Published in final edited form as:

*Cancer Epidemiol Biomarkers Prev*. 2016 April ; 25(4): 584–592. doi:10.1158/1055-9965.EPI-15-1246.

# Multi-level Intervention Raises Latina Participation in Mammography Screening: Findings from ¡Fortaleza Latina!

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## Abstract

**Background—**Breast cancer is the most commonly diagnosed cancer in women in the United States, and Latinas have relatively low rates of screening participation. The Multi-level Intervention to Increase Latina Participation in Mammography Screening study (¡Fortaleza Latina!) sought to assess the efficacy of a clinic- and patient-level program to increase breast cancer screening among Latinas in Western Washington who seek care at a safety net health center.

**Methods—**The study enrolled 536 Latinas ages 42-74 who had a primary care clinic visit in the previous 5 years and had not obtained a mammogram in the previous 2 years. Participants were block-randomized within clinic to either (1) a control arm (usual care) or (2) a *promotora*-led, motivational interviewing intervention that included a home visit and telephone follow-up. At the clinic level, two of four participating clinics were provided additional mammography services delivered by a mobile mammography unit.

**Results—**Rates of screening mammography 1 year post-randomization were 19.6% in the intervention group and 11.0% in the usual care group ($p<0.01$), based on medical record data. No significant differences in participants' mammography screening were observed in clinics randomized to additional mammography services vs. usual care (15.8% vs. 14.4%, $p=0.74$).

**Conclusion—**This multi-level intervention of *promotora*-delivered motivational interviewing and free mammography services modestly raised rates of participation in breast cancer screening among Latinas.

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Conflict of interest:
The authors declare that there are no conflicts of interest.

Clinicaltrials.gov Registration Number: NCT02010008

**Impact—**Our findings can inform future efforts to boost mammography participation in safety net practices.

### Keywords

Breast cancer; mammogram; screening and prevention; Latinas/ Hispanics; multi-level intervention

## Introduction

Breast cancer is the most common cancer among women in the United States and the leading cause of cancer death among Latinas (1, 2). Latinas are more likely than non-Latina whites to be diagnosed with breast cancer in advanced stages. Data from 2012 from the Surveillance, Epidemiology and End Results (SEER) program revealed that 42% of incident breast cancer cases in Latinas were detected in regional or distant stages, compared to 35% in non-Latina whites (1). Indeed, recent analysis of data from 18 SEER cancer registries in the United States showed that, among women diagnosed with breast cancer, Latinas were 30% more likely to be diagnosed with stages II and III (vs. stage I), compared to non-Latina whites (3). The advanced stage of disease detection is thought to be attributable in part to higher occurrence of poor prognosis subtypes of breast cancer and lower rates of screening mammography; national data for women ages 50-74 show a 5% lower rate of mammography participation in the previous 2 years among Latinas, compared to non-Latina whites (69% vs. 74%) (4).

Research has shown that both patient and health system factors are associated with participation in mammography screening among women in general and among Latinas in particular (5, 6). Several previous investigations have articulated individual-level factors associated with screening among Latinas, including low levels of education (7), short length of time in the US (7, 8), psychosocial factors (9-11), limited health care access and use (7, 9, 10, 12-14), lack of a regular care provider (14, 15), no recent clinical visit (13, 14, 16), and having never been screened (17). Although several studies have reported on the importance of provider recommendations in women's decisions to undergo breast cancer screening (10, 13, 18, 19), few studies have attempted to describe clinic-level factors that affect breast screening outcomes. These have identified on-site screening services, electronic medical record prompts, and reminder letters or text messages as facilitators of breast cancer screening (20-26). A limited number of previous studies have highlighted the potential of mobile mammography services to overcome limited mammography capacity and reduce geographic barriers to screening (27-29). Moreover, our formative research involving one-on-one interviews with providers identified on-site mammography as a facilitator to screening (30). Few previous interventions that sought to raise rates of mammography screening in Latinas were designed to address influences at multiple levels. Multi-level interventions are important because even a highly motivated woman may be unable to access and pay for a mammogram, if such services are not routinely offered at her clinic or are otherwise difficult to obtain (e.g. due to referral processes, language, or geographic barriers). As noted by Taplin et al. and Clauser et al., applying a multi-level lens can provide information about the context that may shape how a given intervention is adopted,

implemented or maintained (31, 32). Such interventions offer great potential, but are underrepresented in research in care delivery settings.

