
| RESEARCH ARTICLE

Relationship between Postpartum Depression and Unwanted Pregnancy in Ecuadorian Women: A Quantitative Study

Gustavo Quintero-Cuero¹ ✉ Edison Castro-López², Johanna Freire-Silva³, Mishel Rojas-Granizo⁴, Cristhian Humanante-Jara⁵, Johanna Mendoza-Zambrano⁶ and Jennifer Arcos-Simaluisa⁷

¹Industrial Engineer, Universidad Técnica Luis Vargas Torres, Esmeraldas, Ecuador

²Medical Doctor, Centro de Especialidades Médicas Vital Médica's, Ambato, Ecuador

³Medical Doctor, Consultorios SilvaMedic, Ambato, Ecuador

⁴Ecuadorian National Police, Motorized Operations Group, Riobamba, Ecuador

⁵Medical Doctor, Ministry of Public Health, Coordinación Zonal 2, Centro de Salud Talag, Tena, Ecuador

⁶Medical Doctor, Centeno Clínic, Manta, Ecuador

⁷Medical Doctor, Occupational Health and Safety, Ministerio de Salud Pública, Dirección Distrital 05D06-Salcedo-Salud, Centro de Salud Salcedo, Latacunga, Ecuador

Corresponding Author: Gustavo Quintero-Cuero, **E-mail:** scienceacrev@gmail.com

| ABSTRACT

Analyzing the factors that influence postpartum depression, such as unwanted pregnancies, contributes significantly to the current literature since episodes of postpartum depression tend to leave various psychological sequelae for the mother and the newborn. Several studies provide empirical evidence suggesting that factors such as having experienced a stillbirth episode, having planned the baby by the mother and her partner, being of a non-indigenous ethnicity, having had a normal delivery, and living in an urban area significantly affect the experience of postpartum depressive episodes. We used a representative sample of 20648 mothers from the 2018 National Health and Nutrition Survey (ENSANUT). We used a binary logistic linear regression model where we estimated the Odds Ratio (OR) and marginal impacts with their 95% confidence intervals (95% CI) for each of the independent variables. Our results show that having had an episode of stillbirth (OR=2.521; CI=2.106 - 3.018), having a planned child by the mother (OR=0.648; CI=0.590 - 0.710), and her partner (OR=0.841; CI=0.762 - 0.928), being of an ethnicity other than indigenous, having had a normal delivery (OR=0.775; CI=0.721 - 0.833) and living in the urban area (OR=1.085; CI=1.006 - 1.171) are factors that significantly affect the probability of experiencing an episode of postpartum depression. Based on our findings, we recommend that health policymakers and medical professionals consider that postpartum depression has a great significance or commitment in the puerperal population, constituting a pressing psychological condition, which should not be underestimated, but rather should be encouraged to give due attention it deserves. In addition, we should not exclude the risk factors involved in the possible development of this pathology.

| KEYWORDS

Postpartum depression; Unwanted pregnancy; Maternal mental health; Ecuador; Logit Model; Odd Ratio

| ARTICLE INFORMATION

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1. Introduction

The most common mood disorder associated with childbirth is postpartum depression (PPD). PPD is a major depressive mood disorder that appears between 4 weeks and 1 year after childbirth (Fernández Vera et al., 2014a). During the puerperium, women are at increased risk of experiencing major depressive episodes (MDEs), which increases the likelihood of depression. The

prevalence of depression during pregnancy is 12.4%, and 9.6% in the year following childbirth. Worldwide, it is estimated that about 15% of women suffer from postpartum depression, with an especially significant impact on Latina women, affecting approximately 56% of them (Caparros-Gonzalez et al., 2018). This situation constitutes a psychiatric emergency due to the risk it represents for the mother, the child and the family, especially because of the delusional ideas that the mother may experience (Banti et al., 2011). Although motherhood has been considered by some authors as a protective factor against suicide, it has been observed that suicide is one of the leading causes of death during the perinatal period in high-income countries (Oates, 2003).

Postpartum depression is related to psychological symptoms and alteration of biological patterns, among which are a sad emotional state, high levels of fatigue, sleep disorders and affectation of the hypothalamic-pituitary axis, which secretes the hormone cortisol generated in stressful situations. Although the symptoms usually appear after the birth of the baby, women develop depression after childbirth. They present psychological symptoms during the development of pregnancy (anxiety, depression and specific stress of pregnancy). (Caparros-Gonzalez et al., 2017).

Faced with this serious problem, women do not seek psychological and medical help during pregnancy and puerperium, so they do not have access to information about warning signs and sources of help where to go to (Barrera & Nichols, 2015). To counteract this problem, it would be ideal to promote psychological follow-up throughout pregnancy and puerperium, providing information on warning signs to pregnant women. In addition, it would be ideal to screen all women for postpartum depression in the first hours after the birth of their baby through the application of psychological scales of postpartum depression, as well as the control of stress levels during pregnancy through psychological instruments, which can predict the group of pregnant women at risk of presenting symptoms of postpartum depression, thus strengthening maternal and infant health and development (Caparros-Gonzalez et al., 2017).

Theoretically, no evidence has been found on the specific cause of this disorder; however, factors that may be associated have been described, among which are: demographic, psychosocial and perinatal factors that generate susceptibility to PPD (Rojas et al., 2010a). (Rojas et al., 2010a).. Demographic factors include low or no education, extreme age, and the number of children; psychosocial factors that have a strong association are a personal history of low self-esteem, previous postpartum depression, lack of family or social support, partner support, family violence and stress during pregnancy as if it were an unwanted pregnancy (Wisner et al., 2004). (Wisner et al., 2004). Previous psychiatric history: psychological factors and the coexistence of chronic illnesses. The presence of illness in the newborn and pregnancy-related medical complications (Milgrom et al., 2008).

