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Depression during pregnancy: a risk factor for adverse neonatal outcomes? A critical review of the literature

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Abstract

Objective—We reviewed studies of maternal depression and preterm birth (PTB), low birthweight (LBW) and small-for-gestational-age (SGA) in the context of methodological differences between studies and potential limitations.

Methods—We conducted a literature search of PubMed (1996–2011) for English-language studies of maternal depression and (1) PTB and gestational age (GA), (2) LBW and birthweight (BW) and (3) SGA. Thirty-six studies met eligibility criteria.

Results—Elevated depression levels, particularly in early- to mid-pregnancy, appear to increase risk of PTB and SGA. Findings suggest an increased risk for LBW, but were less consistent. Methodological differences and limitations likely contributed to conflicting findings. A wide range of depression measures were used with the majority of studies utilizing measures not designed, or validated, for pregnant women. Studies failed to assess depression at multiple pregnancy time points, thus constraining the ability to assess the impact of duration and pattern of exposure to depression. Antidepressant use and co-morbid psychosocial factors were rarely considered as potential confounders or effect modifiers.

Conclusions—Studies suggest that depression during pregnancy may be an important risk factor for PTB and SGA, and possibly LBW. Improved study methodology is needed to elucidate the consequence of maternal depression on adverse birth outcomes.

Keywords

Depression; intrauterine growth restriction; low birthweight; pregnancy; preterm birth; small-for-gestational age

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Declaration of interest

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Introduction

Depressive disorders are common during pregnancy affecting up to 18% of women [1]. Many factors contribute to depression during pregnancy, including stress, hormonal changes and the decision made by some women or their clinicians to discontinue antidepressant maintenance medications [2]. Women with a history of depression prior to pregnancy are particularly at risk with depression relapse rates during pregnancy of approximately 43% [3].

Depression during pregnancy has been identified as a potential risk factor for preterm birth (PTB), low birthweight (LBW) and small-for-gestational age (SGA). PTB (<37 weeks gestation) and LBW (<2500 g) are among the leading causes of infant mortality and morbidity in the United States [4,5]. Marked disparities exist for these adverse birth outcomes and the associated infant mortality with non-Hispanic Black women, Puerto Rican women and other women of color experiencing disproportionately high rates compared to non-Hispanic Whites [4,6,7]. Depression may impact adverse birth outcomes by increasing levels of hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system hormones, including corticotropin releasing hormone (CRH), cortisol and catecholamines [8]. These increased hormone levels may either directly or indirectly affect timing of birth and fetal growth. In addition, depression may lead to negative health behaviors, such as increased cigarette smoking, alcohol consumption or inadequate nutrition, which in turn, could increase risk.

While epidemiological studies have suggested a link between depression during pregnancy and adverse birth outcomes, findings have been inconsistent and comparability of results has been complicated by a diversity of study methods used to evaluate this association.

Therefore, this review aims to provide researchers and practitioners with an overview of the literature on maternal depression and 1) PTB and gestational age (GA), 2) LBW and birthweight (BW) assessed continuously, and (3) SGA in the context of the methodological differences between studies and their potential limitations. Finally, the review ends with recommendations for future research and practice.

Methods

Literature search strategy

Articles included in this review were obtained by searching the PubMed database (1996–2011) for the search terms “depression” or “depressive disorders,” along with “preterm birth,” “gestational age,” “prematurity,” “low birth weight,” “birth weight,” “small for gestational age” or “intrauterine growth restriction.” Additional relevant articles cited in identified papers were also included. Eligibility criteria were defined as: (1) articles available in English; (2) studies conducted in humans; (3) depression/depressive symptoms included as a primary independent variable and (4) PTB/GA or LBW/BW, or SGA as the study outcome. In total, 36 studies were identified which fulfilled these criteria (Table 1).

Results

Maternal depression and preterm birth

Of the 27 English language studies that examined the relationship between depression during pregnancy and PTB [9–35], 12 found that depression increased risk of PTB (odds ratios range 1.3–4.9) [24,26–34] or decreased GA at birth [25,35] while the remainder found no effect [9,11–23]. All but one [30] were prospective studies.

