Changes in Depressive Symptoms over 0–9 Months Postpartum

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Abstract

Objective: To investigate mothers' changes in prevalence of postpartum depression (PPD) symptoms over 0–9 months postpartum and determine which symptoms best distinguish depressed from nondepressed women.

Methods: This was a prospective study of English-literate mothers of newborns, recruited from four family medicine clinics and three pediatric clinics. Mothers completed surveys at 0–1, 2, 4, 6, and 9 months postpartum, and surveys included demographic characteristics, a two-question depression screen, the 9-Item Patient Health Questionnaire (PHQ-9), and other health and work characteristics.

Results: There were 506 participants (33% response rate), and 112 (22.1%) had a positive PHQ-9 (score ≥ 10) at some time within the first 9 months after delivery. The proportion of women with a positive PHQ-9 was greatest at 0–1 month (12.5%), then fell to between 5.0% and 7.1% at 2–6 months, and rose again to 10.2% at 9 months postpartum. Most of the PHQ-9 symptoms differentiated well between depressed and nondepressed women; items that were less discriminating were abnormal sleep, abnormal appetite/eating, and fatigue. Assessment of possible predictors of a change from negative to positive PHQ-9 between 6 and 9 months postpartum revealed only one significant predictor: prior history of depression.

Conclusions: Depressive symptoms in this sample were most frequent at 0–1 month and 9 months postpartum. Most PHQ-9 items differentiated well between depressed and nondepressed mothers; these findings support the use of the PHQ-9 for PPD screening. Future research is needed to confirm our observed secondary peak in depressive symptoms at 9 months postpartum and to investigate possible causes.

Introduction

DEPRESSIVE SYMPTOMS are relatively common in the postpartum period. They surface transiently with the blues in up to 80% of mothers¹ and become more severe and prolonged in the estimated 22% of mothers who develop postpartum depression (PPD).² The reported prevalence of PPD varies depending on one's definition of depression (e.g., major vs. minor), the method of diagnosis (e.g., self-report measure vs. criterion standard), characteristics of the population being studied, and the period of time studied (e.g., period vs. point prevalence and length of time after delivery). Point prevalence is based on a single measurement, at one point in time, and tends to underestimate the total frequency of depression. If repeated or continuous assessments of the same individual are possible, a more accurate measure is the

period prevalence, defined as the proportion of a population that is depressed at any time within a stated period.³

The best estimates for PPD prevalence come from large studies or systematic reviews of studies that use a criterion standard (diagnostic interview or survey) for PPD diagnosis. The meta-analysis by Gaynes et al.² of 28 prospective and 2 retrospective studies published from the 1980s through 2003 (total $n > 15,000$), all of which used criterion-based depression diagnoses, found best estimates for 6-month and 12-month period prevalence rates for major PPD to be 6.5% and 21.9%, respectively. Point prevalence rates for major depression at various intervals were 3.8% at 1 month, 5.7% at 2 months, 4.7% at 3 months, 5.6% at 6 months, 1.0% at 8 months, and 3.9% at 12 months postpartum.² Unfortunately, each of the 6–12-month prevalence estimates cited here was based on one or two studies, some of which were relatively small. Also,

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previous studies have tended to look at PPD prevalence rates in earlier rather than later postpartum intervals, as illustrated by a recent study where the prevalence of positive Edinburgh Postnatal Depression Scale (EPDS) screens in 199 mothers at various time intervals was 17% at 2 weeks, 16.5% at 2 months, 10.3% at 4 months, and 18.5% at 6 months postpartum.⁴

Previous PPD prevalence research has been complicated by a lack of simple, easy to use diagnostic instruments, so that researchers have been left with the choice of basing depression diagnoses either on nondiagnostic screens (e.g., the EPDS) or on more time-intensive and labor-intensive diagnostic interviews. Over the past decade, researchers have welcomed the 9-Item Patient Health Questionnaire (PHQ-9) into the field of general depression research as a valid, efficient screening/diagnostic survey that consists of the 9 symptoms that constitute the diagnosis of depression.⁵ The PHQ-9 has more recently been validated in postpartum samples. Although one small study ($n = 13$ depressed women) found the PHQ-9 to be less accurate than the EPDS or Postpartum Depression Screening Scale (PDSS),⁶ the remaining three studies found the PHQ-9 to be sensitive and specific in identifying PPD,⁷ better than or at least comparable to the EPDS.^{8,9} Therefore, it appears that the PHQ-9, which was used in the present study, may be a valuable tool for studying PPD prevalence.

