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Rates and Predictors of Postpartum Depression by Race and Ethnicity: Results from the 2004 to 2007 New York City PRAMS Survey (Pregnancy Risk Assessment Monitoring System)

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Abstract The objective of this study was to examine racial/ethnic disparities in the diagnosis of postpartum depression (PPD) by: (1) identifying predictors that account for prevalence rate differences across groups, and (2) comparing the strength of predictors across groups. 3,732 White, African American, Hispanic, and Asian/Pacific Islander women from the New York City area completed the Pregnancy Risk Assessment Monitoring System from 2004 to 2007, a population-based survey that assessed sociodemographic risk factors, maternal stressors, psycho-education provided regarding depression, and prenatal and postpartum depression diagnoses. Sociodemographic and maternal stressors accounted for increased rates in PPD among Blacks and Hispanics compared to Whites, whereas Asian/Pacific Islander women were still 3.2 times more likely to receive a diagnosis after controlling for these variables. Asian/Pacific Islanders were more likely to receive a diagnosis after their providers talked to them about depressed mood, but were less likely than other groups to have had this conversation. Prenatal depression diagnoses increased the likelihood for PPD diagnoses for women across groups. Gestational diabetes decreased the likelihood for a PPD diagnosis for African Americans; a trend was observed in the association between having given birth to a female infant and increased rates of PPD diagnosis for Asian/Pacific Islanders and Whites. The risk factors that account for prevalence rate differences in postpartum diagnoses depend on the race/ethnic groups being compared. Prenatal depression is confirmed to be a major predictor for postpartum depression diagnosis for all groups studied; however, the associations between other postpartum depression risk factors and diagnosis vary by race/ethnic group.

Keywords Postpartum depression · Health status disparities · Asian Americans · Prenatal depression · Gestational diabetes

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Introduction

Postpartum depression (PPD) is a serious health concern affecting approximately 13 % of all women [1]. At least 19.2 % of women experience depression within 12 months after giving birth [2]. The associations between prenatal depression and PPD depression are well documented [3–5]. Psychosocial factors including high stress, low social support, and low marital satisfaction are also predictors [4, 5].

Surprisingly little is known about the extent to which postpartum depression varies by race and ethnicity, given the effects of culture on the experiences and manifestations of depression [6, 7]. This dearth of information on postpartum depression in ethnic minorities is well recognized. In a published review of maternal depression, the Agency for Healthcare Research and Quality found "screening instruments [to be] poorly representative of the U.S. population," and that "populations [from studies] were overwhelmingly Caucasian" [8]. A review by O'Hara found that meta-analyses on postpartum depression had omitted race and ethnicity as risk factors for postpartum depression [4].

Research studies on postpartum depression that have included ethnic minorities generally compare African

Americans and Hispanics with Whites. In these studies, group differences in prevalence rates have shown to be inconsistent. Across studies, the rates of postpartum depression in African American and Hispanic women were found to be higher [9], lower [10], or no different [11] compared to Whites. What accounts for observed racial and ethnic differences in prevalence is unclear. In some studies, sociodemographic risk variables were associated with higher levels of depressive symptomatology among African Americans, raising the possibility that sociodemographic variables rather than race and ethnicity account for different levels of postpartum depression [12–14]. In contrast, others have shown greater levels of depressive symptomatology among African Americans and Hispanics than Whites, after accounting for sociodemographic factors [9]. While certain social factors could increase risk, some factors might *buffer* against postpartum depression within groups. For instance, low income foreign-born Hispanic women with social support exhibited lower rates of postpartum depression [15], whereas bilingual Hispanic women were at greater risk than those who spoke only Spanish [11]. It is possible that factors such as social support or nativity and its effect on the likelihood of postpartum depression differ by race/ethnicity because they express different meanings or incur different implications for each group. Moreover, stigmas about psychological problems and help-seeking may have an effect on identifying postpartum depression, resulting in a subsequent effect on reported prevalence of postpartum depression rates [6, 16]. Given the mixed picture across groups, this study aimed to systematically determine the extent to which prevalence rates across race and ethnicity are explained by factors associated with postpartum depression.

This study uniquely includes Asian/Pacific Islander (API) women within the U.S. As the fastest growing ethnic minority group, over 16 million APIs are estimated to be living in the U.S [17, 18]. The research on API postpartum experiences is limited, which is striking given that API women may hold several risk factors.

If psychiatric history is a major predictor, API women may be at greatest risk: those between the ages of 15–24 years have the highest rate of depression and suicidality compared to any other ethnicity, gender, or age [19–21]. One study showed APIs to be at lower risk for postpartum depressive symptoms compared to Whites, African Americans, and Hispanics [14], while another study reported a greater percentage of APIs with postpartum symptoms compared to White Americans [22]. Analyses conducted by the New York City Department of Health and Mental Hygiene on data from the 2004 to 2007 New York City (NYC) Pregnancy Risk Assessment Monitoring System (PRAMS) revealed a higher rate of PPD diagnoses among APIs compared to other groups [23–25]. From the most recent sample in 2007, 10.4 % of API received a PPD diagnosis compared to 1.7 % of non-Hispanic White women [26]. These findings suggest a potential risk for postpartum depression in APIs.

This study examines racial/ethnic disparities in PPD diagnosis by identifying predictors accounting for prevalence differences. Because previous studies have either focused mostly on small samples of one group, or did not examine these risk factors by race/ethnicity, we hypothesize that associations of risk factors and PPD differ by race/ethnic group. The risk factors evaluated were selected based on the current literature [27–31]. Our study also sought to explain disparities in PPD rates from a published report by the NYC Department of Health and Mental Hygiene. We utilized the study's comprehensive population-based dataset. We also sought to determine the strength of predictors within each group and differences across groups. Accordingly, we stratified our analyses by race/ethnicity. Determining the strength of predictors by group is essential for identifying individuals most at risk, and may inform the possible causes of depression for different groups. Unique to this study was the use of diagnosis as an outcome measure, the inclusion of information on whether providers talked to women about depressed mood, and an adequate sample size of APIs. This allowed us to also examine disparities in psycho-education and diagnosis across groups.

