

Social determinants of mammography screening among women aged 50 to 59, Peru 2015

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Abstract

Breast cancer (BC) screening could reduce its mortality; however, its access is influenced by societal forces. Our objective is to identify the social determinants associated with mammography screening (MS) in women aged 50 to 59 in Peru. In this cross-sectional analysis of the Peruvian Demographic Health Survey, 2015, MS within the past two years was evaluated through self-report. Prevalence for MS was 21.9% [95% CI: 18.9 to 25.1]. The average age was 54 years (s.d.:2.5). The higher the socioeconomic status, the higher the prevalence of screening (3.2% vs 41.4% in extreme quintiles, $p<.001$). In the adjusted models, higher socioeconomic status (PR: 5.81, 95% CI: 2.28 to 14.79), higher education level (PR: 2.03, 95% CI: 1.30 a 3,15) and having health insurance from the Ministry of Health (PR: 2.21, 95% CI: 1.28 to 3.82) and EsSalud (PR: 4.37, 95% CI: 2.67 to 7.15), were positively associated with MS. Social inequalities in screening access exist and might translate into inequalities in cancer morbidity and mortality. The Peruvian government urgently needs to improve screening rates in these vulnerable populations.

Keywords: Mammography; screening; breast cancer; social determinants of health; health inequalities; health disparities; Peru

Background

The circumstances in which we live, directly and indirectly, influence the health of the population. These circumstances are known as the social determinants of health, which include structural factors (such as the political and economic context, health policies, development programs, among others) and proximal factors (such as the individual socioeconomic status, education, ethnicity, etc) (WHO, 2007). Health and disease are differentially distributed according to these determinants, which is considered unjust, unfair and unacceptable (WHO, 2007; Artica, 2018; Marmot, 2005).

Among several disadvantages, people in a lower socioeconomic position have less access to health services, a greater burden of disease, poorer quality of life and earlier mortality (Marmot, 2005). Social circumstances can also prevent access to healthcare and measures of primary and secondary prevention. Recently, the Pan American Health Organization released the report of the Commission on Equity and Health Inequalities in the Americas. They showed that countries in the region, such as Peru, still face important socioeconomic inequalities in attending basic health needs, such as access to modern contraception (PAHO, 2019). Previous research has also found considerable socioeconomic gaps in access to cervical cancer screening (Gutiérrez et al, 2010; Paz Soldan et al, 2008). Evidence regarding inequalities in other cancer screening strategies is scarce.

Breast cancer (BC) is the third most frequent cancer in Peru (after cervical and stomach cancer), with an annual incidence of 28 cases per 100 000 inhabitants, which has apparently been increasing in the past decade (Instituto Nacional de Enfermedades Neoplásicas [INEN], 2016; Ghoncheh et al., 2016; Dirección General de Epidemiología [DGE], 2013). Nevertheless, this cancer is usually diagnosed during late stages and early detection through mammography screening (MS) could reduce its mortality (Myers et al., 2015). Prevention guidelines from Peruvian Social Security (EsSalud) recommend a biennial mammogram in asymptomatic women aged 50 to 74 years (Baffigo et al., 2015). The National Plan for the Prevention and Control of Breast Cancer in Peru (2017 - 2021), developed by the Ministry of Health (MoH) recommends biennial MS from 50 to 69 years of age (Ministerio de Salud [MINSA], 2017). These recommendations are similar to those of the World Health Organization (WHO) (biennially in women aged 50 to 69) and those of the Canadian Task Force On Preventive Health Care and the United States Preventive Services Task Force (biennially in women aged 50 to 74) (WHO, 2014; Tonelli et al., 2011; Nelson et al., 2016). However, in Peru, there is evidence of poor mammography coverage, with only one mammography machine for an estimated 30 to 75 thousand women (Ramos et al., 2013). Furthermore, it is likely that access to MS is not similar across all members of society. We have not found Peruvian studies evaluating if there are social inequalities in MS. Therefore, our aim is to evaluate the social determinants associated with MS in the Peruvian female population aged 50 to 59 years.

Methods

Study design and population

We carried out a cross-sectional analysis of the Peruvian Demographic Health Survey (DHS), 2015. The National Institute of Statistics and Informatics (*Instituto Nacional de Estadística e Informática*, INEI) conduct the survey annually and select a nationally-representative sample, through a multistage stratified sampling method (INEI, 2016).

