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| RESEARCH ARTICLE

Relationship between Hormonal Contraception and Mental Health: A Cross-sectional Study in Ecuador

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| ABSTRACT

Millions of women worldwide use hormonal contraceptives as an effective form of contraception. However, the focus on their side effects to date has mainly been on the physical aspects, although the most common reason for discontinuation is depression. The main objective of our research is to assess the impact hormonal contraceptives have on mood in women of childbearing age. Surprisingly, there are few studies investigating depression related to hormonal contraceptive use. More research is needed to better inform women and physicians about contraceptive-related depression, as well as clinical guidelines on the different types of oral contraceptives and their possible depressogenic properties. A nationally representative sample of women aged 12 years and older from the 2018 National Health and Nutrition Survey (ENSANUT) was used. We used multicollinearity tests to rule out possible statistical modeling problems and a binary logistic linear regression model where Odds Ratio (OR) with their 95% confidence intervals (95% CI) were estimated for each of the independent variables. In addition, we used specificity tests to test the fit between our dependent and independent variables. That is, our results reveal that the use of hormonal contraceptives increased 3.12-fold (OR=3.12; CI=3.046-3.321) the likelihood of chronic mental illnesses such as depression. This result is statistically significant (p<0.05). It was also demonstrated that women in rural areas with lower income and low schooling are more susceptible to mental disorders compared to the rest of the population. We also showed that variables such as age, a greater number of children, obesity, low schooling, unemployment, being a migrant and greater urban density have a positive influence on the probability of suffering from chronic mental disorders. The results of this study showed that, although poor mental health is correlated with the type of family planning, fear of depression should not be an obstacle to choosing between these methods. It became evident that depression is a multifactorial issue. This study showed that the type of family planning method itself cannot be the cause of depression and should be considered by family planners and counselors.

| KEYWORDS

Contraceptive methods, depression, family planning, mood, side effects

1. Introduction

Reproductive health is a priority in health services since the provision of family planning services is a preventive health action that allows individuals to exercise their right to freely decide the number and timing of their children (Agudelo-Botero, 2009). (Agudelo-Botero, 2009).. Contraceptive methods are those that prevent or significantly reduce the possibility of fertilization in women. Access

to contraceptive methods can contribute to reducing the risk of unwanted pregnancies, to reduce the risk of acquiring sexually transmitted diseases, or space pregnancies in stable couples, contributing in an important way to improve different aspects of public health, especially in adolescents (Peláez Mendoza, 2016).

According to data from the World Health Organization, unplanned pregnancies continue to be a major public health problem worldwide. It is estimated that each year, there are 74 million women in low- and middle-income countries with unplanned pregnancies that are the cause of 25 million unsafe abortions and 47 000 maternal deaths per year(*PAHO, 2019*). In this context, special emphasis is placed on the close relationship between poverty, unsafe abortions and high maternal mortality rates since, as a consequence of the lack of maternal health care and the scarce access to contraceptive methods, women and pregnant women resort to dangerous and clandestine procedures that put their lives at high risk (DaVanzo & Adamson, 1999).

The incidence of complications from unsafe abortion can have a substantial impact on the fragile health system in developing countries, with an estimated 4.7% to 13.2% of maternal deaths due to unsafe abortion each year. It is estimated that 30 deaths occur for every 100,000 unsafe abortions in developed regions, while this proportion rises to 220 deaths per 100,000 unsafe abortions in developing regions. (*WHO, 2021*). One of the strategies to decrease the number of unplanned pregnancies is the use of contraceptive methods; however, their use has prevailed low, given that contraceptive use has increased by only 2.1 percentage points, from 55% to 57.1%, worldwide (Palacios & Lilue, 2020).

Another fundamental aspect to consider is the mental health of women. Depression has been shown to be one of the most prevalent diseases, especially in the female population, so the relationship between a method as widely used as hormonal contraception and this alteration in mood is of great interest. Before 1980, psychological adverse effects of the use of contraceptives were described, but it has to be taken into account that, by that time, the doses of hormones were very high (Hall et al., 2013). Estrogens and progesterone have been shown to play an important role in the development of this pathology (Worly et al., 2018). In addition, women at the psychological and social level are often subjected to the performance of multiple roles with work overload that generates stress and tension (Lazarevich et al., 2013).

