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Geographic Inequities and Temporal Trends in Preterm Births in Ecuador (2015–2023): A Population-Based Cross-Sectional Study

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Abstract

Background:

Preterm birth (PTB) is a primary global public health concern and the leading cause of infant mortality. Monitoring temporal trends and territorial inequities in PTB is essential to guide equitable perinatal and maternal health strategies.

Objective:

To analyze the characteristics, rates, trends, and geographical inequalities in preterm births in Ecuador from 2015 to 2023, using altitude as a geographic equity stratifier.

Methods :

We conducted a population-based cross-sectional study of all newborns using national live birth registry data. After excluding records with missing gestational age, 2,429,016 live births were included. Annual PTB rates per 100 live births were calculated and stratified by year, gestational age, sex, maternal age, ethnicity, region, and province. Annual percentage variation (APV), rate ratios, and 95% confidence intervals were used to assess trends. Geographical inequity was measured using absolute and relative gaps and the slope index of inequality (SII), based on provincial altitude as an equity stratifier.

Results:

The mean PTB rate was 7.1 /100 live births. A significant annual increase of 0.85% (95% confidence interval: 0.48–1.21; $p < 0.01$) was observed. Rates increased across all subcategories: moderate/late (0.78%), very (1.28%), and extremely preterm (1.30%). Higher rates were reported in Afro-descendant and mestizo populations (7.20 per 100), and in provinces such as Pichincha (11.00), Carchi (10.60), and Tungurahua (8.40). Risk was 1.10 times higher among Afro-descendant compared to Indigenous mothers, and 1.80 times higher in the Andean vs. Insular region. Mothers aged ≥ 35 years had a 1.40-fold increased risk. In terms of territorial inequalities, the SII was − 5.0 in 2023, indicating an excess of 5 preterm births per 100 live births when comparing the province with the lowest altitude with the one with the highest altitude (95% CI − 179.65, − 71.49).

Conclusions:

Preterm birth shows an increasing trend in Ecuador, with marked inequalities based on maternal, ethnic, and territorial characteristics. Altitude is significantly associated with the geographic distribution of prematurity, highlighting the need to incorporate intersectional and territorial approaches into perinatal health policies.

1. BACKGROUND

Preterm birth (PTB), defined as the birth of a live infant before 37 completed weeks of gestation, constitute a major cause of neonatal and infant mortality worldwide.[1] [2] PTB is associated with considerable short- and long-term health complications and imposes significant social and economic burdens on families, communities, and health systems.[3]

According to the World Health Organization (WHO), approximately 13.4 million PTB occurred globally in 2020.[4] Reducing PTB is essential to achieving the Sustainable Development Goals (SDGs), particularly those related to neonatal survival.[4] In 2014, the global PTB rate was 10.6%, with an average annual decline of 0.14% reported between 2010 and 2020.[5]

In Ecuador, the National Institute of Statistics and Census (INEC) reported PTB rates ranging from 6.0% to 8.3% in 2020.[6] By 2023, the infant mortality rate was 9.7 per 1,000 live births (LB), with perinatal causes accounting for 1,376 deaths.[7] Despite the importance of this indicator, national-level data on the evolution and determinants of PTB remain limited. Understanding subnational trends and inequities is key to guiding targeted interventions.

Ecuador is a country located on the equator, crossed by the Andes Mountain range, which means it has four geographical regions: Coastal, Andean, Amazonian, and Insular. These regions, in turn, are divided into provinces; thus, their population is distributed at altitudes ranging from 0 to 6,000 meters above sea level. Altitude has been linked to adverse pregnancy outcomes such as preterm birth, making it necessary to determine whether there is geographical inequality in preterm birth rates.

This study aimed to describe the epidemiology of preterm birth in Ecuador between 2015 and 2023 by examining its characteristics, rates, and temporal trends, and to assess geographical inequalities according to altitude using absolute and relative measures of inequality.

Understanding geographical inequalities in preterm birth can help identify populations at greater risk and provide evidence to support more equitable maternal and neonatal health policies in Ecuador. Given the country's marked differences in altitude, geography, and access to healthcare, this information may contribute to the development of targeted public health strategies and a more efficient allocation of health resources. In addition, this study addresses an important gap in the national evidence and may serve as a basis for future research on the geographical and social determinants of preterm birth.

2. METHODS

This study adheres to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies.[8]

2.1 Study design and data source

We conducted a cross-sectional population study using data from Ecuadorian live born certificates recorded in the INEC electronic database between 2015 and 2023.[9] (Fig. 1).

FIGURE 1. *Flow diagram of the selection of the study population in Ecuador, 2015–2023. The flowchart shows the selection of the study population from all registered live births during the study period. Records with missing gestational age were excluded, followed by births at ≥ 37 completed weeks of gestation. The final analytical cohort comprised 174,168 preterm births (< 37 completed weeks of gestation).*

2.2 Study population

The study included 2,575,727 LB registered during the period. Records with missing gestational age (n = 146,711) were excluded. The final analytic sample comprised 2,429,016 LB, of which 174,168 were classified as PTB (Fig. 1).

2.3 Variables

Neonatal variables included sex, type of delivery (vaginal or cesarean), and birth plurality (single, twin, triplet, or more). Demographic variables included year of birth, place of birth (public, private, or home), and region (Insular, Coast, Andean, Amazon).

The Insular region included the province of Galápagos. The Coastal region included the provinces of El Oro, Esmeraldas, Guayas, Los Ríos, Manabí, Santo Domingo, and Santa Elena. The Andean region included Azuay, Bolívar, Cañar, Carchi, Cotopaxi, Chimborazo, Imbabura, Loja, Pichincha, and Tungurahua. The Amazon region included Morona Santiago, Napo, Pastaza, Zamora Chinchipe, Sucumbíos, and Orellana.

