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Screening for depression in the postpartum using the Beck Depression Inventory II: What logistic regression reveals

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Objective: To identify items on the Beck Depression Inventory-II (BDI-II) that best discriminate between clinically depressed and nondepressed postpartum women. **Background**: Postpartum depression is a serious and widespread health burden, and the BDI-II is commonly used to detect depression in the postpartum. Yet certain depressive symptoms are 'normative' sequelae of childbirth, calling into question the discriminative utility of the BDI-II. **Methods:** We examined the prospective contribution of BDI-II items to identify items that have the strongest relation with clinical postpartum depression. Women with BDI-II scores >12 were invited to participate in a structured clinical interview. A logistic regression was conducted to determine which BDI-II items discriminated between women who were later diagnosed as Depressed (n = 75) and Nondepressed (n = 78). **Results:** Of the 11 BDI-II items that differed between the two groups, eight represented cognitive/affective symptoms. Results from the logistic regression indicated that four BDI-II symptoms were significant predictors of Depression status: sadness, pessimism, loss of interest, and changes in appetite. **Conclusion:** The BDI-II should be used in the postpartum with caution. Professionals who screen for postpartum depression should pay particular attention to cognitive/affective symptoms, as they appear more robust to normative physical and emotional changes that occur in the postpartum.

Keywords: Postpartum depression; Beck Depression Inventory-II; screening

Introduction

Depression represents a considerable public health concern and has received increasing attention in the recent years (Wisner, Chambers, & Sit, 2006; World Health Organisation, 2008). Depression during the postpartum period is a common disorder with devastating consequences for the woman who experiences it and for her family (Goodman & Gotlib, 1999; Verbeek et al., 2012). A recent American Academy of Pediatrics report indicated that perinatal depression is the most underdiagnosed obstetric complication in America (Earls and the Committee on Psychosocial Aspects of Child and Family Health, 2010), and as much as 10% of cases

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among inner-city women in the UK may go undetected (Edge, 2007). Furthermore, depression is the third leading cause of disease in the word, ranking just behind respiratory infections and diarrhoeal diseases (WHO, 2008), yet is the most common psychiatric illness to occur in the puerperium (Wisner & Wheeler, 1994). A meta-analysis of 30 studies (Gaynes et al., 2005) found the point prevalence of major and minor depression ranged between 6.5% and 12.9% at different times during the first postpartum year, and around 15% worldwide (Edge, 2007).

Although the prevalence of postpartum depression (PPD) is high and its consequences deleterious, only a small proportion of postpartum women with depression actually seek treatment (Milgrom, Ericksen, Negri, & Gemmill, 2005). There is growing recognition that proactive identification of, and early intervention for, PPD are important. One approach is to systematically screen for PPD which in turn may expedite treatment (Lee et al., 2003). The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) is widely used in screening and postpartum research worldwide (Boyd, Le, & Somberg, 2005). The ability of the BDI-II to accurately detect depression has been called into question (Su et al., 2007; Whiffen, 1988). Critics have noted that the cut-off may classify an individual as 'depressed' even though the individual does not endorse the central features of depressed mood and loss of interest (Ingram & Hamilton, 1999).

One complication in detecting and screening depression during the postpartum period is that a number of commonly occurring sequelae of childbirth and normal physiological changes of the puerperium are similar to symptoms of depression. For example, appetite changes, sleep disturbances and loss of sexual interest could be confused with the somatic symptoms of depression. Thus, measures of depressive symptoms standardised on nonpuerperal women may overstate the severity of depressive symptomatology in puerperal women (O'Hara, Neunaber, & Zekoski, 1984), increasing the number of false positive diagnoses (Kammerer et al., 2009). Alternatively, postpartum women may deny or trivialise depressive symptomatology because they feel that some symptoms are 'normal' for the postpartum period or that admitting to symptoms might reflect negatively on their feelings about motherhood (Whiffen, 1988). Either situation could result in increasing numbers of 'false negatives'. Whiffen and Gotlib (1993) found that depressed nonpostpartum women reported more somatic complaints compared to depressed postpartum women. Women typically experience more somatic symptoms during pregnancy, but whether these somatic symptoms meaningfully indicate that women are experiencing clinical depression is unknown.

