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Socioeconomic inequalities in self-rated health, illness, and Hospitalization in Ecuador from the ENSANUT-2018 Survey

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Conflict of Interest
The authors declare that they have no competing interests.

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ABSTRACT

Background: Social inequalities in health remain a critical public health concern globally, with marginalized populations often experiencing worse health outcomes. In Ecuador, ecological studies have documented disparities in mortality and morbidity linked to socioeconomic factors. Yet, the relationship between socioeconomic determinants and self-reported health outcomes at the individual level has not been thoroughly examined. This study comprehensively assesses health inequalities across different social strata in Ecuador.
Methods: A secondary analysis of the 2018 National Health and Nutrition Survey was conducted. This population-based survey includes economic and health information of 168 747 Ecuadorians (49% men and 51% women). Successive regression models were used to estimate the Slope Index of Inequality (SII) and the Relative Index of Inequality (RII), and the odds ratio (OR) of poor self-rated health (SRH), hospitalization in the last year, and illness in the last 30 days. Health inequalities were described by age, sex, self-reported ethnicity, education, quintiles of wealth, and area (urban/rural).
Results: The prevalence of poor SRH was higher in women (25%) than in men (23%). A strong socioeconomic gradient was observed: in the fully adjusted model, individuals in the poorest wealth quintile were four times more likely to report poor SRH (RII, 3.88; 95% confidence interval [CI], 3.31–4.54; SII, 23%; 95% CI, 20–26) than those in the highest wealth. Similarly, those with no education were almost three times more likely to report poor SRH (RII, 2.69; 95% CI, 2.35–3.08; SII, 18%; 95% CI, 15–20) than those with the highest education. Inequalities in self-reported illness were less consistent, while hospitalizations showed no association with socioeconomic determinants, suggesting potential barriers in healthcare access among disadvantaged groups.
Conclusion: There are significant inequalities in SRH across ethnic groups, economic, and educational lines in Ecuador, exceeding disparities reported in other countries. The discrepant findings highlight the need for continuous health monitoring and targeted policies addressing structural determinants to mitigate health inequalities.

Keywords: Health status; Health inequalities; Social determinants of health; Self-assessment; Epidemiological methods

INTRODUCTION

Sustainable Development Goals advocate for reducing health inequalities and promoting health improvements in the coming years with the central point of leaving no one behind. Continuous monitoring and evaluation are needed to correctly measure health indicators' distribution and accomplish the World Health Organization's call for health equality.[1]

Unlike developed countries, Latin America does not have good monitoring systems to assess the progress toward the achievement of health objectives. This is linked to the lack of high-quality data and the sub-utilization of available information. However, limited evidence suggests large differences in health inequalities between and within Latin American countries.[2] Therefore, extrapolating findings from other places can be misleading.

Information from different countries discloses that adverse health outcomes are more common among the more deprived groups (women, children, deprived groups, manual workers, less educated people, those living in rural areas, and ethnic minorities) and across various health indicators,[3-7] including self-rated health (SRH). Michael Marmot[8] showed that under-five mortality was the highest in the poorest socioeconomic quintile, the poorest countries, and the lowest educated. Men in the lowest income, occupation, and education category were more likely to have non-elective hospitalization compared with higher position groups; however, no differences were found for elective hospitalizations.[9] Additionally, a negative association between socioeconomic indicators and morbidity has been reported in developed[10,11] and developing[12] countries.

Unlike mortality or morbidity data, which often capture only the most severe health events, SRH reflects an individual's comprehensive perception of health.[13] SRH is a widely available and easy-to-analyze outcome to assess health. It has shown a strong association with a wide range of health outcomes such as mortality, heart attack, stroke, and diabetes.[14,15] It can thus serve as a valuable proxy for capturing unmet healthcare needs, psychosocial stressors, and subjective dimensions of health that traditional indicators may miss. In contexts like Ecuador, where official health records may underreport illness due to healthcare access barriers, SRH provides a more inclusive lens to study health disparities. Although morbidity and mortality showed a strong socioeconomic gradient at the ecological level in the Ecuadorian population, little is known about self-reported health outcomes at the individual level. For instance, ecological studies have reported inequalities in the distribution of obstetric complications, abortion complications, and cesareans,[16] as well as higher levels of all-cause mortality,[17] and maternal mortality[18] by geographical location. Granda and Jimenez[19] described the reductions of inequalities by self-reported illness and healthcare utilization between the years 2006 to 2014; income, education, and family size remained the most important determinants of health disparities. Despite these improvements, health inequalities persist and seem to be concentrated in the indigenous population,[20] who are also disproportionately affected by poverty and poor access to education.