Maternal variables considered: nationality (Ecuadorian or foreign). Self-identified maternal ethnicity: indigenous; Afro-descendant (including Afro-Ecuadorian, Afro-descendant, black, mulatto); mestizo (including montubia, mestizo) and white. Maternal marital status (cohabiting and non-cohabiting); maternal education (early childhood, basic, high school, or higher) and maternal age at the time of birth (10–14 years; 15–19 years,9 20–34 years, 35–40 years, 41–45 years, and ≥ 46 years).[10] [11]

2.4 Outcome

PTB was defined as any birth before 37 weeks of gestation; it was classified as extremely preterm: < 28 weeks of gestation; very preterm: 28–31 weeks; moderate and late preterm: 32–36 weeks.[1]

2.5 Statistical analysis

An exploratory analysis was performed, and descriptive statistics were applied, including calculations of percentages, measures of central tendency, and variability. The rates of PTB per 100 LB were calculated, using PTB as the numerator and LB as the denominator, by year, geographic region, province, sex, gestational age, ethnicity, and maternal age. Rate ratios (RTs) were determined according to sex, geographic region, province, gestational age, ethnicity, and maternal age, with 95% confidence intervals (CIs).

Subgroup analyses were restricted to records with complete information for each variable; therefore, denominators may vary slightly across analyses.

For the trend of rates, the analysis of the annual percentage variation (APV) was performed using a linear regression model Joinpoint, considering as the dependent variable the logarithm of the PTB rate and the independent variable the year, considering 95% CI, performing the calculations in general, by sex, geographic region, gestational age, province, ethnicity, and maternal age.

The average altitude was used as a criterion to classify Ecuador's 24 provinces, ranking them from highest to lowest. To analyze inequalities between provinces, the weighted rate of PTB was compared between the groups of provinces located at the extremes of altitude. This

methodological strategy corresponds to an Eco social approach, in which the units of analysis are geographic aggregates (provinces), which defines an ecological design.[12]

Two types of inequality metrics were calculated following the methodology established by WHO: those based on the gap and those based on the gradient. Absolute gap (AG) and relative gap (RG) were estimated by comparing the weighted rates of PTB between the provinces of the first and fourth quartiles of altitude (from the highest altitude group to the lowest altitude group). As measures of the social gradient, the slope index of inequality (SII) and the health concentration index (ICx) were calculated.

A simple linear regression model was fitted to estimate the SII, with the dependent variable the weighted rate of PTB in each province and the independent variable the province's Ridit value. This Ridit value represents the relative social position of each province within the altitude ranking, on a continuous scale from 0 (province with the highest altitude) to 1 (province with the lowest altitude).

The adjusted model was as follows: Ind(Ridit) = a + b × Ridit, where Ind(Ridit) is the value of the health indicator (PTB rate), a is the intercept, b is the slope (inequality coefficient), and Ridit is the relative social position of each province. The SII is interpreted as the absolute difference of the indicator between the provinces located at the extremes of the altitude scale. Specifically, the indicator's value in the province with the lowest altitude (Ridit = 1) is Ind = a + b, and in the province with the highest altitude (Ridit = 0) it is Ind = a. Therefore, the difference between both values corresponds to b, i.e., SII = b.

Data were analyzed using SPSS® Statistics version 27, Microsoft® Excel for Windows, EquiGap®, and QGIS Software version 3.34.

2.6 Missing data

No missing data were reported for neonatal sex or plurality. Missingness was < 0.1% for type of delivery, place of birth, nationality, ethnicity, and maternal age; 0.6% for education; 0.7% for ethnicity; and 10.7% for marital status.

2.7 Ethics

This study used anonymized, publicly accessible data from the INEC website.[9] No identifiable personal data were accessed, and no ethical approval or informed consent was required.

2.8 Conflicts of Interest

None declared.

3. RESULTS

3.1 General characteristics

Of 2,575,727 registered live births in Ecuador between 2015 and 2023, gestational age was available for 2,429,016 (94.3%), of which 174,168 (7.1%) were preterm. Most PTBs were moderate-to-late preterm (86.2%), followed by very preterm (9.9%) and extremely preterm (3.8%). Males accounted for 53.2% of PTBs. Cesarean delivery was the most frequent mode of delivery (63.8%). The majority of PTBs were singleton births (87.8%) and were born in public institutions (82.9%). Regionally, 49.8% were born in the Coast region and 45.7% in the Andean region.

Regarding maternal characteristics, 96% were Ecuadorian, most of whom identified as mestizo (90.9%), followed by indigenous (4.5%) and Afro-descendant (2.7%). 20.3% of mothers had higher education (Table 1).

Mothers aged 10 to 19 accounted for 18.3% of all births, those aged 20 to 34 accounted for 64.9% , and those aged 35 and over accounted for 16.7% (Table 1).

3.2 PTB: national rate and annual trends by gestational age

The average national PTB rate was 7.1 per 100 LB during the study period.

By gestational age, the average rates were 6.1 per 100 LB for moderate-to-late preterm, 0.7 for very preterm, and 0.2 for extremely preterm (Table 2, Figure 2).

FIGURE 2. Annual preterm birth rates by gestational age in Ecuador, 2015–2023. The figure shows annual preterm birth rates per 100 LB according to gestational age categories (<28, 28–31, and 32–36 completed weeks) and the overall preterm birth rate for the study period. Annual percentage variation (APV) was estimated using Joinpoint regression analysis. PTB rates are expressed per 100 live births.

Annual PTB rates showed temporal variation, with higher values in 2019, 2022, and 2023, and lower values in 2015, 2016, and 2020. (Figure 2).

