Title: Factors associated with postpartum depressive symptomatology in Brazil: the Birth in Brazil National Research Study, 2011/2012.

Abstract:

Background: Depression is one of the most common postpartum mental disorders. Many sociodemographic and individuals risk factors are associated with maternal depression but the impact of high levels of birth intervention is unclear. The Brazilian context is characterized by excessive intervention and frequent non-compliance with recommended obstetric protocols. This study therefore examined the impact of sociodemographic, individual, and obstetric risk factors in postpartum depression.

Methods: The Birth in Brazil research study is a national study of 23,894 postpartum women. Information about depression was obtained by telephone interview at 6 to 18 months after birth and was measured using the Edinburgh Postnatal Depression Scale.

Results: The prevalence of probable cases of depression was 26.3%. A multivariate model identified significant sociodemographic and individual risk factors as: brown skin color (OR = 1.15 CI 1.01-1.31), lower economic class (OR=1.70 CI 1.41-2.06), alcohol use (OR= 1.41 CI 1.09-1.84) and a history of mental disorders (OR= 3.13 CI 1.80-5.44). Significant obstetric factors were unplanned pregnancy (OR=1.22 CI 1.05-1.43 for wanted later and OR= 1.38 CI 1.20-1.60 for never wanted), multiparity (OR=1.97 CI 1.58-2.47 for 3 or more children), and poor care during birth (OR= 2.02 CI 1.28-3.20) or of the newborn (OR=2.16 CI 1.51-3.10). Obstetric interventions and complications were not associated with maternal depression.

Limitations: Depression was measured only once so we are not able to examine the course over time. The associational and reverse causality cannot be ruled out for some variables.

Conclusions: The prevalence of postpartum depression is high in Brazilian women six months after birth. Poor care of women and babies during birth is more important in postpartum depression than physical obstetric or neonatal intervention and complications.

Keywords: postnatal depression; screening; Edinburgh Postnatal Depression Scale; mental health; Brazil

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Highlights:

1. Maternal depression is one of the most common mental disorders during pregnancy or after childbirth.

2. In this study the prevalence of symptoms of maternal depression between 6 to 18 months postpartum was 26,3%

3. Poor socioeconomic status, brown skin color, multiparity, unplanned pregnancy, alcohol abuse, prior history of mental disease and poor self-report of care during labor and birth were associated with maternal depression

4. Type of birth and obstetric interventions did not present association with symptoms of maternal depression

1. Introduction

The birth of a child is generally seen as a moment of great joy and positive emotions. However, it paradoxically brings great transformations to a woman's life, with potential risk of psychological disorders (**Dois et al., 2012**). One of the most common disorders at this time is perinatal depression, which can manifest any time from the start of gestation or in the months after childbirth (**American Psychiatry Association, 2013**). Symptomatology varies from mild symptoms to more serious forms. Postpartum depression is also associated with suicidal thoughts and maternal deaths by suicide (**Howard et al. 2011; Lewis, 2007**). The condition can persist for a year or more after childbirth and follow a chronic and recurrent course (**Monti et al.,2008; Mayberry et al., 2007; Woolhouse et al., 2015; Santos et al., 2010**). Postpartum depression can have various negative effects on the woman and her child and particularly on the establishment of the mother-baby bond, breastfeeding and the child's social, affective and cognitive development (**Moehler et al., 2006**). The effect of prolonged postpartum depression on the child continues to later phases of life and is associated with affective disorders in childhood and adolescence (**Halligan et al., 2007; Santos et al., 2014**).

Many risk factors have been identified for postpartum depression. Reviews suggest the strongest risk factors are a history of depression and/or depression in pregnancy, socioeconomic disadvantage and lack of support (**Patel et al., 2012; Rubertsson et al., 2005**). These risk factors appear to be stable across cultures. For example, a review of determinants of common perinatal mental health disorders in low and middle income countries identified socioeconomic risk, previous mental health problems, poor relationships with partner, family and friends, and adverse reproductive events as key categories of risk (**Fisher et al., 2012**).

Research on postpartum depression in Brazil identifies similar risk factors as research in other countries, with women with poor socioeconomic status, high parity, not living with their partner, previous psychological and/or psychiatric disorders, and unintended pregnancy at greater risk of depression (**Silva et al., 2012; Melo et al., 2012; Moraes et al., 2006**). However, very little research has examined the role of obstetric factors and intervention during childbirth as a risk factor for postpartum depression in Brazil.

Maternity care in Brazil is highly medicalized and obstetric interventions in labor and delivery are high, even among low-risk women (**Leal et al., 2014**). The caesarean section rate has been increasing in Brazil since the mid-1990s. In 2013 the rate of cesarean section was 55.6% (**Brazilian Health Informatics Department).** This was even higher in private hospitals where almost 90% of women gave birth by cesarean section (**Domingues et al, 2014**).

In addition, many hospitals in Brazil do not allow women to be accompanied by a partner or family member during labor and birth. This means women have to potentially cope with labor and birth, with associated high levels of intervention, in the absence of a known birth companion. It is noteworthy that in 2005 a Brazilian law was introduced to ensure all women have the right to have a companion of their choice with them at all times during labor and birth. This means that in many cases, hospitals are not complying with the law when they refuse to allow women to have birth companions (**Diniz et al., 2014**).

