Hernández-Vásquez A, Visconti-Lopez FJ, Solorzano-Salazar DM, Barrenechea-Pulache A. Prevalence and factors associated with self-medication for COVID-19 prevention using disproven drugs in Peru: A cross-sectional nationwide study. Pharmacy Practice 2023 Oct-Dec;21(4):2877.

https://doi.org/10.18549/PharmPract.2023.4.2877

Original Research

Prevalence and factors associated with self-medication for COVID-19 prevention using disproven drugs in Peru: a cross-sectional nationwide study

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Received (first version): 04-May-2023 Accepted: 07-Jul-2023 Published online: 13-Oct-2023

Abstract

Objective: The objective of this study was to identify the prevalence and factors associated with the use of drugs without evidence for the prevention of COVID-19 in Peruvians without symptoms or diagnosis, using the National Household Survey (ENAHO) 2021. **Methods:** A secondary analysis was made of the ENAHO 2021. We evaluated participants older than 18 years who did not undergo any test to diagnose COVID-19 and used any drug to prevent COVID-19. Adjusted prevalence ratios (aPRs) were estimated to determine the associated factors. **Results:** Among the 69,815 participants analyzed, the prevalence of taking a drug 4 weeks prior to the survey was 5.64%. Factors associated with drug consumption were: age 30-59 years (aPR 1.47; 95% confidence interval [CI]: 1.32-1.65); having a higher education (aPR 1.73; 95% CI:1.28-2.33); having a chronic disease (aPR 1.40; 95% CI: 1.26-1.56); not having poverty status (aPR 1.40; 95% CI: 1.26-1.56); living in an urban area (aPR 1.61; 95% CI: 1.31-1.99). Meanwhile, living in the highlands (aPR 0.77; 95% CI: 0.60-0.97) and not having a landline, cell phone, television or internet at home (aPR 0.65; 95% CI: 0.43-0.98) were protective factors from unnecessary drug consumption. **Conclusion:** It is concerning that even after one year of living with the pandemic and having refuted the utility of medications such as ivermectin and azithromycin, these drugs are still widely consumed by a sector of the population without symptoms or a diagnosis of COVID-19. Therefore, it is necessary to formulate and implement public health measures that address this problem, considering the associated factors to reduce this consumption.

Keywords: Peru; COVID-19; self-medication; cross-sectional studies; humans; nonprescription drugs

INTRODUCTION

Worldwide, the coronavirus disease 2019 (COVID-19) pandemic has caused more than 624 million cases and at least 6.5 million deaths as of October 26, 2022.[1] After official recognition of the first case in March 2020, the Peruvian State, like many other countries, declared a state of national emergency, establishing a mandatory nationwide quarantine and closing borders.[2] However, despite implementing one of the earliest, most restrictive and lasting measures (e.g., including the complete halt of "non-essential" business), since mid-2021, Peru has positioned itself as the country with the highest number of deaths per million inhabitants (5,551) and the highest fatality rate in the world (5.2%).[3,4]

After the identification of this new virus, the production and dissemination of information regarding the prevention and treatment of COVID-19 increased exponentially,[5] leading to the spread of rumors and false news regarding the prevention and management of COVID-19.[6] Far from being favorable, some of this information turned out to be harmful to health, including the use of drugs without evidence, which were both self-medicated and recommended by health professionals.[7] An iconic case was hydroxychloroquine, which was proposed as an alternative to treat COVID-19 in a study published in a prestigious journal and was later retracted.[8] The exposure of the general population to disinformation was widespread across much of South America and the consequent misuse of antibiotics has now been proposed as the cause of the recent increases in antibiotic resistance in the region.[9]

In Peru, there is little compliance with the regulations for the control of the purchase of prescription medication.[10] This was enhanced during the pandemic due to growing fear of infection and numerous news reports related to different medications as possible preventive options. In a series of 132 patients in a reference hospital in Lima (capital of Peru) it was found that prior to hospitalization, many had self-medicated with antibiotics (28.3%), ivermectin (20.7%) and corticosteroids (17%). While corticosteroids are indeed still part of the current treatment strategy, it is only recommended for hospitalized patients that require oxygen.[11,12] The Peruvian Ministry of Health itself recommended unproven pharmacological treatment of COVID-19 in an attempt to control the infection, and even resorted to the distribution of medical kits for