The overall PTB rate showed a statistically significant annual increase of 0.8% (APC = 0.8%; 95% CI 0.48–1.21; p = 0.002). Trend analyses showed annual increases across all categories: 0.8% per year for moderate-to-late preterm (95% CI: 0.44 to 1.13; p = 0.003), 1.3% per year for very preterm (95% CI: 0.78 to 1.78; p = 0.002), and 1.3% per year for extremely preterm (95% CI: 0.25 to 2.36; p = 0.062) (Table 2).

3.3 PTB according to sex

PTB rates were similar between sexes, with an overall average of 7.1 per 100 LB for both males and females (Supplemental Table 1). Among males, the highest annual PTB rates were observed in 2022, 2019, and 2023, while for females, the peak years were 2017 and 2022.

The annual trend analysis did not reveal significant changes over time: the APV for males was 1.3% (95% CI: –0.07 to 2.70; p = 0.11) and for females 0.2% (95% CI: –1.16 to 1.58; p = 0.78) (Table 2).

No significant annual trend differences by sex were detected during the study period.

3.4 PTB according to geographic region

The Andean region recorded the highest PTB rate (7.7 per 100 LB), followed by the Coast (5.6), Amazon (5.0), and Insular region (4.8). At the provincial level, the highest rates were reported in Pichincha (11.0), Carchi (10.6), Tungurahua (8.4), Azuay (8.3), and El Oro (8.1); the lowest in Cañar (3.8), Los Ríos (3.4), Zamora Chinchipe (3.9), and Santa Elena (3.8) (Figure 3, Supplemental Table 2). The Andean and Coast regions showed significant increasing trends: Andean APV = 1.3% (95% CI: 0.75 to 1.99; p = 0.003) and Coast APV = 1.6% (95% CI: 1.27 to 2.09; p = 0.001). No significant changes were observed in the Amazon or Insular regions. Provincial increases were notable in Zamora Chinchipe, Manabí, Santa Elena, Tungurahua, El Oro, Chimborazo, Carchi, and Pichincha (Table 2).

FIGURE 3. Average preterm birth rates by province in Ecuador, 2015–2023. The map displays the average preterm birth rate per 100 LB for each province in Ecuador during the study period. Provinces are grouped according to the distribution of average rates to illustrate their geographical variation. PTB rates are expressed per 100 live births.

3.5 PTB according to maternal ethnicity

PTB rates above the national average (7.1 per 100 LB) were observed among Afro-descendant (7.2) and mestizo (7.2) mothers, while Indigenous mothers had a lower rate (6.1).

Significant annual increases were observed among Afro-descendant mothers (APV = 0.9%; 95% CI: 0.38 to 1.56; p = 0.014) and mestizo mothers (APV = 0.8%; 95% CI: 0.40 to 1.19; p = 0.002) (Table 2).

3.6 PTB according to maternal age

The highest PTB rate was observed among mothers aged 35 or older, with 9.4, followed by adolescent mothers aged 10–19 years, with 7.0, and the lowest rate among mothers aged 20–34 years, with 6.7 per 100 LB.

Significant annual increases in PTB rates were observed among mothers aged 20–34 years (APV = 0.7%; 95% CI: 0.39 to 1.13; p = 0.005) and among those aged 35 years or older (APV = 0.6%; 95% CI: 0.16 to 1.05; p = 0.03) (Table 2).

3.7 Rate ratios associated with PTB

Rate ratios showed that the Andean region showed 1.8 times higher PTB rates compared to the Insular region. Mothers of Afro-descendant background showed 1.1 times higher PTB rates compared to Indigenous mothers, and mothers aged ≥35 had 1.4 times higher PTB rates compared to those aged 20–34 (Table 3).

3.8 Territorial inequality in PTB

In 2015, the absolute gap in PTB rates between provinces in the highest and lowest altitude quartiles was 2.07 per 100 LB (95% CI 1.85–2.30). By 2023, this gap increased to 3.85 per 100 LB (95% CI 3.57–4.14), representing an 86% increase between 2015 and 2023.

The relative gap (rate ratio) increased from 1.33 (95% CI 1.29–1.37) in 2015 to 1.56 (95% CI 1.51–1.61) in 2023. (Figure 4).

FIGURE 4. Absolute gap in preterm birth rates according to altitude quartiles in Ecuador, 2015-2023. The figure illustrates the absolute gap (AG) in preterm birth rates between provinces in the lowest and highest altitude quartiles for the years 2015 and 2023. Altitude was used as the equity

stratifier, and the AG was calculated as the difference in weighted preterm birth rates between quartile 1 and quartile 4. PTB rates are expressed per 100 LB.

4. DISCUSSION

4.1 Main findings

PTB is a significant public health problem worldwide. In 2020, the global prevalence was 9.9 per 100 LB, with higher rates in low-income regions, such as South Asia (13.2%); in Latin America, rates varied from 5.8 in Nicaragua to 12.8 in Suriname, with a regional average of 8.9.[7, 13, 14] In our study, Ecuador presented an average PTB rate of 7.1 per 100 LB between 2015 and 2023, placing it below the regional average. However, it remains the leading cause of infant mortality in the country.[6] By 2022, Ecuador reported a PTB rate of 7.7 per 100 LB, lower than that reported in the United States (10.3).[15] We found that most PTB were moderate or late preterm (86.2%), consistent with findings from other studies.[16] Worldwide in 2020, 15% of all PTB occurred before 32 gestational weeks; in this study, Ecuador showed a similar figure (13.7%).[7]

The global trend between 2010 and 2020 shows a decrease in PTB rates by approximately 0.14% per year; countries such as Australia, Brazil, Denmark, Germany, and the Netherlands reported reductions up to 0.5% annually. In Latin America, the average annual decrease was 0.05%.[7] Conversely, our study found an increasing trend of 0.8% annually between 2015 and 2023, affecting all preterm categories. Despite slight declines in 2020 and 2021, coinciding with the COVID-19 pandemic (6.9 and 7.3, respectively), the overall trend continued upward. International studies have reported mixed effects of the pandemic on PTB, with some high-income countries noting reductions potentially linked to confinement measures. [17, 18]

