



# Measuring Out-of-pocket Payment, Catastrophic Health Expenditure and the Related Socioeconomic Inequality in Peru: A Comparison Between 2008 and 2017

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**Objectives:** Describe out-of-pocket payment (OOP) and the proportion of Peruvian households with catastrophic health expenditure (CHE) and evaluate changes in socioeconomic inequalities in CHE between 2008 and 2017.

**Methods:** We used data from the 2008 and 2017 National Household Surveys on Living and Poverty Conditions (ENAH0 in Spanish), which are based on probabilistic stratified, multistage and independent sampling of areas. OOP was converted into constant dollars of 2017. A household with CHE was assumed when the proportion between OOP and payment capacity was  $\geq 0.40$ . OOP was described by median and interquartile range while CHE was described by weighted proportions and 95% confidence intervals (CIs). To estimate the socioeconomic inequality in CHE we computed the Erreygers concentration index.

**Results:** The median OOP reduced from 205.8 US dollars to 158.7 US dollars between 2008 and 2017. The proportion of CHE decreased from 4.9% (95% CI, 4.5 to 5.2) in 2008 to 3.7% (95% CI, 3.4 to 4.0) in 2017. Comparison of socioeconomic inequality of CHE showed no differences between 2008 and 2017, except for rural households in which CHE was less concentrated in richer households ( $p < 0.05$ ) and in households located on the rest of the coast, showing an increase in the concentration of CHE in richer households ( $p < 0.05$ ).

**Conclusions:** Although OOP and CHE reduced between 2008 and 2017, there is still socioeconomic inequality in the burden of CHE across different subpopulations. To reverse this situation, access to health resources and health services should be promoted and guaranteed to all populations.

**Key words:** Health expenditure, Healthcare disparities, Financial risk sharing, Universal health insurance, Peru

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## INTRODUCTION

The 2005 World Health Assembly stated that everyone has the right to access healthcare and not to suffer financial difficulties by doing so; this right has been included in the Sustainable Development Goals [1]. Governments are concerned about how to finance Universal Health Coverage (UHC) [2], and in low-income and middle-income countries this concern is greater given the difficulties of health systems to meet the diverse needs of the population.

Non-reimbursable payment made by people who use a

health service, known as out-of-pocket payment (OOP), is one of the means of financing a health system. OOP is more frequent in countries that depend on user fees to contain the costs of the system and rationalize the use of health services [3]. However, OOP may be inefficient and can generate inequalities in health access and financing because of the lower capacity of low-income households to pay for health services [4]. These households may incur catastrophic health expenditure (CHE) when high OOP levels exceed a certain proportion of their payment capacity [5].

Globally more than 800 million people incurred in CHE in 2010 [6], and in some countries up to 11.0% of the population suffers from CHE annually [7], thereby accentuating their level of poverty, maintaining the burden of disease and jeopardizing the achievement of UHC by healthcare systems. Policies such as free public health insurance or financing access to health through taxes are some strategies to achieve UHC and reduce CHE [8].

The total health expenditure in Peru is lower than the average in Latin America (5.5% vs. 7.1% of the gross domestic product, respectively). The per capita expenditure in health in 2014 was 656 dollars power parity purchase (PPP), being less than the average spent in other Latin American countries (PPP 1479) [9,10]. OOP represents 31% of total expenditure in health, similar to the Latin America average [9,10].

In Peru, OOP has reduced since 2008 due to substantial increases in prepaid public financing [9,10]. The percentage of people enrolled in any form of health insurance increased from 53.7% in 2008 to 76.4% in 2017 [11]. However, many do not attend outpatient consultations due to insufficient resources to meet aging population and epidemiological transition health needs [12] as well as the dissatisfaction they perceive with the health system [13]. In addition, the fragmented and decentralized health system in Peru may induce inefficiencies, ineffectiveness and commoditization of healthcare [14]. Thus, the health system may not adequately respond to the health needs of socially disadvantaged people, increasing the risk of impoverishment due to OOP. There is evidence of an increase in OPP for medications in previous years [15], and a recent study found that in 2016, 4.0% of Peruvian households had CHE; households with older adults or people with chronic disease [16].