Although there is clear evidence that social determinants are strongly associated with health outcomes, to the best of our knowledge, the characterization of health inequalities by SRH, self-reported illness, and self-reported hospitalization in the Ecuadorian population has not been done yet. In 2018, Ecuador carried out the National Health and Nutrition Survey (ENSANUT-2018),[21] but most of the information has not been systematically analyzed. This study aims to provide an overview of health inequalities by different socioeconomic indicators.

METHODS

Research design

Data was obtained from the ENSANUT-2018 survey, the most recent source of national health information publicly available to date. The survey was conducted between 2018 and 2019 to collect information on the health and nutritional status of the Ecuadorian population, with a strong focus on children and women of reproductive age. The 24 provinces were included in the study. The sample size was calculated based on the prevalence of three indicators from the 2013–2014 Living Conditions Survey: stunting children under five, underweight and obesity in children aged 5–11, and the proportion of women of reproductive age. The survey employed a stratified, two-stage probabilistic sampling design. In the first stage, sampling units were selected using probability proportional to size, and then a household listing operation was conducted. The second stage involved a random selection of households within each sampling unit. On average, 18 households per sampling unit were selected, with a variation based on the number of children under 5. All individuals in the selected dwelling were surveyed. Sampling weights were provided in the dataset. In total, 46,638 households were selected, and 43,097 were successfully reached (92.4%). The survey instruments included 5 different levels of measurement: household, women of fertile age, sexual and reproductive health in males, health risk factors, and children's development. Methods used validated instruments that followed international standards described in the full protocol.[21]

Study population

ENSANUT-2018 included 168,747 individuals living in 43,097 households. The non-response rate was 1.19% among households reached. All variables included in this analysis belong to the household level instrument, which was answered by a single household member. The final sample size included 168,747 individuals.

Variables and measurements

Three different indicators of health were used as outcomes in the present analysis. First, the selected informant (head of the household) rated the health of all individuals of the same family as excellent, very good, good, regular, or poor. This variable was dichotomized as "poor SRH" if regular or bad health was reported and "good SRH" if good, very good, or excellent health. Second, individuals were asked about hospitalizations during the last year. It was coded as 1 if they had any hospitalization and 0 if not. Third, whether the individual had a mild, moderate, or severe disease during the last 30 days was coded as 1, and those who reported no disease in the last 30 days were coded as 0.

Principal component analysis was used to build a wealth index out of 27 variables. We used information from 43,097 households. The variables were coded as 0 for the lowest level of household amenities, materials, or if an asset was unavailable. The highest level of a variable was dependent on the number of categories, or the number of assets, as specified in **Table 1**. For example, the variable type of road was coded as follows: 0 for trails, river/sea routes, or other non-standard paths; 1 for gravel roads; 2 for stone-paved roads; and 3 for paved or cobblestone streets. Similarly, internet access was coded as 0 for no access and 1 for any form of access. For variables such as number of cars, values were assigned incrementally: 0 if the household did not own a car, 1 if it owned one car, and increasing according to the maximum number of vehicles reported. Two variables (drinking water and ownership of a house) were excluded from the final model because of their negative loadings on the first component. Kaiser-Meyer-Olkin test was ≥ 0.86 for all 25 variables included, and the variance explained

Table 1. Principal component analysis of wealth index (n = 43,097 households)

Variable	Mean	SD	Min	Max	Factor score	KMO
Household services						
Type of road	2.08	1.05	0	3	0.19	0.94
Type of house	3.37	1.10	0	4	0.16	0.86
Main roof material	1.74	0.91	0	3	0.19	0.94
Main floor material	1.33	0.88	0	3	0.24	0.94
Main walls material	0.90	0.51	0	2	0.18	0.92
The general condition of the house	1.30	0.68	0	2	0.21	0.95
Number of rooms used exclusively for sleeping	2.07	1.07	0	11	0.17	0.87
Main cooking fuel	0.95	0.28	0	2	0.16	0.94
Electricity source	1.96	0.22	0	2	0.12	0.92
Waste management	0.83	0.36	0	1	0.20	0.93
Private shower at home	1.63	0.74	0	2	0.22	0.95
Sanitation facility	3.20	1.08	0	4	0.20	0.94
Internet access	0.36	0.48	0	1	0.24	0.91
Cable TV	0.36	0.48	0	1	0.18	0.95
Household number of assets						
Fridge	0.82	0.44	0	5	0.21	0.95
Computer	0.38	0.57	0	6	0.23	0.92
Washing machine	0.48	0.50	0	4	0.22	0.96
Blender	0.78	0.44	0	3	0.21	0.95
Oven, microwave	0.23	0.42	0	3	0.20	0.95
Iron	0.69	0.48	0	5	0.22	0.96
TV	1.13	0.75	0	6	0.23	0.94
DVD	0.36	0.54	0	6	0.12	0.90
Heater	0.08	0.29	0	3	0.13	0.93
Phone line	0.28	0.45	0	2	0.21	0.95
Car	0.21	0.45	0	6	0.18	0.95

Proportion of the variance explained: 29.4%.
SD = standard deviation; KMO = Kaiser-Meyer-Olkin test.

by the first component was 29.4%. Finally, the index of the first component was divided into 5 wealth quintiles and classified as poorest (Q1), poorer (Q2), middle (Q3), richer (Q4), and richest (Q5). Finally, wealth quintiles were matched with the multiple individuals who lived in the same household.