In this study for 2015, the AG in the weighted PTB rate between provinces located in quartile 1 (altitudes above 2,530 meters above sea level) and quartile 4 (altitudes below 600 meters above sea level) was 2.07 per 100 live births (95% CI 1.85, 2.30). This value indicates that in that year, there was an excess of 2.07 premature births per 100 LB across the provinces at the extremes of the altitude gradient. By 2023, this gap had increased to 3.85 per 100 live births (95% CI 3.57, 4.14), representing an 86% increase in absolute inequality between the two periods. In terms of RG, in 2015, the risk of prematurity in the first quartile was 1.33 times the risk in the fourth quartile (95% CI 1.29, 1.37). In 2023, this value increased to 1.56 times (95% CI 1.51, 1.61), equivalent to a relative increase of 17.3%. These results reflect a persistent and growing pattern of territorial inequality in prematurity associated with geographical altitude. Higher rates were identified in the Andean region, where most provinces are located at higher altitudes, and a consistent increase in rates was observed. The analysis of territorial inequality indicated that provinces above 2,500 meters consistently had higher PTB rates. This aligns with the systematic review by Grant, which found an association between PTB and gestation at altitude.[19] Thus, these results confirm the existence of a systematic inequality associated with geographic altitude, with women residing in high-altitude provinces facing a persistently higher risk. Studies in countries with similar geographies reinforce this association, suggesting that hypoxia at high altitudes may contribute to the increased risk.[20, 21, 22, 23]

Regarding maternal age, this study found a higher risk of PTB among adolescent mothers aged 10–14 years and mothers aged 35 years or older, compared to women aged 20–34 years, with a significantly increasing trend over time.[24, 25] In terms of ethnicity, mothers self-identifying as Afro-descendant had a higher risk of PTB compared to Indigenous mothers. It is essential to acknowledge that self-identification could introduce biases in estimating rates by ethnic group in a multicultural context like Ecuador.[26, 27]

Comparatively, in developed countries, PTB rates have generally declined, associated with improved maternal and neonatal care programs.[3] In contrast, the increase in Ecuador may reflect inequalities in healthcare access, maternal malnutrition, uncontrolled chronic diseases, and uneven availability of essential services.[28, 29]

4.2 Strengths of the study

This study provides valuable evidence on territorial inequalities in PTB rates in Ecuador, using absolute and relative inequality measures within an ecosocial framework, and units of analysis at the provincial level. The findings highlight a persistent and increasing inequality associated with altitude, emphasizing the need to integrate geographic and social determinants into public health policies.

4.3 Limitations of the data

The ecological design introduces inherent limitations that must be carefully considered when interpreting the findings. Although the use of aggregated indicators enables the identification of geographic disparities across provinces and provides a useful population-level overview, it precludes any inference at the individual level. Consequently, important within-province heterogeneity cannot be captured, including

disparities related to socioeconomic status, ethnicity, maternal education, or access to health services. This raises the possibility of ecological fallacy [30], whereby associations observed at the group level may not reflect true relationships at the individual level.

In addition, the study is subject to limitations related to data quality and measurement error inherent to the use of birth certificate registries. Although the Live Birth (LB) form is mandatory and standardized nationally, it was not originally designed for research purposes, and its completeness and accuracy may vary across regions and health facilities. The form includes essential demographic and perinatal variables; however, it lacks key clinical and contextual information such as maternal obstetric history, interpregnancy interval, prenatal complications, socioeconomic indicators, and payment source, all of which are known determinants of preterm birth and could act as important confounders.

A further limitation relates to the estimation of gestational age, which is a critical variable for defining preterm birth. In Ecuador, gestational age is frequently determined based on maternal recall of the last menstrual period, a method prone to recall bias and misclassification, particularly in cases of irregular cycles or uncertain dating. [31] Limited availability and unequal access to first-trimester ultrasound, especially in rural and underserved areas, [32] further exacerbate this limitation and may lead to systematic differences in accuracy between regions. In some settings, gestational age is estimated through postnatal clinical assessment, which introduces additional inter-observer variability and subjectivity [33], reducing measurement reliability.[34, 35, 36]

These methodological constraints may result in both non-differential and differential misclassification of preterm birth status. Of particular concern is the potential under-ascertainment of extremely preterm births and early neonatal deaths, which are more likely to occur outside well-equipped facilities or in contexts with weaker reporting systems. Moreover, variability in training, certification practices, and data entry quality across provinces may introduce systematic bias in reporting, leading to spatial heterogeneity that reflects differences in documentation rather than true epidemiological variation.

Finally, although underreporting and measurement error are recognized limitations, it is important to acknowledge that civil registration and vital statistics systems remain the most comprehensive and scalable source of perinatal health data in low- and middle-income settings. Despite their imperfections, they provide critical population-level surveillance capacity. Therefore, strengthening the completeness and accuracy of civil registration systems, standardizing gestational age assessment protocols, and promoting continuous training of health personnel in data recording and quality assurance are essential strategies to improve the validity of future epidemiological assessments. [37]

5. CONCLUSION

Preterm birth remains an important perinatal health concern in Ecuador, with observed variations across provinces and an overall increasing trend over the study period. The analysis highlights differences according to maternal age, with higher proportions observed among adolescents and older mothers, as well as disparities related to geographic context, particularly residence in high-altitude areas.

These findings should be interpreted in light of the study design, which does not allow causal inference. Nevertheless, they suggest the presence of population-level patterns that warrant further investigation using more detailed individual-level data to better understand underlying mechanisms and contributing factors.