The impact of high levels of birth intervention in Brazil on women's postpartum mental health is unclear and may vary for different mental health outcomes. For example, there is fairly consistent evidence that cesarean is associated with an increased risk of women developing post-traumatic stress disorder following birth (**Grekin and O'Hara, 2014**). The evidence for obstetric intervention being associated with postpartum depression is less consistent and may differ between countries. A review of low and middle income countries found cesarean birth was associated with a 2.49 to 3.58 increased risk of postpartum depression (**Fisher et al, 2012**). However, a study of over 14,000 women in the UK found no association between cesarean birth and depression eight weeks postpartum (**Patel et al., 2005**).

Brazil is the seventh world economy, and it was classified as a high human development country in 2013 (**UNDP, 2013**). However, it has huge social inequities expressed by Gini Index equal to 0.527, according to estimates of the World Bank in 2015 (**World Bank, 2015**). The North and Northeast regions are poorer compared with South and Southeast and present important differences in dimension and kinds of health services. Despite being a multiracial society, brown (43%) and black (7.6%) people are the poorest contingent in the country as shown in 2010 Demographic Census. The skin color is associated with social and health inequalities, even controlled for other

socioeconomic variables (**Leal et al, 2005**).

The aim of this study is to analyze the association between sociodemographic, individual and obstetric risk factors and maternal depression, from Birth in Brazil National Research. The cultural context plus the high rates of intervention during birth provide a unique context in which to examine the interplay between these potential risk factors and postpartum depression.

2. Methods

2.1 Sample and study population

This study is part of the Birth in Brazil Research, an investigation with countrywide representation carried out from February 2011 to October 2012 which involved 23,894 women who were recruited within 6 hours of giving birth and followed up to 18 months postpartum. Data were also collected from women and babies' medical records.

Sampling was carried out in three stages. At first, all hospitals which had 500 or more births per year in 2007 were selected. These were classified according to Brazil's five macro-regions (north, northeast, southeast, south and center-west), municipality (capital or interior), and type of hospital (private, public and mixed). Subsequently, the number of days needed to reach the fixed sample of 90 women who had recently given birth in each hospital was calculated. Because smaller hospitals often schedule cesarean births for a particular day, this period had to be a minimum of seven days in each hospital to ensure representative samples were recruited. Finally 90 women who had recently given birth were selected from each hospital remaining in the sample. The final sample was recruited from 266 sampled hospitals in 191 municipalities, including all state capitals. A total of 1,356 (5.7%) postnatal women selected were replaced, 15% due to early hospital discharge and 85% due to refusal to participate**.**

Postnatal women who gave birth to a live newborn, regardless of weight or gestational age, or to a stillborn baby with birth weight ≥500 g and/or gestational age ≥22 weeks of pregnancy in one of the eligible hospitals were invited to participate in this

study. The study excluded women who delivered at home or foreigners who did not understand Portuguese language. Before beginning the interview a Free and Informed Consent Form (FICF) was read and after women gave their consent they received a copy containing all details of the research and contact information for the coordinators.

Women took part in three interviews and data were also collected from medical records. In the first phase face-to-face interviews were conducted with the women during hospitalization, data were taken from the mother and child's medical records, and the women's prenatal medical notes were photographed. As this was a complex sample a calibration procedure was used, along with sample weights to ensure coherence between the sample estimates and the known population totals obtained by an external source.

In the follow-up phase, women were interviewed by telephone the first 45 days after birth (n=16,109; 68% response rate) and between 6 to 18 months after birth (n=11,925; 49.9% response rate) to collect data about maternal and infant outcomes. The average time between the baseline study and the first telephone interview was 90 days, and between the baseline and second telephone interview was 12 months. As it was not possible to contact all the women who took part in the baseline interviews at the hospitals a logistic regression model was adjusted to estimate the probability that each woman who took part at baseline would answer the telephone interview, using a set of variables which differentiated the groups of respondents and non-respondents. Non-response adjustment factors attempt to compensate for the tendency of women having certain characteristics (such as being unmarried or of lower education) to respond at lower rates, affecting the probability of response in a specific stratum (see supplementary material). On the basis of this model, specific sample weights were calculated for the analysis of the telephone interviews. The rationale for applying non-response weights is the assumption that non-respondents would have provided similar answers, on average, to respondents' answers for each stratum and adjustment category. Further details about sampling and the procedure for dealing with missing data can be found in **Vasconcellos et al** (**2014**).

2.2 Study variables

2.2.1. Depression

Information about postpartum depression was obtained in the final telephone

interview at 6 to 18 months. This was measured using the Edinburgh Postnatal Depression Scale (EPDS) validated into Portuguese. The EPDS is a 10-item scale and each item has four possible responses from 0 to 3, with a minimum score of 0 and a maximum of 30. The scale measures the intensity of depressive symptoms over the preceding seven days. A cut-off point of ≥ 13 was used to classify women as probable depressed (or with symptoms of depression) and has been shown to be valid in Brazilian populations (**Santos et al., 2007**). The use of EPDS by telephone was validated in Brazil by **Figueiredo et al** (2015) and the results showed Cronbach's alpha coefficient of 0.861, Spearman's correlation between the EPDS administered by telephone and the self-reported of 0.69 ($p < 0.001$) and ROC curve of 0.78 (95 % CI 0.72- 0.84). For the cutoff >= 13 the EPDS presented 52.2% sensibility, 84.4% specificity, 73.4% positive predictive value.

