ORIGINAL ARTICLE

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Original contribution and significance: This study enabled us to assess the performance of mammography and Pap smear screening in Peru in 2022 and to compare these findings with data from previous years, as well as with various sociodemographic variables associated with these screening practices. Our original contribution was to determine the proportion of women who underwent these examinations within the time frame recommended by the World Health Organization (WHO) and to propose additional recommendations.

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Breast and cervical cancer screening in Peru in 2022

Realización de tamizaje para cáncer de mama y de cuello uterino en Perú en el año 2022

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ABSTRACT

Introduction: Cervical and breast cancer are the most common cancers in our country. Early detection is essential to initiate timely treatment, due to their high morbidity and mortality. In Peru, the performance of screening tests (mammography and Pap smears) has increased; however, they still remain below the latest recommendations. Objectives: To determine the frequency of Pap smears and mammograms in women in Peru in 2022 and the sociodemographic variables with which they were correlated. Methods: Observational, descriptive, correlational, and secondary study of the National Demographic and Family Health Survey (ENDES) database of 2022. which interviewed 18,243 women aged 15 to 97 years. Results: 5,636 participants answered the mammography questions (age: 51.9 +/- 8.8 years), and 13,021 answered the Pap smear (PAP) questions (age: 38.6 +/- 10.5 years). Women aged 70 and over were the most likely to receive mammography; and those aged 35 to 44 were the most likely to receive Pap smears. A total of 62.4% had had their last mammogram more than two years prior to the survey, and 29.1% had had their Pap smear more than three years prior. Conclusions: By 2022, 23.7% and 78.5% of women had undergone mammography and Pap smear tests at some point in their lives, respectively. A statistically significant relationship was found between the performance of these tests and age, education, and level of instruction.

Key words: Mammography, Papanicolaou Test, Breast Neoplasms, Uterine Cervical Neoplasms, Disease Prevention

RESUMEN

Introducción: El cáncer de cérvix y de mama son los más frecuentes en nuestro país. Su detección temprana es fundamental para iniciar un tratamiento oportuno, por tener alta morbimortalidad. En el Perú ha aumentado la realización de sus pruebas de tamizaje (mamografía y papanicolaou); no obstante, aún persisten por debajo de las últimas recomendaciones. Objetivos: Determinar la frecuencia de realización de papanicolaou y mamografía en mujeres en Perú en el año 2022 y las variables sociodemográficas con las cuales se correlacionaron. Métodos: Estudio observacional, descriptivo, correlacional y secundario de la base de datos de la Encuesta Nacional de Demografía y Salud Familiar (ENDES) del año 2022, que entrevistó a 18 243 mujeres de 15 a 97 años. Resultados: 5636 participantes respondieron las preguntas de mamografía (edad: 51,9 +/- 8,8 años), y 13 021, las de papanicolaou (PAP) (edad: 38,6 +/- 10,5 años). Las mujeres de 70 años a más presentaron mayor realización de mamografía; y en PAP fueron las de 35 a 44 años. El 62,4% se había realizado la última mamografía hacía más de 2 años desde la encuesta, y 29,1% se hicieron su PAP hacía más de 3 años. Conclusiones: 23,7% y 78,5% de mujeres se habían realizado las pruebas de mamografía y PAP en algún momento de su vida para el año 2022, respectivamente. Se encontró una relación estadísticamente significativa entre la realización de estas pruebas y la edad, la escolaridad y el grado de instrucción.

Palabras clave: Mamografía, Prueba de Papanicolaou, Neoplasias de la Mama, Neoplasias del Cuello Uterino, Prevención de Enfermedades

Introduction

In 2020, cancer overall was the second leading cause of death in Peru[(1)]. Breast cancer is the most common malignancy among women worldwide, and its incidence has risen in recent decades, according to the International Agency for Research on Cancer (IARC). An estimated 2.3 million new cases were diagnosed, and 685,000 women died from this disease in 2020. Given current trends, the number of cases and deaths is projected to increase by 40% and 50%, respectively, by 2040[(2)].

According to another report, the incidence of breast cancer in Peru was 35.9 per 100,000 inhabitants, with a mortality rate of 9.1 per 100,000 inhabitants, while cervical cancer had an incidence of 22.2 per 100,000 inhabitants and a mortality rate of 11.5 per 100,000 inhabitants in 2020[3]. Although the incidence of cervical cancer has declined over recent decades, its global burden remains substantial, with more than 600,000 new cases and over 300,000 deaths worldwide[4].