It can be affirmed that the determination of the relationship of this pathology with the risk factors is the pillar or the basis of the control of postpartum depression and its consequences. In recent years there have been numerous investigations related to postpartum depression, which we found in a cross-sectional study conducted on 1,359 women who had given birth to a single live baby in the U.S. concluded that there was a statistically significant relationship between age and depressive symptoms ($p < 0.001$), since mothers younger than 25 years presented a higher risk of PPD and, therefore, periodic evaluations should be performed for prolonged periods of time. Another longitudinal study of 622 women in the community determined that risk factors predictive of postpartum depression were: history of depression during pregnancy (OR 3.77, $p = 0.03$), previous postpartum depression (OR 2.21, $p = 0.02$), and an Edinburgh Postnatal Depression Scale (EPDS) score > 9 in the first postpartum week (OR 18.23, $p < 0.001$) (Milgrom et al., 2008)..Another study carried out in the USA to determine the frequency of mental or psychiatric disorders during pregnancy and postpartum showed that pregnancy in itself is not frequently associated with mental problems, but the puerperium is a vulnerable stage with a high risk of triggering depression or other psychological problems, presenting high prevalence rates of 4.7%, more frequently associated with married women, university students, with low socioeconomic income, urban housing and multiparity (Vesga-López et al. (Vesga-López et al., 2008).

Moderate postpartum depression often follows a natural evolution towards improvement around 6 months after delivery. However, if this condition is prolonged and worsens, reaching the level of severe postpartum depression, it can have serious consequences for both the patient and the newborn, altering the mother-child bond that is established during the first weeks of the postpartum period. The impact on the newborn translates into neglect by the mother, decreased breastfeeding, with an increased risk of malnutrition and a higher number of diarrheal episodes and respiratory infections (Fernández Vera et al., 2014a).

It is alarming that this disease, being a psychiatric emergency, is not identified in maternal and childcare centers, despite the fact that its prevalence exceeds that of other obstetric pathologies, such as preeclampsia, premature delivery, or gestational diabetes, among others. In addition, it has been determined that in many cases, women who suffer from postpartum depression fail to inform their family members and treating physicians. Thus, in many cases, affected women do not receive timely and adequate treatment (Fernández Vera et al., 2014). (Fernández Vera et al., 2014b)..

Several studies have found a significant relationship between postpartum depression and unwanted pregnancy. For example, Arrais et al. (2018) found an association between unintended pregnancy and postpartum depression with a p value of 0.02 and an

association between lack of support from the baby's father and postpartum depression with a p value of 0.01, with a very high correlation coefficient for both. Likewise, Oztora et al. (2019) found that, from a sample of 100 mothers, it can be evidenced that 24 suffer postpartum depression during the first two months; however, this is not significantly associated with an unwanted pregnancy. Likewise, Surkan et al. (2018), in a sample of 31,422 mothers, found that unwanted pregnancy was associated with prenatal and postnatal depressive symptoms. In the same vein, using a multivariate model, Suh et al. (2016) found that unintended pregnancy was associated with severe postpartum depression. Ahmed et al. (2021), using logistic regression, verified that a history of depression, history of PPD, history of stressful conditions, family support, unwanted pregnancy, and male preference were statistically significant in PPD ($p < 0.05$). In addition, Walker et al. (2021) found that unwanted pregnancy was associated with an increased risk of postpartum depression; however, having a child with congenital anomalies and abuse were among the most important factors. Along the same lines, Upadhyay et al. (2019) found that unwanted births were associated with an increased risk of PPD in the pooled data (odds ratio: 1.46, 95% CI: 1.29, 1.66), Ethiopia (odds ratio: 1.99, 95% CI: 1.58, 2.50) and Peru (odds ratio: 1.29, 95% CI: 1.04, 1.59) compared to mothers with expected delivery.

Against this background, the aim of this study is to determine the relationship between postpartum depression and unwanted pregnancy. To do so, we use different measures of both the unwanted pregnancy variable and our dependent variable, which is postpartum depression. Therefore, with our study, we seek to deepen the study of family planning that influence mental health. For its prevention, it is necessary to implement public policies that help reduce the impact of this psychiatric condition.

2. Methodology

2.1 Survey and Population

A cross-sectional study was conducted with data obtained from the 2018 National Health and Nutrition Survey of Ecuador (ENSANUT), whose data were obtained and presented by the National Institute of Statistics and Census (INEC). After cleaning the database, a total of 20,648 Ecuadorian women were obtained. Data on normal and cesarean deliveries carried out by women who reported a pregnancy in the last 5 years were included.

2.2 Source of Information

ENSANUT 2018 is a survey included in the National Statistical Program that uses probability sampling applied every 5 years and whose target population is all household members in the 24 provinces of Ecuador. The ENSANUT 2018 includes the form referring to Women of Childbearing Age, Childhood Health and Breastfeeding, which aims to collect information from women aged 10 to 49 years to make representative estimates at the national level, urban-rural, by geographic domain for the 24 provinces of the country.

