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How much does Low Socioeconomic Status Increase the Risk of Prenatal and Postpartum Depressive Symptoms in First Time Mothers?

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Abstract

Objective—To examine socioeconomic status (SES) as a risk factor for depressive symptoms in late pregnancy and the early postpartum period. A secondary objective was to determine whether SES was a specific risk factor for elevated postpartum depressive symptoms beyond its contribution to prenatal depressive symptoms.

Design—Quantitative, secondary analysis, repeated measures, descriptive design.

Setting—Participants were recruited from paid childbirth classes serving upper middle class women and Medicaid-funded hospitals serving low-income clients in Northern California.

Participants—A sample of 198 first time mothers was assessed for depressive symptoms in their third trimester of pregnancy and at one, two, and three months postpartum.

Main Outcome Measure—Depressive symptoms were measured with the Center for Epidemiological Studies-Depression (CES-D) Scale.

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Callouts:
New mothers with low SES are twice as likely as higher SES mothers to develop new onset depressive symptoms at three months postpartum.
Women with four SES risk factors (low monthly income, less than a college education, unmarried, unemployed) were 11 times more likely than women with no risk factors to have clinically elevated depression scores at three months postpartum.
Health care professionals must assess for depressive symptoms during pregnancy and continue to assess for symptoms throughout the first year postpartum regardless of socioeconomic status.

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Results—Low SES was associated with increased depressive symptoms in late pregnancy and at 2 and 3 months, but not at 1 month postpartum. Women with four SES risk factors (low monthly income, less than a college education, unmarried, unemployed) were 11 times more likely than women with no SES risk factors to have clinically elevated depression scores at 3 months postpartum, even after controlling for the level of prenatal depressive symptoms.

Conclusion—Although new mothers from all SES strata are at risk for postpartum depression, SES factors including low education, low income, being unmarried, and being unemployed increased the risk of developing postpartum depressive symptoms in this sample.

Keywords

Postpartum Depression; Prenatal Depression; Socioeconomic Status

Research suggests that women are more likely than men to develop a major affective mood disorder in their lifetime (Burt & Stein, 2002). Moreover, the risk of developing a depressive disorder increases substantially during the prenatal and postpartum period (Burt & Stein). This is understandable given the adaptation and transition from pregnancy and postpartum to motherhood. Meleis and Trangenstein's (1994) Transition theory describes the addition of a new family member as a situational transition which causes multiple changes within the family. One of the major changes includes redefinition of each person's role within the family, for example, the nonparental to parental role. The transition and role change can be especially difficult for the first-time mother who may have little or no past experience to draw upon.

Postpartum affective mood disorders are well documented in the literature and affect women worldwide. The three postpartum affective mood disorders most often discussed in the literature include the blues, postpartum depression (PPD), and postpartum psychosis. Of the three postpartum mood disorders, blues is the most common and affects between 26-85% of all women (Altshuler, Cohen, Moline, Kahn, Carpenter, et al., 2001; Beck, Reynolds & Rutowski, 1992). Presenting within the first few days postpartum, the blues are transitory in nature and treatment is rarely needed. Postpartum psychosis is the most uncommon, but most severe of the three postpartum mood disorders and requires immediate hospitalization and inpatient treatment. Symptoms can present within the first 48 - 72 hours after giving birth and include agitation, pressured speech, hallucinations, delusions, inability to sleep, and confusion (Gale & Harlow, 2003; Sichel, 2000).

As with postpartum blues, the prevalence rate of PPD differs greatly across studies and ranges from 4.5% to 28% (Scottish Intercollegiate Guidelines Network, 2007). This variation is due in part to the differences in sample race/ethnicity, demographics, data collection points, and method of measuring depressive symptoms. The Diagnostic and Statistical Manual of Mental Disorders 4th Edition (*DSM-IV*) (American Psychiatric Association, 1994) defines PPD as a constellation of specific symptoms occurring in the first few weeks postpartum. The temporal boundaries of PPD are still under debate; however experts define PPD as the onset of a depressive episode between two weeks and 12 months after giving birth (O'Hara & Swain, 1996; Sichel & Driscoll, 2002; The Marcé Society, 2006). Timely diagnosis and treatment for PPD is essential because symptoms can lead to poor maternal-infant bonding and disrupt the infant's own emotional and cognitive development if left untreated (Beck, 1995, 1998; Edhborg, Lundh, Seimyr & Widstrom, 2001; Field, Healy, Goldstein & Guthertz, 1990; Grace, Evindar & Stewart, 2003; Murray, 1992). Other detrimental effects of untreated PPD include poor social relationships and interpersonal interactions, substance abuse, infanticide, and suicide (Kelly, Zatzick & Anders, 2001; Lindgren, 2001; Spinelli, 2004).