In 2012, according to the Global Cancer Observatory (GLOBOCAN), Peru reported 3,952 new cases of breast cancer with a mortality rate of 8.5 per 100,000 inhabitants, and 4,636 new cases of cervical cancer with a mortality rate of 12 per 100,000 inhabitants[5]. By 2020, 6,860 new cases of breast cancer and 4,270 new cases of cervical cancer were diagnosed[3], representing a 73% increase in breast cancer incidence within only eight years in the country.

Given the high incidence and mortality associated with breast and cervical cancer, early detection is crucial for ensuring timely treatment. However, the number of mammography and Pap smear screening tests performed in Peru remains below the recommendations of the World Health Organization (WHO), which advises that women aged 50 to 69 undergo mammography every two years[6]. Reports indicate that only 16.9% of women in this age group received a mammogram in 2015[7], and 21.9% in 2018[8]. Regarding Pap smears, the Pan American Health Organization (PAHO) recommends screening every three years for women aged 25 to 64[9], yet only 52.4% of women in Peru had undergone this test by 2017[10].

The objective of this study was to determine the frequency of screening tests for these cancers in Peru and the time elapsed since these tests were last performed, based on the most recent national health surveys. Additionally, the study aimed to identify sociodemographic variables associated with screening uptake, with the purpose of contributing to ongoing monitoring of these public health–significant conditions and proposing strategies to improve access to these screening methods. This study formed part of the medical doctor degree thesis conducted by the same authors[11].

Materials and methods

Descriptive, cross-sectional, secondary study of the database of the 2022 National Demographic and Family Health Survey (ENDES), which was conducted by the National Institute of Statistics and Informatics (INEI) throughout Peru, where 18,243 women between the ages of 15 and 97 were interviewed.

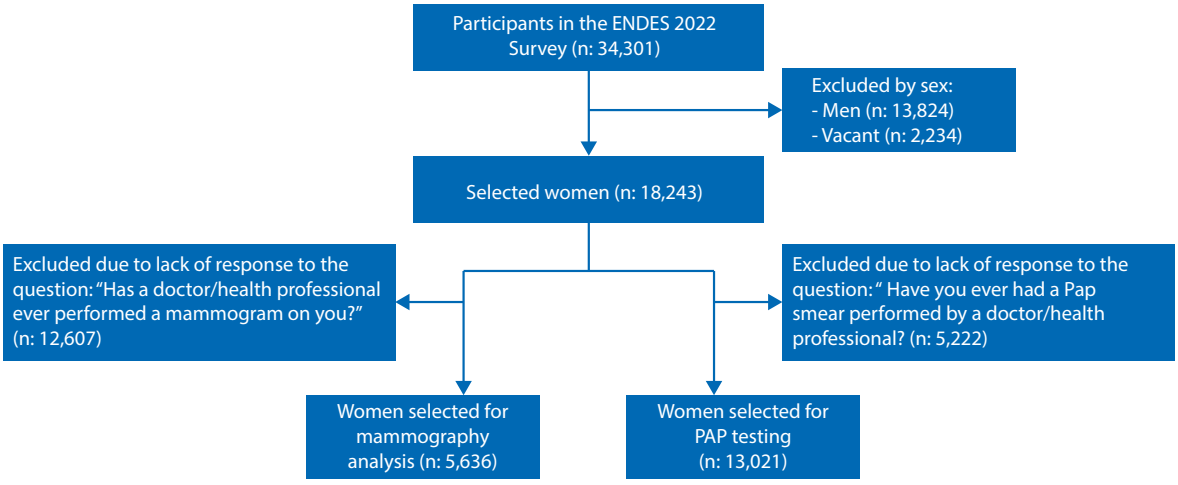
The inclusion criteria were being a female participant in ENDES 2022 and having completed all questions in the Health Questionnaire related to mammography and Pap smears. Women with incomplete sociodemographic information (sex, age, educational level, and health insurance status) were excluded. The ENDES 2022 sample is an annual subsample of the master sample selected for the 2021–2024 period and is characterized as a two-stage, probabilistic, balanced-type, stratified sample, independent at the departmental level and by urban and rural areas[13]. For questions related to mammography, ENDES 2022 included only women aged 40 to 70, while for questions concerning Pap smears, it included women aged 25 to 64.