Information was disaggregated by sex. Age was grouped in intervals of 10 years, except for infants (0–4 years), and children and adolescents (5–19 years). Ethnicity was classified as indigenous, afro-Ecuadorian, *montubios* (a rural minority living on the Pacific coast), and mestizo (indigenous-white mix)/white; education level was classified as non-education, primary, secondary, and tertiary. Finally, the area was included as a dichotomous variable to distinguish between rural and urban zones.

Statistical analysis

Data are presented as frequencies and percentages. Regression analyses were used to estimate the inequalities in poor health outcomes. The Slope Index of Inequality (SII) and the Relative Index of Inequality (RII) for wealth and education were adjusted for covariates in successive models. SII represents the absolute probability (in percentage points) of reporting a poor SRH/hospitalization/illness between the hypothetically most and least advantaged individuals across the entire socioeconomic spectrum, based on a regression model that accounts for population distribution. The SII was estimated using a generalized linear model, where the outcome (poor SRH/hospitalization/illness) was a binary indicator and the key exposure is the relative socioeconomic position (RII variable):

$$E(Yi) = \beta_1 \cdot RIIi + Xi\beta$$

Yi: Binary health outcome (1 = yes, 0 = no); *RIIi*: Ridit score representing relative socioeconomic position (0 = highest, 1 = lowest); β_1: SII, the absolute difference in predicted probability of poor SRH/hospitalization/illness between the most and least advantaged; *Xi*: Vector of covariates (e.g., age, sex, ethnicity, area); β: Coefficients for covariates.

For some outcomes where the model failed to converge, we used survey-weighted linear regression with the same covariates as an approximate method to estimate absolute inequality. The use of these models is specified in the tables when needed.

The RII indicates the ratio of poor SRH/hospitalization/illness risk between the most and least advantaged individuals, reflecting relative disparities while considering the population distribution across all socioeconomic groups. The RII was estimated using a logistic regression model, where the outcome is the log odds of a poor health outcome:

$$log\frac{P(Yi=1)}{1-P(Yi=1)} = \beta_1 \cdot RIIi + Xi\beta$$

β_1: RII is the log-odds difference in poor health outcomes between the lowest and highest socioeconomic group.

Furthermore, the odds of poor SRH/hospitalization/illness on demographic variables were calculated with logistic regressions, as follows:

$$log\frac{P(Yi=1)}{1-P(Yi=1)} = \beta_0 + \beta Xi$$

β: vector of corresponding regression coefficients.

Models were fitted for each health outcome separately and adjusted for covariates. Results were shown at 95% confidence intervals (CIs) using STATA 16.1.

Ethical approval

ENSANUT-2018 was conducted following ethical guidelines and was approved and conducted by the Ministry of Public Health and the National Institute of Statistics of Ecuador. Informed consent was obtained from all participants before data collection.

RESULTS

Table 2 shows the prevalence of poor SRH, hospitalizations in the last year, and illness in the last 30 days disaggregated by demographic characteristics. The overall prevalence of poor SRH was 282.6% in men and 24.9% in women. Poor SRH increased with age (15.2% in infants to 60.0% at ≥ 70 years old), and it was higher among *montubio* ethnicity (35.7% vs. 23.4% in mestizo/white), those with no education (54.9% vs. 15.9% in tertiary education), and the poorest wealth quintile (30.9% vs. 14.0% in the richest). The frequency of hospitalizations increased only with age, from 3.9% in infants to 10.2% in those over 70 years old. The prevalence of illness was the lowest at age 20 to 29 (15.2%) and the highest at

Table 2. Percentage of poor SRH, hospitalization, and illness by demographic characteristics