2.2.2. Sociodemographic risk factors

Sociodemographic risk factors measured were economic class; geographic macro-region; capital or non-capital city; maternal age at delivery (<20; 20-34; ≥35); skin color (white, black, brown, yellow and indigenous) and marital status (whether the woman has a partner or not). Economic class was defined according to the criteria recommended by the Brazilian Criterion of Economic Classification that encompasses information about the level of education of the household's main breadwinner, the possession of selected appliances and durable assets, and whether there is a domestic employee at home (**ABEP, 2011**). Economic classes are divided into five categories, from A (highest class) to E (lowest class). This stratification criterion aims at generating a standardized scoring system that could work as a predictor of individuals' and families' consumption capacity, able to discriminate large groups according to their capacity for consuming products and services that are accessible to a significant part of the population. Due to the small number of women in classes A and E, the economic classes were grouped into three categories: high (A and B); middle (C); and low (D and E).

2.2.3. Individual risk factors

Individual risk factors included were history of chronic diseases (at least one of the following diseases: heart disease, hypertension, diabetes, hyperthyroidism, lupus, anemia, asthma/bronchitis, renal disease, stroke, epilepsy, hepatic disease or infectious disease); history of mental disorder (affirmative answer to the question "before this

pregnancy, were you diagnosed with a mental disorder which required monitoring by a specialist?"); smoking and alcohol use during pregnancy. Alcohol use was measured using the TWEAK **(T**olerance**, W**orried**, E**ye opener**, A**mnesia**, C(K)**ut down**)** instrument, which was originally developed to identify habitual alcohol use among pregnant women. The test has five questions and a cutoff value of two points, TWEAK has a sensitivity of 79% and a specificity of 83% for identifying pregnant women who consume 1 or more ounces of absolute alcohol per day. Women who attained a score of two or more were considered to be at risk of alcoholism (**Sarkar et al., 2010**). The variable was divided into three categories: did not ingest alcoholic beverages during pregnancy; ingested alcoholic beverages but no alcoholism risk exists; ingested alcoholic beverages and a risk of alcoholism exists. Women were considered to be smokers if they had smoked at least one cigarette a day during any trimester of their pregnancy.

2.2.4. Obstetric risk factors

Obstetric risk antecedents included were: prior stillbirth or neonatal death; parity; planned pregnancy; companion during labor and birth; painful maneuvers during labor/birth (positive response to performance of the Kristeller maneuver, associated with the use of oxytocin and/or misosprostol, with an increase of pain and no use of analgesia during labor and birth); type of birth (vaginal, forceps or cesarean); serious complications during pregnancy, labor or postpartum (reference to at least one of the following manifestations: eclampsia, hysterectomy, admission to intensive care unit or serious hemorrhage requiring blood transfusion); self-rating of the level of care received during birth and of the newborn (information collected during the first telephone interview, divided into the following categories; excellent, good, regular, bad/very bad. The categories bad/very bad were considered "poor care". Infant variables included were: hospitalization in the neonatal unit (IU/ICU); congenital anomaly; stillbirth; neonatal death (variables all obtained from newborn's medical record).

2.3 Data analysis

A hierarchical model was used, and socioeconomic variables were analyzed as the most distal level in terms of proximity to the outcome. Variables relating to prior maternal history were considered intermediate. Lastly, the block of variables relating to overall conditions of labor, delivery and neonatal care entered in the model as the proximal level.

Variables from each block with p value ≤ 0.20 were retained in the hierarchized model to control for residual confounder effects on the variables. When analyzing and discussing the results, exposure variables with a 5% level of significance were considered to be associated with symptoms of maternal depression. The theoretical model used in this study was adapted from the systematic review carried out by **Fisher et al (2012**) on the prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries**.**

Figure 1 – Theoretical model of the determinants of maternal depressive symptomatology according to the Birth in Brazil research, 2011/2012.

