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Earlier Breast Cancer Detection in Peru: Establishing a Comprehensive Program in an Underserved Region

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DESCRIPTION OF THE PROBLEM

Rising breast cancer incidence and mortality rates in low- and middle-income countries are largely attributed to changing lifestyle, economic factors, and late-stage diagnosis. In Peruvian women, it is the second most common cancer diagnosis (16%) behind cervical cancer (24%) and is the second leading cause of cancer hospitalizations [1]. The breast cancer burden is expected to rise and cause more premature deaths unless early detection programs are established.

Peru is one of only a few Latin-American countries with a National Cancer Control Plan (*Plan Nacional para la Atención Integral del Cáncer*, originally called *Plan Esperanza*) [1]. For low-income patients, the plan provides universal coverage for cancer detection and treatment through the Comprehensive Health Insurance Scheme (*Seguro Integral de Salud*). The latest version of the cancer control plan prioritizes three cancer types, including breast cancer [1]. The main national cancer hospital (*Instituto Nacional de Enfermedades Neoplásicas*, [INEN]) has undertaken initiatives, such as training primary care providers in fine needle aspiration

and improving access to screening mammography [2]. Despite these efforts, $\leq 20\%$ of screening-eligible women (50-69 years old) have received a mammogram in their lifetime, and most breast cancer is diagnosed at late stages [1]. High costs associated with treating late-stage disease and scaling screening mammography programs—currently only available in the largest cities—have led to questions on the sustainability of universal coverage [3]. Additional efforts are needed, particularly outside metropolitan areas, to improve access to early detection, diagnosis, and treatment.

This article outlines the process and early results of a breast cancer detection program established in Cusco, Peru. It also describes an opportunity for radiologists in the United States to contribute valuable skills outside of the reading room in underserved regions of the world and to potentially apply these solutions (ie, reverse-innovate) to their local lower-resource populations, such as rural, immigrant, or refugee communities.

INTERVENTION

RAD-AID volunteers performed a Radiology-Readiness Assessment in

2018 to collect data on current infrastructure and community resources and to identify potential partners in breast health (Fig. 1). Our primary partner, CerviCusco, is an established nongovernmental organization that provides primary and secondary prevention of cervical cancer in Cusco, an underserved region of Peru. CerviCusco has an on-site cytopathology laboratory with US-based telepathology support, conducts mobile outreach campaigns, and partners with local hospitals and US academic centers.

The resource-stratified National Comprehensive Cancer Network framework categorizes Cusco as having “core resources” for breast cancer detection, which prioritizes clinical breast examination (CBE), risk reduction counseling, and use of ultrasound (US) to evaluate positive symptoms and CBE findings [4]. In this context, the Breast Health Global Initiative and WHO recommend establishing strong diagnostic services, centered on CBE and US, to downstage breast cancer. A phased implementation approach should address (1) strategies for dissemination and implementation (eg, Radiology Readiness Assessment), (2) public

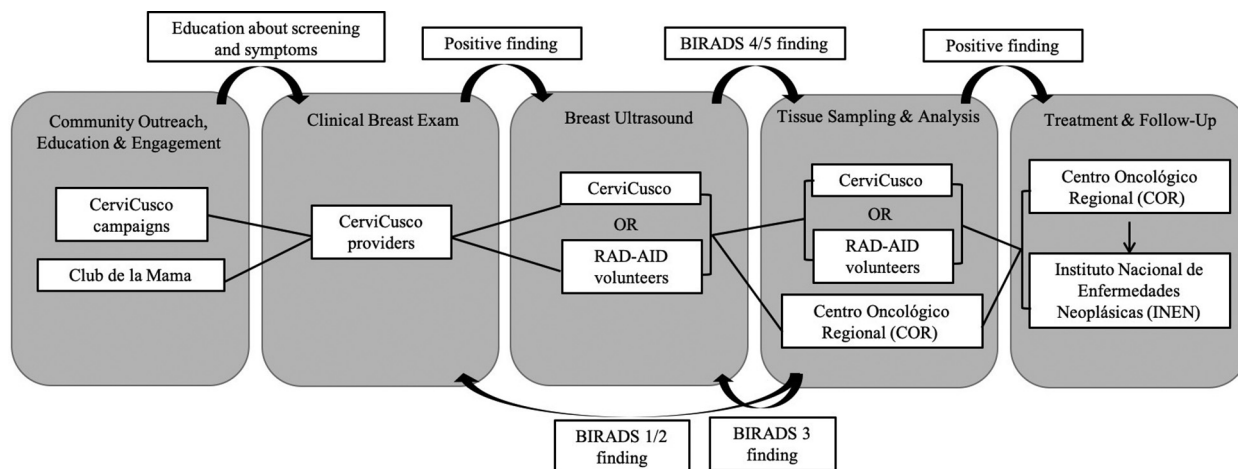


Fig 1. Stakeholder relationships and responsibilities in the early breast cancer detection program, utilizing clinical breast examination (CBE) and ultrasound (US), in Cusco, Peru. Patients with a positive CBE will undergo a breast US on site. Patients with a BI-RADS 1/2 or 3 finding on US will be managed clinically or with imaging. Patients with a BI-RADS 4 or 5 US finding will undergo a biopsy or fine needle aspiration with tissue analysis performed at the Centro Oncológico Regional (COR) in Cusco until CerviCusco develops the capacity. A patient with positive tissue diagnosis will be managed either at COR or the Instituto Nacional de Enfermedades Neoplásicas (INEN) in Lima, depending on disease severity and treatment needs. Club de la Mama will provide support for survivors.