In our secondary data analysis, we included women aged 50 to 59, because that age group benefits from the highest reductions in mortality due to MS and is the target of most prevention guidelines (WHO, 2014; Tonelli et al., 2011; Nelson et al., 2016). We excluded women aged 40 to 49 years because of its controversial recommendation (not consensus), since it is associated with

overdiagnosis and unnecessary treatment (Posso et al., 2015). No women aged 60 or older were asked about MS in the DHS (INEI, 2016).

Dependent variable

We used the self-report of MS within the past two years. It was evaluated through the question: 'Have you ever had a mammography test carried out by a doctor or other health professional?', with three alternatives: 'yes', 'no', and 'do not know'. If they answered 'yes', then they were required to answer: 'How long ago was the last mammography screening?', with three alternatives: 'less than two years ago', 'two or more years ago' and 'Cannot remember'. For the purposes of our study, we generated a dichotomous variable 'Mammography screening within the past two years' (yes vs no) (INEI, 2016).

Independent variables

The independent variables of interest were the following social determinants of health: i) geographical region (Lima Metropolitan Region, rest of the coast, highlands and jungle), ii) residence area (urban or rural), iii) socioeconomic status (wealth index according to the INEI methodology, divided into quintiles) and iv) education (less than high school, complete high school and more than high school). We additionally evaluated health insurance, according to type of coverage: No insurance, Health Insurance of the Ministry of Health (Seguro Integral de Salud, SIS), Health Insurance of the Ministry of Labor (EsSalud), Health Insurance of the Armed and Police Forces and private insurance. We collapsed private and Armed and Police Forces insurance and multiple insurances together because of paucity of observations.

In addition, age (years) and marital status (married/cohabiting, yes vs no) were evaluated as covariates. Being married is associated with a greater performance of mammography and even a group of female population in our country have access to health insurance due to their marital status (Martín-López et al., 2013; Schneider et al., 2014; Cabeza et al., 2007; Hanske et al., 2016).

Data analysis

We performed the data analysis using the statistical package Stata 13.0 (StataCorp, College Station, TX, USA). All analyses considered the multi-stage design of ENDES 2015 (svy module). We used the sample weights and other parameters that were provided by the DHS. The analyses were carried out considering a significance level of 5%.

In the descriptive analysis, we calculated the prevalence of self-reported MS within the past two years and its 95% confidence interval (95% CI). In the bivariate analysis, we compared the prevalence of MS across the different strata of the social determinants of health, using chi-square test. We used generalized linear models of the Poisson family and log link function to calculate crude and adjusted prevalence ratios (PR and aPR) with their respective 95% CI.

In the multivariable models, we analyzed each exposure of interest (rurality, natural region, socioeconomic status, educational level, health insurance) (Nelson, 2016; WHO, 2007; Artica, 2018), adjusted for: i) Model 1: age and marital status; ii) Model 2: Age, marital status and the other exposure variables. We verified the non-existence of multicollinearity between the independent variables.

Ethical aspects

The research protocol was exempted from review by the Research Ethics Committee of the Faculty of Health Sciences of Universidad Peruana de Ciencias Aplicadas (UPC). The analyzed dataset does not contain personal information that allows the participants to be identified and is openly available to the public domain.

Results

From a total of 18,250 women surveyed in the DHS, 13,980 were excluded because they were younger than 50 years of age. Then, 2,462 women were not included because they did not have data for the outcome of interest, which yielded a final sample of 1,808 women ([Figure 1](#)).

Approximately, 21.9% of women reported having undergone MS within the past two years [95%CI: 18.9% to 25.1%]. The average age of the population was 54.1 years (s.d., 2.5). Most women lived in an urban area (75.4%) and had an educational level of primary or less (43.4%). The health insurance coverage was 74.8% and most of them had Ministry of Health insurance. The characteristics of the sample are detailed in [Table 1](#).

