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# Maternal positive affect over the course of pregnancy is associated with the length of gestation and reduced risk of preterm delivery

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ABSTRACT

*Objective:* The association between maternal psychological state during pregnancy and birth outcomes is well established. The focus of previous studies has been on the potentially detrimental consequences of maternal stress on pregnancy and birth outcomes, particularly shortened gestation and increased risk of preterm birth. Despite a growing literature linking positive affect with favorable health outcomes this construct has received little attention in the context of pregnancy. Therefore, in the current study, we tested the hypothesis that maternal positive affect during pregnancy is associated with beneficial consequences in terms of increased length of gestation and reduced risk of preterm birth above that of the absence of stress.
*Methods:* In 169 pregnant women maternal positive affect and perceived stress were serially assessed at 15.2± 0.9 weeks (T1; mean ± SD), 19.7 ± 0.9 weeks (T2) and 30.7 ± 0.7 weeks (T3) gestation. Pregnancy and birth outcomes were abstracted from the medical record.
*Results:* Higher maternal positive affect and a steeper increase in maternal positive affect over pregnancy were positively associated with length of gestation ($p < .05$) and reduced risk of preterm delivery ($p < .01$), whereas maternal perceived stress was not significantly associated with shorter length of gestation ($p > .10$).
*Conclusions:* These findings suggest that maternal positive affect may be beneficial for outcomes related to the length gestation, and that this effect cannot be accounted for by the lower stress levels associated with higher positive affect. Interventions to increase maternal positive affect may be beneficial for fetal development.


## Introduction

The belief that a mother's emotional state during pregnancy may influence the development of her fetus has persisted across time and culture. This has stimulated research on maternal psychological state during pregnancy and various pregnancy and birth outcomes. One of the most consistent findings in this literature is the observed association between higher levels of maternal psychological stress during pregnancy and shortened length of gestation and increased risk of preterm birth [1–14]. Although a growing body of literature has examined and demonstrated that positive affect is independently associated with more favorable health outcomes [15] this question has received relatively little attention in the context of pregnancy and birth outcomes.

Several studies, for example, have shown associations between positive affect and improved cardiovascular function, with positive affect being related to accelerated recovery from cardiovascular reactivity [15–17], decreased blood pressure in ambulatory assessments [18,19], and elevated parasympathetic activation [20]. Positive affect also has been linked to lower cortisol concentrations over the course of the day [21,22] and to higher antibody responses to hepatitis B vaccination [23].

One of the few studies on positive maternal affect during pregnancy found that women with stronger personal resources (mastery, self-esteem, optimism) had higher birth weight babies, even after controlling for the effects of gestational age at birth, psychosocial stress, and other variables [4]. Another study reported that maternal dispositional optimism was related to higher infant birth weight [24]. A more recent study described associations of positive state of mind and emotional stability in the immediate post-partum period with having experienced a normal delivery, however, positive affect was assessed in the immediate post-partum period and the positive delivery experience may have caused the higher positive affect in

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these women and not vice versa [25]. Thus, there is some preliminary evidence suggesting that maternal positive affect may be beneficial in the context of pregnancy and birth outcomes.

The objective of the present study was to assess the relationship between positive affect and length of gestation. We hypothesized that high maternal positive affect would be associated with longer length of gestation, and that this association would be significant even after controlling for the effects of maternal stress levels.

## Method

### Participants

Data for the present analysis were collected in the context of a longitudinal pregnancy and birth outcomes study conducted by the University of California, Irvine Development, Health and Disease Research Program. All study procedures were approved by the institutional review board and all participants provided written, informed consent.

The study population comprised a population-based cohort of 169 pregnant women assessed serially over the course of gestation (at 15.2 ± 0.9 weeks (T1; mean ± SD), 19.7 ± 0.9 weeks (T2) and 30.7 ± 0.7 weeks (T3)) and followed through birth. Women who participated in at least two study visits during pregnancy were included in the current analyses, which allowed assessing rate of change in positive affect over the course of gestation. Subjects were English-speaking adult women with singleton, intrauterine pregnancies. Exclusion criteria included tobacco, alcohol, or other drug use in pregnancy, use of in vitro fertilization/reproductive technology, and uterine or cervical abnormalities.

Furthermore, women who had an elective cesarean section (n = 66) and women who had missing information about mode of delivery (n = 25) were excluded from the present analyses. The final sample included 169 women. Socio-demographic characteristics of the sample are displayed in Table 1.