Characteristics	Total	Poor SRH	Hospitalization	Illness
Total	168,747	40,157 (23.8)	6,773 (4.0)	37,413 (22.2)
Sex				
Male	82,403	18,631 (22.6)	3,026 (3.7)	16,696 (20.6)
Female	86,344	21,526 (24.9)	3,747 (4.3)	20,444 (23.7)
Age (yr)				
0–4	21,759	3,303 (15.2)	852 (3.9)	7,710 (35.4)
5–19	50,877	7,900 (15.5)	1,135 (2.2)	8,728 (17.2)
20–29	27,298	5,168 (18.9)	1,049 (3.8)	4,155 (15.2)
30–39	24,206	5,696 (23.5)	1,020 (4.2)	4,285 (17.7)
40–49	16,766	5,141 (30.7)	710 (4.2)	3,476 (20.7)
50–59	12,502	4,794 (38.6)	676 (5.4)	3,360 (26.9)
60–69	8,199	3,872 (47.2)	600 (7.3)	2,693 (32.9)
≥ 70	7,140	4,283 (60.0)	731 (10.2)	3,006 (42.1)
Ethnicity				
Mestizo/White	131,408	30,707 (23.4)	5,532 (4.2)	30,150 (22.9)
Indigenous	23,695	5,125 (21.6)	667 (2.8)	4,148 (17.5)
Afro	6,940	1,929 (27.8)	279 (4.0)	1,496 (21.6)
Montubio and others	6,704	2,396 (35.7)	295 (4.4)	1,619 (24.2)
Education[a]				
Tertiary	19,140	3,038 (15.9)	972 (5.1)	3,786 (19.8)
Secondary	31,337	7,139 (22.8)	1,380 (4.4)	5,719 (18.3)
Primary	40,566	15,993 (39.4)	2,057 (5.1)	9,781 (24.1)
Non	5,068	2,784 (54.9)	377 (7.44)	1,689 (33.3)
Wealth quintiles				
Q5 (richest)	34,775	4,866 (14.0)	1,535 (4.4)	7,256 (20.9)
Q4	33,467	6,564 (19.6)	1,435 (4.3)	7,359 (22.0)
Q3	33,212	8,397 (25.3)	1,375 (4.1)	7,670 (23.1)
Q2	33,124	9,790 (29.6)	1,304 (3.9)	7,684 (23.2)
Q1 (poorest)	33,169	10,540 (30.9)	1,124 (3.3)	7,444 (21.8)
Area				
Urban	102,072	22,369 (21.9)	4,528 (4.4)	23,463 (23.0)
Rural	66,675	17,788 (26.7)	2,245 (4.0)	13,950 (20.9)

SRH = self-rated health.
[a]Children and adolescents were excluded as they have not completed their education yet.

≥ 70 years old (42.1%), while it was 19.8% in tertiary education versus 33.3% in no education. Geographical differences by province can be observed in **Supplementary Data 1**.

We used education and wealth as ordinal variables to represent the socioeconomic hierarchy in our population, as required by the regression-based inequality models. **Tables 3** and **4** present results separately for children and adolescents, and for adults, since many children have not yet entered or completed formal education. The regression-derived inequality indices revealed pronounced socioeconomic gradients. In both age groups, we observed inequalities in SRH and illness, but not in hospitalizations.

Among children and adolescents, the fully adjusted model (Model 3) showed that those at the bottom of the wealth distribution had a 0.23 higher predicted probability of reporting poor SRH (SII, 0.23; 95% CI, 0.21–0.25), and a 0.32 higher predicted probability of reporting illness (SII, 0.32; 95% CI, 0.30–0.35). However, relative inequalities were even more pronounced: children and adolescents at the bottom of the wealth hierarchy were 5.27 times more likely to report poor SRH than their wealthiest peers (RII, 5.27; 95% CI, 4.22–6.58).

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Table 3. SII and RII by wealth quintile and level of education for infants, children and adolescents in ENSANUT-2018

Variables	Boys[a]		Girls[a]		Model 1		Model 2		Model 3	
	SII	RII	SII	RII	SII	RII	SII	RII	SII	RII
Wealth → SRH	0.24 (0.22–0.26)	5.34 (4.20–6.77)	0.23 (0.21–0.25)	5.15 (4.13–6.40)	0.23 (0.21–0.25)	5.18 (4.27–6.28)	0.23 (0.21–0.25)	5.09 (4.10–6.33)	0.23 (0.21–0.25)[b]	5.27 (4.22–6.58)
Wealth → Hospitalization	0.04 (0.03–0.05)	0.82 (0.57–1.20)	0.02 (0.02–0.03)	0.57 (0.37–0.88)	0.02 (0.02–0.03)	0.70 (0.53–0.94)	0.02 (0.02–0.03)	0.77 (0.54–1.10)	0.02 (0.01–0.03)[b]	0.77 (0.53–1.12)
Wealth → Illness	0.34 (0.32–0.36)	1.08 (0.88–1.32)	0.32 (0.30–0.34)	0.98 (0.81–1.20)	0.28 (0.27–0.30)	1.03 (0.87–1.22)	0.31 (0.29–0.34)[b]	1.22 (1.01–1.48)	0.32 (0.30–0.35)[b]	1.29 (1.07–1.57)

Model 1: Adjusted for age and sex; Model 2: Adjusted for age, sex, and area; Model 3: Adjusted for age, sex, area, and ethnicity. Values are presented as score with 95% confidence interval.
SII = Slope Index of Inequality; RII = Relative Index of Inequality; SRH = self-rated health.
[a]Adjusted for age; [b]Estimated using linear regression (ordinary least squares) due to convergence failure in the generalized linear model.