It is important to evaluate OOP and CHE as indicators of health system performance in order to design and implement more comprehensive and equitable health policies. The aim of this study was to describe both OOP and the proportion of Peruvian

households with CHE, as well as to evaluate changes in socioeconomic inequalities in CHE between 2008 and 2017.

## METHODS

### Study Design and Data Sources

We analysed secondary data from the National Household Survey on Living Conditions and Poverty (ENAHO in Spanish) compiled by the National Institute of Statistics and Informatics of Peru (INEI in Spanish), for the years 2008 and 2017 (the last survey available at the time of the study). These years were chosen in order to describe the levels of OOP and the proportion of households with CHE one year before and eight years after the implementation of the UHC policy in 2009, but avoided establishing relationships or assessing the real impact of the UHC policy.

ENAHO is an annual survey that collects information on the living conditions of the Peruvian population. The study population includes the set of all urban and rural households. The survey is based on probabilistic stratified, multistage and independent sampling of areas that is representative at the national, departmental, geographic and urban/rural levels. The databases were obtained anonymously and freely available at the website of the INEI (<http://inei.inei.gob.pe/microdatos/>).

The size of the national sample of households included in ENAHO for the years 2008 and 2017 was 22 640 and 36 996, respectively. After excluding households with missing data, 21 461 (94.8%) and 34 576 (93.5%) households were included in the analysis, respectively.

### Measuring Out-of-pocket and Catastrophic Spending

Among the continuous variables, OOP was the main study variable. To adjust comparisons of OPP among households with different socioeconomic status, CHE (yes/no) was chosen as a second main variable.

In the ENAHO survey, the variable OOP is the sum of all the payments disbursed by a member of the household for the following health services: medical consultation, medicines, medical examinations and laboratory tests (X-rays, tomography, haemodialysis, among others), dental and related services, ophthalmological services (ophthalmology consultations and the purchase of lenses), child healthcare (vaccines, health control), hospitalization, surgical intervention, maternal health (control of pregnancy and delivery care) and other health ser-

vices (contraceptives, rehabilitation, among others). In 2008, the ENAHO did not include payments disbursed for surgical intervention because they are included in hospitalization services.

The reference period for the reported payments were the previous 4 weeks for medical consultation, medicines, medical tests and laboratory tests; the previous 3 months for dental and related services, ophthalmological services, child health-care and other health services; and the previous 12 months for hospitalization, surgical intervention and maternal health.

The monetary values of OOP were converted to constant prices using the consumer price index, taking 2017 as the reference year [17]. The 2017 base year soles were then converted to US dollars (USD) using the average annual exchange rate for 2017 (1 USD = 3.246 soles) [18].

Although there is still no consensus on the definition of CHE, it is widely accepted that CHE should be measured in relation to the household monetary spending capacity [19]. The monetary expenditure capacity of the household is defined as non-subsistence expenditure, which is calculated as the total household expenditure less the expenditure on basic needs.

In this study, we calculated monetary expenditure capacity by subtracting the total annual monetary expenditure from the total annual food expenditure. To estimate CHE in households, the proportion between OOP (numerator) and the monetary expenditure capacity (denominator) of the household was calculated [20-22]. CHE was considered when the proportion was  $\geq 0.40$ . This threshold coincides with other studies that use this methodology [20-22] and estimate CHE in this way [16,19,23]. In addition, to better understand as well as better compare our results, we performed CHE with thresholds of 0.1, 0.2, and 0.3.

## Independent Variables

The independent variables considered were the following: sex of household head, age grouped in years of household head, household size, elderly members in the household, children in the household, household members with chronic conditions, residence area, natural region, any member of the household with health insurance, and poverty level in the household.

## Statistical Analysis

Database integration, processing and statistical analysis were performed using Stata version 14.2 (StataCorp., College Station, TX, USA). All the analyses were carried out considering the characteristics of the sample design of the survey that in-

cluded the factors of expansion (*factor07*) of ENAHO.

Socio-demographic characteristics of the households were described by frequency and weighted proportions analysis. OOP was expressed as median and interquartile range. To describe CHE, the weighted proportion and the 95% confidence interval (CI) were estimated.