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www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

https://doi.org/10.18549/PharmPract.2023.4.2877

COVID-19 that contained ivermectin, hydroxychloroquine, azithromycin and paracetamol.[13] Thus, among the chaos and despair, the population chose to consume drugs without indication to prevent or treat COVD-19.[14,15]

Globally, multiple studies have focused on self-medication for the treatment of patients with COVID-19, but few studies have addressed the prevention of this virus.[16-18] In the Peruvian population, several small studies have described prevention and self-medication practices against COVID-19; however, they used online surveys distributed via social networks that are not nationally representative.[19,20] Therefore, the objective of this study was to identify the prevalence and factors associated with the use of drugs that were once speculated to be useful but have since been disproven for the prevention of COVID-19 among Peruvians without symptoms or diagnosis of this disease, using information from the National Household Survey (ENAHO, acronym in Spanish) 2021. Our findings will provide insight into the characteristics of individuals who still consume preventive medication in neighboring Latin American countries with similarly disarticulated health care systems and low levels of scientific literacy.[21]

METHODS

Design and study population

We performed an analytical cross-sectional study of the ENAHO 2021 survey carried out by the National Institute of Statistics and Informatics (INEI, acronym in Spanish). The survey was conducted from January to December 2021.[22] The ENAHO is a survey that provides information on the evolution of poverty, well-being and living conditions of households and the Peruvian population.[22] It is carried out at a national level, in urban and rural areas, across all 24 departments of the country and in the constitutional province of Callao. Its target population is composed of private homes in urban and rural areas of Peru. It employs a stratified, multistage and independent sampling technique which ensures representativity within each study department.[22] Its sample size is 36,856 private dwellings, 24,064 of which correspond to the urban area and 12,792 dwellings to the rural area.[22]

Due to the state of national health emergency decreed by the government in response to COVID-19, ENAHO 2021 was conducted in the mixed interview modality, which consisted of an initial face-to-face interview and was complemented by a telephone interview by previously trained interviewers. Further specifications on the sample design, objectives, procedures, and data collection can be found in the ENAHO 2021 technical sheet.[22]

For the present study, data from adult participants aged 18 or over considered as members of the household (residents of 30 days or more in the household) in the ENAHO 2021 were included, and participants with missing data in the variables of interest were excluded.

Variables and measurements

The main study variable was the use of currently disproven medication (ivermectin, azithromycin, hydroxychloroquine, or chloroquine) to prevent COVID-19 in Peruvian adults who had not had any symptoms of COVID-19 stated in the questionnaire as: "COVID-19 symptoms (fever, dry cough, shortness of breath)" and had not undergone any test to rule out COVID-19, both within the timeframe of the 4 weeks prior to the survey. The variable was considered as "Yes" in the event of an affirmative response to any of the following questions: Was the medication you took: chloroquine? Was the medication you took: hydroxychloroquine? Was the medication you took: ivermectin? Was the medication you took: azithromycin?