Methods

Sample

This study used the NYC PRAMS from 2004 to 2007, a population-based survey administered to postpartum women from NYC. Coordinated by the Centers for Disease Control and Prevention and state health departments, PRAMS' goal is to monitor maternal behaviors and experiences of women before, during, and after live birth pregnancies. The dataset was provided by the NYC Department of Health and Mental Hygiene (DOHMH).

The participants were part of an ongoing population-based random sampling of NYC live births. NYC mothers of approximately 180 infants with registered birth certificates that gave birth during the previous 2–4 months were contacted for participation monthly. Eighty-three percent responded by mail and 17 % by phone. The sample was randomized without replacement and stratified by birth weight. The final dataset was weighted for stratification, nonselection, and nonresponse.

According to the DOHMH, a total of 4,813 responses were received with response rates of at least 70 % from July to December of 2004, May to December of 2005, and

January to December of 2006. A rate of 65 % was achieved from January to December of 2007. For 2004–2005, responses were weighted to represent 138,266 live births. For 2006 and 2007, responses represented 119,079 and 122,222 live births, respectively. Based on the DOHMH analysis, respondents differed from non-respondents on some key sociodemographic variables ($p < .05$). APIs compared to other racial and ethnic groups, younger women, and women with less education were less likely to respond to the survey.

Measures

The birth certificate provided information on maternal race/ethnicity and nativity (i.e., U.S. or non-U.S. born mothers). Women were classified as Hispanic or non-Hispanic based on self-report. Non-Hispanic women were categorized in one of the following groups: White, African American, Asian/Pacific Islander, and American Indian/Alaskan Native. Maternal age, nativity (U.S. Born versus Foreign Born) and education (categorized as: 0–8, 9–11, 12, 13–15, and >16 years) were based at the time of infant birth from information in the birth certificate. Mean infant age at the time of survey completion was 9.7 months; there were no significant differences in infant age across groups.

The PRAMS survey itself provided information for remaining variables. To obtain income, women were asked to indicate "total household income before taxes in the 12 months before the new baby was born" by checking off one of the following options: <$10,000, $10,000–$14,999, $15,000–$19,999, $20,000–$24,999, $25,000–$34,999, $35,000–$49,999, $50,000–$74,999, and >$75,000. Stressful events during pregnancy were obtained by "yes" or "no" responses to events that may have occurred during the last 12 months before the new baby was born. Examples include "I moved to a new address," "I had a lot of bills to pay," "I got separated or divorced from my husband or partner," and "Someone very close to me died." These events were counted and categorized into the following: 0, 1–2, 3–5, and 6–13 events. A "yes" or "no" response was also used to obtain information on following: gestational diabetes ("High blood sugar (diabetes) that started during this pregnancy"), social support from partner (responses of "My husband or partner" to the question "During your most recent pregnancy, who would have helped you if a problem had come up"), NICU (Neonatal Intensive Care Unit) ("After your baby was born, was he or she put in an intensive care unit?"), unintended pregnancy ("When you got pregnant with your new baby, were you trying to get pregnant?"). The NYC PRAMS included additional questions related to depression. Mothers were asked to respond "yes" or "no" regarding prenatal depression ("At any time during your most recent pregnancy, did a doctor, nurse, or other health care worker diagnose you with depression?"), and discussion about mood ("At any time during your most recent pregnancy or after delivery, did a doctor, nurse, or other health care worker talk with you about "baby blues" or postpartum depression?"). In addition, mothers were asked about PPD diagnosis ("Since your new baby was born, has a doctor, nurse, or other health care worker diagnosed you with depression?"). The response to this item was the outcome variable used for the analyses in this study.

The language of the survey (English or Spanish version) was also noted.

Variables

Covariates included maternal age, household income, maternal education, nativity, and infant age at the time the mother completed the questionnaire. Variables considered as potential stressors included: gestational diabetes, stressful events, social support, NICU, intention for pregnancy, and prenatal depression. Discussion about mood served as an additional predictor of PPD diagnosis.

Responses with missing variables of interest for this study were eliminated. Variables with less than a 100 % response rate included household income (86.9 %), maternal education (99.3 %), maternal age (97.0 %), and PPD diagnosis (99.4 %) resulting in an unweighted study sample of 3,732.

Statistical Analyses

To account for the stratified and weighted sample, the data was analyzed using the complex samples module of SPSS version 17.0 (SPSS Inc., Chicago, IL). A non-race stratified model was conducted to determine the likelihood of receiving a PPD diagnosis for each race/ethnic group with Whites as the reference group. A series of four logistic regression models were employed where the variables of interest (race/ethnicity, sociodemographic, stressors, and discussion about mood) were sequentially added to the model, allowing incremental examination of the variables' effects in identifying factors that explain racial/ethnic disparities in PPD.

Prevalence estimates within each group were generated according to predictors. To compare the characteristics of those with and without PPD and to understand associated predictors, race-stratified logistic regressions incorporated all predictors, with sociodemographic variables as covariates. Adjusted odds ratios for each predictor were generated by race/ethnic group. Note that our models failed to converge with the inclusion of language, nativity, and NICU variables because of low cell sizes; thus, these variables were dropped from our analyses. Unless

otherwise noted, all reported proportions represent weighted averages.

Results

Compared to other groups, API women showed the highest rate for PPD, followed by Hispanics and African Americans. White women had the lowest rate of PPD. The high rate of a PPD diagnosis among API women is consistent with previous analyses from this dataset, which utilized a larger sample size than the dataset here, as this set includes only women with complete data on the predictor variables. Other racial/ethnic differences among assessed variables are presented (Table 1).