In efforts to examine the degree to which the BDI-II can be used to accurately identify a woman experiencing depression in the postpartum, we focused on the type of symptoms endorsed rather than the total score. The aim of the present study is to identify items on the BDI-II that best discriminate between clinically depressed and nondepressed postpartum women, all of whom scored high on the total BDI-II. Identifying women who are at highest risk for PPD portends better utilisation of limited resources and will encourage those women to seek treatment. To define a cut-off score on BDI-II that is high enough to accurately detect depression, but low enough so as not to miss any women with moderate levels of clinical depression, we reviewed extant studies that used BDI-II and clinical diagnostic criteria in culturally and economically varied postpartum samples (e.g. Beck & Gable, 2001; Ji et al., 2010; Tandon, Cluxton-Keller, Leis, Le, & Perry, 2012). Based on these studies, we selected a cut-off score of >12 as optimal, indicative of mild depression

in the postpartum period. This approach of identifying high scorers on self-reports as potentially depressed, and selecting them for further evaluations and interventions reflects clinical practice and intervention programmes (Tandon et al., 2012). Thus, a unique aspect of this study is that it focuses on a sub-group of women at the highest risk for developing PPD to determine which specific symptoms portend clinical levels of depression.

Method

Participants

This study was approved by the National Institute of Child Health and Human Development IRB. Participants came from a prospective longitudinal study of dyadic interactions between mothers and their infants. The Beck Depression Inventory (BDI-II; Beck et al., 1996) was completed by 982 mothers from the Washington, DC, metropolitan area. Mothers' age ranged from 20 to 45 years (M = 31.75, SD = 5.06). All infants were carried to full-term, healthy, singleton births with no known genetic disorders or birth complications. At the time of BDI-II completion, infants ranged from 4 to 20 weeks (M = 13.92, SD = 3.16). The BDI-II was used as a screening device in the longitudinal study; therefore, zipcodes of the participants were used to glean sociodemographic data for the larger sample. We estimate median family income at $58,043 and the ethnic distribution of 62.5% European American, 26.7% African American, 5.7% Asian American and 5.1% Latin American.

Women were selected into Depressed (n = 75) and Nondepressed (n = 40) groups (see Procedure). There were no significant differences between these groups on maternal age, education, ethnicity, marital status, family income, parity, child gender, or child age at the time of clinical interview (all $p > .05$).

Measures

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) was used to screen for postpartum depression. The BDI-II is a revised 21-item test with 4 response options per item. Each item is representative of a particular symptom of depression and corresponds to the diagnostic criteria listed in the DSM-IV (American Psychiatric Association, 1994). The respondent is asked to choose the statement that best reflects the way she has been feeling over the course of the last 2 weeks. Item scores range from *absence of that symptom* (0) to *severe or persistent expression of that symptom* (3). Estimates of internal consistency reliability (coefficient α) for nonclinical adults range from .91 to .93 (mean α = .92; Dozois, Dobson, & Ahnberg, 1998). Test–retest reliability of .96 has been reported (Sprinkle et al., 2002). In our data, the internal consistency reliability was estimated to be .91 for the general sample (N = 982), .86 in the Depressed group (n = 75), and .60 in the Nondepressed group (n = 40).

The Structured Clinical Interview for the DSM-IV Axis I Disorders (SCID-I; First, Gibbon, Spitzer, & Williams, 2001) was used to diagnose women with major or minor depression. The SCID-I is a semi-structured interview considered the gold standard for making clinical major DSM-IV Axis I diagnoses. The diagnostic interview focused on any depressive episode occurring during the postpartum period. At this interview, the definition of a 'current' episode of major or minor depression was modified to 'within the lifetime of the child' as this was the question of interest.

Procedure

The BDI-II was mailed to 1149 mothers between 5 and 20 weeks postpartum. Of the 982 (85%) women who returned the questionnaire, 311 (32%) met an inclusion criterion of a total BDI-II score >12. They were invited to a laboratory for the clinical assessment and were interviewed by trained mental health professionals who were blind to the participants' BDI-II scores. Of the women who were scheduled, 245 (79%) appeared for the interview. Mothers diagnosed as having had a clinically significant depressive episode in the 5-month lifetime of their infants were selected into the Depressed group (n = 75); mothers not diagnosed with depressive disorders were selected into the Nondepressed group (n = 40). Women with any psychotic or manic depressive symptoms or other Axis I disorders were excluded. Of the women in the Depressed group, 51% had MDD only, 21% had mDD only, 24% had MDD and a current anxiety disorder, and 4% had mDD and a current anxiety disorder.