Literature on factors associated with drug use to prevent or treat COVID-19 was used.[18,20,23,24] Thus, the independent variables considered in the study and available in the ENAHO 2021 were: sex, age groups, educational level, ethnicity, chronic illness, physical or psychological limitation, poverty status, having health insurance, natural region of residence, area of residence and home with landline, cell phone, TV or internet. Sex was classified as male and female. The age of the participants was classified into the age groups of 18 to 29 years, 30 to 59 years and 60 years or more considering the life stages established by the Ministry of Health of Peru.[25] The educational level was classified as no education or primary education, secondary education and higher education. Ethnicity was classified as non-native and native based on the question: Based on your ancestors and traditions, do you consider yourself native or non-native? The non-native category included individuals who considered themselves white, mestizo, black/brown/zambo/mulatto/Afro-Peruvian or others, while the native category included responses from Quechua, Aymara, native or indigenous persons from the Amazon or individuals belonging to another indigenous people. Chronic disease was classified as yes and no, being yes when the person responded affirmatively to the question of whether they had any chronic disease or discomfort? The presence of physical or psychological limitation was considered as "Yes" when an affirmative answer was given to any of the following six questions: Do you have permanent limitations in moving or walking, or in using your arms or legs? Do you have permanently limited vision, even with glasses? Do you have a permanent limitation in speaking or communicating, or do you use sign or another language? Do you have permanently limited hearing, even with hearing aids? Do you have permanent limitations in understanding or learning? Do you have permanent limitations in relating to others, your thoughts, feelings, emotions or behaviors? Poverty and non-poverty were classified based on the household poverty classification, which is calculated based on household spending. The holding of health insurance was classified as "No" and "Yes" depending on whether the person stated that they were affiliated with any type of health insurance at the time of the survey. The natural region of residence was classified as jungle, highlands and coast based on the geographical characteristics of the Peruvian territory, and the area of residence was classified as rural and urban. Finally, a household was classified as having a landline, cell phone, television or internet and "No" otherwise.

Statistical analysis

For the statistical analysis, the Stata 17.0 statistical program

https://doi.org/10.18549/PharmPract.2023.4.2877

(Stata Corp LLC, College Station, TX, USA) was used. The characteristics of the participants and the drugs used were described using absolute frequencies and weighted proportions with their 95% confidence intervals (95% CI). To compare the study variables, the Chi-square test with Rao-Scott correction was used. Associations were then estimated using prevalence ratios (PR) and 95% CI between COVID-19 medication consumption and independent variables using crude and adjusted Poisson lineal generalizable models based on a logarithmic link. The inclusion of variables in the adjusted model considered variables that were statistically significant in the crude analysis. Multicollinearity with variance inflation factor of less than ten was checked before multivariable regression analysis was done. Additionally, a sub-analysis of factors associated with the use of disproven drugs for the prevention of COVID-19 according to the area of residence was performed. All estimates took into account the complex design and expansion factor of the ENAHO 2021 via the svy command. A p value = 0.05 was considered significant.

Ethical considerations

This study used secondary data from the ENAHO 2021, which does not include personal information that allows the identification of the participants. Therefore, ethics committee approval was not sought. The ENAHO 2021 databases are freely accessible and can be found at the following link: http://iinei.inei.gob.pe/microdatos/.

RESULTS

After applying inclusion and exclusion criteria, 69,815 individuals who participated in ENAHO were finally included (Figure 1). Among the participants, 53.2% were female, 52.4% were aged between 30 and 59 years, 41.7% had a secondary education, 72.5% reported having a non-native ethnicity, 51.1% had a chronic disease, 93.9% had no physical disability, 77.5% did not live in poverty, 57.9% lived in the jungle, 80.1% lived in an urban setting, and only 3.4% lived in a household with no landline, TV, cell phone or internet (Table 1).

Of the total number of participants, 3,934 (5.64%) reported that in the 4 weeks prior to the survey they had not had COVID-19 symptoms or undergone a diagnostic test for SARS-CoV-2 but had taken some medication to prevent COVID-19 (Table 3). The drugs most consumed were ivermectin (89.3%) and azithromycin (27.3%) (Table 2).

Among the variables included, the categories associated with the highest probability of consumption were having a secondary education (40.7%, respectively); residents of the coast (70.6%); with some chronic disease (59.9%); without poverty status (88%); residents of an urban area (91.1%); participants aged 30-59 (57.5%); non-natives (79.8%); female gender (51.1%); no physical or psychological limitation (98.5%); and those who had a landline, cell phone, TV or internet at home (98.7%) (Table 3).