In addition to there being relatively few previous studies on changes in PPD prevalence over the first postpartum year, we are also limited in our understanding of which symptoms best distinguish mothers with PPD from those without depression. Therefore, the purposes of this study were to investigate 0–9-month changes in the prevalence of a positive PHQ-9 and two-question depression screen (modified version of the first two questions of the PHQ-9) and to determine which depressive symptoms best discriminate between women with and without PPD.

Materials and Methods

This prospective cohort study, performed as part of a randomized controlled trial (RCT) on stepped care treatment of PPD,¹⁰ was approved by the University of Minnesota Institutional Review Board. Subjects were recruited and consented to the study through seven participating clinics from October 1, 2005, through September 30, 2006. Mothers registering their infants for an initial (0–1 month) well-child visit were given an enrollment packet consisting of a brief description of the study, enrollment form, consent form, and initial survey. Enrollees were given follow-up surveys at subsequent 2, 4, and 6 month well-child visits, or if unable to complete a survey at a visit, they were offered a telephone or mailed survey. Mothers received the final survey by mail at 9 months postpartum.

Study participants

Participants were recruited from four urban family medicine residency clinics and three suburban private pediatric clinics. Eligibility criteria were English literate, age ≥ 12 , and the mother of a 0–1-month-old infant registered at a participating clinic or hospital. All the participants in the current study were part of the previously reported study,¹⁰ in which a subsample of 39 women were randomized, 20 to a usual care

group and 19 to a stepped care collaborative treatment group (the intervention consisted of referral to a primary care provider for treatment, regular case manager follow-up, decision support, and mental health referral as needed). As no group differences were seen in depression outcomes,¹⁰ the 39 randomized women were included in the current study.

Measures

Survey measures included (1) demographic information (initial survey): age, education, race/ethnicity, total family income, health insurance, marital status, number of children, and delivery date, (2) two depression screens (initial and follow-up surveys) (Table 1): the PHQ-9,⁵ which contains the DSM-IV criteria for major depressive disorder (MDD) (simple score, sum total; complex score, positive if ≥ 5 items have response of 2 or 3, and question 1 or 2 is included), and the two-question screen,¹¹ which consists of the two fundamental symptoms of depression, diminished mood and pleasure (positive if either question is answered yes), and (3) other health and work characteristics (from 9-month survey unless otherwise indicated), including history of depression before pregnancy (initial survey), breastfeeding status, job status, length of maternity leave, and infant cared for outside the home.

Data analysis

Significant changes over time in the proportion of women with positive depression screens (PHQ-9 simple, PHQ-9 complex, and two-question screen) were evaluated using repeated measures analysis of variance (ANOVA). Tests of within-subject contrasts revealed significant differences in rates of positive screens between paired intervals, for example, 6 and 9 months. We investigated the possibility of seasonal variations in depressive symptoms using ANOVAs to compare 0–1-month mean PHQ-9 simple scores among women who gave birth in these seasons: winter (December, January, February), spring (March, April, May), summer (June, July, August), and fall (September, October, November).

A PHQ-9 item analysis was performed to assess the ability of individual items to discriminate between depressed and nondepressed women using likelihood ratios (probability of a positive test symptom in cases divided by the probability of a positive test symptom in noncases). A score of 1–3 on the suicidal ideation question was considered positive (symptoms occurring several days or more over the previous 2 weeks), whereas a score of 2–3 on all other PHQ-9 items was coded as positive (symptoms occurring more than half the days or nearly every day).

Given that the percentage of women with positive PHQ-9 scores increased from 6 to 9 months postpartum, we also wanted to examine potential predictors (some discretionary) of this change. We, therefore, conducted a logistic regression analysis, using only women with negative PHQ-9 scores at 6 months. The dependent variable was PHQ-9 positive (vs. negative) at 9 months, and independent variables were PHQ-9 positive at 0–1 month, breastfeeding status, mother's age, number of children, marital status, length of maternity leave, prepregnancy history of depression, currently working at a job, and infant cared for outside the home.