2.3 Study Variables

Our dependent variable of interest is the risk factors that predispose the mother to depression in the puerperium. The information for this variable was obtained through the questions: "After any of your deliveries, did you feel sad, was it a little sad or a lot sad, and for how long did you feel sad? Our independent variable, which refers to risk factors, included sociodemographic information on the mother (place of residence, age, marital status, and level of education). In addition, control variables were considered through the information obtained by the question, "Of all the pregnancies you have had in your life, did you have a child who died/died before birth (stillbirth) but after five months of pregnancy? At the time you became pregnant with (...), did you want to: have this child, wait longer, did you not want any more children, did your partner want to have this child, did he/she not want to have children, did you have any control after the birth, did you have any control after the birth, did you have any control after the birth, did you have any control after the birth, did you have any control after the birth, did you have any control after the birth?"

2.4 Inclusion and Exclusion Criteria

Included were women who responded to the questions on the form of women of childbearing age 10-49 years, childhood health, and breastfeeding. Missing values of data and those women who did not report a pregnancy in the last 5 years were excluded.

2.5 Statistical Analysis

The ENSANUT 2018 survey database was analyzed with the statistical package Stata v15 (Stata Corporation, College Station, Texas, USA). A value of $p < 0.05$ was considered to determine the statistical significance between variables. The Chi-square test was used to determine the overall correlation between the variables of interest. The association was evaluated by prevalence ratios with their respective 95% confidence intervals with an analysis for each of the variables included in the study. For the determination of the model of risk factors affecting postpartum depression in the postpartum period, binary logistic regression was applied to calculate the OR with their 95% confidence intervals; in addition, the sociodemographic characteristics were reported as absolute frequencies, and the numerical variables were reported as means. Finally, for the determination of the predictor variables, the ROC curve was applied with the probabilities estimated by applying logistic regression under the method of introducing their confidence intervals and their statistical significance $p < 0.05$.

3. Results

Table 1 presents the descriptive statistics of the variables used in this study. Here we observe that 22.47% (CI=21.90% - 23.04%) of Ecuadorian women reported having suffered from postpartum depression. This information is of great relevance given that this percentage is relatively high. Our data also reveal that the average age of the mothers surveyed is 28 years. In addition, 2.56% (CI=2.35% - 2.78%) of women reported having experienced an episode of stillbirth (fetus stillborn at more than 20 weeks gestation). Likewise, 26.73% (CI=26.14% - 27.31%) of mothers reported that they did not want to have the baby at that time, while 21.41% (CI=20.86% - 21.95%) reported that their partner did not want to have the baby either. Our data also indicate that 38.66% (CI=38.01% - 39.30%) of the mothers did not have a postpartum checkup. Also, 30% of the mothers were married, while 75.61% reported being of mixed race ethnicity. We also found that the average number of children is 2, and 42.64% of the women have a high school level of education, and 60% report being from the urban sector. In addition, 60.11% (CI=59.74% - 61.04%) reported having a normal (vaginal) birth.

The descriptive statistics of the variables used in this study, as observed in Table 1, are presented below. It is highlighted that 22.47% (CI=21.90% - 23.04%) of the Ecuadorian women reported having experienced postpartum depression, which is a relatively high percentage and of great relevance to this study.

In relation to the age of the mothers surveyed, the average age was found to be 28 years. In addition, 2.56% (CI=2.35% - 2.78%) of the women reported having experienced an episode of stillbirth, which is defined as the death of a fetus after 20 weeks of gestation. Regarding willingness to have the baby, 26.73% (CI=26.14% - 27.31%) of mothers indicated that they did not want to have the baby at that time, while 21.41% (CI=20.86% - 21.95%) reported that their partner did not want to have the baby either. These data highlight the importance of considering aspects related to planning and conception circumstances in the study. In relation to postpartum care, 38.66% (CI=38.01% - 39.30%) of the mothers did not have a postpartum checkup, which could have implications for maternal and newborn health. Other demographic characteristics show that 30% of the mothers were married, while 75.61% belonged to the mestizo ethnic group. As for the average number of children, it was found to be 2. In addition, 42.64% of the women had a high school level of education and 60% reported living in urban areas. Regarding the type of delivery, 60.11% (CI=59.74% - 61.04%) of the mothers reported having a normal or vaginal delivery. These results provide an overview of the descriptive statistics of the variables studied and provide relevant information on the prevalence of postpartum depression, demographic characteristics and the experiences of Ecuadorian mothers in relation to pregnancy and childbirth.

Table 1: Descriptive statistics of the variables used in this study.

Variable	N	Mean	SD	Min	Max	95% CI	
Postpartum depression							
No	16010	77.53%	0.42	0	1	76.96%	- 78.10%
Yes	4641	22.47%	0.42	0	1	21.90%	- 23.04%
You wanted to have the baby.							
No	5851	26.73%	0.44	0	1	26.14%	- 27.31%
Yes	16041	73.27%	0.44	0	1	72.69%	- 73.86%
Her partner wanted to have the baby.							
No	4686	21.41%	0.41	0	1	20.86%	- 21.95%
Yes	17206	78.59%	0.41	0	1	78.05%	- 79.14%
Mother's age							
Age	21892	27.88	7.62	10	49	27.78	- 27.99
Sex of newborn							
Man	11283	51.54%	0.50	0	1	50.88%	- 52.20%
woman	10609	48.46%	0.50	0	1	47.80%	- 49.12%
Mortinato							
No	20129	97.44%	0.16	0	1	97.22%	- 97.65%
Yes	529	2.56%	0.16	0	1	2.35%	- 2.78%
Postpartum checkup							
No	8463	38.66%	0.49	0	1	38.01%	- 39.30%