Several researchers have tried to find the association between the use of hormonal contraceptives and the risk of depression. In this context, a prospective study was conducted in which women between 15 and 34 years old in Denmark participated. The analysis included 1,061,997 women with an average age of 24 years. It is the study with the largest number of women, which highlights its importance. During follow-up, 55.5% of the women were found to be current or recent users of hormonal contraception, either pills, patches, vaginal rings or levonorgestrel-containing devices, and the results showed that approximately 2.2% of 100 women compared with 1.7% of non-users were using hormonal contraception (Skovlund et al., 2016). Another study conducted in Mexico City in 2014 to students from two public universities, whose average age was 21 years, evidenced that Women presented a higher proportion of elevated depressive symptomatology (17.2%) than men (13.3%), with statistically significant differences ($\chi2 = 4.48$, $p < 0.05$), in this case, it was evident that When analyzing the association of EDS with the use of natural contraceptive methods (interrupted coitus, cervical mucus checking method, basal temperature or calendar), no statistically significant association was obtained for both the group of men and women; The same was true for the variable of hormonal contraceptive use (daily pill, injection, dermal patch, subdermal implant, vaginal ring or IUD with hormones), indicating that the use or not of some type of contraceptive method is not related to the presence or absence of depressive symptoms (*Hurtado-de-Mendoza et al., 2017*).

It is important to highlight the fact that any woman who is prescribed hormonal contraception, with emphasis on the adolescent population or first-time users, should be advised to keep a careful note of her changes, good or bad, physical or mental, to discuss them during follow-up visits with her professional, in order to indicate reformulations or psychotherapy, changes in lifestyle, exercise, yoga, diet.

There is really little research that can estimate the role of hormonal contraception in suicide. One study documents a suggestive increase in the risk of suicide in users of hormonal contraception sometime after its use (Hannaford et al., 2010). It is documented that women in the late luteal phase may be at increased risk for suicide attempts and severe suicide attempts, so hormonal contraception could be a useful temperament moderator in women with suicidal ideation (Lombardo, 2021).

Therefore, for women with these mental conditions who wish to prevent an unwanted pregnancy, effective contraception is vital to maintain their physical and mental balance. Good medical guidance is essential, with professionals who can provide adequate counseling. Careful history taking, patient questioning, empathy, and the use of reflective listening, a non-judgmental tone, and open-ended questions can facilitate the interview to find mental health problems, which are often underestimated by the woman and the medical professional. In this context, the objective of this review is to determine, through current scientific evidence, the relationship between hormonal contraceptive therapy and depression.

2. Methodology
2.1 Survey and Population
An ecological, 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 5,493 Ecuadorian women of childbearing age, currently using contraceptives between hormonal and non-hormonal, were obtained.

2.2 Source of Information
The 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 HOGAR, where all the characteristics of the Ecuadorian population are evidenced to make representative estimates at the national level, urban-rural, by geographic domain for the 24 provinces of the country. In addition, the anthropometric measurements of women currently using contraceptive methods can also be found.

2.3 Study Variables
Our independent variable refers to information on the mental state of women of childbearing age. This information could be obtained from the question: In the last 30 days, have you had psychological distress? We were also able to control for other variables such as sex, age, schooling, number of children, type of employment and hours of work.

On the other hand, our independent variable is the use of family planning contraceptive methods. The information for this variable was obtained by calculating the data provided in the Women of childbearing age form.

2.4 Inclusion and Exclusion Criteria
Data were included for women over 15 years of age who were currently using a contraceptive method.

2.5 Statistical Analysis
In order to statistically verify how contraceptives affect women's mental health (depression), a linear regression model has been proposed to demonstrate these relationships. For this, we have:

$$MH = \beta_0 + \beta_1 X_i + \sum_{j=2}^{12} \beta_j Z_i + \varepsilon_i$$

Where MH_{i_i} represents mental health (measured by asking whether or not an individual had psychological problems), X_i represents the variable use of contraceptive methods and Z_i represents a set of control variables of the linear regression model. Finally, ε_i represents the stochastic error term.

