Risk factors for depressive symptoms during pregnancy: a systematic review

Christie A. Lancaster, MD, MS; Katherine J. Gold, MD, MSW, MS; Heather A. Flynn, PhD; Harim Yoo; Sheila M. Marcus, MD; Matthew M. Davis, MD, MAPP

The purpose of this study was to evaluate risk factors for antepartum depressive symptoms that can be assessed in routine obstetric care. We evaluated articles in the English-language literature from 1980 through 2008. Studies were selected if they evaluated the association between antepartum depressive symptoms and ≥1 risk factors. For each risk factor, 2 blinded, independent reviewers evaluated the overall trend of evidence. In total, 57 studies met eligibility criteria. Maternal anxiety, life stress, history of depression, lack of social support, unintended pregnancy, Medicaid insurance, domestic violence, lower income, lower education, smoking, single status, and poor relationship quality were associated with a greater likelihood of antepartum depressive symptoms in bivariate analyses. Life stress, lack of social support, and domestic violence continued to demonstrate a significant association in multivariate analyses. Our results demonstrate several correlates that are consistently related to an increased risk of depressive symptoms during pregnancy.

Key words: depression, pregnancy, risk factor

Depression is one of the most common complications in pregnancy. As many as 12.7% of pregnant women experience a major depressive disorder.[1] Several professional organizations now recommend routine screening for antepartum depression.[2,3] In fact, the American College of Obstetricians and Gynecologists (ACOG) recommends screening for depression during each trimester of pregnancy.[2]

Prenatal care providers are uniquely suited to address antepartum depression. First of all, providers have already captured their target population, because most women will use obstetric services at some point during their pregnancies. Providers also have multiple opportunities to assess, treat, and follow-up with patients, as obstetric visits are recurring during a several-month span. Despite these qualifications, prenatal care providers are constrained by a lack of education in the evaluation and treatment of depression. Less than half of obstetricians report that residency prepared them to diagnose depression.[4]

Although several metaanalyses have summarized risk factors for postpartum depression,[5-8] there has been no systematic synthesis of the literature regarding risk factors for depressive symptoms during pregnancy, when obstetric providers will have their most frequent contact with patients. We cannot assume that the risk factors during pregnancy are the same as those postpartum, because certain factors, such as pregnancy intention and social support, may operate differently before and after the arrival of a baby.

If providers know the clinical significance of risk factors for depression in pregnancy, they may be able to more easily identify women with the highest chance for developing this condition. Therefore, the purpose of our study was to examine risk factors for antepartum depression that can be assessed in routine obstetric care.

Materials and methods

In consultation with an experienced research librarian, we developed Boolean search strategies (Appendix) with the key words "depression," "screening," and "pregnancy." We searched for articles, abstracts, and dissertations from January 1980 through March 2008 in the following databases: PubMed, CINAHL, SCOPUS, PsycINFO, Sociological Abstracts, ISI Proceedings, and ProQuest Dissertations and Theses. In addition, we searched the bibliographies of a large systematic review,[9] 2 ACOG Committee Opinions,[2,10] and 3 medical guidelines.[3,11,12] Finally, we hand-searched the bibliographies of each included article.

The Figure outlines the selection process. Two independent reviewers examined each article for inclusion. If the 2 reviewers disagreed on whether to include an article, they repeated the review of inclusion/exclusion criteria and met to discuss these criteria in regard to the article in question. A third reviewer was available to resolve any disagreements that could not be resolved by consensus of the first 2 reviewers. However, all disagreements were resolved without the need for a third review.

★ EDITORS' CHOICE ★

From the Robert Wood Johnson Clinical Scholars Program (Dr Lancaster); Department of Obstetrics and Gynecology (Drs Lancaster and Gold); Division of General Internal Medicine (Drs Lancaster and Davis); Department of Family Medicine (Dr Gold); Department of Psychiatry, Women's Mood Disorders Program (Drs Flynn and Marcus); Child Health Evaluation and Research Unit, Division of General Pediatrics (Dr Davis); and Gerald R. Ford School of Public Policy (Dr Davis), University of Michigan (Mr Yoo), Ann Arbor, MI.

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Reprints: Christie A. Lancaster, MD, MS, University of Michigan, 6312 Medical Science Bldg. I, 1150 W. Medical Center Dr., Ann Arbor, MI 48109-5604. chrlanca@umich.edu.

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We included studies that assessed for depressive symptoms during pregnancy and evaluated the association between depressive symptoms and ≥1 potential risk factors. We excluded studies that provided only descriptive statistics; studies in a non-English language; studies performed outside of the United States, Canada, Europe, Australia, or New Zealand; studies with an exclusively adolescent sample; studies of women with known depression at the time of screening; and case series, case reports, and review articles with no original data. In addition, we excluded studies with <20 subjects so that the included studies would have sufficient power to examine the association for at least 1 potential risk factor.

