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# CHRONIC PRENATAL DEPRESSION AND NEONATAL OUTCOME

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Four hundred and thirty pregnant women were recruited at approximately 22 weeks gestation at prenatal clinics. Of these, 86 (20%) were diagnosed as depressed. The women were seen again at approximately 32 weeks gestation and after delivery. Chronicity of depression was evidenced by continuing high depression scores in those women diagnosed as depressed. Comorbid problems were chronically high anxiety, anger, sleep disturbance, and pain scores. Less optimal outcomes for the depressed women included lower gestational age and lower birthweight of their newborns.

**Keywords** low birthweight, prematurity, prenatal depression

## INTRODUCTION

Depression is particularly prevalent in women during pregnancy, affecting anywhere from 10% to 25% (Burt & Stein, 2002; Marcus et al., 2003; Nonacs & Cohen, 2002). In a study in New Zealand, 13% of a sample of pregnant women scored greater than 12 (Carter et al., 2005). In a sample in the U.S., using a BDI score of 14 as the cutpoint, over half the sample was categorized as having significant depression symptoms (Mckeen et al., 2001).

Mothers exhibiting depression during pregnancy are more likely to deliver prematurely (Orr et al., 2002). Maternal symptoms of depression are also related to birthweight (both corrected and uncorrected for gestational age), with neonates of depressed mothers being at greater risk for low birthweight (<3,700 grams) and small-for-gestational-age (<10th percentile) (Field et al., 2004; Hoffman & Hatch, 2000). A number of risk factors have been identified

for low birthweight including prenatal stress, anxiety, and depression (see Valero de Bernabé et al., 2004 for a review). Prenatal depression has also been associated with elevated cortisol levels in both the mother and the newborn (Lundy et al.,1999), which, in turn, has been associated with prematurity and low birthweight (Field et al., 2004).

Most prenatal depression studies have been conducted at one time point during pregnancy. An exception is a longitudinal assessment across pregnancy that reported a steady decrease of depressive tendencies across two prenatal assessments compared to a postnatal assessment (Hayes & Muller, 2004). The women were less depressed postnatally than prenatally. The purpose of the present study was to determine whether prenatal depression observed early in pregnancy persists across pregnancy, and to assess the neonatal outcome for women who were chronically depressed during pregnancy.

## METHODS

### Participants

Four-hundred thirty pregnant women were recruited at approximately 22 weeks gestation (R = 20–24 weeks, M = 22 weeks), at prenatal clinics at a university hospital. Following informed consent, they were then given a diagnostic interview, the Structured Clinical Interview for DSM IV Disorders (SCID), to determine whether they were depressed or non-depressed. Twenty percent ($n = 86$) of the women were diagnosed as having dysthymia or major depression disorder. The sample was low to middle SES on average and was distributed 55% Hispanic, 23% African-American, and 22% non-Hispanic white. The depressed and non-depressed groups differed on socioeconomic status (M = 3.7 for the nondepressed and 4.0 for the depressed, $p < 0.01$). None of the women tested positive for substance use or smoking, and none of the women were receiving treatment or medications for depression.

### Procedure

After the diagnostic interview, the mothers were given a battery of self-report measures for comorbid problems including anxiety, anger, daily hassles, sleep disturbances, and pain. They also provided a urine sample to be assayed for cortisol. These measures were repeated at the subsequent prenatal visit at approximately 32 weeks gestation (R = 30–35 weeks) and at the postnatal visit

at 2 days (R = 1–4 days). Neonatal birth measures were also recorded at that time.

## Self-Report Measures

*Structured Clinical Interview for DSM-IV Disorders (SCID).* All women in the study were given the SCID (research version) to determine depression and anxiety diagnoses and to screen out other disorders including bipolar disorder, schizophrenia, and other psychotic disorders. The women were diagnosed with Dysthymia or Major Depression on the SCID based on DSM IV symptoms. The DSM IV defines Major Depression Disorder as five (or more) of the following symptoms being present nearly everyday during the same two-week period, at least one of the symptoms being depressed mood or loss of interest/pleasure. The symptoms are: (1) depressed most of the day; (2) markedly diminished interest or pleasure in all or almost all activities most of the day; (3) significant weight loss when not dieting, or weight gain, or decrease or increase in appetite; (4) insomnia or hypersomnia; (5) psychomotor agitation or retardation; (6) fatigue or loss of energy; (7) feelings of worthlessness or excessive or inappropriate guilt; and (8) diminished ability to think or concentrate, or indecisiveness. Dysthymic Disorder is defined as depressed mood for most of the day for more days than not for at least two years. To be classified as Dysthymic, the criteria are the presence of two or more of the following symptoms: (1) poor appetite or overeating; (2) insomnia or hypersomnia; (3) low energy or fatigue; (4) low self-esteem; (5) poor concentration or difficulty making decisions; and (6) feelings of hopelessness. Both depression types (Major Depression and Dysthymia) and those diagnosed with co-morbid anxiety disorder were eligible for the study. The SCID was administered by research associates following training and with continuing supervision by a clinical psychologist.

*Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977).* This 20-item scale was included to assess symptoms of depression. The women are asked to report on their feelings during the preceding week. The scale has adequate test/retest reliability (0.60 over several weeks), internal consistency (0.80–0.90), and concurrent validity (Wells et al., 1987). A score of 16 on the CES-D is considered the cutpoint for depression (Radloff, 1991).

*State/Trait Anxiety Inventory (STAI) (Spielberger et al., 1970).* This scale was used to assess co-morbidity of anxiety and depression. The State/Trait

Anxiety Inventory is comprised of 20 items and is summarized by a score ranging from 20 to 90 and assesses how the person usually feels in terms of severity ("not at all" to "very much so"). Characteristic items include "I feel nervous" and "I feel calm." Research has demonstrated that the STAI has adequate concurrent validity and internal consistency ($r = .83$). The cutoff score for high anxiety in the present studies has been 48.

*State/Trait Anger Inventory (STAXI) (Spielberger et al., 1995).* This is a 10-item inventory that assesses general feelings of anger based on a 4-point Likert scale ranging from 1 (almost never) to 4 (almost always). Typical questions include "I am quick tempered" and "I fly off the handle." Psychometric properties have been established for the STAXI on diverse ethnic groups. Reliability coefficients have been reported between 0.97 (state) and 0.89 (trait).

*Daily Hassles Scale (Field, 2003).* This scale was developed to assess the degree of hassle being experienced by expectant mothers. The 16 items on this 4-point Likert scale include questions on people such as family members, landlord, and friends creating hassles and the problem of finding resources as creating hassles.

*Urine Assays.* Urines were collected at the same time of day (mid-morning) to control for diurnal variation and they were, then, frozen and subsequently sent to Saul Schanberg and Cynthia Kuhn at Duke University Medical School, where they were assayed for cortisol. Cortisol was measured in urine by radioimmunoassay using a specific antiserum from Radioassay Systems Laboratories. The sensitivity of the assay is 0.025 ng/tube. The inter-assay and intra-assay coefficient of variation is less than 10% and 5%, respectively.

## RESULTS

Group by repeated measures analyses of variance were conducted on each of the variables followed by Bonferroni *t*-tests for interaction effects. As can be seen in Table 1, the group of women who had been diagnosed as depressed differed across pregnancy (at both prenatal visits) and postnatally on the self-report measures as follows: (1) higher depression (CES-D) scores, (2) higher anxiety (STAI) scores, and (3) higher anger (STAXI) scores. The depressed group also reported a greater number of daily hassles at the first prenatal visit. At the two prenatal visits they were noted to have: (1) greater sleep disturbances and

**Table 1.** Means for self-report measures and cortisol at prenatal visit 1 (M = 20 weeks gestation), prenatal visit 2 (M = 32 weeks gestation) and postnatal visit (M = 2 days). Means for depressed group are in parentheses

| | Visits | | |
|---|---|---|---|
| | Prenatal visit 1 | Prenatal visit 2 | Postnatal visit |
| Variables | | | |
| Depression (CES-D) | 11.3[4] | 12.0[4] | 9.9[4] |
| | (22.5) | (19.7) | (19.0) |
| Anxiety (STAI) | 34.1[4] | 37.4[3] | 33.1[1] |
| | (42.9) | (43.2) | (36.9) |
| Anger (STAXI) | 17.3[4] | 16.2[4] | 16.0[4] |
| | (20.5) | (22.3) | (21.0) |
| Daily hassles | 20.8[4] | | |
| | (24.7) | | |
| Sleep disturbance | 39.3[1] | 42.1[1] | |
| | (46.9) | (51.5) | |
| Back pain | 3.5[1] | 3.6[1] | |
| | (4.7) | (5.5) | |
| Leg pain | 2.9[1] | 3.2[1] | |
| | (4.0) | (4.8) | |
| Cortisol | 141.4[1] | 195.5 | |
| | (173.7) | (216.9) | |

Superscripts are for non-depressed/depressed group comparisons ([1]$p < 0.05$, [2]$p < 0.01$, [3]$p < 0.005$, [4]$p < 0.001$).

(2) greater back and leg pain. At the first prenatal visit, the depressed group had higher cortisol levels than the non-depressed group, and at the second prenatal visit, the groups no longer differed on cortisol levels. As can be seen in Table 2, the depressed group had newborns with less optimal neonatal outcomes including: (1) lower gestational age and (2) lower birthweight.

## DISCUSSION

Chronic depression has been noted in other samples of pregnant women (Diego et al., 2004), and has been reported to have negative effects on neonatal outcomes including shorter gestation and lower birthweight (Field et al., 2004). Most samples of prenatally depressed women have only been assessed at one time point during pregnancy. In the current study, the chronicity was

**Table 2.** Means for neonatal measures

| | Groups | |
|---|---|---|
| | Non-depressed | Depressed |
| Measures | | |
| Gestational age | 39.1 | 37.5[2] |
| Birthweight | 3332.3 | 3093.3[1] |

Superscripts are for non-depressed/depressed group comparisons ([1]$p < 0.05$, [2]$p < 0.01$).

demonstrated at three points in time including the second and third trimesters of pregnancy and postnatally.