A major objective was to determine whether sociodemographic variables, stressor variables, and discussion about mood accounted for PPD differences. In the unadjusted model, likelihood estimates indicate that API women were 4.6 times more likely and Hispanic women 2.7 times more likely than Whites to receive a PPD diagnosis. African American were 1.7 times more likely to receive the diagnosis than Whites, although this was not statistically significant (Table 2). Once sociodemographic factors were entered, African Americans were no more likely to receive a diagnosis than Whites. For Hispanics, the greater likelihood for a diagnosis compared to Whites was less pronounced after accounting for sociodemographic factors and was eliminated with the inclusion of stressors. The diagnosis likelihood was slightly reduced for APIs after accounting for sociodemographic factors, and significantly reduced with stressor variables, although diagnosis likelihood was still more than double the rate of Whites and African Americans. In contrast to the other groups, diagnosis likelihood for APIs increased to 3.2 times relative to Whites, after accounting for reports of having discussed mood with a provider. Prenatal depression was by far the strongest predictor for all women compared to other stressors, although women who gave birth to females were more likely to receive a diagnosis than women with male infants. Overall, those who had a discussion about mood were also more likely to receive a diagnosis.

Profiles of women with PPD diagnoses compared to women without a diagnosis differed by race/ethnicity. The majority of White women reporting a PPD diagnosis received a postgraduate education, while API and African American women with the diagnosis tended to be high school graduates. Approximately half of the White women with PPD had household incomes above $75,000 per year. Among APIs, Hispanics, and African Americans, more women with PPD had less than $15,000 of household income per year than those without a diagnosis (Table 3).

With regard to stressors, we found a significantly higher rate of gestational diabetes among those with PPD than those without PPD, but only for White women. However, after controlling for sociodemographic variables through our race-stratified adjusted model, gestational diabetes did not significantly predict PPD in White, API, or Hispanic women (Table 4). In fact, African American women with gestational diabetes were less likely to receive a diagnosis of PPD.

Compared to those without PPD, there was a higher percentage among APIs and Hispanics with the diagnosis who had an unintended pregnancy. In addition, the majority of APIs with PPD had a diagnosis of prenatal depression compared to the other groups. Stressful events were not associated with greater likelihood for PPD, but API women who reported having 6–13 stressful events were significantly more likely to have PPD, a rate that was statistically significant. The association between prenatal depression and PPD persisted for all groups, even after controlling for sociodemographic variables.

Overall, there was a higher rate of women with PPD who had a discussion about mood with their providers than women without the diagnosis. However, the association between PPD and discussion about mood with providers was specific to only API and African American women in the adjusted model.

Women from all groups who received a diagnosis of PPD were more likely to have given birth to females although the differences were not statistically significant. However, having a female infant seemed to slightly increase the likelihood of a PPD diagnosis among White and API women based on the race-stratified analyses.

Discussion

This study assessed PPD estimates and identified predictors of PPD as defined by women's reports of receiving a diagnosis from a health care provider. We included API women and used race-stratified analyses, allowing us to determine whether predictors varied by race/ethnicity.

This study also sought to identify factors that explained racial/ethnic disparities obtained in a previous analysis of the dataset by the NYC Department of Health and Mental Hygiene. As with other studies, we found that sociodemographic factors accounted for the higher rates of PPD among African Americans and Hispanics. Based on such findings, some have argued for prevention or intervention programs to provide resources (e.g., financial support, education) in addressing the racial/ethnic disparities of PPD for African Americans and Hispanics [12]. However, unlike other studies that primarily assessed reported symptoms [9, 12, 14], we used the diagnosis of PPD as the

Table 1 Weighted percentage distribution of mothers who recently gave birth that completed the NYC PRAMS from 2004 to 2007, by characteristic, according to race/ethnicity

	White (n = 1,043)	Asian/ Pacific Islander (n = 425)	Hispanic (n = 1,253)	Black (n = 1,027)
Maternal age				
<20	2.4[a]	0.9[a]	9.9[b]	6.9[c]
20–34	70.1[a]	75.4[b]	76.8[b]	73.8[a,b]
≥35	27.5[a]	23.7[a,b]	13.3[c]	19.3[b,d]
Maternal education				
0–8	1.7[a]	2.7[a]	11.7[b]	1.6[a]
9–11	4.2[a]	10.7[b]	19.6[c]	15.8[d]
12	22.6[a]	26.1[a]	34.4[b]	32.1[b]
13–15	16.2[a]	14.7[a]	21.1[b]	28.1[c]
≥16	55.4[a]	45.8[b]	13.2[c]	22.4[d]
Income				
<10,000	10.0[a]	20.4[b]	40.3[c]	29.2[d]
10,000–14,999	6.7[a]	15.1[b]	14.3[b]	10.3[c]
15,000–19,999	4.6[a]	8.0[b]	8.8[b]	8.6[c]
20,000–24,999	4.7[a]	5.8[a]	6.8[b]	9.2[c]
25,000–34,999	6.8[a]	5.7[a]	9.5[b]	13.2[c]
35,000–49,999	8.7[a]	6.0[a]	6.7[a]	10.1[a]
50,000–74,999	12.1[a]	9.9[a]	6.3[a]	10.2[a]
≥75,000	46.4[a]	29.1[b]	7.1[c]	9.0[d]
Maternal nativity				
U.S. born	68.4[a]	11.1[b]	34.1[c]	56.3[d]
Non-U.S. born	31.1	88.9	65.6	43.0
Missing data	0.5	0	0.3	0.7
Language of questionnaire				
English	99.1[a]	99.5[a]	51.2[b]	98.8[a]
Spanish	0	0	48.5	0
Missing data	0.5	0.5	0.3	1.2
NICU				
Yes	5.1	5.9	6.4	14.4
No	94.9[a]	94.1[a]	93.6[a]	85.5[b]
Don't know	0	0.1	0	0.1
Gender				
Male	49.3[a]	52.1[a]	51.1[a]	52.0[a]
Female	50.7	47.9	48.9	48.0
Diabetes				
No	92.4	85.1	89.9	89.9
Yes	7.6[a]	14.9[b]	10.1[c]	10.1[c]
Stresses				
0	45.1[a]	49.1[a]	31.6[b]	26.5[c]
1–2	41.8[a]	38.7[a]	41.5[a]	42.8[a]
3–5	12.1[a]	11.3[a]	23.3[b]	25.2[b]
6–13	1.1[a]	0.8[a]	3.6[b]	5.5[c]
Social support				
No	90.4	90.8	76.9	75.2
Yes	9.6[a]	9.2[a]	23.1[b]	24.8[b]
Intention for pregnancy				
No	30.9[a]	35.1[a]	59.0[b]	66.5[c]
Yes	69.1	64.9	41.0	33.5
Prenatal depression diagnosis				
No	97.2	87.6	92.4	94.5
Yes	2.8[a]	12.4[b]	7.6[c]	5.5[d]
Discussion about mood				
No	46.0	61.4	42.7	39.3
Yes	54.0[a]	38.6[b]	57.3[a,c]	60.7[c]
Postpartum depression diagnosis				
No	97.4	89.3	93.6	96.3
Yes	2.6[a]	10.7[b]	6.4[c]	3.7[a]

