

Running title: AFFECT IS DYNAMIC DURING PREGNANCY

Affective Experience in Ecologically Relevant Contexts is Dynamic,  
and Not Progressively Attenuated During Pregnancy

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### **Abstract**

Pregnancy is thought to diminish a woman's appraisals of and affective responses to stressors. To examine this assumption, we used an electronic diary and an ecological momentary assessment strategy to record women's (n=85) experiences of positive and negative affect five times each day over two days within each trimester of pregnancy. Women also completed the Edinburgh Postnatal Depression Scale each trimester. Multi-level modeling indicated non-linear patterns for both positive and negative affect that differed by level of depressive symptoms. The findings suggest that changes in psychological experience over the course of pregnancy are dynamic and not progressively attenuated.

### **Keywords**

Keywords: Pregnancy, positive affect, negative affect, gestational age, depressive symptoms, EPDS

## INTRODUCTION

Women's psychological distress (including depression and anxiety) during pregnancy is associated with adverse birth and developmental outcomes (Christian 2012) and long-term risk for physical and mental disease (Class et al. 2011; Glynn et al 2001). It is commonly held that women's appraisal of and affective response to stressors decrease with advancing gestation and that this decreasing response protects the fetus from the potentially adverse psychophysiological effects of distress on development (e.g., Entringer et al. 2011; Glynn et al. 2001). The data in support of this claim, however, are equivocal. Although some studies show that women appraise potential stressors as more distressing when they occur earlier compared to later in gestation (Entringer et al. 2010; Glynn et al. 2001), others report no change (Nierop et al, 2006) or even increased distress during the second half of pregnancy (Heron et al. 2004). Further, there is evidence that changes in the way women perceive and experience distress over the course of pregnancy may depend to some extent on overarching mood characteristics such as ongoing levels of depressive symptoms (Manber et al. 2008). Conclusions from previous studies are limited by the lack of prospective data, failure to assess women in all three trimesters, and by an exclusive focus on negative psychological appraisals.

The current study was designed to examine the trajectory of positive and negative affect over the course of pregnancy and to determine whether these trajectories differ as a function of depressive symptoms. Women used an electronic diary to record their current experiences of positive and negative affect five times each day over two days within each trimester of pregnancy. Ecological momentary assessment is well-suited to address the limitations of previous studies because it reduces recall bias that can influence results of retrospective self-report questionnaires, it increases the ecological validity of the data by recording observations

within ecologically relevant contexts, and it captures variability over time in dynamic processes, such as affect (Cranford et al. 2006).

## **METHODS**

### **Participants**

Eighty five women (mean age = 31.7 years, SD = 3.8) with singleton intrauterine pregnancies were enrolled prior to 14 weeks gestation. Three participants discontinued the study because of miscarriage. Seventy eight and seventy six women completed the 2<sup>nd</sup> and 3<sup>rd</sup> trimester assessment, respectively. Participants were not enrolled if they reported: a) smoking, b) consuming alcohol or illicit drugs, c) any known pregnancy or fetal complications (e.g., preeclampsia or gestational diabetes), d) illness during data collection (e.g., fever), or e) taking a steroid medication. Gestational age (GA) was determined on the basis of last menstrual period, confirmed by ultrasonography. Women were primarily White (91%), highly educated (71% had a university degree), married or living common law (98%), employed (61% worked full time at study entry) and had household incomes above \$70,000 CAD (86%).

### **Procedure**

Ecological momentary assessment (Cranford et al., 2006) with a personal digital assistant (PDA) was used to assess women's positive and negative affect at home over 2 consecutive days within each trimester on the following schedule: 30 minutes after waking, and semi-randomly around the anchor times of 1100h, 1530h, and 2000h. The semi-random signals occurred on the PDA once within 15 minutes following the anchor times to reduce the possibility of affect changes associated with anticipation of the signal. Each time the PDA rang, women reported their current experience of positive and negative affect. The PDA allowed a 20 minute post-signal time window for response, after which data were considered missing.

## Measures

### *Positive and Negative Affect*

Positive and negative affect at each sampling moment were measured using items from the Profile of Mood States (McNair & Heuchert, 2003), a multidimensional measure of mood with strong psychometric properties (e.g.,  $\alpha = .79 - .93$ ). Based on previous work by Cranford and colleagues (2006), a set of 19 items from the anger, anxiety, dejection, fatigue, and positive mood scales were selected for administration via PDA. A mean negative affect score within each trimester for each woman was derived from the set of 16 negative items administered 8 times for a total of 128 responses per trimester. Similarly, a mean positive affect score was obtained from the set of 3 positive items repeatedly administered to a total of 24 responses per trimester.

