JAOA ORIGINAL CONTRIBUTION

Risk Factors for Postpartum Depression: A Retrospective Investigation at 4-Weeks Postnatal and a Review of the Literature

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Objective: To describe possible correlations between incidence of postpartum depression and the following patient characteristics: age, breastfeeding status, tobacco use, marital status, history of depression, and method of delivery.

Study Design: Data gathered at routine 4-week postnatal visits were obtained from the patient records of 209 women who gave birth between June 1, 2001, and June 1, 2003, at three university medical clinics in Tulsa, Okla. Inclusion criteria required that the records of potential study subjects contain data on the characteristics noted as well as patient-completed Edinburgh Postnatal Depression Scale forms.

Results: Formula feeding in place of breastfeeding, a history of depression, and cigarette smoking were all significant risk factors for an Edinburgh Postnatal Depression Scale score of 13 or higher, indicating probable postpartum depression.

Conclusion: The authors' findings corroborate the results of previous investigators. To facilitate prophylactic patient education and intervention strategies, a larger study is recommended to determine risk factors for postpartum depression.

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Postpartum depression (PPD) is a serious public health concern[1] that affects approximately 13% of women who give birth.[2] As routine screening for this condition has become more common in routine obstetric care,[3,4] data are now more readily available to assist researchers in identifying patient characteristics that may be associated with increased risk of PPD.

The self-administered, 10-question Edinburgh Postnatal Depression Scale (EPDS)[5] is an effective screening tool for PPD because it is reliable, easy for clinicians to score, and predictive of a clinical diagnosis of PPD.[3–8] In addition, other patient characteristics routinely recorded in patient records may be underutilized by physicians when screening patients for PPD: age, breastfeeding status, tobacco use, marital status, history of depression, and method of delivery.

Identification of clear correlations between certain risk factors and a diagnosis of PPD could lead to earlier intervention for these patients.

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Materials and Methods

Subjects

We sought to analyze patient records for the following patient characteristics at 4-weeks postnatal: EPDS numerical score, breastfeeding status, method of delivery (ie, vaginal birth vs cesarean section), history of depression, marital status, tobacco use, and patient age ($<$ 21 years vs $\geq$21 years). With regard to dividing subjects into two groups by patient age, we used the same protocol used in a 1996 study by Chen.[9]

Potential subjects for our study were women who gave birth between June 1, 2001, and June 1, 2003, at three sites in the Oklahoma State University (OSU) Physician clinic system in Tulsa. The urban population served by the OSU Physician clinic system is largely uninsured.

Our study was conducted prior to the implementation of universal screening for PPD in the OSU Physician clinic system. However, screening for PPD was often conducted at clinic sites during the standard 4-week postnatal visit.

Study inclusion was dependent on the presence of complete patient data for the characteristics under investigation as well as a patient-completed EPDS from the 4-weeks postnatal visit. In addition, to distinguish potential PPD from a previous diagnosis of major depression, the records of patients whose list of current medications included an antidepressant were excluded from study. Finally, any patients whose infants were stillborn or died before the 4-week postnatal follow-up were excluded from the study because we sought to examine risk factors that correlate with typical PPD, rather than the grief process that accompanies the loss of an infant.

Because other relevant and potentially interesting data, such as race and family history of depression, were not available in many patient records, these data were excluded from analysis in the present study.

The study protocol was developed in accordance with the Health Insurance Portability and Accountability Act guidelines enacted in 2003, and patient confidentiality was

protected through all phases of this investigation. In addition, the protocol described was reviewed and approved by the institutional review board at the OSU Center for Health Sciences.

Statistical Analysis

Patient data were systematically recorded by one investigator (S.B.M.S.) and a medical student for analysis on a spreadsheet (Microsoft Excel 2003; Microsoft Corp, Redmond, Wash).

After appropriate study subjects were identified, investigators masked the identity of the patients, concealing patient names and assigning a random number that was used as an identifier. The master list that contained the name-number conversions was destroyed at the project's close. All data provided in the present study are reported as mean scores of all study participants.

Patient characteristics were analyzed individually against EPDS scores with χ^2 tests. Possible patient scores for the 10-question EPDS can range from 0 to 30. Test sensitivity and specificity for the EPDS are reported at 86% and 78%, respectively.[5] Cox et al,[5] the instrument's developers, recommend that patients with EPDS scores higher than 12 receive a clinical evaluation for diagnosis of PPD.