All the variables included in the crude analysis were significantly associated with the probability of taking drugs to prevent COVID-19, except for having health insurance (p = 0.954). In the adjusted analysis, the variables associated with a higher probability of taking medications to prevent COVID-19 were the age group, mainly participants aged 30-59 (adjusted Prevalence Ratio [aPR] 1.47; 95% CI: 1.32-1.65); a higher educational level (aPR 1.73; 95% CI: 1.28-2.33); the presence of any chronic disease (aPR 1.40; 95% CI: 1.26-1.56); non-poverty status (aPR 1.40; 95% CI: 1.26-1.56); and residents of an urban area (aPR 1.61; 95% CI: 1.31-1.99). On the other hand, the variables associated with the lower probability of consuming drugs to prevent COVID-19 were being female (aPR 0.90; 95%

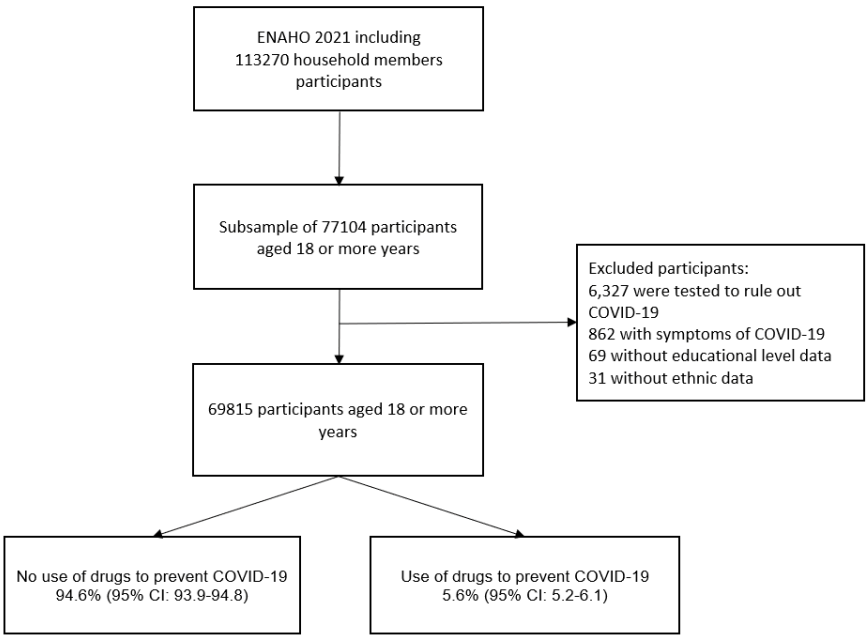

Figure 1. Flowchart of participants included in the study

https://doi.org/10.18549/PharmPract.2023.4.2877

CI: 0.83-0.97); highland residents (aPR 0.77; 95% CI: 0.60-0.97); and participants in homes without a landline, cell phone, TV or internet (aPR 0.65; 95% CI: 0.43-0.98) (Table 4).

Table 1. Characteristics of the adults included in this study, ENAHO 2021

Characteristic	Absolute frequency (*n*=69,815)	%* (95% CI)
Gender		
Male	32,766	46.8 (46.4-47.1)
Female	37,049	53.2 (52.9-53.6)
Age group (years)		
18-29	16278	24.4 (23.9-24.9)
30-59	36595	52.4 (51.8-53.0)
60 or more	16942	23.2 (22.6-23.8)
Educational level		
None or elementary school	4,444	5.5 (5.3-5.8)
Primary education	19,565	25.1 (24.5-25.7)
Secondary education	26,120	40.7 (39.9-41.4)
Higher education	19,686	28.7 (28.0-29.5)
Ethnicity		
Non native	48,629	72.5 (71.4-73.6)
Native	21,186	27.5 (26.4-28.6)
Chronic disease		
No	33,981	48.9 (48.2-49.7)
Yes	35,834	51.1 (50.3-51.8)
Physical or psychological limitation		
No	65,070	93.9 (93.5-94.2)
Yes	4,745	6.1 (5.8-6.5)
Poverty status		
Poverty	14,393	22.5 (21.5-23.5)
No poverty	55,422	77.5 (76.5-78.5)
Has health insurance		
No	13,958	22.1 (21.4-22.7)
Yes	55,857	77.9 (77.3-78.6)
Natural region of residence		
Jungle	14,592	11.3 (10.4-12.1)
Highlands	24,270	30.8 (29.4-32.3)
Coast	30,953	57.9 (56.4-59.5)
Area of residence		
Rural	23,572	19.9 (19.2-20.5)
Urban	46,243	80.1 (79.5-80.8)
Home with landline, cell phone, TV or internet		
Yes	66,563	96.6 (96.4-96.9)
No	3,252	3.4 (3.1-3.6)

*The weighting factor and sample specifications of ENAHO were included.
ENAHO: Encuesta Nacional de Hogares. TV: Television. CI: Confidence Interval.

