Predictors of Postpartum Depression

An Update

Cheryl Tatano Beck

- ***Background:*** Approximately 13% of women experience postpartum depression. Early recognition is one of the most difficult challenges with this mood disorder because of how covertly it is suffered.
- ***Objectives:*** The purpose of this meta-analysis was to update the findings of an earlier meta-analysis of postpartum depression predictors that had synthesized the results of studies conducted mostly in the 1980s.
- ***Method:*** A meta-analysis of 84 studies published in the decade of the 1990s was conducted to determine the magnitude of the relationships between postpartum depression and various risk factors. Using the software system Advanced Basic Meta-Analysis, effect sizes were calculated three ways: unweighted, weighted by sample size, and weighted by quality index score.
- ***Results:*** Thirteen significant predictors of postpartum depression were revealed. Ten of the 13 risk factors had moderate effect sizes while three predictors had small effect sizes. The mean effect size indicator ranges for each risk factor were as follows: prenatal depression (.44 to .46), self esteem (.45 to. 47), childcare stress (.45 to .46), prenatal anxiety (.41 to .45), life stress (.38 to .40), social support (.36 to .41), marital relationship (.38 to .39), history of previous depression (.38 to .39), infant temperament (.33 to .34), maternity blues (.25 to .31), marital status (.21 to .35), socioeconomic status (.19 to .22), and unplanned/unwanted pregnancy (.14 to .17).
- ***Conclusions:*** Results confirmed findings of an earlier meta-analysis and in addition revealed four new predictors of postpartum depression: self-esteem, marital status, socioeconomic status, and unplanned/unwanted pregnancy.

- ***Key Words:*** meta-analysis • postpartum depression • risk factors

Postpartum depression has been described as a dangerous thief that robs women of precious time together with their infants that they had been dreaming of throughout pregnancy (Beck, 1999). Approximately 13% of women experience this crippling mood disorder sometime during the first year after delivery (O'Hara & Swain, 1996). In addition to the personal suffering of the mothers, postpartum depression can have more insidious consequences, such as disturbed mother-infant relationships and impaired cognitive and emotional development of the children (Beck, 1995). A significant factor in the duration of postpartum depression is the length of delay to adequate treatment (England, Ballard, & George, 1994).

Preventive measures, early identification and treatment can alleviate months of suffering from postpartum depression for a woman and minimize its potentially harmful effects on her infant. Early recognition is one of the most difficult challenges with this mood disorder because of how covertly it is suffered. The social stigma associated with postpartum depression often blocks mothers from seeking professional help they so desperately need. In order to prevent this, mothers who are at risk for developing this mood disorder need to be identified early, preferably during pregnancy. Identification of a woman's risk factors or predictors that have been reported to increase the probability of developing postpartum depression is crucial. Interventions can then be initiated before the onset of postpartum depression in hopes of preventing this debilitating mood disorder.

In 1996 two meta-analyses had been conducted to determine the magnitude of the relationship between significant risk factors and postpartum depression (Beck, 1996a; O'Hara & Swain, 1996). Since then, the amount of research on risk factors for postpartum depression has dramatically increased. As a result of these recent studies, two questions needed answers: (a) Have new predictors been identified? and (b) Has the strength of the magnitude of previous risk factors changed? To answer these questions and provide an update on this expanding body of knowledge, another meta-analysis was conducted.

Theoretical Framework: Sichel and Driscoll's (1999) earthquake model for conceptualizing women's mental health and the treatment of women provided an organizing

