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Women's participation in a cervical cancer screening program in northern Peru

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Abstract

Cervical cancer is often the most common cancer among women in developing countries, yet current screening efforts have not been effective in reducing incidence and mortality rates in these settings. In an effort to increase knowledge about screening participation in low-resource settings, this study sought to identify key factors affecting women's participation in a cervical screening program in north central Peru. We studied women who were exposed to various health promotion educational activities and compared a total of 156 women who sought screening between July 2001 and October 2003 with 155 women who did not. Results from logistic regression identified four significant predictors of screening: higher relative wealth, knowing other screened women, seeking care from a health facility when sick and satisfaction with services at the health facility. When we restricted our analysis to women who had experienced screening in the past, two additional predictors emerged: having a husband who was supportive of screening participation and attending an awareness-raising session. These results have important programmatic value for tailoring outreach efforts for women and indicate that different strategies may be required to best reach women who have never been screened.

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Introduction

Cervical cancer is the second-most common cancer among women worldwide, with ~470 000 new cases diagnosed each year [1]. About 80% of cases occur in developing countries, where it is often the most common cancer among women [1]. In many developed countries, cytological screening has led to a significant reduction in the incidence of and mortality from cervical cancer; however, in developing country settings, organized screening programs are limited, and testing is often of poor quality and performed inefficiently among the population [2]. Each year, >48 000 new cases of cervical cancer are reported in South America [3]. Current screening efforts have not been effective in reducing high incidence and mortality rates due to cervical cancer in Latin America [4, 2].

One of the major barriers to prevention of cervical cancer is low screening coverage [1]. In Peru, ~43% of women reported having had a screening test within the past year [5]. In a recent review of qualitative studies related to cervical cancer screening in Latin America, Agurto *et al*. [6] found that the main barriers to screening included a lack of accessible and available high-quality services, a lack of comfort and privacy in health centers, discourtesy on the part of health center staff, high cost of services, anxiety related to waiting for test results and an overall fear of cancer. Women also reported benefits of screening, such as peace of mind and being in control of their health [6]. An understanding of the factors affecting women's participation in cervical cancer screening programs is an important element in designing and implementing a program tailored to women's needs—one that encourages

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women to seek screening, thereby reducing overall disease burden [7].

Although reasons for low participation rates in screening have been studied extensively, a recent Cochrane review of interventions to promote cervical screening shows that they were undertaken primarily in Europe and North America. Few studies meeting Cochrane criteria were found in developing country settings [8]. In an effort to increase knowledge about screening participation in low-resource settings, we conducted a study to identify key factors affecting women's participation in a cervical screening program in north central Peru. The project was part of the Alliance for Cervical Cancer Prevention (ACCP).

Based on a summary of selected ACCP research projects, Bingham *et al.* [9] developed a framework for conceptualizing the factors affecting the use of cervical cancer prevention services in low-resource settings. This framework identified three sets of factors: (i) sociocultural norms, (ii) service delivery system and (iii) women's perceptions of quality of care [9]. Our study's objectives were to validate the framework and to develop a model of factors significantly associated with women's screening participation.

Since this study was part of a broader program impact evaluation, we were especially interested in understanding why women, despite having been exposed to cervical cancer prevention promotional activities, did not subsequently seek screening. In this article, we report logistic regression and simulation model results, discuss the findings in light of recently published work in developing country settings and discuss program implications for improving women's screening coverage.

Study area

San Martín is an economically poor jungle region in north central Peru. According to the country's most recent census, in 1993, ~87% of San Martín's households were of low socioeconomic status; >70% of the population was living in conditions in which their basic needs were unmet [10]. Peru has one of the highest incidence rates of invasive cervical cancer in the world. The age-standardized incidence rate of cervical cancer in Peru is 48.2/100 000, compared to a world incidence rate of 16.2/100 000 [3].

This study was part of the TATI project (TATI is the Spanish acronym for Screening and Immediate Treatment), which was a large-scale research service delivery demonstration collaboration involving PATH, the Pan American Health Organization and the Peruvian Ministry of Health. The project was designed to implement the Peruvian national plan for preventing cervical cancer in the Department of San Martín. Its ultimate aim was to reduce the incidence and mortality rates for cervical cancer among women aged 25–49 years; this age range was defined by regional Ministry of Health authorities. The TATI project's prevention activities consisted of cervical screening using visual inspection with acetic acid (VIA) and cryotherapy treatment for cervical lesions. Beginning in 2000, health facilities throughout the region routinely provided these services free of charge to female clients aged 25–49 years.

One component of the project was investigating the effectiveness of a community promotion strategy to facilitate women making decisions about their bodies, particularly about cervical cancer screening and treatment, which would lead to increased cervical screening uptake. Seventy-nine community promotion teams—each comprising one trained staff person from a Ministry of Health clinic or hospital and one community leader—were formed throughout the region and carried out community promotion activities. These health promotion activities included community awareness-raising sessions, health education sessions and home visits. Awareness-raising activities informed women of early detection and treatment of precancerous lesions and where they could go for services. Once awareness was raised in the community, the promotion teams held four educational sessions with groups of women: 'knowing my body', vaginal infections, prevention of cervical cancer and self-esteem. A highly interactive adult education

methodology was used in these educational sessions [11]. Teams made home visits to discuss the importance of participating in cervical cancer prevention activities and to follow up with patients with positive results, whom they encouraged to continue appropriate examinations or treatments.