To determine if dropouts (women who did not complete the final survey) differed from women who completed the

TABLE 1. DEPRESSION SCREENS: TWO-QUESTION SCREEN AND 9-ITEM PATIENT HEALTH QUESTIONNAIRE

*2-Question Screen*¹¹

1. During the past month, have you often been bothered by feeling down, depressed, or hopeless? (Yes/No)
2. During the past month, have you often been bothered by having little interest or pleasure in doing things? (Yes/No)

*PHQ-9*⁵

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed or the opposite—being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

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study, *t* tests and chi-square tests were used to compare these two groups on the following characteristics: mother's age, number of children, marital status, education, family income, and positive PHQ-9.

Results

Participants' characteristics

Of the estimated 1556 eligible women, 506 (33%) agreed to participate. The remaining 1050 eligible nonparticipants included an estimated 210 women who were inadvertently not offered an enrollment form by the receptionist due to other responsibilities and distractions and an estimated 840 women who declined participation either by directly refusing (170 women) or by failing to complete or return an enrollment form or initial survey, either because they forgot or because they chose not to participate (670 women).

Demographic characteristics included mean age of 29.1 years (standard deviation [SD] = 6.2) and a racial composition of 67% white, 18% black, and 7% Asian women. Twenty-seven percent had annual family incomes of <\$20,000, and 37% had incomes of ≥\$80,000; 16% had less than a high school diploma, and 52% had a 4-year degree or more; 55% had private health insurance, and 31% had medical assistance. Most mothers were married (65%) and employed (64%), and 42% had only one child. One hundred sixty-seven (33%) participants were recruited from family medicine practices, and 339 (67%) were from pediatric practices. There were no significant differences in 9-month PHQ-9 scores between participants from family medicine vs. pediatric sites.

Only 6.7% (34 of 506) of participants did not complete the final 9-month survey. When compared to study completers, these dropouts were younger (26 vs. 29 years old, $p = 0.001$), less educated (32% vs. 73% had some posthigh school edu-

cation, $p = 0.000$), less likely to be married (27% vs. 68%, $p = 0.000$), and had more children (2.5 vs. 1.9, $p = 0.000$), lower family incomes (64% vs. 25% had annual income <\$20,000, $p = 0.000$), and more depressive symptoms (21% vs. 6% had a positive PHQ-9, $p = 0.008$).⁷

Changes in depressive symptoms over time

Of the 506 total participants, 112 (22.1%) had a positive PHQ-9 (simple score ≥10) at some time within the first 9 months postpartum. The proportion of women with positive depression scores was highest at 0–1 month postpartum, dropped to lower levels at 2–6 months postpartum, and increased again at 9 months postpartum (Table 2). The 9-month increase in prevalence of positive depression scores was statistically significant for the PHQ-9 simple score and two-question screen but not for PHQ-9 complex score. PHQ-9 simple score changes are also shown graphically in Figure 1. There were no significant seasonal variations in PHQ-9 scores.

PHQ-9 item analysis

The PHQ-9 item analysis showed that most of the PHQ-9 items differentiated well between women with and without PPD, with likelihood ratios typically >20 (Table 3 and Fig. 2; note that Fig. 2 includes only three time intervals in order to maintain simplicity). Items that were less discriminating were those relating to sleep, appetite/eating, and energy (likelihood ratios of approximately 5–17). These three symptoms were also the most prevalent depressive symptoms among women with positive PHQ-9 scores, with prevalence rates that persisted near or above 70% 0–9 months postpartum.

TABLE 2. SIGNIFICANT CHANGES IN NUMBER (%) OF WOMEN WITH POSITIVE DEPRESSION SCREENS ACROSS TIME (N=506)

Depression screen	Postpartum survey interval (in months)					Total ^a n = 506	p value	Significant paired comparisons
	0-1 n = 506	2 n = 464	4 n = 459	6 n = 455	9 n = 472			
PHQ-9 (simple)	63 (12.5)	33 (7.1)	32 (7.0)	23 (5.0)	48 (10.2)	112 (22.1)	0.000	0-1 > 2,4,6,9 9 > 2,4,6
PHQ-9 (complex)	38 (7.5)	18 (3.9)	11 (2.4)	12 (2.6)	28 (5.9)	69 (13.6)	0.000	0-1 > 2,4,6,9 9 > 4,6
Two-question screen	206 (40.7)	95 (20.4)	83 (18.0)	77 (16.9)	134 (28.4)	303 (59.9)	0.000	0-1 > 2,4,6,9 9 > 6

Definition of positive screens: PHQ-9 (simple): total score ≥ 10 ; PHQ-9 (complex): >5 items have response of 2-3, must include question 1 or 2; two-question screen: either question answered yes.