Australian investigators in a 1993 study[8] (N=103) reported even better results for the sensitivity (100%) and specificity (95.7%) of the EPDS when using the developers' recommended 12- or 13-point cutoff for a diagnosis of probable PPD. Although the 1993 article by Boyce and colleagues[8] had a sample population from Australia and New Zealand, and their results, therefore, perhaps cannot be applied to the present study, we believe that the sensitivity and specificity values reported by the instrument's developers[5] may be conservative.

In light of the long-term reliable performance of the EPDS,[4,5,8,10,11] we decided to label subjects as either "depressed" or "not depressed" based on EPDS scores alone, with a score of 13 on the EPDS indicating probable PPD.

We are aware that several other instruments may be used by clinicians to diagnose PPD more definitively than the EPDS[10] (eg, Beck Depression Inventory,[12–14] Center for Epidemiologic Studies Depression Scale,[15] Zung's Self-rating Depression Scale,[16] Hamilton Rating Scale for Depression[17]). Physicians in the OSU Physician clinic system use the EPDS for convenience (ie, it is reliable, easy to score, and highly predictive). Therefore, the EPDS provided the only standardized data related to PPD available in patient records for our retrospective investigation.

We calculated the relative risk for each statistically significant risk factor. Significant risk factors were then analyzed using log-linear models, or multidimensional χ^2 tests. We determined that P values at the level of $\leq .05$ would be considered statistically significant. Small P values (ie, $<.05$) were considered to indicate a lack of additivity—or to indicate a lack of independence of these factors as they affect PPD. Conversely, nonsignificant P values indicated some degree of additivity.

Results

During the study period, 1072 women delivered infants at the three study sites. Of these 1072 potential subjects, 217 (20%) women had patient records in which none of the variables noted was missing from their patient records.

Of the 217 women whose records contained a patient-completed EPDS, 7 (3.2%) were eliminated from the study because their lists of current medications included an antidepressant. One potential subject was excluded because her infant was stillborn.

Of the 209 women remaining in the study population after inclusion and exclusion criteria were applied, 128 (61%) had an EPDS score of 12 or below (ie, not depressed), and 81 (39%) had a score of 13 or higher (ie, depressed).

Among the 81 women whose EPDS results indicated a possible diagnosis of PPD, there was no significant difference by patient age or marital status at 4-weeks postnatal (*Table*).

Breastfeeding was associated with a significantly lower occurrence of PPD than formula feeding only ($P<.001$). The relative risk factor for formula feeding only was 2.04 ($P<.05$).

There was a significant difference in the occurrence of PPD between women who had a history of depression noted in their records and those without a history of depression ($P=.003$). The relative risk factor for women with a history of depression was 1.87 ($P<.05$).

Cigarette smoking was associated with a significantly higher occurrence of PPD than was not smoking ($P=.01$). The relative risk factor for cigarette smoking was 1.58 ($P<.05$).

Vaginal birth was not associated with a significantly lower occurrence of a positive screen for PPD than cesarean section ($P=.09$).

Three combinations of patient characteristics were found to have additive effects on the likelihood of subjects receiving an EPDS score that was predictive of PPD:

- not breastfeeding and a history of depression ($P=.12$),
- cigarette smoking and a history of depression ($P=.29$), and
- cigarette smoking and not breastfeeding ($P=.96$).

Comment

We acknowledge the limitations of a study based, as ours is, on convenience sampling. However, we are persuaded that the statistical findings we have reported have merit because they tend to support the findings in numerous randomized studies,[7,10,18–29] as noted elsewhere.

Although PPD affects approximately 13% of women who give birth,[2] a disproportionately high number of women (81 [39%]) in this patient sample had EPDS scores that indicated possible diagnosis for PPD. Because universal screening for PPD at 4-weeks postnatal was not in effect at the three study sites during the study period, our study may have been affected by referral bias. Physicians may have been more likely to ask patients with signs and symptoms of depression to take the EPDS.

A second contributing factor to the disparity between

Editor's message: In the original print publication, the Yes and No column headings under "EPDS Score, ⩾13" were accidentally reversed. The error has been corrected here.