Methods

Study design and sampling

We studied women who were exposed to health promotion educational activities and compared those who adopted the health intervention (screening) with those who did not [12]. A multistage random sampling approach was used to select study participants (Fig. 1). The sample universe consisted of women who had received education about cervical cancer prevention from one of the 79 health promotion teams working in San Martín between July 2001 and October 2003. A subsample of 16 community promotion teams was randomly selected, and all women who had been exposed to their educational activities were considered eligible participants. Sample size estimates for logistic regression models were estimated using two-sided significance levels set at 0.05 and a power of 0.78. Anticipating possible respondent refusals, variation in quality of record keeping and the loss to follow-up due to the sometimes-difficult geographic terrain in the study area, we oversampled by 50%.

All teams kept comprehensive lists in community promotion notebooks of women whom they contacted through their various activities. Women gave verbal consent to have their names included in this notebook, which stated each woman's name, place of residence, age and screening status. Each of the 16 teams shared its notebook with the study coordinator. Gathering the names of all women 25–49 years old who had been contacted by the promotion team during the study time frame, the coordinator made two lists: one that contained names of women who had received cervical cancer prevention screening and the other with the names of those who had not. A random sample of screened and unscreened women was selected from each promotion team's list in proportion to the total number of women contacted by the team. The screening status of each woman selected to participate in the study was verified in the TATI project database. This database included all women screened with VIA as part of the TATI screening and treatment project.

To be eligible for this study, women needed to have been contacted by the promotion team between June 2001 and October 2003 in (i) a community awareness-raising event, (ii) a women's education session or (iii) a home visit. In addition, women identified as having been screened needed to have their screening status confirmed by the TATI database (confirming they had been screened by a TATI-trained provider). Women identified as unscreened could not report any type of cervical screening since June 2001. Women living in the project coverage area who were not exposed to cervical cancer prevention promotional activities were not included in the study.

Data collection procedures

Interviews were conducted in Spanish in the interviewees' homes by trained and experienced interviewers. Information collected included demographic indicators, distance to health facility and travel costs, attitudes and beliefs about cervical cancer and its prevention, sociocultural norms, knowledge and attitudes toward screening, spousal and family support for the screening program, level of exposure to educational interventions and experiences with the service delivery structure. Carefully selected quality-of-care and client satisfaction measures validated through previous use by reproductive health researchers in Peru [13] were also included in the survey. All respondents gave written consent to be interviewed. The PATH Human Subjects Protection Committee and the San Martín Ministry of Health approved the study.

Methods for analysis

Data were entered into Microsoft Access 2000 (Microsoft Corporation, Redmond, WA, USA) and analyzed using SPSS (SPSS Inc., Chicago, IL, USA, version 11.5.1) for univariate and bivariate statistics.