Though the majority of studies focused on PTB overall, some studies focused on spontaneous PTB (preterm labor or preterm premature rupture of the membranes) as research suggests that etiology may vary depending on type of PTB [32]. In the largest cohort study focusing on spontaneous PTB ($n = 5337$) [21], women who reported depression, assessed with the Centers for Epidemiological Studies Scale (CES-D), had 40% increased odds of spontaneous PTB compared to women who were not depressed in adjusted analyses (OR = 1.4 [95% CI = 1.01, 2.1]). However, this effect was no longer statistically significant after adjusting for stress and anxiety. Among the three other studies that focused on spontaneous PTB, 2 found that depression increased risk [24,32] while the third found no association [11].

Other studies evaluated early, moderate and late PTB. Li et al. [29] observed a positive dose response relationship between depressive symptoms, assessed via the CES-D, and the incidence of moderate/late PTB (>32 weeks gestational age) in adjusted analyses. Women scoring >22 had more than twice the risk of PTB (HR = 2.2 [95% CI = 1.1, 4.7], p -trend <0.01) as compared to women scoring less than 16. Exclusion of CES-D questions querying depressive symptoms that are also common to pregnancy (e.g. fatigue) from the depression score did not alter the association. In a study of 918 African-American women, Kiely et al. [20] found that depression increased risk for early PTB (<33 weeks gestational age), but only when restricted to women of “normal” weight (OR = 2.91 [95% CI = 1.01, 9.46]).

In the only study to assess depression at multiple time points during pregnancy and GA, Hoffman et al. [19] found no association between elevated CES-D scores at early, mid and late pregnancy and GA at birth among 666 predominantly White women in New York and Pennsylvania.

Evidence suggests that use of particular antidepressants may independently increase risk of PTB, though findings have been inconsistent [36]. Both Gavin et al. [14] and Wisner et al. [23] found that among depressed women, only those who were also taking antidepressants had an increased risk of PTB. However, other studies have found that elevated depressive symptoms increased risk for PTB after accounting for potential antidepressant use in the study population [29].

In summary, studies conducted to date suggest that depression, particularly in early- to mid-pregnancy (<23 weeks gestational age), increases risk of PTB [25–27,29,32,34,35]. Those studies not finding an association when assessing depression during this timeframe tended to be limited by small sample size [9,12]. However, all but one study to date only assessed

depression at a given time point during pregnancy, and none examined the effect of duration of exposure to depression over pregnancy on risk of PTB.

Maternal depression and low birthweight

A total of 20 studies [9–12,16–18,22,25,26,31,33–35,37–41] examined the association between maternal depression and LBW or BW evaluated continuously. The majority of these studies did not find an association [9–12,17,18,22,33–35,37–39,41] while six found that depression increased risk for LBW (Odds Ratio Range: 1.4–2.2), or, similarly, decreased BW [16,20,25,26,31,40]. All but two of the studies [39,41] were prospective.

Evans et al. [38] conducted one of the few studies to assess depression at multiple time points during pregnancy, and the only study to assess the effect of cumulative duration of exposure on LBW/BW. Among the 13 194 participants in the Avon Longitudinal Study of Parents and Children (ALSPC), women with elevated scores on the Edinburgh Postnatal Depression Scale (EPDS) at 18 weeks gestation had a 57% increased odds of LBW at term in adjusted analyses (OR =1.57 [95% CI =1.08, 2.29]); however this effect was no longer statistically significant after additional adjustment for smoking (OR =1.38 [95% CI =0.94, 2.01]). Elevated EPDS scores at both 18 and 32 weeks gestation were not statistically significantly associated with decreased BW in adjusted analysis.

In a recent prospective cohort study of 819 African–American women, El-Mohandes et al. [16] found that women with depression, assessed at <29 weeks gestational age, had 71% increased odds of LBW in adjusted analysis (OR =1.71 [95% CI =1.12, 2.62]). In another recent study among 583 women in Bangladesh, Nasreen et al. [40] found that depression in the 3rd trimester, assessed via the EPDS, doubled the odds of LBW (OR =2.24 [95% CI =1.37, 3.68]) in adjusted analysis. Finally, in a recent large prospective study among 3149 predominantly African–American Women, Neggers et al. [31] found that elevated depressive symptoms, defined as scoring greater than the median on the CES-D at 22–23 weeks gestation, increased odds of LBW (OR =1.4 [95% CI =1.1, 1.7]).

In summary, findings for the impact of depression on LBW have been conflicting, but suggestive of an increased risk. Differences in study findings may be due to the wide range of depression measures as well as varying time points of assessment.