education and training programs, and (3) technology for detecting and diagnosing disease in an effective manner [5]. Therefore, although the ultimate goal is to establish population-based mammography screening, we prioritized detection and effective management of palpable breast cancers based on these recommendations.

Effective diagnostic services require we first establish referral systems, develop a patient medical record system for tracking and quality assurance, and acquire technology (eg, linear US transducer, Cloud storage). The program developed an algorithm for managing patients with positive CBE and US findings through collaboration with local, regional, and national partners. The Regional Oncology Center (*Centro Oncológico Regional* [COR]), a satellite national cancer hospital with medical and surgical oncology capabilities, agreed to partner with our program to obtain a tissue diagnosis and manage women diagnosed with breast cancer, rather than travel to Lima (bus: 24 hours,

plane: 1.5 hours) for these services. INEN became a national partner to assist with oversight, planning, and treatment of the cases that cannot be managed at COR and to provide potential telemedicine support and trainings for local health care providers. A memorandum of understanding was signed between RAD-AID, INEN, and CerviCusco in 2019. Club de la Mama, the national breast cancer awareness and survivor organization, agreed to assist with patient navigation, education, survivorship, and counseling [3]. RAD-AID and CerviCusco shared the cost of the purchase of a SonoSite (Fujifilm) Edge II US unit, which included transducers for breast, abdominal, and obstetric and gynecologic examinations to replace outdated on-site equipment. Ambra Health (Google Inc, Mountainview, California) provided Cloud services through the RAD-AID Friendship Cloud, and Koios Medical donated decision-support software for artificial intelligence assistance for breast US interpretation.

The program launch (January 22 to March 6, 2020) provided 5 weeks of initial on-site training by volunteer board-certified radiologists over the 7-week period. Before arrival of the first volunteers, community outreach focused on breast cancer awareness and publicity regarding the location and services of the new program at CerviCusco. The initial volunteer team—a fellowship-trained breast imager, a nurse manager, and a fourth-year medical student—set up the US unit, developed protocols, and trained local staff to perform CBEs and US and to record findings in the medical records. Nursing support and partnership with Club de la Mama provided on-site patient education and screening goals [6]. The in-person clinical curriculum, including US reporting systems, was previously validated in low-resource settings [7]. We also developed an electronic medical record database to remotely monitor quality assurance and improvement. Subsequent volunteer teams from both the United States

Table 1. Characteristics of women undergoing asymptomatic (screening) and symptomatic (diagnostic) examinations

Characteristic	Reason for consult, N (%)		Total (n = 220)
	Screening (n = 148)	Diagnostic (n = 72)	
Age, median (IQR)	42 (32-52)	35.5 (28.5-44)	40 (31-50)
Age at first pregnancy, median (IQR)	22 (19-26)	23 (20-26)	22.5 (19.5-26)
Gravida (mean ± SD)	2.7 ± 1.7	2.5 ± 2.2	2.6 ± 2.0
Contraceptive use, n (%)	34 (23.0)	25 (34.7)	59 (26.8)
Hormone therapy, n (%)	4 (2.7)	2 (2.8)	6 (2.7)
Breastfeeding, n (%)	60 (40.5)	34 (47.2)	94 (42.7)
Family history, n (%)			
Breast cancer	22 (14.9)	9 (12.5)	31 (14.1)
Ovarian cancer	6 (4.0)	5 (6.9)	11 (5.0)
Alcohol use, n (%)	24 (16.2)	13 (18.1)	37 (16.8)
Prior breast examination(s), n (%)*			
None	113 (76.3)	36 (50.0)	149 (67.7)
Ultrasound	15 (10.1)	25 (34.7)	40 (18.2)
Mammogram	26 (17.6)	12 (16.7)	38 (17.3)
Biopsy	3 (2.0)	3 (4.2)	6 (2.7)

IQR = interquartile range.

*Total percentages may be >100% because patients may have received >1 prior examination.

and Spain built upon the training and reinforced CBE and US skills. Overlap between volunteer teams and on-site staff ensured smooth transitions that allowed trainee experience building in a relatively short time. During the program launch period, volunteers gave 26 hours of lectures (14.5 hours of didactics, 11.5 hours practical experience on phantoms) to Cervi-Cusco staff.