Results

In preliminary analyses, the BDI-II item means were first examined for varying BDI-II total scores for the entire sample of participants who filled out this instrument (N = 982). As seen in Figure 1, women with low BDI-II scores (0–4) endorsed more somatic items (e.g. loss of energy and changes in sleep), whereas women with high BDI-II scores (30 or higher) endorsed more cognitive/affective items (e.g. self-criticalness and punishment feelings).

We next conducted t-tests comparing Depressed and Nondepressed groups, all of whom had initial BDI-II scores >12. Women in the Depressed group had a mean BDI-II of 24.43 (SD = 8.67), and women in the Nondepressed group had a mean BDI-II of 18.51 (SD = 4.47), $t(151) = -5.34$, $p < .001$. Individual BDI-II item means for the two groups are presented in Table 1. Of the 11 BDI-II items that differed between the two groups, 8 represented cognitive/affective symptoms.

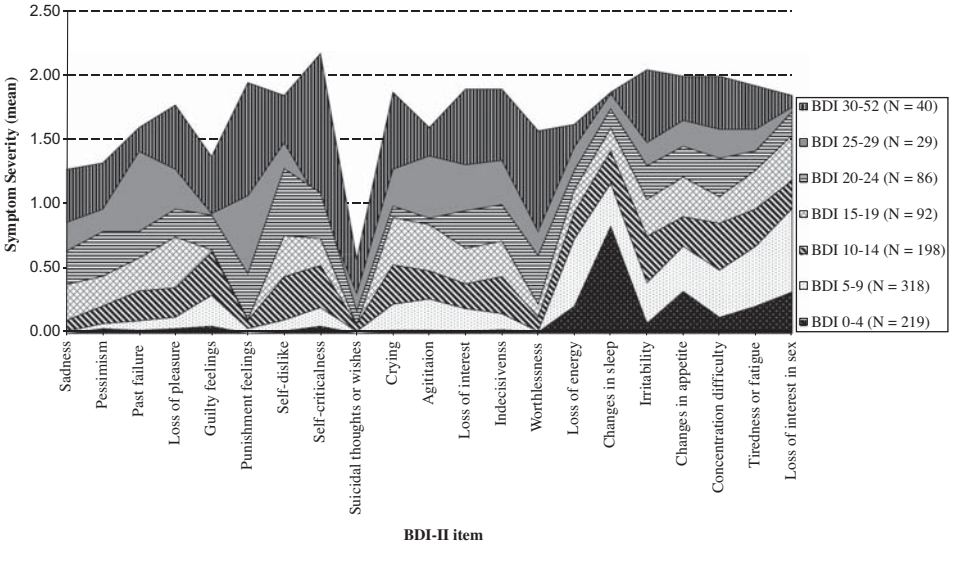

Figure 1. Item means for different BDI-II scores.

Table 1. Descriptive statistics for individual BDI-II item for Depressed and Nondepressed women.

BDI-II item	Depressed *M* (SD)	Nondepressed *M* (SD)	
1. Sadness	0.83 (0.69)	0.38 (0.63)	$t(113) = 3.46$, $p = 0.001$
2. Pessimism	1.03 (0.75)	0.55 (0.55)	$t(113) = 3.53$, $p = 0.001$
3. Past failure	1.00 (0.85)	0.60 (0.78)	$t(113) = 2.47$, $p = 0.015$
4. Loss of pleasure	1.12 (0.68)	0.75 (0.63)	$t(113) = 2.86$, $p = 0.005$
5. Guilty feelings	0.88 (0.81)	0.53 (0.55)	$t(113) = 2.49$, $p = 0.014$
6. Punishment feelings	0.64 (1.10)	0.45 (0.96)	ns
7. Self-dislike	1.33 (0.92)	1.18 (0.78)	ns
8. Self-criticalness	1.23 (0.92)	0.98 (0.73)	ns
9. Suicidal thoughts or wishes	0.23 (0.45)	0.13 (0.34)	ns
10. Crying	1.15 (0.90)	0.93 (0.86)	ns
11. Agitation	1.05 (0.79)	0.78 (0.80)	ns
12. Loss of interest	1.20 (0.77)	0.70 (0.69)	$t(113) = 3.44$, $p = 0.001$
13. Indecisiveness	1.20 (0.93)	0.78 (0.66)	$t(113) = 2.56$, $p = 0.012$
14. Worthlessness	0.72 (0.85)	0.40 (0.59)	$t(113) = 2.13$, $p = 0.036$
15. Loss of energy	1.40 (0.59)	1.20 (0.46)	ns
16. Changes in sleeping pattern	1.75 (0.64)	1.73 (0.51)	ns
17. Irritability	1.47 (0.84)	1.28 (0.72)	ns
18. Changes in appetite	1.52 (0.86)	1.18 (0.55)	$t(113) = 2.30$, $p = 0.023$
19. Concentration difficulty	1.39 (0.72)	1.28 (0.64)	ns
20. Tiredness or fatigue	1.60 (0.72)	1.45 (0.55)	ns
21. Loss of interest in sex	1.71 (0.96)	1.70 (0.88)	ns