Table 4. SII and RII by wealth quintile and level of education for adults in ENSANUT-2018

Variables	Men[a]		Women[a]		Model1		Model 2		Model 3		Model 4	
	SII	RII	SII	RII	SII	RII	SII	RII	SII	RII	SII	RII
Education → SRH	0.30 (0.28, 0.33)	6.65 (5.68, 7.79)	0.30 (0.27, 0.33)	5.24 (4.53, 6.07)	0.31 (0.29, 0.34)	5.74 (5.09, 6.47)	0.31 (0.29, 0.34)	5.04 (4.46, 5.70)	0.30 (0.28, 0.33)	4.92 (4.35, 5.58)	0.18 (0.15, 0.20)[b]	2.69 (2.35, 3.08)
Wealth → SRH	0.24 (0.21, 0.26)	6.44 (5.56, 7.45)	0.26 (0.23, 0.28)	6.10 (5.27, 7.06)	0.27 (0.25, 0.29)	6.18 (5.45, 7.023)	0.32 (0.30, 0.35)	6.17 (5.33, 7.16)	0.31 (0.28, 0.34)[b]	5.98 (5.15, 6.94)	0.23 (0.20, 0.26)[b]	3.88 (3.31, 4.54)
Education → Hospitalization	0.00 (−0.01, 0.01)	0.96 (0.70, 1.32)	−0.004 (−0.01, 0.005)	0.73 (0.55, 0.98)	0.00 (−0.01, 0.01)	0.82 (0.66, 1.02)	−0.002 (−0.1, 0.006)	0.92 (0.72, 1.16)	−0.002 (−0.01, 0.006)	0.92 (0.72, 1.17)	−0.005 (−0.01, 0.004)	0.82 (0.62, 1.09)
Wealth → Hospitalization	0.003 (−0.01, 0.01)	1.16 (0.89, 1.52)	0.01 (−0.001, 0.01)	0.80 (0.63, 1.01)	0.01 (0.002, 0.01)	0.95 (0.80, 1.13)	0.01 (0.001, 0.01)	1.15 (0.92, 1.43)	0.009 (0.0007, 0.01)	1.16 (0.93, 1.44)	0.01 (0.003, 0.02)	1.25 (0.97, 1.61)
Education → Illness	0.02 (0.005, 0.05)	1.17 (0.98, 1.40)	0.04 (0.02, 0.07)	1.24 (1.06, 1.44)	0.04 (0.02, 0.06)	1.20 (1.06, 1.37)	0.02 (0.0002, 0.04)	1.20 (1.05, 1.38)	0.02 (−0.01, 0.04)	1.21 (1.06, 1.38)	−0.007 (−0.03, 0.01)	0.97 (0.83, 1.13)
Wealth → Illness	0.05 (0.03, 0.07)	1.40 (1.18, 1.65)	0.08 (0.06, 0.10)	1.55 (1.33, 1.81)	0.07 (0.06, 0.09)	1.48 (1.29, 1.68)	0.06 (0.04, 0.09)	1.59 (1.37, 1.84)	0.07 (0.04, 0.09)	1.61 (1.39, 1.87)	0.08 (0.05, 0.010)	1.62 (1.37, 1.92)

Model 1: Adjusted for age and sex; Model 2: Adjusted for age, sex, and area; Model 3: Adjusted for age, sex, area, and ethnicity; Model 4: Adjusted for age, sex, area, ethnicity, and education/wealth. Values are presented as score with 95% confidence interval.
SII = Slope Index of Inequality; RII = Relative Index of Inequality; SRH = self-rated health.
[a]Adjusted for age; [b]Estimated using linear regression (ordinary least squares) due to convergence failure in the generalized linear model.