Yes	13429	61.34%	0.49	0	1	60.70%	-	61.99%
Marital status								
Another	15324	70.00%	0.46	0	1	69.39%	-	70.61%
married?	6568	30.00%	0.46	0	1	29.39%	-	30.61%
Mother's ethnicity								
Indigenous	3224	14.73%	0.35	0	1	14.26%	-	15.20%
Afro-Ecuadorian	882	4.03%	0.20	0	1	3.77%	-	4.29%
Mongrel	16553	75.61%	0.43	0	1	75.04%	-	76.18%
White	289	1.32%	0.11	0	1	1.17%	-	1.47%
Montubio	944	4.31%	0.20	0	1	4.04%	-	4.58%
Sons								
Number of children at home	20658	2.23	1.32	0	13	2.16	-	2.52
Form of delivery								
Cesarea	8733	39.89%	0.49	0	1	39.24%	-	40.54%
Normal	13159	60.11%	0.49	0	1	59.46%	-	60.76%
Mother's level of education								
None	260	1.19%	0.11	0	1	1.04%	-	1.33%
Basic Education	7926	36.21%	0.48	0	1	35.57%	-	36.84%
Middle/High School	9334	42.64%	0.49	0	1	41.98%	-	43.29%
Superior	4372	19.97%	0.40	0	1	19.44%	-	20.50%
Residential area								
Rural	8671	39.61%	0.49	0	1	38.96%	-	40.26%
Urban	13221	60.39%	0.49	0	1	59.74%	-	61.04%
Mother's region of origin								
Sierra	8299	37.91%	0.49	0	1	37.27%	-	38.55%
Costa	8115	37.07%	0.48	0	1	36.43%	-	37.71%
Amazon	5070	23.16%	0.42	0	1	22.60%	-	23.72%
Insular	408	1.86%	0.14	0	1	1.68%	-	2.04%

Next, we performed a correlation matrix to perform a detailed analysis of the correlation between the variables and to highlight possible multicollinearity problems. **Table 2** shows significant correlations between postpartum depression and the independent variables: stillbirth, desire to have the baby by mother and partner, married marital status, mother's ethnicity, number of children in the household, mode of delivery, and mother's region of origin. All these variables have an expected sign which is correct. In addition, we observe that no correlation between the independent variables is greater than 50%. This shows that there are probably no serious multicollinearity problems among the variables. Below we perform a formal test to test for multicollinearity among the variables.

Table 2: Correlation matrix of the variables

	Var 1	Var 2	Var 3	Var 4	Var 5	Var 6	Var 7	Var 8	Var 9	Var 10	Var 11	Var 12	Var 13	Var 14
Var 1	1													
Var 2	0.1005*	1												
Var 3	-0.0089	0.0095	1											
Var 4	0.0826*	0.0739*	-0.0023	1										
Var 5	0.1001*	0.0485*	-0.0045	-0.0116	1									
Var 6	0.0840*	0.0307*	0.0046	-0.0119	0.6216*	1								
Var 7	0.0113	0.0394*	-0.0054	0.0014	0.0220*	0.0251*	1							
Var 8	0.0276*	0.3312*	0.0061	0.0217*	0.0689*	0.0787*	0.0489*	1						
Var 9	-0.0468*	0.0058	0.0073	0.0000	0.0114	0.0148*	0.0547*	-0.0697*	1					
Var 10	0.0716*	0.4734*	0.0021	0.0529*	-0.0685*	-0.0404*	-0.0471*	0.1700*	-0.1847*	1				
Var 11	-0.0393*	-0.0979*	0.0080	0.0074	-0.0207*	-0.0267*	-0.0781*	-0.0228*	-0.2026*	0.1239*	1			
Var 12	-0.0098	0.0531*	0.0099	-0.0440*	0.0219*	0.0187*	0.1295*	0.1134*	0.1410*	-0.3042*	-0.1964*	1		
Var 13	0.0087	0.0548*	-0.0007	0.0015	-0.0123	-0.0021	0.0529*	0.0065	0.2222*	-0.1598*	-0.1992*	0.3081*	1	
Var 14	-0.0196*	-0.0450*	-0.0028	-0.0079	0.0059	0.0055	-0.0455*	-0.0683*	-0.1774*	0.1067*	0.0786*	-0.0485*	-0.1707*	1

Note: Var 1= Postpartum depression. Var 2=Mother's age. Var 3=Newborn's sex. Var 4=Mortinate. Var 5=You wanted to have the baby. Var 6=Your partner wanted to have the baby. Var 7=Postpartum checkup. Var 8=Marital status. Var 9=Ethnicity of mother. Var 10=Number of children in the household. Var 11=Shape of delivery. Var 12=Mother's educational level. Var 13=Area of residence. Var 14=Region of origin of the mother. Asterisks mean: *p < 0.05.

In this study, a formal test was carried out to rule out the presence of multicollinearity among the independent variables. **Table 3** shows the multicollinearity analysis performed using the Variance Inflation Factor (VIF). According to previous literature, a VIF greater than 5 may indicate the presence of multicollinearity in the data. When examining the results of our test, it can be observed that no variable presents a VIF greater than 5. This allows us to rule out multicollinearity problems in the independent variables. It is important to note that the presence of multicollinearity can cause instability in the regression parameters, incorrect signs and higher standard errors, resulting in a lack of statistical significance of the parameters. Performing this multicollinearity analysis is relevant because it ensures the validity of the regression results. By ruling out the presence of multicollinearity, we can have greater confidence in the interpretation of the estimated parameters and in the conclusions derived from our logistic regression model.