Lower case superscripts that differ across each row represent statistically different values across racial/ethnic groups. Conversely, groups within a row that share the same superscript demonstrate no statistically significant difference in values within $p < .05$

outcome measure. This raises the possibility that sociodemographic status accounts for the rates at which one *receives* a diagnosis; in our study, African Americans and Hispanics with lower sociodemographic statuses were less likely to receive a diagnosis compared to Whites. If race/ethnic disparities are found among rates of diagnosis, then the diagnostic process may be another area to target for improvement among lower sociodemographic status groups.

Among ethnic minorities in our study, API women were the most likely to receive a PPD diagnosis, and unlike African Americans and Hispanics, the likelihood of receiving a PPD diagnosis for APIs remained significantly higher even after accounting for other variables (e.g., sociodemographic factors). Prenatal depression was associated with PPD for all groups in our study, but the likelihood was highest for APIs. Although psychiatric history for depression was not available, the strong association between prenatal depression and PPD observed among the API women in our sample adds to the growing concern of depression experiences and its effects on API women during motherhood [19–21]. A number of factors specific to API women's experiences are potentially associated with later postpartum mood. The high rate of depression and suicidal ideation during adolescence and young adulthood may reflect family and societal pressures faced by young women to uphold high academic standards and traditional gender roles [32]. These young women likely must negotiate their cultural values and beliefs when assuming a mother's identity [33, 34]. In addition, the cultural preference for male infants may affect PPD.

Table 2 Logistic regression models of race/ethnicity, other sociodemographic factors, stressors, and discussion of mood with provider, with adjusted odds of postpartum depression diagnosis

	Model 1		Model 2		Model 3		Model 4	
	OR	CI	OR	CI	OR	CI	OR	CI
Race								
White	1.0		1.0		1.0		1.0	
Asian/Pacific Islander	4.6***	2.6–8.2	4.0***	2.2–7.2	2.7**	1.4–4.9	3.2***	1.7–6.0
Hispanic	2.7***	1.7–4.5	1.8*	1.0–3.1	1.5	0.9–2.7	1.5	0.9–2.7
Black	1.7†	1.0–3.0	1.2	0.6–2.2	0.9	0.5–1.8	0.9	0.4–1.8
Maternal age								
<20			1.0					
20–34			0.5	0.3–1.1	0.5	0.2–1.1	0.5	0.2–1.2
≥35			0.7	0.3–1.6	0.7	0.3–1.7	0.7	0.3–1.9
Maternal education								
0–8			1		1		1	
9–11			0.8	0.3–1.9	1.2	0.4–3.2	1.1	0.4–3.0
12			1.0	0.5–2.1	1.6	0.7–4.1	1.6	0.7–4.0
13–15			1.1	0.5–2.5	1.6	0.6–4.2	1.6	0.6–4.3
≥16			0.8	0.4–1.8	1.5	0.6–4.0	1.6	0.6–4.2
Income								
<10,000			1.0		1.0		1.0	
10,000–14,999			1.2	0.7–2.1	1.5*	0.8–2.8	1.5*	0.8–2.8
15,000–19,999			0.8*	0.3–1.6	1.1	0.5–2.4	1.0	0.5–2.2
20,000–24,999			0.5	0.2–1.2	0.6	0.3–1.4	0.6	0.2–1.3
25,000–34,999			0.6	0.3–1.3	0.7	0.3–1.7	0.7	0.3–1.6
35,000–49,999			0.3	0.1–0.7	0.3	0.1–0.9	0.3	0.1–0.8
50,000–74,999			0.4	0.2–0.9	0.5	0.2–1.3	0.5	0.2–1.3
≥75,000			0.5	0.3–1.0	0.7	0.3–1.5	0.7	0.3–1.4
Gender								
Male					1.0		1.0	
Female					1.6*	1.1–2.4	1.7*	1.1–2.5
Diabetes								
No					1.0		1.0	
Yes					0.8	0.4–1.5	0.8	0.4–1.6
Stresses								
0					1.0		1.0	
1–2					0.8	0.5–1.3	0.8	0.5–1.3
3–5					1.0	0.6–1.8	1.0	0.6–1.8
6–18					1.8†	0.7–4.9	2.0†	0.8–5.1
Social support								
No					1.0		1.0	
Yes					1.1	0.7–1.9	1.2	0.7–2.0
Intention for pregnancy								
No					1.0		1.0	
Yes					1.2	0.8–1.8	1.2	0.8–1.8
Prenatal depression diagnosis								
No					1.0		1.0	
Yes					17.3***	10.9–27.5	15.0***	9.4–23.8
Discussion about mood								
No							1.0	
Yes							2.6***	1.6–4.1

† $p < 0.1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 3 Weighted percentage of mothers who completed the NYC PRAMS from 2004 to 2007, by characteristic according to race/ethnicity and postpartum depression diagnosis

