



## Prenatal stress perception and coping strategies: Insights from a longitudinal prospective pregnancy cohort



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### ABSTRACT

**Objective:** Prenatal distress has been linked to pregnancy complications and poor offspring's health, despite the fact that longitudinal assessments of various stress dimensions are still lacking. Hence, we aimed to assess perceived stress over the course of pregnancy. Moreover, we examined whether social support and coping styles are linked to prenatal stress trajectories.

**Methods:** Data from 543 women participating in the PRINCE (Prenatal Identification of Children Health) study, a prospective population-based cohort study, was used for the present analyses. Once per trimester the women completed questionnaires regarding different psychometric measures, including the Perceived Stress Scale (PSS). Linear mixed regression models were used to examine perceived stress development longitudinally and to relate social support and coping styles to stress trajectories during pregnancy.

**Results:** A significant decrease of perceived stress was observed over the course of pregnancy. Stratifying the study sample according to parity, women delivering their first child had continuously lower perceived stress scores compared to women having already one or more children, and a significant decrease during pregnancy was exclusively observed in primiparous women. Both, positive coping strategies and higher perceived and received social support were independently associated with lower perceived stress, while evasive coping strategies were associated with higher levels of perceived stress.

**Conclusion:** Our study reveals stress perception trajectories during pregnancies in primi- and multiparous women. Our findings underscore the need for intervention strategies aiming to improve social support and positive coping strategies especially in multiparous women in order to reduce the risks for adverse pregnancy outcomes.

### 1. Introduction

According to the developmental origins of health and disease concept, intrauterine exposures have long-term programming effects on the offspring's health. Among those exposures, prenatal distress has received rising awareness [1,2]. Epidemiologic studies have linked high levels of maternal stress perceived during pregnancy to an increased risk of preterm birth and low birth weight [3–6] as well as several disease conditions in the offspring including an increased risk for chronic immune diseases [7,8], impaired metabolic function and obesity [9] and developmental problems [2,10,11]. Also, prenatal stress is

associated with multiple adverse pregnancy outcomes, including the poor maintenance of optimal health behaviors during pregnancy [12] and the inadequate use of prenatal care [13]. Moreover, women experiencing high levels of stress during pregnancy have a higher risk to develop hypertensive pregnancy disorders [14] or postpartum depression [15,16]. Of note, these outcomes are not restricted to mothers with diagnosed mental illness, but can affect a large number of ostensibly asymptomatic women at a sub-clinical level e.g. via subjectively perceived daily hassles [6,10,17].

While prenatal stress has been examined in several studies, it has been defined differently among those studies, often using proxies such

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as severe life events. Moreover, different single time points during pregnancy have been assessed, hampering the direct comparisons of the obtained results between studies [18]. From a methodological point of view, stress is a multidimensional concept, resulting from a perceived imbalance between environmental demands in form of acute and chronic stressors and individual resources to cope such as socio-economic conditions, personality traits and social support [19,20]. Hence, longitudinal observations including also the beginning of pregnancy and applying different instruments simultaneously are urgently needed.

The described inconsistencies of prenatal stress assessments across studies might also be one explanation for the lack of intervention studies aiming to reduce stress perception during pregnancy, hereby modifying the risk for pregnancy complications and children's health. In this light, it is of pivotal interest to also assess the impact of (perceived) social support and individual coping styles on stress perception. While some studies already showed beneficial effects of social support and positive coping styles on perceived stress and maternal well-being [21–24], investigations of influences on longitudinal stress trajectories are still missing.

With the present study, we aimed to overcome the limitations of previous studies by examining stress perception over the course of pregnancy using the standardized Perceived Stress Scale (PSS), which has been identified as a well-established and suitable instrument to assess daily hassles in the general population, but also in the specific period of pregnancy [25]. By choosing this metric we were hence able to assess sub-clinical levels of maternal distress as opposed to more pronounced stress in our low risk population. Also, we assessed perceived stress in the light of psychometric and psychiatric co-morbidities, including depressive symptoms, neuroticism and anxiety. Lastly, our aim was to assess the relevance of coping strategies and social support in aggravating or ameliorating stress perception.

## 2. Materials and methods

### 2.1. Study design and population

The PRINCE (Prenatal Determinants of Children's Health) study is an ongoing prospective cohort study of pregnant women and their children. The study is based at the University Medical Center Hamburg-Eppendorf and was initiated in 2011. Women were recruited via resident gynecologists. Inclusion criteria were maternal age of 18 years or higher and a viable singleton pregnancy at gestational week 12–14. Women with chronic infections (HIV, hepatitis B/C), known substance abuse, multiple pregnancies or pregnancies conceived after assisted reproductive technologies (ART) were excluded. Pregnant women were invited to three antenatal visits, scheduled once per trimester (gestational week 12 to 14, 24 to 26, and 34 to 36). All study subjects signed informed consent forms and the study protocol was approved by the ethics committee of the Hamburg Chamber of Physicians.