Table 3: Multicollinearity test of the variables

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Mother's age	1.49	1.22	0.6695	0.3305
Sex of newborn	1.00	1.00	0.9966	0.0004
Mortinato	1.01	1.00	0.9918	0.0082
You wanted to have the baby	1.64	1.28	0.6101	0.3899
Her partner wanted to have the baby	1.63	1.28	0.6145	0.3855
Postpartum checkup	1.02	1.01	0.9764	0.0236
Marital status	1.13	1.06	0.8821	0.1179
Mother's ethnicity	1.13	1.07	0.8812	0.1188
Number of children	1.58	1.26	0.6310	0.3690
Form of delivery	1.09	1.05	0.9146	0.0854
Level of education	1.29	1.14	0.7746	0.2254
Residential area	1.17	1.08	0.8583	0.1417
Mother's region of origin	1.05	1.02	0.9537	0.0463
Mean VIF	1.28			

In **Table 4**, we can observe the age group into 7 categories and the number of women who reported experiencing postpartum depression and women who reported an unwanted pregnancy. For example, in the case of postpartum depression, we observe that 1316 women aged 18-25 years and 1066 women aged 26-30 years experienced postpartum depression. Likewise, when we looked at unwanted pregnancy, we found that 578 women aged 26-30 years and 486 women aged 31-35 years reported an unwanted pregnancy. This analysis is of great relevance since it allows us to provide more precise evidence of the frequency with which these events occurred, which may be determinant in understanding postpartum depression in Ecuadorian women.

Table 4. Grouped age and number of mothers with postpartum depression and unwanted pregnancy

Age grouped	Depression		Unwanted pregnancy	
	No	Yes	No	Yes
13-17 years	4422	6454	4673	3097
18-25 years old	6081	1316	59	43
26-30 years	3625	1066	725	578
31-35 years old	2880	963	8577	486
36-40 years old	1793	648	4166	49
41-45 years	736	299	28	24
46-49 years	156	54	8	7

The following table, **Table 5**, presents a multivariate logistic regression analysis examining the influence of unwanted pregnancy by the mother and her partner on postpartum depression. In this analysis, a total of 20,648 female respondents were included. The dependent variable is dichotomous, taking the value of 1 if the mother experienced postpartum depression and 0 if she did not. Logistic regression results reveal that certain variables have a significant association with postpartum depression. As expected, the odds ratio (OR) of having experienced a stillbirth is significant and greater than 1. This indicates that having experienced infant death after 20 weeks gestation increases the risk of postpartum depression by 2.5 times (CI=2.106 - 3.018). Another significant odds ratio is related to the mother's desire to have the baby. An OR of less than 1 is observed, which means that women who want to have their babies reduce the risk of postpartum depression by 0.64 times (CI=0.590 - 0.710). This pattern is repeated when analyzing the variable indicating whether the mother's partner wanted to have the baby. In this case, women who reported that their partner wanted to have the baby decreased the risk of postpartum depression by 0.84 times (CI=0.762 - 0.928). These findings are especially interesting because of the magnitude of the odds ratios found. Another variable highlighted in the analysis is the mother's ethnicity. Women belonging to an ethnicity other than indigenous ethnicity are found to have a lower risk of postpartum depression. Finally, normal or vaginal delivery was found to reduce the probability of postpartum depression by 0.77 times (CI=0.721 - 0.833). **Table 5 shows** that the chi-square (X²) and log-likelihood statistics are stable and statistically significant. The chi-square statistic suggests that, taken together, the independent variables explain the variability of the dependent variable. On the other hand, the log-likelihood statistic is negative and captures as much information as possible in the analysis.

Table 5. Logistic regression analysis between postpartum depression and unwanted pregnancy

	OR	Std. Err.	P>z	95% CI		
Dep. var: Depression=1, 0 otherwise						
You wanted to have the baby.						
No	Ref.					
Yes	0.648***	0.031	0.000	0.590	-	0.710
Her partner wanted to have the baby.						
No	Ref.					
Yes	0.841***	0.042	0.001	0.762	-	0.928
Mortinato						
No	Ref.					
Yes	2.521***	0.231	0.000	2.106	-	3.018
Mother's age						
Age	1.028***	0.003	0.000	1.022	-	1.033

Sex of newborn							
Man	Ref.						
Woman	0.950	0.032	0.133	0.889	-	1.016	
Postpartum checkup							
No	Ref.						
Yes	1.025	0.036	0.492	0.956	-	1.099	
Marital status							
Another married?	Ref.						
	0.972	0.038	0.460	0.901	-	1.048	
Mother's ethnicity							
Indigenous	Ref.						
Afro-Ecuadorian	0.817*	0.082	0.045	0.670	-	0.995	
Mongrel	0.773***	0.042	0.000	0.696	-	0.860	
White	0.592**	0.100	0.002	0.425	-	0.826	
Montubio	0.678***	0.073	0.000	0.548	-	0.838	
Children							
Number of children at home	1.043**	0.016	0.006	1.012	-	1.076	
Form of delivery							
Cesarea	Ref.						
Normal	0.775***	0.028	0.000	0.721	-	0.833	
Mother's level of education							
None	Ref.						
Basic Education	0.853	0.126	0.281	0.638	-	1.139	
Middle/High School	0.800	0.119	0.133	0.597	-	1.071	
Superior	0.804	0.123	0.153	0.596	-	1.085	
Residential area							
Rural	Ref.						
Urban	1.085*	0.042	0.033	1.006	-	1.171	
Mother's region of origin							
Sierra	Ref.						
Costa	0.663***	0.027	0.000	0.612	-	0.719	
Amazon	0.996	0.045	0.932	0.912	-	1.089	
Insular	0.875	0.112	0.297	0.681	-	1.125	
Constant	0.284***	0.050	0.000	0.201	-	0.401	
Observations	20648						
A/C	23975.03						
B/C	23138.09						
R ²	0.025						
X ²	3.956***						
Log-likelihood	-31461.5						