	White		Asian/Pacific Islander		Hispanic		Black	
	No PPD (n = 1,010)	PPD (n = 33)	No PPD (n = 383)	PPD (n = 42)	No PPD (n = 1,162)	PPD (n = 91)	No PPD (n = 979)	PPD (n = 48)
Maternal age								
<20	2.3	5.9	1	0	9.6	13.4	6.2	25.2***
20–34	70.4	62	74.1	86.1†	77.7	63.7**	74.2	63.4†
≥35	27.4	32.1	24.9	13.9	12.6	22.9**	19.6	11.5
Maternal education								
0–8	1.7	0	2.4	4.9	11.5	15.8	1.7	0.7
9–11	4	9	10.6	11.4	19.3	23	15.9	12.5
12	22.9	12.1	23	52.8***	34.9	25.9†	31.4	49.3***
13–15	16.5	5.3	14.5	16.5	20.7	27.7	28.2	26.2
≥16	54.9	73.6†	49.5	14.3***	13.6	7.6	22.8	11.4
Income								
<10,000	9.9	15.4	18.7	34.2*	40.1	44.2	28.6	46.9***
10,000–14,999	6.7	4.7	14.8	18.2	13.5	27***	9.8	21.8***
15,000–19,999	4.8	0	7.3	13.5	9.1	5.3	8.4	14.9*
20,000–24,999	4.8	0	6	4.5	6.7	8.5	9.6	0.6**
25,000–34,999	7	0.5	4.6	15.3	9.7	5.8	13.5	4.8*
35,000–49,999	8.5	15.1	6.7	0.3	7.1	0.5*	10.5	1.7**
50,000–74,999	12.1	11.5	10.7	3.6	6.5	4.4	10.6	0.5**
≥75,000	46.2	52.7	31.3	10.3**	7.3	4.3	9	8.8
Maternal nativity								
U.S. born	68.4	66.7	12.3	100***	35.0	23.1*	56.4	54.2
Non-U.S. born	31.1	30.3	87.7	0	64.7	76.9	42.9	45.8
Missing data	0.5	0.3	0	0	0.3	0	0.7	0
Language of questionnaire								
English	99.2	97.0	99.5	100	50	46.2	98.8	100
Spanish	0	0	0.1	0	50	53.8	1.1	0
Missing data	0.8	3.0	0.4	0	0	0	0.1	0
NICU								
No	94.9	94.2	93.6	98.1	93.7	91.9	85.7	82.3
Yes	5.1	5.8	6.3	1.9	6.3	8.1	14.3	17.3
Don't know	0	0	0.1	0	0	0	0.1	0.5
Gender								
Male	49.5	40.2	53.2	43	51.7	43.8	52.3	44.7
Female	50.5	59.8	46.8	57	48.3	56.2	47.7	55.3
Diabetes								
No	92.5	90	85.6	81.4	90.2	86.2	89.6	98.9
Yes	7.5	10*	14.4	18.6	9.8	13.8	10.4	1.1
Stresses								
0	45.6	26.4*	47.6	61.2	31.6	30.8	27	12.5**
1–2	41.4	54.3	39.9	28.8	42.6	25	42.9	39.4
3–5	12	14.2	12.1	5.4	22.7	32.1	24.6	41.2
6–13	1	5.1*	0.4	4.5**	3	12.1	5.4	6.9
Social support								
No	9.4	15.3	8.6	13.7	22.7	28.3	24.6	31.4
Yes	90.6	84.7	91.4	86.3	77.3	71.7	75.4	68.6
Intention for pregnancy								

Table 3 continued

	White		Asian/Pacific Islander		Hispanic		Black	
	No PPD (n = 1,010)	PPD (n = 33)	No PPD (n = 383)	PPD (n = 42)	No PPD (n = 1,162)	PPD (n = 91)	No PPD (n = 979)	PPD (n = 48)
No	31.1	26.3	33.4	49.2	58.2	69.8	66.4	67.6
Yes	68.9	73.7	66.6	50.8*	41.8	30.2**	33.6	32.4
Prenatal depression diagnosis								
No	98	67.1	93.8	35.8	95	54.4	95.4	71
Yes	2	32.9***	6.2	64.2***	5	45.6***	4.6	29***
Discussion about mood								
No	46.5	26.1	66.2	21.1	43.5	30.5	40.5	8.6
Yes	53.5	73.9*	33.8	78.9***	56.5	69.5**	59.5	91.4***

† $p < 0.1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Chinese women with a female infant were more likely to experience PPD [35, 36]. In another study on Indian women, having a female infant increased the effects of other risk factors [37]. Recent findings have also demonstrated a greater likelihood for Asian women to develop gestational diabetes, which is associated with PPD [38–40]. Other explanations for Asian American depression in the literature range from biological [41] to social [42]. Together, these explanations may represent a general vulnerability for depression generalizing to API women's depressed mood during the postpartum period. Future studies in PPD research may want to specifically examine the association between psychiatric history and PPD by race/ethnicity to determine if psychiatric history predicts PPD more strongly in API women.

Furthermore, discussing depressed mood with providers increased the likelihood for women to receive a diagnosis. This was especially true for APIs where the likelihood of receiving a diagnosis was 3.2 times more than White women after our analyses considered such discussions as a factor. These high rates could reflect the quality of the diagnostic processes that take place between API women and their providers. The use of a diagnostic criterion by the NYC PRAMS to assess PPD is unlike other prevalence studies that typically use structured assessments for PPD (e.g., a single question on depressive mood during pregnancy, multiple items covering symptomatology, etc.) [9, 12–14]. APIs tend to endorse somatic experiences rather than psychological symptoms [43, 44]. Conversations with a provider could increase sensitivity during the assessment, thus facilitating a positive diagnosis. Increased research on the diagnostic process within a health care setting would greatly enhance understanding of how dialogues between provider and patient result in diagnoses. In particular, future research should consider differences in the characteristics of providers and clinics among those who did and did not receive a PPD diagnosis, and the nature of the actual exchanges occurring between providers and patients.

It was particularly striking that approximately half of the providers did not talk to women about PPD. Racial/ethnic disparities were also found when assessing these rates. While the majority of African American, Hispanic, and White women reported having had a conversation with their providers, only 38.6 % of API women in our study reported this. Given that Asians tend to minimize their psychological distress [6, 16], providers may not realize distress nor recognize the need to bring up depressed mood. APIs who had a conversation were 9.1 times more likely to receive a diagnosis than APIs without, regardless of their sociodemographic background. Thus, although APIs were the group *most likely* to benefit from information about depressed mood, they were the *least likely* to be provided with it. Additionally, African Americans showed the highest rate of having been presented with information about mood compared to the other groups; those with a conversation were 5.8 times more likely to receive a diagnosis.