Risk factors identified in the development of PPD include: hormonal changes, antenatal depression, lack of social support, marital status, child-care stress, adolescent pregnancy, poor

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relationship satisfaction, infant temperament, and low self-esteem (Beck, 1996, 2001; Goyal, Gay & Lee, 2009; Hendrick, Altshuler & Suri, 1998; Logsdon & Usui, 2001; McGrath, Records & Rice, 2008; Studd & Panay, 2004). Low socioeconomic status (SES) is often associated with lack of social support, low self-esteem, younger age, and absence of spousal financial and social support (Beck, 1996, 2001; Hendrick et al., 1998; Logsdon & Usui, 2001; McGrath et al., 2008; Studd & Panay, 2004). These risk factors are bio-psycho-social in nature and the complexities of their interactions require a framework to better explore these factors and their contribution to the stress of transitioning to a maternal role and identity for the first-time mother (Goyal, 2007; Goyal et al., 2009)

Although biological changes after childbirth will be the same to some degree for all women, SES is unique for each new mother and her family. The birth of a child can be joyful, demanding, and stressful for all parents (Muslow, Caldera, Pursley, Reifman & Huston, 2002). How a new mother copes with the challenges of motherhood is also very individual and can be addressed within Lazarus and Folkman's (1984) theory of stress, appraisal, and coping. This theory considers an individual's efforts to manage stressors that are taxing or potentially exceeding their resources. Women with low SES are at greater risk of developing both antenatal depression and PPD (Beeber & Miles, 2003; Beeghly, Olson, Weinberg, Pierre, Downey, et al., 2003; Rich-Edwards, Kleinman, Abrams, Harlow, McLaughlin, et al., 2006). Furthermore, women with lower incomes are less likely to have adequate access to mental health services and are least likely to report symptoms of depression to health care professionals (Kimerling & Baumrind, 2005; Song, Sands & Wong, 2004).

Few researchers specifically set out to determine how demographic factors such as income, education, and age correlate with postpartum mood disorders. Even fewer studies have compared affluent and low income women longitudinally from the prenatal period through 3 months postpartum. Therefore, the overall purpose of this study was to examine SES as a risk factor for depressive symptoms among women in late pregnancy through their third month postpartum. A secondary objective was to determine which of the four components of SES (income, marital status, education level, employment) was a specific risk factor for elevated postpartum depressive symptoms beyond their initial contribution to prenatal depression.

Literature Review

The research evidence for a relationship between SES and depressive symptoms during the childbearing period is conflicting. Some studies suggest that low SES contributes to the development of PPD and that a higher SES is protective against PPD, while others report that low SES has very little influence on the development of PPD. A recent report compiled by the Center for Health Statistics (2008) estimated that 1 in 5 women would suffer from PPD in her lifetime, with the risk magnified in younger, less educated, low-income women, who were recipients of Medicaid. Income and occupational prestige were significant predictors of PPD in a logistic regression analysis to determine the specific role of social status in the development of PPD (Segre, O'Hara, Arndt & Stuart, 2007). Severity of depressive symptoms was assessed in a cross-sectional sample of 4,332 postpartum women at an average of 4.6 months postpartum. Twelve percent of the women screened positive for PPD, with a higher prevalence in unmarried, younger, multiparous women with low income and in those without a college education (Segre, et al., 2007).

Mayberry and colleagues (2007) studied over 1300 primiparous and multiparous American women who had all delivered a healthy infant. Depressive symptoms were assessed at six-month intervals (0-6, months, 7-12 months, 13-18 months, and 19-24 months) and their results suggest that younger, unemployed, low-income, less educated, multiparous women were at an increased risk for developing PPD. Moreover, the severity and duration of depressive

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symptoms decreased as income levels rose. A second study conducted by Rich-Edward and colleagues (2006) assessed depressive symptoms mid pregnancy and again at 6 months postpartum in over 1600 women. Results suggested younger maternal age, lack of a partner, lower income, and financial hardship were factors associated with both prenatal and postpartum depressive symptoms. In a meta-analysis that included 84 studies and approximately 3000 participants Beck (2001) noted that SES and marital status were additional predictors of PPD that were not apparent in her earlier study (Beck, 1996).

