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Research paper

Factors associated with postpartum depression in women from low socioeconomic level in Argentina: A hierarchical model approach

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ABSTRACT

Purpose: to estimate the prevalence of depression at 4-week postpartum using the Edinburgh postpartum Depression Scale (EPDS) in women who delivered in a public maternity hospital in Argentina.

Methods: This prospective cohort study was carried out from March to August 2016 in northwest Argentina. Eligibility included delivering a singleton live birth 28 weeks of gestational age or over, 18 years or older and resided within 1 h from the maternity hospital. Women were excluded if they or their newborn were in the intensive care unit. We defined a positive screening as an EPDS score of 10 or higher or a positive response to item 10, which indicates thoughts of self-harm.

Results: A total of 587 women were enrolled and 539 women completed the home visit interview and the EPDS. A total of 167 (31.0%, 95% CI 27.1–35.1) mothers screened positive in the EPDS using a score ≥ 10 and 99 (18.4%, 95% CI 15.1–21.6%) using a score ≥ 13, which indicate increased severity of depressive symptoms. In both cases, the 23 (4.3%) women that responded as having thoughts of self-harm were included.

Conclusion: Nearly a third of women who participated had depressive symptoms at four weeks postpartum in a public hospital in Tucumán, Argentina. Socio-demographic, particularly personal psychiatric history, factors and social and cultural influences can impact results.

Our results highlight the need for improved screening and better diagnostic tool for women with postpartum depression in Argentina and to investigate the impact of postpartum depressive symptoms on women's health and their families.

1. Introduction

Perinatal maternal depression, defined as the onset of a non-psychotic depressive episode of mild to major severity during pregnancy or the first 12 months postpartum (Gavin et al., 2005; Depressive Disorders, 2013), can in turn result in impaired mother-to-child bonding (Beck, 1998; Stein et al., 1991), adverse child development (Beck, 1998), and even suicide (Tabb et al., 2013) or infanticide (Barr and Beck, 2008). Unfortunately, despite its negative impact on maternal and child health, perinatal maternal depression is often under-diagnosed and under-treated (Gelaye et al., 2016a).

Postpartum depression (PPD) is considered one of the most frequent maternal morbidities after delivery, yet the published prevalence rates of PPD are difficult to compare across studies and countries. Initial reports of the World Health Organization described a prevalence of PPD of 10% for high-income countries (HICs) and 15% for low and middle-income countries (LMICs) (Fisher et al., 2012). A more recent a systematic review of PPD in 23 LMICs showed a pooled prevalence of 19.0% (15.5–23.0) (Gelaye et al., 2016a). However, studies from low to high-income countries show a wide variability that can be attributed to

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multiple factors such as the time of evaluation, the method of assessment, and the different assessment tools with various cutoff points (Halbreich and Karkun, 2006; O'Hara and Swain, 1996). Several literature reviews regarding PPD have shown that socioeconomic and cultural factors, such as dialects, perception and stigma of mental health and the utilization of a "Western" screening tool in a non-Western community, can also be driving forces for the wide range of PPD prevalence rates (Gelaye et al., 2016a; Zubaran et al., 2010; Bashiri and Spielvogel, 1999).

Argentina's healthcare system is comprised of 3 distinct sectors: the labor union, the private, and the public. There are two reported studies estimating PPD, which were conducted in the labor union and private sectors. Mathisen et al. found that 37.2% (27.7–47.7) of the 86 middle-class women interviewed from the labor union sector had depressive symptoms at 6-week postpartum, and the risk factors associated were cesarean section, pregnancy complications, labor complications, multiparity, and incomplete breast feeding (Mathisen et al., 2013). Rozic et al. estimated a prevalence of 17.8% (14.4–21.9) of the 398 women from the private sector at 5 days postpartum, and the risk factors included personal history of PPD or depression, maternal age less than 25 years old, tobacco consumption and complications in the newborn (Rozic et al., 2012).

It is relevant to provide information regarding the prevalence of PPD in the public sector. The public sector serves about 50% of the population, including those who lack formal work or cannot afford private insurance and are not eligible to receive labor union insurance funds. Women who receive care from the public hospitals are more likely to belong to a lower-middle socioeconomic level and prevalence of PPD in the public sector is expected to be higher due to the increased prevalence of risk factors (lower maternal age, multiparty, lower socioeconomic status (SES), and lesser access to health care) (Argentina, 2010; Schwarcz et al., 2008).