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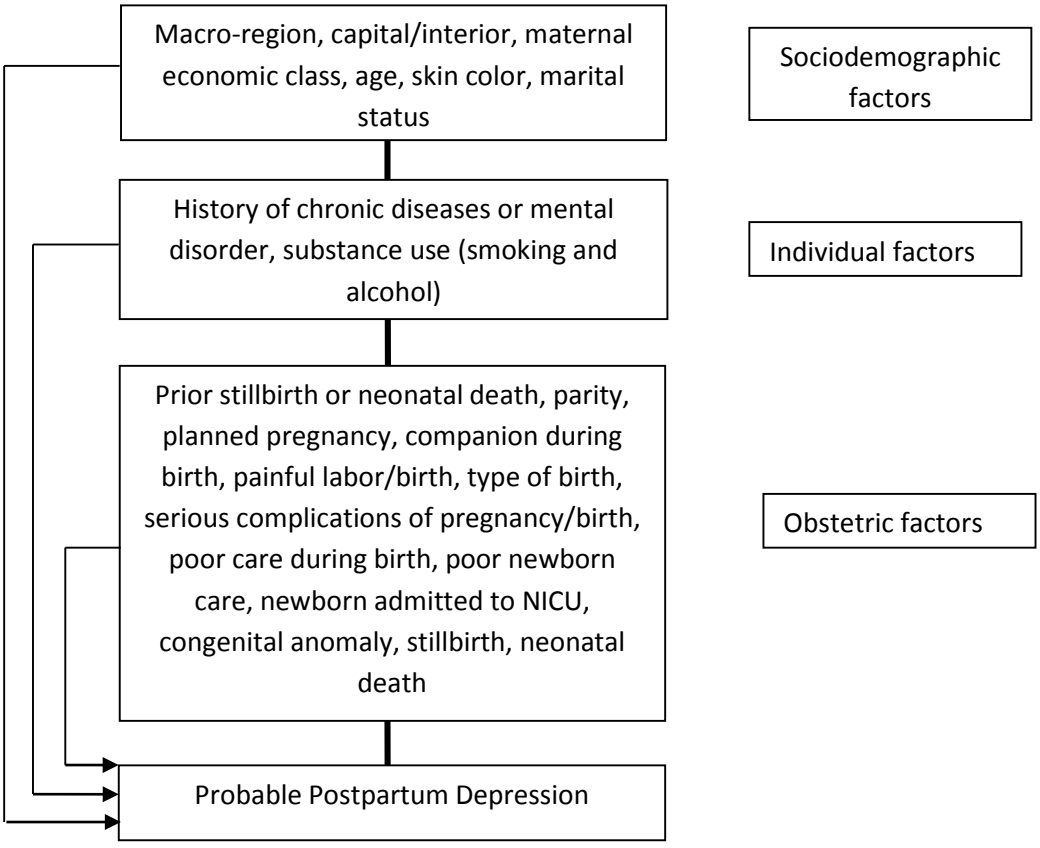

The analyses were performed on the SPSS 17.0 software (Statistical Package for Social Science for Windows – Chicago, IL, USA), and since it was a complex sample the Complex Sample module was used to correct the design effect.

The hospital interview was performed following the signing of a Free and Informed Consent Form (FICF), which included authorization for subsequent telephone

contact. The Birth in Brazil research was approved by the Sérgio Arouca National Public Health School Ethics Committee, under number CAAE 0096.0.031.000-10.

3. Results

The average of the sample was 25.6 years old (SD = 6. 4) with ages ranging from 12 to 54. Thirty four percent of the women self-reported skin color as white and 56.1% as brown, as defined by Brazilian census. As for marital status, 18.7% of the mothers had no partner, and 52% were classified as middle economic class. Considering different forms of birth, 46.7% delivered vaginally, while 51.9% had cesarean delivery.

Forty seven percent were primiparous, 42.7% had one or two previous deliveries, and 10.4% were having their third deliveries or subsequent children, respectively. Seven percent of women smoked at least one cigarette a day during any trimester of the pregnancy, and the same percentage referred to regular alcohol consumption, classified as at risk of alcoholism (see Supplementary Table 1).

The prevalence of probable cases of depression in this study was 26.3%. Prevalence did not differ according to the length of time since birth that interviews were conducted (25.7% in women up to nine months postpartum; and 27.1% in women 9 to 18 months postpartum; p value = 0.28).

Analysis of sociodemographic risk factors and symptoms of maternal depression is shown in Table 1. The strongest risk factors were economic class and skin color. In relation to economic class, an inverse gradient was seen with women in the middle economic class being 1.53 (95% CI 1.36-1.73) more likely to develop depression compared to women in the highest class; and women in the lowest class being 1.89 (95% CI1.58-2.25) times more likely to develop depression after adjustment for other sociodemographic variables. In relation to skin color, the women who declared themselves indigenous and brown were at greater risk of maternal depression symptoms (OR_u = 2.78 and OR_u = 1,34, respectively). However, only brown women, who comprised 56.1% of the sample, maintained a significant risk after adjusting for other sociodemographic variables (OR_a = 1.18; CI 95% = 1.03-1.34). Nevertheless, it is worth noting the high proportion of depression among indigenous women and the magnitude of association (OR_a = 2.23 95% CI 0.87-5.73). It is probable that the loss of statistical

significance after adjustment is due to the low numbers of these women in the sample (0.4%). Maternal age, marital status and location (capital or non-capital) were not associated with risk of depression. Among the different geographical region only living in the North region was associated with increased and significant risk, but this effect was lost after adjustment for other sociodemographic risk factors.

Analysis of individual risk factors and probable maternal depression is shown in Table 2. All of the individual risk factors were significantly associated with EPDS score ≥13 after adjusting for significant sociodemographic variables (economic class, skin color) and all individual risk factors. Women with a history of mental disorders and chronic disease were 2.72 (95% CI 1.63-4.53) and 1.18 (95% CI 1.03-1.36) times more likely to report symptoms of postpartum depression respectively. Women who smoked during pregnancy were 1.62 (95% CI 1.28-2,06) times more likely to report depression and, similarly, women who used alcohol during pregnancy were between 1.24 (95% CI 0.92-1.67) times (with no alcoholism risk) and 1.45 (95% CI 1.13-1.85) times (with alcoholism risk) more likely to report depression.