3. Results
Table 1 shows the descriptive statistics of the variables. Here, we analyze all the variables used in this study and see that the sample is 5,493 women of childbearing age. We observe that 15.69% (CI=15.02%-16.77%) of the sample reported suffering from psychological problems. This percentage is alarming, given that almost a quarter of the female population has poor mental health. This fact makes it evident that mental health policies should be a priority in a developing country like Ecuador. In addition, we observed that, in line with the above evidence, 64.57% of women use hormonal contraceptive methods. Therefore, there seems to be a clear positive relationship between the use of contraceptive methods and mental health. The average age of the sample is 34 years, and 53.33% are men. Also, the average number of children is 4. On the other hand, the average monthly labor income is $444.01 USD. The average years of schooling is 7 years of schooling. This shows that the level of schooling is relatively low in Ecuador. We also found that 28.55% of the sample suffers from obesity. That is, they have a body mass index (BMI) greater than or equal to 30. Unemployment is reported in 30.55% of the respondents, and the average number of hours of work is 42.78. In addition, 82.52% of the sample reported that they had migrated at some point. This fact evidences that Ecuador is a country of high internal migration. In terms of ethnicity, 75.61% of the population is mestizo. The average urban density is 157 people per square kilometer, while we observe that 55.51% of people are from urban areas.

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

Variable	Mean-Percent	SD	Min	Max	95% CI		
Did you have psychological problems?							
Yes	25.89%	0.44	0	1	25.02%	-	26.77%
No	74.11%	0.89	0	1	73.17%	-	75.43%
Contraceptive methods							
Hormonal methods	64.57%	0.44	0	1	59.97%	-	69.12%
Non-hormonal methods	35.43%	0.89	0	1	30.0%5	-	41.66%
Age							
Age	33.8	0.12	15	40	33.13	-	34.22
Number of children							
Number of children at home	4.12	0.25	0	8	4.01	-	4.98
Monthly labor income							
Income in dollars	444.01	100	0	2033	441.68	-	448.49
Years of schooling							
Years of schooling	7.08	1.77	0	22	2.97	-	3.96
Obesity							
No	71.45%	0.12	0	1	68,45%	-	73,45%
Yes	28.55%	0.43	0	1	25,55%	-	30,55%
Work method							
Employee	69.45%	0.66	0	1	66,45%	-	71,45%
Unemployed	30.55%	0.26	0	1	27,55%	-	32,55%
Out of the workforce	3.55%	0.26	0	1	2,67%	-	3,77%
Working hours							
Number of working hours	42.78	0.55	4	52	41.54	-	46.86
Are you a migrant?							
No	17.48	0.89	0	1	14,48%	-	19,48%
Yes	82.52%	0.67	0	1	79,52%	-	84,52%
Ethnicity							
Indigenous	14.73%	0.35	0	1	14.26%	-	15.20%
Afro-Ecuadorian	4.03%	0.20	0	1	3.77%	-	4.29%
Mongrel	75.61%	0.43	0	1	75.04%	-	76.18%
White	1.32%	0.11	0	1	1.17%	-	1.47%
Montubio	4.31%	0.20	0	1	4.04%	-	4.58%
Urban density							
Inhabitants per square kilometer	157.01	1152.5	321	2653.12	146.32	-	160.33
Area							
Urbana	55.51%	0.54	0	1	52,51%	-	57,51%
Rural	44.49%	0.36	0	1	41,49%	-	46,49%

Subsequently, 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 our variables of interest, i.e. between mental health and the use of hormonal contraceptive methods, showing a positive coefficient of 0.4505. In addition, we observed some other variables with significant correlations, such as income, schooling, hours of work, number of children and urban density. All these variables have an expected sign, which is correct. In addition, we observe that some correlations between the independent variables are not greater than 50%. This shows that there are probably no multicollinearity problems among the variables. Below, we perform a formal test to test for multicollinearity among the variables.