Several longitudinal studies have also reported associations between low SES and PPD. Beeghly and colleagues (2003) assessed depressive symptoms (CES-D) and socio-demographic risk profiles in 163 African American women at 2, 3, 6, 12, and 18 months postpartum. Among other results, single marital status and low-income status were significantly related to higher CES-D scores by women at all assessment periods. Seguin and colleagues (1999a) assessed depressive symptoms in 68 first-time low SES mothers. A relationship between several stressful life conditions, including a lack of money and elevated postpartum depressive symptoms, was noted in first-time mothers at 6 months postpartum. Moreover, 32% were still reporting elevated depressive symptoms at 6 months postpartum. Other research by Seguin and colleagues (1999b) compared socio-environmental factors and postpartum depressive symptoms in 80 low SES and 36 high SES mothers from 3-9 weeks postpartum. Results suggested no difference in depressive symptoms at 3 weeks postpartum. However, at 9 weeks postpartum, the low SES mothers' depression scores were elevated when compared to mothers of higher SES. Hobfoll and colleagues (1995) interviewed impoverished, inner-city women twice during pregnancy (second and third trimester) and at 7 to 9 weeks after birth. The high rate of PPD (23%) was double that of middle-class samples suggesting SES may be associated with PPD.

In contrast, other researchers have reported that low SES has very little influence on the development of PPD. Adewuya and colleagues (2005) found no difference between depressed and non-depressed Nigerian mothers with regard to their level of education or SES. Given that all of the women in the sample were of low SES this may be a non-significant finding. However, unmarried status was a predictor of PPD (OR 3.44, CI 2.15-5.53). Ross and colleagues (2006) noted in their meta-analysis that sociodemographic data are often not reported, or are adjusted and controlled statistically, thereby limiting the external validity of the results. Their meta-analysis included 143 studies with a total of 51,453 women to identify demographic characteristics of participants in studies of risk factors, treatment, or prevention of PPD. They reached two conclusions: 1) most (83%) studies were conducted in Western societies with a higher percentage of older, white, partnered women of higher SES; and 2) the proportion of participants for whom demographic variables were reported (maternal age, ethnicity, relationship status, SES) varied between 18-92% (Ross, Campbell, Dennis & Blackmore).

Even with the differences in research findings, there is strong evidence to suggest that women of low SES have higher risk of developing PPD. Moreover, very few studies have compared PPD prevalence rates in low and high income primiparas when controlling for parity and partner status. The current study describes the relationship of SES to depressive symptoms during the transition to motherhood for first time mothers in partnered relationships. A second objective was to determine which component of SES is a specific risk factor for PPD beyond the contribution to prenatal depression.

Methods

Study Design and Sample

As part of a longitudinal randomized clinical trial to improve parents' sleep in the first postpartum month, 198 expectant mothers were recruited from childbirth education classes and

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prenatal clinics. Eligible mothers included partnered women expecting their first child, at least 18 years of age, willing to participate, and able to read and write English. Informed consent was obtained from each participant, and all women were paid for their participation. This study was approved by the institution's Committee on Human Research.

Procedure

Women were studied in their homes during their last month of pregnancy and at one, two, and three months postpartum. Mothers randomly assigned to the intervention group (n = 117) were given strategies to improve their postpartum sleep, and mothers assigned to the control group (n = 81) were given comparable attention from the research team in the form of information on how to eat a healthy diet. Although there was no group difference on any depression measure, group assignment was included as a covariate in all multivariate analyses.

Measures

Socio-demographic Measures—During the third trimester participants were asked to provide information regarding age, race, ethnicity, education, employment, and household income. Income was reported as an estimate of either monthly or annual household income. Postpartum information included type of delivery (cesarean or vaginal), infant gender, and maternal work status.

Depressive Symptoms—The Center for Epidemiological Studies -Depression (CES-D) Scale is widely used to screen for depressive symptoms in the general population and in women before and after childbirth (Radloff, 1977). The instructions ask respondents to think about the past week and check the response that best describes how often they felt or behaved this way. Responses range from 0 (rarely/none or < 1 day) to 3 (most/all the time or 5-7 days). To account for response bias, four items are positive feelings that are reverse coded. The total score ranges between 0 and 60, with a higher score representing more frequent depressive symptoms. A score ≥ 16 is suggested as a risk factor for depressive illness and need for clinical evaluation (Radloff).

For the purpose of this analysis, this cutoff was used as an indicator of prenatal or postpartum "depression risk." The CES-D was administered at each of the four assessments. The CES-D has been found to have adequate sensitivity to detect major depression and good internal consistency and test-retest reliability in postpartum first-time mothers (Beeghly, et al., 2003; Beeghly, Weinberg, Olson, Kernan, Riley, et al., 2002). In the current sample, the Cronbach alpha coefficient was .86 in the third trimester and .85 at three months postpartum. While the CES-D has strong psychometric properties and provides a reliable estimate of depressive symptom severity, it is important to note that a score of 16 or above is not the equivalent of a PPD diagnosis.