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In adults, Model 1 (adjusted for age and sex) indicated substantial inequalities in both SRH and illness. Adults at the bottom of the education distribution had a 0.31 higher predicted probability of poor SRH compared to those at the top (SII, 0.31; 95% CI, 0.29–0.34), while the relative risk was 5.74 times higher (RII, 5.74; 95% CI, 5.09–6.47). Wealth-related inequalities in adults were also pronounced: those in the lowest wealth quintile had a 0.27 higher predicted probability of poor SRH (SII, 0.27; 95% CI, 0.25–0.29) and were 6.18 times more likely to report poor SRH than the wealthiest adults (RII, 6.18; 95% CI, 5.45–7.02). In fully adjusted models (Model 4), the magnitude of these inequalities was attenuated but remained statistically significant. For example, inequalities in illness were still present, though smaller (SII, 0.08; RII, 1.62), and no significant inequalities were found in hospitalizations by education or wealth. Finally, sex-stratified analyses suggested that socioeconomic inequalities, both in education and wealth, were more pronounced among men.

Differences in the odds of poor SRH, hospitalization, and illness by socioeconomic indicators are shown in **Table 5**. All odds ratios (ORs) were simultaneously adjusted for age, sex, ethnicity, education, wealth, and area. After controlling for these variables, women had higher odds of poor SRH (OR, 1.28; 95% CI, 1.22–1.33), hospitalization (OR, 1.22; 95% CI, 1.09–1.36), and illness (OR, 1.39; 95% CI, 1.32–1.46) compared to men. The odds also increased with age,

Table 5. Odds ratio of poor SRH, hospitalization, and illness by demographic characteristics

Characteristics	Poor-SRH[a]	Hospitalization[a]	Illness[a]
Sex			
Male	Ref.	Ref.	Ref.
Female	**1.28 (1.22–1.33)**	**1.22 (1.09–1.36)**	**1.39 (1.32–1.46)**
Age[b]			
20–29	Ref.	Ref.	Ref.
30–39	**1.30 (1.20–1.41)**	1.11 (0.93–1.33)	**1.16 (1.06–1.27)**
40–49	**1.93 (1.76–2.10)**	1.18 (0.98–1.42)	**1.43 (1.30–1.56)**
50–59	**2.52 (2.29–2.77)**	**1.40 (1.17–1.68)**	**2.00 (1.80–2.22)**
60–69	**3.34 (3.00–3.72)**	**2.20 (1.80–2.69)**	**2.55 (2.28–2.85)**
≥ 70	**4.82 (4.28–5.42)**	**3.12 (2.55–3.81)**	**3.40 (3.01–3.84)**
P-value trend	**< 0.001**	**< 0.001**	**< 0.001**
Ethnicity			
Mestizo/White	Ref.	Ref.	Ref.
Indigenous	**0.77 (0.67–0.89)**	1.02 (0.81–1.28)	**0.85 (0.76–0.96)**
Afro-Ecuadorian	**1.24 (1.06–1.44)**	0.93 (0.73–1.17)	1.02 (0.86–1.19)
Montubio and others	**1.43 (1.24–1.65)**	0.93 (0.75–1.16)	1.01 (0.88–1.15)
Education			
Tertiary	Ref.	Ref.	Ref.
Secondary	**1.53 (1.38–1.69)**	0.91 (0.77–1.07)	0.94 (0.86–1.03)
Primary	**2.04 (1.85–2.26)**	0.87 (0.71–1.04)	0.95 (0.86–1.05)
Non	**2.47 (2.13–2.85)**	1.09 (0.82–1.44)	1.16 (0.98–1.36)
P-value trend	**< 0.001**	0.518	0.718
Wealth			
Q5 (richest)	Ref.	Ref.	Ref.
Q4	**1.67 (1.48–1.89)**	0.95 (0.79–1.13)	**1.13 (1.02–1.25)**
Q3	**2.07 (1.85–2.32)**	1.10 (0.92–1.30)	**1.30 (1.15–1.46)**
Q2	**2.64 (2.34–2.97)**	1.20 (0.99–1.45)	**1.38 (1.21–1.56)**
Q1 (poorest)	**2.80 (2.45–3.21)**	1.00 (0.80–1.25)	**1.40 (1.22–1.61)**
P-value trend	**< 0.001**	0.097	**< 0.001**
Area			
Urban	Ref.	Ref.	Ref.
Rural	0.98 (0.88–1.09)	**0.78 (0.68–0.90)**	0.92 (0.83–1.01)

Values are presented as odds ratio (95% confidence interval). Values marked with bold indicate statistically significant.
SRH = self-rated health.
[a]All variables included in the models; [b]Children and adolescents excluded as they have not completed education yet.

