

Maternal Self-Efficacy Reduces the Impact of Prenatal Stress on Infant's Crying Behavior

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Objective To determine whether prenatal stress is associated with behavioral and emotional regulation problems (crying/fussing) in infants, after controlling for confounding factors. Furthermore, the study investigated the stress-buffering effect of maternal self-efficacy.

Study design Data were collected in 120 pregnant women (29 ± 3.2 weeks gestation) and their infants at 6 weeks of age. Expecting mothers completed a structured interview and self-report questionnaires on prenatal stress and self-efficacy. Crying/fussing data were obtained with a validated parental diary.

Results After controlling for confounding variables, multiple regression analyses show that prenatal stress and self-efficacy accounted for 20% of the variance of infant's fussing and crying behavior. Results suggest a mediating role of self-efficacy. Babies of mothers reporting high levels of prenatal stress cried less when their mother had high levels of self-efficacy compared with mothers with low self-efficacy. In addition, mothers of infants with excessive crying reported more symptoms of stress, depression, and anxiety in pregnancy.

Conclusion To foster the development of well-adapted parent-infant relationships and potentially to reduce infant crying in the early postpartum phase, health care professionals need special education about the effects of prenatal stress and interventions that promote self-efficacy. (*J Pediatr* 2012;161:104-9).

Unexplained crying in early infancy is a major stress and common to many parents. In Western Europe, estimates of infants exhibiting excessive crying range from 5% to 29%, depending on the study population.¹ Infant crying also has been linked to prenatal, perinatal, and/or postnatal stress and complications during childbirth.²⁻⁵ Numerous animal studies suggest that repeated stress during pregnancy may produce long-term biologic and behavioral disorders in the offspring. For example, prenatal stress has been found to provoke structural changes in the hippocampus of juvenile rhesus monkeys.⁶ Besides the hypothalamic-pituitary-adrenal-axis, other neurotransmitter systems may be modified in offspring of stress-exposed rat mothers: norepinephrine,⁷ dopamine,⁸ acetylcholine,⁹ and serotonin.¹⁰ These neuro-endocrine variations may result in increased stress vulnerability and enhanced emotional reactivity. In contrast to the well-controlled animal studies, prospective human studies are sparse.¹¹ Prenatal stress predicts restless/disruptive temperament, more behavioral problems, and more externalizing behavioral problems in 2-year-old children,¹² and perceived stress was associated with difficult behavior in 3-month-old infants.¹³ There are a few prospective studies on infant crying focusing on psychosocial risk factors in the expecting mother.^{4,5,14} However, studies considering maternal resource factors such as self-efficacy are sparse. Self-efficacy is defined as a person's beliefs about his/her own capabilities to perform in a certain manner to attain personal goals¹⁵; such expectation influences how one feels, thinks, or behaves. Thus, sufficient self-efficacy might play an important role in protecting mothers against heightened stress during the transition to motherhood.

We hypothesized that prenatal stress could impact behavioral and emotional regulation problems (crying/fussing) in infants. We also investigated whether maternal personality resources (self-efficacy) could buffer the effect of stress during pregnancy with positive effects on behavioral and emotional regulation in 6-week-old babies. In a final step, we investigated whether mothers of infants who meet the modified Wessel criteria¹⁶ showed more symptoms of anxiety and depression in pregnancy to help explain findings.

Methods

The study protocol was approved by the ethics committee of Basel and is consistent with the revised Helsinki Declaration of 1975. Expectant mothers were recruited from birth preparation classes ($n = 163$). After giving informed consent, a structured interview on sociodemographic information was conducted by trained research assistants. Questionnaires on stress and self-efficacy were provided to the participants in their third trimester (29 ± 3.2 weeks gestation) in a single session. Six weeks after giving birth, mothers were asked to complete a 3-day behavior diary to obtain amounts of

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DASS-21 Depression Anxiety Stress Scales
FKK Competence and Control Questionnaire

infant fussing and crying. Subjects were included when they could communicate in German, were 18 to 40 years of age, and had filled out the questionnaires and the diaries (3 days) completely. Women were excluded when the birth weight of their child was ≤ 2500 g, when the gestational age of their child was ≤ 37 weeks, or both. Consequently, data from 120 women were available for this study. Comparisons between the final sample and the 43 excluded women indicated no significant differences in the two groups on demographic variables or prenatal variables.

A structured interview inquired about sociodemographic and medical circumstances. Women were asked to recall the amount and frequency of cigarettes smoked per day and alcoholic drinks consumed per week. The use of tobacco and alcohol were coded dichotomously (smoking: none versus one or more cigarettes per day; drinking: none versus one or more than one alcoholic beverage per week). Prenatal, perinatal, and postnatal complications and birth characteristics were extracted from medical records.