After estimating the logit model, we can calculate the marginal impacts (MI) of the independent variable on the probability of experiencing postpartum depression. **Figure 1** shows that as age increases, the probability of experiencing postpartum depression also increases. Specifically, it is observed that a 21-year-old woman has a 0.4% chance of experiencing postpartum depression, while a 39-year-old woman has a 0.6% chance of experiencing postpartum depression. This indicates that the risk of postpartum depression increases with increasing age.

In addition, it can be seen that having a greater number of children in the household increases the probability of experiencing postpartum depression. An increasing marginal effect of this continuous variable (number of children) is observed, implying that as the number of children increases, so does the probability of experiencing postpartum depression. These results highlight the importance of considering both age and number of children as relevant factors in the probability of postpartum depression. Figure 2 provides a clear visualization of how these variables relate to the likelihood of postpartum depression in the context of the estimated logit model.

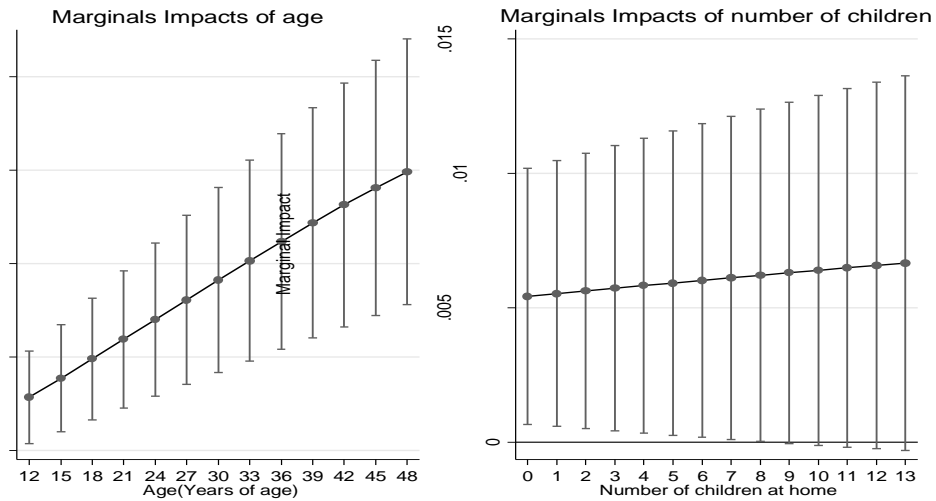


Figure 1. Marginal impacts of age and number of children on the probability of postpartum depression and stillbirth and their respective 95% confidence intervals.

To evaluate the discriminatory power of the predictor variables, the ROC curve was used in **Figure 2**. Logistic regression was applied by entering the estimated probabilities, along with their confidence intervals and statistical significance ($p < 0.05$). The ROC curve shows the ability to correctly distinguish cases of postpartum depression from those that are not, using the significant predictor variables. An area of 0.50 on the ROC curve represents the worst case scenario, where there is no ability to discriminate. In our study, the significant variables considered were having experienced a stillbirth episode, lack of infant planning by the mother and her partner, ethnicity other than indigenous, having had a normal delivery, and living in an urban area. These variables had an area under the curve of 0.6969 (95% CI: 0.651-0.794), indicating that they have adequate ability to predict cases of postpartum depression ($p < 0.001$).

On the other hand, the sensitivity and specificity curve shows an adequate pattern, indicating good curve performance. Specifically, it is observed that the curves cross at a value of approximately 0.25, which is indicative of good curve formation and a reasonable ability to discriminate between cases of postpartum depression and those that are not. In summary, the results obtained from the ROC curve and the sensitivity and specificity curve indicate that the selected predictor variables have adequate ability to predict postpartum depression in the study. This provides valuable information on the usefulness of these variables in the early identification and management of postpartum depression.