### *Depressive Symptoms*

Depressive symptoms within each trimester were assessed via the Edinburgh Postnatal Depression Scale (EPDS; Cox 1987), a 10-item instrument that is widely used to screen for perinatal depression. It has excellent reliability and validity among pregnant women. The EPDS was administered within each trimester and then aggregated to estimate average levels of depressive symptoms for each woman. High scores ( $> 12$ ) are strongly predictive of major depressive disorder (Cox 1987).

### *Statistical Procedures*

Separate multilevel models for positive and negative affect were specified at two levels to account for the nested data structure (trimester nested within persons)<sup>1</sup>. At level-1 (trimester-level), between-trimester variability in positive and negative affect for each individual were modeled as a function of GA (centered at 6 weeks) and GA squared. Our primary goal was to

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<sup>1</sup> The data could be structured in four levels (moments within days, within trimesters, within persons), however for simplicity we use a 2-level structure.

determine the trajectory of positive and negative affect over the course of pregnancy.

Accordingly, the focus of the analysis was on the slope estimates for GA and GA squared.

Depressive symptoms (grand mean centered) were included in the level-2 sub model (person-level) to determine if between-person differences in EPDS scores moderated the positive and negative affect trajectories. Results are based on estimation of fixed effects with robust standard errors.

## RESULTS

As a preliminary step, we used the deviance statistic to test whether the quadratic models fit the data better than the linear models. The difference in deviance for the positive and negative affect models were 4.25 and 8.83, respectively, which are significant ( $p < .05$ ) in a Chi Square distribution with d.f. = 1.

### Positive Affect

The linear ( $B = .0402, p < .05$ ) and quadratic ( $B = -.0012, p < .05$ ) slope parameters for positive affect indicated increasing positive affect in early gestation but decreasing positive affect in later gestation for non-depressed women (solid line Fig. 1). However, women with high levels of depressive symptoms (EPDS = 13) had decreasing levels of positive affect that remained low through the middle portion of pregnancy and increased toward the end of pregnancy (dashed line Fig. 1). The effects of EPDS for the linear and quadratic slopes were  $B = -.0156, p = .001$ , and  $B = .0004, p = .003$ , respectively.

### Negative Affect

For negative affect, the linear ( $B = -.1481, p < .001$ ) and quadratic ( $B = .0047, p < .001$ ) slope parameters indicated initial decreases in negative affect but increases in later gestation for all women regardless of depressive symptoms (Fig. 2). Depressive symptoms, however, had a

significant effect on the intercept ( $B = .2149, p = .006$ ). Women with high depressive symptoms had a negative affect trajectory that was consistently higher compared to non-depressed women.

### **Exploratory Analyses**

Additional analyses including demographic (income, education, ethnicity, and age), obstetric history (number of previous pregnancies, whether the current pregnancy was planned, and previous miscarriage), and anthropometric measurements (pre-pregnancy body mass index) as potential moderators of these trajectories did not change the results for either positive or negative affect (all  $p$ 's  $> .05$ ).

### **DISCUSSION**

The purpose of this study was to determine whether and in what manner positive and negative affect change over the course of pregnancy. The results indicated non-linear patterns for both positive and negative affect. Depressive symptoms moderated the trajectory for positive affect such that women with high and low depressive symptoms showed opposite trajectories. Whereas women with low depressive symptoms had increasing levels of positive affect in early pregnancy and decreasing levels in later pregnancy, women with high levels of depressive symptoms showed decreasing levels of positive affect in early pregnancy and an increase in later pregnancy. In contrast, the negative affect trajectory was not moderated by depressive symptoms but women with high depressive symptoms experienced elevated levels of negative affect over the course of pregnancy. For all women, levels of negative affect decreased in the first trimester and increased in the third trimester. The results confirm previous findings that psychological experience differs as a function of GA, but challenge the claim that psychological distress is progressively dampened over the course of gestation (Glynn et al., 2001).

The current findings may have relevance to the notion that dynamic changes in women's experiences of psychological distress serve to protect the mother and fetus from the psychophysiological consequences of distress. Although it is commonly held that progressive attenuation of psychological distress shields the fetus from potential exposure to the psychophysiological consequences of distress, the current findings suggest that mid-gestation may offer more protective advantage than later gestation because positive affect is at its highest and negative affect is at its lowest. To the extent that this relatively tranquil period also results in reduced physiological stress signals to the fetus, this period may indeed serve a protective function, especially for the fetal hypothalamic pituitary adrenal (HPA) axis which develops rapidly during mid-gestation (Christian 2012). It is known that biological systems are exquisitely sensitive to exposure during periods of rapid development, therefore increases in positive affect and decreases in negative affect at mid-gestation may be designed to protect the fetal HPA axis from exposure to maternal cortisol. Support for this suggestion comes from studies demonstrating that overall levels of cortisol are lowest in women who report high positive affect (Bostock et al. 2011) and highest among women reporting high negative affect (Giesbrecht et al. 2012). Fetal exposure to maternal cortisol subsequent to psychological distress is believed to have lasting effects on behavior and physiology resulting in exaggerated HPA axis reactivity (Christian 2012), which may increase the risk of physical and mental disease (Class et al. 2011; Glynn et al 2001).