Our primary objective is to estimate the prevalence of PPD using the Edinburgh Postpartum Depression Scale (EPDS) at 4-week postpartum in women who delivered in a public maternity hospital in Tucumán, Argentina and to examine the association between PPD and sociodemographic, medical and obstetric factors.

2. Materials and methods

2.1. Study design and participants

This observational prospective cohort study was carried out from March to August 2016 in San Miguel de Tucumán at the Instituto Maternidad Provincial Nuestra Señora de las Mercedes, a public maternity hospital that serves as the referral ward for northwest Argentina with approximately 7000 deliveries per year (Cormick et al., 2015).

Eligible women were those that had delivered a singleton live birth 28 weeks of gestational age or over, were 18 years or older, could provide at least 2 sources of contact information and resided within 1 h from the maternity hospital. Women were excluded if they were in the intensive care unit (ICU) or had a newborn in the neonatal ICU (NICU) or with congenital abnormalities.

2.2. Procedures

Trained research personnel reviewed the Labor and Delivery book Mondays to Saturdays, with the exception of national holidays, to identify eligible candidates and inform them about the study's objectives. Those agreeing to participate signed a written informed consent and completed a baseline survey. Medical and obstetric factors were collected from the participants' clinical records.

Approximately four weeks after delivery, a trained social worker conducted a follow-up home visit to complete the survey, including administering the EPDS. Participants were considered lost to follow-up if they could not be located after two home visits and/or three phone calls. Women who screened "positive" or had thoughts of self-harm were then referred to the hospital mental health professional.

2.3. Instrument and study variables

2.3.1. Edinburg Postnatal Depression Scale (EPDS)

Our primary outcome was PPD, as measured by the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987) at 4-week postpartum. The EPDS is a 10-item self-reported questionnaire that measures depressive symptoms in the past 7 days. Each item is scored on a 4-point scale (0–3), with higher scores reflecting increasing severity of depressive symptoms. We defined a positive screening of PPD as an EPDS score of 10 or higher or a positive response to item 10, which indicates thoughts of self-harm. This definition was used in the two previous studies in Argentina, which permits their comparison with our results (Rozic et al., 2012, Matisen et al., 2013). The EPDS version validated in Chile showed that a cutoff point of 10 or 11 has a good accuracy; however, we also report the cutoff point of 13 or higher, as the EPDS accuracy was maximized with a cutoff point of 12 or 13 (Alvarado et al., 2015a; Victora et al., 1994).

The 4-week postpartum follow-up was chosen based on the DSM-V definition (Diagnostic and Statistical Manual of Mental Disorders) of the postpartum period. A study by Cox et al. also demonstrated a threefold increase in the rate of onset of depression one month after delivery (Cox and Chapman, 1993).

2.4. Baseline characteristics

Self-reported variables collected at baseline included sociodemographic characteristics (education, birthplace, occupation, and with whom the mother lives), self-reported maternal and familial psychiatric history, family planning (Mosher et al., 2012), and pregnancy birth experience (hospitalization during pregnancy, if the woman heard her baby's first cry at delivery and skin to skin contact with the mother).

Information extracted from clinical records included: gestational history, history of chronic diseases, first prenatal screening, number of prenatal visits, complications during pregnancy, delivery mode and indications for cesarean delivery, Apgar scores, newborn resuscitation requirements, gestational age at birth, birth weight and sex of the baby.

2.5. Postpartum experience at 4 weeks

Data collected regarding maternal experience after birth included: help with the baby's care, breastfeeding, complications with the baby or the mother immediately after delivery or after discharge, and experience of disrespect from a healthcare professional during delivery (defined as someone who made ironic, disqualifying or sarcastic comments to the woman or if the way the woman was attended to make her feel vulnerable, guilty or insecure).

2.6. Statistical analysis

2.6.1. Sample size

Taking into account a prior Argentine study (Rozic et al., 2012) which found a prevalence of PPD of 17.8%, we determined the sample size required to estimate the prevalence of PPD with a desired precision of 5% at alpha = 0.05 was 227 women. However, due to our strong interest in the secondary outcome of assessing the relationship between sociodemographic, medical and obstetric factors and PPD, we increased the sample size to have sufficient power to address this objective. A total of 516 participants was required to include in a multivariate model up to four factors described to be associated with PPD (age, education, parity and history of depression) with a power of 80%. After adjusting for potential loss to follow up (10%), we targeted a sample size of 570 participants. (http://sampsize.sourceforge.net/iface/).

