positive tone in communication. This subscale reflects the caregiver/parent’s ability to facilitate an infant’s social-emotional growth through caregiver/parent’s tone and pitch of voice, facial expression, types of touch, social interaction, types of statements made to and about the child, positioning of the child, gentle pat, caress or hug of the child. Improvement of this subscale indicates that the mother facilitates the infant’s social-emotional growth. Caregiver Total score was also improved. This result shows overall increased maternal responsiveness during the interaction interlude with higher sensitivity to cues, alleviation of infant distress cues, and promotion of growth fostering situations. In addition, there were significant correlations between the mean difference (post minus pre-intervention) NBAS Orientation, State Regulation cluster scores and the NCAST Caregiver Total score. Improvement of an infant’s neurobehavior and quality of maternal interaction skill may be closely correlated.

These results suggest that the NBAS-based intervention facilitates mother-infant interactions, sensitize mothers to the individuality of their infant’s behavioral strengths and weaknesses, thereby helping mothers bond with their infants. The intervention also has the potential to influence the parent-infant relationship by helping the parents learn techniques to help them deal with their infant’s individual behavioral characteristics, thereby facilitating their development. These favorable changes in maternal abilities to handle and interact with their infants are anticipated to continue after discharge. The results of follow-up studies of low-birth weight and/or premature infants indicate positive long-term effects of early intervention on child behavior, cognitive development(13–16). Kleberg et al. suggested that early intervention in the form of family-centered developmentally supportive care according to NIDCAP (Newborn Individualized Developmental Care and Assessment Program) for very low birth weight infants have certain positive long-term effects on the child’s behavior and mother-child interaction on the development and behavior of the child and on the mother-child interaction at 3 years of age(16). Though participants of our study included infants with more severe developmental disabilities, we believe that the interaction between parents and their infants is likely to facilitate the infant’s development and the parents’ own recovery, by reducing parental anxiety and encouraging bonding

Table 4. NCATS

<table>
<thead>
<tr>
<th></th>
<th>Intake (a)</th>
<th>Pre-intervention (b)</th>
<th>Post-intervention (c)</th>
<th>Mean difference (b–a)</th>
<th>Mean difference (c–b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity to Cues</td>
<td>6.93 (0.43)</td>
<td>6.47 (0.32)</td>
<td>8.47 (0.34)</td>
<td>–0.46 (0.52)</td>
<td>2.00 (0.52)**</td>
</tr>
<tr>
<td>Response to Distress</td>
<td>8.07 (0.44)</td>
<td>7.93 (0.45)</td>
<td>8.93 (0.43)</td>
<td>–0.13 (0.64)</td>
<td>1.00 (0.63)</td>
</tr>
<tr>
<td>Social-Emotional Growth</td>
<td>6.13 (0.31)</td>
<td>6.07 (0.25)</td>
<td>7.47 (0.42)</td>
<td>–0.06 (0.47)</td>
<td>1.40 (0.47)*</td>
</tr>
<tr>
<td>Cognitive Growth</td>
<td>8.73 (0.59)</td>
<td>9.33 (0.54)</td>
<td>11.27 (0.58)</td>
<td>0.60 (0.80)</td>
<td>1.93 (0.80)</td>
</tr>
<tr>
<td>Mother Total Score</td>
<td>29.87 (1.28)</td>
<td>29.80 (0.94)</td>
<td>36.13 (1.00)</td>
<td>–0.07 (1.54)</td>
<td>6.33 (1.54)**</td>
</tr>
</tbody>
</table>

Average (standard error)

*: p<0.05, **: p<0.01.
between the parents and the infant.

Several limitations are present in this study. The time series design may produce time-dependent confounding. While it is reasonable to attribute the positive change on neurobehavior and infant-mother interaction attribute to the intervention, it is also possible that the change may occur in the natural course of infants’ neurobehavioral maturation and maternal experience in caregiving. However, the use of a randomized controlled trial study was difficult due to the necessity of having a control group without intervention, which raises ethical concerns, since previous studies with healthy newborn and premature infants have shown positive effects of NBAS intervention on infant-mother interaction and developmental outcome. Infants with developmental disabilities are at increased risk for problems in the parent-infant interaction, maternal depression, stress and anxiety. However, the associations between maternal self-perceptions of well-being and of satisfaction, maternal behavior and infants’ disabilities are complex. Risk factors for maternal depression and poor mother-infant interaction include specific characteristics of an infant with a disability (i.e., the diagnostic classification), poor marital relationships, lack of social support, and personal and family psychopathology, and others. Therefore, we need to assess the influences of intervention on maternal mental health and mother-infant interaction according to these factors in future studies.

In conclusion, while acknowledging possible confounding factors in the time series design, the present data provide evidence for the effectiveness of the NBAS-based intervention on neonatal neurobehavioral organization, quality of mother-infant interaction skills, and maternal self-efficacy, in infants with developmental disabilities. Attunement of mothers to their infants’ behaviors early on in life may promote a positive cycle of interaction between parents and infants.

ACKNOWLEDGEMENTS

We appreciate the input and suggestions from Kek Khee Loo, M.D., Department of Pediatrics, David Geffen School of Medicine at UCLA, U.S.A.

REFERENCES

16) Kleberg A, Westrup B, Stjernqvist K: Developmental
outcome, child behaviour and mother-child interaction at 3 years of age following Newborn Individualized Developmental Care and Intervention Program (NIDCAP) intervention. Early Hum Dev, 2000, 60: 123–135.