ns, not significant.

Specifically, Depressed as compared to Nondepressed women scored higher on the following BDI-II items representing cognitive/affective symptoms: sadness, pessimism, past failure, loss of pleasure, self-criticalness, loss of interest, indecisiveness and worthlessness. Three somatic items – crying, agitation and changes in appetite – were rated higher among Depressed women as compared to Nondepressed women.

A logistic regression was then conducted to determine which symptoms predicted depression among postpartum women. All BDI-II items were included in the model. The overall model fit the data well (χ^2 (21) = 56.68, $p < .001$). Four symptoms were significant predictors of depression status: sadness, pessimism, loss of interest, and changes in appetite. As seen in Table 2, as sadness, pessimism, loss of interest and changes in appetite increased, the odds of becoming depressed increased between 1.8- and 3.8-fold. None of the other cognitive or somatic symptoms were significantly predictive of depression group membership.

Discussion

Accurate screening of depression in the postpartum is of critical importance given the impressively large number of women with perinatal depression (Earls, 2010). Previous research has shown that some items may be more important than others in the accurate diagnosis of postpartum depression (Campbell, Cohn, & Myers, 1995; Hopkins, Campbell, & Marcus, 1989; Huffman, Lamour, Bryan, & Pederson, 1990). In past research, the predictive power of specific symptoms of depression

Table 2. Logistic regression analysis of depressive symptoms associated with depression status (Depressed vs, Nondepressed) during the postpartum.

BDI-II item	B (SE)	Wald χ^2	OR	95% CI
1. Sadness	1.11 (.44)	6.42**	3.05	1.29–7.21
2. Pessimism	1.34 (.42)	10.33***	3.83	1.69–8.70
3. Past failure	–.41 (.34)	1.47	.67	.34–1.29
4. Loss of pleasure	.30 (.44)	.48	1.35	.58–3.19
5. Guilty feelings	.21 (.32)	.44	1.23	.66–2.28
6. Punishment feelings	–.33 (.24)	1.92	.72	.46–1.15
7. Self-dislike	.04 (.28)	.02	1.04	.60–1.81
8. Self-criticalness	.09 (.29)	.10	1.10	.62–1.95
9. Suicidal thoughts or wishes	–.76 (.66)	1.33	.47	.13–1.70
10. Crying	.23 (.27)	.74	1.26	.74–2.13
11. Agitation	–.15 (.33)	.20	.86	.45–1.65
12. Loss of interest	.60 (.31)	3.70*	1.83	.99–3.39
13. Indecisiveness	.39 (.33)	1.42	1.47	.78–2.79
14. Worthlessness	.03 (.34)	.01	1.03	.52–2.02
15. Loss of energy	.21 (.37)	.34	1.24	.60–2.55
16. Changes in sleeping pattern	.35 (.36)	.93	1.41	.70–2.85
17. Irritability	–.26 (.32)	.64	.78	.41–1.45
18. Changes in appetite	1.06 (.33)	10.36***	2.89	1.52–5.52
19. Concentration difficulty	–.16 (.36)	.21	.85	.42–1.71
20. Tiredness or fatigue	.06 (.38)	.02	1.06	.50–2.25
21. Loss of interest in sex	.01 (.24)	.001	1.01	.63–1.60

Note: R^2 = .41 (Nagelkerke). Model χ^2 (21) = 56.68, $p < .001$. *$p < .05$; **$p < .01$; ***$p < .001$.

was tested among postpartum women with a wide range of depressive symptoms (Campbell et al., 1995; Hopkins et al., 1989; Huffman et al., 1990). Unique to this study was that all the women participants had elevated BDI-II scores. Thus, our focus was on the individual contributions of the symptoms and whether we could identify symptoms that accurately identified clinical depression among a population of women at high risk for developing depression on the basis of self-reported BDI-II scores.