Altogether, and of greatest concern were the low rates of assessment for all groups, and especially for APIs. Our findings suggest that the information presented by a provider has powerful implications for determining diagnosis, especially for APIs and African Americans. This finding has implications for studies obtaining prevalence rates without considering racial/ethnic disparities within the screening or diagnostic process. Differences in prevalence rates may be attributed to the lack of medical information and treatment opportunities available to certain groups.

Our inclusion of known predictors for PPD in race-stratified analyses allowed us to compare the strength of stressors across groups. Most of the group differences in the predicted likelihood for PPD were not statistically significant suggesting few group differences in the

Table 4 Race/ethnicity stratified logistic regression showing adjusted odds of postpartum depression diagnosis per predictor by race/ethnic group

	White		Asian/Pacific Islander		Hispanic		Black	
	OR	CI	OR	CI	OR	CI	OR	CI
Gender								
Male	1.0		1.0		1.0		1.0	
Female	2.2†	0.9–5.8	2.6†	0.9–7.2	1.5	0.8–2.7	1.5	0.5–4.1
Diabetes								
No	1.0		1.0		1.0		1.0	
Yes	1.0	0.3–3.8	0.8	0.2–3.7	1.4	0.6–3.3	0.1**	0.0–0.5
Stresses								
0	1.0		1.0		1.0		1.0	
1–2	2.3†	0.8–6.7	0.8	0.3–2.2	0.4*	0.2–0.9	1.8	0.3–10.2
3–5	1.2	0.2–8.5	0.1	0.0–1.1	0.8†	0.4–1.8	3.1	0.4–21.7
6–13	5.2	0.9–30.8	2.7*	0.5–15.8	2.5	0.7–9.7	1.5	0.1–15.6
Social support								
No	1.0		1.0		1.0		1.0	
Yes	1.6	0.4–6.0	1.9	0.4–9.5	0.9	0.4–1.7	1.5	0.5–4.6
Intention for pregnancy								
No	1.0		1.0		1.0		1.0	
Yes	0.9	0.3–3.3	2.2	0.8–6.4	1.4	0.7–2.6	0.7	0.2–1.9
Prenatal depression diagnosis								
No	1.0		1.0		1.0		1.0	
Yes	29.4***	8.5–101.4	52.1***	16.4–166.0	15.3***	7.6–30.9	8.1***	2.9–22.8
Discussion about mood								
No	1.0		1.0		1.0		1.0	
Yes	1.7	0.6–4.8	9.1**	2.5–33.4	1.3	0.7–2.6	5.8**	2.1–15.9

Only adjusted odds ratios are presented because race/ethnic stratified analyses did not converge when including unadjusted factors in the model. This was due to zero to small sample sizes in race × sociodemographic contingency tables

† $p < 0.1$; * $p < .05$; ** $p < .01$; *** $p < .001$

association between stressors and PPD. Furthermore, stressful events were not associated with a greater likelihood at a statistical level, with the exception of API women; those who reported 6-13 stressful events were significantly more likely to receive a diagnosis. The explanation may reside in the distribution of reported stressful events for APIs; compared to other groups, the majority of API women reported zero stressful events. As such, the few APIs who disclosed high numbers of stressful events may have been the most likely to receive a diagnosis. APIs may still minimize their experience of stress despite being asked to state the occurrence of stressful events given their tendency to minimize psychological problems in general [6, 16]. Providers may want to inquire further about actual events and how it affects their API patients both psychologically and physically.

A number of associations between stressors and PPD require clarification through further research. There was a trend for increased PPD rates among API and White women who gave birth to female infants. Few studies have included infant gender in PPD studies within the U.S.; those that have find no association [45, 46]. Given these studies' small samples (n <200), any effects may have been too small to detect. One study did find increased self-esteem in mothers of male infants, although this association was mediated by paternal support [47]. The statistical trend in our data may indicate actual preferences for infant gender, but it could also reflect other factors moderated by infant gender. Our findings demonstrate the need to include infant gender in future studies and to identify mechanisms that explain this association.

In addition, we did not find a general link between gestational diabetes and PPD, despite a previous study's results [39]. When examining groups separately, APIs in our study were more likely to have gestational diabetes; however, this did not predict PPD. Instead, we found a *decrease* in the likelihood for PPD diagnoses among African Americans with gestational diabetes. There is evidence to suggest that African Americans may be less inclined to disclose symptoms even though providers speak

with them about prenatal depression and PPD at a higher rate [48]. Mistrust and perceived discrimination within the medical care setting may prevent disclosure about depression [22, 49]. In particular, some studies have found that among those with depressive mood accompanied with diabetes, African Americans were less likely to be recognized as depressed and to receive depression treatment [49–51]. Given our initial findings, the association between gestational diabetes and PPD may not be generalizable, although further research is needed to fully understand the relationship. Studies that do not stratify by race may overlook differences in the effect of gestational diabetes on depression by race/ethnicity.

Interpretation of results should be made with caution in light of our limitations. As with any self-report, inaccuracies in this data are possible given recall problems. In addition, prenatal and PPD diagnoses were used in our study. It would have been far preferable to obtain corroborating information from medical records; however, this information was unavailable within this survey study. It is possible that providers employed different standards for diagnoses, which may be reflected in this data, for instance, the consideration of "baby blues" or the inclusion of different methods to assess depression (e.g., questionnaire, verbal report). Furthermore, these diagnoses may not necessarily reflect actual depression rates, but as discussed, may be more of a reflection of provider sensitivity to detecting symptoms in a particular group. Finally, the race/ethnic categories are a proxy for a culture, and are comprised of heterogeneous subgroups. For instance, the unique experiences of Chinese, Japanese or Filipino groups may have been overlooked since they were combined into one race/ethnic category.