Maternal depression and small-for-gestational age

A total of 10 studies [11,15,19,26,31,33,42–45] examined the association between depression and SGA or fetal growth. Of these studies, five found an increased risk of SGA [15,19,26,44,45] and the remainder found no association [11,31,33,42,43]. All but one [44] were prospective studies.

In a 2009 prospective study of 336 African-American women, Field et al. [26] found that diagnosis of depression assessed by the Structured Clinical Interview for DSM-IV Diagnoses (SCID) was associated with a lower BW percentage for GA. In a recent large cohort of 8050 women in Amsterdam, Goedhart et al. [15], found that women with elevated levels of depressive symptoms in mid-pregnancy, as assessed by the CES-D, had 25% greater odds of SGA in adjusted analyses (OR =1.25 [95% CI =1.07, 1.45]).

Two studies finding a positive association between depression and SGA examined depression at multiple time points during pregnancy [19,45]. In a cohort of 396 nulliparous women in Amsterdam, Paarlberg et al. [45] found that depressive mood, as assessed by the Hopkins Symptoms Checklist, in early-, but not in mid- or late- pregnancy, was associated with an increased risk for SGA (using population standards of BW for GA) (OR =1.12 [95% CI =1.01, 1.24]). In a cohort of 666 predominantly White women, Hoffman et al. [19] found that depression assessed via the CES-D in mid- pregnancy was inversely associated with fetal growth rate only among women with low social status.

In summary, studies suggest that early to mid-pregnancy depression increases risk for SGA. Studies finding a positive association tended to focus on early-to-mid pregnancy depression [15,26,45], whereas those finding a null association generally focused on mid-to-late pregnancy depression [11,31,42]. Though several studies examined depression at several time points during pregnancy, only one of the studies examined duration of exposure to depression over the course of pregnancy and the majority of the studies did not take antidepressant use into account.

Discussion

A number of studies have been conducted examining the association between depression and PTB, LBW and SGA. The majority of these studies have focused on the association between maternal depression and PTB and LBW, with fewer studies examining the effect on SGA. Studies to date suggest that early-to-mid pregnancy depression increases risk for PTB and SGA. Findings for depression and LBW less consistently suggested an increased risk. Differences in study findings are likely due, in part, to methodological differences and their associated potential limitations as discussed below.

Measurement of depression

Studies have utilized a wide range of measures to operationalize depression, making it difficult to compare findings across studies. Many studies assessed depressive symptoms as a screening tool to identify individuals at increased risk for depression, and thus are subject to potential misclassification, as elevated symptom scores do not necessarily correspond to clinical depression. In contrast, studies using clinical records to identify diagnosis of clinical depression [10,34,46] minimize this potential source of misclassification, but are subject to other limitations as depression during pregnancy is often underdiagnosed and undertreated [47]. Studies that use clinical interviews, such as the Structured Clinical Interview for DSM-IV (SCID), to systematically assess and diagnose depression, minimize this potential bias, but have a higher participant burden that decreases feasibility for large epidemiologic studies and may also lead to potentially biased results [48].

Among studies utilizing questionnaire-based depression measures, the instruments used varied across studies. The majority of studies used measures that were not designed for, or validated for use, among pregnant women (e.g. CES-D, BDI, GHQ). The majority of these questionnaires (e.g. CES-D, BDI) include common symptoms of pregnancy (e.g. fatigue, loss of appetite) in their assessment of somatic depressive symptoms, thereby, resulting in overestimates of depressive symptom scores that increase the risk for false positive

depression cases [49]. Though some studies tried to account for this misclassification by increasing the cut-point for depression or conducting sensitivity analyses [11,14,19,29,32], the majority did not. Very few studies used the EPDS, the only instrument designed to exclude somatic depressive symptoms that are also common symptoms of pregnancy [22,24,27].

An additional barrier to comparing findings across studies is the use of inconsistent cut-point values to assess depression in studies using questionnaire-based measures of depressive symptoms. Cut-points varied between studies and were often not consistent with recent recommendations [50].

A final challenge to comparing findings is the use of instruments that have not been validated within specific cultural/ethnic groups. Though many of the instruments have been validated in a variety of languages, studies suggest that the validity of psychosocial assessment instruments may vary depending on descent and country of residence, which is generally not taken into account [51].

Cumulative exposure and timing of exposure to depression

Cumulative exposure to depression as well as timing of exposure may be important factors influencing risk of PTB, LBW and SGA. Prolonged elevated levels of cortisol and norepinephrine are thought to be potential mediators of depression/stress and growth restriction [52,53]. However, only two studies assessed duration of exposure to elevated depressive symptoms during pregnancy and LBW or growth restriction, both finding that cumulative exposure increased risk, but that this effect was attenuated after adjustment [19,38]. However, it is not clear if there was sufficient power to detect an effect in adjusted analyses.