Data Analysis

The sample was split into two groups based on monthly household income (<$3,000 and ≥ $3,000). This cutoff corresponds to approximately 200% of the Federal Poverty Level for 3-person families at the time the data were collected and to 50% of the median household income in San Francisco. This income level is somewhat higher than that used in other studies but takes into account the relatively high cost of living in the San Francisco Bay Area. Descriptive statistics were used to describe sample characteristics, and independent t-tests and Chi-square tests were used to identify group differences on continuous and categorical outcomes, respectively. Repeated measures analysis of variance was used to evaluate the pattern of CES-D scores over time among women in higher and lower income groups, controlling for group assignment. A square-root transformation was used to normalize CES-D scores and meet the homogeneity of variance assumption for analysis. Logistic regression was used to determine

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the unique contribution of SES factors (income, marital status, education level, employment) to postpartum depressive symptoms after controlling for prenatal depressive symptoms and randomized group assignment. Analyses were conducted using SPSS 14.0 (SPSS, Inc, Chicago) and all tests used a significance level of 0.05 and 95% confidence interval (CI).

Results

Sample Characteristics

Of the 304 women enrolled in the larger study, 27 were excluded from the analysis because they did not have a partner, 44 were excluded due to missing prenatal or postpartum CES-D data, and 18 women were excluded due to incomplete income data. An additional 17 women were excluded due to a history of mood disorder prior to pregnancy as this analysis was focused on prenatal and postpartum depressive symptoms and not chronic depression. Sample characteristics and descriptive data for the 198 women in the final sample are presented in Table 1. Most participants reported their household income as being within a given range (e.g., <$1,000 per month or $60,000 - $74,999 per year) rather than as an exact figure. The median annual income category was $45,000 - $59,999, and annual household incomes ranged from <$12,000 to >$150,000. On average, those with monthly household incomes <$3,000 were significantly younger and more ethnically diverse than those with higher incomes. Women in the lower income group also tended to live in larger households and were less likely to be college-educated, married, or employed. The income groups had similar cesarean delivery rates and a comparable proportion of the women in each group had returned to work by 3 months postpartum. Prenatal data were collected a mean of 3.2 ± 1.5 weeks before delivery and postpartum data were collected 3.2 ± 1.4, 7.8 ± 1.4, and 12.1 ± 1.4 weeks after delivery.

Depressive Symptoms by Income Group

Table 2 illustrates that lower income was associated with higher depression risk, but the increased risk was not consistent over time. The lower income group reported significantly more depressive symptoms than the higher income group prenatally, but at one month postpartum, the two groups reported similar levels of depressive symptoms. At two and three months, the lower income group was again reporting more depressive symptoms than the higher income group.

The pattern of depressive symptoms over time for both income groups is also illustrated in Figure 1. While depressive symptoms generally improved from the prenatal assessment to the third month postpartum and the lower income group generally reported more depressive symptoms than the higher income group, the pattern over time differed for the two groups. The lower income group improved relatively steadily, while the higher income group had an increase in symptoms at one month postpartum before their symptoms began to improve. A repeated measures ANOVA controlling for group assignment indicated main effects for time ($F[3,192]=16.95$, $p<.001$, partial eta squared = .21) and income ($F[1,194]=6.93$, $p=.009$, partial eta squared = .03), reflecting the general trends for depressive symptoms to improve over time and for the low income group to report more depressive symptoms than the high income group. However, a significant time-by-income interaction effect ($F[3,192]=2.76$, $p=.044$, partial eta squared = .04) indicated that the pattern of depressive symptoms over time differed for the two income groups and that the effect of income varied over time. The randomized group assignment (control or intervention) main and interaction effects were not significant.

The Influence of Prenatal Depression Risk

Given that a history of prenatal depression has been shown to be a strong predictor of PPD (Beck, 1996, 2001; Logsdon & Usui, 2001), the frequency of elevated postpartum depressive symptom scores was calculated separately for women with low and high prenatal CES-D

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scores. As illustrated in Figure 2, women with high prenatal depression risk (CES-D ≥ 16) were more likely than those with low prenatal depression risk to have elevated depression scores at one, two, and three months postpartum (χ^2[1]=19.9 to 32.5, all p<.001).