Table 2. Summary of the drugs consumed (*n*=3934)

Drugs	%* (95% CI)
Chloroquine	1.0 (0.7-1.6)
Hydroxychloroquine	1.3 (0.9-2.0)
Ivermectin	89.3 (87.6-90.9)
Azithromycin	27.3 (24.7-30.0)

* The weighting factor and sample specifications of ENAHO were included
ENAHO: Encuesta Nacional de Hogares. CI: Confidence Interval.

Table 3. Frequency of drug use to prevent COVID-19 among adults by background characteristics, ENAHO 2021.

Characteristics	Consumption of drugs to prevent COVID-19		
	No (*n*=65881) %* (95% CI)	Yes (*n*=3934) %* (95% CI)	P-value**
Overall	94.4 (93.9-94.8)	5.6 (5.2-6.1)	
Gender			
Male	46.6 (46.2-47.0)	48.9 (46.9-50.9)	0.031
Female	53.4 (53.0-53.8)	51.1 (49.1-53.1)	
Age group (years)			
18-29	24.7 (24.2-25.2)	19.1 (17.5-20.9)	<0.001
30-59	52.1 (51.5-52.7)	57.5 (55.2-59.8)	
60 or more	23.2 (22.6-23.8)	23.3 (21.1-25.8)	
Educational level			
None or elementary school	5.7 (5.4-5.9)	2.9 (2.2-3.9)	<0.001
Primary education	25.5 (24.9-26.1)	17.7 (16.1-19.5)	
Secondary education	40.6 (39.9-41.3)	41.7 (39.3-44.1)	
Higher education	28.2 (27.5-29.0)	37.7 (35.0-40.4)	
Ethnicity			
Non native	72.1 (70.9-73.2)	79.8 (77.3-82.2)	<0.001
Native	27.9 (26.8-29.1)	20.2 (17.8-22.7)	
Chronic disease			
No	49.5 (48.7-50.2)	40.1 (37.5-42.8)	<0.001
Yes	50.5 (49.8-51.3)	59.9 (57.2-62.5)	
Physical or psychological limitation			
No	93.8 (93.4-94.1)	95.5 (94.1-96.6)	0.016
Yes	6.2 (5.9-6.6)	4.5 (3.4-5.9)	
Poverty status			
Poverty	23.1 (22.1-24.1)	12 (10.0-14.4)	<0.001
No poverty	76.9 (75.9-77.9)	88 (85.6-90.0)	
Has health insurance			
No	22.1 (21.4-22.8)	22.0 (19.7-24.4)	0.954
Yes	77.9 (77.2-78.6)	78.0 (75.6-80.3)	
Natural region of residence			
Jungle	11.3 (10.5-12.2)	10.1 (8.1-12.5)	<0.001
Highlands	31.5 (30.0-33.0)	19.3 (16.7-22.2)	
Coast	57.2 (55.6-58.7)	70.6 (67.1-73.9)	

https://doi.org/10.18549/PharmPract.2023.4.2877

Area of residence			
Rural	20.5 (19.8-21.2)	8.9 (7.7-10.4)	<0.001
Urban	79.5 (78.8-80.2)	91.1 (89.6-92.3)	
Home with landline, cell phone, TV or internet			
Yes	96.5 (96.3-96.7)	98.7 (98.1-99.2)	<0.001
No	3.5 (3.3-3.7)	1.3 (0.8-1.9)	

Data are shown as weighted % of the row unless otherwise indicated.
* The weighting factor and sample specifications of ENAHO were included.
** Estimated P-value using the Chi-square test with Rao-Scott adjustment.
ENAHO: Encuesta Nacional de Hogares. TV: Television. CI: Confidence Interval.