Our initial sample contained 197 articles, covering >100 potential risk factors. Using existing guidelines and prenatal intake forms,[2,13-15] we narrowed our analysis to include 20 risk factors that could be clinically assessed in routine obstetric practice: maternal anxiety; life stress; depression history; social support; domestic violence; unintended pregnancy; insurance status; socioeconomic status (SES); income; employment; education; age; race/ethnicity; cohabitation status; relationship quality; smoking; alcohol use; illicit drug use; parity; and obstetric history. Excluded risk factors included items such as negative self-schema and acculturation. In addition, we excluded risk factors for which there were <3 studies in the literature.

The primary investigator developed a data extraction tool a priori that was used to assess the following article details: study design; screening method; patient characteristics; and associations between predictor variables and depression, including appropriate statistics. A second reviewer examined the extracted data for accuracy. Whenever there was insufficient information to calculate the association between a risk factor and depression, an effort was made to contact the corresponding author. If a study assessed the relationship between a predictor and depressive symptoms at multiple time points, the most conservative effect size was recorded.

In addition, we developed an article quality assessment tool adapted from methods of the US Preventive Services Task Force[16] and a systematic review of perinatal depression.[9] The tool included items related to internal validity, external validity, and precision in relation to our study's key question. Therefore, these ratings reflected the quality of each article for the purpose of our study and not necessarily for the original purpose of the research. The scores from each item were summed to yield a total rating of 0-10. Two independent reviewers assessed each study for quality. When there was disagreement between raters, the article was assigned the most conservative quality score.

The heterogeneity among studies for all risk factors precluded the use of meta-analytic techniques. For each study, the primary investigator recorded the effect size of the association between a given risk factor and depressive symptoms. The effect was recorded in units of standardized effect size, using Cohen's[17] definitions of small, medium, and large effects.

Then, for each potential risk factor, 2 blinded, independent reviewers evaluated the data from the included studies. If there was consistency of effect across the studies, each reviewer determined the overall trend of association, based on the magnitude of effect sizes, statistical significance, sample size, and direction of effect. The intraclass correlation for interrater reliability was 0.86 (95% confidence interval, 0.79–0.93). Any disagreements between the 2 reviewers were resolved by consensus. In this case, the 2 reviewers met to discuss their assessments and mutually decided on the best estimate of the overall trend of association.

For example, 11 studies involving 4696 women examined the bivariate association between maternal anxiety and antepartum depressive symptoms.[18-28] All 11 studies showed a statistically significant association. One small study showed a less than small effect size, but 5 studies showed a medium effect and 5 studies showed a large effect. Therefore, we summarized the trend of evidence as demonstrating a medium-to-large effect. Even though the 11 studies were heterogeneous in their samples, the trend of evidence was consistent across them.

However, if heterogeneity of effect precluded our ability to assess the trend of evidence, we determined that the results were inconclusive for that particular risk factor. For example, 14 studies examined race and antepartum depression.[29-42] Six studies showed a significant association (n = 3567), but in 8 studies (n = 3104) the association was not statistically significant. Seven studies showed a negligible effect, and 7 studies demonstrated a small-to-medium effect. Therefore, we concluded that the evidence is inconclusive regarding any association between race and antepartum depression.

All final summary trends were reviewed by the entire panel of coauthors.

Trends of evidence were stratified by bivariate and multivariate comparisons.

Results

A total of 159 articles met inclusion criteria (Figure). Studies were most often excluded because they did not assess predictors for depression (n = 55) or they presented only postpartum data (n = 45). A table of the excluded articles is available by request from the corresponding author (C.A.L.).

The 159 included articles had a mean sample size of 522 subjects (SD = 1014; median = 175). Approximately half (54.1%) of the studies were performed in the United States. Seventeen studies (10.7%) were longitudinal in design, and 52 studies (32.7%) included multivariate analysis. The 159 studies used 24 different depression screeners, with the Center for Epidemiological Studies Depression Scale (31.4%), the Edinburgh Postnatal Depression Scale (18.2%), and the Beck Depression Inventory (17.0%) being the most common. Only 20 studies (12.6%) used a formal diagnostic assessment for depression.

Overall, the mean study quality score was 6.3 (SD = 1.1). Due to the large number of studies and heterogeneity of study designs, we limited our analysis to the top 25th percentile of quality scores (≥7). In addition, to reach a score of 7, studies must have addressed quality items involved in both internal and ex-

ternal validity. A total of 57 studies met this quality cutoff (hereafter referred to as "high-quality studies") and are presented in Table 1.