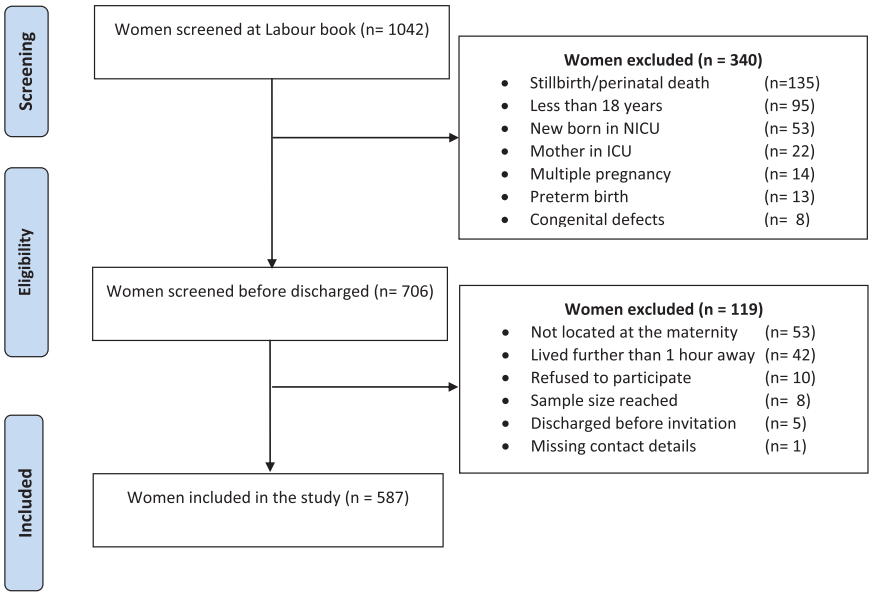

Fig. 1. Flow diagram.

2.7. Data analysis

A descriptive analysis of the maternal characteristics was performed and the absolute number and proportion were calculated. The prevalence of PPD and its precision (reported as 95% Confidencial Interval [CI]) was determined. Next, a bivariate analysis was performed to examine the relationship between PPD and covariates of interest; for each covariate category, the number and proportion of women with PPD was reported. Subsequently, crude odds ratios (ORs) and 95% CIs were computed to measure the association between PPD and each covariate.

Finally, we conducted a multivariate analysis using hierarchical modeling following the recommendations about the design (Victora et al., 1997). This conceptual hierarchical framework was constructed using knowledge of the demographic and biological determinants of PPD looking for an explanatory or causal model. The relationship between PPD and the study variables was conceptually based on a theoretical hierarchical model designed by the study investigators (see Fig. 2) (Victora et al., 1994). According to this model, socio-demographic data in the first level may directly or indirectly determine all the other factors under study. The second hierarchical level comprised maternal medical history and maternal and familial psychiatric history, which can be partially explained by socio-demographic factors. The third level includes maternal medical data of the current pregnancy and the fourth level combines the experience of hospital stay and newborn data. At the last level, the postpartum experience until 4 weeks may be affected by preceding variables, and directly influence PPD.

We considered determinants of PPD to be those variables that showed a statistically significant association ($p < 0.05$) with PPD in each respective level of the hierarchical model. In the first step all variables were entered and all statistically significant variables were kept. The variables in the second level were then added keeping only those that were significant. A similar procedure was repeated for the variables for the other levels. The reported crude ORs were those corresponding to the level in which the risk factor of interest was first entered, and the adjusted ORs were those corresponding to the final full model with all the variables.

Data was entered in the REDCap Software, Version 6.5.20 and analysis was performed using SAS 9.3. P-value < 0.05 was considered statistically significant.

2.8. Ethics

The protocol, study instruments and informed consents were approved by the ethics committee of the University of North Carolina at Chapel Hill (Chapel Hill, NC, USA) and the local ethics committee, El Centro de Educación Médica e Investigaciones Clínicas (CEMIC; Buenos Aires, Argentina).

3. Results

1042 women were screened consecutively from the Labor and Delivery book and 706 were classified as potentially eligible (see Fig. 1). However, 119 were further excluded as they could not provide two sources of contact information (n = 1), lived more than 1 h from the maternity hospital (n = 42), were discharged from the maternity before study personnel could invite them (n = 5), refused (n = 10), were unable to be located (n = 53), or were not invited because the desired sampled size had been reached (n = 8). A total of 587 women were enrolled in the study and 559 women completed the home visit interview (95.9% follow-up rate). Of the 28 women lost to follow up, 4 dropped out of the study, 6 moved outside the city and 18 could not be located. Twenty additional women were excluded due to incomplete outcome data, leaving a total of 539 participants for analysis.