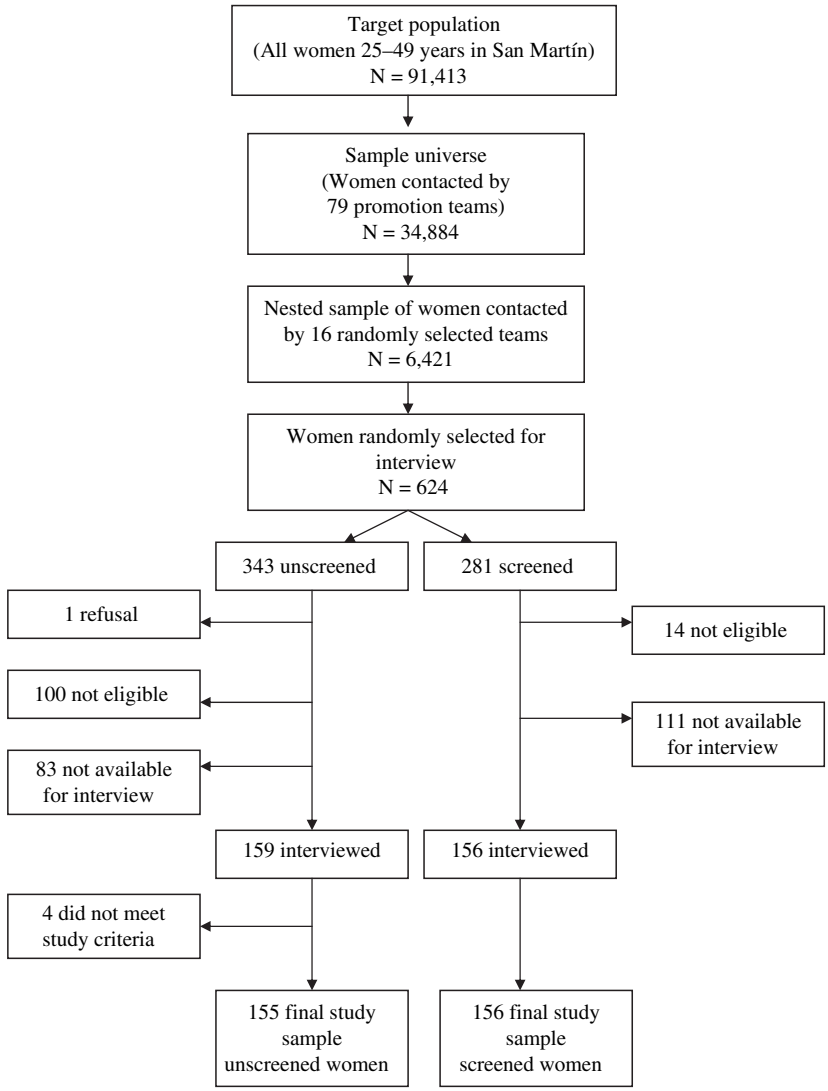

Fig. 1. Sample design.

SYSTAT (SYSTAT, Richmond, CA, USA, version 11.0) was used for logistic regression modeling.

For the univariate and bivariate statistical analysis, we generated means and standard deviations for continuous variables and obtained frequencies and percentages for each binary or categorical variable. We used Pearson's chi square for binary and categorical variables and the independent samples *T*-test to test significance levels for continuous measures. Bivariate scatterplots of the dependent variable (VIA screened or unscreened women) were generated against each variable to look for directional linear relationships. A number of composite measures consisting of a Guttman scale, Likert scales and indices were generated in order to consolidate related measures and to address collinearity

in the data following methods outlined in Wilkinson *et al.* [14], Stenson and Wilkinson [15] and Bernard [16]. A Guttman scale of household wealth was created from 10 items (stove, radio, television, bicycle, refrigerator, car, motorbike, tubed water, electricity and sewage system) with a coefficient of reproducibility of 0.875. For the sample tested, the household wealth scale is unidimensional [16]. A six-item Likert scale measured the perceived quality of care that individuals received at their health facility along several dimensions (client comfort, access and acceptability and overall satisfaction with services received) (Cronbach's alpha = 0.740).

Highly correlated variables were combined into new variables [14]. For some measures, a new binary variable was created by assigning a valued of '1' if a respondent answered 'yes' to any one of the related question series; otherwise, the value was coded '0'. A composite 'supportive social network' measure consisted of two items ('it is acceptable for women in my community to get screened' and 'my friends encourage me to get screened'). A two-item composite variable measured the degree of 'husband support' ('my husband is supportive of decision to get screened' and 'my husband does not believe that screening is a harmful practice'). The composite measure 'myths and rumors about cervical screening' consisted of two items ('when a woman is screened she receives additional medical tests' and 'screening is a harmful practice'). Finally, three items made up a composite measure aimed to measure whether respondents believed that women were 'being turned away from screening services' ('providers are too busy', 'facility was closed' and 'facility had no supplies'). Preliminary results of these composite measures are presented in Table I. To treat missing data, a missing values analysis was carried out using Little's missing completely at random test and the expectation maximization estimation method for replacing missing values [17].

Models were tested using logistic regression (LOGIT) and followed backward entry techniques outlined in Steinberg and Colla [18] and Hosmer and Lemeshow [19]. Determinants significant in the bivariate analysis, including the composite measures described above, were included in the unrestricted model. The restricted model examined possible interactive effects. To guard against errors arising from possible model misspecification and small cell sizes, the quasi-maximum likelihood estimation procedure was used. The model fit was confirmed using the following procedures: the Hosmer–Lemeshow test, which examines model validity; diagnostic plots to identify cases with a poor fit or high influence that could significantly alter model estimates; a model prediction success table to determine the sensitivity and specificity of the fitted model and simulation modeling to obtain probabilities for the model covariates, including interactive effects. Odds ratios (ORs), their 95% confidence intervals (CIs) and probability values were generated to demonstrate the effect of the significant determinants.

Results

Based on the multistage sampling scheme (Fig. 1), a total of 624 eligible women were randomly selected for the interview and visited by the interviewers from March through May 2004. Nearly half of these women were dropped from the study for reasons described below. Many women in both groups were unavailable for the interview. Reasons for unavailability were similar in the two groups. Of those selected, interviewers could not find information on the whereabouts of 26 women in each group. Although interviewers made three attempts to contact each woman, some had moved (32 screened and 20 unscreened), and others were away working on family farms (22 screened and 16 unscreened) or were away from home (18 screened and nine unscreened). Other women were not interviewed because access was dangerous or extremely difficult for interviewers (nine screened and six unscreened). In addition, three women in the unscreened group could not be interviewed because they had died. One hundred participants selected for participation in the unscreened group were, in fact, ineligible; most had received cervical screening elsewhere during the study period, and therefore were not captured by the TATI database. (These women were screened