To estimate socioeconomic inequality in CHE, we estimated Erreygers concentration indices (ECI) according to the household annual per capita adjusted expenditure as a proxy variable for ordering households according to their level of wealth. This decision was taken because the results of the Pearson correlation coefficient showed a strong relationship between household income and household expenditure ( $r=0.77$ ). Furthermore, since household expenditures are more stable in comparison to household income, the structure of expenditure and consumer spending may reflect the economic well-being of the households [24]. Lastly, INEI and other national institutions jointly estimated the poverty levels using household expenditures [25].

The annual per capita adjusted expenditure was constructed dividing the total annual expenditure of the household by the total number of household members. Then we applied equivalence scales in order to adjust the expenditures of the households due to the size of the household and the age of its members (considering whether they are adults or children). The methodology used has been described elsewhere [26-28].

We calculated the ECI due to the binary characteristics of CHE. ECI has methodological advantages in comparison to the standard concentration index when the outcome variable is dichotomous [29]. Mathematically,

$$ECI(a|y) = \frac{1}{n} \sum_{i=1}^n \left[ \frac{4a_i}{(a^{max} - a^{min})} (2R_i - 1) \right]$$

in which  $a_i \in [a^{min}, a^{max}]$  denotes the variable CHE with the limit values 0 and 1 and  $R_i - 1$  denotes the fractional range of per capita expenditure. The values for any ECI range from -1 to 1, reflecting the variability and strength of the relationship among the variables studied. The values are positive (negative) when there is a greater CHE for households with higher (lower) levels of per capita expenditure.

## Ethics Statement

This study did not require institutional review board ethical approval because it analyses public domain secondary aggre-

gated data that cannot be used to identify the participants surveyed.

## RESULTS

The socio-demographic characteristics of the individuals and households included in the study are described in Table 1. In both years, most of the household heads were male, between 35 years and 54 years of age. In 2008, 74.0% of households had a member with health insurance, while in 2017 this percentage was 88.5%. Non-poor households accounted for 68.8% in 2008 and 82.6% in 2017 (Table 1).

The median OOP decreased from 205.8 USD to 158.7 USD between 2008 and 2017. Non-extremely poor households (-47.3%), extremely poor households (-39.2%) and rural households (-34.1%) showed the greatest reduction in OOP. For both years, the households with the highest median OOP were those located in Metropolitan Lima, non-poor households, households with at least 1 member with chronic disease, and households in the urban area (Table 2).

Households with CHE decreased from 4.9% (95% CI, 4.5 to 5.2) in 2008 to 3.7% (95% CI, 3.4 to 4.0) in 2017. Households with six or more members (-61.9%) and households with children under five years of age (-53.7%) largely reduced CHE during the time span. In 2008, CHE was more frequent in households with elderly members, rural households and households with members with chronic conditions. In 2017, CHE was more frequent in households with elderly members, households with 1 to 3 members, households in rural areas and households without members with health insurance. Gaps in CHE between poor and non-poor households increased from 1.6 to 1.9 percentage points between 2008 and 2017. On the other hand, the gaps decreased from 3.4 in 2008 to 1.8 percentage points in 2017 among urban and rural households (Table 2).

At cut-off points of 0.1, 0.2, and 0.3, CHE was 36.0%, 17.8%, and 9.1%, respectively, in 2008, and 28.1%, 13.2%, and 6.8%, respectively, in 2017 (Supplemental Material 1).

Table 3 shows the concentration index for CHE. For rural households, CHE was less concentrated in richer households in 2017 in comparison to 2008 ( $p < 0.05$ ); and in households located on the rest of the coast in 2017, the concentration of CHE increased in richer households compared to 2008 ( $p < 0.01$ ). For the rest of the subgroups, the comparison of the inequality of CHE did not show any difference between 2008 and 2017. There were no differences in inequality of CHE be-

**Table 1.** Socio-demographic characteristics of the Peruvian households, 2008 and 2017 National Household Surveys on Living and Poverty Conditions (ENAHO in Spanish) surveys