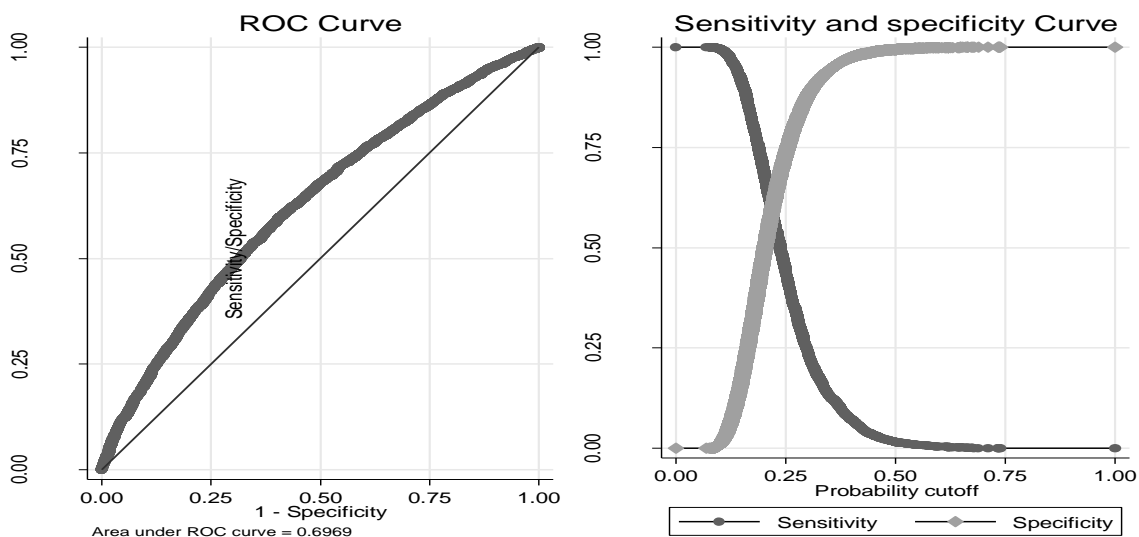


Figure 2. ROC curve and sensitivity and specificity curve for the determination of the sensitivity of the model of factors associated with postpartum depression.

4. Discussion

Postpartum depression is an urgent psychiatric condition that occurs quite frequently but often goes unnoticed. In recent years, an increase in its incidence has been observed, possibly due to the lack of psychological care during pregnancy, childbirth and the postpartum period, as well as the decrease in follow-up visits after childbirth. In addition, various social risk factors, such as those mentioned in this research, are part of the daily reality of Ecuadorian women. This has negative repercussions at the personal, family and social levels, requiring urgent intervention by a multidisciplinary team.

While it is known that, during the postpartum period, both biochemical changes and stress can trigger postpartum depression (Alonso et al., 2000), there is no evidence that hormonal or neurotransmitter imbalance is the sole cause of this condition. Through a literature review of several studies, we have found that most of them focus on investigating demographic, social and psychological factors that may influence women's mood after childbirth rather than focusing exclusively on biological aspects. This highlights the importance of understanding the complexity of postpartum depression and approaching it from a holistic perspective that considers not only biological factors but also social, emotional and psychological aspects. It is essential to provide adequate care and support to women during this critical period in order to prevent and treat postpartum depression effectively.

In the present study, an association was found between PPD and some factors: unwanted pregnancy, maternal age, history of having had a deceased child before birth (stillbirth), unwanted pregnancy on the part of the mother and partner, marital status, ethnicity, number of children and origin of the mother, in the case of postpartum depression. Maternal age was evidenced as the main risk factor since we observed that 1316 women aged 18-25 years and 1066 women aged 26-30 years experienced postpartum depression. This coincides with the studies carried out by Lee et al. (2007), Blom et al. (2010), McMahon et al. (2011) and Mori et al. (2011)(2010), McMahon et al. (2011) and Mori et al. (2011), which mention the importance of highlighting that the range of greatest risk would be for women under 18 years of age as well as for those over 30 years of age, since as age increases, the probability of suffering from postpartum depression increases. Specifically, a 21-year-old woman has a 0.4% chance of postpartum depression compared to a 39-year-old woman who has a 0.6% chance of postpartum depression. This fact could be due to the fact that younger women have a social and economic situation that is not appropriate for facing motherhood, and older women may have greater psychological pressure in the face of possible obstetric complications that may arise during pregnancy, especially in those cases in which gestation has been achieved through assisted reproduction techniques, as referred to in their study McMahon et al. (2011). We can also highlight the lack of social and family support, as suggested by Satoh et al. (2009). Blom et al. (2010) y Mori et al. (2011).

A significant result was found in the OR associated with the question of whether the mother wanted to have her baby, with an OR of less than 1. This indicates that women who wanted to have their babies reduced the risk of postpartum depression by 0.64 (CI=0.590 - 0.710) times. This pattern is repeated when we analyze the variable assessing whether the mother's partner wanted to have the baby. This finding is very interesting, as the magnitude of the OR is even larger than the coefficient mentioned above. In this case, women who reported that their partner wanted to have the baby reduced 0.84 (CI=0.762 - 0.928) times the probability of suffering from postpartum depression. These results are consistent with previous research by Vilouta et al. (2006), who indicated that the lack of family support is a significant factor in the risk of developing postpartum depression. Alvarado-Esquivel et al. (2010) also found a significant association between problems with family members and postpartum depression ($p=0.007$). Similarly, Rojas et al. (2010b) found that most of the women they studied cared for their babies alone, and when they received help, in most cases, it came from their own mother, whose presence conditioned a higher risk of postpartum depression due to greater psychosocial stress. In addition, they noted that one in three women who experienced psychological distress at the end of pregnancy and perceived social isolation would develop postpartum depression. It is important to mention that most of the factors associated with the possibility of developing postpartum depression are familial in nature. Therefore, if we consider that the family is the first socializing agent and then the couple becomes part of this environment, the interactions that occur in that environment have a significant impact on the affectivity of the woman throughout her life, especially in periods of greater sensitivity such as pregnancy and the puerperium.

It was also evidenced that having experienced an episode of stillbirth (death of the baby after 20 weeks of gestation) increases 2.5 times (CI=2.106 - 3.018) the risk of suffering postpartum depression, results consistent with Surkan et al. (2018) who refer that gestational loss is a traumatic event that negatively impacts the woman's perception of future reproductive events, in the same way referring that each new pregnancy is loaded with emotions such as fear and anxiety, which lead, if the grief is not managed in time, to perinatal depression.