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framework for conducting this meta-analytic review. This model explains why a woman's unique brain and hormone chemistry result in her vulnerability to mood disorders at critical times in her life, such as after the birth of a baby. Depression can result from a process of long-term biochemical "loading" as a woman's brain repeatedly responds to stress in her life. Sichel and Driscoll suggest that a woman's genetic makeup, hormonal and reproductive history, and life experiences all combine to predict her risk of "an earthquake" which occurs when her brain cannot stabilize and mood problems erupt. The analogy of an earthquake with its tremors, viewed as ominous precursors, is used to anticipate the impact of a woman's stress and reproductive hormones on her brain biochemistry. An earthquake results when the internal pressures on the weakened fault line become overwhelming and the fault line gives way to relieve this intense pressure. Sichel and Driscoll equate a woman's basic brain biochemistry to the fault line underneath the earth's crust. Stressful life events and/or hormonal events can disrupt the delicate balance of brain biochemistry resulting in an emotional earthquake, such as postpartum depression. Sichel and Driscoll (1999) acknowledge that in a woman's life the postpartum period is an especially high-risk period for the emergence of a mood disorder. Their model allows for a wide breadth of risk factors such as previous episodes of depression, history of difficult life events, a family history of psychiatric disorders, the unique life stress of having a baby, the massive hormonal shift and maternity blues.

Review of the Literature: Beck (1996) conducted a meta-analysis of 44 studies to determine the magnitude of the relationships between various predictor variables and postpartum depression. The strongest predictor of this mood disorder was prenatal depression, which had a large effect size (r = . 51). Moderate effect sizes were revealed for the relationships between postpartum depression and the following predictors: childcare stress (r = . 48), life stress (r = . 40), social support (r = . 38), prenatal anxiety (r = . 35), maternity blues (r = . 36), and martial satisfaction (r = . 35). Lastly, history of previous depression was shown to have a small effect size (r = .29) when determining its relationship with postpartum depression. In a different meta-analysis (Beck, 1996b) infant temperament was also revealed to be a significant predictor of postpartum depression.

A significant factor in the duration of postpartum depression is the length of delay to adequate treatment

In addition to Beck's (1996a, 1996b) meta-analyses, one other meta-analysis of predictors of postpartum depression had been conducted. Using the DSTAT (Johnson, 1992) computer package, O'Hara and Swain (1996) determined the effect sizes of a number of risk factors for postpartum depression that had been measured during pregnancy. Effect sizes were reported as Cohen's d indicators, with a d of .2 indicating a weak relationship, .4 indicating a moderate relationship, and .8 or more indicating a strong relationship (Cohen, 1988).

O'Hara and Swain (1996) reported that the strongest predictors of postpartum depression were prenatal depression (d = .75), prenatal anxiety (d = .68), social support (d = -.63), life events (d = .60) and mother's history of psychopathology (d = .57). The meta-analysis revealed the following three predictors that had small, significant relationships with postpartum depression: neuroticism (d = .39), negative cognitive attributional style (d = .24) and obstetric variables (d = .26).

Method

Research Questions

1. What is the magnitude of the relationship between postpartum depression and each of the following predictor variables: prenatal depression, self esteem, childcare stress, prenatal anxiety, life stress, social support, marital relationship, history of depression, infant temperament, maternity blues, marital status, socioeconomic status (SES), and unplanned/unwanted pregnancy?
2. To what extent are the effect sizes of these predictor variables correlated with the following methodological variables: sample size, quality index, and postpartum depression measurement?
3. How do the effect sizes of these predictor variables compare with those reported in Beck's (1996a, 1996b) previous meta-analyses?

Sample: Cooper's (1982) five approaches were used to retrieve the sample of studies for this meta-analysis: the ancestry approach, descendancy approach, on-line computer search, informal contacts at professional research conferences, and abstracting services.

The following on-line databases were searched for the 10-year period between 1990-2000: CINAHL, Medline, Psych Info, Eric, Popline, Social Work Abstract, Sociological Abstracts, Dissertation Abstracts and JREF. Examples of search terms used included postpartum depression, postnatal depression, puerperal depression, predictors, and risk factors.

The four inclusion criteria for the meta-analysis included: (a) the study assessed the relationship between postpartum depression and predictor variables; (b) this mood disorder was measured after 2 weeks postpartum to comply with DSM-IV (APA, 1994) diagnostic criteria and also to avoid inadvertently measuring maternity blues; (c) adequate statistics were present in the results section of the study to allow meta-analytic calculations; and (d) if an F or χ^2 statistic was used to analyze data, a degree of freedom equal to 1 was necessary to avoid unfocused, general comparisons between several means (Mullen, 1989).