Characteristics	2008 (n = 21 461) <sup>1</sup>	2017 (n = 34 576) <sup>1</sup>
Sex of household head		
Male	16 696 (76.4)	25 042 (70.5)
Female	4765 (23.6)	9534 (29.5)
Age grouped in years of household head (y)		
15-24	655 (3.0)	622 (1.8)
25-34	3417 (15.2)	3919 (11.1)
35-44	5085 (23.2)	6949 (20.2)
45-54	4866 (22.7)	7997 (23.4)
55-64	3546 (17.1)	6831 (20.2)
≥ 65	3895 (18.8)	8258 (23.3)
Household size (n)		
1-3	8719 (40.6)	17 668 (49.7)
4-5	7784 (37.5)	11 916 (35.7)
≥ 6	4958 (21.9)	4992 (14.6)
Elderly members (≥ 65 y) in the household		
No	16 431 (75.7)	24 518 (71.2)
Yes	5030 (24.3)	10 058 (28.8)
Young children (< 5 y) in the household		
No	14 650 (69.7)	26 377 (76.6)
Yes	6811 (30.3)	8199 (23.4)
Household members with chronic conditions		
No	8598 (38.6)	8634 (24.1)
Yes	12 863 (61.4)	25 942 (75.9)
Residence area		
Urban	13 065 (73.7)	21 667 (76.6)
Rural	8396 (26.3)	12 909 (23.4)
Natural region		
Metropolitan Lima	2688 (30.9)	4058 (30.9)
Rest of the coast	5518 (23.4)	10 309 (22.9)
Andean	8764 (33.9)	13 190 (34.2)
Amazon	4491 (11.8)	7019 (12.0)
Any member of the household with health insurance		
No	5548 (26.0)	3809 (11.5)
Yes	15 913 (74.0)	30 767 (88.5)
Poverty level in the household		
Non-poor	13 770 (68.8)	28 119 (82.6)
Poor	7691 (31.2)	6457 (17.4)
Extreme poor	2574 (28.1)	1211 (16.5)
Non-extreme poor	5117 (71.8)	5246 (83.5)

Values are presented as number (%).

<sup>1</sup>Count "number" are unweighted. The proportions include the expansion factor and the complex survey design of ENAHO in both years.

tween 2008 and 2017.

Most of the households classified as poor with CHE reduced

**Table 2.** Trends in the level of OOP and the proportion of CHE in Peruvian households, 2008 and 2017 National Household Surveys on Living and Poverty Conditions (ENAHO in Spanish) survey<sup>1</sup>