The database for Module 1640 of ENDES 2022 was downloaded in Excel format. The variables included in the Health Questionnaire were taken for analysis, considering only the variables included in our study.

The ENDES 2022 Health Questionnaire was answered by 34,301 people. Men (13,824 participants) and individuals who had left the "sex of the selected person" box blank (2,234 participants) were excluded. Finally, 5,636 women were included for the mammogram analysis and 13,021 for the PAP analysis (Figure 1).

Subsequently, a unique code was generated for each participant surveyed, and the data was checked for duplicate information. The final database was securely stored in Excel format, accessible only to the principal investigators, and then analyzed in STATA v14. Descriptive statistical analysis was performed on the selected variables, calculating frequencies, mean, median, standard deviation, and range. For the inferential statistical analysis, a correlation analysis with chi-square tests (for nominal variables) was performed to determine whether there was any statistically significant relationship ($P < 0.05$) between certain variables.

Figure 1: Flowchart of the study.



This research was approved by the ethics committee of the Cayetano Heredia Peruvian University, under number 211770 [CONSTANCIA-CIEI-425-39-23 of September 28, 2023], under the category "exempt," as it was an analysis of secondary data.

Results

The 5,636 participants who responded to the questions regarding mammography had a mean age of 51.9 ± 8.8 years. Of these, only 23.7% (1,334 of 5,636 women) reported having undergone this examination at least once in their lives. Forty-five point six percent belonged to the 40–49 age group, which also showed the highest proportion of women who had never had a mammogram at any point (84.5%). In addition, 91.6% had attended school, and 87.5% had health insurance coverage. Thirty-three percent of women aged 70 years or older had undergone a mammogram; however, this age group accounted for only 1.6% of the total respondents (Table 1).

Only 1,328 participants answered the question regarding the time elapsed since their last mammogram, of whom 62.4% had undergone their most recent examination three years or more prior (Table 2).

The 13,021 women who responded to the questions regarding Pap smears had a mean age of 38.6 ± 10.5 years. Of these, 78.5% (10,223 of 13,021 women) reported having undergone this test at least once in their lives. In addition, 96.8% had attended school, and 88.4% had health insurance coverage. Forty-four point three percent were in the 25–34 age group; however, the 35–44 age group had the highest proportion of women who had undergone a Pap test at some point (84.8%) (Table 3).

Although 9,808 women answered the question regarding the time elapsed since their last Pap test, only 83.6% retrieved the results. Fifty-four point six percent (5,354 of 9,808 women) had undergone their most recent Pap test two or more years before ENDES 2022 (Table 2).

The sociodemographic variables that showed a statistically significant relationship were age, having attended school, and level of education regarding mammography (Table 1). In the case of PAP, they were associated with the same variables, but also with having health insurance (Table 3).

Discussion

In our study, only 23.7% of women aged 40 to 70 had ever undergone a mammogram by 2022, a figure considerably lower than that reported in the 2019 and 2020 ENDES surveys, which found mammography rates of 46.4% and 43.5%, respectively, among women aged 25 to 69[12]. However, it was slightly higher than the 21.6% reported in the 2021 ENDES, which—like our study—also analyzed women aged 40 to 70[14]. The 2017–2021 National Plan for the Prevention and Control of Breast Cancer in Peru indicated that breast cancer, in addition to being the sec-

Table 1: Mammography screening according to sociodemographic characteristics

	Has a professional ever performed a mammogram on you?								p
	Yes		No		Does not know/cannot remember		Total		
	n	%	n	%	n	%	n	%	
Age group									
40–49 years old	398	15.5	2170	84.5	1	0.0	2569	45.6	< 0.001
50 - 59 years old	504	29.6	1195	70.3	1	0.1	1700	30.2	
60 - 69 years old	402	31.5	871	68.3	3	0.2	1276	22.6	
>= 70 years old	30	33.0	60	65.9	1		91	1.6	
Attended school									
Yes	1293	25.0	3866	74.9	5	0.1	5164	91.6	< 0.001
No	41	8.7	430	91.1	1	0.2	472	8.4	
Level of education (*)									
Early childhood education, preschool	3	14.3	18	85.7	0	0.0	21	0.4	< 0.001
Elementary school	296	13.5	1886	86.3	4	0.2	2186	42.3	
Middle school	491	28.1	1256	71.9	1	0.1	1748	33.9	
Non-university higher education	260	37.9	426	62.1	0	0.0	686	13.3	
University higher education	191	43.8	245	56.2	0	0.0	436	8.4	
Postgraduate	52	61.2	33	38.8	0	0.0	85	1.6	
Health insurance									
Yes	1178	23.9	3747	76.0	4	0.1	4929	87.5	0.177
No	156	22.1	549	77.6	2	0.3	707	12.5	

** Responses were received from 5,162 participants. The remaining sociodemographic variables received 5,636 responses.*

Table 2: Time elapsed since last mammogram and Pap smear (PAP).