In addition, the impact of timing of depression during pregnancy has not been fully explored and may have an important impact on the magnitude of the association between depression and adverse birth outcomes as studies suggest that exposure to early-to-mid pregnancy depression may increase risk for PTB and SGA. Studies have also shown that HPA axis function varies over pregnancy [54] and exposure to cortisol is a theorized mechanism by which depression may increase risk for PTB, LBW and SGA.

Confounding and effect modification

A number of studies were limited by lack of consideration of confounding factors [12,22,25,34,37,41,42]. Some studies suggest that the use of particular antidepressants during pregnancy may be associated with increased risk of PTB, LBW and SGA [36], however, few studies included anti-depressant use in their statistical models. In the few that have taken into account antidepressant use, some have found that antidepressant use rather than depression increased risk [14,23], whereas, others have found that elevated depressive symptoms increased risk for adverse birth outcomes independent of antidepressants [29].

Similarly, few studies adjusted for co-morbid psychosocial factors such as anxiety and stress [13,19,21,24,29,45]. Even fewer examined whether the association between depression and adverse birth outcomes differed according to presence or absence of these factors (e.g. effect

modification) [13,30]. It is important to take these psychosocial conditions into account when examining the association between depression and adverse pregnancy outcomes to disentangle the effects of anxiety and stress from those of depression and to examine possible synergistic or interactive effects.

Recommendations for future research

We offer the following recommendations for future research in an effort to better develop future studies of this topic:

- Improved assessment of depression during pregnancy is needed for more accurate and consistent estimates. Although there are several self-report measures of depression, many are not designed for use during pregnancy and are impacted by physical symptoms of pregnancy. In addition, self-reported depression is particularly susceptible to cultural differences and any measure used should be culturally adapted and modified if necessary to address literacy issues.
- Although recent advancements have been made in identifying determinants of adverse birth outcomes, there is an important need for theoretically-driven observational studies to better understand the complex interactions among the psychological, behavioral and biological determinants to develop more effective interventions.
- There is an important need for research to better understand the role that depression during pregnancy plays in infant growth and development. Studies that assess depression prior to pregnancy as well as depression over multiple time points during pregnancy can assess the impact of duration of exposure, and specific time points, on risk.
- Research is warranted further examining the impact of maternal depression on future risks for both mother (e.g. postpartum depression) and child. The fetal origins hypothesis suggests that infant development is impacted by many factors including maternal genetics, behavioral, psychological and environmental influences [55].
- Most healthcare providers are not specifically trained to counsel pregnant women about depression during pregnancy and guidance on behavioral strategies to address depression is not a part of the standard of care. There is evidence that pregnant women are motivated to make changes and seek help for the health of their babies and, thus, pregnancy may be a teachable moment for such interventions.

In conclusion, epidemiologic studies on the impact of depression during pregnancy over the past 15 years suggest an increased risk for adverse birth outcomes. However, more research with improved methodology is needed to improve our understanding of the consequence of maternal depression on adverse birth outcomes.

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Table 1

Epidemiologic Studies of Depression during Pregnancy and Preterm Birth (PTB)/Gestational Age (GA), Low Birth Weight (LBW)/Birth Weight (BW), and Small-for-Gestational Age (SGA).