Analysis of obstetric risk factors and probable maternal depression is shown in Table 3. The strongest risk factors were greater parity, unplanned pregnancy, and poor self-rated care during birth (with increased adjusted odds ratios of between 1.44 and 2.0) and poor self-rated care of the newborn (with increased adjusted odds ratios of between 1.60 and 2.0). An increased risk was observed in women with a higher number of children. Women with up to two prior births were 1.58 (95% CI 1.38-1.81) times more likely to be depressed and women with three or more births 1.95 (95% CI 1.56-2.43) times more likely to be depressed when compared with women who had only given birth once. The same effect was observed in relation to unplanned pregnancy. Women who had not planned to become pregnant had a higher risk of depression (OR_a = 1.40; 95% CI 1.22-1.60) than those who were planning their pregnancy for later (OR_a = 1.24; 95% CI 1.05-1.44) when compared with women who planned to become pregnant at that time (Table 3).

The effect of greater parity, unplanned pregnancy, and poor self-rated care during birth and of the newborn on increased risk of symptoms of depression remained significant after adjusting for significant sociodemographic variables (economic class, skin color), individual risk (history of chronic disease or mental disorder, smoking and

alcohol use), and other obstetric risk factors (parity, history of stillbirth/neonatal death, unplanned pregnancy, complications during pregnancy/birth, having a companion during labor and birth, newborn admitted to NICU, congenital anomaly, stillbirth, neonatal death, self-rating of care during birth and of the infant).

Very few physical labor and birth factors were associated with EPDS score ≥13. No association was found with serious complications during pregnancy or birth, type of birth, or the experience of intense pain without analgesia in unadjusted analysis. Women who were not allowed to have a companion present during labor and birth, or were only allowed to have their companion present for a short time, had a 1.24 and 1.18 greater risk of depression respectively compared to women whose companion was allowed to be present during all of labor and birth. However, this effect was no longer significant once other risk factors were controlled for.

Negative outcomes for the newborn, such as admission into NICU and the presence of congenital anomalies were not associated with depression. Mothers who experienced foetal loss or neonatal death had a 2.40 and 1.66 greater risk of symptoms of depression compared to those whose babies were born alive and healthy. However, this effect was no longer significant following adjustment for other significant risk factors (as listed above), despite maintaining an important magnitude, particularly stillbirth. This may be because infant complications were very rare events in the study, varying from 0.4% (foetal death) to 1.5% (congenital anomaly).

3.1 Model of risk for probable maternal depression

All variables that maintained a significant association with probable maternal depression after adjustment for other risk factors were entered into a multivariate model to identify key risk factors. Results are shown in Table 4. In the final explanatory model, the following variables maintained significant statistical association with maternal depression: being of a brown skin color (OR = 1.15 95% CI 1.01-1.31), belonging to middle (OR = 1.41 95% CI 1.23-1.61) or low economic classes (OR = 1.70 95% CI 1.41-2.06), multiparity (up to two prior births OR = 1.59 95% CI 1.39-1.82); three or more births (OR = 1.95 95% CI 1.56-2.44), history of mental disorders (OR = 3.21 95% CI 1.86-5.46), unplanned pregnancy (OR = 1.23 95% CI 1.05-1.44) for wanted later and (OR = 1.40 95% CI 1.23-1.60) for never wanted, alcohol use with alcoholism risk (OR

= 1.41 95% CI 1.09-1.84) and poor care during birth and of the newborn (OR = 2.02 95% CI 1.28-3.20) and (OR = 2.16 95% CI 1.51-3.10) respectively.

4. Discussion

The results of this study suggest probable postpartum depression in Brazil has a high prevalence which affects over 1 in 4 women (26.3%). This prevalence is higher than that reported in many countries in Europe, Australia and the United States. However, a systematic review of articles published between 2005 and 2014 in the international literature concluded that the prevalence of postpartum depression varies from 1.9% to 82.1% in developing countries, and from 5.2% to 74.0% in developed countries. Low-income women are particularly at high risk of postpartum depression. A striking prevalence of postpartum depression of 33% to almost 40% was observed among low-income mothers between three months and nine months after delivery (**Norhayati et al., 2015**).

The prevalence in this study is consistent with other studies carried out in Brazil using EPDS scale. A recent review reported the prevalence of symptoms of postpartum depression ranging from 20% to 40% (**Lobato et al., 2011**). The high prevalence found in this study after the sixth month postpartum demonstrates that these depression symptoms may persist for prolonged periods, and that women who develop depressive symptoms in the immediate postpartum period may continue to suffer a year or more after giving birth (**Santos et al., 2010**). **Matijasevich et al. (2009**) comparing data from two cohort studies in the UK and Brazil using EPDS showed higher prevalence of maternal depression in Brazil. Although the burden of depression had been more important in Brazil, results revealed a relationship between high prevalence of depression with income inequalities in both studies. This association was mantained after control for covariates. It is probable that social inequalities in Brazil could be responsible for high rates of maternal depression symptomatology in the country.