Participant characteristics are described in Table 1. Most participants had at least started (n = 176, 32.7%) or completed secondary education or higher (n = 237, 44.1%). All but 4 participants (0.7%) were born in Argentina. The majority had a stable partner (n = 388, 72.0%), were housewives (n = 459, 85.2%) and lived with a partner (n = 231, 42.9%) while about a third lived with parents (n = 194, 36.0%). Most women reported not suffering from chronic diseases (n = 478, 88.7%). Regarding maternal psychiatric history, 15.4% (n = 83) self-reported family history of depression and 11.9% (n = 64) a personal history of depression. Almost half of pregnancies were reported as unwanted or mistimed. Most women had their first prenatal visit during the first trimester (n = 445, 84.3%) and had more than four prenatal visits (n = 443, 89.1%). 28.8% (n = 155) reported experiencing some complications during pregnancy while 44.3% (n = 239) of deliveries were by Cesarean-section.

A total of 167 (31.0%, 95% CI 27.1–35.1) mothers screened positive on the EPDS using a score ≥ 10 and 99 (18.4%, 95% CI 15.1–21.6%) using a score ≥ 13, which indicates increased severity of depressive symptoms. In both cases, the 23 (4.3%) women that responded having thoughts of self-harm were included. The results of the EPDS by item are shown in Table 2.

Looking at socio-demographic variables, PPD was inversely related to education level. Women with incomplete primary (OR 2.43, 95% CI

Level	Variables
Level 1	**Sociodemographic Data:** Age, Education, Nationality, Marital Status, Occupation, Lives with
Level 2	**Maternal Medical History:** No. of Births, Abortions/Miscarriages, Chronic diseases. **Maternal Psychiatric History (self-reported):** Depression, Depression in previous pregnancies, Post partum depression. **Family Psychiatric History (self-reported):** Depression, Psychiatric History.
Level 3	**Maternal Medical History of Current Pregnancy:** Planned pregnancy, Gestational Age at 1st prenatal visit, Number of prenatal check-up visits, Complications during pregnancy.
Level 4	**Experience of Hospital stay:** Healthcare professional made ironic or joking comments to the woman; Healthcare professional made woman feel vulnerable, guilty, or insecure; Partner or close family member present during delivery; Gestational age; Mode of delivery; Indication for CS; Did the mother hear the baby cry; Skin to Skin contact immediately after birth; Immediate Complications of the mother after birth. **Recent Newborn Data:** Birth weight, Sex, Apgar, Neonatal Resuscitation, Immediate Complication of the baby after birth.
Level 5	**Postpartum Experience until 4 weeks (as reported during the home visit):** Help with baby, Breastfeeding; Complication of the baby after discharge; Complication of the mother after discharge.

Fig. 2. Hierarchical model explaining the relationship between the study variables and postpartum depression.

1.13–5.22) or complete primary (OR 2.28, 95% CI 1.38–3.77) were more likely to develop PPD compared to women with higher levels of education. Women reporting being housewives were most likely to have PPD symptoms (OR 3.40, 95% CI 1.17–9.86). Maternal age, marital status, living alone or accompanied were not associated with PPD (Table 3).

Women with more than 2 previous births had a higher risk of PPD when compared to women with no previous births (OR 2.36, 95% CI 1.36–4.09). Women reporting a personal history of depression (OR 4.23, 95% CI 2.46–7.27), history of depression in previous pregnancies (OR 2.22, 95% CI 1.1–4.14), family history of depression (OR 1.78, 95% CI 1.1–2.88) or family history of psychiatric illness (OR 1.99, 95% CI 1.02–3.91) were shown to have an increased risk for PPD.

History of previous abortions, or variables related to the current pregnancy such as unwanted or unintended pregnancy, gestational age at first prenatal visit, number of prenatal checks or complications during pregnancy showed no significant association with PPD in the bivariate analysis.

Regarding the hospital experience, women who reported a negative interaction with their healthcare professional (OR 3.32, 95% CI 1.45–7.65) or felt vulnerable, guilty or insecure during their delivery (OR 3.26, 95% CI 1.74–6.11) had a significantly higher risk of PPD in the bivariate model.