A total of 107 potential studies were located. Eighty-four studies met the sample criteria. Twenty-three studies

were excluded from the meta-analysis due to postpartum depression measurements prior to 2 weeks after delivery ($N = 5$) and to insufficient statistics or to χ^2 or F test with a degree of freedom greater than 1 ($N = 18$).

Procedure Codebook: A revised version of the meta-analysis codebook for postpartum depression studies developed by Beck (1995) was used to code the extracted methodologic, substantive, and miscellaneous variables from each study. Methodologic variables coded focused on sampling, research design, statistics, measurement of postpartum depression and predictors. Coded substantive variables included age, parity, marital status, ethnicity, education, socioeconomic status, and employment. The following were some miscellaneous variables that were coded: publication type (i.e., journal article, book chapter, dissertation, masters thesis), publication date, source derivation (i.e., on line computer search, library browsing, networking, references at end of an article), funding, and country. Both the researcher and a research assistant coded these variables independently for a random sample of 25% ($N = 20$) of these studies, and an initial interrater agreement ranging from 85% to 100% was reached. Interrater agreement was tested only one time. Once a disagreement was noted, it was immediately discussed between the researcher and the research assistant till a consensus was reached between the two raters.

Depression can result from a process of long-term biochemical "loading" as a woman's brain repeatedly responds to stress in her life

Quality Index: The quality of each study included in the meta-analysis was assessed by a modification of the scoring index developed for evaluating research on postpartum depression (Beck, 1995). The highest possible score that a study can achieve is 32 on the Quality Index. The revised quality index consisted of 11 criteria. First author expertise was scored as 1 (a bachelor's or master's degree was the highest degree held), 2 (PhD, MD or other doctoral degree was the highest degree held), or 3 (doctoral degree plus published multiple studies on postpartum depression as the first author). A score of 1 was assigned to a study if it had received funding, and a 0 was assigned if it had not received funding. Sampling was scored as 1 (convenience), 2 (matched), or 3 (random). Sample size was scored as 1 (1–50 subjects), 2 (51–100 subjects), or 3 (more than 100 subjects). Both criteria of postpartum depression instrument's reliability and validity and predictor instrument's reliability and validity were scored as 0 (no mention of reliability and validity), 1 (mention of only previous reliability and/or validity), 2 (addressed reliability or validity in current study), or 3 (addressed reliability and validity in current study).

Postpartum depression measurement was scored as 1 (self-report), 2 (unstructured interview), 3 (diagnosis based on DSM/RDC criteria), or 4 (a combination of 1 & 3). In regards to postpartum depression type, a study was assigned a score of 1 if it only measured depressive symptomatology. If a diagnosis of postpartum depression was made, a score of 2 was achieved. Research design was scored as 1 (descriptive), 2 (correlational), 3 (quasi-experimental), and 4 (experimental). Time dimensional design was assessed as 1 (cross sectional) or 2 (longitudinal). Data analysis was scored a 1 (only descriptive statistics were used), 2 (nonparametric statistics were used), 3 (bivariate statistics were used), or 4 (multivariate statistics were used).

Data Analysis: The meta-analysis was conducted using a software system called Advanced Basic Meta-Analysis (Mullen, 1989). This software calculated the general combinations and comparisons of significance levels and effect sizes in three ways: unweighted, weighted by sample size and weighted by quality index score.

Cohen's (1988) conventional operational definitions of small, medium, and large effect sizes were used to interpret the findings. When using r as the effect size indicator, $r = .10$ is considered small, $r = .30$, a medium effect size, and $r = .50$, a large size.

Multiple operationism of the predictors and of postpartum depression was used in this meta-analytic review. In multiple operationism, several measures that are supposed to measure the same theoretical construct but have differing patterns of error variance are included in a meta-analysis (Webb, Campbell, Schwartz, Sechrest, & Grove, 1981). Multiple operationism can strengthen a meta-analysis because its findings may not be contaminated by one specific pattern of error variance (Cooper, 1984)

One source of non-independence in a meta-analysis can result from using multiple hypothesis tests based on multiple predictor measurements obtained from a single study (Strube & Hartman, 1983). In this meta-analysis, if multiple measures of the relationship between a predictor and postpartum depression were found within a single study, the various findings were collapsed into a single global hypothesis test as suggested by Mullen (1989). A mean effect size correlation was calculated based on the average correlation from a single study (Steinkamp & Maehr, 1983).