Table
Postpartum Depression by Patient Characteristic: Results of χ^2 Test Analysis (N=209)*

Characteristic	n	EPDS Score, ⩾13 Yes	EPDS Score, ⩾13 No	*P*
■ **Age**				.57
□ <21 y	72	26 (36)	46 (64)	
□ ⩾21 y	137	55 (40)	82 (60)	
■ **Breastfeeding**				<.001
□ Yes	70	16 (23)	54 (77)	
□ No	139	65 (47)	74 (53)	
■ **Married**				.28
□ Yes	64	21 (33)	43 (67)	
□ No	145	60 (41)	85 (59)	
■ **History of depression**				.003
□ Yes	26	17 (65)	9 (35)	
□ No	183	64 (35)	119 (65)	
■ **Cigarette smoker**				.01
□ Yes	59	31 (53)	28 (47)	
□ No	150	50 (33)	100 (67)	
■ **Method of delivery**				.09
□ Vaginal birth	163	58 (36)	105 (64)	
□ Cesarean section	46	23 (50)	23 (50)	

* Data are reported as No. (%) unless otherwise specified. EPDS indicates Edinburgh Postnatal Depression Scale.[5] For the purposes of this study, investigators divided subject records into two categories. Subjects with EPDS scores of 12 or lower were labeled "not depressed"; subjects with EPDS scores of 13 or higher were labeled "depressed."

this study group's incidence of PPD and incidence levels reported elsewhere[8,10,30,28] may be that the population served by the three study sites is mostly poor and/or indigent. Poverty is a risk factor for PPD and is associated with more than twice the documented rate of occurrence of PPD.[31] Morris-Rush and coauthors[4] studied two inner city practices in New York and found that 22% of patients who took the EPDS had results that were positive for PPD.

Having a sample of patients whose incidence of PPD approached the known incidence of PPD across the general population was not germane to the primary objective of our study, however. We suggest that having more women with possible PPD in our sample group does not significantly alter the results of the statistical tests that look for associations between PPD and the patient characteristics studied.

Review of the Literature and Research Synthesis

Age

Chen[9] and Sierra Manzano and colleagues[32] found a higher incidence of PPD in teenage or adolescent mothers than in older mothers. Sierra Manzano and coinvestigators[32] used the EPDS in a study of 306 women, treating age as a continuum, rather than dividing the women into two or more distinct groups by age. The age of the mother was one of several independent variables associated with PPD, including poverty, previous mental disturbance, use of anesthesia during birth, and family dysfunction.

Although our results disagreed with those of Chen[9] and Sierra Manzano et al,[32] one possible reason for the discrepancy could relate to cultural factors or societal views of young mothers. In our sample, most of the women were from disadvantaged socioeconomic backgrounds.

Breastfeeding Status

Misri and colleagues[18] observed an association between patients with PPD and cessation of breastfeeding. However, in that retrospective study[18] (N=51), 83% of patients claimed that the symptoms of PPD began before the cessation of breastfeeding. Fergerson and coauthors[7] reported that a failed attempt at breastfeeding or early cessation of breastfeeding was found to be significantly associated with higher patient scores on the EPDS (N=72). Abou-Saleh and colleagues[19] reported that

women who breastfed their infants had significantly lower scores than their nonlactating counterparts on the EPDS as well as on a standard measure of anxiety, the Present State Examination.[33] Our findings strongly support the results of these earlier studies.[7,18,19]

Additional support for the association of breastfeeding with a lower incidence of PPD is provided by Labbok,[20] who observed that, in countries where exclusive breastfeeding is the norm, incidence of PPD peaks at around 9-months postpartum; whereas, in countries where formula feeding is the norm, the incidence of PPD peaks at 3-months postpartum.[20] If research could demonstrate conclusively that women who breastfeed are less likely to experience PPD, those data might provide additional motivation for women to choose breastfeeding over formula feeding for their infants.

Marital Status

Some studies[10,21,30] have reported that unmarried women are more likely than their married counterparts to have PPD. In a 1990 study of 69 white women recruited from Lamaze classes and obstetricians' offices, Pfost and colleagues[21] found that marital status was a significant predictor of PPD. The strength of this correlation was second only to that of preexisting depression.[30] A 1995 Chilean study of 542 women found that single mothers (defined by researchers as unmarried, separated, or widowed) were twice as likely to have PPD as their married counterparts.[30] Finally, a meta-analysis in 2001 of 84 studies found marital status to be a small but significant predictor of PPD (confidence interval, 0.21–0.35).[10]

Our results disagreed with those of Pfost et al,[21] Jadresic et al,[31] and Beck.[10] One possible explanation is that both Pfost et al[21] and Beck[10] did their analyses on data obtained in the 1980s, a time when societal acceptance of unmarried mothers in the United States may not have been as widespread as it is today.[22,25] Furthermore, as noted, the research published by Jadresic et al[30] was conducted in Chile, which may have a different set of cultural values than the United States.