Giving birth to a female newborn was significant positive association with PPD (OR 1.56, 95% CI 1.08–2.26). Women who reported receiving no help with baby care and women who reported receiving help from only her mother were most likely to have PPD when compared to women with help from both her partner and her mother (OR 3.97, 95% CI 1.96–8.02 and OR 2.08, 95% 1.08–4.01, respectively). Breastfeeding or complications of the newborn or the mother after discharge showed no association with PPD.

Results of the hierarchical model are shown in Table 3. Education was the only variable from the first level that remained significantly associated to PPD and was kept in the model. When variables from the second level were added, number of previous births (OR 1.79, 95% CI 1.00–3.22) and maternal history of depression (OR 3.78, 95% CI 2.16–6.59) remained significant. In the third level, perceived negative comments (OR 2.91, 95% CI 1.15–7.36), feelings of insecurity (OR 3.21, 95% CI 1.62–6.37), and having a female newborn (OR 1.60, 95% CI 1.07–2.38) remained significant.

4. Discussion

We found that the prevalence of PPD was 31.0% (95% CI 27.1–35.1) and 18.4% (95% CI 15.1–21.6%), using the cutoff score ≥ 10 and ≥ 13, respectively. The analysis from the hierarchical model showed that lower education level, higher parity, personal history of depression, perceived negative interaction with health care professionals, or feelings of vulnerability or insecurity at delivering, having a female newborn, or lacking childcare help were risk factors for screening positive for PPD.

Maternal depression is one of the major contributors of pregnancy-related morbidity and mortality. Despite its enormous burden, maternal depression in LMICs remains under-recognized and under-treated (Oates, 2003). Considering a cut-off of 10 our study found a higher prevalence than the recent systematic review in 23 LMICs, however, using the cutoff point of 13 or higher, the PPD prevalence is similar (Gelaye et al., 2016b). The systematic review included studies using different depression scales including the Patient Health Questionnaire-9 (PHQ-9), the Beck Depression Inventory II (BDI-II), the Mini International Neuropsychiatric Interview (MINI) and the EPDS among others, that measure different factors of depressive symptoms (Shafer, 2006).

Table 1
Sociodemographic characteristics, maternal medical, psychiatric and obstetric history.

Variables	n (%)
Maternal Age (years)	
18 – less than 20	63/539 (11.7%)
20 – less than 35	429/539 (79.6%)
≥ 35	47/539 (8.7%)
Level of Education	
Incomplete primary	31/538 (5.8%)
Complete Primary	94/538 (17.5%)
Incomplete Secondary	176/538 (32.7%)
Complete Secondary or more	237/538 (44.1%)
Nationality	
Argentina	535/539 (99.3%)
Others	4/539 (0.7%)
Marital Status	
Married	63/539 (11.7%)
With a stable partner	388/539 (72.0%)
Single/separated	88/539 (16.3%)
Occupation	
Housewife	459/539 (85.2%)
Student	32/539 (5.9%)
Dependent Job	23/539 (4.3%)
Independent Job	25/539 (4.6%)
Live with:	
Alone	1/539 (0.2%)
With partner (with or without kids)	231/539 (42.9%)
With parents (with or without others)	194/539 (36.0%)
Others	113/539 (21.0%)
Total number of previous births	
0	176/539 (32.7%)
1–2	276/539 (51.2%)
More than 2	87/539 (16.1%)
Chronic Disease	
Yes	61/539 (11.3%)
No	478/539 (88.7%)
History of Depression	
Yes	64/539 (11.9%)
No	475/539 (88.1%)
History of Depression in Previous Pregnancies	
Yes	38/536 (7.1%)
No	498/536 (92.9%)
History of Postpartum Depression	
Yes	37/537 (6.9%)
No	500/537 (93.1%)
Family History of Depression	
Yes	83/538 (15.4%)
No	455/538 (84.6%)
Family History of Psychiatric Illness	
Yes	37/539 (6.9%)
No	502/539 (93.1%)
Planned Pregnancy	
Intended	252/539 (46.8%)
Mistimed	51/539 (9.5%)
Unwanted	236/539 (43.8%)
Complications during pregnancy[a]	
Yes	155/539 (28.8%)
No	384/539 (71.2%)
Type of Delivery	
Vaginal Delivery	300/539 (55.7%)
C-Section	239/539 (44.3%)

[a] Threat of premature birth, anemia, urinary tract infection.