We included 20 potential predictor variables for antepartum depressive symptoms. Table 2 displays the overall trend of association for each potential risk factor.

Maternal anxiety

In the general population, depression and anxiety are highly comorbid, with almost 60% of individuals with major depression also meeting criteria for an anxiety disorder.[75] In this review, 11 studies evaluated the relationship between maternal anxiety and depression.[18-28] Anxiety showed one of the strongest associations with antepartum depressive symptoms. On average, anxiety during pregnancy had a medium-to-large correlation with depressive symptoms in bivariate analysis.

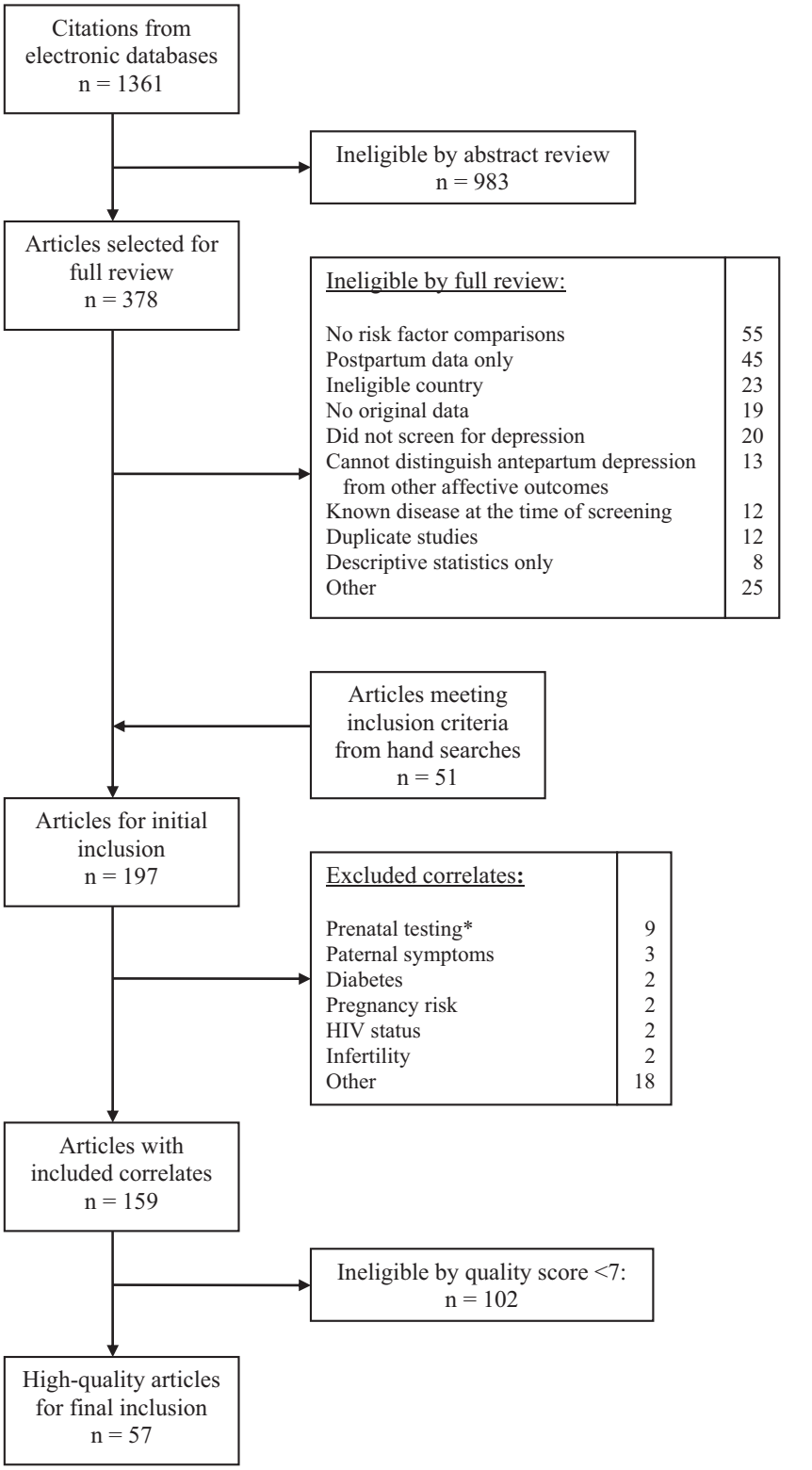
Life stress

Eighteen studies assessed life stress as a potential predictor of antepartum depression.[20,24,29-32,43,47-49,52,55-57,68,69,72,73] When considering all measures of stress, increased stress showed a medium association with depressive symptoms in bivariate and multivariate analyses. For example, in 1 study of 3011 women, those with ≥2 stressful life events within the past year were 3 times as likely to have an elevated Edinburgh Postnatal Depression Scale score.[68]

Stress can be measured in a variety of ways, and the most common conceptualizations of stress in our sample were life events (n = 15 studies) and daily hassles (n = 5 studies).