Table N°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	Var14
Var 1	1													
Var 2	0.4505*	1												
Var 3	0.0045	0.0054	1											
Var 4	-0.0826*	0.0739*	-0.0023	1										
Var 5	0.1501*	0.0498*	-0.0045	-0.0116	1									
Var 6	-0.4340*	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	0.0568*	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	-0.0087	0.0548*	-0.0007	0.0015	-0.0123	-0.0021	0.0529*	0.0065	0.2222*	-0.1598*	-0.1992*	0.3081*	-0.304*	1

Note: Var 1: Did you have psychological problems? Var 2: Use of contraceptive methods. Var 3: Age. Var 4: Sex. Var 5: Number of children. Var 6: Monthly labor income. Var 7: Years of schooling. Var 8: Obesity Var 9: Type of work. Var 10: Working hours. Var 11: Migrant. Var 12: Ethnicity. Var 13: Urban density. Var 14: Urban area. Asterisks mean *$p < 0.05$.

Next, we performed a formal test to rule out the presence of multicollinearity among our independent variables. In **Table 3,** we present a multicollinearity analysis. We use the Variance Inflator Factor (VIF) to perform this test. Previous literature indicates that a VIF greater than 5 can demonstrate that there is multicollinearity in our data. As we can see, no variable presents a VIF greater than 5; therefore, we discard multicollinearity problems in our independent variables. This analysis is important since multicollinearity problems cause instability of the parameters of a regression, incorrect signs and higher standard errors, which translates into statistical insignificance of the parameters.

Table N° 3: Multicollinearity test of the variables

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Contraceptive methods	1.45	1.88	0.8821	0.1179
Age	2.14	1.98	0.9918	0.0082
Sex	2.89	1.09	0.4101	0.3899
Number of children	1.88	1.74	0.4145	0.3855
Monthly labor income	1.97	1.45	0.9744	0.0234
Years of schooling	1.45	1.88	0.8821	0.1179
Obesity	1.55	1.33	0.9944	0.0004
Work method	1.44	1.43	0.8812	0.1188
Working hours	1.22	1.75	0.6310	0.3690
Are you a migrant?	1.12	1.86	0.9126	0.0852
Ethnicity	1.88	1.67	0.7726	0.2252
Urban density	1.67	1.09	0.8583	0.1217
Urban area	1.05	1.32	0.9537	0.0263
Mean VIF	1.90			

Subsequently, in **Table 4,** we observe the grouped age and the number of women with psychological problems and who reported using hormonal and non-hormonal contraceptive methods. Here, we observe that as age increases, so do the cases of psychological problems. In this table, we can observe an interesting pattern: there is a large number of women reporting psychological problems concentrated in certain age ranges. This fact leads us to strongly suspect that there is a strong positive relationship between the use of contraceptive methods and psychological problems, but much depends on the age of the woman.

Table N°4: Age grouped and number of cases of psychological problems and hormonal methods

		Psychological problems			Contraceptive Methods	
Age		No	Yes		Hormonal	Non-hormonal
15-20		664	256		659	302
21-25		967	438		843	365
26-30		974	299		598	399
31-35		643	304		999	421
36-40		449	499		489	418

Subsequently, **Table 5** shows a multivariate logistic regression analysis to analyze the factors influencing mental health in the sample of women. Our logistic regression involves 5,493 women. Here, we observe that the dependent variable is a dichotomous variable that takes the value of 1 if a woman reported having had psychological problems. We find that, as expected, the odd ratio (OR) of using hormonal contraceptive methods is significant and greater than 1. Our results show that those women who use hormonal contraceptive methods have a higher risk of psychological problems. In other words, our results specifically show that hormonal contraceptive methods increase the probability of suffering from psychological problems by 3.12 times (OR=3.12; CI=3.046-3.321). This result is statistically significant. We also observed that other variables that influence mental health are the number of children, which positively affects the probability of suffering from psychological problems. Likewise, labor income reduces the probability of suffering from psychological problems by 2.48 times. A similar result is observed in the variable of years of schooling. Being unemployed and out of the labor force also positively predicts the probability of suffering from psychological problems. An interesting variable is migration, as we find that migrants are more likely to suffer from mental illness. Finally, we also observed that living in a more densely populated city increases the risk of suffering from psychological problems.