When comparing the prevalence of MS according to the evaluated social stratifiers, we found gradients for the measures of socioeconomic position, as well as differences according to rurality and natural region of residence. The prevalence was higher in women of higher socioeconomic status (3.2% in the poorest quintile vs 41.4% in the richest quintile, $p<0.001$) and in women with the highest educational level (10.2% in those who did not complete secondary education vs 44% in those who achieved a higher education, $p<0.001$). Compared to women living in urban areas, those who lived in rural areas were less likely to report the screening (5.1% vs. 27.4%, $p<0.001$). Approximately, 34% of women living in Lima had a mammography, while in other regions of the country, this proportion was less than 20%. The prevalence of the outcome was also higher among women who had health insurance; likewise, there were differences between the different types of insurance. The details of the bivariate analysis can be found in [Table 2](#) and [Figure 2](#).

In the multivariable analysis, we found that women from the highest socioeconomic status were almost six times more likely to report the screening than women at the lowest socioeconomic status, independently of all the other variables [aPR: 5.81; 95% CI: 2.28 to 14.79]. Likewise, compared to those women with no complete high school education, those with higher education were twice as likely to report MS [aPR: 2.03; 95% CI: 1.30 to 3.15]. On the other hand, women who had some type of health insurance were at least twice as likely to report the screening than uninsured participants [SIS-Ministry of Health: aPR: 2.21; 95% CI: 1.28 to 3.82]; [EsSalud: PR: 4.37; 95% CI: 2.67 to 7.15]; [Other: PR: 4.96 95% CI: 2.81 to 8.75]. The results from the multivariable models are found in [Table 3](#).

Discussion

Our results show that approximately 20% of Peruvian women reported having undergone mammography in the past two years; however, this proportion was dramatically different according to socioeconomic status, educational level and health insurance. This shows important avoidable gaps between different strata of the population. The most intuitive explanation to these findings would be to think that these differences are due to inequalities in health provision by the Peruvian health services. And this is a likely scenario given that the country has a highly fragmented health system and that approximately a quarter of the population was uninsured for 2015 (INEI, 2016). However, social inequalities in health are evident in most countries, including those with universal health coverage (Bartley, 2017; CSDH, 2008; Marmot, 2010). Developed and developing countries, with and without universal coverage, have failed to reduce in social inequalities in health (CSDH, 2008; Johar et al., 2018; Li & Shao, 2015; Marmot, 2010; Vieira et al., 2017). Therefore, health services themselves do not seem to explain all the variation in access to healthcare. The World Health Organization states that socioeconomic disadvantage limits access to healthcare through different barriers, not only including those factors that are intrinsically economic, but also work-related restrictions, cultural factors or co-existent illnesses

that can considerably limit access to healthcare (CSDH, 2008; WHO, 2007; Wilkinson & Marmot, 2003).

The percentage of MS found in this study is slightly lower to that of neighboring countries like Chile (22%), Argentina (27%) or Brazil (34%) (Reyes-Ortiz et al., 2006) and way below that of developed countries, such as US (66%), UK (74%), Australia (56%), Italy (59%) and France (44%) (Dowling et al., 2010). While the overall proportion of MS in Peru was around 20%, it was only 3% among women in the lowest wealth quintile. Also, a lower wealth index was one of the strongest determinants that prevented access to MS, even after controlling for potential confounders. Similar findings have been reported in developed countries like Spain, Italy and France, where women with higher incomes were up to 20% to 30% more likely to report the screening. (Martín-López et al., 2013; Damiani et al., 2012; Duport & Ancelle-Park, 2006). In Brazil, Schneider (2014) observed that women in the upper wealth quartile were twice more likely to get a mammogram. As well as Brazil, previous research in samples from Argentina (PAHO, 2010) and Colombia (Castillo-Ávila et al., 2014) have yielded same results. It is important to notice that the strength of the association found in our study is much higher than in those reports. This greater inequality could be due to: i) Different measures of the variable income/wealth, ii) Different categorizations of the variable (quintiles in our study are more sensitive to greater differences than quartiles or binary exposures, like the study by Martín-López (Martín-López et al., 2013), or iii) That a lower socioeconomic status, in Peru, poses greater disadvantage in terms of access to health than in other countries. It is especially remarkable that these differences persist, even after accounting for the level of education, rurality and health insurance, which also influence MS.