Life events refer to psychologically significant events that occur in a person's life, such as a divorce or death in the family.[76] In addition, life events may be perceived as positive or negative. When considering all types of life events, there was a small-to-medium association in bivariate analysis but inconsistent results in multivariate analysis. However, negative life events were significantly associated with an increase in depressive symptoms in both bivariate and multivariate analyses.

FIGURE
Study selection



*Refers to studies that assessed for depression after prenatal testing, such as amniocentesis, was performed.

HIV, human immunodeficiency virus.

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TABLE 1
Included studies

Study	Assessment	Country	Sample size	Mean maternal age, y (SD)	Gestational age at screen	Potential risk factors							
						DEM	DV	OB	PSY	REL	SS	STR	SUB
Affonso[43]	HSCL, SADS	US	202	30 (4.72)	10-14, 20-22, and 30-32 wk	✓				✓	✓	✓	
Alati et al[44]	DSSI	Australia	4527	25 (5.0)	First antenatal care visit								✓
Alvik et al[45]	HSCL	Norway	1424	30.8 (4.4)	17-18 and 30 wk								✓
Armstrong[18]	CESD	US	40	32.6 (4.6)	15-32 wk			✓	✓				
Bennett et al[46]	CESD	US	766	26.1 (5.4)	Unknown	✓	✓	✓		✓		✓	✓
Bergner et al[47]	DEPS	Germany	108	32.1 (6.4)	Each trimester	✓		✓	✓			✓	
Berle et al[28]	HADS	Norway	680	28.9 (4.8)	Varied				✓				
Bernazzani et al[48]	BDI	Canada	213	29.3 (4.0)	Second trimester	✓		✓	✓	✓	✓	✓	
Blaney et al[49]	CESD	US	307	28.7 (6.1)	≥24 wk	✓					✓	✓	✓
Bowen and Muhajarine[33]	EPDS	Canada	39	23.2 (4.1)	Varied (mean = 17 wk)	✓				✓	✓		✓
Cooklin et al[50]	EPDS, POMS	Australia	144	31.3 (4.9)	Third trimester	✓				✓			
Condon[51]	Self-developed	Australia	165	25[a]	Varied (58% in third trimester)			✓					
Da Costa et al[52]	DACL	Canada	80	29.1 (3.7)	Every month					✓	✓	✓	
Edge et al[42]	EPDS	England	301	28.8 (6.5)	Third trimester	✓							
Elsenbruch et al[53]	ADS-K	Germany	896	29.2 (5.0)	First trimester						✓		
Flynn et al[36]	CESD	US	1131	28.7 (5.3)	Varied (mean = 25 wk)	✓		✓		✓			✓
Flynn et al[54]	CESD	US	1054	28.2 (5.6)	Varied (mean = 25 wk)		✓		✓				✓
Franche and Mikail[19]	BDI	Canada	62	29.8 (4.5)	10-24 wk			✓	✓				
Glazier et al[20]	CESD	Canada	2052	30.7 (4.5)	24 wk	✓		✓	✓	✓	✓	✓	
Grant et al[21]	EPDS, MINI	Australia	100	32.0 (4.4)	Third trimester	✓			✓				
Heaman[55]	POMS	Canada	56	28.2 (4.9)	Third trimester						✓	✓	
Hobfoll et al[39]	BDI, SADS	US	192	24.5 (5.1)	Second and third trimester	✓		✓					
Hoffman and Hatch[56]	CESD	US	662	27.5 (4.5)	13, 28, and 36 wk	✓		✓			✓	✓	✓
Holzman et al[29]	CESD	US	1321	[b]	16-26 wk	✓	✓					✓	✓
Jesse et al[57]	Self-developed	US	120	[b]	16-28 wk	✓	✓				✓	✓	✓
Jesse[58]	Self-developed	US	120	[b]	16-28 wk	✓							
Jesse et al[30]	BDI	US	128	[b]	16-28 wk	✓	✓				✓	✓	✓
Kleiverda et al[27]	HSCL	Netherlands	170	28.9[a]	18 and 34 wk	✓			✓	✓	✓		
Larsson et al[59]	EPDS	Sweden	1489	[b]	35-36 wk	✓		✓	✓	✓			✓
Leathers and Kelley[60]	CESD	US	124	30 (4.1)	2-3 mo before birth			✓		✓	✓		
Lindgren[37]	CESD	US	252	29.5 (6.1)	20-40 wk	✓		✓		✓			
Morse et al[22]	EPDS	Australia	251	30[c]	24-26 and 36 wk	✓		✓	✓	✓	✓		
Najman et al[61]	DSSI	Australia	6642	[b]	First clinic visit (mean = 18 wk)			✓					