The dynamic course of positive and negative affect during pregnancy suggests that depression screening should be conducted repeatedly. Furthermore, the current findings support the recommendation for clinicians to routinely ask pregnant women about their experiences of both negative and positive affect because both are important for identifying women who

experience depression (Manber et al. 2008). For example, women who report a lack of positive affect or a decrease in positive affect from first to second trimester may require more support to adjust to the challenges of pregnancy. Pregnant women tend to experience increased somatic complaints, especially in early pregnancy, but depressed women report significantly more somatic disturbance than non-depressed women (Manber et al. 2008). Among women with depressive symptoms, the lack of increase in positive affect in the second trimester suggests ongoing challenges and possibly poor resolution of their pregnancy-related somatic complaints.

Strengths of this study include repeated, naturalistic, and prospective assessment of momentary psychological experience which reduces recall bias (Cranford et al. 2006) and inclusion of women within the first trimester of pregnancy. Although we found no evidence that individual differences in demographic or obstetric history affected the pattern of results, caution should be exercised when interpreting the results given our sample consisted mainly of White women with relatively high socioeconomic status and without complicated pregnancies. In summary, the findings suggest that the changes in women's psychological experience during pregnancy are dynamic and not progressively attenuated.

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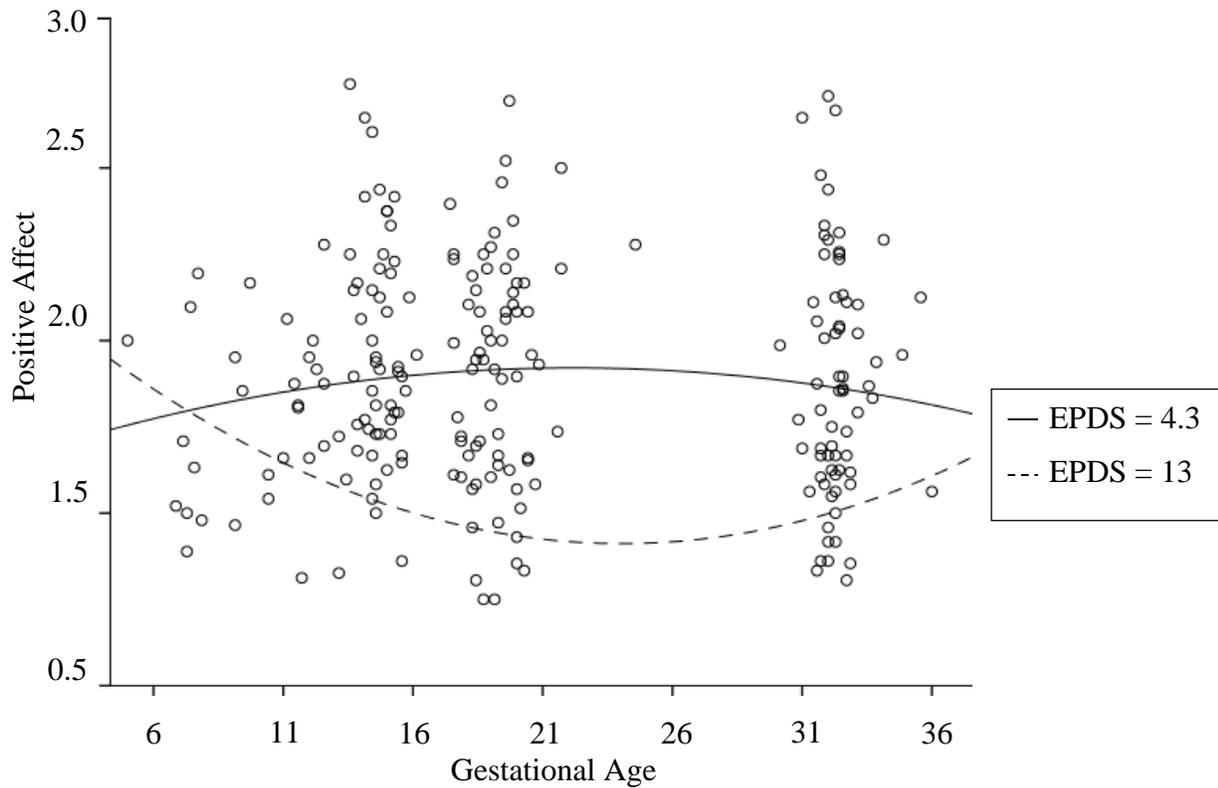
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Table 1. Descriptive statistics for study variables by trimester