Factors associated with the use of preventive COVID-19 drugs by area of residence

The factors associated with a higher prevalence of consumption of disproven drugs for COVID-19 prevention were the same as those identified in the non-stratified analysis. However, there was a greater aPR of consumption of these drugs for rural residents with a higher education (aPR 4.62; 95% CI: 2.83-7.53) those with a non-poverty status (aPR 2.07; 95% CI: 1.55-2.77) and those living in the coast (aPR 2.01; 95% CI: 1.33-3.03). Meanwhile, the protective factors for consumption of these drugs were female sex (aPR 0.89; 95% CI: 0.82-0.97) in an

Table 4. Factors associated with drug use to prevent COVID-19 among adults, ENAHO 2021

Variable	Crude		Adjusted*	
	PR (95% CI)	P-value	aPR (95% CI)	P-value
Gender				
Male	Reference		Reference	0.007
Female	0.92 (0.85-0.99)	0.031	0.90 (0.83-0.97)	
Age group (years)				
18-29	Reference		Reference	
30-59	1.40 (1.25-1.56)	<0.001	1.47 (1.32-1.65)	<0.001
60 or more	1.28 (1.10-1.50)	0.001	1.43 (1.22-1.67)	<0.001
Educational level				
None or elementary school	Reference		Reference	
Primary education	1.34 (1.01-1.79)	0.042	1.10 (0.84-1.45)	0.476
Secondary education	1.95 (1.45-2.63)	<0.001	1.45 (1.08-1.94)	0.013
Higher education	2.49 (1.84-3.37)	<0.001	1.73 (1.28-2.33)	<0.001
Ethnicity				
Non native	Reference		Reference	0.213
Native	0.67 (0.58-0.77)	<0.001	0.91 (0.78-1.06)	
Chronic disease				
No	Reference		Reference	<0,001
Yes	1.43 (1.28-1.59)	<0.001	1.40 (1.26-1.56)	
Physical or psychological limitation				
No	Reference		Reference	0.099
Yes	0.72 (0.54-0.94)	0.018	0.79 (0.60-1.04)	
Poverty status				
Poverty	Reference		Reference	<0,001
No poverty	2.12 (1.74-2.59)	<0.001	1.72 (1.40-2.10)	
Has health insurance				
No	Reference		Not included	
Yes	1.00 (0.88-1.15)	0.954		
Natural region of residence				
Jungle	Reference		Reference	
Highlands	0.70 (0.55-0.89)	0.004	0.77 (0.60-0.97)	0.030
Coast	1.36 (1.09-1.71)	0.007	1.07 (0.85-1.36)	0.567
Area of residence				

https://doi.org/10.18549/PharmPract.2023.4.2877

Rural	Reference		Reference	
Urban	2.52 (2.13-2.99)	<0.001	1.61 (1.31-1.99)	<0,001
Home with landline, cell phone, TV or internet				
Yes	Reference		Reference	
No	0.37 (0.25-0.57)	<0.001	0.65 (0.43-0.98)	0.038

Weighting factors and sample specifications of ENAHO were included for all analysis.
ENAHO: Encuesta Nacional de Hogares. TV: Television. PR: Prevalence Ratio. aPR: Adjusted Prevalence Ratio. CI: Confidence Interval.
*Adjusted model for all the variables that resulted in a value of p <0.2 in the crude model.

urban area and living in a household without a landline, cell phone, TV or internet for both regions (Table S1).

DISCUSSION

This is the first nationally representative study in Peru that evaluates the prevalence of preventive use of drugs without evidence for the treatment of COVID-19 (i.e., ivermectin, azithromycin, hydroxychloroquine, or chloroquine) in people without symptoms and the associated factors. Preventive medication for COVID-19 was consumed by 5.6% of the study population and was associated with age, a higher educational level, having a chronic disease, residing in an urban area, and not having a state of poverty, while being a woman, residing in the highlands, and not having a landline, cell phone, TV or internet were associated with a lower prevalence of drug use. The misuse of medications can lead to health consequences, by increasing the risk of drug interactions and adverse reactions due to inadequate dosing (i.e., QT interval prolongation, bleeding, diarrhea, nausea),[26-29] and the use of antibiotics exacerbates the rise in antimicrobial resistance.[30,31] Thus, it is noteworthy that even after one year of the pandemic and strong recommendations against the use of many of the "preventive" drugs by international guidelines, their consumption is still prevalent in the Peruvian population.