Because of the open cohort design, complete data was not present for all participants. At the time of this analysis, data on psychometric characteristics were available for 615 participants. To be included in the present analyses, at least two assessments of the PSS, including baseline values, had to be available, which was the case for 550 women. A further 7 women had to be excluded because of missing data on maternal education, which we considered a relevant covariable, leaving 543 women for final analyses on the PSS. Regarding data on the associations between the PSS and coping strategies as well as between the PSS and social support, the final dataset included 505 and 524 participants, respectively (Fig. 1).

### 2.2. Assessment of maternal psychometric characteristics

At each study visit, different aspects of psychometric characteristics were assessed using standardized questionnaires. Stress perception was measured using the German version of the 14-item PSS [26]. It contains

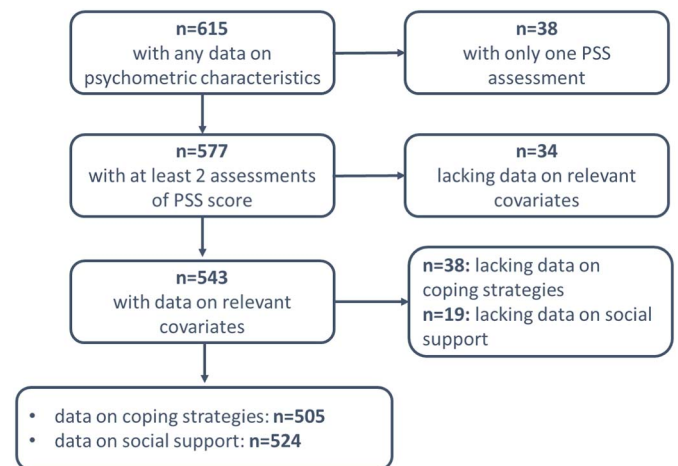


Fig. 1. Flow chart of the study sample.

14 questions to measure the degree to which situations in one's life in the past month are appraised as unpredictable, uncontrollable and overwhelming. In order to compare our cohort data to the newly published norm values for the German population, the PSS-10 was calculated [27]. To assess mental health (physical and psychological aspects of quality of life), the multipurpose SF12 survey was applied – a short version of the widely used SF-36. It contains 12 questions on the impact of physical health problems, physiological and emotional issues on different daily life activities, resulting in two global health measures, the physical and mental health composite scores (PCS and MCS) [28,29]. Symptoms of depression during pregnancy were evaluated using the validated German version of the 'Edinburgh Postnatal Depression Scale' consisting of 10 items (EPDS) [30]. The Spielberg State and Trait Anxiety Inventory (STAI) was applied to assess both state and trait anxiety. It contains two 20-item scales, measuring current and general feelings of anxiety [31].

While the former scales were applied at each trimester to study longitudinal changes, others were only applied once: To include all aspects of the stress model, neuroticism was assessed as a personality trait by applying the neuroticism subscale of the NEO-Five-factor-inventory in the 3rd trimester [32]. Furthermore, social support and coping strategies were assessed. Here, the Brief COPE covering 14 different coping strategies was used in the 2nd trimester. These were further combined to yield four subscales covering focus on positive, active, support seeking, and evasive coping strategies (Carver, 1997). Social support was evaluated in the 1st trimester using two subscales of the Berlin Social Support Scales (BSSS): Perceived available social support and actually received social support [33]. Finally, life changing events during pregnancy were assessed in the third trimester according to a modified version of the Inventory of Life-Changing events [34].

Sum scores were computed according to the respective manuals and subsequently used for analyses.

### 2.3. Assessment of relevant covariates

On the initial visit, participants were asked to complete a questionnaire inquiring their sociodemographic background, general health and chronic diseases (such as hypertension, hypo-/hyperthyreosis, asthma or kidney disease). Furthermore, during each study visit, maternal anthropometry was assessed. The maternal height and weight - light clothing, but no shoes allowed - were measured to the nearest 0.5 cm or 0.1 kg respectively, and taken with the same instruments (scale and yardstick) at each visit that were calibrated in regular intervals for the whole population. Furthermore, the occurrence of pregnancy complications (pregnancy-related hypertension, pre-eclampsia, HELLP-syndrome, gestational diabetes, preterm labor,

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