Strengthening research in this area is essential to support the development of more precise and context-specific maternal and neonatal health strategies aimed at reducing geographic and demographic inequalities in preterm birth in Ecuador.

ABBREVIATIONS

PTB: Preterm birth.

APV: Annual percentage variation.

SII: Slope Index of Inequality.

CIs: Confidence intervals.

WHO: World Health Organization.

SDGs: Sustainable Development Goals.

INEC: National Institute of Statistics and Census.

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology.

LB: Live births.

RTs: Rate ratios.

AG: Absolute gap.

RG: Relative gap.

ICx: Health Concentration Index.

DECLARATIONS

Ethics approval and consent to participate:

This study used anonymized, publicly accessible data from the INEC website.[9] No identifiable personal data were accessed, and no ethical approval or informed consent was required.

Consent for publication

'Not applicable'

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

EM and TO developed the methodology, statistical analysis, and discussion of the study, and performed the overall evaluation. AS developed the methodology, statistical analysis, and discussion of Geographic Health Inequalities in Preterm Birth. CM reviewed the overall evaluation of the study. AM, MG, and JH reviewed the literature and background of the study, as well as the discussion and references. JO created the graphs and tables. All authors read and approved the final manuscript.

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Data Availability

The datasets analyzed during the current study are publicly available from the Ecuadorian National Institute of Statistics and Census (INEC)

Availability of data and materials

The datasets analyzed during the current study are publicly available from the Ecuadorian National Institute of Statistics and Census (INEC) [9]. The data can be accessed at: https://www.ecuadorencifras.gob.ec/anuario-de-nacimientos-y-defunciones/ . The analyses were based on the annual national birth registry datasets corresponding to the years 2015–2023.

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TABLES

Table 1
Types of PTB according to newborn, maternal, and demographic characteristics. Ecuador 2015–2023.

Characteristics		Gestational age (weeks)								Total	
		≤ 27		28–31		32–33		34–36			
		Number	%[a]	Number	%[a]	Number	%[a]	Number	%[a]	Number	%[a]
		6618	3.80	17 369	9.97	21 892	12.57	128 289	73.66	174 168	100
Sex	Male	3536	2.03Da	9428	5.41	11 791	6.77	67 945	39.01	92 700	53.22
	Female	3082	1.77	7941	4.56	10 101	5.80	60 344	34.65	81 468	46.78
Type of birth	Normal	3038	1.74	4995	2.87	6319	3.63	48 638	27.93	62 990	36.17
	Cesarean section	3580	2.06	12 374	7.10	15 571	8.94	79 644	45.73	111 169	63.83
Product	Single	5702	3.27	14 714	8.45	18 321	10.52	114 194	65.57	152 931	87.81
	Double	850	0.49	2459	1.41	3405	1.96	13 932	8.00	20 646	11.85
	Triple	62	0.04	173	0.10	150	0.09	159	0.09	544	0.31
	≥ Quadruple	4	0.00	23	0.01	16	0.01	4	0.00	47	0.03
Place of	Public	5970	3.43	14 930	8.57	18 042	10.36	105 502	60.57	144 444	82.93
	Private	610	0.35	2335	1.34	3700	2.12	21 639	12.42	28 284	16.24
	Home	30	0.02	75	0.04	117	0.07	1030	0.59	1252	0.72
Nationality	Ecuadorian	6362	3.65	16 668	9.57	20 919	12.01	123 338	70.82	167 287	96.05
	No Ecuadorian	255	0.15	688	0.40	964	0.55	4865	2.79	6772	3.89
Ethnicity	Afro-descendant	264	0.15	555	0.32	626	0.36	3350	1.92	4795	2.75
	Indigenous	281	0.16	784	0.45	917	0.53	5876	3.37	7858	4.51
	Mestizo	5967	3.43	15 788	9.06	20 009	11.49	117 242	67.32	159 006	91.29
	White	50	0.03	105	0.06	166	0.10	905	0.52	1226	0.70
Marital Status	With partner	2811	1.61	7905	4.54	10 396	5.97	62 293	35.77	83 405	47.89
	Without partner	3112	1.79	7555	4.34	9079	5.21	52 376	30.07	72 122	41.41
Instruction	Initial	42	0.02	147	0.08	179	0.10	969	0.56	1337	0.77
	Basic	3899	2.24	10 297	5.91	12 682	7.28	72 603	41.69	99 481	57.12
	Bachelor	1437	0.83	3616	2.08	4483	2.57	27 193	15.61	36 729	21.09
	Superior	1209	0.69	3202	1.84	4424	2.54	26 649	15.30	35 484	20.37
Maternal age	10 to 14 years	73	0.04	193	0.11	253	0.15	1387	0.80	1906	1.09
	15 to 19 years	1148	0.66	3002	1.72	3892	2.23	22 006	12.63	30 048	17.25
	20 to 34 years	4294	2.47	10 964	6.30	13 846	7.95	83 944	48.20	113 048	64.91
	35 to 40 years	919	0.53	2612	1.50	3137	1.80	17 173	9.86	23 841	13.69
	41 to 45 years	176	0.10	560	0.32	718	0.41	3520	2.02	4974	2.86
	≥ 46 years old	9	0.01	34	0.02	44	0.03	247	0.14	334	0.19

Abbreviations: PTB, Preterm birth.

[a] Row percent.

Table 2
Preterm birth rates, annual percentage variation, and 95% confidence intervals according to newborn, maternal, and demographic characteristics. Ecuador, 2015–2023.