We found that MS prevalence was significantly lower in rural areas; however, these differences vanished after controlling for other variables. This is because Peruvian rural populations are more likely to be poor, less educated and uninsured, and the multivariable regression accounted for their confounding effect (Posso et al., 2015). A Korean study found that living in a rural area was positively associated to have ever had a mammogram in women aged 40 to 74 years (Park et al., 2011). However, researchers from Argentina (PAHO, 2010), Brazil (Moreira et al., 2018), Mexico (Agudelo-Botero et al., 2013) and the US (Chandak et al., 2018) have reported a higher mammography uptake among residents of urban areas. Similar patterns have been found in eastern countries (Aminisani et al., 2016; Kulkarni et al., 2018). Better public health policies should be encouraged to achieve equal goals in rural health coverage. The differences we initially found between Lima and the other regions could be similarly explained, given that the Highlands and the Jungle have also a higher proportion of rural, less educated and less wealthy citizens.

Women with higher education were more likely to have had a mammography in the previous two years. This was also found in a systematic review of studies from North America and Europe (Damiani et al., 2015), where a high educational level was positively associated with MS. Research conducted in South American countries has yielded similar results (Schneider et al., 2014; PAHO, 2010; Castillo-Ávila et al., 2014). In contrast, Documèt (2015) and Kwok (2014) did not find significant differences between education and mammography. Their findings could be explained by the existence of lower inequalities, due to better social policies in their respective countries. Peru still has difficulties to guarantee education in the poorest and most remote areas, and improving this indicator could potentially reduce inequalities in access to screening and other health services (Cárdenas et al., 2017; De la Torre-Ugarte-Guanilo & Oyola-García, 2014; MINSA, 2017).

Health insurance should be universal according to the WHO, but poor coverage of Peruvian population persists, which significantly limits their access to health care. Health coverage is associated with a higher rate of mammograms compared to those that do not have insurance, as found by Aminisani (2016), Documèt (2015), Calo (2016), Henry (2014) and in our study. There were also differences between types of insurance. Those covered by EsSalud and Private/Police

and Armed forces were more than four times more likely to report MS. In Latin America, studies shows that women without health insurance are less likely to access MS than those who have insurance (Agudelo-Botero et al., 2013; Castillo-Ávila et al., 2014; Charry et al., 2008; Moreira et al., 2018; PAHO, 2010). Along with the lack of health insurance, the main barriers to accessing health care are financial problems, and poor health literacy (Mezones-Holguin et al., 2019; Soto, 2019), and these gaps are much wider if we look for vulnerable populations, whether in Peru (DGE, 2012) or other countries (Olorunsaiye et al., 2020; Olukotun et al., 2019; Steiness et al., 2018). Health policies must also focus on these barriers when planning to reduce health inequalities. In the case of Peru, there have been certain reforms in national health policies (Mezones-Holguin et al., 2019); but these had only led to modest improvements in cancer mortality and recent survival trends (Poma, 2017; Tamayo et al., 2018; Zafra-Tanaka et al., 2020). This could be explained by late diagnosis and treatment due to the lack of timely screening (Marmot, 2017).

We could argue that guaranteeing access to a universal health insurance might not be enough to reduce inequalities. There are deficiencies in our national health services (most importantly in important segments of the public sector, such as the Ministry of Health). These include a low supply of general and specialized human resources for health, (Zevallos et al., 2011) as well as poor infrastructure to cover health care needs (Soto, 2019). It is also important to note that Peru does not have enough equipment in all regions and there is a deficit of mammographs, especially in the less wealthy provinces. According to the latest data (MINSA, 2017), Peru has 202 establishments with mammographs, and approximately of them belong to the private sector. From the 52 mammographs of the Ministry of Health (biggest provider of the public sector), only 37 would be operational by that date and most of them would be in the capital, Lima. On the other hand, Argentina (INC, 2018), with a population approximately 40% higher than the Peruvian population, had 377 mammograms were registered, only in the public sector.

The study has limitations to consider. First, we cannot infer that reporting MS in the past two years means the recommended continuous biennial screening. Second, self-report might be subject to measurement bias, as they may not remember accurately. However, breaking the assessment of the variable into two questions (one for the occurrence and one for the timing) might reduce this problem. Third, Peruvian DHS did not evaluate a potential confounder, which is parity. Nulliparous women are more likely to develop BC and, therefore, could be targeted with preventive measures, such as screening. Also, nulliparity is more common among urban, richer and more educated women. This might probably have reduced the strength of the associations we have found. However, we did control for a proxy of this variable (marital status).