Conclusion

Our results highlight racial/ethnic disparities in PPD and its diagnosis, inviting a more nuanced approach in the consideration of PPD risk factors. Although we relied on broad race/ethnic categories, these findings demonstrate at a basic level, the possibility of differential effects in the risk factors associated with PPD. Explanations for racial/ethnic disparities in diagnosis compared to Whites differ by group and are not necessarily due to sociodemographic status or stress, factors that usually explain racial/ethnic disparities. While prenatal depression seems to be a major risk factor for PPD across all groups, the extent to which a factor is a "risk" for a particular racial/ethnic group needs to be evaluated. These associations point to the possibility of group-specific mechanisms leading to a PPD diagnosis. Universal postpartum depression screening as a single approach may not be adequate given the role that provider-patient interactions might have as suggested by these study findings. Rather, this study broadly reveals a need to consider the diagnostic process between provider-patient by race/ethnicity to better understand the source of treatment disparities.

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References

1. O'Hara, M. W., & Swain, A. M. (1996). Rates and risk of postpartum depression-A meta-analysis. *International Review of Psychiatry, 8*, 37–54.
2. Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics and Gynecology, 106*, 1071–1083.
3. Leigh, B., & Milgrom, J. (2008). Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC Psychiatry, 8*, 24.
4. O'Hara, M. W. (2009). Postpartum depression: What we know. *Journal of Clinical Psychology, 65*, 1258–1269.
5. Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: A synthesis of recent literature. *General Hospital Psychiatry, 26*, 289–295.
6. Kleinman, A. (2004). Culture and depression. *New England Journal of Medicine, 351*, 951–953.
7. Chentsova-Dutton, Y. E., & Tsai, J. L. (2007). Cultural factors influence the expression of psychopathology. In S. O. Lilienfeld & W. T. O'Donohue (Eds.), *The great ideas of clinical science: 17 principles that every mental health professional should understand* (pp. 375–396). New York: Routledge/Taylor & Francis Group.
8. United States. Agency for Healthcare Research and Quality. (2005). Perinatal depression: Prevalence, screening accuracy, and screening outcomes. In B. N. Gaynes, N. Gavin, S. Meltzer-Brody, K. N. Lohr, T. Swinson, G. Gartlehner, S. Brody, W. Miller Evidence Report/Technology Assessment No. 119. Contract No. 290-02-0016.
9. Howell, E. A., Mora, P. A., Horowitz, C. R., & Levanthal, H. (2005). Racial and ethnic differences in factors associated with early postpartum depressive symptoms. *Obstetrics and Gynecology, 105*, 1442–1450.
10. Wei, G., Greaver, L. B., Marson, S. M., Herndon, C. H., Rogers, J., & Robeson Healthcare Corporation. (2008). Postpartum depression: racial differences and ethnic disparities in a tri-racial and bi-ethnic population. *Maternal and Child Health Journal, 12*, 699–707.
11. Yonkers, K. A., Ramin, S. M., Rush, J., Navarrete, M. A., Carmody, T., March, D., et al. (2001). Onset and persistence of postpartum depression in an inner-city maternal health clinic system. *American Journal of Psychiatry, 158*, 1856–1863.
12. Beeghly, M., Olson, K. L., Weinberg, M. K., Pierre, S. C., Downey, N., & Tronick, E. Z. (2003). Prevalence, stability, and socio-demographic correlates of depressive symptoms in black