To fill this important research gap, we tested the efficacy of a combined patient-level and clinic-level intervention on mammography screening participation among Latinas who receive care in a safety net health center. The intervention involved a *promotora*-led, motivational interviewing program of home visits and follow-up telephone calls (at the patient level) and additional mammography services delivered by a mobile mammography unit (at the clinic level). We implemented this study in partnership with two community-based partners—Sea Mar Community Health Centers and the Seattle Cancer Care Alliance.

## Methods/ Design

### Setting

We conducted this study in Washington State, where the Latino population represents 12% of the total population. The Latino population is the fastest growing in the state; in fact, it increased by 71% (or 314,281 individuals) between the 2000 and 2010 censuses (33). The four participating clinics are part of Sea Mar Community Health Centers, a federally qualified health center (FQHC) that operates a network of 28 clinics in Western Washington specializing in the delivery of primary care services to low-income Latinos. The participating clinics are located in King (two clinics), Snohomish, and Skagit counties, where Latinos represent 9%, 10%, and 34% of the total county's population, respectively. They were chosen based on size and location. Clinics had to have sufficient numbers of women due for mammography screening (n >350), be in close proximity to Seattle to minimize distance travelled by the mammovan, and yet located in distinct geographic regions to allow comparisons of neighborhood factors. the selected clinics were located 10-20 miles south of Seattle (n = 2) and 35-60 miles north of Seattle (n = 2).

The Seattle Cancer Care Alliance (SCCA) is a joint partnership between the Fred Hutchinson Cancer Research Center, the University of Washington, and Seattle Children's Hospital; the SCCA provides comprehensive breast cancer screening, diagnostic evaluation, and care that include a mobile mammography van deployed in the community to increase access.

### Participants

We recruited Latinas who had visited one of four participating clinics of Sea Mar Community Health Centers in the previous 5 years (i.e., 2007-2012) and had not obtained a mammogram within the previous 2 years. Eligible women were 42-74 years of age. At the time of the study the US Preventive Services Task Force recommended informed decision-making with a health care provider for women ages 40-49 and biennial mammography beginning at age 50, but we opted to include women ages 42-49 for two reasons: 1) the Breast, Cervical, and Colon Health Program in King County, the program that serves many Sea Mar patients, provides reimbursements for screening among average-risk women beginning at age 40, and 2) the Preventive Health Mandate of the Affordable Care Act requires that all health insurance plans cover mammography screening at no cost for women

beginning at age 40. We excluded women ages 40-41 because they were not 2-years overdue for a mammogram. Our participants were English and Spanish speakers.

### Recruitment of participants

Our recruitment strategy has been reported previously (34). Briefly, we used computerized records to identify eligible Latinas at the four participating Sea Mar clinics, and Sea Mar staff invited eligible women in-person or over-the-phone to participate in the study. Interested women were asked to provide both an informed consent to participate in the project and access to their medical records (HIPAA authorization) so that we could verify their breast cancer screening status. After we obtained consent, a study interviewer telephoned or visited the participants to complete a baseline survey in English or Spanish. All study participants signed a consent form.

### Baseline and follow-up surveys

The baseline questionnaire was a 161-item survey that addressed sociodemographic characteristics, health care utilization, breast cancer-screening behaviors and intentions, breast cancer knowledge, attitudes and barriers, functioning and well-being, mental health status, social norms, social support, perceived susceptibility of breast cancer, perceived effectiveness of a mammogram, health care interactions, perceived discrimination, neighborhood characteristics, and willingness to pay for a mammogram. We administered baseline surveys between April 2011 and May 2013. All study procedures and materials were reviewed and approved by the Institutional Review Board at the Fred Hutchinson Cancer Research Center.