In terms of risk factors, probable PPD in this sample was predominantly associated with sociodemographic and individual factors of ethnicity, economic class, a history of mental health problems and alcohol use. After adjusting for these risk factors, remaining obstetric risks were being multiparous, having an unplanned pregnancy, and poor hospital care during labor and birth and/or of the newborn. The effect of

sociodemographic and individual risk factors is highly consistent with previous literature on PPD (**Rubertsson et al., 2005; Silva et al., 2012**). The higher prevalence of probable PPD among non white women is coherent with other studies about inequalities in health in Brazil. **Leal et al (2005**) analysing inequalities in access to and utilization of health care services according to skin color showed worst outcomes among women with black and brown skin color. The disadvantages evidenced among black and brown women went much beyond socioeconomic indicators.

However, the influence of obstetric complications and interventions was not supported. Obstetric variables that were not associated with probable PPD included serious complications during pregnancy or birth, type of birth, painful birth without analgesia, history of stillbirth or neonatal death, and congenital abnormalities.

The lack of a relationship between physical obstetric factors and PPD symptoms adds to the inconsistency in the literature about whether obstetric intervention is a risk factor for PPD. As mentioned in the introduction, a review of low and middle income countries found cesarean birth was associated with a 2.49 to 3.58 increased risk of PPD (**Fisher et al., 2012)**. However other studies, including ours, find no association between cesarean birth and probable PPD (**Patel et al., 2005**). This inconsistency could be due to methodological differences, cultural differences, and/or mediating variables. For example, there is fairly consistent evidence that cesarean section is associated with increased risk of posttraumatic stress in Western countries and that posttraumatic stress is highly comorbid with depression (**Grekin and O'Hara, 2014**). It is therefore possible that posttraumatic stress mediates the relationship between obstetric intervention and PPD. In the current study cesarean section was the norm with 52% of women giving birth this way. This normalization of cesarean may minimize any potential negative or traumatic psychological impact. Other possible explanations include the use of different definitions of obstetric complications adopted by different studies. In this study we used self-reported information from women on obstetric complications. However, a study of the validation of severe maternal morbidity symptoms concluded that women do not accurately remember serious obstetric complications such as hemorrhage and infections, and the greater the time interval between the clinical complication and the interview, the stronger the memory bias (**Souza et al., 2010**).

In contrast to physiological birth variables, the support and care of women and babies during labor and birth was consistently associated with reduced PPD symptomatology. Care from hospital staff was most important - where women who rated their care or the care of their infants as regular or bad were up to two times more likely to present EPDS score ≥ 13. Having a companion present continuously throughout labor and birth was also associated with reduced risk in unadjusted analyses. This emphasizes the importance of continuous and supportive care during labor and birth and is consistent with evidence on the impact of continuous support during childbirth. A Cochrane review of 23 randomized controlled trials from 16 countries found continuous support during childbirth results in a number of positive outcomes, including less instrumental or cesarean births, less pain medication, shorter labors and the babies having better Apgar scores. Women were also more likely to be satisfied with their labor and birth experiences (**Hodnett et al., 2011**). These findings on the importance of support during childbirth are also consistent with evidence that it is important in buffering against the impact of potentially traumatic complications or birth events (**Ford and Ayers, 2011; Ford and Ayers, 2009**).

4.1. Limitations and strenghts

A number of methodological issues need to be took in account before considering the implications of the results of this study. The strengths of the current study are that it is based on a large, nationwide sample of women who were representative of all live births in Brazil in the year it was conducted. This is the first nationwide study about symptoms of maternal depression in Brazil and results are mostly consistent with other national and international studies. The measure of probable depression with the Edinburgh Postnatal Depression Scale has been widely used and validated in Brazil and other countries. The telephone interview strategy has also been used in population studies in Canada (**Lanes et al., 2011)** and United States of America **(Beck et al., 2011**), and validated in Brazil (**Figueiredo et al., 2015**) with good internal consistency. In this research the telephone interview presented good consistence too with Cronbach's alpha coefficient of 0.8. This study therefore provides reliable and comparable information about probable PPD prevalence and risk factors in Brazil. However it is important to emphasize that the EPDS is a screening test and therefore the diagnosis of depression was

not carried out. In a clinical perspective, the EPDS may be applied to help identify women who would benefit from in-depth psychiatric evaluation and ensuing follow up.

Study limitations are that the symptomatology was only measured between 6 to 18 months after birth. This has a number of implications. First, it means results are associational and reverse causality cannot be ruled out. For example, it is possible that women with symptoms of PPD are more likely to report poor care during birth rather than vice versa. Second, the months since birth may mean women's memory and recall is inaccurate or more likely to be negative. Studies of satisfaction with birth show a trend towards women making worse assessments of birth with the passing of time (**Hodnett et al., 2011**). Third, measuring depression at one time point means we are not able to examine the course of depression over time. For example, some women with probable PPD may have already had depression in pregnancy. Another potential limitation was loss of women in the follow-up, with significant differences between respondents and non-respondents. However, the use of statistical modeling allowed us to reconstitute the original sample composition.

Unfortunately, some important variables were not measured, such as intimate partner violence and use of illicit drugs, both strong predictors of PPD. In addition, only women with prior history of mental disorder monitored by specialist were considered. The difficulty of access to specialized services may have influenced the response rate.

4.2. Implications

The results have a number of implications for research and maternity services. This study confirmed findings from other research about the influence of socioeconomic and individual risk factors on maternal depression symptomatology, pointing to vulnerable groups of women who could be identified in pregnancy and interventions put in place to prevent or treat current or future depression. The finding that depressive symptoms are not restricted to the early postpartum period but also reported by a significant proportion of women six months after birth has implications for screening and treatment interventions. Although we did not look at depression over time, it is possible that if assessment is restricted to the earlier phases the identification of women with PPD may be underestimated.