History of Depression

The meta-analysis by Beck[10] found strong evidence that history of depression is a moderate predictor of PPD (confidence interval 0.38–0.39). O'Hara and Swain[2] found that prenatal depression, in particular, was a strong predictor of PPD (d=0.75), as did Pfost et al.[21] Both studies[2,21] replicated the results of earlier work,[24–26,34,35] and our results strongly concur.

Tobacco Use: Cigarette Smoking

Cigarette smoking is more common in patients with depression than in people in the general population.[23] Furthermore, cigarette smoking has been found to be a valuable predictor of substance use (eg, illegal drugs and alcohol), which is also associated with increased risk of moderate and severe depression.[27] In addition, a survey of primiparous adolescents found significant statistical associations between PPD and the use of alcohol, illegal drugs, and cigarettes.[36] The authors of that study[36] suggested that the stresses of adolescent parenthood predisposed young mothers to PPD, and the use of these substances were likely coping mechanisms or attempts to self-medicate. Our findings, regarding the incidence of PPD as measured through the EPDS in association with tobacco use, support the assertions of Barnet et al.[36]

Method of Delivery: Vaginal Birth vs Cesarean Section

The National Center for Health Statistics reports that the percentage of US births delivered by cesarean section in 2003 was 27.5%, the highest level ever recorded in this country.[28] Ascertaining whether this method of delivery is significantly associated with incidence of PPD could be a valuable tool in assisting clinicians identify a large (and growing) number of at-risk women.

Bergant and coauthors[29] report that cesarean section was one of several variables considered to be a significant risk factor for patients with "early postpartal depressive disorder" at 5 days after childbirth. Fisher and colleagues[37] reported that cesarean section was associated with increased risk to patients of PPD at 5-weeks postpartum in nulliparous women.

Our results tend to support those of the two previous investigations.[29,37] Although our results did not achieve a level of statistical significance ($P<.1$), a trend can be described in which 36% of subjects who delivered vaginally had EPDS scores indicating possible PPD at 4-weeks postnatal vs 50% of subjects who underwent cesarean sections for delivery. We recommend additional research on the relationship between method of delivery and PPD.

Additivity

To determine whether multiple significant risk factors enhanced clinicians' abilities to identify women at increased risk of PPD, we assessed additivity of patient characteristics.

As noted elsewhere, we identified three significant risk factors: formula feeding in place of breastfeeding, history of depression, and cigarette smoking. None of the three possible combinations of these risk factors were significantly *nonadditive*. In other words, all three possible combinations may be somewhat additive.

However, the association between increased incidence of PPD and the combination of formula feeding in place of breastfeeding and prior history of depression was weakest (ie, closest to significantly nonadditive). Therefore, based on the data reported, additivity between formula feeding only and prior history of depression is least convincing.

Formula feeding and cigarette smoking were the most additive, but cigarette smoking and history of depression were also additive. In other words, a patient with two of these risk factors is even more likely to suffer from PPD than ifshe had any one of these three risk factors alone. Confirmation of these relationships with further

research could supply physicians with valuable information for educating and evaluating their patients for PPD.

Conclusion

It is our hope that researchers will assist clinicians in identifying the conditions and patient characteristics of postpartum women that are associated with an increased risk of PPD. Researchers may then develop reliable screening tests that predate the onset of postpartum dysphoria.

We recommend that physicians inquire about breastfeeding status, history of depression, and tobacco use among their postpartum patients. Three risk factors for PPD may serve as valuable "red flags" to assist physicians in diagnosing patients with PPD: formula feeding in place of breastfeeding, history of depression, and cigarette smoking. The presence of more than one of these risk factors in postpartum patients should serve as an even greater warning to physicians that these patients should be observed, evaluated for, and educated about PPD. As more women with PPD are diagnosed earlier as a result of such precautions, it is our hope that the suffering of both mother and infant can be reduced.

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