Characteristics		PTB rate	APV	95% CI
Gestational age (weeks)	General	7.17	0.85 **	(0.48, 1.21)
	32 to 36	6.18	0.78 **	(0.44, 1.13)
	28 to 31	0.72	1.28 **	(0.78, 1.78)
	< 28	0.27	1.3 *	(0.25, 2.36)
Sex	Male	7.15	1.30	(-0.07, 2.70)
	Female	7.13	0.20	(-1.16, 1.58)
Region	Andean	7.74	1.37 **	(0.75, 1.99)
	Coast	5.67	1.68 **	(1.27, 2.09)
	Amazon	5.09	1.17	(-0.44, 2.81)
	Insular	4.8	1.7	(-2.20, 5.79)
Provinces	Azuay	8.33	0.20	(-0.65, 1.06)
	Bolivar	5.81	0.91	(-0.53, 2.37)
	Cañar	3.84	3.19	(0.46, 5.98)
	Carchi	10.65	1.82 *	(0.93, 2.72)
	Cotopaxi	7.02	2.26	(-0.03, 4.62)
	Chimborazo	7.99	1.62 *	(0.63, 2.62)
	El Oro	8.15	2.14*	(0.64, 3.66)
	Emeraldas	6.16	0.65	(-0.68, 2.01)
	Guayas	7.02	-0.58	(-1.09, -0.06)
	Imbabura	7.13	0.50	(-0.02, 1.03)
	Loja	7.10	-0.07	(-0.85, 0.70)
	Los Rios	3.48	1.49	(-0.04, 3.05)
	Manabí	5.53	3.90 **	(2.96, 4.85)
	Morona Santiago	5.43	-0.04	(-2.56, 2.54)
	Napo	4.36	1.32	(-1.41, 4.14)
	Pastaza	5.26	-0.97	(-2.97, 1.07)
	Pichincha	11.05	1.17 **	(0.77, 1.57)
	Tungurahua	8.46	2.80 **	(1.58, 4.04)
	Zamora Chinchipe	3.92	5.47 *	(2.07, 8.99)
	Galapagos	4.81	1.70	(-2.22, 5.79)
	Sucumbíos	5.96	0.94	(-0.38, 2.29)
	Orellana	5.60	1.65	(-0.19, 3.53)
	Santo Domingo	5.49	1.61 *	(0.35, 2.89)

Abbreviations: PTB, preterm birth; LB, live births; APV, annual percentage variation; CI, confidence intervals.

*p value <0.05; (**)(p value <0.01)

Characteristics		PTB rate	APV	95% CI
	Santa Elena	3.88	3.78 *	(1.99, 5.60)
Maternal ethnicity	Afro-descendant	7.25	0.97 *	(0.38, 1.56)
	Indigenous	6.19	0.17	(-0.64, 0.99)
	Mestizo	7.24	0.80 **	(0.40, 1.19)
	White	7.19	0.35	(-0.34, 1.05)
Maternal age (years)	≤ 19	7.58	0.54	(0.01, 1.07)
	20 to 34	7.52	0.76 *	(0.39, 1.13)
	≥ 35	10.7	0.60 *	(0.16, 1.05)
Abbreviations: PTB, preterm birth; LB, live births; APV, annual percentage variation; CI, confidence intervals.				
*p value <0.05; (**)(p value <0.01)				

Table 3
Rate ratios according to selected maternal and demographic characteristics. Ecuador, 2015–2023.

Characteristics		R	95% CI
Sex	Male / Female	1.00	(0.99, 1.01)
Region	Andean /Insular	1.87 **	(1.60, 2.18)
Maternal ethnicity	Afro-descendant / Indigenous	1.17	(1.13, 1.21)
Maternal age	≥ 35 / 20 to 34	1.42 **	(1.41, 1.44)
	10 to 14 /20 to 34	1.48 **	(1.42, 1.55)
	15 to 19 /20 to 34	1.03 **	(1.02, 1.05)
Abbreviations: RR, rate ratio; CI, Confidence intervals.			
**p value <0.01			