Moreover, studies using the EPDS report different cutoff points, even within the same country (Santos et al., 2007; Tannous et al., 2008) leading to different prevalence of depressive symptoms. Additionally, the population used in the studies included in the review varied. As one of the main determinants of PPD symptoms is socioeconomic status; the way the sample is selected can lead to different prevalence values. Our aim was to determine the prevalence of PPD in the public sector, and therefore, higher levels of PPD were expected.

A cutoff point of 10, though it increased the false positive rate enabled comparison with the two previous studies in Argentina. In the Rozic et al. (2012) study. PPD prevalence in the private sector measured at 5 days postpartum is lower than that reported in our study. These differences could be explained by their shorter time frame to assess PPD, when higher risk of PPD is between 4 and 5 weeks; and a sample with more than 97% of women with > 12 years of education, reflecting a higher socio-economic status. Mathisen et al. reported that 37.2% (27.7–47.7) of middle-class women had depressive symptoms at 6-week postpartum that are within the range described in our study (Mathisen et al., 2013). While previous studies evaluated PPD at the health facilities, we chose to administer the EPDS outside the hospital to control for courtesy bias; however, we had difficulty limiting the influence of a family member, potentially exaggerating or minimizing the respondent's psychiatric symptoms (Cox et al., 1987).

Consistent with the epidemiological literature, we observed that a low educational level was associated with a higher prevalence of PPD. Fisher et al. (2012); Séguin et al. (1999), The same association has been described in the general population in Argentina (Daray et al., 2017). The relationship between education and depression is poorly understood. Education may influence the subjective experience, self-awareness or the acceptance of depressive feelings, and therefore delay disclosure of psychiatric symptoms and help seeking behaviors (Cook and Wang, 2010). Moreover, education combined with other socio-economic factors may also modulate the maturation of specific brain regions involved in mood disorders, such as the prefrontal cortex (Shonkoff et al., 2009).

A review of the prevalence of self-harming thoughts using the EDPS found a range between 4% and 15.4% (Lindahl et al., 2005). In our study, 23 (4.3%) women responded as having thoughts of self-harm, which is within the range reported in the literature. Although it is a single item within the scale, which may or may not reflect intention to die, it could be useful to develop new studies exploring other dimensions of suicidal behavior during the postpartum period. Women with postpartum psychiatric disorders present approximately four times higher mortality rate ratios when compared to mothers with no previous psychiatric history and suicide is one of the main unnatural causes of death in this vulnerable group, especially during the first year after diagnosis (Johannsen et al., 2016). To develop a comprehensive prevention strategy for suicide, the first step is the identification of high-risk groups and precipitating factors that lead to attempted or completed suicide. One of the strongest predictors of suicide attempt and completion is the presence of suicidal ideation (Joiner et al., 2000). Therefore, identifying individuals who endorse suicidal ideation presents an important opportunity for directing suicide prevention efforts to those at highest risk.

The relationship between number of previous birth and PPD is controversial. Most studies reported an association between multiparity and PPD (Mayberry et al., 2007; Righetti-Veltema et al., 1998), others showed no association (Chi et al., 2016), while some found primiparous were at higher risk (Kheirabadi et al., 2009). In the present study, we found a positive association between higher parity and the risk of PPD. This could reflect higher care burden and psychological stress. Similar results have been observed in the previous study in the labor union sector in Argentina (Mathisen et al., 2013).

An association between PPD and personal history of a previous depressive episode has been described before (Halbreich and Karkun, 2006; Beck, 2001; Kimmel et al., 2015). Accordingly, we observed that personal history of depression had the strongest association with developing depressive symptoms by a factor of 4 in comparison with mothers without personal history of depression. This could reflect an interaction between psychiatric vulnerability and pregnancy as a stressor leading to acute depression during the postpartum period. The personal history of depression could be useful to identify women at high risk of PPD.

In the present study, women who received no help with baby care were at highest risk of postpartum depression. The association between lack of social support and PPD has been previously reported by studies from both developing and developed countries (Dibaba et al., 2013;

Table 2
Edinburg Postnatal Depression Scale - EPDS.

Outcome	Outcome (Edinburg Postnatal Depression Scale - EPDS):	Number of women reporting positive for each idem[a] n (%)
1	I have been able to laugh and see the funny side of things	55 (10.2)
2	I have looked forward with enjoyment to things	29 (5.4)
3	I have blamed myself unnecessarily when things went wrong	279 (51.8)
4	I have been anxious or worried for no good reason	273 (50.6)
5	I have felt scared or panicky for no very good reason	192 (35.6)
6	Things have been getting on top of me	230 (42.7)
7	I have been so unhappy that I have had difficulty sleeping	159 (29.5)
8	I have felt sad or miserable	89 (16.5)
9	I have felt sad or miserable that I have been crying	70 (13.0)
10	The thought of harming myself has occurred to me	23 (4.3)

[a] Scoring 2 or 3 for that question.