mothers during the first 18 months postpartum. *Maternal and Child Health Journal, 7*, 157–168.
13. Hobfoll, S. E., Ritter, C., Lavin, J., Hulsizer, M. R., & Cameron, R. P. (1995). Depression prevalence and incidence among inner-city pregnant and postpartum women. *Journal of Consulting and Clinical Psychology, 63*, 445–453.
14. Rich-Edwards, J. W., Kleinman, K., Abrams, A., Harlow, B. L., McLaughlin, T. J., Joffe, H., et al. (2006). Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. *Journal of Epidemiology and Community Health, 60*, 221–227.
15. Huang, Z. J., Wong, F. Y., Ronzio, C. R., & Yu, S. M. (2007). Depressive symptomatology and mental health help-seeking patterns of U.S.- and foreign-born mothers. *Maternal and Child Health Journal, 11*, 257–267.
16. Hsu, L. K. G., Wan, Y. M., Chang, H., Summergrad, P., Tsang, B. Y. P., & Chen, H. (2008). Stigma of depression is more severe in Chinese Americans than Caucasian Americans. *Psychiatry: Interpersonal and Biological Processes, 71*, 210–218.
17. U.S. Census Bureau. (2010). National population projections. Washington, DC.
18. United States. Census Bureau, Population Division. (2008). *Projections of the population by sex, race and Hispanic origin for the United States: 2010 to 2050*.
19. Centers for Disease Control and Prevention. (2003). Deaths*: Leading causes for 2001*. National Vital Statistics Reports, vol. 52.
20. United States. Public Health Service, National Center for Health Statistics. (2003). Health, United States, 2003.
21. Duldulao, A. A., Takeuchi, D. T., & Hong, S. (2009). Correlates of suicidal behaviors among Asian Americans. *Archives of Suicide Research, 13*, 277–290.
22. Hayes, D., Ta, V., Hurwitz, E., Mitchell-Box, K., & Fuddy, L. (2010). Disparities in self-reported postpartum depression among Asian, Hawaiian, and Pacific Islander Women in Hawaii: Pregnancy Risk assessment monitoring system (PRAMS), 2004–2007. *Maternal and Child Health Journal, 14*, 765–773.
23. New York City Department of Health and Mental Hygiene, Bureau of Maternal, Infant and Reproductive Hygiene. (2004). *Number and percent of women diagnosed with postpartum depression by select sociodemographic characteristics*: NYC PRAMS, 2004–2005.
24. New York City Department of Health and Mental Hygiene, Bureau of Maternal, Infant and Reproductive Hygiene. (2006). *Number and percent of women diagnosed with postpartum depression by select sociodemographic characteristics*: NYC PRAMS, 2006.
25. New York City Department of Health and Mental Hygiene, Bureau of Maternal, Infant and Reproductive Hygiene. (2007). *Number and percent of women diagnosed with postpartum depression by select sociodemographic characteristics*: NYC PRAMS, 2007.
26. New York City Department of Health and Mental Hygiene, Bureau of Maternal, Infant and Reproductive Hygiene (2010). *Number and percent of women diagnosed with postpartum depression*.
27. Segre, L. S., O'Hara, M. W., Arndt, S., & Stuart, S. (2007). The prevalence of postpartum depression: The relative significance of three social status indices. *Social Psychiatry and Psychiatric Epidemiology, 42*, 316–321.
28. Dennis, C. L., & Letourneau, N. (2007). Global and relationship-specific perceptions of support and the development of postpartum depressive symptomatology. *Social Psychiatry and Psychiatric Epidemiology, 42*, 389–395.
29. Bernazzani, O., Marks, M. N., Bifulco, A., Siddle, K., Asten, P., & Conroy, S. (2005). Assessing psychosocial risk in pregnant/postpartum women using the contextual assessment of maternity experience (CAME): Recent life adversity, social support and maternal feelings. *Social Psychiatry and Psychiatric Epidemiology, 40*, 497–508.
30. Boyce, P., & Hickey, A. (2005). Psychosocial risk factors to major depression after childbirth. *Social Psychiatry and Psychiatric Epidemiology, 40*, 605–612.
31. Wolf, A. W., De Andraca, I., & Lozoff, B. (2002). Maternal depression in three Latin American samples. *Social Psychiatry and Psychiatric Epidemiology, 37*, 169–176.
32. Noh, E. (2007). Asian American women and suicide: Problems of responsibility and healing. *Women & Therapy, 30*, 87–107.
33. Kumar, R. (1994). Postnatal mental illness: A transcultural perspective. *Social Psychiatry and Psychiatric Epidemiology, 29*, 250–264.
34. Morsbach, G., Sawaragi, I., Riddell, C., & Carswell, A. (1983). The occurrence of 'maternity blues' in Scottish and Japanese mothers. *Journal of Reproductive and Infant Psychology, 1*, 29–35.
35. Xie, R. H., He, G., Liu, A., Bradwejn, J., Walker, M., & Wen, S. W. (2007). Fetal gender and postpartum depression in a cohort of Chinese women. *Social Science and Medicine, 65*, 680–684.
36. Xie, R. H., He, G., Koszycki, D., Walker, M., & Wen, S. W. (2009). Prenatal Social Support, Postnatal Social Support, and Postpartum Depression. *Annals of Epidemiology, 19*, 637–643.
37. Patel, V., Rodrigues, M., & DeSouza, N. (2002). Gender, poverty, and postnatal depression: A study of mothers in Goa, India. *The American Journal of Psychiatry, 159*, 43–47.
38. Chu, S. Y., Abe, K., Hall, L. R., Kim, S. Y., Njoroge, T., & Qin, C. (2009). Gestational diabetes mellitus: All Asians are not alike. *Preventive Medicine, 49*, 265–268.
39. Kozhimannil, K. B., Pereira, M. A., & Harlow, B. L. (2009). Association between diabetes and perinatal depression among low-income mothers. *JAMA: Journal of the American Medical Association, 301*, 842–847.
40. Pedula, K., Hillier, T., Schmidt, M., Mullen, J., Charles, M., & Pettitt, D. (2009). Ethnic differences in gestational oral glucose screening in a large US population. *Ethnicity and Disease, 19*, 414–419.
41. Way, B. M., & Lieberman, M. D. (2010). Is there a genetic contribution to cultural differences? Collectivism, individualism and genetic markers of social sensitivity. *Social Cognitive and Affective Neuroscience, 5*, 203–211.
42. Wong, S. L. (2001). Depression level in inner-city Asian American adolescents: The contributions of cultural orientation and interpersonal relationships. *Journal of Human Behavior in the Social Environment, 3*, 49–64.
43. Ryder, A. G., Yang, J., & Heini, S. (2002). Somatization versus psychologization of emotional distress: A paradigmatic example for cultural psychopathology. In W. J. Lonner, D. L. Dinnel, S. A. Hayes, & D. N. Sattler (eds) *Online readings in psychology and culture,* Unit 9. Center for Cross-Cultural Research, Western Washington University: Washington.
44. Ryder, A. G., Yang, J., Zhu, X., Yao, S., Yi, J., Heine, S. J., et al. (2008). The cultural shaping of depression: Somatic symptoms in China, psychological symptoms in North America? *Journal of Abnormal Psychology, 117*, 300–313.
45. Cho, J., Holditch-Davis, D., & Miles, M. (2008). Effects of maternal depressive symptoms and infant gender on the interactions between mothers and their medically at-risk infants. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 37*, 58–70.
46. Beebe, B., Jaffe, J., Buck, K., Chen, H., Cohen, P., Feldstein, S., et al. (2008). Six-week postpartum maternal depressive symptoms and 4-month mother-infant self-and-interactive contingency. *Infant Mental Health Journal, 29*, 442–471.
47. Shea, E., & Tronick, E. (1988). The Maternal Self-Report Inventory: A research and clinical instrument for assessing

maternal self-esteem. In H. E. Fitzgerald, B. M. Lester, & M. W. Yogman (Eds.), *Theory and research in behavioral pediatrics* (Vol. 4, pp. 101–141). New York: Plenum Publishing Corporation.

48. Sussman, L. K., Robins, L. N., & Earls, F. (1987). Treatment-seeking for depression by Black and White Americans. *Social Science and Medicine, 24*, 187–196.
49. Wagner, J., Tsimikas, J., Abbott, G., de Groot, M., & Heapy, A. (2007). Racial and ethnic differences in diabetic patient-reported depression symptoms, diagnosis, and treatment. *Diabetes Research and Clinical Practice, 75*, 119–122.
50. Wagner, J. A., Perkins, D. W., Piette, J. D., Lipton, B., & Aikens, J. E. (2009). Racial differences in the discussion and treatment of depressive symptoms accompanying type 2 diabetes. *Diabetes Research and Clinical Practice, 86*, 111–116.
51. Tiwari, A., Rajan, M., Miller, D., Pogach, L., Olfson, M., & Sambamoorthi, U. (2008). Guideline-consistent antidepressant treatment patterns among veterans with diabetes and major depressive disorder. *Psychiatric Services, 59*, 1139–1147.