Prenatal Stress

To assess frequency and severity of maternal stress during pregnancy, we used the short version of the Depression, Anxiety and Stress Scale (DASS-21; German version: 17). The DASS-21 measures the total amount of prenatal stress along the axes of depression, anxiety (symptoms of psychological arousal), and stress (the more cognitive, subjective symptoms of anxiety). The 21-item version was developed by selecting the highest loading items from each scale of the original 42-item version of the DASS, while also aiming to retain coverage of the full symptom content of each of the 3 affective states.¹⁸ The questionnaire holds good convergent and discriminant validity and high internal consistency ($\alpha = .77 - \alpha = .88$) in clinical and in non-clinical samples.¹⁷ Examples of the 21 items are: "I found it difficult to relax" and "I felt that I was using a lot of energy." Ratings are made on a 4-point rating-scale (0 = never, 3 = very often). Scores of the DASS-21 range from 0 to 63, with higher scores indicating more symptoms of prenatal stress.

Maternal Self-Efficacy

Self-efficacy was assessed with the subscale "self-efficacy" of the Competence and Control Questionnaire (FKK).¹⁹ The 16-item subscale "self-efficacy" ranked on a 6-point scale (1 = fully disagree, 6 = fully agree), with scores ranging from 16 to 96 (higher values indicating a greater expressiveness of self-efficacy). The questionnaire exhibits good reliability and good construct, internal, and convergent validity.¹⁹

Infant Fussing and Crying

A German adaptation of Barr's²⁰ standardized 24-hour behavior diary was used to obtain amounts of infant fussing, crying, and unsoothable crying (cry bouts that are difficult or impossible to soothe) at 6 weeks of age. Infant's behaviors were defined on the diary as exclusive and comprehensive. The recorded intervals had an accuracy of 15 minutes and

represented 4 6-hour periods: morning (6 am to noon), afternoon (noon to 6 pm), evening (6 pm to midnight), and night (midnight to 6 am). Barr's²⁰ behavior diary is widely used in the international literature and has been validated against audio-recordings with satisfactory results.^{21,22} Because fussing, crying, and unsoothable crying represent the same behavioral problem on a continuum, we calculated a crying and fussing sum score, adding the total amount of fussing, crying, and unsoothable crying.

To prove the clinical implications of our findings, we categorized fussing and crying behavior according to Wessel.¹⁶ Because infant's behavior has been observed in a period of 3 days, infants were classified as crying excessively when they cried, fussed, or both for longer than 3 hours/day at the 3 assessment days.

Data Analysis

Data were analyzed with SPSS statistical software for Windows, release 18 (SPSS, Chicago, Illinois). Analyses were performed with two-sided tests, with a P value $< .05$ considered to be significant.

In exploratory data analyses, no problems were noted for the assumptions of normality and homogeneity of variance. Different statistical models were used to assess our research questions. The first approach was to determine the impact of prenatal stress on infant fussing and crying behavior. For this purpose, we performed an ordinary least square regression analysis. The predictor prenatal stress, the moderator self-efficacy, and an interaction term were entered in the model for prediction of infant's behavior (sum score of fussing, crying, unsoothable crying) in a 24-hour period. Following Aiken and West²³ (see also Baron and Kenny²⁴), the predictor and moderator variables were mean-centered to avoid multicollinearity between the interaction term and its constituents. The centered predictor and moderator variables were then multiplied to form the interaction term. Conducting hierarchical regression analyses, the simple effects of prenatal stress and self-efficacy and the interaction term were entered listwise. To interpret the size and direction of the interaction-effect, Aiken and West²³ recommended plotting regression slopes by identifying predicted points in Y at levels of X and Z . Therefore, we computed the predicted values for infant's fussing and crying in points 1 SD greater than and less than the mean of prenatal stress at points 1 SD greater than and less than the mean of self-efficacy. Lines connecting these points indicate the conditional slopes relating fussing and crying and prenatal stress conditional on self-efficacy.

To test the hypothesis that mothers of infants who do or do not meet the modified Wessel criteria showed more symptoms of stress, anxiety, and depression in pregnancy, the fussing and crying classification (excessive crying versus normal) was used as a between-group factor predicting stress, anxiety, and depressive symptoms (subscales of the DASS-21) in an independent samples t test.

To give further information on the clinical relevance of the found relation between prenatal stress and infant crying, effect sizes (Cohen d) are presented.

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