Regression Models to Predict Postpartum Depression Risk

Since the previous analyses indicated that prenatal and postpartum depressive symptom risk were strongly associated and that both were associated with income, logistic regression analyses were conducted to determine whether low income was a specific risk factor for postpartum depressive symptoms beyond its contribution to prenatal depressive symptoms. Separate models were evaluated for predicting depression risk (CES-D ≥ 16) at one, two, and three months postpartum. Income group was included in each model, while controlling for prenatal depression risk and randomized group assignment. As expected, prenatal depression risk was associated with depression risk at each postpartum assessment, and group assignment was not a significant predictor at any time point. Income group was not a significant predictor of depression risk at one or two months postpartum, but was associated with increased depression risk at three months postpartum. The regression model predicting depression risk at 3 months postpartum is summarized as Model 1 in Table 3. The overall model explained between 15.6% (Cox and Snell R Square) and 26.9% (Nagelkerke R square) of the variance in PPD risk and was statistically significant (χ^2[3]=33.5, p<.001), indicating that income group was able to distinguish between women with high and low risk for depression at three months postpartum.

Given that income is only one dimension of SES and requires interpretation with respect to household resources, geography and cost of living, the relationship of other SES indicators (education, employment, and marital status) to prenatal and postpartum depressive symptoms was also evaluated. Having less than a college education, being unemployed, and being unmarried were individually associated with depressive symptoms in late pregnancy and at three months postpartum (all p<.01). Like income, these factors were unrelated to depressive symptoms at 1 and 2 months postpartum. Given the lack of association between SES risk factors and depressive symptoms at one and two months postpartum, subsequent analyses were focused on predicting depression risk at three months postpartum only.

To determine the unique contribution of each SES risk factor to depression risk at three months postpartum, all four were included in a logistic regression analysis controlling for prenatal depression risk and randomized group assignment (see Model 2 in Table 3). As expected, prenatal depression risk continued to be a significant predictor, but of the four SES indicators, only marital status made a significant contribution to the model. The results indicate that unmarried first-time mothers were 2.9 times more likely than married women to have an elevated depression score at three months postpartum, even after controlling for prenatal depression risk and group assignment. The overall model explained between 18.3% (Cox and Snell R Square) and 31.5% (Nagelkerke R square) of the variance in PPD risk and was statistically significant (χ^2[6]=40.0, p<.001), suggesting that Model 2 was a slightly better fit for the data than Model 1. The lack of significance among the other SES risk factors was likely due to the high inter-correlation between income, education, employment, and marital status (χ^2[1]=11.8 to 73.5, all p<.001).

Finally, an exploratory analysis was conducted to evaluate the possibility of cumulative risk associated with multiple SES risk factors. An SES risk score was calculated as the total number of SES indicators (income less than $3,000 per month, less than college education, unemployed, and unmarried) for each woman. The SES risk scores ranged from 0 (no risk factors) to 4 (all risk factors). When included in the regression model, the SES risk score was a significant predictor, even after controlling for prenatal depression risk and group assignment.

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Furthermore, depression risk increased with each additional SES risk factor. Those with all 4 SES risk factors (monthly income < $3,000, less than college education, unemployed, and unmarried) were 11 times more likely than those with no SES risk factors to have an elevated depression score at 3 months postpartum. Model 3 was statistically significant ($\chi^2[6]=41.33$, $p<.001$) and explained between 18.8% (Cox and Snell R Square) and 32.5% (Nagelkerke R square) of the variance in PPD risk.

Discussion

All new mothers are at risk for developing PPD, in fact, Postpartum Support International (2009) states that a common complication of childbirth is depression. The purpose of this study was to describe depressive symptoms in partnered pregnant women experiencing their first birth from the third trimester to three months postpartum, specifically on demographic indicators associated with SES (low monthly income, less than a college education, unmarried, unemployed). Since household income is often higher for partnered women, and a partner is also a source of social support, this sample was limited to partnered women, regardless of marital status.

Depressive Symptoms

Increased frequency of depressive symptoms was experienced by both low (35%) and high (17%) income women in the third trimester. The overall rate of antenatal depressive symptoms in this sample of women is comparable to other studies (Austin, 2004; Chaudron, 2003). Significantly more depressive symptoms in the low income group suggest that the third trimester may be more stressful for low-income women. These findings are worrisome given Kopelman and Colleagues (2008) noted women with antenatal depressive symptoms were more likely than women without symptoms to cite barriers to care that included cost and long waits for treatment, lack of insurance and problems with transportation. Pregnant women with low SES are already at a disadvantage with regard to resources which may in part add to their stress and require additional resources for coping.