Study (author)	Sample	Depression Measure	Assessment Timepoint (s)	Comparison Groups	PTB/GA	LBW/BW	SGA
Bodecs [9]	261 women in Hungary	Short-form BDI	Mean GA = 8.1 wks	Continuous score	GA: stratified by infant sex: N.S. (results not shown)	BW: N.S. by infant sex (results not shown)	n/a
El-Mohandes [16]	819 African-American women	Audio-Computer-Assisted Self Interview	<29 wks GA (mean = 19 wks GA)	Depression versus no depression	PTB: N.S. (results not shown)	LBW: OR = 1.71 [95% CI = 1.12, 2.62]	n/a
Fransson [27]	2904 Swedish women	EPDS	Mean = 16 wks GA	12 versus <12	PTB: OR = 1.56 [95% CI = 1.03, 2.35]	n/a	n/a
Kiely [20]	918 African American Women	HSC	1st and 2nd trimester	Depressed versus not depressed	PTB (early & very early): weight among normal women OR = 2.91 [95% CI = 1.01, 9.46]	LBW: among normal weight, non-smokers without preeclampsia OR = 1.9 [95% CI = 1.00, 3.64]	n/a
Smith et al [33]	1100 women (13% non-Hispanic White, 34% Black, 50% Hispanic, 3% Other)	PRIME-MD	<37 weeks	Depressed versus not depressed	PTB: OR = 1.83 [95% CI = 1.17, 2.86]	LBW: OR = 1.69 [95% CI = 0.89, 3.22]	SGA: OR = 0.95 [95% CI = 0.5, 1.79]
Uguz [44]	148 women in Turkey	SCID	3rd trimester	Major depression versus no major depression	n/a	n/a	IUGR: $B = -1.75, p = 0.001$
Goedhart [15]	8050 multiethnic women in Amsterdam	CES-D	Mailed questionnaire 2 wks after 1st prenatal visit	16 versus <16	PTB: OR = 1.16 [95% CI = 0.93, 1.45]	n/a	SGA: OR = 1.19 [95% CI = 1.02, 1.39]
Hodgkinson [18]	294 pregnant teens (76% Black, 24% Latina)	Five questions at intake (unvalidated)	During pregnancy	Depressive symptoms versus no depressive symptoms	GA: N.S. ($F = 0.004, p = 0.95$)	BW: difference = 42.3gms [95% CI = -68.8, 153.4]	n/a
Misra [30]	872 African American women	CES-D	Varied: 28 wks GA or postpartum	16 versus <16	PTB: OR = 1.46 [95%	n/a	n/a

Study (author)	Sample	Depression Measure	Assessment Timepoint (s)	Comparison Groups	PTB/GA CI = 1.05, 2.04]	LBW/BW	SGA
Nasreen [40]	583 women in Bangladesh	EPDS	3rd trimester	10 versus <10	n/a	LBW: OR = 2.24 [95% CI = 1.37, 3.68]	Szegedi et al. n/a
Van Dijk [35]	4044 women in Amsterdam	CES-D	~16th wk GA	>22, 16–22 versus <16	GA: B = -0.2 [95% CI = -0.4, 0]	BW: B = -19 [95% CI = -58, 20]	n/a
Wang [22]	431 women in Taiwan	EPDS	17–38 wks GA	>14, 10–14 versus <9	PTB: Chi-square = 0.152; $p = 0.927$	BW: $F = 0.213$, $p = 0.809$	n/a
Diego [12]	80 women (59% Hispanic, 32% Black, 9% White)	SCID	18–20 wks GA	Depressive disorder versus no depressive disorder	PTB: OR = 2.61 [95% CI = 0.73, 9.32]	LBW: OR = 4.75 [95% CI = 0.94, 23.99]	n/a
Field [26]	336 Black women	SCID	18–22 wks GA	Depressed versus not depressed	PTB: 12% versus 6.3% (F -test = 5.38, $p = 0.05$)	BW (mean): 3246 gms versus 3310 gms, $p = 0.05$	BW (percentage for gestational age): 39.9% versus 45.5%, $p = 0.05$
Gavin [14]	3019 women in Michigan (70% White, 25% Black, 5% Other)	CES-D	15–27 wks GA	24 versus <24	PTB: OR = 1.0 [95% CI = 0.7, 1.3]; among antidepressant users: OR = 2.0 [95% CI = 1.1, 3.6]; among nonusers: OR = 0.6 [95% CI = 0.4, 0.9]	n/a	n/a
Kramer [21]	5337 women in Montreal	CES-D	24–26 wks	16 versus <16	PTB (spontaneous): OR = 1.4 [95% CI = 1.01, 2.1]; N.S. after adjustment for anxiety and perception of high risk pregnancy.	n/a	n/a