As in the previously described table, in **Table 5,** we observe that the chi-square (X^2) and log-likelihood statistics are stable and statistically correct. The chi-square statistic is significant, suggesting that, as a whole, the independent variables together explain the variability of the dependent variable. On the other hand, the log-likelihood statistic is negative and is observed to collect as much information as possible.

Table N° 5: Logistic regression analysis between mental health and contraceptive use

Variable		OR		Std. Err.		P>z		95% CI		
Contraceptive methods										
Non-hormonal methods		Ref.								
Hormonal methods		3.12**		0.982		0.002		3.046	-	3.321
Age										
Age		1.001		0.863		0.057		0.872	-	1.321
Number of children										
Number of children at home		2.112**		0.054		0.004		2.096	-	2.197
Monthly labor income										
Income in dollars		-2.489**		0.987		0.872		-2.001	-	-2.321
Years of schooling										
Years of schooling		-1.686***		0.542		0.001		-1.543	-	-1.754
Obesity										
No		Ref.								
Yes		3.00**		0.982		0.002		3.046	-	3.321
Work method										
Employee		Ref.								
Unemployed		1.55*		0.216		0.032		1.321	-	1.765
Out of the workforce		1.026*		0.321		0.021		1.0321	-	1.0765
Working hours										

Number of working hours	1.653		0.654		0.035		1.345	-	1.897
Are you a migrant?									
No	Ref.								
Yes	1.567*		0.535		0.045		1.354	-	1.853
Ethnicity									
Indigenous	Ref.								
Afro-Ecuadorian	-1.043		0.312		0.067		-1.012	-	-1.231
Mongrel	-1.065		0.432		0.655		1.001	-	1.198
White	-1.986		0.563		0.192		-1.452	-	-2.004
Montubio	1.654		0.643		0.431		1.594	-	1.865
Urban density									
Inhabitants per square kilometer	1.654**		0.543		0.031		1.493	-	1.985
Area									
Urbana	Ref.								
Rural	1.456		0.753		0.912		1.321	-	1.764
Observations	5,493								
AIC	24232.03								
BIC	23520.09								
R^2	0.025								
X^2	3.956***								
Log-likehood	-31221.51								

Notes: Asterisks mean: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. In the table, the dependent variable is the dichotomous variable of psychological problems that takes a value of 1=Yes and 0=No.

Finally, **Figure 1 shows** the spatial distribution of non-hormonal contraceptive use and mental health in Ecuador in all provinces. In the figures, we observe that there is a significant pattern. In general, the provinces with the highest use of non-hormonal methods are those that report the least psychological problems in Ecuador. This is evidence that there is an effectively inverse relationship between mental health and non-hormonal methods in our results. Other variables that affect mental health are schooling and age, which significantly predicted the mental health of the individuals in this study. Therefore, **Figure A1** in Appendix A shows the spatial distribution of these variables. To give robustness to the model, the confusion matrix of the estimated model is also presented in Appendix A, **Figure A2.**