Despite the fact that all the women in this sample had elevated BDI-II scores, a number of women were diagnosed as Nondepressed on clinical interview. We sought to understand why; specifically, whether some individual symptoms were more important than others in the accurate diagnosis of depression in the postpartum. We identified four symptoms that were predictive of whether or not a woman became clinically depressed in the postpartum: sadness, pessimism, loss of interest in other people and changes in appetite. These findings accord with Hopkins and colleagues (1989) who reported that loss of interest discriminated between Depressed and Nondepressed postpartum women. However, they did not focus on the subset of women who might be at highest risk for developing depression in the postpartum. Our independent replication speaks to the importance of assessing loss of interest among postpartum women, as women who endorse these symptoms might be more likely to have ‘true’ depression. In Hopkins et al. (1989), the women in the Depressed group had rather low BDI scores (i.e. 20% of women ultimately diagnosed as Depressed had BDI scores <7). In the current study, all women had elevated BDI-II scores, indicating that, the criteria for the logistic regression were more stringent.

Surprising to us was that changes in appetite emerged as a significant predictor of depression status. This finding is in contrast to Bernstein and colleagues (2008), who found that changes in appetite and weight were more strongly related to depression occurring outside of the postpartum compared to depression in the postpartum. Upon further examination of why women ultimately diagnosed as Depressed were more likely to endorse this item compared to women with similarly high BDI-II scores but diagnosed as Nondepressed, we noted significant differences in the SCID item that assessed for weight changes. Interestingly, women ultimately diagnosed as Depressed were significantly more likely to report changes in weight occurring in the previous month (65.3% vs. 15.4%, $p < .001$) compared to women diagnosed as Nondepressed. Perhaps women diagnosed as Depressed attempted to regulate their mood through changes in eating habits, resulting in increased or decreased weight. Why this behaviour was more likely among women diagnosed as Depressed is unclear, but may be reflective of underlying differences in regulatory behaviours among women with high BDI-II scores who were later diagnosed with Depression.

The results of this study raise interesting questions regarding methodological and developmental differences in assessing depression. A meta-analysis revealed that self-report measures of postpartum depression result in higher prevalence rates of PPD compared to interviews (O'Hara & Swain, 1996). As the validity of self-reports depends on how accurately they classify women as Depressed on clinical interview, the over-estimation of PPD by self-report might be due to measurement error associated with self-report measures (O'Hara & Swain, 1996). The SCID also assesses how a symptom or cluster of symptoms impairs a woman's ability to function in social or occupational realms. Even if a woman endorses some symptoms of depression in self-report, she may not be diagnosed as Depressed if the symptoms do not cause clinically significant distress. However, this difference in the identification of who meets criteria for depression does not necessarily imply that clinical interviews measure 'true' depression. Clinical interviews such as the SCID are themselves in need of refinement as some symptoms contribute little to diagnostic classification (Magalhães, Pinheiro, Horta, Pinheiro, & da Silva, 2008).

The present study is not without limitations. First, we did not administer the BDI-II at multiple time points; perhaps different BDI-II items would discriminate if the mothers completed the BDI-II at different intervals after birth. For instance, one study found no change in the ratings of cognitive or affective symptoms from a prenatal to a postnatal assessment, but somatic symptoms declined significantly (O'Hara et al., 1984). Second, our sample was diverse in terms of ethnicity, but 39% of the sample was educated beyond college level. Replication with a more socioeconomically heterogeneous sample is warranted.

Conclusions and clinical implications

To identify postpartum women at risk for depression the BDI-II should be used with caution, unless screeners pay particular attention to cognitive/affective symptoms. Cognitive/affective symptoms appear more robust to normative physical and emotional changes that occur in the postpartum. Indeed, mean levels of cognitive symptoms of depression do not change from the pre- to postpartum, whereas somatic symptoms decrease (O'Hara et al., 1984). The total BDI-II score may overrepresent depressive symptoms among postpartum women, as many symptoms

assessed using the BDI-II are normal concomitants of childbirth. Norms should be developed specifically with postpartum samples to increase the sensitivity and specificity of the BDI-II. In lieu of focusing solely on the total score, our findings suggest that clinicians might assign weights to certain symptoms when considering depression in postpartum women as such a diagnostic approach may prove more refined and predictive.

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