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Brazelton Neonatal Behavioral Assessment Scale: A psychometric study in a Portuguese sample

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ABSTRACT

Background: The Neonatal Behavioral Assessment Scale (NBAS, Brazelton & Nugent, 1995) is an instrument conceived to observe the neonatal neurobehavior. Data analysis is usually performed by organizing items into groups. The most widely used data reduction for the NBAS was developed by Lester, Als, and Brazelton (1982).
Objective: Examine the psychometric properties of the NBAS items in a sample of 213 Portuguese infants.
Method: The NBAS was performed in the first week of infant life (3 days ± 2) and in the seventh week of life (52 days ± 5).
Results: Principal component analyses yielded a solution of four components explaining 55.13% of total variance. Construct validity was supported by better neurobehavioral performance of 7-week-old infants compared with 1-week-old infants.
Conclusion: Changes in the NBAS structure for the Portuguese sample are suggested compared to Lester factors in order to reach better internal consistency of the scale.

1. Introduction

The Neonatal Behavioral Assessment Scale (NBAS) was conceived with the purpose of assessing the contribution of the neonate to the parent-infant system (Brazelton & Nugent, 1995), assuming that the newborn is both competent and organized (Brazelton, 1973). The main aim is to gather a comprehensive profile of neonatal functioning by describing the full range of neonatal behavior, including competencies and strengths, as well as difficulties or deviation. This instrument has proved to be of great clinical interest because it detects infants at risk for later developmental problems. Additionally, it is also used in clinical practice as an intervention instrument for improving mother–infant bonding in risk samples (Brazelton & Nugent, 1995). The study of this instrument in a sample of Portuguese infants is relevant in order to document cultural variation in neonatal behavior. The NBAS is composed of 28 behavioral items scored on a 9 point-scale, 14 reflex items scored on a 4 point-scale, and 7 supplementary items scored on a 9 point-scale. Data analyses can be difficult because of the high number of correlated behavioral items, so the items need to be organized in groups in order to reduce the probability of chance findings from multiple analyses. This can be done through the construction of a priori factors or factor analytical studies. One of the first attempts to reduce the NBAS behavioral items using factor analysis was developed by Osofsky and O'Connell (1977) in a sample of 328 infants. They found a six factor solution: (1) responsivity, (2) reactivity, (3) habituation, (4) state control and the fifth and sixth factors were named motor maturity. Als (1978) conceived a procedure to reduce

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the NBAS behavioral item scores to four dimensions based on postulated neurophysiological and psychological processes in the neonate: (1) interactive processes; (2) motoric processes; (3) organization processes: state control; (4) organizational processes: physiological response to stress. Kaye (1978) reduced the behavioral item scores to a few dimensions using and comparing four different approaches: (1) factor analysis, (2) canonical correlation, (3) lumping and smoothing, and (4) multiple regression. Strauss and Rourke (1978) performed a factorial analysis and came up with an eight factor solution for the behavioral items. Sostek, Davitt, Renzi, Born, and Kiely (1982) performed a factor study with pre-term infants that revealed a four factor structure: (1) alertness; (2) quieting; (3) habituation; (4) irritability and (5) motor functioning. The aforementioned studies yielded quite different results which might be due to different statistical procedures and sample characteristics.

The most widely used data reduction system for the NBAS items was developed by Lester, Als, and Brazelton (1982) that conceived a seven factor scoring based on both previous factorial analysis studies and their own statistics. The factors are: (1) habituation, (2) orientation, (3) motor, (4) range of state, (5) regulation of state, (6) autonomic stability and (7) reflexes. The habituation factor refers to the ability to respond to and inhibit discrete stimuli while asleep. The orientation factor includes the ability to attend to visual and auditory stimuli and the quality of overall alertness. The motor factor measures motor performance and the quality of movement and tone. The range of state is a measure of infant arousal and state lability. The regulation of state reports the infant's ability to regulate his/her state in the face of increasing levels of stimulation. The autonomic stability records signs of stress related to homeostatic adjustments of the central nervous system, whereas the reflexes are a record of the number of abnormal reflexes (Brazelton & Nugent, 1995).