Household characteristics	Annual OOP level (USD) <sup>2</sup>			Proportion of household with CHE at 0.4 threshold		
	2008 Median (Q1-Q3)	2017 Median (Q1-Q3)	Percent change in the level of OOP from 2008 to 2017 (%)	2008 % (95% CI)	2017 % (95% CI)	Percent change in CHE from 2008 to 2017 (%)
Total population	205.8 (57.6 - 592.8)	158.7 (39.4 - 488.6)	-22.9	4.9 (4.5, 5.2)	3.7 (3.4, 4.0)	-24.5
Sex of the household head						
Male	207.5 (58.1 - 605.4)	157.1 (39.7 - 497.8)	-24.3	4.8 (4.4, 5.2)	3.5 (3.2, 3.8)	-27.1
Female	200.2 (56.4 - 551.8)	161.1 (39.1 - 463.6)	-19.5	5.0 (4.2, 5.8)	4.3 (3.7, 4.9)	-14.0
Age in grouped years of household head (y)						
15-24	86.08 (32.07 - 246.87)	105.36 (31.42 - 288.04)	22.4	1.7 (0.8, 3.3)	0.5 (0.2, 1.3)	-70.6
25-34	144.14 (46.28 - 389.79)	114.60 (35.12 - 352.12)	-25.9	3.2 (2.5, 4.0)	1.7 (1.2, 2.3)	-88.2
35-44	179.46 (50.75 - 486.43)	132.77 (37.27 - 388.47)	-26.0	3.3 (2.7, 4.0)	1.6 (1.2, 2.0)	-51.5
45-54	240.37 (69.83 - 647.63)	179.60 (48.05 - 532.96)	-25.3	4.0 (3.3, 4.7)	2.3 (1.9, 2.7)	-42.5
55-64	285.85 (75.52 - 775.53)	191.31 (47.75 - 571.80)	-33.1	6.0 (5.1, 7.0)	4.3 (3.7, 5.0)	-28.3
≥65	257.42 (65.77 - 794.21)	162.96 (36.96 - 560.99)	-36.7	8.8 (7.7, 9.9)	7.7 (7.0, 8.5)	-12.5
Household size (n)						
1-3	157.9 (44.2 - 476.7)	118.0 (29.6 - 387.2)	-25.3	5.9 (5.3, 6.5)	5.5 (5.1, 6.0)	-6.8
4-5	231.4 (69.8 - 646.4)	182.4 (55.1 - 540.4)	-21.2	4.2 (3.6, 4.7)	2.1 (1.7, 2.4)	-50.0
≥6	254.6 (72.3 - 686.6)	223.7 (63.8 - 638.4)	-12.1	4.2 (3.5, 4.9)	1.6 (1.2, 2.0)	-61.9
Elderly members (≥65 y) in the household						
No	192.5 (54.4 - 530.3)	149.1 (38.8 - 458.1)	-22.5	3.7 (3.3, 4.1)	2.3 (2.1, 2.6)	-37.8
Yes	275.3 (70.6 - 840.5)	184.8 (41.9 - 583.5)	-32.9	8.6 (7.6, 9.6)	7.3 (6.6, 8.0)	-15.1
Young children (<5 y) in the household						
No	208.7 (56.8 - 609.8)	152.8 (37.3 - 479.4)	-26.8	5.2 (4.8, 5.7)	4.3 (4.0, 4.6)	-17.3
Yes	201.0 (59.3 - 559.5)	172.2 (48.1 - 513.6)	-14.3	4.1 (3.5, 4.7)	1.9 (1.5, 2.3)	-53.7
Household members with chronic conditions						
No	113.7 (35.3 - 342.3)	75.2 (24.6 - 240.0)	-33.9	2.4 (2.0, 2.8)	1.2 (0.9, 1.5)	-50.0
Yes	279.8 (82.4 - 756.8)	193.0 (50.5 - 563.2)	-31.0	6.4 (5.9, 7.0)	4.5 (4.2, 4.9)	-29.7
Residence area						
Urban	261.5 (80.0 - 685.8)	201.5 (56.4 - 565.9)	-22.9	4.0 (3.6-4.4)	3.3 (3.0, 3.6)	-17.5
Rural	74.3 (24.4 - 241.6)	49.0 (13.2 - 176.8)	-34.1	7.4 (6.7, 8.0)	5.1 (4.7, 5.5)	-31.1
Natural region						
Metropolitan Lima	361.8 (122.2 - 891.3)	293.8 (87.5 - 760.6)	-18.8	4.0 (3.2, 4.8)	3.0 (2.4, 3.6)	-25.0
Rest of the coast	207.1 (66.2 - 558.7)	177.4 (55.5 - 497.2)	-14.3	5.0 (4.3, 5.7)	3.9 (3.4, 4.4)	-22.0
Andean	108.8 (29.2 - 361.8)	77.6 (18.8 - 273.9)	-28.7	5.2 (4.7, 5.8)	4.5 (4.1, 4.9)	-13.5
Amazon	145.4 (48.7 - 404.4)	103.8 (30.8 - 301.0)	-28.6	5.8 (5.0, 6.7)	2.9 (2.5, 3.4)	-50.0
Any member of the household with health insurance						
No	162.4 (48.7 - 458.4)	138.3 (37.0 - 408.8)	-14.8	5.6 (4.8, 6.3)	5.1 (4.1, 6.1)	-8.9
Yes	223.3 (63.3 - 641.5)	161.7 (40.4 - 500.9)	-27.6	4.6 (4.2, 5.1)	3.6 (3.3, 3.8)	-21.7
Poverty level in the household						
Non-poor	294.4 (89.3 - 772.3)	195.9 (55.1 - 562.5)	-33.5	5.4 (4.9, 5.8)	4.1 (3.7, 4.4)	-24.1
Poor	75.1 (24.4 - 212.0)	42.5 (12.9 - 130.3)	-43.4	3.8 (3.3, 4.3)	2.2 (1.8, 2.7)	-42.1
Extreme poor	36.5 (13.0 - 95.4)	22.2 (7.4 - 59.1)	-39.2	4.0 (3.1, 4.9)	2.8 (1.6, 4.0)	-30.0
Non-extreme poor	94.6 (30.8 - 247.7)	49.9 (14.8 - 145.7)	-47.3	3.8 (3.2, 4.4)	2.1 (1.6, 2.6)	-44.7