Figure N° 1. Provincial spatial distribution of non-hormonal method use and mental health in Ecuador**.**
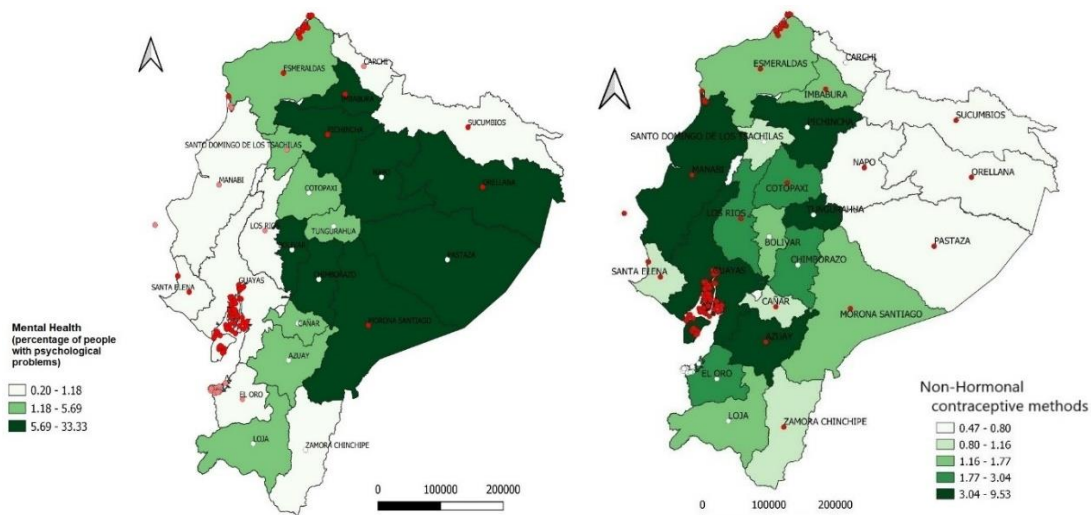
Finally, to determine the fit and explanation of the independent variables, the ROC curve was applied with the probabilities estimated by applying logistic regression. The ROC curve in **Figure 2** coincides with the probability of correctly distinguishing a case of psychological problems from another that is not, through the significant predictor variables, with the worst scenario being when the area is equal to 0.50. In our case, the use of hormonal contraceptive methods together with other significant variables, such as labor income, schooling, obesity, number of children, having been a migrant, age, being unemployed or out of the labor force, and urban density, represented an area under the curve of 0.80880 (95% CI: 0.752-0.854), considering that they adequately predict (positively or negatively) cases of psychological problems ($p < 0.001$). On the other hand, to give rigor to our analyses, **Figure A2** in Appendix A shows the confusion matrix of the model, indicating that the independent variables explain a large proportion of the variability of our independent variable. Specifically, we observe that the independent variables explain 73.47% of the variability in the dependent variable, this percentage being relatively high.

Figure N° 2. ROC curve of the estimated model.

Area under ROC curve = 0.8008
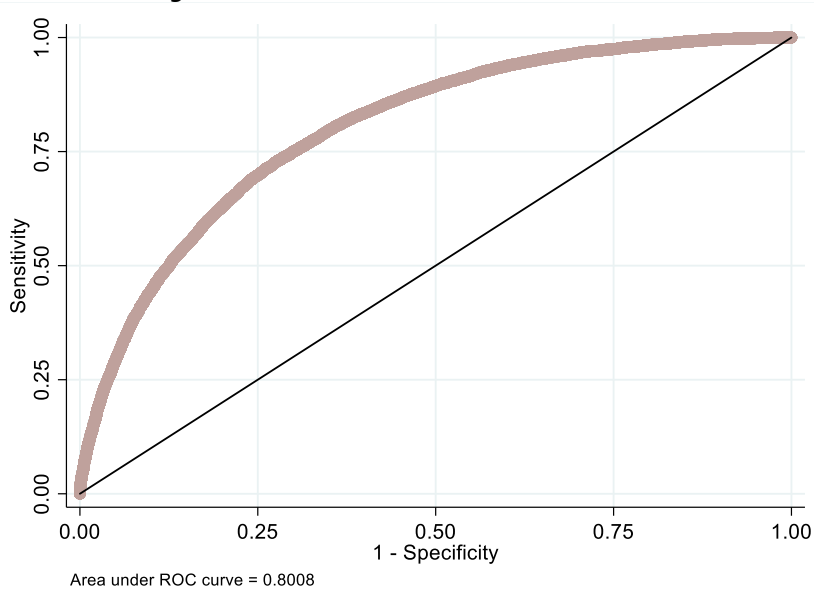
4. Discussion

Reproductive health represents a priority for global health services, one of the most salient aspects being pregnancies, specifically unintended pregnancies, as they suggest a problem for women's health worldwide (Rivera-Galvan et al., 2022). This literature review has synthesized and organized the barriers perceived by women to carry out contraceptive behavior; it was found that the perceptions for the acceptance of this behavior depend on individual, interpersonal and organizational factors such as myths, misconceptions, beliefs and lack of staff training (Eduardo Durán, 2020).