Conclusion

In conclusion, one in every five Peruvian women aged 50 to 59 years reported MS within the past two years. Women from lower socioeconomic status, lower education and uninsured women were less likely to report having had screening. Inequalities in access to screening services might potentially translate into inequalities in cancer morbidity and mortality. Thus, we strongly recommend that government authorities pay attention to our results for the execution of future health policies to reduce these inequalities. Interventions must target these vulnerable populations.

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Figure 1. Selection of participants, Peruvian women aged 50-to-59-year-old interviewed by the Demographic Health Survey, 2015.

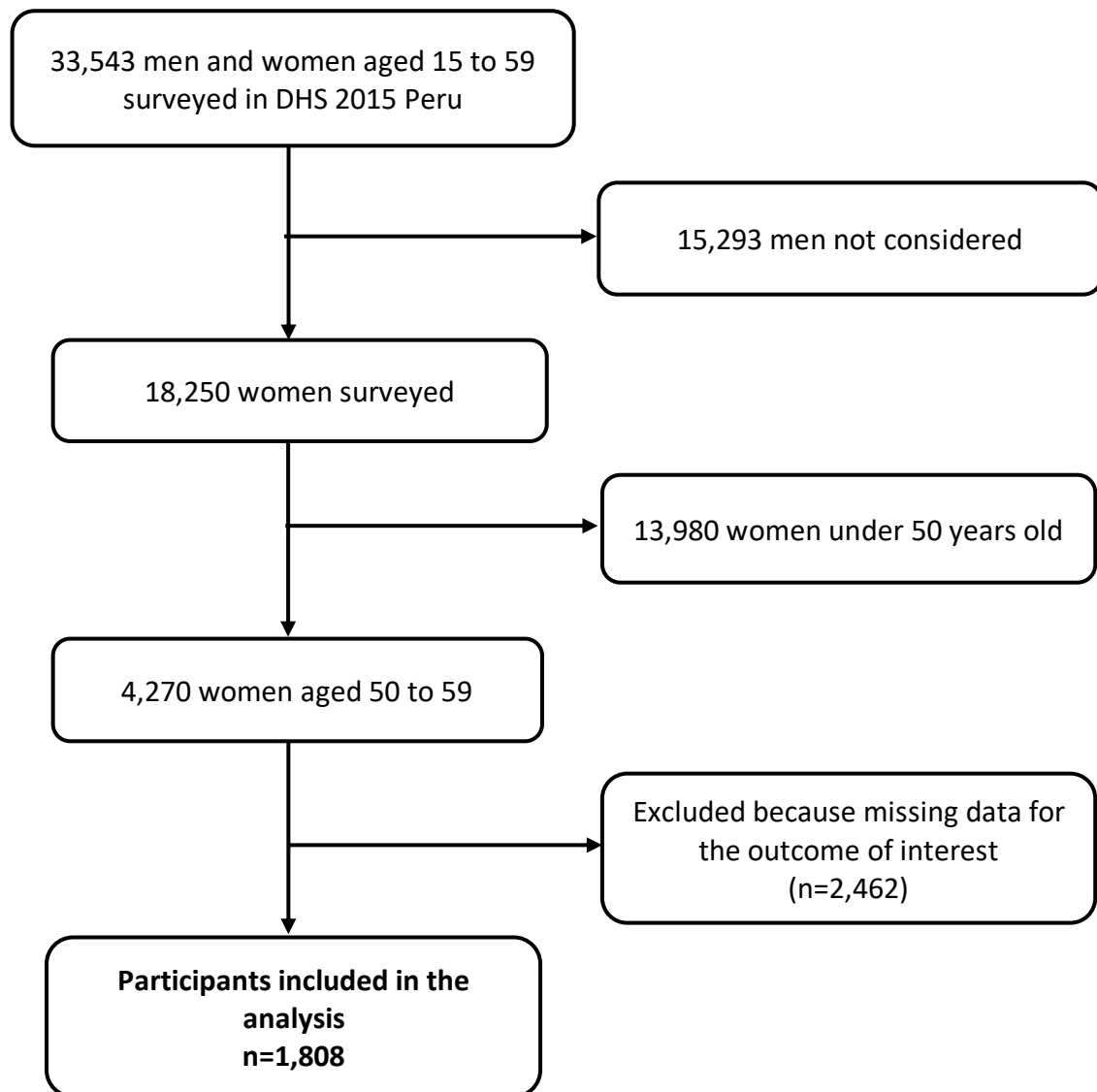


Figure 2. Prevalence of mammography screening within the past two years according to different social stratifiers among women aged 50 to 59 years, Peru 2015.