At one month postpartum both groups reported similar levels of depressive symptoms. This was not surprising given all new mothers are going through similar biological changes as well as adjusting to a new role and routine with their baby. Moreover, most new mothers, regardless of race or ethnicity, have additional support in the first few weeks postpartum. The support comes in many forms, from help with meals to frequent visits from well-meaning family and friends.

At two and three months postpartum, the low income group was again reporting significantly more depressive symptoms than the high income group. Again, this may in part be explained by the lack of resources available to low SES mothers including access to medical care, transportation, and partner or spousal support. The additional social support that was available in the first few weeks postpartum may have also decreased. According to CES-D mean scores, 9-25 % of the partnered first-time mothers in this sample were at risk of developing PPD at three months postpartum. These rates are similar to the 13-20% rates reported in previous studies (Austin, 2004; Chaudron, 2003; Chen, Chan, Tan & Lee, 2004; Kim, Mandell, Crandall, Kuskowski, Dieperink, et al., 2006; O'Hara & Swain, 1996). This range in prevalence may be due to sampling bias for factors such as SES, martial status, and parity as well as timing during postpartum recovery. A population-based rate of 20% has been acknowledged for the United States (Center for Health Statistics, 2008). It is important to note that CES-D scores significantly improved from the month before delivery to the third month postpartum in both groups of women.

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Clinical Implications

When both low and high income women were combined, 24% (n = 48) scored 16 or higher on the CES-D in the third month postpartum and 16% (n = 31) scored 16 or higher on the CES-D at three months postpartum. These rates are consistent with other rates reported in the literature and similar to what would be expected in the general population. Prenatal screening for depression is clearly warranted, as women with elevated prenatal CES-D scores are more likely to have elevated depressive symptoms at three months postpartum. The risk of PPD in women with elevated prenatal CES-D scores was further increased in those reporting income < $3000 per month, those who were partnered but unmarried, those without a college education, and those who were unemployed before and after giving birth. Not surprisingly, multiple risk factors compound the risk of PPD. Health care providers must integrate depression screening into prenatal patient assessment throughout the course of pregnancy and through the first 3 months postpartum or later. More importantly, healthcare providers need to become educated in the trajectory of postpartum mood disorders and counsel and refer their patients accordingly. All new mothers are experiencing similar biological hormonal changes which can lead to emotional lability and maternity blues in up to 80% of women. Although 20% of women do go on to experience depressive symptoms, symptoms do tend to improve over time for the majority of postpartum women. Situational transition and adaptation to the new family member initiates redefinition of roles within the family which can lead to maladaptation and stress. All of these issues are important to assess along with depressive symptoms.

Results from this study suggest that partnered women with socioeconomic risk factors for depression (less than a college education, unmarried, unemployed) were nearly 11 times more likely to develop PPD than primiparas with none of these risk factors, and there was a clear dose-response reflecting the compounded risk of PPD when multiple SES risk factors were present. These results reflect recent findings in which researchers have utilized a multi-risk or cumulative risk approach to identify predictors of PPD (Klier, Rosenblum, Zeller, Steinhardt, Bergemann, et al., 2008; Oppo, Mauri, Ramacciotti, Camilleri, Banti, et al., 2009). Moreover, the results from this study are congruent with those of Rich-Edward and colleagues (2006), Segre et al., (2007), and Seguin, Potvin, St-Denis, and Loiselle (1999a, b) which suggested low-income, unemployed, and less educated women were at an increased risk of developing PPD. All of these results strengthen the evidence for screening in all women, especially those who have one or more SES risk factors.

Research Limitations and Implications

Very few studies specifically set out to examine the effect of SES on the development of PPD. The strength of this study included the longitudinal research design and direct comparison of low and high income partnered women who were all expecting their first child. The self-selected convenience sample of first-time mothers, the inclusion of the sleep intervention group, the timing of their self-report on frequency of depressive symptoms, and the lack of specific information about social support limit the generalizability of the findings. Other limitations include exclusion of unpartnered women, as it is impossible to account for how much a partnered relationship might have served as a protective role. It is also important to consider that the cutoff of <$3000 monthly household income used to identify those with low income is a relative number that may apply to the San Francisco area but not necessarily generalize to the rest of the population in the United States.

Results from this study indicate that multiple risk factors likely have a cumulative effect on depressive symptoms, which may be explained by disparity of resources between low income and affluent families. Future research should include recruitment of multiparous women from diverse ethnic and SES backgrounds. In addition, SES is a vague term that needs an operational definition with relevance to women having their first baby, particularly given the potential

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fluidity in employment status during the transition to motherhood. Future research should also include biomarkers, such as salivary cortisol, that can estimate the level of stress experienced by first-time mothers during this transition. Finally, a mixed method design with the addition of a qualitative interview would further our understanding of specific issues that low income postpartum women experience that may differ from women with more affluent backgrounds (Kennedy, Beck & Driscoll, 2002). The stories of women's personal experiences will be an invaluable perspective for designing future interventions by identifying specific barriers low income women may face in access to health care and mental health services.