Several studies have been conducted using NBAS Lester factors: studies of neuropsychological development (e.g. Field, Diego, Hernandez-Reif, Schanberg, & Kuhn, 2002), risk factors (e.g. Ohgi et al., 2003), effects of maternal substance use (Myers et al., 2003), inter-cultural studies (Loo, Ohgi, Zhu, Howard, & Chen, 2005), gender differences (Boatella-Costa, Moragas, Mussons, Deu, & Zurita, 2007) and intervention studies (Ohgi, Fukuda, Akiyama, & Gima, 2004). Considering the importance of assessing the psychometric properties of these factors, two lines of studies have emerged using: (1) confirmatory factorial analyses and (2) exploratory factorial analyses with comparison of the psychometric properties of the derived factor with the psychometric properties of the Lester et al. (1982) factors. To date, only two confirmatory factor analyses were reported to evaluate the psychometric properties of the Lester factors, one with premature infants and the other in a normative sample. Azuma, Malee, Kavanagh, and Deddish (1991) performed confirmatory factor analyses to analyze the psychometric properties of Lester's factors and compare them to three other data reduction models in a sample of 166 pre-term infants. None of the four models could be confirmed, the maximum likelihood factor analysis failed to confirm Lester's factors system or any of the three alternative models. The authors conclude that the lack of empirical support for the Lester model could be due to the specificities of the premature sample behavior. McCollam, Embretson, Mitchell, and Horowitz (1997) assessed the fit of the NBAS data in a sample of 160 healthy infants to variation of the Lester factor model. Four different models of confirmatory factor analysis were used and compared indicating that the general configuration of the Lester factors is a good baseline for reducing the NBAS items, although some modifications are suggested.

Two exploratory factor analyses have been reported to reduce the NBAS items with posterior comparison of the derived factors psychometric properties with the psychometric properties of Lester's factors. Jacobson, Fein, Jacobson, and Schwartz (1984) examined the properties of the Lester's behavioral factors in a sample of 160 neonates and compared them with a revised set of factors. They found that the revised factors exhibited greater internal consistency, stronger test–retest reliability and orthogonality compared with the Lester factors. More recently, Moragas, Deu, Mussons, Boatella Costa, and Zurita (2007), in a psychometric evaluation of the scale with a sample of 220 infants, used exploratory factor analysis and obtained five factors identical to the Lester factors. The reliability analysis revealed moderate to high scores.

The aim of this study is to reduce the NBAS behavioral items into factors using principal component analyses. It is also our aim to compare the reliability of the extracted factors in our sample of 213 Portuguese infants with the reliability of the Lester factors.

2. Method

2.1. Participants

The sample was composed of 213 Portuguese infants (54.7% males) born of vaginal delivery (44.4%) and cesarian section (55.6%). Most newborns were full-term (94.1%) and had no need for reanimation at birth (92.9%). The apgar score in the 1st and 5th minute was equal or above 7 in most cases (90% and 97.7%). The weight ranged from 1830 to 4430 g ($M = 3132.7$ g, SD = 480.8) and was equal or above 2500 g in almost all sample (93.4%). The height ranged from 42 to 54 cm ($M = 48.4$ cm, SD = 2.3) and the cephalic perimeter ranged from 30 to 45.5 cm ($M = 35.1$ cm, SD = 6.1).

2.2. Procedure

The parents of the infants were contacted during pregnancy in three public health care institutions from Porto district (Portugal). Informed consent was given prior to birth. Infants neurobehavioral functioning was evaluated using the Neonatal Behavioral Assessment Scale (NBAS, Brazelton & Nugent, 1995). Half of the sample was examined in the first week of life (3 days ± 2), while the other half was examined in the seventh week of life (52 days ± 5). This examination was conducted