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being the highest among people older than 70 years. The odds of hospitalization or illness did not vary by ethnicity, but indigenous people had statistically significantly lower odds of reporting poor SRH (OR, 0.77; 95% CI, 0.67–0.89) when compared to mestizos/whites, while the opposite is true for montubios (OR, 1.43; 95% CI, 1.24–1.65) and afro-Ecuadorians (OR, 1.24; 95% CI, 1.06–1.44). The odds of poor SRH increased steadily at lower levels of education and wealth, it was the highest among non-educated individuals (OR, 2.47; 95% CI, 2.13–2.85), as well as the poorest individuals (OR, 2.80; 95% CI, 2.45–3.21). The odds of hospitalization were not statistically significant associated with ethnicity, the level of education, or wealth, but living in a rural area showed statistically significant lower odds of hospitalization (OR, 0.78; 95% CI, 0.68–0.90). The odds of illness did not increase by education, but a lower wealth was associated with higher odds of reporting illness, being the highest in the lower quintile (OR, 1.40; 95% CI, 1.22–1.61). Finally, indigenous people had lower odds of reporting illness (OR, 0.85; 95% CI, 0.76–0.96) when compared with mestizo/white ethnicity.

DISCUSSION

Different measurements were used to describe the burden of health inequalities in the Ecuadorian population, showing that health outcomes were not equally distributed. Women showed the highest odds of poor SRH, hospitalizations, and illnesses, but when analysis of the RII was disaggregated by sex, we found that relative SRH inequalities were more pronounced among men. Additionally, more deprived groups such as the elderly, ethnic minorities, the poorly educated, and the lower wealth quantile suffered disproportionately from the burden of poor SRH, when compared to the reference group. Additionally, neither ethnicity, lower education, nor lower wealth increased the odds of hospitalizations in the last year. While lower education did not increase the odds of illness during the last 30 days.

Poor SRH was reported for 23.8% of the Ecuadorian population, which was higher than previous reports from other regions. For instance, information from the World Health Survey (WHS) conducted between 2002 and 2004 showed that the prevalence of poor SRH was 6.7% in men and 8.5% in women from high-income countries in Europe, while Sub-Saharan African countries reported 10.1% in men and 13.8% in women.[22] However, the WHS also had information from Ecuador and reported a prevalence of 7.1% in men and 11.9% in women; the Latin American prevalence was 5.1% and 7.9%, respectively.[22] These findings contrast with more recent evidence: national data from Brazil reported 33.9% of poor SRH in people over 18 years old[23] while a small sample from a traditional suburban community in Colombia registered 40.1% of poor SRH.[24] There are difficulties in cross-country comparisons because of the variability in the outcome measurement. In Argentina, the prevalence of poor SRH was 18.2%;[25] however, this corresponded to illnesses in the last 30 days, which mirrors the 22.2% found here.

Parallel to Granda and Jimenez's report,[19] our results showed that the poorest wealth quintile had the worst health outcomes. However, instead of income, the present measurement of wealth included 25 variables on material circumstances, public services, and housing. Thus, quintiles of wealth presented here encompassed the public social investment plus family material accumulation. Although people with poorer SRH are more likely to have a higher prevalence of chronic diseases[26] and higher mortality,[15] the results did not find an association between wealth and hospitalizations. It is possible that during the

years that preceded the data collection, the quality of public health services had improved, making hospitals more accessible for acute conditions.[27,28] However, austerity policies implemented in 2019 could have inverted this association, thus, private hospitals gained importance, a lack of income limits access to health, and only people with economic capacity can be hospitalized, while the poorer stay at home, as can be inferred from early 2020 and the coronavirus disease 2019 outbreak.[29-31]

Education has a direct effect on health, but also indirect pathways have demonstrated to be significant through income, health-related behaviors, and access to health services.[32,33] We hypothesized that lower levels of education in the Ecuadorian population would be associated with higher prevalence of self-reported health outcomes, particularly chronic diseases as reported in other Latin-American settings.[6] Our results showed a gradient between education and SRH. Those with no education had 2.7 times higher relative risk of reporting poor SRH than those at the highest level of education. However, education showed no inequalities in hospitalizations or illness. Although the present analysis showed a strong association between education and SRH, the real burden of poor SRH might be underestimated because people with a higher level of education are more likely to report health issues compared to the less educated.[34] To better understand the complex role of education in the Ecuadorian context, researchers should also investigate the potentially bidirectional relationship between education and health, and understand how other indicators of health—years of education, quality of education, literacy, health literacy—can also play a role in shaping health outcomes.[33]

It is acknowledged that ethnicity does not capture characteristics inherent to the biology or genetics of a group, instead, it could be a measure of systematic social exclusion, reflect the upstream barriers imposed, or the accumulation of adverse social determinants of health in deprived groups.[35] People of ethnic minorities in Ecuador have suffered exclusion, higher indices of illiteracy, poverty, and racism.[36] Indeed, racialized people can experience poorer income and education, but also inadequate access to public and health services.[35] We found that living in a rural place was associated with a reduced risk of hospitalization, however, it might reflect the lack of access to health services of higher complexity. It was contradictory that indigenous people reported better SRH than other ethnicities, including mestizos/whites. This might be associated with a comparison of their health contrasted with the health of their peers. In the United States, Blacks and Hispanics rated their health better than other groups, however a deeper analysis showed that this was result of differences in reporting health than true differences in health.[34] A similar analysis from Argentina revealed that provinces with high mortality rates reported better SRH, probably because of less awareness of health conditions, social comparison with peers, or expectations of their health, including a social stigma of being sick, mainly among males.[37] There is a need for future research to address the lack of knowledge of the cultural differences in indigenous Ecuadorians that might have a protective role, such as social support[35]; and other potential risk factors, such as reduced social mobility and their intergenerational health effects.