Bilingual interviewers administered a follow-up survey in-person or over-the-phone approximately 1 year after randomization. The follow-up questionnaire was a 91-item survey that included a subset of questions from baseline and added process questions regarding the intervention (e.g. did they receive a *promotora* visit). Follow-up surveys were administered between August 2012 and August 2014. We offered each participant a $10 gift card for completing each survey.

### Medical record verification

For the purposes of verifying self-reported mammography screening at baseline, among the 204 women who reported having had a mammogram in the previous two years, we asked for the name of the clinic where the mammogram was performed. Women who were confirmed to have had a mammogram within the previous 2 years were excluded from the study (N=184). Women whose self-reported mammography screening could not be verified were included in the study (N=20).

### Follow-up EMR data

For purpose of analysis, we obtained EMR data at follow-up (1 year post randomization) using electronic health records at Sea Mar. The EMR data included date of most recent mammogram, and number of clinic visits in each year from 2010-2015. In addition, we solicited records from outside clinics and hospitals for women who reported having had a mammogram 1 year post-randomization and for whom there was no medical record

evidence of a mammogram at Sea Mar. The solicitation requested date of most recent mammogram. Where records could not be found, the study clinic EMR data was considered the gold standard.

## Randomization

To ensure equal distribution across study arms and across age groups (42-49 and 50-74), we used a computerized program with randomized blocks to allocate eligible participants to the intervention or control arms. The randomization sequence was generated by a statistician who was not involved with implementation of the study. Participants allocated to the control arm (usual care) received no motivational messages or intervention materials from study staff.

## Patient-level intervention

We devised a culturally appropriate program using promotoras trained to use motivational interviewing to encourage Latinas to obtain mammograms. Promotoras are lay community members who receive specialized training to deliver health education in the community. Promotora-led interventions have been successful in promoting health behaviors among Latinas (35, 36). Before developing the program, we gathered formative data from patients and providers (30, 37). We used these data to design our patient-level intervention. Each patient randomized to the intervention received a home visit from a promotora, who engaged her in a discussion about breast cancer prevention. The promotora followed principles of motivational interviewing, a patient-centered counseling approach that is considered culturally responsive because counselors can incorporate issues related to social context into the discussion. Motivational interviewing is a well-validated approach that is offered in various clinical settings and has been found to be successful in interventions among Latinas (38, 39). Motivational interviewing is based on self-determination theory, which posits that individual motivations are linked to three psychological needs: competence, autonomy, and relatedness (40). Two weeks after the home visit, the promotora made a follow-up telephone call to the woman to review any planned action steps and assess readiness to schedule a mammogram.

We recruited *promotoras* from the community; promotoras were hired as paid staff by Sea Mar Community Health Centers and provided 3-day training session on procedures for approaching households and delivering the intervention, breast cancer screening facts, and tracking and documentation. We recorded 160 in-home sessions (for the remaining sessions, the participant displayed discomfort with the recording or refused). On a random subset of 52 recordings, we assessed the fidelity of the intervention by coding and scoring recorded sessions using behavior counts defined by the Motivational Interviewing Treatment Integrity (MITI) manual (41, 42). All *promotoras* met levels of minimum proficiency. We also offered 4 additional booster training sessions for the *promotoras*.

## Clinic-level intervention

For the clinic-level intervention, the Seattle Cancer Care Alliance provided additional screening mammography services through its state-of-the-art digital mobile mammography unit (“mammovan”) at two of the four participating clinics. The two clinics had available

space for a mobile mammography van (for one clinic, its parking lot, and for the other, a nearby grocery store). All eligible women were invited to obtain mammograms in the mobile van through referral from their primary care provider or self-referral: that is, mammography services provided through the van were not limited to study participants. The mammography services were offered free to uninsured women or those enrolled in the Washington State Breast, Cervical, and Colon Health Program. Insured women were billed according to their insurance plan(s). During the intervention period, mammovan staff provided 461 mammograms in Clinic 1 (average of 19 per month) and 258 mammograms in Clinic 2 (average of 11 per month). Clinics were allocated to intervention or usual care at convenience by clinic and research staff.