**Table 1**
Participant characteristics of the study sample (n = 169)

| Variable | Total sample (n = 169) | Low positive affect (n = 85) | High positive affect (n = 84) |
|---|---|---|---|
| *Sociodemographic characteristics* | | | |
| Maternal age[a] | 28.6 ± 5.6 yrs | 27.2 ± 5.3 yrs | 30.0 ± 5.5 yrs[b] |
| Race/ethnicity[c] | | | |
| Non-Hispanic White | 70 (41.4%) | 35 (41.2%) | 35 (41.7%) |
| Hispanic White | 58 (34.3%) | 33 (38.8%) | 25 (29.8%) |
| Other | 41 (24.3%) | 17 (20.0%) | 24 (28.5%) |
| Annual family income[c] | | | |
| Under $20,000 | 28 (16.6%) | 17 (22.1%) | 11 (13.8%)[b] |
| Between $20,000 and $50,000 | 43 (25.5%) | 29 (37.6%) | 14 (17.5%)[b] |
| Between $50,000 and $80,000 | 35 (20.7%) | 16 (20.8%) | 19 (23.7%)[b] |
| Over $80,000 | 51 (30.2%) | 15 (19.5%) | 36 (45.0%)[b] |
| Marital status[c] | | | |
| Separated/divorced from or not living with baby's father | 15 (8.9%) | 13 (17.1%) | 2 (2.5%)[b] |
| *Pregnancy-related characteristics* | | | |
| Obstetric risk[c] | 48 (28.4%) | 27 (31.8%) | 21 (25.0%) |
| Parity[c] (≥1) | 93 (55.0%) | 46 (54.1%) | 47 (56.0%) |

*Note*. A median split was performed to create high and low positive affect groups.
[a] Values represent mean ± SD.
[b] Difference between high and low positive affect group significant at $p < .05$.
[c] Values represent frequency n (% of total sample or group).

### Study protocol

Study participants were assessed serially at least two and up to three times over the course of gestation. Gestational age was determined by best obstetric estimate with a combination of last menstrual period and early uterine size, and was confirmed by obstetric ultrasonographic biometry using standard clinical criteria [26]. Pregnancy and birth outcomes were abstracted from medical charts. Sociodemographic information (i.e., marital status, family income and maternal age at delivery) was assessed by interview.

### Measures

#### Maternal positive affect

Positive affect was assessed using a questionnaire on attitudes towards pregnancy, adapted from prior research in pregnancy [27,28]. This self-report questionnaire consists of 7 positive and 6 negative feelings towards pregnancy. Participants read statements such as "In the last week, I often felt happy about being pregnant" and responded with answers ranging from 1 (never), 2 (rarely), 3 (sometimes), 4 (often) to 5 (always). At each assessment a sum score for positive attitudes toward pregnancy, termed positive affect, was computed from the 13 items, for which purpose the negative items were reverse coded. Thus, scores could range from 13 to 65 with higher scores reflecting higher positive affect. Average scores at each of the three assessments are depicted in Table 2.

#### Maternal perceived stress

At each study visit, current levels of perceived stress were measured with the Perceived Stress Scale [29]. The PSS consists of 12 items that are designed to measure how uncontrollable, unpredictable and overloaded participants find their lives. Responses are given on a 5-point Likert scale from 0 to 4. For each participant, an average score was computed over all time points of assessment and used as a covariate in the analyses.

#### Obstetric conditions and birth outcomes

Length of gestation was abstracted from medical charts after delivery and assessed as a continuous variable by completed weeks gestation. Obstetric risk was defined as the presence of major medical complications in the index pregnancy, i.e., gestational diabetes, vaginal bleeding, placenta abruptio, pregnancy-induced hypertension, preeclampsia, or infection. Information on presence of any of these conditions was retrieved by medical interviews with the pregnant women at each of the three pregnancy visits and by medical chart abstraction. Obstetric risk was then coded as a dichotomous variable as previously described [14].

### Data analysis

Previous studies have reported that both average levels of psychological state as well as its change over the course of pregnancy can have an impact on pregnancy and birth outcomes [30,31]. Therefore, we assessed whether mean positive affect scores changed over gestation and determined the associations between level as well as rate of change of positive affect over gestation with birth outcomes.

**Table 2**
Overview of positive affect and perceived stress scores over the course of gestation

| Variable | T1 (15.2 ± 0.9[a]) | T2 (19.7 ± 0.9[a]) | T3 (30.7 ± 0.7[a]) |
|---|---|---|---|
| Positive affect (mean ± SD) | 52.4 ± 8.0 | 53.9 ± 7.6 | 54.2 ± 8.2 |
| Perceived stress (mean ± SD) | 2.2 ± 0.6 | 2.2 ± 0.7 | 2.2 ± 0.7 |

[a] Average weeks gestation at assessment ± SD.