Also unique to this study was the assessment of comorbidity on multiple self-report scales. The chronicity of other problems in this sample like anxiety, anger, sleep disturbances, and pain highlight the complexity of prenatal stress. The comorbidity of these problems confounds the question of what predicts to the shorter gestation and lower birthweight outcomes. The lower socioeconomic status of the depressed group may have contributed to at least the greater number of daily hassles reported by the depressed women. The generally lower socioeconomic status of the entire sample may have also contributed to the relatively high incidence of chronic depression in this sample (20%).

The elevated cortisol in the depressed group likely also contributed to the shorter gestation and lower birthweight of the newborns, as it has in other samples the authors have followed (Field et al., 2004). In the Field et al. (2004) study, elevated cortisol at 20 weeks gestation was the strongest predictor of prematurity and low birthweight. In the current study, cortisol levels were no longer higher in the depressed group at the second prenatal assessment, as would be expected inasmuch as cortisol levels are noted to increase significantly across all pregnancies. But the Field et al. (2004) results would suggest that elevated cortisol at the earlier stage of pregnancy (around 20 weeks) would be sufficient to heighten the risk of prematurity and low birthweight. Whether depression itself contributed to elevated cortisol is not clear given that the comorbid factors such as anxiety and anger may have also been related to elevated cortisol.

Further research is needed to explore relationships between depression and cortisol, and cortisol and prematurity. The relative contributions of each of these comorbid problems to the less optimal neonatal outcomes, as in a regression or in a path analysis model, would help identify those problems most needing prenatal intervention.

## REFERENCES

Burt, V. K., & Stein, K. (2002). Epidemiology of depression throughout the female life cycle. *Journal of Clinical Psychiatry*, *63*(Suppl. 7), 9–15.

Carter, F. A., Carter, J. D., Luty, S. E., Wilson, D. A., Frampton, C. M., & Joyce, P. R. (2005). Screening and treatment for depression during pregnancy: A cautionary note. *Australian and New Zealand Journal of Psychiatry*, *39*, 255–261.

Diego, M. A., Field, T., Hernandez-Reif, M., Cullen, C., Schanberg, S., & Kuhn, C. (2004). Prepartum, postpartum, and chronic depression effects on newborns. *Psychiatry*, *67*, 63–80.

Field, T. (2003). Daily Hassles Scale, unpublished.

Field, T., Diego, M., Dieter, J., Hernandez-Reif, M., Schanberg, S., Kuhn, C., Yando, R., & Bendell, D. (2004). Prenatal depression effects on the fetus and the newborn. *Infant Behavior and Development*, *27*, 216–229.

Hayes, B. A., & Muller, R. (2004). Prenatal depression: A randomized controlled trial in the emotional health of primiparous women. *Research Theory of Nursing Practice*, *18*, 165–183.

Hoffman, S., & Hatch, M. C. (2000). Depressive symptomatology during pregnancy: evidence for an association with decreased fetal growth in pregnancies of lower social class women. *Health Psychology, 19*(6), 535–543.

Lundy, B. L., Jones, N. A., Field, T., Nearing, G., Davalos, M., Pietro, P., Schanberg, S., & Kuhn, C. (1999). Prepartum depression effects on neonates. *Infant Behavior and Development*, *22*, 121–137.

Marcus, S. M., Flynn, H. A., Blow, F. C., & Barry, K. L. (2003). Depressive symptoms among pregnant women screened in obstetrics settings. *Journal of Women's Health*, *12*, 373–380.

Mckeen, M. D., Cunningham, M., Jankowski, K. R., & Zayas, L. (2001). Health-related functional status in pregnancy: Relationship to depression and social support in a multi-ethnic population. *Obstetrics and Gynecology*, *97*, 988–993.

Nonacs, R., & Cohen, L. S. (2002). Depression during pregnancy: diagnosis and treatment options. *Journal of Clinical Psychiatry, 63*(Suppl 7), 24–30.

Orr, S. T., James, S. A., & Blackmore Prince, C. (2002). Maternal prenatal depressive symptoms and spontaneous preterm births among African-American women in Baltimore, Maryland. *American Journal of Epidemiology*, *156*, 797–802.

Radolff, L. S. (1977). The CES-D Scale: A self-report depression scale for research in the general population. *Journal of Applied Psychological Measures*, *1*, 385–401.

Spielberger, C., Gorsuch, R. L., & Lushene, R. E. (1970). *The State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D., Ritterband, L. M., Sydeman, S. J., Reheiser, E. C., & Unger, K. K. (1995). Assessment of emotional states and personality traits: Measuring psychological vital signs. *Clinical Personality Assessment: Practical Approaches*. (pp. 42–58). New York: Oxford University Press.

Valero de Bernabé, J., Soriano, T., Albaladejo, R., Juarranz, M., Calle, M., Martínez, D., & Domínguez-Rojas, V. (2004). Risk factors for low birth weight: A review. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *116*, 3–15.

Wells, V. E., Klerman, G. L., & Deykin, E. Y. (1987). The prevalence of depressive symptoms in college students. *Social Psychiatry, 22*, 20–28.