Another variable that stands out in the analysis is the mother's ethnicity since we observed that women with an ethnicity different from the indigenous ethnicity have a lower risk of postpartum depression. Finally, we observed that a normal mode of delivery (vaginal) reduces 0.77 (CI=0.721 - 0.833) times the probability of postpartum depression. When evaluating the mode of birth, it was found that vaginal delivery represented a protective factor for the development of PPD, while women whose children were delivered by cesarean section were three times more at risk for depression, coinciding with another study where it was found that women with a cesarean section had a much higher risk of PPD. (O'Hara et al., 1984). In contrast, the results obtained in other

studies showed that the type of delivery, either cesarean section or vaginal delivery, was not statistically different for the risk of postpartum depression ((Braverman & Roux, 1978)while this study also indicates that the use of anesthetics during labor (cesarean section or epidural analgesia) was independently related to scores higher than 13 on the EDPS and to the occurrence of postpartum depression (OR= 3.2).

It has also been suggested that the number of births is a factor associated with postnatal depression; several studies have concluded that the birth of the first child represents a unique stress and correlates more strongly with depression than the second or third birth. However, as well as the results obtained by both Jadresic (1990) and Nielsen Forman et al. (2000)in this study, parity was not shown to be a determining factor for the presence of postpartum depression; similar scores were observed between primigravidae and multiparous women, which indicates that a screening instrument such as the EDPS should be applied universally to all postpartum women and not be restricted to populations of supposedly higher risk. Another factor that has a direct impact on PPD is the personal history of psychiatric illness. Mayberry et al. (2007) consider this risk factor as an exclusion criterion when selecting the study sample and do not include questions about this history in their assessment surveys.

Mayberry et al. (2007) also found that another risk factor that has been less studied but no less important is the fact that the woman is a victim of domestic violence. This not only affects the marital and family relationship but also damages the woman's self-esteem and psychological capacity to cope with her new role as a mother. On the other hand, we have found that most studies identify a series of factors as predisposing to the possibility of presenting PPD.

Therefore, we consider that these four factors: older age of the mother, the mother has had history of termination of pregnancy due to stillbirth, unwanted pregnancy, a high number of children and lack of support from the partner, are predictors of PPD risk and should be part, together, of the training, prevention and follow-up processes for pregnant women; these five factors, which in the proposed model adequately predict the event, their probabilities are predictive as well.

5. Conclusion

This cross-sectional study with a representative sample of 20648 Ecuadorian women of reproductive age 10-49 years from the 2018 National Health and Nutrition Survey (ENSANUT) of Ecuador. A linear regression model was used to estimate the associated parameters, and a binary logistic regression to estimate the Odds Ratio (OR) and their 95% confidence intervals (95% CI) for each of the independent variables.

Our results reveal that the average age of the mothers surveyed is 28 years. In addition, 2.56% (CI=2.35% - 2.78%) of women reported having experienced an episode of stillbirth (fetus stillborn at more than 20 weeks gestation). Likewise, 26.73% (CI=26.14% - 27.31%) of mothers reported that they did not want to have the baby at that time, while 21.41% (CI=20.86% - 21.95%) reported that their partner did not want to have the baby either. Our data also indicate that 38.66% (CI=38.01% - 39.30%) of the mothers did not have a postpartum checkup. Also, 30% of the mothers were married, while 75.61% reported being of mixed race ethnicity. We also found that the average number of children is 2; 42.64% of the women have a high school level of education, and 60% report being from the urban sector. In addition, 60.11% (CI=59.74% - 61.04%) reported having a normal (vaginal) birth.

Our logistic regression involves 20,648 female respondents. Here we observe that the dependent variable is a dichotomous variable that takes the value of 1 if the mother experienced an episode of postpartum depression and 0 if she did not. We show that, as expected, the odd ratio (OR) of having experienced a stillbirth is significant and greater than 1. This shows that having experienced an episode of stillbirth (death of the baby after 20 weeks of gestation) increases 2.5 times (CI=2.106 - 3.018) the risk of postpartum depression. Another significant OR is associated with the question of whether the mother wished to have her baby since we observed an OR that is less than 1. This means that women who wished to have their baby decreased 0.64 (CI=0.590 - 0.710) times the risk of suffering from postpartum depression. This scenario is repeated when we analyze the variable containing the question related to whether the mother's partner wanted to have the baby. This finding is extremely interesting since the magnitude of the OR is much greater than the previous coefficient mentioned, since, in this case, women who reported that their partner wanted to have the baby decreased 0.84 (CI=0.762 - 0.928) times the probability of suffering from postpartum depression. Another variable that stands out in the analysis is the mother's ethnicity since we observed that women with an ethnicity other than indigenous ethnicity have a lower risk of postpartum depression. Finally, we observed that a normal mode of delivery (vaginal) reduces 0.77 (CI=0.721 - 0.833) times the probability of postpartum depression.

Based on our findings, we recommend that health policymakers and medical professionals consider that postpartum depression has a great significance or commitment in the puerperal population, constituting a pressing psychological condition, which should not be underestimated, but rather, should be encouraged to pay the due attention it deserves. In addition, we should not exclude the risk factors involved in the possible development of this pathology. It is worth mentioning that although postpartum depression is more frequent in adolescent women, it also occurs in multiparous women who present obstetric complications during pregnancy or after childbirth, have unwanted or planned pregnancies, are unemployed and with social status. The main limitation we could

find in our study was that we only had 3 questions that evidenced postpartum depression; unfortunately, the 10 questions of the Edinburgh test could not be found. For future research, it would be interesting to be able to demonstrate the causes and factors that make a woman more susceptible to postpartum depression.

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Informed consent: It was not necessary to apply informed consent to the participants since the data were obtained through a database available from the National Institute of Statistics and the Census of Ecuador.

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