Table I. *Sample characteristics and results of bivariate analysis*

Characteristic/variable	Screened (n = 156)	Not screened (n = 155)	Significance level
Average age (mean years/SD)	35.4/6.3	34.6/6.5	NS
Years of education			
None	3.9%	7.2%	
1–5	22.6%	26.8%	
6–10	48.4%	51.6%	
⩾11	25.1%	14.4%	$P < 0.08$
Average number live births (mean/SD)	3.8/2.0	4.0/2.2	
Has a husband or male partner	96.2%	85.2%	$P < 0.002$
Exposure to TATI cervical screening promotional activities			
Had contact with TATI promotion team	100.0%	100.0%	NS
Attended at least one educational session	84.0%	92.3%	$P < 0.02$
Attended all four educational sessions	65.4%	53.4%	$P < 0.03$
Attended an awareness-raising session	26.3%	12.9%	$P < 0.003$
Received a home visit from TATI community promoter	1.3%	1.3%	NS
Civic involvement			
Has membership in a women's organization	50.3%	62.6%	$P < 0.03$
Reported leadership role in a community organization	28.8%	27.7%	NS
Wealth status			
Employed (receive a weekly or monthly wage)	74.4%	76.8%	NS
Owns property or land	74.4%	78.1%	NS
Attitudes and beliefs about cervical screening (agree = 1, disagree = 0)			
Agree that the screening examination is important to protect their own health	99.4%	95.5%	NS
Agree it is acceptable for women in their community to go for the examination	84.5%	81.0%	NS
Agree that women in their community find it shameful to receive a vaginal examination	13.6%	10.0%	NS
Agree that a woman receives additional procedures (e.g. hysterectomy, human immunodeficiency virus test, family planning) at the same time without her knowledge	0.6%	3.3%	NS
Agree that the screening examination is an evil or harmful practice	3.9%	21.6%	$P < 0.001$
Report that their husband believes that screening may be a harmful practice	5.4%	20.9%	$P < 0.001$
Supportive social environment			
Receives support from husband/male partner to go for screening (agree = 1, disagree = 0)	97.4%	90.3%	$P < 0.009$
Has a supportive social network (agree = 1, disagree = 0)	82.1%	76.8%	NS
Has friends who encourage each other to go for screening (agree = 1, disagree = 0)	92.2%	84.9%	$P < 0.04$
Knows other screened women (average number family members, friends or acquaintances who have gone for screening in the past 3 years)	7.0/4.2	5.8/4.1	$P < 0.001$
Previous experience with service delivery system			
Has been screened prior to onset of TATI project (yes = 1, no = 0)	76.3%	44.5%	$P < 0.001$
Say they have been turned away from screening (yes = 1, no = 0)	16.0%	23.5%	NS
First place to seek health care when sick			$P < 0.002$
Lay healer	0.6%	2.6%	
Pharmacy	11.0%	13.5%	
Private physician	2.6%	5.2%	
Health facility	49.7%	27.7%	
Treat self	36.1%	51.0%	

Table I. *Continued*

Characteristic/variable	Screened (n = 156)	Not screened (n = 155)	Significance level
Last time visited a health facility for own health			$P < 0.02$
Visited <3 months ago	40.6%	34.4%	
Visited between 3 months and 1 year ago	29.0%	22.7%	
Visited >1 year ago	29.7%	36.4%	
Has never visited health facility	0.6%	6.5%	
Last visit to health facility for someone else			NS
Visited <3 months ago	51.6%	58.3%	
Visited between 3 months and 1 year ago	30.3%	21.2%	
Visited >1 year ago	18.1%	20.5%	
Use oral contraceptives (pill) (yes = 1, no = 0)	55.5%	72.4%	$P < 0.002$
Average cost to travel to facility (in Peruvian Soles) (mean/SD)	1.31/2.3	0.83/1.6	$P < 0.03$
Attitudes about access to the service delivery system and quality of care received			
Believes there is no problem with a male provider performing the examination on a woman (agree = 1, disagree = 0)	71.2%	52.9%	$P < 0.001$
Believes that women are turned away from screening services because of the following reasons (agree = 1, disagree = 0)			
Providers are too busy	50.3%	57.6%	NS
Facility was closed when they arrived	54.9%	63.0%	NS
Facility had no supplies and could not provide the services	24.6%	28.2%	NS
Agrees with the following statements (agree = 1, disagree = 0)			
The health center has clean equipment	93.4%	90.0%	NS
The health center uses safe equipment	80.1%	64.4%	$P < 0.002$
The waiting time (to be seen) is acceptable	68.6%	48.3%	$P < 0.001$
The time and day screening services are offered makes it easy for women to get screened	86.5%	59.9%	$P < 0.001$
She receives good-quality care	82.1%	70.4%	$P < 0.02$
She is satisfied with services received at health facility	81.4%	49.3%	$P < 0.001$
Composite measures			
Average score on 10-item Guttman wealth scale (mean/SD)	3.9/2.0	3.1/2.0	$P < 0.001$
Believes certain myths and rumors about cervical screening (two items)	4.5%	21.3%	$P < 0.001$
Has a supportive social network (two items)	82.1%	76.8%	NS
Has a supportive husband (two items)	97.4%	90.3%	$P < 0.009$
Believes that women are being turned away when seeking screening	44.9%	56.8%	$P < 0.04$
Average score on six-item client satisfaction scale (mean/SD)	3.9/2.0	3.1/2.0	$P < 0.001$