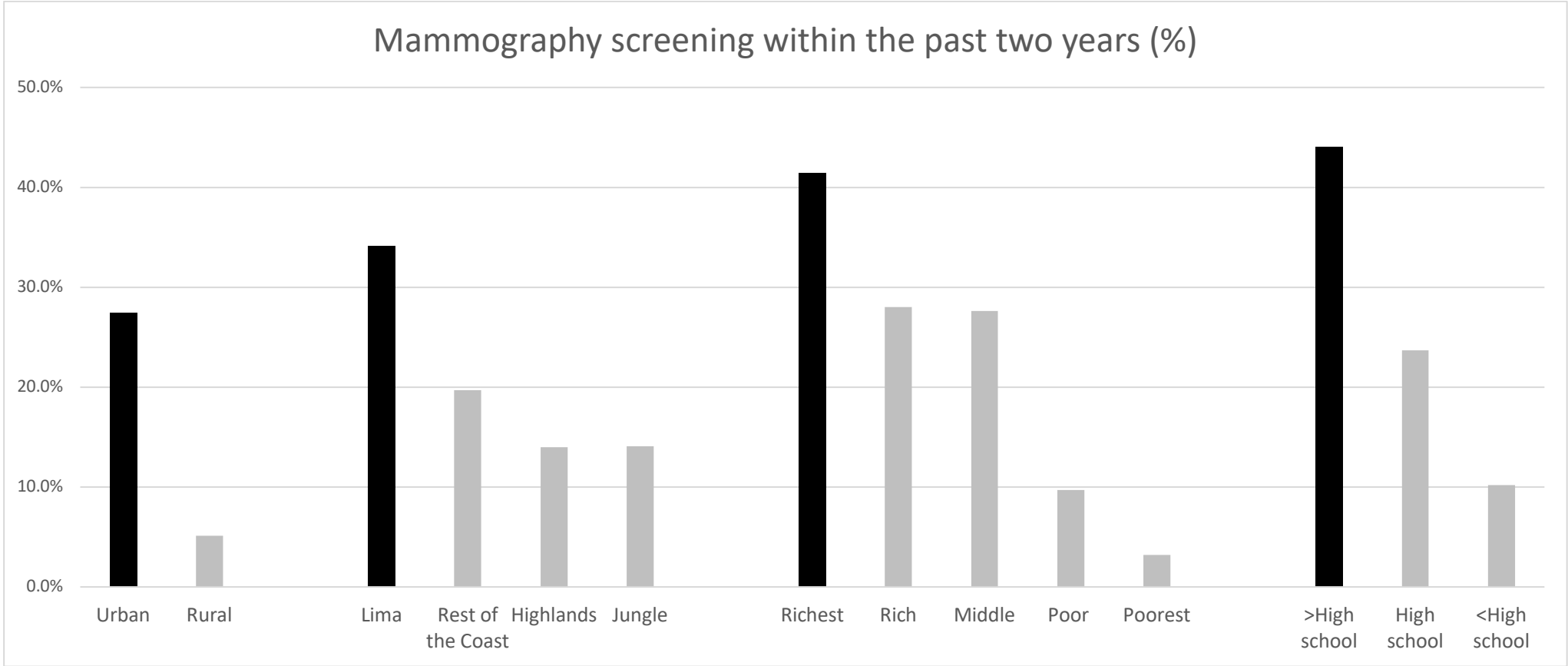


Table 1. Sociodemographic characteristics of women from 50-to-59-years-old, Peruvian Demographic Health Survey 2015. (N=1,808)

Characteristics	n^a	%
Age, years (mean, s.d.)	54.1, 2.5	
Married/cohabiting	1,185	64.9
Area		
Urban	1,171	75.4
Rural	629	24.6
Natural region		
Lima	206	31.4
Rest of the coast	552	26.8
Highlands	652	30.1
Jungle	398	11.7
Socioeconomic status		
Poorest	491	19.5
Poor	427	21.3
Middle	331	17.0
Rich	322	22.2
Richest	237	20.0
Education level		
None/Primary school	820	43.4
High school	478	29.5
Higher education	320	27.1
Health Insurance		
None	407	25.2
SIS-Ministry of Health	930	44.0
EsSalud	420	26.9
Police and Armed Forces	34	2.3
Private	3	0.2
More than one	14	1.4
Mammography screening (<2 years)	329	21.9

^a Different total due to missing values.