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TABLE 1
Included studies *(continued)*

Study	Assessment	Country	Sample size	Mean maternal age, y (SD)	Gestational age at screen	Potential risk factors							
						DEM	DV	OB	PSY	REL	SS	STR	SUB
Nicholson et al[34]	CESD	US	175	28 (6.2)	≤20 wk (mean = 14.6 wk)	✓		✓		✓	✓		
Norbeck and Tilden[23]	DACL	US	117	26.2 (4.2)	12-20 wk (mean = 16.2 wk)				✓				
O'Heron[62]	BDI, SCID	US	92	28.5[a]	Second-third trimester	✓		✓	✓	✓			
Orr and Miller[63]	CESD	US	1163	[b]	First prenatal care visit			✓					
Pajulo et al[64]	EPDS	Finland	391	28 (4.8)	18-35 wk (mean = 23 wk)	✓		✓		✓	✓		✓
Pascoe et al[65]	CESD	US	105	[b]	Varied					✓			
Pascoe et al[66]	CESD	US	139	24.5 (2.3)	24-28 wk			✓					✓
Records and Rice[24]	CESD	US	139	27 (5.2)	Third trimester		✓	✓	✓	✓	✓	✓	
Ritter et al[31]	BDI	US	191	24.5[a]	Second and third trimester	✓					✓	✓	
Rodriguez et al[67]	BDI	US	210	27.7 (5.8)	≥12 wk	✓	✓						
Rowe et al[25]	HADS	Australia	134	29.1 (4.7)	8-14 wk (mean = 12 wk)				✓				
Rubertsson[68]	EPDS	Sweden	3011	[b]	15 wk	✓		✓		✓	✓	✓	
Seguin et al[69]	BDI	Canada	144	24.2 (5.0)	30 wk	✓			✓	✓	✓	✓	
Smith et al[40]	PHQ	US	387	[b]	Varied (mean = 24 wk)	✓							
Söderquist et al[26]	BDI	Sweden	951	28.7 (4.5)	12-20 wk (mean = 18 wk)				✓				
Tilden[70]	DACL	US	141	26.3[a]	Second trimester					✓			
van de Pol et al[71]	CESD	Netherlands	511	30 (3.6)	12 and 36 wk	✓				✓			✓
Vander Weg et al[38]	CESD	US	245	25.6 (5.2)	Unknown	✓				✓			✓
Ward et al[41]	CESD	US	248	24.2 (5.1)	Varied (mean = 21 wk)	✓							✓
Westdahl et al[35]	CESD	US	1047	20.4 (2.6)	Second trimester (mean = 18 wk)	✓		✓		✓	✓		
Zayas et al[72]	BDI	US	106	25 (5.6)	Third trimester	✓		✓		✓	✓	✓	
Zelkowitz et al[73]	EPDS	Canada	119	30.6 (4.9)	Varied (mean = 29 wk)	✓		✓		✓	✓	✓	
Zuckerman et al[32]	CESD	US	1014	[b]	First or second prenatal care visit	✓		✓	✓	✓	✓	✓	✓
Zuckerman et al[74]	CESD	US	1123	[b]	Unknown				✓				

ADS-K, Allgemeine Depressions Skala (German version of CESD); *BDI*, Beck Depression Inventory; *CESD*, Center for Epidemiological Studies Depression Scale; *DACL*, Depression Adjective Checklist; *DEM*, demographic factors (age, race, income, education, employment, insurance status, socioeconomic status); *DEPS*, the Depression Scale; *DSSI*, Delusions-Symptoms-States Inventory; *DV*, domestic violence; *EPDS*, Edinburgh Postnatal Depression Scale; *HADS*, Hospital Anxiety and Depression Scale; *HSCL*, Hopkins Symptom Checklist; *MINI*, Mini International Neuropsychiatric Interview; *OB*, obstetric factors (pregnancy intention, parity, obstetric history); *PHQ*, Patient Health Questionnaire; *POMS*, Profile of Mood States; *PSY*, psychiatric factors (history of depression, maternal anxiety); *REL*, relationship factors (cohabitation status, relationship quality); *SADS*, Schedule for Affective Disorders and Schizophrenia; *SCID*, Structural Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders*; *SS*, social support; *STR*, life stress; *SUB*, substance abuse (tobacco, alcohol, illicit drugs).