Results

Sample: The total sample consisted of 84 studies published between 1990-—1999. Fifty-four (64%) of the studies were journal articles, 28 (34%) were unpublished dissertations, and two studies were unpublished master's theses. Forty-four studies (52%), took place in the United States, 11 (13%) in Canada, 7 (8%) in the United Kingdom, 3 (4%) in New Zealand, two each in Australia, South Africa, Ireland, and France and one each in Japan, Belgium, Portugal, United Arab, Israel, Switzerland, Brazil, China, Nigeria, Netherlands, and Finland. Thirty-seven (44%) of studies were funded while 47 (56%) did not receive funding.

The measurement approach for postpartum depression was based on self-report of depressive symptomatology in 68 (81%) of the studies. Only 16 (19%) of the studies used

TABLE 1. Profile Statistics of the Postpartum Depression Predictors Meta-Analysis

Predictor	Number of studies	Total subjects	Fail-safe *N*	Homogeneity test (diffuse comparison of effect sizes) χ^2	1-Tailed *p*	95% confidence intervals
Social support	27	2,692	3,493	31.78	.20	0.362–0.442
Prenatal depression	21	2,305	3,540	26.97	.14	0.435–0.519
Life stress	16	2,324	1,749	16.71	.34	0.352–0.436
Marital relationship	14	1,554	1,188	18.78	.13	0.358–0.460
Depression history	11	991	464	13.53	.20	0.341–0.481
Infant temperament	10	1,056	431	6.38	.70	0.283–0.405
Socioeconomic status	8	1,732	184	4.77	.69	0.021–0.215
Childcare stress	7	789	395	9.56	.14	0.420–0.566
Self esteem	6	570	274	6.36	.27	0.403–0.571
Unplanned/unwanted pregnancy	6	1,199	52	3.59	.61	0.083–0.197
Maternity blues	5	643	69	5.63	.23	0.168–0.332
Prenatal anxiety	4	428	96	2.65	.45	0.331–0.531
Marital status	3	580	26	2.78	.25	0.140–0.284

a formal diagnostic assessment. A longitudinal research design was overwhelmingly used in 67 (80%) studies while 17 (20%) studies employed a cross sectional design. Seventy-six (90%) studies used convenience sampling, 5 (6%) random sampling, and 3 (4%) matched pairs.

Postpartum Depression Measurement: In the studies included in this meta-analysis, depressive symptomatology was most often measured ($N = 30$; 36%) by the Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987), followed in frequency by the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) in 24 (29%) studies, and the Center for Epidemiological Studies - D Scale (Radloff, 1977) in 16 (19%) studies. An array of other self-report instruments were used each in only a couple of studies, such as the Zung's Self Rating Depression Scale (Zung, 1965) and the Hamilton Rating Scale for Depression (Hamilton, 1960). In the studies that actually did a formal diagnostic assessment of postpartum depression, the most frequently used interview was the Schedule for Affective Disorders and Schizophrenia (Endicott & Spitzer, 1978).

Predictors: The meta-analysis revealed 13 significant predictors of postpartum depression. Profile statistics for each of these 13 subsets of predictor studies in the meta-analysis are located in Table 1. For each subset the number of studies, total subjects, fail-safe number, homogeneity tests and 95% confidence intervals are reported.

The fail-safe number refers to the minimum number of unpublished studies reporting nonsignificant findings that would be needed to overturn the conclusion reached in a specific meta-analysis (Rosenthal, 1979). A fail-safe number addresses the file drawer problem in which the possibility that unknown, unpublished studies might exist whose results fail to confirm the trend identified by the published findings. Rosenthal (1984) and Rosenthal and Hall (1981) have suggested that a reasonable tolerance for dismissing the file drawer problem is achieved if the fail-safe number exceeds $5 K + 10$ (K = the number of studies included in the meta-analysis). In this meta-analysis, a reasonable tolerance level was achieved for the fail-safe numbers for each the 13 subsets of predictor studies.