All proportions consider the complex sampling design.

Table 2. Social determinants associated with mammography screening within the past two years in women aged 50 to 59 years, Peru 2015: bivariate analysis.

Characteristics	Mammography screening within the past 2 years				<i>p</i> ^b
	No		Yes		
	n ^a	%	n ^a	%	
Age, years (mean, s.d.)	54.1 / 2.5		54.2 / 2.2		0.781 ^c
Married/cohabiting					0.652
No	512	77.2	111	22.8	
Yes	967	78.6	218	21.4	
Area					<0.001
Urban	886	72.6	288	27.4	
Rural	593	94.9	41	5.1	
Natural region					<0.001
Lima	132	65.9	74	34.1	
Rest of the coast	441	80.3	111	19.7	
Highlands	566	86.0	86	14.0	
Jungle	340	85.9	58	14.1	
Socioeconomic status					<0.001
Poorest	472	96.8	19	3.2	
Poor	382	90.3	45	9.7	
Middle	260	72.4	71	27.6	
Rich	226	72.0	96	28.0	
Richest	139	58.6	98	41.4	
Education level					<0.001
<High school	747	89.8	73	10.2	
High school	366	76.3	112	23.7	
>High school	184	56.0	136	44.0	
Health Insurance					<0.001
None	372	92.6	35	7.4	
SIS-Ministry of Health	842	87.4	88	12.6	
EsSalud	236	54.4	184	45.6	
Others	29	44.0	22	56.0	

^a Different total due to missing values.

^b chi²

^c Mean difference

All proportions consider the complex sampling design.

Table 3. Social determinants associated with mammography screening within the past two years in women aged 50 to 59 years, Peru 2015: crude and adjusted analysis.

Social stratifiers ^a	Crude model		Model 1 ^b		Model 2 ^c	
	PR	95%CI	aPR	95%CI	aPR	95%CI
Area						
Urban	1	Ref	1	Ref	1	Ref
Rural	0.18	0.12 to 0.27	0.18	0.12 to 0.27	0.97	0.54 to 1.76
Natural region						
Lima	1	Ref	1	Ref	1	Ref
Rest of the coast	0.57	0.41 to 0.80	0.57	0.41 to 0.80	0.82	0.60 to 1.11
Mountain range	0.41	0.28 to 0.58	0.41	0.28 to 0.59	0.80	0.56 to 1.12
Jungle	0.41	0.27 to 0.61	0.41	0.27 to 0.61	0.80	0.54 to 1.20
Socioeconomic status						
Poorest	1	Ref	1	Ref	1	Ref
Poor	3.04	1.59 to 5.80	3.02	1.59 to 5.76	2.57	1.14 to 5.80
Middle	8.65	4.77 to 15.67	8.63	4.76 to 15.66	5.79	2.39 to 14.02
Rich	8.79	4.89 to 15.80	8.76	4.88 to 15.74	4.63	1.85 to 11.60
Richest	13.00	7.37 to 22.93	12.96	7.34 to 22.88	5.81	2.28 to 14.79
Education level						
<High school	1	Ref	1	Ref	1	Ref
High school	2.32	1.54 to 3.50	2.34	1.56 to 3.53	1.37	0.89 to 2.11
>High school	4.33	3.03 to 6.18	4.45	3.12 to 6.35	2.03	1.30 to 3.15
Health Insurance						
None	1	Ref	1	Ref	1	Ref
SIS-Ministry of Health	1.71	1.00 to 2.93	1.72	1.00 to 2.94	2.23	1.29 to 3.85
EsSalud	6.18	3.87 to 9.86	6.26	3.91 to 10.01	4.37	2.67 to 7.15
Others	7.59	4.36 to 13.20	7.86	4.49 to 13.75	4.96	2.81 to 8.75

^a All results consider the complex sampling design.

^b Model 1: Each social determinant, separately, adjusted by age and marriage/cohabitation status.

^c Model 2: Final model with all the social determinants included in the table, in addition to the variables age and marriage/cohabitation status.

PR: Prevalence ratio; aPR: adjusted prevalence ratio