Table 3
Variables significantly associated with postpartum depression.

	PPD Cases/Total (%)	Crude OR	P-Value	OR Adjusted[a]	P-Value
Level 1. Sociodemographic Data					
Level of Education					
Incomplete primary	14/31 (45.2%)	2.43 (1.13–5.22)	0.023	2.43 (1.13–5.22)	0.023
Complete Primary	41/94 (43.6%)	2.28 (1.38–3.77)	0.0013	2.28 (1.38–3.77)	0.0013
Incomplete Secondary	51/176 (29.0%)	1.20 (0.78–1.86)	0.407	1.20 (0.78–1.86)	0.407
Complete Secondary or more	60/237 (25.3%)	1	–	1.00a	–
Occupation					
Housewife	150/459 (32.7%)	3.40 (1.17–9.86)	0.0245		
Student	4/32 (12.5%)	1	–		
Dependent Job	8/23 (34.8%)	3.73 (0.96–14.5)	0.0566		
Independent Job	5/25 (20.0%)	1.75 (0.42–7.34)	0.4447		
LEVEL 2. Maternal Medical History					
Total number of previous births					
0	42/176 (23.9%)	1	–	1.00b	–
1–2	88/276 (31.9%)	1.49 (0.97–2.29)	0.0671	1.36 (0.87–2.12)	0.1768
More than 2	37/87 (42.5%)	2.36 (1.36–4.09)	0.0021	1.79 (1.00–3.22)	0.0515
Maternal and Familial Psychiatric History					
History of Depression					
Yes	39/64 (60.9%)	4.23 (2.46–7.27)	< 0.0001	3.78 (2.16–6.59)	< 0.0001
No	128/475 (26.9%)	1	–	1.00b	–
History of Depression in Previous Pregnancies					
Yes	23/46 (50.0%)	2.22 (1.19–4.14)	0.012		
No	104/335 (31.0%)	1	–		
Family History of Depression					
Yes	35/83 (42.2%)	1.78 (1.10–2.88)	0.0181		
No	132/455 (29.0%)	1	–		
Family History of Psychiatric Illness					
Yes	17/37 (45.9%)	1.99 (1.02–3.91)	0.0447		
No	150/502 (29.9%)	1	–		
LEVEL 4. Experience of Hospital stay					
Made ironic, disqualifying or joking comments					
Yes	14/24 (58.3%)	3.32 (1.45–7.65)	0.0047	2.91 (1.15–7.36)	0.0236
No	152/513 (29.6%)	1	–	1.00c	–
Feelings of vulnerability, guiltiness or insecurity					
Yes	25/44 (56.8%)	3.26 (1.74–6.11)	0.0002	3.21 (1.62–6.37)	0.0009
No	142/494 (28.7%)	1	–	1.00c	–
Recent Newborn Data (LEVEL 4)					
Sex					
Male	74/281 (26.3%)	1	–	1.00c	–
Female	90/251 (35.9%)	1.56 (1.08–2.26)	0.0179	1.60 (1.07–2.38)	0.0209
LEVEL 5. Postpartum Experience until 4 weeks					
Help with Baby Care					
With no help	28/53 (52.8%)	3.97 (1.96–8.02)	0.0001	3.54 (1.62–7.74)	0.0016
With help from only partner	48/151 (31.8%)	1.65 (0.94–2.91)	0.0838	1.70 (0.90 −3.18)	0.0997
With help from only mother	27/73 (37.0%)	2.08 (1.08–4.01)	0.0289	2.36 (1.15–4.87)	0.0199
With help only from partner and mother	24/109 (22.0%)	1	–	1.00d	–
Help from other	40/153 (26.1%)	1.25 (0.70–2.24)	0.4441	1.23 (0.65–2.34)	0.5246

[a] OR Adjusted by all variables in the same level.

Dennis et al., 2004). These studies have shown that social support plays a buffering role from stressful life events by providing resources, support and strength during pregnancy.

In some Asian cultures such as China and India there is preference for a first-born male child (Mithra, 2017) and this gender preference has been reported to be stressful for the mothers giving birth to a female child (Patel et al., 2002). In the present study having a female newborn also presented a risk for PPD. This finding was unexpected since there are no reports in Argentina about gender preference.