Homogeneity tests were conducted to identify any outliers in each of the 13 subsets of studies in this meta-analysis. To quantitatively combine separate studies in meta-analyses, it is assumed that each study provides a sample estimate of the effect size that is representative of the population effect size (Wolf, 1986). If a group of individual studies provides a homogeneous estimate of the effect size, it is more likely that these separate studies are testing the same hypothesis. A nonsignificant homogeneity test indicates that no outliers are present. If these estimates are heterogeneous, it may not be appropriate to combine all these individual studies in one meta-analysis. A significant homogeneity test indicates that outliers are present. Once the outliers are identified, they can be removed one at a time and then the homogeneity test can be recalculated with the remaining studies. Once a nonsignificant homogeneity statistic is achieved, the effect sizes of the remaining studies are then combined to calculate a mean effect size. Wolf (1986) suggests conducting separate meta-analyses for different subsets of the deleted studies if these outliers are homogeneous. In this meta-analysis, whenever more than one outlier was identified in a predictor subset, a second meta-analysis for that predictor subset was calculated with just these outliers. None of these secondary meta-analyses for outliers were found to be homogeneous.

A 95% confidence interval around the average effect size was computed to determine if it encompassed zero or

TABLE 2. Significance Levels and Effect Sizes for Each of the 13 Predictors of Postpartum Depression

	Significance levels		Effect sizes
Predictor	**Z for combination**	**Associated 1-tailed *p***	**Mean *r***
Prenatal depression			
Unweighted	21.42	0	.45
Weighted by sample size	20.86	0	.44
Weighted by quality	21.49	0	.45
Self esteem			
Unweighted	11.24	1.86 E-24	.47
Weighted by sample size	10.87	2.08 E-23	.45
Weighted by quality	11.27	1.54 E-24	.46
Childcare stress			
Unweighted	12.46	8.84 E-28	.46
Weighted by sample size	12.68	2.27 E-28	.46
Weighted by quality	12.50	7.12 E-28	.45
Prenatal anxiety			
Unweighted	8.21	1.02 E-15	.45
Weighted by sample size	7.95	5.56 E-15	.41
Weighted by quality	8.35	4.02 E-16	.45
Life stress			
Unweighted	17.28	2.63 E-39	.40
Weighted by sample size	16.03	1.48 E-36	.38
Weighted by quality	17.60	5.39 E-40	.40
Social support			
Unweighted	18.78	2.00 E-42	.41
Weighted by sample size	17.77	2.34 E-40	.36
Weighted by quality	18.78	2.02 E-42	.40
Marital relationships			
Unweighted	15.24	9.68 E-35	.39
Weighted by sample size	15.13	1.71 E-34	.39
Weighted by quality	15.15	1.55 E-34	.39
Depression history			
Unweighted	10.81	3.02 E-23	.39
Weighted by sample size	11.15	3.61 E-24	.39
Weighted by quality	10.90	1.65 E-23	.38
Infant temperament			
Unweighted	10.93	1.39 E-23	.34
Weighted by sample size	10.68	7.15 E-23	.33
Weighted by quality	11.01	8.13 E-24	.34
Maternity blues			
Unweighted	6.34	1.63 E-10	.31
Weighted by sample size	5.02	2.74 E-07	.25
Weighted by quality	6.31	6.31 E-10	.31
Marital status			
Unweighted	5.10	1.75 E-07	.25
Weighted by sample size	4.53	2.93 E-06	.21
Weighted by quality	5.12	1.65 E-07	.25
Socioeconomic status			
Unweighted	8.07	2.58 E-15	.22
Weighted by sample size	7.01	2.64 E-12	.19
Weighted by quality	8.08	2.42 E-15	.22
Unplanned/unwanted pregnancy			
Unweighted	5.13	1.52 E-07	.16
Weighted by sample size	4.54	2.80 E-06	.14
Weighted by quality	5.17	1.25 E-07	.17

not (Wolf, 1986). If this interval does not contain $r = 0$, the null hypothesis that no relationship exists between postpartum depression and a specific predictor can be rejected. As can be seen in Table 2, none of the confidence intervals in this meta-analysis contained zero.