Average time since your...	last mammogram		last PAP	
	n	%	n	%
0-2 years old	499	37.6	5354	54.6
3-5 years old	517	38.9	3150	32.1
6-10 years old	199	15.0	874	8.9
≥ 11 years old	113	8.5	430	4.4
TOTAL	1328	100.0	9808	100.0

ond most common neoplasm in the country, accounted for the loss of 27,929 healthy life years due to premature mortality[15].

With mammographic screening every one to two years, mortality among women aged 40 to 74 can be reduced by 40%[16]. Beyond enabling the detection of breast tumors, mammography offers the advantage of visualizing soft tissue, bone, and blood vessels, and the procedure requires only a few minutes. However, it also has limitations, including exposure to ionizing radiation and relatively low diagnostic accuracy, which is further diminished in patients with dense breasts[17]. Despite these drawbacks, mammography remains the most cost-effective early detection method for breast cancer in Peru[18,19].

For this reason, the WHO recommends that all women between the ages of 50 and 69 undergo mammography screening every 2 years[7], but in our study, only 30.4% of that age group had had a mammogram. Regarding the time elapsed since their last mammogram, 37.6% responded that it had been between 0 and 2 years, which is also far from the recommendations of the WHO and the Peruvian Ministry of Health (MINSA). This is comparable to the findings of ENDES 2015, which reported that 21.9% of women aged 50 to 59[8], the 2018 ENDES, which reported that 16.9% of women aged 40 to 59[9], and the 2021 ENDES, which reported that 41.6% of women aged 30 to 49[20] had had a mammogram in the two years prior to the survey. Although our study evaluated a wider age range, it can be inferred that even after seven years, less than 50% of women had had a mammogram in the last two years, as recommended by the WHO. This may have been a reflection of women's reduced access to health facilities during the COVID-19 pandemic, although it may also have been due to the absence of health campaigns on these gynecological cancer screenings, because economic and health personnel resources were allocated more to respiratory diseases during those years.

Table 3: Demographic variables according to Pap smear performance.

	¿Has a professional ever performed a PAP test on you?								p
	Yes		No		Does not know/cannot remember		TOTAL		
	n	%	n	%	n	%	n	%	
Age group									
25-34 years old	4193	72.8	1559	27.1	10	0.2	5762	44.3	< 0.001
35-44 years old	3265	84.8	580	15.1	3	0.1	3848	29.6	
45-54 years old	1568	82.9	320	16.9	3	0.2	1891	14.5	
55-64 years old	1197	78.8	322	21.2	1	0.1	1520	11.7	
Attended school									
Yes	9982	79.2	2604	20.7	17	0.1	12603	96.8	< 0.001
No	241	57.7	177	42.3	0	0.0	418	3.2	
Level of education (**)									
Early childhood, preschool	17	68.0	8	32.0	0	0.0	25	0.2	< 0.001
Elementary school	2338	73.2	849	26.6	5	0.2	3192	26.5	
Middle school	4136	79.4	1062	20.4	11	0.2	5209	43.2	
Non-university higher education	1925	84.1	364	15.9	1	0.0	2290	19.0	
University higher education	1408	82.3	302	17.7	0	0.0	1710	14.2	
Postgraduate	156	89.1	19	10.9	0	0.0	175	1.5	
Health insurance									
Yes	9153	79.5	2351	20.4	12	0.1	11516	88.4	< 0.001
No	1070	71.1	430	28.6	5	0.3	1505	11.6	