Determined by repeated measure analysis of variance (ANOVA).

^aTotal, number of women who had a positive test at any time from 0 to 9 months.

PHQ-9, 9-Item Patient Health Questionnaire.

Predictors of change: Negative to positive PHQ-9 at 9 months postpartum

Of the 388 women who were included in the logistic regression evaluating predictors of change from negative to positive PHQ-9 at 9 months postpartum, 22 women had changed from a negative to positive PHQ-9 score over this interval. Results showed only one significant predictor of PHQ-9 score change: prior history of depression. Non-significant variables included positive PHQ-9 score at 0-1 month, breastfeeding status, mother's age, number of children, marital status, length of maternity leave, currently working at a job, and infant cared for outside its home.

Discussion

Twenty-two percent of participants had a positive PHQ-9 score from 0-9 months postpartum, a finding that is comparable to Gaynes et al.'s 22% 12-month period prevalence of major (postpartum) depression.² The point prevalence of positive PHQ-9s was greatest at 0-1 month postpartum (12.5%), then fell to lower levels (5-7%) at 2-6 months postpartum, and rose again to 10.2% at 9 months. This secondary peak at 9 months was unexpected and could not be explained by certain discretionary factors, such as length of maternity leave, currently working at a job, infant cared for outside of home, or 9-month breastfeeding status. It is possible that we did not have adequate power to detect such associations, given that only 22 women changed from a negative PHQ-9 score at 6 months to a positive score at 9 months. Previous research has

found PPD to be associated with prenatal depression and anxiety, other history of depression, child care stress, life stress, lower levels of social support (including partner support), marital dissatisfaction, infant temperament, maternity blues, poor self-esteem, lower socioeconomic status, single status, younger age, and unplanned/unwanted pregnancy.¹²⁻¹⁴ We did not include social support variables in this study, so it is not known if changes in social support may have contributed to the 9-month increase in depressive symptoms.

In looking at specific PHQ-9 items in this postpartum population, we found that most of the PHQ-9 items—mood, pleasure, self-esteem, difficulty concentrating, psychomotor agitation/retardation, and suicidal ideation—discriminated very well between depressed and nondepressed women, with most likelihood ratios being >20 . Three somewhat less discriminating symptoms—abnormal sleep, appetite/eating, and fatigue—still differentiated reasonably well between cases and noncases, with likelihood ratios of approximately 5-17. Our PHQ-9 item analysis results are quantitatively different from but qualitatively similar to those of Weobong et al.,⁸ on 160 postpartum women from Ghana, 18 of whom had PPD. Here, likelihood ratios were lower overall, ranging from 1.82 to 5.74, and symptoms with the lowest likelihood ratios (≤ 3.1) included sleep problems, feeling depressed, little interest, poor appetite, and feeling tired. Three of these symptoms corresponded to our less discriminating symptom group (sleep, appetite, and fatigue).⁸

The fact that the symptoms of abnormal sleep, poor appetite, and fatigue did not differentiate between cases and noncases as well as other symptoms does not lessen their importance. In fact, abnormal sleep/appetite and fatigue were the most prevalent of symptoms among our cases (women with positive PHQ-9 scores), with $>70\%$ of cases acknowledging these symptoms at nearly every observed interval. Both fatigue and sleep loss are commonly considered a normal part of the postpartum experience because of the process of mothers' postpartum recovery and newborns' needs for continuous care, yet it is possible that these so-called normal symptoms could be precursors to depression, particularly when they are intense or prolonged or when the mother is otherwise susceptible to depression. One study found that maternal fatigue as early as 7 days postpartum was predictive of depression on day 28.¹⁵ Another study found that mothers

FIG. 1. Percent of women with positive 9-Item Patient Health Questionnaire (PHQ-9) (simple scoring) at various postpartum intervals.