Contrary to what would be expected, we found that individuals with secondary and especially higher education had a higher prevalence of self-medication for COVID-19 prevention. This contradicts studies that report that higher education attainment is associated with higher scores on the health literacy aspects, appraisal of health information, and navigating the health care system.[32] Although this finding only represents approximately 3.5% of all Peruvians, it is still noteworthy; as mentioned in a systematic review on the subject, participants may have been motivated by a desire to avoid stigmatization and quarantine, which, in Peru, could lead to job loss.[17] Contrary to prompting paid sick leave as was done in some high-income countries, the Peruvian government implemented "*Suspension perfecta de labores"* by which companies could stop paying workers for up to 90 days given that their production had halted due to the restriction measures.[33,34] These measures were reportedly abused and left many people without stable income in uncertain times of everchanging restrictive measures.[35] During 2020, both the proportion of the population that works informally and the proportion of people in a state of economic poverty (residing in a household that is unable to meet their basic food and living expenses) rose compared to pre-pandemic times. Economic poverty rose from 20.2% to 30.1% between 2019-2020 and reduced to 25.9% in 2021 and unemployment rates increased 39.6 percentage points in the second trimester of 2020 compared to the previous year.[36] Thus, the livelihoods of several families were severely affected by the pandemic, potentially motivating those most educated with a formal job contract and regular income to consume drugs to minimize the risk of being laid-off after succumbing to illness.

In our study, residing in an urban area was associated with a higher probability of consuming preventive drugs compared to living in a rural area. Although no study has evaluated the relationship between urban residence and the preventive consumption of drugs against SARS-CoV-2, it has been reported that urban areas have both a higher socioeconomic level and out-of-pocket spending for drugs compared to rural areas.[37] In addition, access to all levels of health care is more available for the urban compared to the rural population, with geographic barriers being an important reason for inaccessibility.[38] Likewise, 97% of first level health care establishments in Peru,[39] the main access to health in rural communities,[40] have inadequate infrastructural conditions for competent operation, impeding access and quality of health services in these areas.[41] These limitations may have motivated more educated, well off individuals in rural areas to self-medicate in order to prevent disease which cannot easily be treated within their communities. During the pandemic, because of the higher incidence of COVID-19 in urban areas due to the increased population density,[42] there was a greater demand and a consequent increase in prices in the pharmaceutical market.[43,44] Thus, primary health care, especially in rural areas, needs to be strengthened so that individuals can obtain comprehensive health care in times of need and not consider self-medication as the only option.

Peru is divided into the three natural regions of the coast, highlands, and jungle, comprising 57.7%, 28%, and 14.2% of the Peruvian population, respectively.[45] Residents of the coast had a higher prevalence of preventive medication consumption compared to residents of the highlands and jungle. It is to be expected that the coast, which has a greater number of urbanized cities (88.9%),[46] would have a greater supply and demand of medicines compared to the highlands and jungle where there is a greater proportion of rural areas. However, prior to the pandemic, it was described that limited access to health services generates a higher prevalence of the acquisition of medicines without a prescription in the Peruvian highlands and jungle.[10,47] Finally, consumption of drugs to

https://doi.org/10.18549/PharmPract.2023.4.2877

prevent COVID-19 in the jungle and highlands could have been mitigated by the lower presence of health establishments, media,[38,48] and the high value of traditional medicine by the local population.[49]

Having a home without a landline, cell phone, TV or internet was associated with a lower probability of taking preventive medications in people without symptoms. The global overload of information about COVID-19, and its management and prevention was considered a major problem for public health,[50] because it exposed people to news with false or erroneous information about methods to prevent COVID-19,[51,52] resulting in potentially dangerous attitudes such as incorrect and excessive use of disinfectants.[53,54] Although there is no study on the impact of this news on the Peruvian population, it has been reported that Peru is a country at high risk of this "infodemic".[55] Despite the existence of a rumor surveillance system implemented by the Ministry of Health, this did not prevent pseudoscientists from appearing in several mass media outlets to make controversial claims on the protective effects of different drug combinations or preclude the spread of fake news through social media platforms. Indeed, several studies have described high rates of the population being unable to distinguish relevant information.[56-58] A previous study found that educational campaigns on responsible self-medication through social networks may be useful especially for low-income people.[59] Therefore, the government should establish information channels to disseminate reliable and quality information to avoid dangerous attitudes in the population.