PROGRAM OUTCOMES

Program evaluation and quality improvement are essential components of implementation sciences. During the program launch's 5 clinical weeks, 220 women received an US, with 19 findings referred to COR for further management (eg, biopsies or surgical consultation; Tables 1 and 2). The median age of women presenting was 40 years, with slightly older patients presenting for screening (42

versus 35.5 years). Over two-thirds of women had never had a prior breast examination. Although most women presenting were younger than the national recommended age for screening, the hope is that these early adopters would have positive experiences and increase their communities' awareness, thereby encouraging health-seeking behavior among more at-risk women [8]. Of the diagnostic USs performed, 75% (n = 77) had normal or benign findings requiring no additional workup, and an additional 16% (n = 16) could be managed locally with imaging follow-up. Before this program, all women with positive CBEs required long-distance travel and potential biopsy to rule out malignancy. Furthermore, US identified suspicious or highly suspicious masses in 5% (n = 10 of 188) of women with normal or benign CBEs.

Patient care ceased in March 2020 because of the coronavirus disease

2019 (COVID-19) lockdown but will resume once the nationwide sequestration plan ends. Thereafter, humanitarian opportunities, including periodic review of images and reports remotely via the Cloud, will be extended for collaboration with interested professionals. These reviews will also inform future needs, such as scalability to outlying communities. This resource-appropriate model may serve as a sensible breast cancer detection strategy in rural areas in the United States where mammography is inaccessible. As in Cusco, the aim is for this practice to enable earlier detection of breast carcinoma until screening mammography becomes available.

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Table 2. Findings and management of women undergoing asymptomatic (screening) and symptomatic (diagnostic) examinations

Category	Reason for consult, N (%)		Total (n = 220)
	Screening (n = 148)	Diagnostic (n = 72)	
Breast-related complaint(s), n (%) [*]			
None	148 (100.0) [*]	0 (0.0)	148 (67.3)
Painful breast	0 (0.0)	25 (34.7)	25 (11.4)
Painful mass	0 (0.0)	24 (33.3)	24 (10.9)
Painless mass	0 (0.0)	23 (31.9)	23 (10.4)
Skin or nipple complaints	0 (0.0)	7 (10.1)	7 (3.2)
CBE finding, n (%)			
Normal	121 (81.8)	20 (27.8)	141 (64.1)
Benign	19 (12.8)	28 (38.9)	47 (21.4)
Probably benign	8 (5.4)	22 (30.6)	30 (13.6)
Suspicious for cancer	0 (0.0)	2 (2.8)	2 (0.9)
Definitely cancer	0 (0.0)	0 (0.0)	0 (0.0)
CBE plan, n (%)			
Normal annual examination	77 (52.0)	25 (34.7)	102 (46.4)
Clinical follow-up	2 (1.3)	1 (1.4)	3 (1.4)
Recommend US	39 (26.3)	37 (51.4)	76 (34.5)
Refer to cancer center	0 (0.0)	1 (1.4)	1 (0.4)
Not specified	30 (20.3)	8 (11.1)	38 (17.3)
US finding(s), n (%) [†]			
	n = 266	n = 107	n = 373
Normal tissue	209 (78.6)	50 (46.7)	259 (69.4)
Infection	0 (0.0)	4 (3.7)	4 (1.1)
Fat necrosis	0 (0.0)	2 (1.9)	2 (0.5)
Cyst or ductal ectasia	40 (15.0)	16 (15.0)	56 (15.0)
Mass	16 (6.0)	35 (32.7)	51 (13.7)
Other	1 (0.4)	0 (0.0)	1 (0.3)
BI-RADS, n (%) [†]			
	n = 264	n = 103	n = 367
1	205 (77.6)	49 (47.6)	254 (69.2)
2	38 (14.4)	28 (27.2)	66 (18.0)
3	14 (5.3)	16 (15.5)	30 (8.2)

(continued)

health work presented in this paper, listed [here](https://www.rad-aid.org/about-us/leadership/) (<https://www.rad-aid.org/about-us/leadership/>) for further attribution and

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Table 2. Continued

Category	Reason for consult, N (%)		
	Screening (n = 148)	Diagnostic (n = 72)	Total (n = 220)
4	6 (2.3)	10 (9.7)	16 (4.3)
5	1 (0.4)	0 (0.0)	1 (0.3)
Final management, n (%) [†]	n = 264	n = 103	n = 367
Normal annual examination or clinical follow-up	247 (93.6)	75 (72.8)	322 (87.7)
Imaging follow-up	10 (3.8)	16 (15.5)	26 (7.1)
COR referral for further management [‡]	7 (2.6)	12 (11.7)	19 (5.2)

CBE = clinical breast examination; COR = Centro Oncológico Regional; US = ultrasound.

*Includes women with nonfocal symptoms.

[†]Totals in these categories are greater than patient totals, because patients may have had >1 complaint or finding.

[‡]Referral for cyst drainage, biopsy or fine needle aspiration, or excision of BI-RADS 3 mass >2.5 cm.

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