OOP, out-of-pocket payment; CHE, catastrophic health expenditure; USD, US dollar; Q1-Q3, percentile 25 - percentile 75.

<sup>1</sup>Estimations include the factor expansion and the complex survey design of ENAHO for both years.<sup>2</sup>Exchange rate: 1 US dollar=3.246 soles.

**Table 3.** Inequality in the burden of catastrophic health expenditure (CHE) across Peruvian households, 2008 and 2017 National Household Surveys on Living and Poverty Conditions (ENAHO in Spanish) survey

Households characteristics	Concentration index for CHE		p-value
	2008	2017	
Total population	0.001	0.006 <sup>†</sup>	0.371
Sex of household head			
Male	0.000	0.003	0.659
Female	0.006	0.013 <sup>†</sup>	0.561
Age in grouped years of household head (y)			
15-24	-0.022 <sup>†</sup>	0.002	0.080
25-34	0.005	-0.001	0.603
35-44	-0.003	0.005	0.371
45-54	-0.003	-0.001	0.830
55-64	-0.002	0.001	0.826
≥65	0.016	0.027 <sup>***</sup>	0.504
Household size (n)			
1-3	-0.001	0.003	0.639
4-5	0.003	0.007 <sup>†</sup>	0.590
≥6	-0.007	0.000	0.447
Elderly members (≥65 y) in the household			
No	-0.004	0.004	0.116
Yes	0.025 <sup>*</sup>	0.019 <sup>*</sup>	0.688
Young children (<5 y) in the household			
No	0.000	0.002	0.759
Yes	-0.004	0.008 <sup>†</sup>	0.150
Household members with chronic conditions			
No	-0.008 <sup>†</sup>	-0.006 <sup>†</sup>	0.723
Yes	-0.003	0.014 <sup>*</sup>	0.065
Settlement			
Urban	0.015 <sup>***</sup>	0.013 <sup>***</sup>	0.832
Rural	0.065 <sup>***</sup>	0.041 <sup>***</sup>	0.017
Natural region			
Metropolitan Lima	0.022 <sup>***</sup>	0.012 <sup>†</sup>	0.338
Rest of the coast	-0.001	0.027 <sup>***</sup>	0.013
Highlands	0.009	0.009 <sup>†</sup>	0.957
Jungle	0.009	0.139 <sup>*</sup>	0.701
Any member of the household with health insurance			
No	-0.001	0.024 <sup>†</sup>	0.123
Yes	0.002	0.004	0.799

<sup>†</sup>p<0.1, \*p<0.05, \*\*\*p<0.001.

0.5 percentage points or more between 2008 and 2017 (Table 4). In 2008, in La Libertad, San Martín and Pasco, households classified as poor had a higher CHE compared to other households classified as poor in other departments. In 2017, households classified as poor in Tumbes, Puno and Cajamarca had a

**Table 4.** Proportion of household with catastrophic health expenditure according to poverty condition, 2008 and 2017 National Household Surveys on Living and Poverty Conditions (ENAHO in Spanish) survey