*** There were responses from 12,061 participants. The remaining sociodemographic variables had 13,021 responses.*

We found a statistically significant relationship between having had a mammogram and certain sociodemographic variables such as age, having attended school, and level of education. More women who had attended school underwent mammography than those who had not (25% vs. 8.7%). In addition, more than 60% of women with postgraduate degrees underwent mammography, while less than 15% of women with primary or lower levels of education underwent the test. This coincides with the study by Komenaka et al.[21], which reported that women with low levels of education were less likely to undergo mammography screening because they did not find any abnormal findings in their breasts or because they did not believe it was necessary, suggesting a poor understanding of the concept of screening. Meanwhile, the 2019-2020 ENDES reported that a low level of education and a lack of knowledge about gynecological screening were an obstacle to undergoing a clinical breast exam and mammogram[12]; and the 2021 ENDES found a significant relationship between higher education/complete secondary education and a higher frequency of mammograms[14,20]. Similarly, a study conducted in Saudi Arabia found that the educational level of participants was significantly related to a higher rate of mammography, which was associated with a higher socioeconomic status, and this could have an impact on the understanding of diseases and their prevention[22].

In our study, the only sociodemographic variable that did not show a statistically significant association with mammography was having health insurance. This finding was also observed in the analysis of the 2021 ENDES[14,20]. In this regard, the study by Komenaka et al.[21] reported that more than one-third of participants did not undergo mammography due to its cost, and thus the lack of health insurance was identified as one of the principal sociodemographic factors associated with not receiving this examination. Furthermore, it has been noted that individuals who previously lacked health insurance may be unaware of the preventive services that such coverage includes. Similarly, another study conducted in Spain found that women with private health insurance had higher mammography screening rates[23].

Although cervical cancer has declined in recent years, our study found that only 78.5% of women aged 25 to 64 in Peru had a Pap smear. The 2019 ENDES reported that 67.6% of women had ever

had a PAP test, although this year women aged 12 to 49 were included[24]. Meanwhile, in the 2021 ENDES, 79.5% of women aged 25 to 64 had ever had a PAP test[14]. It is well known that this neoplasm affects women in developing countries with weak screening systems to a greater extent, causing most cases to be diagnosed at advanced stages, with minimal possibility of treatment. This reinforces the importance of screening the population at the recommended times[25].

The WHO recommendation for cervical cancer screening is that all women between the ages of 25 and 64 should have a PAP test every 3 years[10]. Although our study found that almost 80% of women had had a Pap smear at some point in their lives, only 54.6% had had one in the last 2 years and 70.9% in the last 3 years since the survey was completed. This is similar to what was reported in the 2015-2017 ENDES, where 52.4% of women had the same time interval (last 2 years)[11]. However, 57.6% had a PAP test in the last 3 years according to ENDES 2021[14], which was slightly higher than in our study.

We found a statistically significant association between age and having ever undergone a Pap test, with the 25–34 age group showing the lowest percentage of Pap testing at 72.8%. This finding is consistent with a 2017 study conducted in a rural district of Lima, Peru, which reported that younger women were less likely to undergo a Pap smear[26]. However, the 2019 ENDES reported that only 36.9% of women aged 29–36 had received a Pap smear[24].

A study conducted in the United States prior to 1991 found that the prevalence of premalignant and malignant cervical lesions declined proportionally with an increasing number of previous negative test results. Specifically, women aged 30 to 64 with three or more negative Pap smears had a cervical cancer risk of only 3 per 100,000. This figure served as the basis for the current WHO recommendation[27].

In our study, we found that 29.1% of participants responded that it had been more than three years since their last PAP test, and 12.3% had not had a PAP test in six years or more. A statistically significant relationship was found between having had a PAP test and each of the sociodemographic variables studied and, unlike mammography, also with the health insurance variable. This is consistent with another study from Peru, which reported that 50% of women with higher education had had a PAP test in 2019[26]. In our study, the groups with the highest level of education, such as non-university higher education, university higher education, and postgraduate education, were those with the highest frequency of PAP smears (84.1%, 82.3%, and 89.1%, respectively), while the lowest percentage of PAP smears was found among women with the lowest level of education (elementary or preschool level) at 68%. Likewise, only 57.7% of women who did not attend school underwent the test, compared to 79.2% of those who did attend. This could be because women with higher levels of education may have greater access to information and awareness platforms about the risks and prevention of this disease.