These findings underscore the critical role of upstream social determinants of health, such as wealth distribution, public expenditure, education, and racial exclusion, in shaping health outcomes in Ecuador. To address these inequalities, public policies should prioritize equitable access to essential services, particularly in regions with high concentrations of historically marginalized and racialized populations. This could include targeted infrastructure investments in water, sanitation, and housing to mitigate health risks

associated with inadequate living conditions. Furthermore, improving retention within the education system is crucial for long-term health benefits. Policies might include expanding scholarship programs for low-income students, enhancing school-based health services, and implementing programs that incentivize school attendance. Additionally, increasing public spending on educational infrastructure in underserved communities could help reduce dropout rates and improve future health outcomes.

By using a nationally representative dataset, this analysis contributed to filling the gap on health inequalities within the Ecuadorian population. It showed that estimates of health inequalities from other countries, principally developed countries, cannot be extrapolated to Ecuador. The ENSANUT-2018 dataset offered several advantages when analyzing the effect of socioeconomic differences on health outcomes. First, the sampling method guaranteed representativeness at national, provincial, and urban-rural zone levels. It also ensured adequate representation of smaller populations, including Afro-Ecuadorians, indigenous, and montubios. Second, the high levels of participation ensured that all economic groups were captured, and reduced selection bias, increasing the reliability and generalizability of the findings. This unusually high response rate might be explained by a coordinated national campaign that involved widespread public communication and logistical support to promote participation. Moreover, Ecuador has historically reached high response rates in health surveys, principally on maternal studies. For example, the National Survey of Demographics and Maternal and Child Health (ENDEMAIN) survey had a non-response rate of 3.6% and 3% among legible women in 1994 and 2004 respectively.[38,39] Third, the dataset provided information on access to public services and material assets, allowing a multidimensional estimation of wealth beyond income. Self-reported family income, for example, has several limitations for the Ecuadorian population, including the lack of consistency given the elevated levels of unemployment and underemployment. Nevertheless, results displayed large variability in the richer wealth category, which showed a right-skewed distribution (**Table 1**), highlighting potential challenges in capturing upper-tail inequality.

The cross-sectional nature of the data did not allow us to test the direction of the effects or causality. Therefore, reverse causation is a possibility. It means that poorer SRH could also lead to poorer income or lower school attainment. However, previous analyses have mentioned that reverse causation did not account for all the variability explained by socioeconomic position.[40] Although self-assessed data is easy to obtain, it is prone to bias. However, SRH has shown good correlation with direct indicators of health.[14,41]

A key limitation of this study is the potential of proxy response bias, which might have a greater impact on SRH, as this might not accurately capture how individuals perceive their health. In contrast, more objective indicators, such as illness in the last 30 days and hospitalization in the last year, are less prone to perceptual bias and may be reported more accurately by proxies. This might explain the discrepancies between the three outcomes compared in this study. Therefore, the estimates should be interpreted cautiously, considering the potential for misclassification and measurement error in proxy-reported subjective outcomes.

In the future, it is important to measure the influence of other variables such as major public policies or public expenditure, neighborhood or city-level variables, loss of income, or loss of working days due to illness. Economists might contribute to the understanding of the Ecuadorian situation through the analysis of the monetary costs of health inequalities.

In conclusion, poor SRH was concentrated among socially deprived individuals. The present analysis identified targets of potential intervention for reducing inequalities in health among Ecuadorians. Improving the wealth distribution and education of people is likely to have a positive impact on SRH. Efforts must focus on women, the most deprived groups, and ethnic minorities. Additionally, wealth quintile and ethnicity seemed to play a role in the odds of illness, while neither education, wealth quintile, nor ethnicity was associated with the odds of hospitalization. These patterns may indicate how individuals perceive and respond to disease and suggest barriers in the healthcare continuum, such as delays in recognizing symptoms, limited use of preventive services, or difficulties accessing primary care. These discrepancies highlight the need for policies that reduce health inequalities.

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SUPPLEMENTARY MATERIAL

Supplementary Data 1

Distribution of poor SRH by province. It includes children and adolescents.

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