### Primary outcome

Our primary outcome was completion of a mammogram within 1 year after randomization. We assessed differences in mammography rates between mammography services intervention clinics and usual care clinics, and between individuals in the motivational interviewing intervention and control arms, adjusting for clinic-level differences. Separate analyses and publications address our secondary outcomes—cost-effectiveness and neighborhood-level influences.

### Statistical analysis

The primary endpoint (i.e., receipt of a mammogram in the year following randomization) was coded as a binary variable. Because we enrolled women not up-to-date with screening mammography, our evaluation was based on receipt of a recent mammogram at follow-up assessment. The intent-to-treat analysis used a mixed effects logistic regression to model screening mammography as a function of intervention assignment entered as a fixed effect. Randomization block was accounted for as a random effect. The SAS version 9.3 GLIMMIX procedure with adaptive Gaussian quadrature was used to fit the mixed effects model. We conducted a separate analysis to compare the intervention effect by clinic assignment to intervention condition (additional mammography services provided by the mammovan) or usual care condition (no additional mammography services), and adjusted for potential confounding characteristics such as age and income to account for potential biases in the randomization. We assessed program efficacy across subgroups defined by age (42-49 vs. 50-74), preferred language (Spanish vs. non-Spanish), insurance status (insured vs. uninsured), birthplace (Mexico vs. US/other), education (less than high school vs. high school or more), income (less than 30,000 vs. 30,000 or more). We also assessed efficacy across subgroup defined by health care utilization: clinic visit in the past year (yes vs. no), and previous mammogram (yes vs. no). Statistical power for our individual-level effects was reported previously (34); we had insufficient power to detect meaningful clinic-level differences.

## Results

### Response rate

**Percent eligible and complete by clinic at baseline—**We initially identified 2,064 women as meeting the study eligibility criteria, based on data in the EMR (Figure 1). We

could not determine the eligibility of 876 women because they had moved (588) or were otherwise unavailable (288). An additional 128 addresses were not residential households. We attempted to contact the remaining 1,060 women and found that 317 were ineligible—204 because of a recent mammogram (within the prior 2 years), 42 because of non-Hispanic ethnicity, and 71 for other reasons (age, deceased, non-English/non-Spanish language, gender, and other). In total, 743 women were eligible (207 in Clinic 1, 121 in Clinic 2, 176 in Clinic 3, and 239 in Clinic 4), and of these 542 (72.9%) completed the baseline survey (60% in Clinic 1, 72% in Clinic 2, 87% in Clinic 3 and 74% in Clinic 4).

**Percent complete by clinic at follow-up—**We invited all 542 women who completed the baseline survey to complete a follow-up survey. Of these, 72 had moved or were otherwise unreachable and 27 chose not to complete the follow-up survey. We included the remaining 439 (81%) women (152 (73%) in clinic 1, 120 (99%) in clinic 2, 64 (36%) in clinic 3, 103 (43%) in clinic 4) in this analysis.

Of the 542 enrolled women, an additional 6 were excluded after the follow-up survey, because of age (3), mammography history (1), or other reasons (2). This resulted in 536 eligible women. Of these, we completed medical record verification of mammography receipt for 533 women. We categorized the remaining women 3 (0.6%) as not having had a mammogram, consistent with our intention-to-treat design.

## Clinic-level characteristics

Clinic populations ranged from 6,571-11,657 overall, and from 1,159-1,740 for female patients ages 40-74. Uninsured patients ranged from 36%-49%, and Hispanics ranged from 42%-71% across clinics. Over one-half of patients in all clinics had household incomes at or below 100% of the federal poverty line. Mammography screening in 2011 as a proportion of the age-eligible population ranged from 14.5%-22.0%. Clinic-level characteristics are shown in Table 1.

## Patient-level characteristics

The characteristics of the 536 participants are shown in Table 2. One-half of respondents were ages 42-49. Eighty percent were born in Mexico, and the majority of the participants had lived in the US for 10 or more years. Ninety-two percent preferred speaking Spanish. Slightly less than one-half were employed. Among the 443 who reported a household income, the majority earned less than $20,000 annually. The majority of respondents had completed 8 or fewer years of education and were married or living as married. Nearly three-quarters lacked health care insurance. Nearly three-quarters had ever had a mammogram.