in settings including a private doctor's clinic, within the social security health care system or at a Ministry of Health facility that was not participating in the VIA study.) Eleven women had been screened as part of the TATI project and were not found in the TATI database because their names had been recorded incorrectly during their screening visit. Other ineligible participants had not received education about cervical cancer screening or were out of the study's age range. Only one woman refused to be interviewed. A total of 311 women were included in the analysis (156 screened and 155 unscreened women).

Characteristics of the population and results of bivariate analysis

While the average age of both screened and unscreened women was 35 years, overall, screened women were slightly more educated (Table I).

Some important differences were noted in exposure levels to TATI promotional activities. Screened women were more likely to have attended an awareness-raising event ($P < 0.003$) and more likely to have completed the four-session education series ($P < 0.03$) than unscreened women. Surprisingly, screened women were less likely to report membership in any type of women's organization ($P < 0.03$). The majority of women in both groups was employed and reported owning land. However, screened women were wealthier; more women who were screened reported owning a stove, television and bicycle in their households than those who were unscreened. Significant differences in scores from the Guttman social wealth scale were noted between groups; screened women reported owning a mean average of 3.9 items versus 3.1 items for unscreened women ($P < 0.001$). Screened women were also more likely to have a living husband or male partner ($P < 0.002$).

Attitudes and beliefs about screening

Unscreened women were more likely to report that their husbands believe screening to be a harmful practice ($P < 0.001$) and also that they themselves believe screening is an evil or harmful practice ($P < 0.001$). Interestingly, a majority of unscreened and screened women agreed with a prevailing rumor that women were being turned away because either providers were too busy (58 and 50%, respectively) or the facility was closed (63 and 55%, respectively). A minority of both groups felt women were also turned away because facilities had no supplies (28 and 25%, respectively). Furthermore, a significantly higher percentage (57%) of the unscreened women answered yes to at least one or more of the three reasons for being turned away, compared with 45% of the screened women. This means that unscreened women were far more likely to believe that women were being turned away when they sought screening ($P < 0.04$). While the majority of women in both groups saw screening as an important aspect of protecting one's own health, unscreened women were more likely to disagree with this statement ($P < 0.03$).

Supportive social environment

Not surprisingly, screened women were more likely to have friends that encourage each other to get screened ($P < 0.04$) and knew more family members, friends or acquaintances who had gone for screening in the past 3 years than unscreened women ($P < 0.001$). Screened women reported knowing an average of seven other women who had been screened, compared with 5.8 women reported among the unscreened sample ($P < 0.001$).

Experience with the health care delivery system

A total of 119 (76.3%) screened women and 69 (44.5%) unscreened women reported they had been screened at least once in their lifetime prior to 2000. Noteworthy is that both screened and unscreened women (16 and 24%, respectively) reported that they had been turned away from a health facility that offered screening services. When compared with unscreened women, screened women appeared to be more experienced with the health care delivery system. Screened women had been screened more times in their lifetime than unscreened women ($P < 0.001$) and were also more likely to have been screened prior to the onset of the TATI project ($P < 0.001$). Screened women were also more likely to use an oral contraceptive family planning method than unscreened women ($P < 0.002$) (pills and condoms were the most frequently reported contraceptives among both groups). Unscreened women were more likely to treat themselves when they fell sick (51%), with only 28% first seeking care at a health center. Screened women, on the other hand, were more likely to first seek care (~50%) from a health center ($P < 0.002$), with only 36% not going anywhere or treating themselves.

Attitudes and beliefs about cervical screening and perceived quality of care received at health facility

In this sample, unscreened women expressed more concerns about a male provider giving the examination than screened women ($P < 0.001$). Screened and unscreened women differed significantly on

a number of quality-of-care indicators. Overall, results suggest that screened women felt more satisfied with the general level of quality of care at health centers than unscreened women—they were more likely to believe that equipment was safe ($P < 0.002$), found waiting times acceptable ($P < 0.001$), reported receiving good care ($P < 0.02$) and were more likely to say that they were satisfied with the services they had received at the health facility ($P < 0.001$). In addition, screened women exhibited significantly higher mean scores on the client satisfaction scale ($P < 0.001$) than unscreened women.

Logistic regression results: determinants of VIA screening

Table II presents the results of logistic regression analysis. The dependent variable for this analysis was screening status during the 2000–03 TATI screening program. The reference group used to generate ORs was those women who were not screened by a TATI provider. The unrestricted model showed that 'no prior screening history' was the strongest predictor (OR 0.2, CI 0.1–0.5); therefore, researchers examined this effect independently against the other significant predictors to determine whether any interactive effects existed in the data.