Out of the 13 significant risk factors for postpartum depression, 10 of these predictors had moderate r effect sizes: (a) prenatal depression, (b) self-esteem, (c) childcare stress, (d) prenatal anxiety, (e) life stress, (f) social support, (g) marital relationship, (h) history of depression, (i) infant temperament, and (j) maternity blues (see Table 2). Three predictors had small r effect sizes: marital status, SES and unplanned/unwanted pregnancy.

The strongest predictors of postpartum depression were prenatal depression, self-esteem, childcare stress, and prenatal anxiety. The effect sizes of these four risk factors closely approached Cohen's (1988) cut off for a large effect size. The three risk factors of maternity blues, childcare stress, and infant temperament were specific to only the postpartum period while the other 10 predictors were also operant during pregnancy.

Prenatal Depression: In 21 studies prenatal depression was examined to determine its relationship with postpartum depression. Quality index scores ranged from 16–25 with a mean of 18.9. Three studies were deleted in order for the homogeneity test for effect sizes to be nonsignificant (Brugha et al., 1998; Elliott et al., 1996; Gotlib, Whiffen, Wallace, & Mount, 1991). As indicated in Table 2, the r effect sizes indicated that the relationship between prenatal and postpartum depression was in the range of a medium effect size ($r = .44$ to .45).

The four new predictors identified in this replication meta-analysis included low self-esteem, single marital status, low socioeconomic status, and unplanned/unwanted pregnancy

Self-Esteem: The relationship between self-esteem and postpartum depression was investigated in six studies. The quality index scores of these six studies combined in the meta-analysis ranged from 16 to 21, with a mean of 18.7. The homogeneity test was nonsignificant once two outliers were deleted (Nieland & Roger, 1997; Olioff & Aboud, 1991). As indicated in Table 2, when r was the effect size indicator, the relationship between self-esteem and postpartum depression was considered to be a medium effect size, with a mean r ranging from .45 to .47.

Childcare Stress: The correlation between childcare stress and postpartum depression was examined in seven studies in this meta-analysis. The quality index scores ranged from 16 to 25, with a mean of 19.4. Two studies were identified as outliers (Bernazzani et al., 1997; Aderibegbe et al., 1993). They were deleted in order to obtain a nonsignificant homogeneity test (see Table 1). A moderate effect size was obtained in the meta-analysis between childcare stress and postpartum depression. When unweighted and weighted by sample size, the mean r was .46. When weighted by quality, it was .45. The magnitude of the relationship between childcare stress and postpartum depression co-varied significantly with the predictor of postpartum depression type ($r = -.67$, $P = .01$). This significant, negative correlation indicated that studies in which postpartum depression was diagnosed had smaller effect sizes than studies in which only depressive symptomatology was measured.

Prenatal Anxiety: Four studies were combined to investigate the magnitude of prenatal anxiety as a predictor of postpartum depression. One study was deleted in order for the homogeneity test for effect sizes to be nonsignificant (Righetti-Veltema, Conne-Perreard, Bousquet, & Manzano, 1998). The range of quality index scores was 17–20, with a mean of 18. A moderate effect size was obtained in the meta-analysis between prenatal anxiety and postpartum depression (see Table 2). Depending on whether the effect sizes were weighted or unweighted, the mean r ranged from .41 to .45.

Life Stress: Life stress as a risk factor was investigated in 16 studies. Two studies were identified as outliers (Carro et al., 1993; Lesser, 1997). When they were deleted from the subset, the homogeneity test was nonsignificant. The quality index range of the 16 studies combined in this subset was 16–26, with a mean of 19.3. A moderate effect size ranging from $r = .38$ to .40 was revealed in the meta-analysis between life stress and postpartum depression (see Table 2). The magnitude of the relationship between this risk factor and postpartum depression co-varied significantly with the variable of sample size ($r = .27$, $P = .04$). As the sample size increased in the studies, the effect size decreased.