Routine screening for depression during pregnancy and postpartum has been adopted in some countries with the aim of providing early intervention and reducing

maternal suffering and its repercussions on the health of the woman and their baby. These gains are particularly important with the discovery that depressive symptoms are not restricted to the postpartum period, may affect women with a history of psychological pathology or not, and may occur during pregnancy. Additionally, undiagnosed symptoms may progress and persist over long periods **(Santos et al., 2010).** This study suggests an important intervention could be to ensure all women receive continuous and supportive care during labor and birth, as per national recommendations (**Diniz et al., 2014**).

4.3. Conclusions

This study shows that PPD symptoms is reported by just over 1 in 4 Brazilian women six months after birth. Sociodemographic and individual risk factors identified are broadly consistent with previous research in Brazil and other countries. Contrary to expectations, physical obstetric or neonatal intervention and complications were not risk factors for postpartum depression. Poor newborn outcomes did not present significant association in this study, but they must be considered a probable important risk factor, and mothers with stillbirth or neonatal death should receive appropriate support and care. In view of the high prevalence of probable maternal depression revealed in national studies and confirmed by this research, it is recommended that Brazil implement screening for mental health in antenatal and postpartum care, and during routine follow-up of children. The extension of primary care within the Unified Health System, through the Family Health Strategy, allows this measure to cover a large portion of pregnant women, particularly those at higher risk for the problem. Availability of a test that is easy to apply by trained non-specialist health workers and with acceptable sensitivity and specificity would facilitate the implementation of such a measure in routine care. The diagnosis and treatment should be made at the first level of health care since the majority of women will not need specialized mental health services. However, it is also necessary to ensure the system of care is structured in a way that enables women at risk to be identified, supported, and referred to more specialist services following diagnosis.

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Table 1 Unadjusted and adjusted association (OR) of sociodemographic variables and symptoms of PPD . Birth in Brazil Research, 2011/2012.

Variables	Total sample (n)	% EPDS ≥13	OR_u(95% CI)	P value	OR_a (95% CI)	P value
Geographic region				**<0.001**		0.245
South	2984	23.8	1		1	
North	2296	31.7	1.49 (1.23-1.79)		1.16 (0.95-1.42)	
Northeast	6903	26.8	1.17 (0.97-1.42)		0.96 (0.79-1.16)	
Southeast	10155	25.8	1.11 (0.93-1.32)		1.01 (0.85-1.21)	
Center-west	1555	24.9	1.06 (0.87-1.31)		0.94 (0.76-1.16)	
Municipality				0.869		-
Capital	8917	26.5	1		-	
Interior	14976	26.2	1.07 (0.95-1.20)		-	
Maternal age				0.748		-
<20	4570	26.9	1.05 (0.89-1.23)		-	
20-34	16807	26.4	1		-	
≥ 35	2509	25.9	1.07 (0.87-1.31)		-	
Skin color				**<0.001**		**0.036**
White	8079	22.8	1		1	
Black	2051	25.6	1.16 (0.94-1.44)		0.99 (0.79-1.24)	
Brown	13402	28.4	1.34 (1.18-1.52)		1.17 (1.03 – 1.34)	
Yellow	257	27.1	1.26 (0.80-1.98)		1.21 (0.76-1.91)	
Indigenous	99	45.1	2.78 (1.11-6.94)		2.23 (0.87-5.73)	
Marital status				**0.085**		0.259
With partner	19731	25.9	1		1	
Without partner	4526	28.5	1.14 (0.98-1.32)		1.09 (0.94-1.27)	
Economic class				**<0.001**		**<0.001**
High	5754	19.1	1		1	
Middle	12316	27.3	1.59 (1.42-1.79)		1.53 (1.36-1.73)	
Low	5610	32.0	1.99 (1.67-2.37)		1.89 (1.58-2.25)	

Table 2 Unadjusted and adjusted association (OR) of individual risk factors and symptoms of PPD. Birth in Brazil Research, 2011/2012

Variables	Total sample (n)	% EPDS ≥13	OR_u (CI 95%)	P value	OR_a (CI 95%)	P value
History of chronic disease				**0.005**		**0.014**
No	18688	25.5	1		1	
Yes	4995	29.6	1.23 (1.06-1.42)		1.18 (1.03-1.36)	
History of mental disorders				**<0.001**		**<0.001**
No	23680	26.2	1		1	
Yes	180	48.4	2.65 (1.58-4.42)		2.72 (1.63-4.53)	
Smoked during pregnancy				**<0.001**		**<0.001**
No	22270	25.6	1		1	
Yes	1623	38.2	1.80 (1.49-2.17)		1.62 (1.28-2,06)	
Alcohol use				**<0.001**		**0.012**
No	20069	25.0	1		1	
Yes, but with no alcoholism risk	1675	29.3	1.24 (0.94-1.64)		1.24 (0.92-1.67)	
Yes, with alcoholism risk	1588	35.3	1.63 (1.31-2.04)		1.45 (1.13-1.85)	

Table 3 Unadjusted and adjusted association (OR) of obstetric risk factors and maternal depression. Birth in Brazil Research, 2011/2012.