The final restricted model consisted of five significant independent predictors and two interaction effects. The log likelihood test comparing the unrestricted and restricted LOGIT models indicated that the restricted LOGIT solution was more robust (unrestricted model log likelihood [LL] test = 133.4, restricted model LL test = 117.1, LL probability = 0.130). The model prediction success table indicated that this model successfully predicted screened and unscreened respondents with a sensitivity and specificity of ~68%. This indicates that the model coefficients had modest utility in predicting factors affecting screening status. On the other hand, these findings indicate that there is some variability that the model was not able to capture. Diagnostic tests indicate that the model was fit (H-L statistic, df = 8, $P = 0.623$) and consistently predicted observed versus expected results.

Noteworthy is that among all women, regardless of prior screening status, five significant predictors were found. When compared with women who reported that they treated themselves at home when sick, women who reported they first seek care at a health facility were more than twice as likely to be screened. The more satisfied a woman was with services she had received at the health facility, the more likely she was to have been screened during the project. Similarly, women with higher Guttman wealth scale scores were significantly more likely to have been screened. Another strong predictor of screening status was the number of screened women that a woman knew. While most women knew at least one other screened woman, the odds of a woman being screened increased ~10% for each extra woman that she knew. Marital status also showed some effect; however, a log likelihood test confirmed that this variable only modestly improved the final model solution.

Two factors appear to be related to women's previous experiences with health facilities. The effects of two predictors differed when we controlled for previous screening status. A significant interactive effect was found among women who had been screened before and who had attended an awareness-raising session, as well as among women who had been screened before and who had a husband supportive of screening. These same effects, as Table II shows, were not true with women with no previous screening experience.

Simulation model

Because the effect of previous screening was so strong, we ran separate simulation models for women without prior screening experience (Table III) and those with previous screening experience (Table IV) to better understand the implications of the interactions found in the fitted model. Different profiles are represented as rows and consist of different combinations of predictors. The odds for a particular profile resulting in the decision to get screened are based on a comparison with a reference group which has none of the specified effects of the particular profile. Profile 1 in Table III depicts a woman who has no screening experience, did not attend an awareness-raising session, is married but her husband is not supportive of screening, was not satisfied with the services she received at the health

Table II. *Determinants of participation in the TATI VIA screening program (2000–04)*

Factor	Unrestricted OR (95% CI)*	Restricted OR (95% CI)
Previous screening experience (yes = 1, no = 0)	4.6 (2.5–8.7)***	1.3 (0.265–6.8)
Attended a health awareness-raising session (yes = 1, no = 0)	4.1 (1.7–10.1)***	2.6 (0.839–7.8)
Husband supportive of screening (yes = 1, no = 0)	2.8 (0.8–9.9)	1.6 (0.500–4.8)
Satisfied with services received at health facility (six-item scale)	1.6 (1.3–2.0)***	1.6 (1.3–2.0)***
Knows other screened women (number of women)	1.1 (1.1–1.2)***	1.1 (1.1–1.2)***
Material wealth status (10-item Guttman scale)	1.3 (1.1–1.6)***	1.3 (1.2–1.6)***
First place seeks care when ill		
Treat self	Reference	Reference
Lay healer	0.593 (0.051–6.9)	0.433 (0.030–6.2)
Pharmacy	2.3 (0.844–6.0)	2.0 (0.858–4.9)
Private physician	0.448 (0.114–1.8)	0.581 (0.164–2.1)
Health facility	2.6 (1.2–5.6)	2.7 (1.2–4.5)*
Neither is currently married nor has male partner (yes = 1, no = 0)	0.377 (0.133–1.067)	0.293 (0.100–0.863)*
Interactive effects		
Previously screened × attended awareness-raising session		7.1 (2.1–24.0)**
Previously screened × husband supportive of screening		2.8 (1.6–5.0)***
Never been screened × attended awareness-raising session		2.6 (0.875–8.0)
Never been screened × husband supportive of screening		3.2 (0.484–21.9)
Other controls		
Years of education		
None	Reference	Reference
1–5	0.376 (0.100–1.4)	0.664 (0.199–2.2)
6–10	0.356 (0.100–1.3)	0.602 (0.189–1.9)
⩾11	0.559 (0.130–2.4)	1.3 (0.346–5.2)
Belongs to a women's group/organization (yes = 1, no = 0)	0.554 (0.304–1.0)	0.665 (0.379–1.2)
Acceptable to be seen by male provider (agree = 1, disagree = 0)	1.7 (0.888–3.2)	1.5 (0.847–2.7)
Uses oral contraceptives (yes = 1, no = 0)	1.4 (0.734–2.6)	1.5 (0.835–2.6)
Has supportive social network (family/friends) (yes = 1, no = 0)	1.9 (1.0–3.8)*	1.6 (0.836–3.1)
Able to receive community assistance to go for screening (yes = 1, no = 0)	0.837 (0.435–1.6)	1.1 (0.608–1.9)
Heard negative rumors about screening test (yes = 1, no = 0)	0.392 (0.134–1.2)	0.476 (0.180–1.3)
Has ever been turned away (by health facility staff) from being screened (yes = 1, no = 0)	0.511 (0.234–1.1)	0.584 (0.286–1.194)
Cost to travel to facility (in Peruvian Soles)	1.1 (0.919–1.2)	1.0 (0.891–1.2)