We found that individuals over 30 had a higher prevalence of consumption of preventive COVID-19 medication compared to younger individuals. Since COVID-19 tends to be more severe in older adults compared to young people,[60] this population would have a greater interest in preventing their infection. Likewise, it has been suggested that older adults in urban areas had better prevention practices for COVID-19, while adults in rural areas are attributed a lower educational level and consequent ignorance of these. On the other hand, a study based on an online survey during the COVID-19 pandemic found that being an older adult was associated with taking antiretrovirals to prevent or treat respiratory symptoms.[20] Another study described a two-fold greater frequency of self-medication in older adults before going to a health facility,[61] attributing this to being a common practice in Peru. It is possible that psychological factors such as anxiety also increased the frequency of consumption in the older adult population.[62] Furthermore, older adults have greater exposure to misinformation through communication technologies.[63] Therefore, strategies to control prehospital medication and ensure dissemination of accurate information should be formulated to minimize the risk of preventive self-medication.

Individuals suffering from a chronic disease were found to have a higher consumption of preventive medications. Similar to older people, it is likely that participants with a chronic disease were more concerned and anxious about the prevention of COVID-19, as they are considered a risk group.[64-66] It should be noted that, in Peru, people with a chronic disease and a low educational level and economic status have difficulties in accessing health services,[67] and, therefore, had less knowledge about preventive measures for COVID-19. In addition, people with chronic diseases and low resources are more likely to take a medication that is recommended to treat or prevent any symptom.[68,69] Evaluation of the medication practices in this population are necessary due to the likelihood of polypharmacy and more frequent drug interactions, leading to greater health risks and a lower quality of life beyond the effects of the chronic disease itself.[26,66,70]

Among the limitations of this study, we highlight that the cross-sectional study design does not allow establishing causality among the variables studied due to a lack of temporality. Secondly, the study may present a memory bias since the variables of interest were self-reported. In addition, there may be a social desirability bias since respondents may have modified their answers. Third, as this is a secondary analysis of a national survey, only the variables previously collected could be included in the study, while factors such as cultural beliefs, use of traditional or alternative medicine, specific chronic conditions, severity of contagion in the surrounding community, ethnic group of the participants, employment status (formal employment, informal employment or unemployed) or having recently contacted a person previously diagnosed with COVID-19 could not be explored. Finally, given the temporal timeframe of the questions, our study only describes the characteristics of individuals that self-medicated in 4 weeks prior to the survey, long after the peak of contagion and death in Peru.

Despite this, we have collected the data from a nationally representative survey to estimate the irrational consumption of medication for COVID-19 prevention that still persists among Peruvians even after having become widely accepted that these drugs are not effective for the prevention of disease. Even though the variables related to medication consumption were self-reported, participants were asked specifically to recall the situations that occurred in the 4 weeks previous to the survey, which should have limited measurement error. We hope our findings motivate targeted interventions to alleviate unnecessary exposure to drugs, associated adverse reactions and additional medical costs from iatrogenic events.

CONCLUSIONS

In conclusion, preventive consumption of ivermectin, azithromycin, hydroxychloroquine, or chloroquine for the management of COVID-19 was associated with age, a higher educational level, having a chronic disease, living in an urban area, and not smoking. Being a woman, living in the country, and not having a landline, cell phone, TV, or internet were all associated with a lower likelihood of the consumption of these medications. It is concerning that even after one year of living with the pandemic and having refuted the utility of medications such as ivermectin and azithromycin, these drugs are still widely consumed by a sector of the population without symptoms or a diagnosis of COVID-19. Consequently, it is necessary to develop and implement public health policies that address this issue while considering the associated factors to reduce indiscriminate medication consumption.

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