TABLE 3. 9-ITEM PATIENT HEALTH QUESTIONNAIRE LIKELIHOOD RATIOS: PROBABILITY OF POSITIVE SYMPTOM IN CASES/NONCASES AT 0-9 MONTHS POSTPARTUM

PHQ-9 item	0-1 month			2 months			4 months			6 months			9 months		
	Cases ^a n = 63	Noncases n = 443	LR	Cases n = 33	Noncases n = 431	LR	Cases n = 32	Noncases n = 427	LR	Cases n = 23	Noncases n = 432	LR	Cases n = 48	Noncases n = 424	LR
1. Little interest or pleasure	57%	2%	28	58%	2%	31	31%	0.7%	44	57%	1.4%	41	50%	1.4%	35
2. Feeling down, depressed	70%	4%	19	64%	0.9%	69	44%	2%	21	57%	1.4%	41	69%	1.7%	42
3. Trouble with sleep	71%	10%	7	76%	4%	17	72%	6%	11	83%	6%	14	75%	6%	13
4. Feeling tired	83%	23%	4	76%	15%	5	84%	13%	6	96%	14%	7	85%	14%	6
5. Poor appetite or overeating	78%	8%	9	76%	7%	11	87%	5%	18	83%	6%	13	69%	5%	15
6. Feeling bad about yourself	51%	3%	16	67%	2%	29	47%	2%	22	65%	1.6%	40	71%	2.6%	27
7. Trouble concentrating	52%	3%	18	61%	1.6%	37	66%	2%	35	52%	3%	20	46%	1.4%	32
8. Moving or speaking slowly or rapidly	32%	1.4%	23	24%	0.7%	35	44%	0.5%	93	30%	0.9%	33	19%	0.5%	40
9. Suicidal ideation	29%	0.5%	63	27%	1.2%	24	22%	0.7%	31	22%	0.5%	47	31%	1.4%	22

Likelihood ratios (LRs) were calculated by dividing the percent of cases with positive PHQ-9 item by the percent of noncases with positive PHQ-9 item. Probabilities for cases/noncases usually are rounded to whole numbers, so the quotient of the two numbers may not exactly equal the LR.

^aCases are defined here as participants with a positive PHQ-9 (simple score ≥ 10), and noncases are defined as participants with negative PHQ-9 scores at a given postpartum interval.

FIG. 2. Likelihood ratios (probability of positive symptom in cases/noncases) for PHQ-9 items at three postpartum intervals.

with high EPDS scores (>12) at 4 and 8 weeks postpartum reported that their babies cried often, did not sleep well, woke them up three or more times a night, and did not allow them to get a reasonable amount of sleep (<6 hours of sleep in a 24-hour period).¹⁶ Given this apparent relationship between poor infant and maternal sleep and maternal mood disorders, additional research on sleep interventions and sleep education, particularly in the setting of PPD, may be useful. Some experts question the use of a PPD screen that includes symptoms that overlap with the normative postpartum experience, such as fatigue and sleep loss. We would argue that abnormal sleep and fatigue are just as important, and perhaps moreso for women with PPD than for women with non-postpartum depression, and should be recognized in both the diagnosis and treatment of PPD.

Strengths of the study include its prospective, longitudinal design, use of the PHQ-9 depression screen, which contains the 9 criteria for depression diagnosis, performance of PHQ-9 item analysis in a postpartum sample, and the diversity of study participants in factors of maternal race, education, earnings, and marital status. Although our dropout rate over 9 months was respectable at 6.7%, dropouts (vs. study completers) were more likely to have positive PHQ-9 screens (21% vs. 6% at 0-1 month), suggesting that selection bias that may have caused us to underestimate actual depression prevalence rates at later postpartum intervals. Other limitations include our modest response rate, our inability to compare participants with nonparticipants (we did not collect data on non-participants), and our inability to show why depressive symptoms increased from 6 to 9 months postpartum or to examine social support systems as a possible predictor of this change. We did not include additional popular PPD screens, such as the EPDS, so we do not have comparative data on the prevalence of depressive symptoms with those instruments. Future studies of similar populations may consider having dedicated research assistants at each study site to ensure that all eligible women are invited to participate.

In conclusion, results from this study revealed a bimodal peak in depressive symptoms at 0-1 month and 9 months postpartum, which suggests the need for repeat screening for PPD during the first postpartum year. We also found that most PHQ-9 items discriminate well between depressed and nondepressed mothers, which supports the use of the PHQ-9 for identifying PPD. Given that the PHQ-9 is becoming increasingly popular in general depression care as an easy to administer diagnostic survey, we hope that the growing evidence of its applicability to PPD will help improve screening and detection of depression in the postpartum period.

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Disclosure Statement

The authors have no conflicts of interest to report.

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