*$P < 0.03$, **$P < 0.002$, ***$P < 0.001$.

facility and knows no other women who have been screened. The likelihood that she will get screened is very small (OR 0.0) compared to the reference group. Contrast this with Profile 7: the woman attended an awareness-raising session, has a supportive husband, believes that she receives good-quality care at the health facility and knows other women who have been screened. The odds that this woman is screened jumps to ~3.0; however, the lower confidence limit is less than one, so there is still a possibility that she may not get screened.

In Table IV, the same simulation model was run on women who had previous screening experience. The results are somewhat different because the same key predictors and interactions had different effects on women who had been screened before. Profile 1 is a woman who has been screened in the past, did not attend an awareness-raising session, does not have a husband supportive of screening, did not report being satisfied with services at the health facility and did not know other screened women. Like her never-screened counterpart in

Table III. *Simulation models: women with no previous screening experience*

Factor	Profile						
	1	2	3	4	5	6	7
OR	0.0[a] (0.0–0.0)	0.3 (0.0–3.0)	0.0 (0.0–0.1)	0.7 (0.2–3.5)	1.0 (0.4–2.9)	0.0 (0.0–0.3)	2.8 (0.9–5.3)
She attended an awareness-raising session			Yes[b]	Yes		Yes	Yes
She has a supportive husband			Yes	Yes	Yes	Yes	Yes
She is highly satisfied with services received at health facility[c]		Yes		Yes	Yes		Yes
She knows other women who have been screened[d]		Yes			Yes	Yes	Yes

[a]The odds for a particular profile are based on a comparison with a reference groups that has none of the specified factors of a particular profile. [b]Yes indicates that factor is present in simulated profile. An empty cell indicates factor is absent from model. [c]Calculations based on a score of 6 on a six-point client satisfaction scale. [d]Based on the calculation that she knows between five and eight screened women.

Table IV. *Simulation models: women with previous screening experience*

Factor	Profile						
	1	2	3	4	5	6	7
OR	0.0[a] (0.0–0.2)	1.1 (0.2–5.6)	0.3 (0.1–1.4)	0.8 (0.2–3.6)	2.5 (1.1–5.6)	4.6 (1.0–21.3)	13.0 (2.9–57.3)
She attended an awareness-raising session			Yes[b]	Yes		Yes	Yes
She has a supportive husband			Yes	Yes	Yes	Yes	Yes
She is highly satisfied with services received at health facility[c]		Yes			Yes	Yes	Yes
She knows other women who have been screened[d]		Yes		Yes	Yes		Yes

[a]The odds for a particular profile are based on a comparison with a reference groups that has none of the specified factors of a particular profile. [b]Yes indicates that factor is present in simulated profile. An empty cell indicates factor is absent from model. [c]Calculations based on a score of 6 on a six-point client satisfaction scale. [d]Based on the calculation that she knows between five and eight screened women.

Table III, the odds that she will be screened are small (OR 0.0). Contrast her situation with Profile 7. As in Table III, this woman attended an awareness-raising session, has a supportive husband, believes that she receives good-quality care at the health facility and knows other women who have been screened. Her odds of being screened have dramatically increased to 13.0.

Results in Table IV also illustrate how the presence of certain factors may offset the absence of other factors. For instance, Profile 6 is a woman who has been screened before, attended an awareness-raising session, has a supportive husband and thinks favorably of the services she has received at the health facility; she does not, however, know other screened women. These other factors offset her not knowing other screened women. The odds that she will seek screening are fairly good (4.6).

It is also noteworthy from both tables that, for women who have never been screened before, most of these factors independently have negligible effects. It is only when all key predictors are either present or maximized that the odds of being screened approach significance.

Discussion

Our study findings validate the applicability of a framework that offers a multipronged approach to increasing cervical screening uptake and early treatment in low-resource settings [9]. Findings from the logistic regression were consistent with the framework proposed by Bingham *et al*. [9], with factors significantly associated with screening participation being identified in each of the three categories of the framework—sociocultural norms (experience with health delivery system and perceived quality of care), service delivery system (ability and willingness to seek care) and quality of care (client satisfaction and confidence in delivery of services). Personal wealth was also found to be important. The framework should emphasize such factors in a more focused way in the future.