This finding is similar to a secondary study to ENDES 2005-2008, which reported a statistically significant association between education and PAP testing, with illiterate women being the least likely to undergo this test, compared to women with higher education (49% versus 75%, respectively)[28]. Similarly, the 2019-2020 ENDES reported that women with a primary education were less likely to undergo the test than those with a higher level of education[12]. And in another study conducted in Italy, it was reported that women with higher levels of education were more likely to have a PAP test than those with lower levels of education (48% vs. 20%)[29]. These differences could also be explained by the fact that in our country, women with higher levels of education have greater work responsibilities and, therefore, less time to take care of their health. On the other hand, women with lower levels of education may have more time during the day to go to a health center for screening.

Similarly, having health insurance showed a statistically significant relationship with having a PAP test in our study. This is consistent with data from ENDES 2005-2008, which reported that women with health insurance were more likely to have this test than those without. Participants with private health insurance were even more likely to have a Pap test[28]. Meanwhile, the 2019-2020 ENDES reported that not having health insurance increases the interference with having a PAP smear[13]. In Korea, it was also reported that having private health insurance was associated with a higher probability of having a PAP smear[30].

Comparatively, the number of women who have had PAP tests is significantly higher than those who have had mammograms. The reason may be the accessibility of each test, since while PAP tests can be performed in almost any health facility, mammograms require centers equipped with mammography machines. In 2017, there were 202 health facilities in Peru offering this service, and mammography machines were operational in only 19 of the 25 regions[15].

Among the limitations of PAP smears are technical errors (inadequate or insufficient sampling, incorrect staining and reading), low sensitivity, and the fact that patients often do not collect their results. In our study, more than 80% of women collected their results. This increases the likelihood that most women with abnormal or insufficient results can receive early treatment or have the test repeated, respectively[13].

The limitations of our study were that not all women surveyed completed the entire health questionnaire, leaving some variables of interest unanswered. This may have been due to incorrect completion of the database or because the questions were not asked. On the other hand, the database does not contain detailed information on screening tests, such as the number of tests performed over time for each woman and the time interval between tests, as well as the reason for performing them (whether for screening or clinical suspicion of disease).

There is also memory bias, which is reflected in the percentage of women who responded that they "do not know/do not remember" certain information, or who provided information that was incorrect or inaccurate. Finally, the association between the performance of these screening tests and other sociodemographic variables, such as socioeconomic status, demographic area, previous pathologies, level of awareness of prevention, level of prior knowledge about cancer, and type of insurance, was not analyzed, as we did not consider them relevant to the results we obtained. Furthermore, in previous ENDES surveys, these variables did not change significantly over the years, and their analysis did not contribute to the possible recommendations that could be suggested.

In conclusion, the percentage of women aged 40 to 70 who had undergone mammograms and Pap smears was 30.4%, and 78.5% of women aged 25 to 64 had undergone these tests at some point in their lives, respectively, for the year 2022 in Peru. A relationship was found between the performance of both screening tests and the age, schooling, and level of education of women. Only 37.6% of women surveyed had a mammogram in the last 2 years, and 54.6% had a Pap smear in the last 3 years.

Although other authors have previously made several recommendations to improve access to these screening tests, such as invitation flyers, media announcements, health campaigns, and more frequent educational talks, and suggesting fair access to education and health services (14), according to our results, these have not had much impact over the last 10 or 15 years at least. It is also obvious that the equipment of health facilities with mammography machines must be improved nationwide[20], but this is unlikely to happen in the short term, as a 2023 report stated that up to three regions of Peru do not have mammography equipment[31]. Therefore, it may be more practical and quicker to improve referral systems in rural areas, so that patients can more efficiently access cities where mammography equipment is available. However, radiology specialists are also needed to interpret the findings of the examinations performed with this equipment, although this can be remedied by the implementation and institutionalization of telemammography[32]. We propose different recommendations in this era of social media, such as using educational reels on TikTok, Instagram, or Facebook to communicate the consequences of breast and cervical cancer and the possibility of prevention with mammography and PAP tests. Health campaigns can also be promoted through influencers on these networks or on some popular YouTube channels. Although these suggestions may not be applicable to more remote rural areas where even basic services are lacking, we believe that a culture of gynecological cancer prevention can be promoted in urban and rural areas of the country that do have access to the internet and social media. This has begun to be explored in other countries, where women exposed to regular information campaigns on social media have a high level of awareness of the need for screening for early detection of breast cancer and visit their doctors more frequently for breast cancer screening tests[33]. Perhaps in Peru this could have similar

results, as more than 80% of households in rural areas had internet access, more than 75% of women used the internet in 2023 in general, and 95.4% of respondents used it to access social media and instant messaging services[34].

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