## Primary outcome

EMR data showed that 19.6% of women randomized to the intervention and 11.0% of women randomized to the usual care condition ($p<0.01$) had obtained mammography screening in the year following randomization (Table 3). Proportions of women who self-reported a mammogram in the year following randomization were 37.2% and 20.5% among intervention and usual care women, respectively ($p<0.01$; data not shown). When we

examined clinic-level effects, we found that the adjusted proportion of women screened in clinics receiving additional mammography services (Clinics 1 and 2) did not differ from the proportion in clinics allocated to usual care (Clinics 3 and 4) (15.8% vs. 14.4%; p value = 0.68; data not shown). There was no significant interaction between the clinic-level and patient-level effects (p value = 0.34).

### Moderators of efficacy

We examined the efficacy of the program across patient subgroups defined by sociodemographic characteristics, health care utilization, breast cancer screening behaviors, functioning and well-being, mental health status, social norms, social support, perceived susceptibility of breast cancer, perceived effectiveness of a mammogram, health care interactions, and perceived discrimination. None of these was found to be a statistically significant moderator (data not shown).

### Concordance between EMR and self-report

Among the 427 women with both survey and EMR data, receipt of mammogram in the previous year was concordant on the survey and EMR for 338 (79.2%). A total of 73 (17.1%) women reported that they had obtained a mammogram in the past year which was not verified in the EMR, while 16 (3.7%) women reported that they had not obtained a mammogram in the previous year, though evidence was found of mammogram receipt in the EMR. Concordance differed by randomization assignment, with higher concordance observed among women assigned to usual care than in women assigned to the intervention (85.4% vs. 72.7%; $p < 0.01$).

## Discussion

Our analysis describes the efficacy of a combined clinic-level and patient-level program to raise rates of mammography screening among Latinas who received care at FQHCs. Women who were randomized to receive the promotora-led mammography screening intervention had modestly higher rates of screening than women randomized to usual care (19.6% vs. 11.0%, $p < 0.01$). We found no significant improvements in mammography screening among study participants in clinics that received additional mammography services compared to clinics that received usual care (15.8% vs. 14.4%, $p = 0.68$). Furthermore, the efficacy of the program did not vary significantly by patient characteristics, psychosocial factors, or health care utilization.

Our finding of increased rates of mammography screening among women who received the *promotora*-led intervention is consistent with findings from a limited number of previous interventions incorporating lay health education among Latinas (36, 43, 44). We uniquely trained *promotoras* to use motivational interviewing, a strategy commonly used in clinical and community settings, but to our knowledge never by *promotoras*. Although we assessed the fidelity with which it was delivered over the course of the intervention, we could not determine whether motivational interviewing added value beyond the *promotora* visit. This is an important area for future research. Moreover, because our study was limited to Latinas,

most of whom lived in urban areas and preferred to speak Spanish, our findings may not be directly comparable to previous studies involving more diverse groups.

While not directly comparable to our study, at least two other studies used multi-level approaches and showed boosts in mammography screening. Fiscella and colleagues partnered with an inner-city family medicine practice, and showed substantial increases in mammography screening among women randomized to receive outreach and point-of-care patient and clinician prompts versus usual care (41% vs. 16.8%) (45). Similarly, in a network for 12 primary care practices, Atlas and colleagues conducted a multi-level health information technology intervention combining EMR tools and outreach letters and phone calls to patients due for screening. The findings showed a higher mammography completion rate over 3 years among women in the intervention clinics vs. usual care (51.7% vs. 45.8%; P = .002) (46). While these studies used multi-level interventions, neither reported on the effects of the different levels separately, as we do here.