Study (author)	Sample	Depression Measure	Assessment Timepoint (s)	Comparison Groups	PTB/GA	LBW/BW	SGA
Li [29]	791 women (40% White, 22% Hispanic, 30% Asian, 7% Black)	CES-D	~10 wks GA	>21, 16–21 versus <16	PTB (>32 wks GA): OR =2.2 [95% CI =1.1, 4.7]; OR =1.6 [95% CI =0.7, 3.6]; <i>p</i> -trend = <0.01	n/a	n/a zegda et al.
Wiser [23]	238 predominantly White women	SCID	Throughout pregnancy	Continuous depression & continuous SSRI; partial SSRI no SSRI; depression & no SSRI versus no SSRI/no depression	PTB: RR =5.43 [95% CI =1.98, 14.8]; RR =0.86 [95% CI =0.11, 6.92]; RR =3.71 [95% CI =0.98, 14.13]; RR =1.04 [95% CI =0.22, 5.01]	n/a	n/a
Field [25]	430 women (55% Hispanic, 23% Black, 22% non-Hispanic White)	SCID	22 wks GA	Depressed versus not depressed	GA: 37.5 wks versus 39.1 wks, <i>p</i> <0.01	BW: 3093.3 gms versus 3332.2 gms, <i>p</i> <0.05	n/a
Borders [41]	294 low income women (77% Black, 16% White, 5% Hispanic)	CES-D	Interview within 6 months of delivery (pre- & postnatal)	Depressed versus not depressed	n/a	LBW: OR =2.2 [95% CI =0.98, 5.1]	n/a
Evans [38]	10 967 women in UK	EPDS	18 & 32 wks GA	>12 versus 12 at 18 wks; >12 versus 12 at 18 and 32 wks	n/a	LBW (among term infants): 18 wks: OR =1.38 [95% CI =0.94, 2.01]; 18 and 32 wks: N.S. after adjustment (results not shown)	n/a
Suri [34]	90 women	Clinical diagnosis/SCID	First trimester	Major depressive disorder (MDD) & antidepressants, MDD & minimal antidepressants versus no MDD & no antidepressants	PTB: 14.3%, 0% versus 5.3%, <i>p</i> =0.05	BW: 3.28 kg, 3.39 kg versus 3.36 kg, <i>p</i> =0.63	n/a
Dayan [24]	681 women in France	EPDS	20–28 wks GA	14 versus <14	Spontaneous PTB OR =4.9 [95% CI =1.6, 14.9]	n/a	n/a

Study (author)	Sample	Depression Measure	Assessment Timepoint (s)	Comparison Groups	PTB/GA	LBW/BW	SGA
Neggers [31]	3149 predominantly African-American women	Modified CES-D	22–23 wks GA	median, <median	PTB: OR =1.3 [95% CI =1.04, 1.7]	LBW: OR =1.4 [95% CI =1.09, 1.79]	SGA: N.S. (results not shown)
Berle [37]	680 women from Norway	HADS	Various timepoints during pregnancy	8 versus <8	n/a	LBW: OR =1.78 [95% CI =0.23, 14.0]	n/a
Andersson [10]	1465 women from Sweden	PRIME-MD	2nd trimester	Depressive disorder, no depressive disorder	PTB (overall): OR =1.19 [95% CI =0.59, 2.4]; PTB (spontaneous): OR =0.9 [95% CI =0.32, 2.67]	LBW: OR =1.19 [95% CI =0.4, 3.56]	n/a
Dole [13]	1962 women in NC (52% White, 36% Black, 7% Other)	CES-D	24–30 wks GA	25, 17–25 versus <17	PTB: OR =1.2 [95% CI =0.9, 1.5]; OR =1.0 [95% CI =0.7, 1.4]	n/a	n/a
Jesse [28]	120 women from Appalachia	Two questions taken from validated instruments	16–28 wks GA	Yes to both questions	PTB: OR =3.88 [95% CI =1.18, 12.73]	n/a	n/a
Orr [32]	1399 African-American women	CES-D	1st prenatal visit (median =17 wks GA)	90th percentile, <90th percentile	PTB (spontaneous): OR =1.96 [95% CI =1.04, 3.71]	n/a	n/a
Walker [39]	305 women (25% White, 25% African American, 45% Hispanic)	CES-D	Late pregnancy (retrospectively)	Continuous	n/a	BW: B =0.0, SE =0.1	n/a
Chung [43]	642 women in China	BDI	1st prenatal visit or 3rd trimester	14.5 versus <14.5	n/a	n/a	SGA: 1st prenatal visit: OR =1.6 [95% CI =0.69, 3.72], 3rd trimester: N.S. (results not shown)
Hoffman [19]	666 women (98% White)	CES-D	13, 28 & 36 wks GA	Continuous; 16 versus <16 at 28 and 36 weeks	GA: N.S. (results not shown)	n/a	Fetal growth: 13wks: B =3.9 [95% CI =0.1, 7.0]; 28wks: 4

IUGR =Intrauterine Growth Restriction
N.S. =Not significant
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