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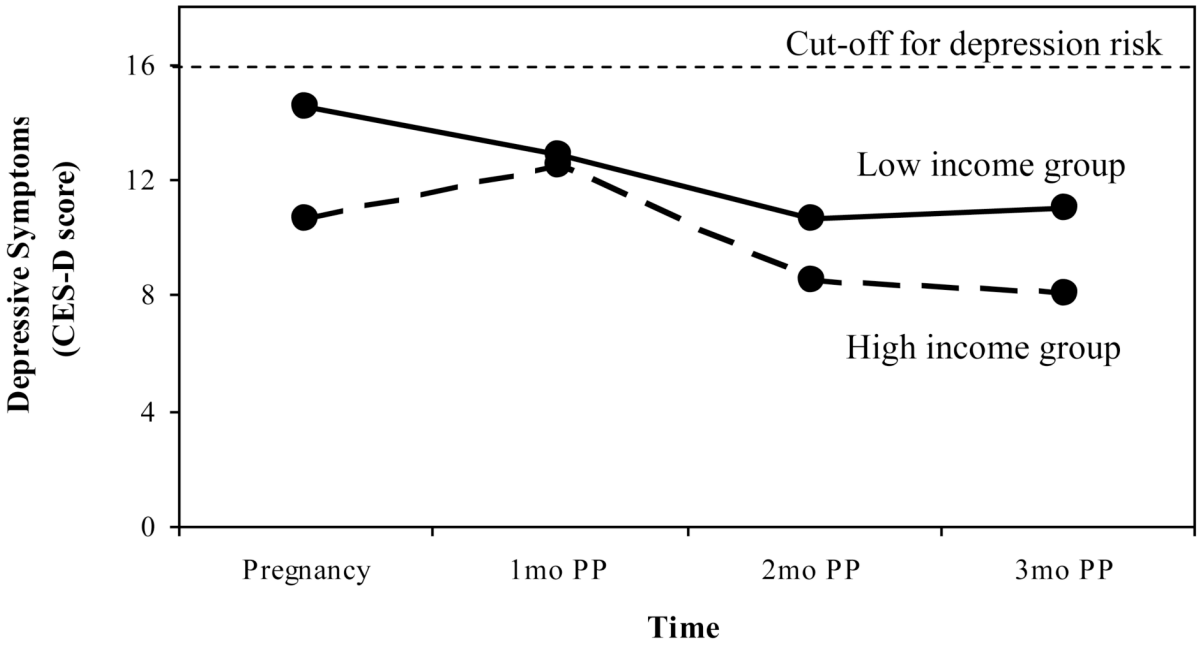

Figure 1.
Depressive symptoms over time by income group (n=198)

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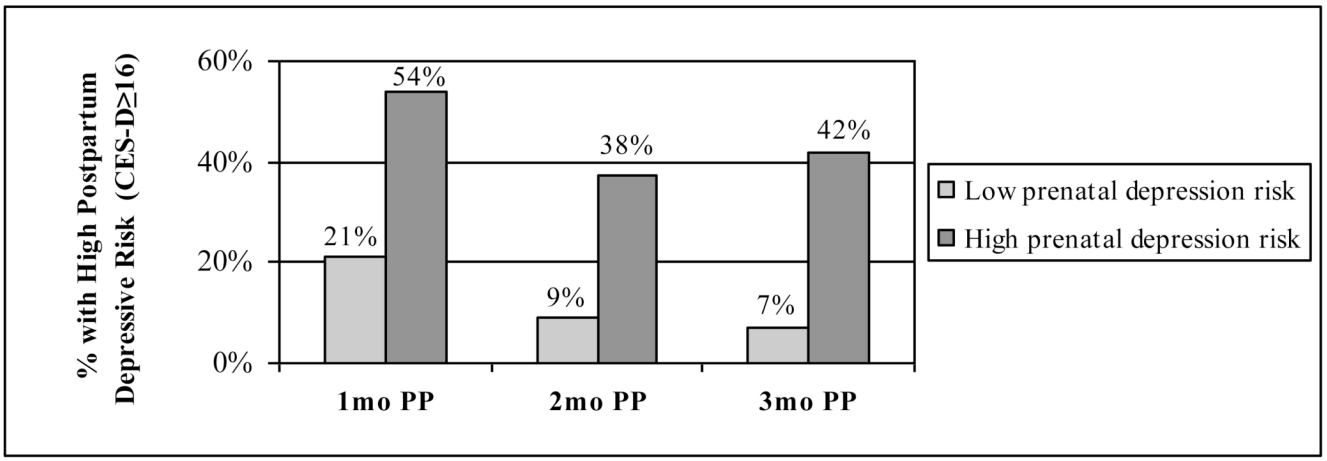