Departments	2008		2017	
	Non-poor	Poor	Non-poor	Poor
Amazonas	13.1 (9.7, 16.4)	5.5 (3.1, 7.8)	6.5 (4.7, 8.3)	3.0 (1.2, 4.8)
Ancash	6.9 (4.9, 8.8)	3.5 (1.5, 5.6)	5.8 (4.3, 7.3)	3.2 (1.1, 5.3)
Apurímac	7.8 (4.2, 11.4)	2.6 (1.1, 4.0)	3.8 (2.2, 5.3)	2.2 (0.5, 3.8)
Arequipa	4.4 (2.9, 5.9)	2.6 (0.0, 6.1)	1.9 (1.2, 2.6)	1.5 (0.0, 3.7)
Ayacucho	7.4 (4.7, 10.2)	3.8 (2.1, 5.6)	6.7 (4.9, 8.4)	2.4 (0.7, 4.1)
Cajamarca	11.6 (8.5, 14.7)	6.5 (4.3, 8.6)	6.2 (4.6, 7.7)	3.3 (2.0, 4.7)
Callao	4.9 (2.8, 6.9)	1.9 (0.0, 4.1)	3.6 (2.4, 4.9)	2.2 (0.0, 5.3)
Cusco	5.7 (3.4, 8.0)	1.6 (0.0, 3.0)	4.4 (2.8, 6.0)	0.9 (0.0, 2.0)
Huancavelica	6.9 (3.1, 10.7)	1.4 (0.3, 2.4)	4.0 (2.4, 5.7)	1.3 (0.0, 2.8)
Huanuco	2.9 (1.1, 4.7)	2.4 (1.1, 3.7)	3.9 (2.7, 5.2)	2.9 (1.1, 4.7)
Ica	2.5 (1.4, 3.6)	1.1 (0.0, 2.6)	1.2 (0.0, 1.9)	0.0 (0.0, 0.0)
Junín	4.0 (2.6, 5.3)	3.1 (1.0, 5.1)	5.0 (3.4, 6.6)	1.6 (0.3, 2.9)
La Libertad	6.0 (3.9, 8.1)	10.2 (6.3, 14.1)	5.8 (4.4, 7.3)	2.9 (1.0, 4.8)
Lambayeque	6.4 (4.2, 8.5)	5.7 (1.7, 9.8)	4.0 (2.8, 5.1)	1.9 (0.0, 4.1)
Lima	5.0 (4.0, 5.9)	1.5 (0.0, 2.5)	3.5 (2.8, 4.1)	1.2 (0.0, 2.4)
Loreto	2.0 (0.6, 3.3)	3.2 (1.4, 5.0)	1.5 (0.7, 2.2)	1.3 (0.0, 2.6)
Madre de Dios	1.4 (0.5, 2.3)	2.2 (0.0, 6.6)	1.2 (0.3, 2.0)	0.0 (0.0, 0.0)
Moquegua	2.3 (0.9, 3.7)	1.2 (0.0, 2.9)	2.9 (1.7, 4.0)	0.0 (0.0, 0.0)
Pasco	6.0 (3.1, 8.9)	6.3 (3.6, 9.0)	4.1 (2.6, 5.7)	1.8 (0.2, 3.4)
Piura	5.7 (3.8, 7.7)	5.1 (2.5, 7.8)	5.3 (3.9, 6.7)	1.7 (0.4, 3.1)
Puno	5.2 (2.7, 7.7)	3.7 (1.9, 5.4)	5.3 (3.5, 7.1)	4.0 (0.9, 7.0)
San Martín	10.0 (6.9, 13.2)	7.6 (4.4, 10.7)	5.5 (3.9, 7.0)	1.4 (0.0, 2.7)
Tacna	3.5 (1.8, 5.2)	2.3 (0.0, 5.5)	4.2 (2.8, 5.7)	2.8 (0.0, 6.3)
Tumbes	3.0 (1.6, 4.4)	1.8 (0.0, 4.2)	3.7 (2.2, 5.3)	4.5 (0.0, 9.8)
Ucayali	2.7 (1.3, 4.1)	3.8 (1.2, 6.4)	0.6 (0.0, 1.2)	1.9 (0.2, 3.6)

Values are presented as % (95% confidence interval).

higher CHE compared to other households classified as poor in other departments.

## DISCUSSION

This study provides evidence that both OOP and CHE in Peru decreased between 2008 and 2017. CHE seemed to be concentrated in richer households and the comparison of inequality showed no differences between 2008 and 2017, except for rural households in which CHE became less concentrated in richer households and in households located on the rest of the coast, in which CHE became more concentrated in richer households.

