Bulletin of the Psychonomic Society
1991, 29 (1), 1-3

The perinatal stress composite: A validation study

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This initial version of the Perinatal Stress Composite (PSC) was validated as a measure of the magnitude of maternal stress from having a premature baby. Scores for Blumberg's (1980) scale of neonatal risk (the validity criterion) and the six components of the PSC (gestational age of the baby, birthweight, Apgar (1953) scores at 1 and 5 min, length of hospitalization, and severity of the baby's complications) were obtained from the hospital records of 189 births of premature babies at a Midwestern hospital. Factor analyses indicated that the six components could be represented by two factors: the degree of the baby's prematurity, and the baby's Apgar scores. There was a significant multiple correlation between the six components of the PSC and Blumberg's scale ($R = .76$), indicating that the PSC holds promise as a valid measure of perinatal stress.

Pregnancy (along with the general expectation of delivering a healthy, full-term infant) has been identified as a stressful event (Holmes & Rahe, 1967). Conceptually, the birth of a sick baby requiring an extended hospitalization should produce even greater stress for parents. This initial version of the Perinatal Stress Composite (PSC) was constructed to provide a measure of the magnitude of medically related stressors associated with the birth of infants, both healthy and sick.

Components of the PSC consist of the following six items, which are obtainable from hospital records: the estimated gestational age of the baby (in weeks); the baby's birthweight (in grams); the Apgar (1953) scores at 1 and 5 min; the baby's total length of hospitalizations, including rehospitalizations (in days); and a measure of the severity of the baby's postnatal complications (the Postnatal Complications Rating). These components were chosen for two reasons. First, the components have been frequently used as either predictors of or criteria for the morbidity and mortality rates of neonates (Behnke et al., 1987; Myers, Paton, & Fisher, 1987; Tejani & Verma, 1988). Second, reports from parents and perinatal professionals indicate that each component may contribute to the perceived stressfulness of birth, especially the birth of a premature or high-risk baby (Blumberg, 1980; Harrison & Kositski, 1983; Hynan, 1987; Nance, 1982).

The purpose of this initial research was twofold. First, previous studies have found that many of the components of the PSC are intercorrelated (Behnke et al., 1989; Catlin et al., 1986; Tejani & Verma, 1988). So I conducted factor analyses on the components to determine whether the six components would form a smaller number of distinct factors in a sample of births of premature babies. Second, I investigated the concurrent validity of the PSC as a measure of maternal stress. In validating the PSC, I chose a previously validated scale of neonatal risk as the criterion measure (Blumberg, 1980).

Blumberg's (1980) neonatal risk scale (adapted from Babson, Benson, Pernoll, & Benda, 1975) consists of five categories of birth outcomes ranging from highest risk (e.g., birthweight less than 1,600 g, in premature nursery) through moderate risk (e.g., birthweight of 2,000-2,500 g, in premature nursery) to no risk suspected (e.g., normal birthweight, in normal nursery). The Blumberg risk scale has an interrater reliability of $r = .96$ and criterion validity as a measure of maternal stress. Blumberg found that mothers of babies with higher levels of risk experienced greater anxiety and depression and also had more negative perceptions of their baby, relative to mothers of lower risk babies.

There were two reasons for constructing the PSC rather than continuing to use Blumberg's (1980) scale to estimate perinatal stress. First, Blumberg's scale was designed to be used during the 1st postpartum week. Thus, stressors such as a lengthy hospitalization of the baby or late-developing complications are not included in Blumberg's framework.

Second, Blumberg's (1980) scale appears to have a low ceiling of the magnitude of risk when viewed in the context of current treatment in a neonatal intensive care unit (NICU). That is, there is likely to be greater parental stress in giving birth to a 25-week gestational age, 600-g baby requiring mechanical ventilation for respiration throughout a 4-month hospitalization than in giving birth to a 32-week, 1,500-g baby that breathes without assistance and is hospitalized 3 weeks. Both these babies would be categorized the same (i.e., highest risk) according to Blumberg's (1980) scale, but they would have very different ratings of stress magnitude on the PSC.

I wish to thank Howard Harris, Mary Hott, and Elise Papke for their help in collecting the data. Correspondence concerning this article should be sent to Michael T. Hynan, Department of Psychology, University of Wisconsin, P.O. Box 413, Milwaukee, WI 53201.

Table 1
Postnatal Complications Rating

0. No apparent complications.
1. Anemia; Hypocalcemia; Hypoglycemia; Jaundice; Transient tachypnea of newborn.
2. Apnea; Bradycardia; Feeding intolerance, 3 or more days.
3. Respiratory distress syndrome, on respirator less than 5 days; Inguinal hernia; Intraventricular hemorrhage (IVH)-Grade I; Pneumonia; Sepsis.
4. Retinopathy of prematurity; Renal failure; Hearing impairment; Meconium aspiration; Patent ductus arteriosus; Meningitis; IVH-Grade II.
5. Brain Edema; Hydrocephalus; Necrotizing enterocolitis; Pneumothorax; Pulmonary insufficiency; Respiratory distress syndrome, on respirator 5 or more days; Seizures.
6. Bronchopulmonary dysplasia; Congenital heart defect; Diaphragmatic hernia; Gastroschisis; Ileostomy; IVH-Grade III; Other congenital abnormalities (e.g., Downs syndrome).
7. Anencephaly; IVH-Grade IV; Severe cardiopulmonary insufficiency; Extracorporeal membrane oxygenation.