Figure 2.
Postpartum depression risk by prenatal depression risk (n = 198)

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Table 1

Sample demographic characteristics by income group (n=198)

Variable	Low Income[a] (n=81)	High Income[b] (n=117)	Statistic
Age	26.3 ± 6.0	32.6 ± 4.2	$t(132)=8.77^{***}$
Race/Ethnicity			$\chi^2(4)=36.56^{***}$
Black/African-American	11%	2%	$\chi^2(1)=8.06^{**}$
Hispanic/Latina	22%	7%	$\chi^2(1)=9.93^{**}$
Asian	36%	21%	$\chi^2(1)=5.71^{*}$
White/Caucasian	23%	63%	$\chi^2(1)=30.43^{***}$
Mixed or Other race	7%	8%	ns
Married Status (all partnered)	32%	87%	$\chi^2(1)=63.54^{***}$
College graduate	30%	89%	$\chi^2(1)=73.54^{***}$
Household size	3.9 ± 2.8	2.2 ± 0.5	$t(184^{c})=6.46^{***}$
Initial employment rate[d]	28%	80%	$\chi^2(1)=53.43^{***}$
Working 3mos postpartum	16%	21%	ns
Cesarean birth rate	32%	27%	ns

[a] Low income = monthly household income < $3,000;

[b] High income = monthly household income ≥ $3,000

[c] Separate variance t-test, degrees of freedom adjusted for unequal variances

[d] Employment rate includes employed women on maternity leave

* p<.05,

** p<.01,

*** p<.001

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Table 2

Prenatal and postpartum depression scores and risk by income group (n=198)

Variable	Lower Income[a] (n=81)	Higher Income[b] (n=117)	Statistic
Mean CES-D Scores[c]			
Prenatal	14.1 ± 8.3	10.6 ± 8.0	$F(1,194)=10.70^{**}$
1 Month Postpartum	12.8 ± 8.8	12.4 ± 6.6	ns
2 Month Postpartum	10.6 ± 7.0	8.5 ± 7.1	$F(1,194)=3.96^{*}$
3 Month Postpartum	10.9 ± 7.5	8.0 ± 7.2	$F(1,194)=7.54^{**}$
Risk for depression[d]			
Prenatal	35%	17%	$\chi^2(1)=7.96^{**}$
1 Month Postpartum	28%	29%	ns
2 Month Postpartum	21%	12%	ns
3 Month Postpartum	25%	9%	$\chi^2(1)=8.47^{**}$

[a] Lower income = monthly household income < $3,000;

[b] Higher income ≥ $3,000

[c] Analyses control for the non-significant effect of group assignment

[d] Percentage of CES-D scores ≥ 16

* p<.05,

** p<.01

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Table 3

Logistic regression predicting depression risk at 3 months postpartum.

Model / Predictors	Odds Ratio	95% CI
MODEL 1 – Income group		
Intervention group assignment	0.55	0.23, 1.33
Prenatal CES-D ≥ 16	8.04***	3.39, 19.08
Monthly income < $3,000	2.52*	1.05, 6.08
MODEL 2 – Individual SES Risk		
Intervention group assignment	0.74	0.29, 1.87
Prenatal CES-D ≥ 16	7.08***	2.92, 17.20
SES risk factors:		
Monthly income < $3,000	0.85	0.22, 3.26
Not married	2.90*	1.01, 8.34
No college education	1.12	0.37, 3.41
Unemployed	2.50	0.86, 7.26
MODEL 3 – Cumulative SES Risk		
Group assignment	0.71	0.27, 1.82
Prenatal CES-D ≥ 16	6.82***	2.81, 16.52
SES risk score[a]		
All 4 risk indicators (n=28)	11.07**	2.06, 59.39
3 of the 4 risk indicators (n=37)	7.58*	1.42, 40.50
2 of the 4 risk indicators (n=21)	7.19*	1.13, 45.64
1 of the 4 risk indicators (n=37)	6.53*	1.20, 35.59
No risk indicators (n=75)	ref	

* p<.05,

** p<.01,

*** p<.001

[a] SES risk indicators included: monthly income < $3,000, less than college education, being unemployed, and being unmarried