[a] SD not provided; [b] Mean not provided (Holzman et al[29]: 56% aged 20-29 y), (Jesse et al[57]: 83% adult), (Jesse[58]: 83% ≥20 y), (Jesse et al[30]: 78% ≥20 y), (Larsson et al[59]: 71% aged 25-34 y), (Najman et al[61]: 51% aged 19-25 y), (Orr and Miller[63]: all subjects ≥18 y), (Pascoe et al[65]: 48% aged 20-25 y), (Rubertsson[68]: 70% aged 25-35 y), (Smith et al[40]: 80% ≥20 y), (Zuckerman et al[32]: 49% aged 21-29 y), (Zuckerman et al[74]: 83% >18 y); [c] Median 27.

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TABLE 2
Potential risk factors for antepartum depression

Factor	Total no. of studies	Total no. of subjects	Bivariate trend of association[a]	Multivariate trend of association[a]
Anxiety[18-28]	11	4696	++++	[b]
Life stress, composite[20,24,29-32,43,47-49,52,55-57,68,69,72,73]	18	9973	+++	+++
Life events, total (positive and negative)	15	9645	+++	Inconsistent
Negative life events			++++	+++
Daily hassles	5	1134	[c]	[b]
Personal history of depression[24,32,54,62,69,74]	6	3566	+++	[b]
Social support[20,22,24,27,28,30-35,43,48,49,52,53,55-57,60,64,68,69,73]				
Lack of social support, any source	17	5752	+++	+
Lack of social support, partner	9	7139	++++	++++
Domestic violence[24,29,30,46,54,57,67]	7	3738	+	++
Unintended pregnancy[24,60,61,63,64,68]	6	11,470	+++	[b]
Relationships[20,22,24,27,32-38,43,46,48,50,52,59,60,62,64,65,68-73]				
Cohabitation	19	12,483	++	Inconsistent
Poor relationship quality	11	4005	+++	[c]
Demographics				
Public insurance/uninsured[29,30,34,50,57,58]	6	2008	+++	[b]
Medicaid (US studies only)			+++	[b]
Socioeconomic status[56,59,64,69,73]	5	2805	[c]	[c]
Lower income[20,31,32,37-39,46,48,49,56,64]	11	6285	+	[b]
Unemployment[20,27,32,35,38,39,47,49,50,64,68,71-73]	14	9417	[c]	Inconsistent
Lower education[20,21,30,32-39,43,49,50,56,62,68,71-73]	20	11,529	+	[c]
Maternal age[20,22,30,32-39,43,46,48,49,59,62,64,67,68,71,73]	22	13,837	Inconsistent	[c]
Maternal race/ethnicity[29-42]	14	6671	Inconsistent	[c]
Substance abuse				
Smoking[30,32,33,36,38,41,54,56,57,59,71]	11	6641	+	[c]
Alcohol use[32,33,36,44,45,54,56,57,66,71]	10	10,621	Inconsistent	[c]
Illicit drug use[30,32,33,38,46,49,57,64]	8	3010	[c]	Inconsistent
Nulliparity[22,24,34-37,39,46-48,51,59,62,64,66,68,72,73]	18	9786	[c]	Inconsistent
Poor obstetric history[19,24,32,34,39,47,49,59,64,68]	10	6888	[c]	[c]

Based on Cohen's[17] definitions of standardized effect sizes: + = small association; ++ = small-to-medium association; +++ = medium association; ++++ = medium-to-large association. We did not summarize the multivariate body of evidence for the following potential risk factors: Anxiety: only 3 studies assessing anxiety and depressive symptoms used multivariate statistics. One of these studies did not provide an effect size, and another study did not provide a *P* value for the association. Daily hassles: only 3 high-quality studies assessed daily hassles in multivariate models, and one of these 3 did not give an effect size. Depression history: only 3 studies assessed a history of depression in multivariate models, and one of these studies did not provide an effect size. Pregnancy intent: our multivariate analysis was limited by a sample size of 3 studies, including one study that did not present an effect size. Insurance status: only 2 studies addressed insurance status in a multivariate model. Income: only 2 studies addressed income in multivariate models.

[a] Results were not pooled for meta-analysis but rather represent review of overall trend of evidence as described in "Materials and Methods"; [b] Could not give summary due to lack of sample size (see text for discussion); [c] No effect.

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In contrast to life events, Holm and Holroyd[77] noted that daily hassles represent "irritating, frustrating demands that occur during everyday transactions with the environment," such as work hassles and time pressures. Validated tools, such as the Daily Hassles Scale, have been developed to measure this construct.[78] Five studies assessed daily hassles in relation to antepartum depression.[30,52,56,57,69] Bivariate results demonstrated no significant relationship between daily hassles and antepartum depression.

Lifetime depression history

Six studies addressed the relationship between a history of depression and

depressive symptoms during pregnancy.[32,54,62,69,74] In bivariate analysis, a personal history of depression was significantly associated with an increased risk of antepartum depressive symptoms.