Figures

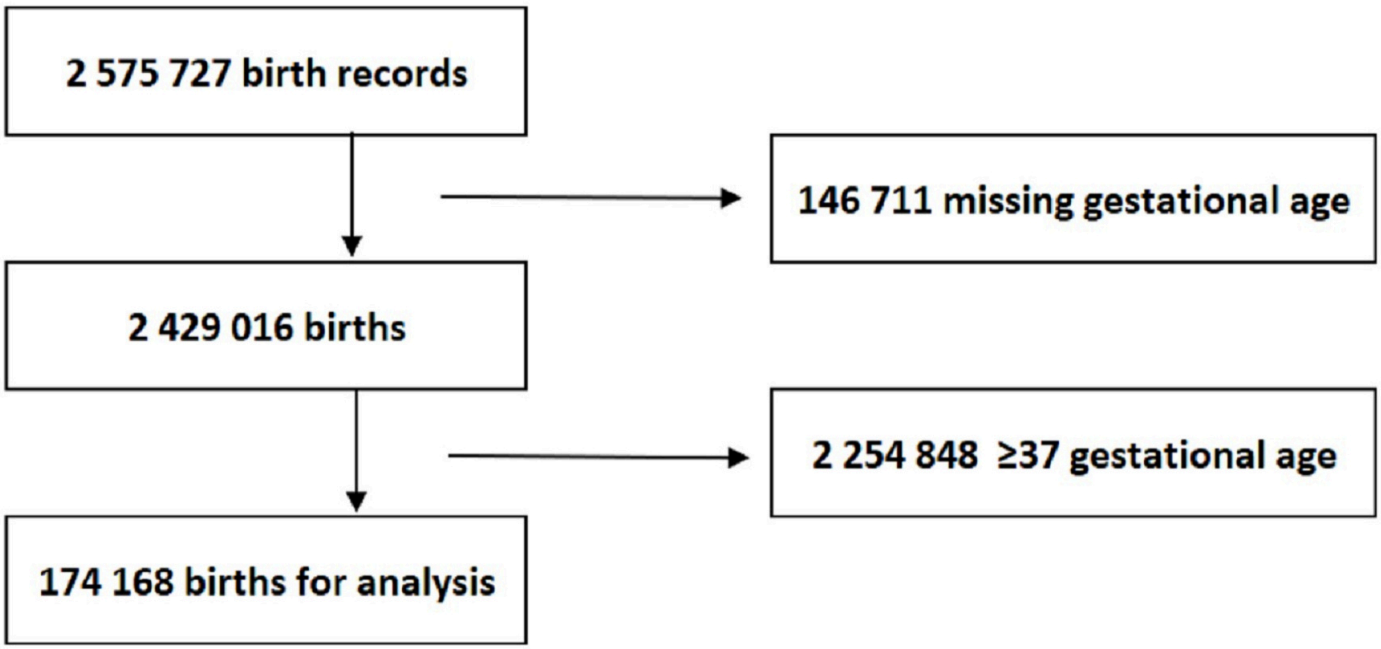


Figure 1

Flow diagram of the selection of the study population in Ecuador, 2015–2023. The flowchart shows the selection of the study population from all registered live births during the study period. Records with missing gestational age were excluded, followed by births at ≥37 completed weeks of gestation. The final analytical cohort comprised 174,168 preterm births (<37 completed weeks of gestation).

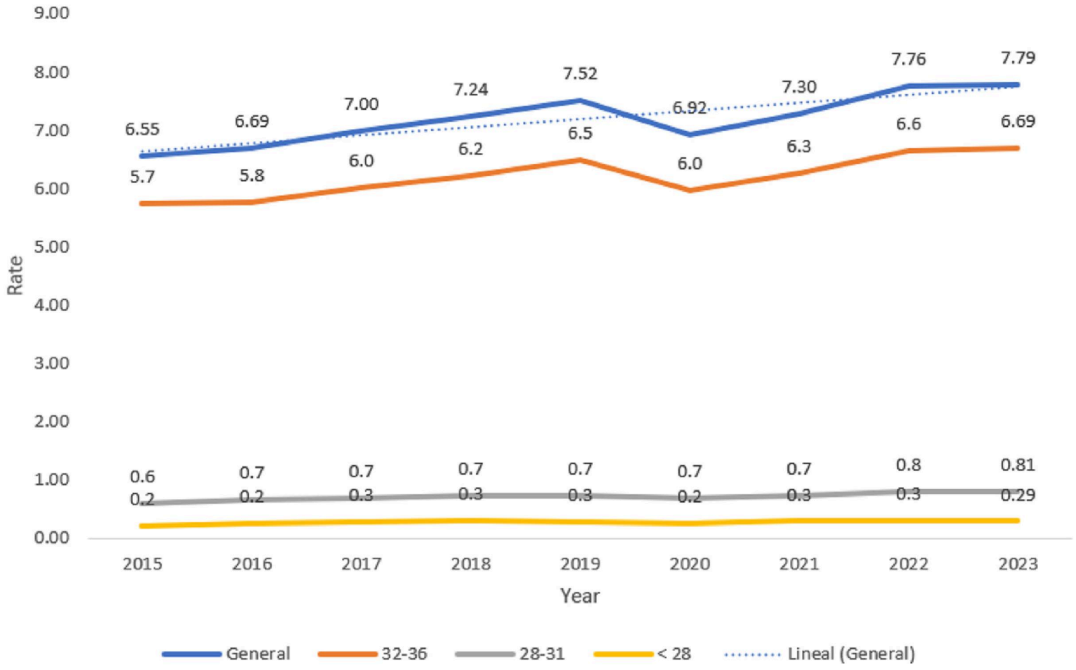


Figure 2

Annual preterm birth rates by gestational age in Ecuador, 2015–2023. The figure shows annual preterm birth rates per 100 LB according to gestational age categories (<28, 28–31, and 32–36 completed weeks) and the overall preterm birth rate for the study period. Annual percentage variation (APV) was estimated using Joinpoint regression analysis. PTB rates are expressed per 100 live births.