The total sample of our study was 5,493 Ecuadorian women of childbearing age currently using hormonal and non-hormonal contraceptives. We observed that 15.69% (CI=15.02%-16.77%) of the sample reported suffering from psychological problems. This percentage is alarming, given that almost a quarter of the female population has poor mental health. It was determined that 64.57% of the women use hormonal contraceptive methods. Therefore, we found that, as expected, the odd ratio (OR) of using hormonal contraceptive methods is significant and greater than 1. Our results show that those women who use hormonal contraceptive methods have a higher risk of suffering from psychological problems. That is, our results specifically show that hormonal contraceptive methods increase the probability of suffering from psychological problems by 3.12 times (OR=3.12; CI=3.046-3.321). This result is statistically significant. Our results are similar to those of a cohort study in which data from women in the United States were analyzed in the Health and Nutrition Examination and Health and Nutrition Examination Survey (NHANES), which provides information on mental health and age at first use of oral contraceptives. A total of 1236 women were included, most of whom had used oral contraceptives before the age of 19, and these participants were assessed to determine whether they had had any episodes of depression in the past 12 months. Of the 1,236 eligible women, 561 had used oral contraceptives since adolescence, 353 had used oral contraceptives for the first time in adulthood, and 322 had never used oral contraceptives. Those women who had used oral contraceptives during adolescence showed a higher 1-year prevalence of major depressive disorder compared with adult women who had never used oral contraceptives (Anderl et al., 2020).

The average years of schooling is 7 years of schooling. This shows that the level of schooling is relatively low in Ecuador. This fact shows that there is a large gap between knowledge, access and use of family planning methods and mental health. Our results are

consistent with those found in a study in the United States from 2008 to 2015, with a total population of 349,697 women 34 years of age or younger. Where it was obtained as a result that the most popular method was the use of oral contraceptives (82%), followed by the intrauterine device (7%), within which methods other than oral contraceptives had a higher risk of causing depression in women. It is important to highlight that one limitation of the study was to study women who were under academic pressure, as well as other important factors for the development of the pathology under study. (Bennett et al., 2006). On the other hand, a prospective cohort study in Denmark with women from 15 to 34 years of age, from 2000 to 2013, with a total of 1,061,997 women. It was found that adolescent girls were more likely to suffer from depression than older women. Compared to women who did not use contraceptive methods, those who used oral methods had a lower relative risk of first antidepressant use than for the other contraceptive methods, with the highest risk being patch use (norgestrolim), followed by the vaginal ring (etonogestrel), an intrauterine device with levonorgestrel and progestogens alone (Garbers et al., 2010).

Another important factor is age since it has been shown that a large number of women report psychological problems concentrated in certain age ranges. This fact leads us to strongly suspect that there is a strong positive relationship between contraceptive use and psychological problems, but it is highly dependent on the age of the woman. However, our results differ from the current evidence since, in a study derived from the TRIALS trial, prospective cohort type with a population of 1010 women aged 16 to 25 years, with follow-up from September 1, 2005, to December 31, 2016, where an increase in the number of crying episodes and hypersomnia was documented. Those aged around 16 years obtained higher scores for depressive symptoms with the use of oral contraceptives according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) classification, compared to those women in this age group who did not use them (Montealegre et al., 2020). The relationship between contraceptive use and the risk of suicidal ideation have been documented in a study conducted in Denmark from 1996 to 2013 aimed to assess suicide and suicide risk in users who used hormonal contraception. Patients with previous suicide attempts, psychiatric diagnoses, cancer, or deep vein thrombosis were excluded. The population used was 475,802 women from the age of 15 years, which was described as a strength of the study since others included patients older than 25 years who had already started some form of hormonal contraception previously and would not be expected to be suicidal. The relative risk was 1.97 (95% CI = 1.85-2.10) for attempted suicide and 3.08 (95% CI = 1.34-7.08) for suicide compared to women who had never used hormonal contraception. It is important to highlight that the method with the highest relative risk was the patch, followed by the vaginal ring, progestogens alone and finally, the method with the lowest risk was combined oral contraceptives. Finally, it managed to describe that young women were the most prone to suicidal behaviors (Skovlund et al., 2018).