Social support

In total, >20 articles addressed the relationship between social support and depressive symptoms during pregnancy.[20,22,24,27,30-35,43,48,49,52,53,55-57,60,64,68,69,73] Seventeen studies assessed total social support from any source. On average, these studies demonstrated a medium correlation between a lack of social support and depressive symptoms. In multivariate analysis, the average effect size was small.

In addition, 9 studies specifically addressed intimate partner support. These studies demonstrated that a lack of partner support is also significantly associated with increased risk of depressive symptoms during pregnancy. In fact, lack of partner support showed 1 of the strongest associations in bivariate and multivariate analyses (medium-to-large effect).

Domestic violence

Overall, 7 studies addressed the relationship between a history of domestic violence and antepartum depression.[24,29,30,46,54,56,57,67] On average, bivariate studies showed a small association between domestic violence and depressive symptoms, and multivariate studies showed a small-to-medium association. In 1 study of 128 women, a history of abuse within the past year was associated with almost 2.5 times the odds of a positive screen for depression.[30]

Pregnancy intent

Six studies examined the association between pregnancy intention and depressive symptoms.[24,60,61,63,64,68] Unintended pregnancy showed a medium correlation with depressive symptoms in bivariate analysis.

Intimate relationships

Overall, 27 studies evaluated intimate relationships and their association with depression during pregnancy.[20,22,24,27,32-38,43,46,48,50,52,59,60,62,64,65,68-73] Nineteen studies specifically addressed relationship status. In bivariate analysis, noncohabitation status was significantly associated with an increased risk of depressive symptoms. However, in multivariate analysis, the results were inconsistent.

Eleven of the studies evaluated relationship quality. Overall, improved relationship quality was associated with a lower likelihood of depression in bivariate analysis, but it was not associated with depression in multivariate analysis.

Insurance status

Six studies compared insurance status in depressed and nondepressed pregnant women.[29,30,34,50,57,58] Five of these studies specifically compared women with Medicaid vs women with private insurance in the United States. In bivariate analysis, having Medicaid was significantly associated with a higher likelihood of depressive symptoms.

Socioeconomic status

Five studies assessed measures of composite SES, such as the Hollingshead Index (which considers occupation and education).[56,59,64,69,73] In bivariate and multivariate analyses, there was no significant association between SES and depressive symptoms.

Inconsistent results were found for 3 subcomponents of SES: income, employment, and education. Lower income had a small correlation with depressive symptoms in bivariate analysis. However, only 2 studies addressed income in multivariate models.[37,39] Lower educational attainment demonstrated a small association in bivariate studies, but it was not significantly associated with depressive symptoms in our multivariate analysis. Finally, unemployment was not significantly associated with depressive symptoms in bivariate analysis, and the research was inconsistent among multivariate studies.

Additional factors with inconsistent findings and null findings

The pools of evidence for several risk factors demonstrated inconsistent findings. These factors included smoking, alcohol use, illicit drug use, parity, maternal race/ethnicity, and maternal age. In addition, obstetric history (ie, spontaneous abortions, elective abortions, and fetal deaths in utero) was not significantly associated with depressive symptoms in bivariate or multivariate analyses.

Analyses of studies of all quality scores

We repeated our analyses with studies of all quality scores, including those studies that did not make the high-quality cutoff of a score ≥7. Our results did not significantly change for any potential risk factors, except for daily hassles. When analyzing studies of all quality scores, daily hassles were consistently related to an increased risk of depressive symptoms during pregnancy (bivariate trend of association: ++; multivariate trend of association: ++++).

Comment

In summary, our results highlight several important correlates of depressive symptoms during pregnancy, including maternal anxiety, life stress, prior depression, lack of social support, domestic violence, unintended pregnancy, relationship factors, and public insurance. Life stress, lack of social support, and domestic violence continued to be associated with antepartum depressive symptoms in multivariate analyses.

In general, our findings regarding antepartum depression are consistent with those of previous metaanalyses that evaluated postpartum depression.[5-8] However, while 2 of the postpartum metaanalyses[6,8] found an association between SES and postpartum depression, our review showed no association between composite SES measures and antepartum depression. This disparity could be due to the fact that their metaanalyses evaluated risk factors for postpartum depression, while our review focused on risk factors for depression during pregnancy. Also, the studies in our sample tended to compare SES within homogeneous patient populations. The lack of variability within each study sample could have decreased the power to detect an association. In addition, the power of our review to detect an association was limited by the fact that we did not use metaanalytic techniques. Third, the lack

of an association between SES and antepartum depression may be due to true mediators that explain this phenomenon, such as chronic stress.[69] Finally, SES may not be directly associated with antepartum depressive symptoms, but it may moderate the relationship between other risk factors and depression during pregnancy.