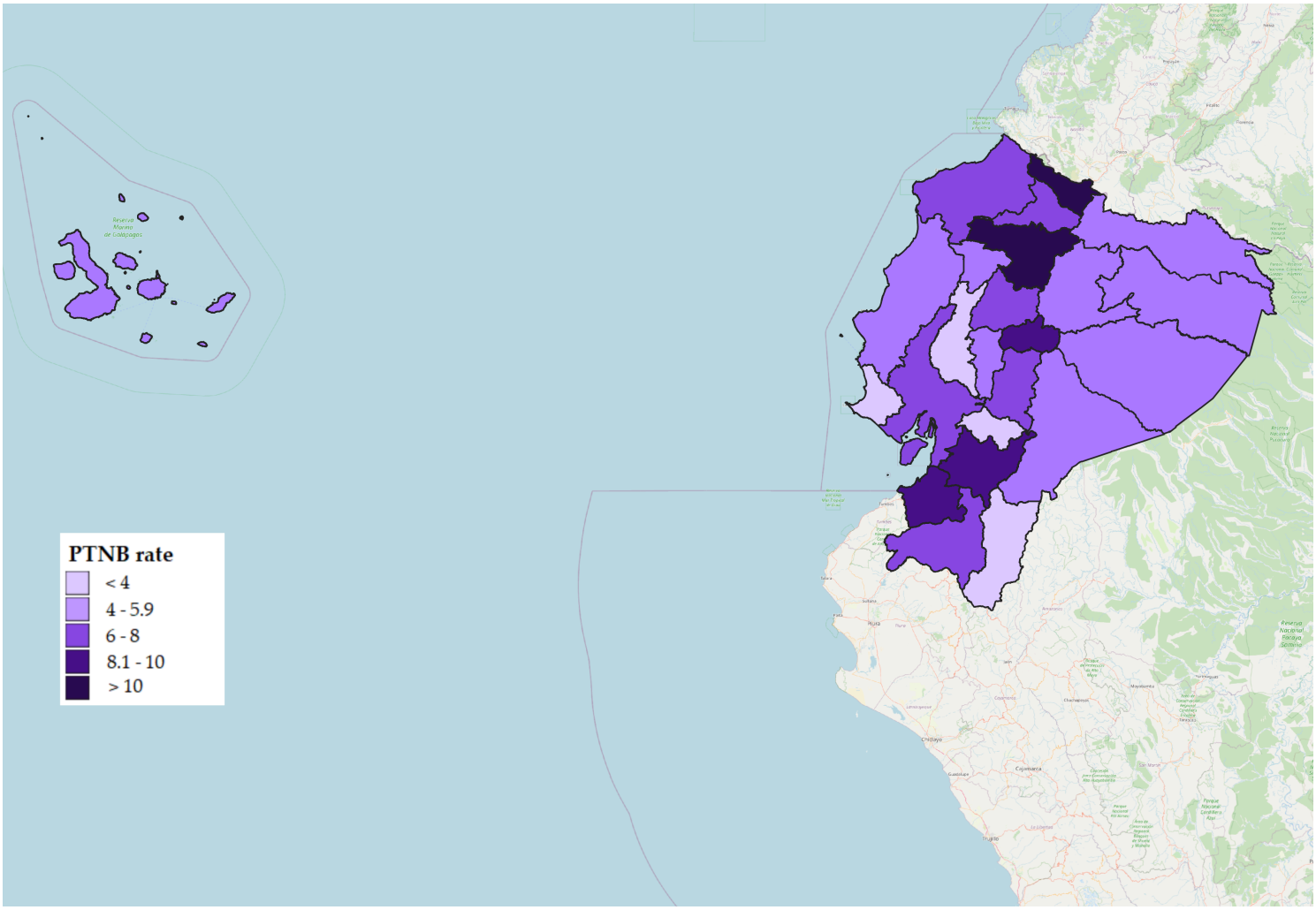


Figure 3

Average preterm birth rates by province in Ecuador, 2015–2023. The map displays the average preterm birth rate per 100 LB for each province in Ecuador during the study period. Provinces are grouped according to the distribution of average rates to illustrate their geographical variation. PTB rates are expressed per 100 live births.

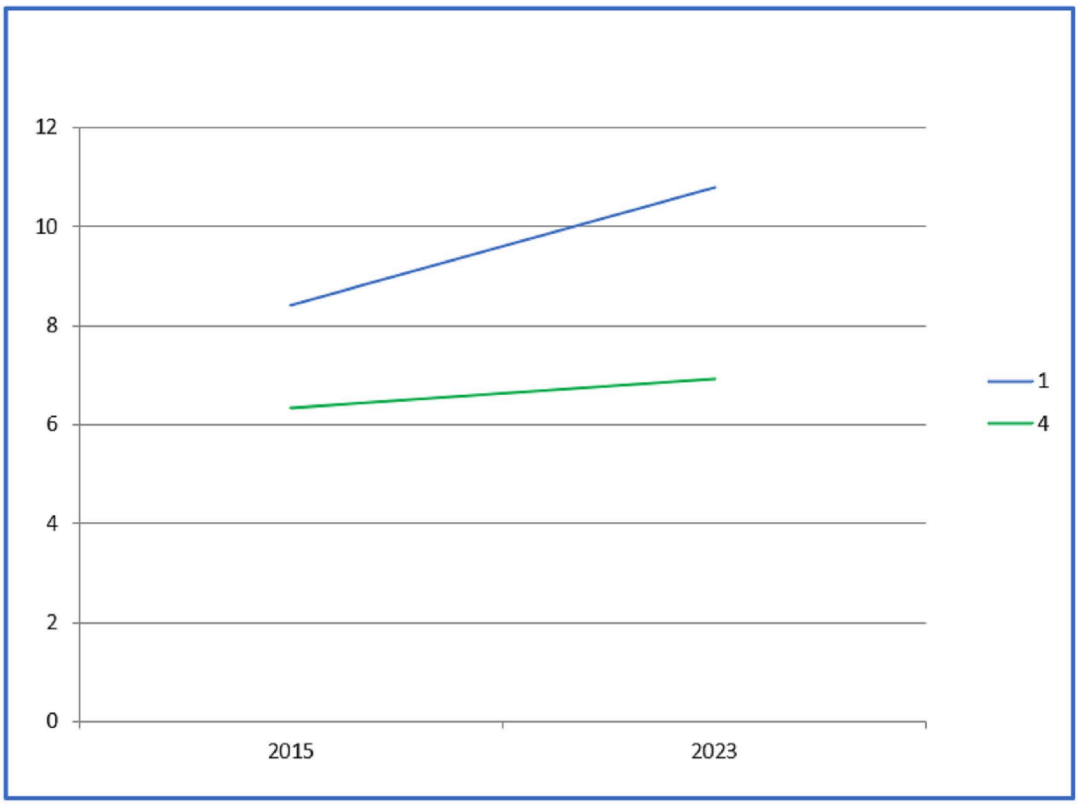


Figure 4

Absolute gap in preterm birth rates according to altitude quartiles in Ecuador, 2015-2023. The figure illustrates the absolute gap (AG) in preterm birth rates between provinces in the lowest and highest altitude quartiles for the years 2015 and 2023. Altitude was used as the equity stratifier, and the AG was calculated as the difference in weighted preterm birth rates between quartile 1 and quartile 4. PTB rates are expressed per 100 LB.

Supplementary Files

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