From our study, we observed how educational level, multi-parity, history of psychiatric illnesses, negative experience during pregnancy and labor, newborn gender and social support can influence the development of PPD in Tucuman mothers. While the focus of this study was to examine the social and cultural factors associated with developing PPD, there has been increasing evidence that hormonal changes during and after pregnancy can make women more susceptible to developing PPD (Bloch et al., 2000; Schiller et al., 2015). In our study sample, women at risk for postpartum depression may have been more vulnerable to the effects of hormonal changes than their non-depressed counterparts and that their social circumstances triggered their susceptibility for having depressive symptoms. Future studies can further evaluate and analyze the influence of hormonal changes around delivery as a marker for developing PPD. In summary, pregnancy is a major life event that is inevitably accompanied by social, psychological and biological changes (Bennett et al., 2004) and these changes can trigger depressive episodes with serious implications for both maternal and infant outcomes (Field et al., 2006; Dayan et al., 2006; Hollins, 2007).

4.1. Strengths and weaknesses

We minimized potential selection bias by conducting a consecutive cohort study where all eligible women were invited to enroll. We achieved a high response rate by administering the EPDS at the participants' homes. Thus, our study sample is more representative than if we had conducted the follow-up at a postpartum clinic visit because it would potentially underrepresent mothers who may not have access to attend their postpartum checkup. One limitation of the study is that we excluded women with severe health complication or adverse neonatal outcomes as it is known to increase risk of PPD (Nelson et al., 2013, 2016), and we only recruited women who lived less than 1 h away from the capital city, excluding mothers from rural areas, who may be poorer and have less access to health care. Another limitation of this study is no data was collected about different substances of abuse like nicotine, alcohol or other hard drugs. A further limitation is that we did not collect the data about the pharmacological lifetime, recent history of antidepressants use or data of bipolarity that would provide the prevalence of women with diagnosis and treatment of depression.

The EPDS has been widely accepted as a useful and quick screening tool for PPD due to its ease of use and has been validated across different cultures and languages (Alvarado-Esquivel et al., 2006; Vega-Dienstmaier et al., 2002; Garcia-Esteve et al., 2003; Jadresic et al., 1995). However, it must be emphasized that the EPDS is not a diagnostic tool and it can overestimate the prevalence of PPD in comparison to well-structured interview-based methods (Halbreich and Karkun, 2006; Katon et al., 2014; Santos et al., 2016). Comparing the available validated Spanish versions, we adopted the Chilean version with 100% sensitivity, 80% specificity and 37% positive predictive value (cutoff score $\geq$ 10). The Chilean version is applicable for middle- and working-class women, the language is most similar to that of Argentina, and the previous studies in Argentina had used this version as well (Mathisen et al., 2013; Rozic et al., 2012; Alvarado et al., 2015a, 2015b).

While this allows comparing the results, subtle language differences were noted and even though they were addressed at the interviews, this could lead to misinterpretation, potentially affecting the results.

We found that demeaning comments made by a healthcare professional or feelings of vulnerability, guiltiness or insecurity in the mother were associated with reporting symptoms of PPD. Questions regarding the inter-relationship with healthcare provider or the amount of childcare support received was based on the woman's perception. In other words, people with depression are more likely to perceive their relationship with others or their level of support more negatively compared to their non-depressed counterparts (Logsdon et al., 2000). Our method of measuring support was over-simplified. We did not measure social support as a multi-dimensional construct, as the mother may be receiving other types of support, such as informational, financial or emotional.

5. Conclusion

Our prospective cohort study shows that nearly a third of women had depressive symptoms at four weeks postpartum in a public hospital in Tucumán, Argentina and further revealed that socio-demographic factors, particularly personal psychiatric history, and social and cultural influences can impact results. Due to the limited evidence in Argentina, our results highlight the need for improved screening and a better diagnostic tool for women with PPD. In addition, it would be prudent to further investigate the impact of postpartum depressive symptoms and measure the burden on women's health and their families. The impact of improved provider and patient inter-relationship on PPD should be further explored. A formal validated version of the EPDS in Argentina is warranted to determine the appropriate language and threshold score. Future studies including hospitals from different regions of the country are also needed in order to estimate the prevalence of PPD in Argentina and to further elucidate potential risk factors in order to aid future community interventions to prevent and treat PPD.

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