We were also surprised to find few multivariate studies assessing a history of depression. In postpartum reviews,[7,8] lifetime depression history has proven to be a potent risk factor for postpartum depression; and indeed, in bivariate analysis, our results demonstrated a significant relationship between a history of depression and depressive symptoms during pregnancy. Our multivariate analysis of depression history was limited by sample size, as we found only 3 high-quality studies that addressed this risk factor in multivariate models. Each of these 3 studies used a different method to assess for a history of depression, and none of the 3 used *Diagnostic and Statistical Manual of Mental Disorders* criteria. In addition, this body of evidence generally referred to a history of depression as occurring at any point in a woman's life. There were insufficient data to examine whether there is specific risk associated with a history of perinatal depression, such as a history of postpartum depression.

We should highlight several general limitations to the current body of evidence. First of all, there is significant heterogeneity among studies, including differences in the screeners that are used, the populations that are studied, the risk factors that are addressed, and the confounders that are controlled for in statistical analyses. In addition, only a third of the studies controlled for any confounders in a multivariate model. This heterogeneity limited our ability to summarize the evidence for any given risk factor and precluded the use of metaanalytic techniques.

In addition, most studies used depression screening tools but did not perform diagnostic assessments for depression. Studies also used different cutoff points on screening tools to determine clinically significant symptomatology. These limitations constrain our ability to determine the predictive validity of the risk factors studied.

Similarly, most studies in our sample were cross-sectional in design, limiting the ability to draw conclusions about the direction of causality. For example, a woman who is depressed during pregnancy may be more likely to recall the conception as unintended or may be more likely to view her social network as lacking.

In response to these limitations, we make several suggestions for future research. First of all, authors should attempt to use consistent screening tools so that cross-study comparisons evaluate similar outcomes. In addition, more studies should include diagnostic assessments for depression when examining risk factors. Such data would allow us to determine the predictive validity of using such risk factors in clinical practice. Finally, we need more longitudinal study designs to examine causality between potential correlates and depressive symptoms.

We should also point out several limitations to our analysis of these data. While we attempted to minimize publication bias by searching multiple databases and the grey literature (the body of materials that cannot easily be found through conventional channels; eg, dissertations, conference abstracts, and medical guidelines), it is possible that such a bias still existed. In addition, we limited our analysis to studies in English and in developed, mostly westernized countries. Therefore, our results are only generalizable to such populations. However, there is still cultural heterogeneity within these regions and this may have affected our results. Also, while we attempted to develop a valid quality assessment tool for the articles in our sample, the assessment of quality is inherently a subjective process. Finally, this is a systematic review of mostly observational studies. Due to the inherent nature of observational study design, we cannot ensure that all potential confounders were controlled for in studies with multivariate models.

Despite these limitations, our results demonstrate several correlates that are consistently related to increased risk of depressive symptoms during pregnancy. As major depression affects up to 12.7% of our prenatal population[1] and ACOG recommends routine depression screening for all pregnant patients,[2] it is imperative that obstetric providers are educated about identifying antepartum depression. Our results are important for practicing clinicians because they identify risk factors that can be assessed during routine obstetric care. For current practice, providers should especially consider the likelihood of depressive symptoms in women with these risk factors, such as report of domestic violence or a lack of social support during pregnancy. Reminder boxes for history of depression and domestic violence are included in the ACOG Antepartum Record.[13] Future work should address how well our current obstetric screening forms capture these constructs and how we can use risk factor identification to improve screening efficiency and accuracy and to enhance our clinical assessments during pregnancy. For example, future research studies could evaluate the likelihood of major depressive disorder in women with positive depression screens that do or do not have these additional risk factors. ■

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Appendix

Search strategy

Database	Search terms	Yield
PubMed	"Depressive disorder" OR "depression" AND "mass screening" OR "psychiatric status rating scales" OR "questionnaires" AND "prenatal care" OR "postpartum period" OR "pregnancy"	620
CINAHL	"Depression+" AND "diagnosis+" AND "pregnancy+" OR "postnatal period+" OR "postnatal period+" OR "prenatal care" OR "prenatal diagnosis+"	339
SCOPUS	"Screening" AND "depression" AND "pregnancy" OR "prenatal"	232
PsycINFO	"Screening+" OR "screening tests+" AND "pregnancy+" OR "prenatal care+" OR "postnatal period" AND "depression+"	41
Sociological Abstracts	"Depression" OR "depressive disorder" OR "postpartum depression" AND "pregnancy" OR "antenatal" OR "postpartum" AND "screening"	39
ISI Proceedings	"Preg*" AND "dep*" AND "screen*"	79
ProQuest Dissertations and Theses	IF (depression OR depression screening) AND IF (pregnancy)	11

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