Note—The rating is the largest number associated with any complication reported in the hospital records.

I predicted that a multiple regression would show a significant relationship between the six components of the PSC and Blumberg's (1980) scale of neonatal risk.

METHOD

Subjects

Data were obtained from the hospital records of 189 premature babies discharged from a level-3 NICU in a midwestern hospital from 1987 to 1989. The hospital records were screened to include only premature babies of 37 weeks or less gestational age. Additional criteria included the survival of the infant and maternal age between 18 and 35 years (M = 25.1).

Sixty-five percent of the mothers were white, 28% were black, 5% were Hispanic, and 2% were of Middle Eastern origin. Fifty-nine percent of the mothers were married and living with their husbands, 29% were unmarried and living with their families of origin, 7% were unmarried and living with the father of the baby, and 5% were unmarried and living alone. Forty-three percent of the births required Caesarean surgery. In cases of multiple births, the record of the sibling with the most severe Postnatal Complications Rating was the only one included in data analyses.

Materials and Procedure

The six elements in the PSC were as stated above.

The Apgar is a composite rating of the neonate's physical condition based on five criteria: heart rate, respiration, muscle tone, reflex irritability, and skin color. Each criterion is rated on a scale of 0-2 with an optimum composite score of 10. The Apgar has good interobserver agreement, and validity studies have shown that the Apgar correlates negatively both with infant mortality rates and with various forms of fetal distress (Apgar, Holaday, James, Weisbrot, & Berrien, 1958; Quilligan, 1985).

The Postnatal Complications Rating (presented in Table 1) is an 8-unit scale quantifying the severity of postnatal complications. The scale was constructed by listing the more common complications from a high-risk birth. This list was then scaled in pilot research, using a group of neonatal physicians and nurses who were instructed to rank the complications in terms of their stressfulness upon parents. The score recorded on the Postnatal Complications Rating was the most severe complication.

After examining each hospital record, the author also made a rating of neonatal risk, using the Blumberg (1980) scale.

RESULTS

The average gestational age of these babies was 32.2 weeks (SD = 2.7), and the average birthweight was 1,755.3 g (SD = 606.0). Mean Apgar scores were 5.8 (SD = 2.3) and 7.5 (SD = 1.6) for 1 and 5 min, respectively. The babies were hospitalized for an average of 26.0 days (SD = 24.8). The average Postnatal Complications Rating was 2.7 (SD = 1.8) and the average rating on the Blumberg (1980) neonatal risk scale was 4.0 (SD = 0.8), high risk.

The intercorrelation matrix among all measures in the PSC and the Blumberg (1980) scale is presented in Table 2. This table shows that there were significant correlations among all these measures.

The measures in the PSC were subjected to a principal components factor analysis. There were two principal factors with eigenvalues greater than 1.0, accounting for 74.7% of the original variance. These factors were rotated to an orthogonal simple structure, using the varimax procedure. Results of this factor analysis appear in Table 3. Factor 1 (accounting for 51.0% of the total variance) was represented by the following components (with factor loadings > .45): gestational age, birthweight, days hospitalized, and the Postnatal Complications Rating. Factor 1 was interpreted as reflecting the degree of the baby's prematurity. Factor 2 (accounting for 23.7% of the variance) was interpreted as a dimension reflecting the Apgar ratings, which both had very large loadings. A separate factor analysis involving oblique rotations by the direct oblimin procedure produced a very similar factor structure. The correlation between the two oblique factors was low (r = .32).

A multiple regression was performed to determine the correlation between the components of the PSC as predictors and the Blumberg (1980) neonatal risk scale as the criterion. The six components of the PSC were significantly related to the Blumberg [multiple R = .76, $F(6,182)$ = 42.7, p < .01], accounting for 58.5% of the variance.

Table 2
Intercorrelations Among the Measures

	Measures					
	Birthweight	Apgar 1 min	Apgar 5 min	Hospital Stay	Postnatal Complications	Blumberg Scale
Gestational age	.76‡	.22†	.32‡	−.70‡	−.40‡	−.61‡
Birthweight		.14*	.21†	−.59‡	−.21†	−.53‡
Apgar, 1 min			.81‡	−.28‡	−.24‡	−.24‡
Apgar, 5 min				−.38‡	−.30‡	−.28‡
Hospital stay					.50‡	.51‡
Postnatal complications						.63‡

*p < .05. †p < .01. ‡p < .001.