5. Conclusion

Despite the evidence obtained over many years, currently, it has not been possible to strongly determine the pathophysiological causal relationship between the use of any type of contraceptive therapy versus mental illness in women, but thanks to the most recent information and among the results found in our study in which 5,493 Ecuadorian women of childbearing age between 10 and 49 years old who currently use hormonal and non-hormonal contraceptives participated. We observed that 15.69% (CI=15.02%-16.77%) of the sample reported suffering from psychological problems. This percentage is alarming, given that almost a quarter of the female population has poor mental health. It was determined that 64.57% of women use hormonal contraceptive methods. Therefore, we show that, as expected, the odds ratio (OR) of using hormonal contraceptive methods is significant and greater than 1. Our results show that those women who use hormonal contraceptive methods have a greater risk of suffering from psychological problems. That is, our results specifically show that hormonal conception methods increase the probability of suffering from psychological problems by 3.12 times (OR=3.12; CI=3.046-3.321). Therefore, our results show the importance of monitoring through tests to identify psychiatric pathology prior to the use of contraceptives in order to monitor depressive symptoms, mainly since they can affect their quality of life and put non-compliance at risk of the contraceptive scheme. The main limitations of our study were that we did not have data on specific depression symptoms of each patient. For future research, it is recommended to perform a test to identify depressive symptoms before, during and after contraceptive treatment. Since as we could see, it has been possible to affirm that there is a strong association of hormonal contraceptives with the subsequent development of psychological pathology, especially when they are used from early stages such as adolescence, where the hormonal environment of women is in constant change.

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Appendix A

Figure A1. Spatial distribution of schooling and age in the provinces of Ecuador.
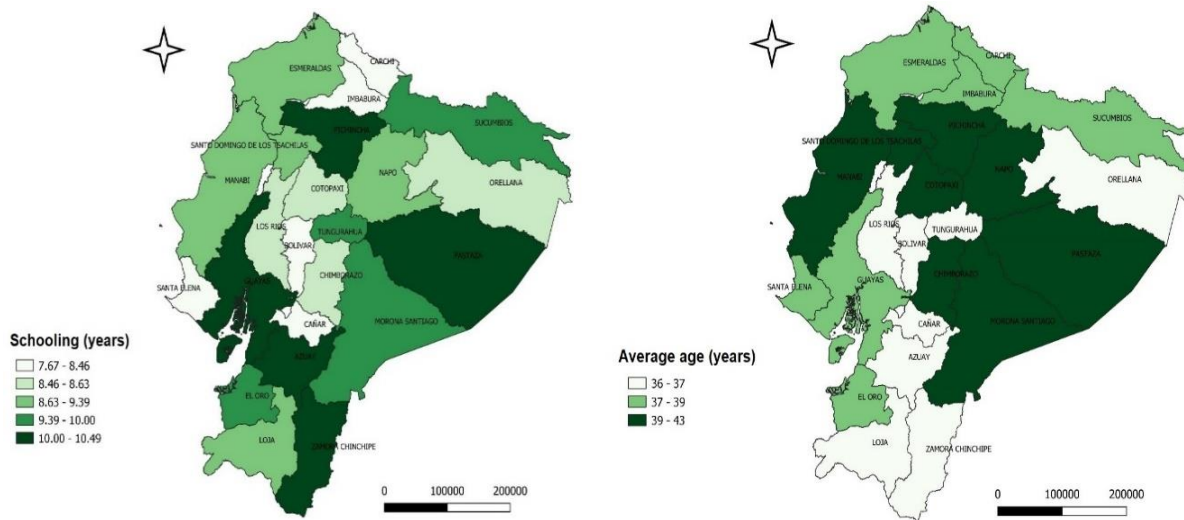
Figure A2. Confusion matrix of the estimated model

Probit model for sectores

		── True ──		
Classified		D	−D	Total
+		516	444	3596
−		596	210	1210
Total		9112	654	5516

Classified + if predicted Pr(D) >= .5
True D defined as sectores != 0

Sensitivity	Pr(+| D)	60.54%
Specificity	Pr(−|−D)	82.10%
Positive predictive value	Pr(D| +)	69.30%
Negative predictive value	Pr(−D| −)	75.71%
False + rate for true −D	Pr(+|−D)	17.90%
False − rate for true D	Pr(−| D)	39.46%
False + rate for classified +	Pr(−D| +)	30.70%
False − rate for classified −	Pr(D| −)	24.29%
Correctly classified		73.47%