Variables	Total sample (n)	% EPDS ≥13	OR_u (CI 95%)	P value	OR_a (CI 95%)	P value
Parity				**<0.001**		**<0.001**
0	11208	20.5	1		1	
1 to 2	10212	30.6	1.71 (1.50-1.94)		**1.60 (1.40-1.82)**	
3 or more	2473	39.8	2.57 (2.08-3.17)		**1.98 (1.58-2.48)**	
History of stillbirth or neonatal death				**0.089**		0.782
No	23106	26.2	1		1	
Yes	788	30.7	1.25 (0.97-1.61)		1.17 (0.38-3.57)	
Planned pregnancy				**<0.001**		**<0.001**
Yes	10575	21.8	1		1	
No, wanted later	6058	26.8	1.31 (1.15-1.50)		**1.24 (1.05-1.44)**	
No, never wanted	7092	33.3	1.79 (1.56-2.06)		**1.40 (1.22-1.60)**	
Serious complications during pregnancy/birth				**0.163**		0.773
No	23639	26.2	1		1	
Yes	254	32.9	1.38 (0.88-2.17)		1.06 (0.70-1.64)	
Companion during labor and birth				**<0.001**		0.169
At all moments	4492	20.9	1		1	
At some moments	13549	26.9	1.39 (1.12-1.73)		1.24 (0.98-1.56)	
At no moment	5836	29.6	1.59 (1.26-1.99)		1.18 (0.91-1.54)	
Type of birth				0.248		-
Vaginal	11152	27.5	1		-	
Caesarean	12395	25.3	0.89 (0.78-1.02)		-	
Forceps	347	29.0	1.08 (0.66-1.76)		-	
Painful labor without analgesia				0.517		-
No	6901	27.4	1		-	
Yes	4973	26.1	0.94 (0.77-1.14)		-	
Newborn admitted to NICU				0.067		0.096
No	21191	26.0	1		1	
Yes	2702	29.4	1.27 (0.98-1.64)		1.26 (0.96-1.66)	
Newborn with congenital anomaly				**0.107**		0.286
No	23555	26.2	1		1	
Yes	338	34.1	1.4 (0.922-2.30)		1.26 (0.81-1.97)	
Stillbirth				**0.011**		0.399
No		26.2	1		1	
Yes		50.8	2.91 (1.28-6.62)		2.04 (0.39-10.73)	
Neonatal death				**0.004**		0.340
No		26.2	1		1	
Yes		44.9	2.30(1.31-4.04)		1.43 (0.69-3.00)	
Care during birth				**<0.001**		**<0.001**
Excellent	7259	22.8	1		1	
Good	6944	27.2	1.26 (1.13-1.41)		1.03 (0.91-1.17)	
Regular	1452	35.4	1.85 (1.55-2.22)		**1.44 (1.17-1.78)**	
Bad/very bad	574	44.5	2.71 (1.80-4.06)		**2.00 (1.28-3.13)**	
Care of newborn				**<0.001**		**<0.001**
Excellent	8491	23.8	1		1	
Good	6340	26.6	1.16 (1.01-1.34)		0.97 (0.84-1.12)	
Regular	982	36.2	1.82 (1.48-2.24)		**1.60 (1.30-1.99)**	

Bad/very bad	414	51,4	3.39 (2.35-4.89)	**2.00 (1.42-2.83)**

Table 4 Adjusted final model for the association between main risk factors and symptoms of PPD. Birth in Brazil Research, 2011/2012.

Variables	OR (CI 95%)	p value
Skin color		**0.014**
White	1	
Black	0.91 (0.71-1.16)	
Brown	**1.15 (1.01-1.31)**	
Yellow	1.08 (0.69-1.72)	
Indigenous	2.87 (0.92-9.00)	
Economic class		**<0.001**
High	1	
Middle	**1.41 (1.23-1.61)**	
Low	**1.70 (1.41-2.06)**	
History of chronic disease		0.055
No	1	
Yes	1.15 (0.99-1.32)	
Maternal mental disorder		**<0.001**
No	1	
Yes	**3.21 (1.86-5.56)**	
Smoked during pregnancy		0.030
No	1	
Yes	1.33 (1.03-1.68)	
Alcohol use		**0.030**
No	1	
Yes. but with no alcoholism risk	1.23 (0.93-1.64)	
Yes. with alcoholism risk	**1.44 (1.12-1.86)**	
Parity		**<0.001**
0	1	
1 to 2	**1.59 (1.39-1.82)**	
3 or more	**1.95 (1.56-2.44)**	
Planned pregnancy		**<0.001**
Yes	1	
No, wanted later	**1.23 (1.05-1.44)**	
No, never wanted	**1.40 (1.23-1.60)**	
Care during birth		**<0.001**
Excellent	1	
Good	1.11 (0.98-1.26)	
Regular	**1.51 (1.22-1.87)**	
Bad/very bad	**2.02 (1.28-3.20)**	
Care of newborn		**<0.001**
Excellent	1	
Good	1.01 (0.87-1.18)	
Regular	**1.65 (1.33-2.05)**	
Bad/very bad	**2.16 (1.51-3.10)**	