Table 3
Factor Loadings, Varimax Rotation

	Factors	
Components	1 Degree of Prematurity	2 Apgar Ratings
Gestational age	.91	.13
Birthweight	.86	−.01
Days hospitalized	−.83	−.25
Complications rating	−.51	−.33
Apgar, 1 min	.08	.94
Apgar, 5 min	.20	.92

A step-wise forward regression procedure was also performed, entering predictors in order of their largest correlation (partial correlation for all predictors after the first one) with the Blumberg (1980) scale. This analysis indicated that the first predictor, the Postnatal Complications Rating, accounted for 39.8% of the variance [$F(1,187) = 123.8, p < .01$]. The next two predictors, birthweight [$F(1,186) = 69.8, p < .01$] and gestational age [$F(1,185) = 6.7, p < .05$], also accounted for significant increments in the variance (16.4% and 1.5%, respectively). The remaining components of the PSC did not significantly increase the predictability of the Blumberg scale.

DISCUSSION

The results indicate that the six components of the PSC can be adequately represented by two factors, and that the PSC can be used as a valid indicant of perinatal stress.

The identification of two factors in the PSC is interesting in light of recent research regarding Apgar scores and other measures of the physical status of the neonate. The factor represented by the Apgar scores was only weakly related to the major factor representing the severity of prematurity. The magnitude of this relationship supports other research concluding that Apgar scores may have less utility in describing the medical condition of the infant (and predicting medical outcomes) than was once thought (Behnke et al., 1989; Silverman, Suidan, Wasserman, Antoine, & Young, 1985).

The strong relationship of the PSC to the Blumberg (1980) scale is promising evidence of the validity of the PSC. It is quite likely that the PSC can be used to quantify perinatal stress. Research using different samples and validity criteria is indicated. The present results also suggest that perinatal stress may be adequately estimated using only some of the components of the PSC. The Postnatal Complications Rating, birthweight, and gestational age were almost equivalent to all six components of the PSC in predicting Blumberg scores.

The sample of premature babies used in this study limits the generalizability of the results. The factor structure of the PSC may be quite different in a sample that included healthy, full-term and premature babies. Although I expect that the PSC would continue to have validity in a sample that included the full range of stressors from childbirth, such speculations await support from cross-validation studies.

REFERENCES

APGAR, V. A. (1953). A proposal for a new method of evaluation of the new-born. *Anesthesia & Analgesia Current Research*, **32**, 260-267.

APGAR, V. A., HOLADAY, D. A., JAMES, L. S., WEISBROT, I. M., & BERRIEN, C. (1958). Evaluation of the newborn infant—Second report. *Journal of the American Medical Association*, **168**, 1985-1988.

BABSON, S. G., BENSON, R. C., PERNOLL, M. L., & BENDA, G. I. (1975). *Management of the high-risk pregnancy and intensive care of the neonate*. St. Louis, MO: Mosby.

BEHNKE, M., CARTER, R. L., HARDT, N. S., EYLER, F. D., CRUZ, A. C., & RESNICK, M. B. (1987). The relationship of Apgar scores, gestational age, and birthweight to survival of low-birthweight infants. *American Journal of Perinatology*, **4**, 121-124.

BEHNKE, M., EYLER, F. D., CARTER, R. L., HARDT, N. S., CRUZ, A. C., & RESNICK, M. B. (1989). Predictive value of Apgar scores for developmental outcomes in premature infants. *American Journal of Perinatology*, **6**, 18-21.

BLUMBERG, N. L. (1980). Effects of neonatal risk, maternal attitude, and cognitive style on early postpartum adjustment. *Journal of Abnormal Psychology*, **89**, 139-150.

CATLIN, E. A., CARPENTER, M. W., BRANN, B. S., MAYFIELD, S. R., SHAUL, P. W., GOLDSTEIN, M., & OH, W. (1986). The Apgar score revisited: Influence of gestational age. *Journal of Pediatrics*, **109**, 865-868.

HARRISON, H., & KOSITSKY, A. (1983). *The premature baby book*. New York: St. Martins.

HOLMES. T. H., & RAHE, R. H. (1967). The social readjustment rating scale. *Journal of Psychosomatic Research*, **11**, 213-218.

HYNAN, M. T. (1987). *The pain of premature parents: A psychological guide for coping*. Lanham, MD: University Press of America.

MYERS, S. A., PATON, J. B., & FISHER, D. E. (1987). The effect of initial Apgar score on the birthweight-specific survival of the very low-birthweight infant. *American Journal of Perinatology*, **4**, 288-292.

NANCE, S. (1982). *Premature babies*. New York: Arbor House.

QUILLIGAN, E. J. (1985). Identification of fetal distress. In J. T. Queenan (Ed.), *Management of high-risk pregnancy* (pp. 135-142). Oradell, NJ: Medical Economics.

SILVERMAN, F., SUIDAN, J., WASSERMAN, J., ANTOINE, C., & YOUNG, B. K. (1985). The Apgar score: Is it enough? *Obstetrics & Gynecology*, **66**, 331-336.

TEJANI, N., & VERMA, U. L. (1988). Neonatal depression and birth asphyxia in the low birthweight neonate. *American Journal of Perinatology*, **5**, 85-88.

(Manuscript received May 8, 1990.)