Social Support: Social support as a predictor of postpartum depression was examined in 27 studies. The range of quality index scores was 13 to 26, with a score of 18.2 as the mean. Only one outlier was discovered (Fisch et al., 1997) and once it was deleted from the subset, the homogeneity test was nonsignificant. As indicated in Table 2, when r was the effect size indicator, the relationship between social support and postpartum depression can be considered in the range of a moderate effect size. The mean r ranged from .36 to .41.

Two variables co-varied significantly with the magnitude of the relationship between social support and postpartum depression. These variables were sample size ($r = -.48$, $P = .001$) and quality index ($r = -.42$, $P = .01$). These correlations indicate that as sample size and the quality of studies increased, the effect size decreased.

Marital Relationship: Marital relationship as a risk factor was investigated in 14 studies that were aggregated in this meta-analysis. The homogeneity test became nonsignificant once three outliers were deleted from the subset (Gotlib, et al., 1991; Spangenberg & Pieters, 1991; Web-

ster, Thompson, Mitchell, & Werry, 1994). The quality index scores of the 14 studies ranged from 17–26, with a mean of 19.6. The meta-analysis computations revealed a moderate relationship between marital relationship and postpartum depression, with a mean r effect size of .39. Postpartum depression type (diagnosis vs. symptomatology) significantly co-varied with the magnitude of the relationship between marital relationship and this mood disorder ($r = -.36$, $P = .02$).

History of Depression: In this meta-analysis, history of depression as a risk factor for postpartum depression was assessed by combining the results of 11 studies. Once three studies were deleted, the homogeneity test was nonsignificant (Appleby et al., 1994; Campbell, Cohn, Flanagan, Popper, & Meyers, 1992; Webster et al., 1994). The quality index scores of the 11 studies ranged from 15 to 25, with a mean of 19.2.

A moderate r effect size for the relationship between a history of depression and postpartum depression was revealed. When unweighted and weighted by sample size, the mean r was .39. It was .38 when weighted by quality index.

Infant Temperament: After deleting two studies as outliers (Corrigan, 1996; Gotlib et al., 1991), 10 studies were combined to determine the magnitude of the relationship between infant temperament and postpartum depression. The range of the quality index of these studies was 17–26, with 19.3 as the mean. As indicated in Table 2, when *r* was used as the effect size indicator, infant temperament was moderately related to postpartum depression. The mean *r* effect size ranged from .33 to .34.

Maternity Blues: Five studies were combined to determine the magnitude of the relationship between maternity blues and postpartum depression. No outliers were found when the homogeneity test was run. The quality index range was 17–20, with a mean of 18.4. The meta-analysis revealed a moderate *r* effect size for the relationship between the blues and postpartum depression. When unweighted and weighted by quality index, the mean *r* was .31. The mean *r* decreased to .25 when weighted by sample size.

Both sample size ($r = -.88$, $P = .03$) and postpartum depression type ($r = -.86$, $P = .01$) significantly co-varied with the magnitude of the relationship between maternity blues and postpartum depression. As the sample size increased in these studies, the effect size decreased. Also, the effect size was smaller in studies where a diagnosis of postpartum depression was made rather than just identifying depressive symptomatology.

Marital Status: Marital status as a predictor of postpartum depression was examined in three studies. Their quality index scores ranged from 13 to 17, with 15.7 as the mean. One outlier was deleted and once removed from the subset, the homogeneity test became nonsignificant (Morton, 1999). A small *r* effect size for the relationship between marital status and postpartum depression was shown in this meta-analysis (see Table 2). The mean *r* effect sizes ranged from .21 to .25.

Socioeconomic Status: In eight studies the risk factor of socioeconomic status for postpartum depression was examined. The quality index scores for these eight studies ranged from 16 to 20, with a 17.7 as the mean. No outliers were identified in this subset of SES studies. As indicated in Table 2, when *r* was used as the effect size indicator, the relationship between SES and postpartum depression was in the range of a small effect size (.19 −.22).