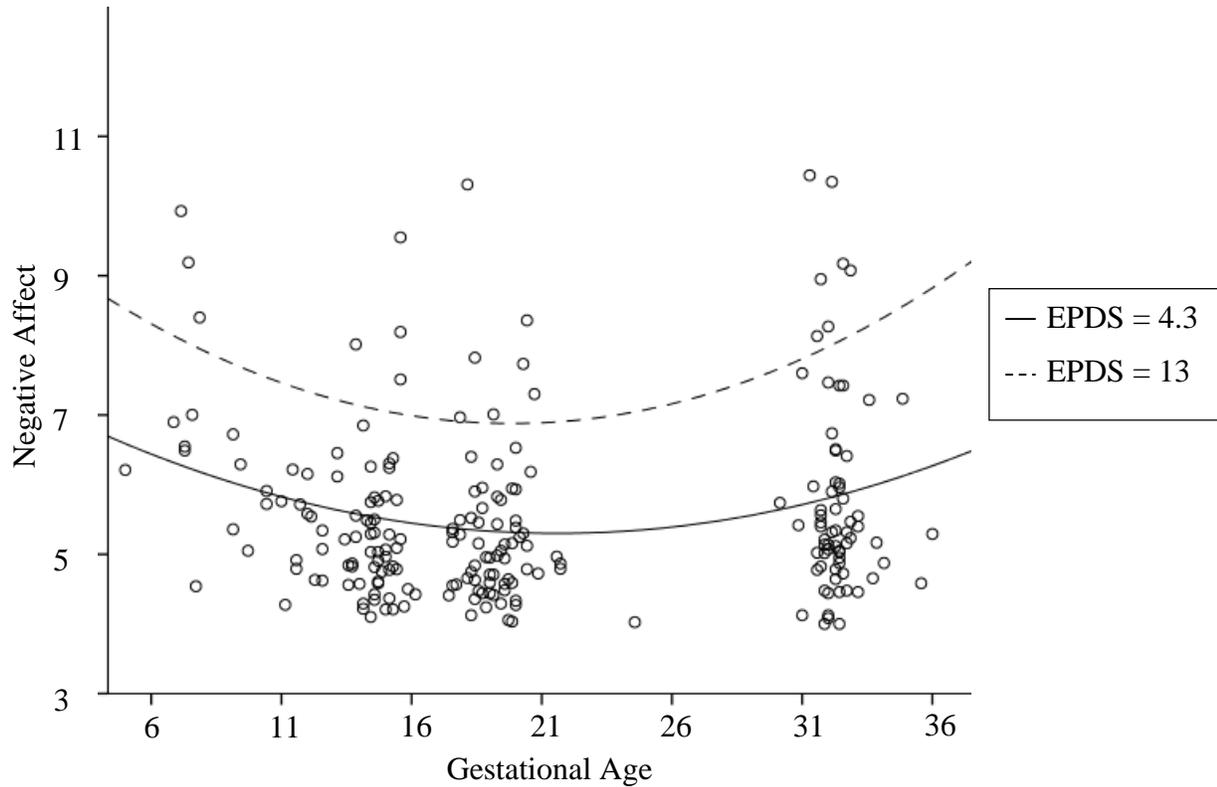
Variables	1 <sup>st</sup> Trimester			2 <sup>nd</sup> Trimester			3 <sup>rd</sup> Trimester		
	(n = 85)			(n = 78)			(n = 76)		
	Mean	S.D.	Range	Mean	S.D.	Range	Mean	S.D.	Range
Positive Affect	2.30	.63	1.13-3.99	2.32	.66	1-3.89	2.26	.66	1-3.92
Negative Affect	5.60	1.22	4.10-9.93	5.29	1.10	4.03-10.31	5.78	.68	4.00-10.44
EPDS	4.67	3.59	0-15	4.13	3.67	0-15	4.54	4.29	0-18
Gestational Age	12.9	2.7	5-15.9	19.3	1.2	16.1-24.6	32.4	.92	30.1-36.0

Figure 1. Changes in positive affect over the course of pregnancy for women with average and high depressive symptoms.



Note: EPDS = Edinburgh Postnatal Depression Scale. The solid line is based on results of the multi-level model for women with an EPDS score of 4.3 (the sample mean); the dashed line is for women with an EPDS score = 13.

Figure 2. Changes in negative affect over the course of pregnancy for women with average and high depressive symptoms.



Note: EPDS = Edinburgh Postnatal Depression Scale. The solid line is based on results of the multi-level model for women with an EPDS score of 4.3 (the sample mean); the dashed line is for women with an EPDS score = 13.