Results from this study support findings from other research about women's participation in screening carried out in low-resource settings. In our study, a supportive social network and actually knowing other screened women had an important effect on a woman's decision to seek screening. Similarly, in South Africa, results suggest that knowing someone else who had a cervical smear was an independent predictor of screening [20]. Of particular interest is our study finding that showed an increase in the OR of a woman's participation with an increase in the number of screened women she reported knowing. Facilitating interaction among screened women who had positive experiences and unscreened women is one way to increase screening coverage.

In our study, screened women were more likely to seek care from a health facility when sick. This result is consistent with findings from other studies that suggest more contact with the health care system increases the likelihood of a woman being screened [21–23]. It is possible that women who routinely seek care from a health facility for curative purposes are also more comfortable accessing those services for preventive options such as screening. Sociocultural beliefs may impinge on health care-seeking behavior. For example, Serbian women believe that patients should only present to a health care professional for certain curative health problems and not at all for preventive health care [24].

Alternatively, women who participate in screening may simply have easier access to health services in general. A population-based survey in Nicaragua identified distance to health facility—as well as age, educational status and knowledge about cervical cancer and its prevention—as significantly predictive of cervical screening status [25]. However, this study did not take into account the effect that previous exposure to health promotional activities had on screening status.

The importance of a client's perspective of quality and satisfaction with health services, and particularly with women's reproductive health services, has been proposed as a significant factor by a number of authors [26–28]. Results from this study indicate that satisfaction with services at the health facility had a significant predictive effect on screening status.

As in our study, researchers in other settings have found an association between higher income and participation in cervical screening [29, 30]. This stands to reason; women with financial resources may find it easier to access health services and leave other activities aside for the time it takes to seek screening. However, this finding has not been entirely consistent. A study that explored determinants of participation in rural south India found that low-income women had higher compliance with screening [31]. In this case, where screening services were available through the public sector only, women with higher incomes may have chosen not to participate because they held the perception that poor-quality services were offered in the public sector.

Among women who had previous screening experience, two additional predictors emerged: having a husband who was supportive of screening participation and attending an awareness-raising session. A qualitative study in Mexico sheds further light on this finding; researchers specifically noted that women, particularly those living in poverty, may fail to seek screening not only because they are prioritizing primary needs but also because their male sexual partners may be opposed to a male provider giving the examination, or the women themselves may reject the pelvic examination [32].

In our study, awareness raising was a more important component of mobile outreach than of facility-based promotion efforts. This finding makes sense because in remote settings, where a mobile clinical team came to a community to offer screening, the promotion team often provided shorter awareness-raising sessions immediately before the scheduled screening rather than offering longer educational sessions that were conducted independent of the screening activity. It is not clear why these issues were of importance only among previously screened women: perhaps their prior experience made them more receptive to messages about screening. It would be interesting for future research to explore this finding in more detail.

Qualitative studies conducted in Latin America suggest that women lack information about cervical cancer, feel anxiety about test results or experience fear of cancer and death [6, 32], and these factors in turn can affect the decision to seek screening. However, results from our simulation modeling indicate that providing information about cervical cancer prevention and screening services would not alone be enough to ensure that a woman would seek screening. In fact, no single factor was enough to ensure that a woman would do so. Only a combination of factors associated with screening status would be able to increase the likelihood that a woman would seek screening. These findings support the importance of a multistrategy approach suggested by others that includes, but is not limited to, health education [9, 20, 33].

The loss of participants is a key limiting factor to this study and was due largely to unavailability and ineligibility. Loss of participants due to unavailability was anticipated in this highly mobile population, and an oversample was randomly selected for interview. While the number of participants lost to unavailability was larger in the screened group, an analysis of the reasons why women were not interviewed showed the reasons were similar in both groups and, thus, do not suggest a systemic bias. Loss due to ineligibility was considerably higher in the unscreened group, as a substantial number of women self-reported that they had, in fact, received screening during the study period. Most of these women were screened in clinics not participating in the TATI study, where clinical screening data were collected. This suggests that while perhaps inspired by their contact with the health promotion team to seek screening, these women were screened in a setting outside of the TATI study.

Results of this study have substantial utility for tailoring outreach efforts for economically marginalized women regardless of screening experience. Our finding that increased wealth is predictive of screening participation speaks to the need for screening programs to make a special effort to reach out to poorer women. Programs may also benefit from linkages with development programs that improve women's economic capacity and ensure that they can financially support their health care needs. A supportive social environment is also an important screening motivator. Screened women could be encouraged to share their screening experience broadly with friends and neighbors. Screened women could be invited to voluntarily share their stories in public settings or through outreach to individual women who have not yet sought screening, although privacy issues on both sides would have to be safeguarded. Programs could incorporate screening recruitment beyond the health facility to reach out to women who treat themselves at home when they are sick. Finally, improving overall client satisfaction with health services could contribute to a successful approach.

This study highlighted the importance of previous screening on screening attendance and strongly indicates that different strategies may be required for women who have never been screened. It will be essential to explore new and creative strategies to encourage screening in this hard-to-reach population. And finally, more research is needed to fully understand the issues relevant to women who have never participated in screening.

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Conflict of interest statement

None declared.

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