Unplanned/Unwanted Pregnancy: Six studies were combined in this meta-analysis, which had investigated unplanned or unwanted pregnancy as a predictor of postpartum depression. No outliers were found in this subset of studies. The range of quality index scores was 16 to 26, with a mean of 19.3. A small relationship was indicated between unplanned or unwanted pregnancy and postpartum depression. Depending on the unweighting or weighting of the study, the mean *r* effect size ranged from .14 to .17.

Discussion

All 13 significant predictors of postpartum depression identified through this meta-analysis fit under the umbrella of Sichel and Driscoll's (1999) earthquake model. These risk factors can repeatedly weaken a mother's fault line placing her in a dangerous position for an emotional earthquake. Ten of these predictors were considered to have a moderate predictive relationship to this crippling mood disorder while three predictors had a small predictive relationship. The results of this meta-analysis confirmed Beck's (1996a; 1996b) earlier meta-analytic findings and in addition revealed four new significant predictors of postpartum depression. These confirmed predictors include prenatal depression, childcare stress, life stress, prenatal anxiety, low social support, maternity blues, low marital satisfaction, history of depression, and difficulty infant temperament. The strengths of these predictive relationships were similar to Beck's previous meta-analyses except for the two predictors of prenatal depression and depression history. In this replicated meta-analysis, the strength of prenatal depression decreased slightly from what was considered a large ($r = .51$) relationship with postpartum depression to a moderate ($r = .46$) one. The predictor of depression history prior to this pregnancy increased in strength from Beck's (1996a) earlier meta-analysis where it was considered to have a small ($r = .29$) predictive relationship to a moderate ($r = .38$) relationship in this current meta-analysis. The four new predictors identified in this replication meta-analysis included low self-esteem, single marital status, low socioeconomic status, and unplanned/unwanted pregnancy.

This replicated meta-analysis also confirmed some findings from O'Hara and Swain's (1996) meta-analysis. O'Hara and Swain reported that the strongest predictors of postpartum depression were past history of psychopathology, psychiatric disturbance during pregnancy, poor marital relationship, low social support, and stressful life events. They also identified that low social status showed a small but significant predictive relationship. Three predictors that displayed significant relationships

with postpartum depression in this replication meta-analysis that were not found in O'Hara and Swain's meta-analytic review were self-esteem, single marital status, and unplanned/unwanted pregnancy.

The focus of this discussion turns now to the four new predictors that were revealed in this updated meta-analysis. Two of these new predictors of postpartum depression are demographic variables: marital status and socioeconomic status. These characteristics help to sketch out a beginning demographic profile of vulnerable women who tend to be unmarried and have low household incomes. These women at risk for postpartum depression may experience a number of stressors such as financial difficulties, related to their demographic status that is exacerbated after childbirth. Single mothers of low income may have fewer resources to draw upon to manage the transition to motherhood.

An unplanned or unwanted pregnancy was another new predictor of postpartum depression. An unplanned pregnancy did not automatically mean, however, it was an unwelcome pregnancy. Even if the surprise pregnancy was a welcome one, women still had to cope with the ramifications of this unplanned event that would affect the rest of their lives.

Based on research in the 1990s, self-esteem has emerged not only as a new, significant predictor of postpartum depression but also as one of the strongest predictors. Self-esteem, with its emphasis on feelings of self worth, buffers the negative effects of stressful life events (Orozco, 1995). Mothers with high levels of self-esteem have the ability to withstand stressors that may jeopardize this sense of self-worth and contribute to the development of postpartum depression. Clinicians though should not to be lulled into a false sense of security if a mother does possess a high level of self-esteem. In their model of women's mental health, Sichel and Driscoll (1999, p. 198) warn that the postpartum period "is a fragile time for the self-esteem of the ablest of women and is made much worse by the occurrence of a depression."

The 13 significant predictors of postpartum depression that were identified in this replicated meta-analysis can be used by clinicians as markers or red flags that a woman may be at risk for developing this crippling mood disorder. Specific interventions can then be designed to fit the profile of risk factors for each individual woman. ▼

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