The reduction of OOP, especially in households with social

disadvantage in Peru, goes against the evidence of a growing trend of OOP in Latin America [24] and other countries such as Chile [4]. This reduction may be explained because a larger proportion of poor people, or people without health insurance, increased their access to health through the Comprehensive Health Insurance (CHI), which rose from 17.0% of affiliates in 2007 to 46.3% in 2016 [30]. However, further analysis is required to assess the real impact of CHI in OOP. A second possible explanation is that, even though medications are free of charge, the poorest individuals simply forgo their health needs and health expenses because they cannot afford other expenses such as transportation costs or indirect costs such as income loss due to medical appointments. One study found that 12.9% of Peruvians reported that they did not receive medical care because they did not have money, and 43.1% of people in moderate or extreme poverty claimed that money was a barrier for access to healthcare [31].

The reduction of CHE in Peru was similar to national estimates of a retrospective study worldwide [6], although it differs from the growing trend of CHE in countries in other parts of the world, such as Cambodia [32], Iran [33], India [34], or countries in the region, such as Brazil [35] and Chile [4]. Differences in population characteristics, poverty rates, national income level, economic structure, and payment mechanisms for access to health services may explain the difference in CHE proportions.

The analysis of socioeconomic inequalities showed that the burden of CHE is concentrated in richer households, in contrast to results from Iran [36,37], Brazil [35] or China [38]. This can be explained by the segmentation in health insurance plans in Peru. In one extreme, the poorest people can receive free medication or simply forego healthcare due to incapacity to afford other expenditures. Thus, the lack of economic resources in these individuals prevents CHE. In the other extreme, the richest individuals can afford medicine or purchase private health insurance. However, due to the growing prevalence of diseases that demand long-term treatment and high technological resources, the budgets of even upper middle class individuals can be compromised, incurring CHE. In the middle of these extremes there is a proportion of individuals who are not considered or recognized as poor, and they, therefore, have difficulties applying for insurance. If this individual is a self-employed, non-dependent worker, then access to worker health insurance (Social Health Insurance) is not possible. In addition, if this individual has limited income, then it may not be able to purchase private health insurance [39]. Whatever the case, these individu-

als may fall into the same situation as the poorest individuals.

Our results showed that CHE is dissimilar at a departmental level. CHE in poor households increased from 2008 to 2017 in departments such as Callao, Huanuco, Tacna and Tumbes. Some of these departments report a low supply of human resources and low availability of physical resources such as hospitals or health centres [40]. Inequalities of CHE and in the endowment of human and physical resources across the Peruvian departments reflect the inefficiency and ineffectiveness of the system to deliver health. Therefore, the public health system should implement mechanisms such as financial incentives for redistribution of human and physical resources to guarantee financial protection in each department.

This study has some limitations that must be taken into consideration in order to interpret the results. First, cross-sectional data are used instead of longitudinal data, and therefore, it is not possible to establish causality among the study variables. However, the data are representative at the national level and come from the only survey designed to measure the socioeconomic conditions of the Peruvian population. Second, the questions in the surveys related to the expenditure disbursed for health services may underestimate or overestimate the expenditure estimates because of the different question periods. Third, all expenditure questions were self-referred, and reported values may incur memory recall biases that could affect the accuracy of the information.

Although OOP and CHE decreased between 2008 and 2017, there is still socioeconomic inequality in relation to the burden of CHE across different subpopulations. To reverse this situation, it is necessary to effectively cover all the population, and promote, and guarantee access to health resources and services.

## SUPPLEMENTAL MATERIALS

Supplemental material is available at <https://doi.org/10.3961/jpmph.20.035>.

## CONFLICT OF INTEREST

The authors have no conflicts of interest associated with the material presented in this paper.

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## AUTHOR CONTRIBUTIONS

Conceptualization: AHV, CRR. Data curation: AHV, CRR. Formal analysis: AHV, CRR. Funding acquisition: None. Methodology: AHV, CRR. Visualization: CRR. Writing – original draft: AHV, CRR, RVF, DR. Writing – review & editing: AHV, CRR, RVF, DR.

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