It is important to note several contextual factors that may have influenced our outcomes. First, the mammovan was parked in the clinic parking lot at Clinic 1 where the highest boost in mammography screening was observed (22.4%). In this location, the mammovan may facilitate convenient same-day services for women who visit the clinic and serve as a visual cue for the importance of mammography screening to both patients and providers. In contrast at Clinic 2, the mammovan was parked at a nearby Safeway parking lot (0.8 miles from the clinic), where the lowest boost in mammography screening was observed (9.7%). This location offered no visual cues for women who visit the clinic and might have introduced transportation obstacles for women interested in screening. While the space requirements of the mammovan (i.e. square footage, level ground) dictated our decisions about locating the mammovan for this study, future efforts involving a mammovan may benefit this consideration. Moreover, additional contextual factors (e.g. clinic characteristics and provider practices) that we did not measure could have also influenced our findings.

Our study was conducted during important changes in national and state health care policies. The Affordable Care Act has spurred efforts to improve access to preventive care services, including mammography. Medicare now covers adult clinical preventive services graded A (strongly recommended) or B (recommended) by the USPSTF (ACA §2713). (Mammography screening is a Grade B recommendation of the USPSTF for women >50 years of age.) Moreover, as part of the Preventive Health Mandate of the Affordable Care Act, newly qualified private health plans operating in state-based insurance exchanges were required to cover mammography screening at no cost to patients. This mandate specifically uses 2002 USPSTF recommendations and prohibits cost-sharing for mammograms among women starting at age 40. Successful implementation of the Affordable Care Act is expected to raise rates of mammography screening and to reduce disparities among underserved populations by expanding insurance coverage among the uninsured population (47). Given the historically high proportions of uninsured patients who receive care at FQHCs, such changes will likely expand access for many of these patients.

Despite recent efforts to expand access to preventive services in both government-sponsored and commercial health plans, some population subgroups will remain uninsured. An

important population subgroup served by Sea Mar and other FQHCs is individuals and families who lack documentation to live and work in the United States. It is unclear from our data how many of the uninsured will remain uninsurable for this reason.

### Strengths and limitations

This study has several strengths that deserve mention. Our primary analysis relied on EMR information on mammogram receipt and overcomes biases in self-reported data, and we report on the concordance between the two. Our follow-up response rate was high. We took a novel approach, motivational interviewing, which is increasingly used to promote behavior change in clinical and community settings, but has rarely been evaluated for its efficacy when applied by *promotora*-led interventions.

The study also had important limitations. Notably, selection of the two clinics that received additional mammography services was made by clinic and research staff for convenience, not at random, and the physical location of the mammovan differed by clinic site. Moreover, our relatively small sample size prohibited us from performing a rigorous comparison of our moderator variables, which, when combined with the relatively low number of participating clinics, meant that we were underpowered to examine clinic-level effects or moderators. While we considered EMR evidence of a mammogram our “gold standard,” it is possible that the EMR record may have been incomplete or inaccurate, and in 3 cases, we were unable to obtain mammography records from referral sites. As some mammograms are performed off-site at local hospitals and breast cancer centers, we anticipate that EMR data underreports true mammography screening rates. Finally, our follow-up survey response rates varied substantially by clinic and, consistent with previous research (48), our concordance findings show more pronounced over-reporting of mammography screening among intervention versus usual care women. However, our reliance on EMR data meant our primary outcome analysis would not be biased for these reasons.

Our combined clinic- and patient-level program to raise rates of mammography screening in Latinas who received care at FQHCs resulted in an 8.6 percentage point increase in mammography screening over usual care, based on EMR data. Future research could expand the program to additional clinics to more rigorously evaluate the advantage of combining clinic- and patient-level activities.

## Acknowledgments

Financial support

Funding: This study was supported through funding from the National Cancer Institute grant R25 CA92408 awarded to Dr. India Ornelas; National Center for Advancing Translational Sciences of the National Institutes of Health grant UL1TR00042 awarded to Dr. India Ornelas; all authors received support from the Center for Population Health and Health Disparities grant 5 P50 CA148143.

## References

1. American Cancer Society. Cancer Facts & Figures for Hispanics/Latinos 2012-2014. Atlanta, GA: 2014.

2. American Cancer Society. Breast Cancer Prevention and Early Detection 2015. Available from: http://www.cancer.org/cancer/breastcancer/moreinformation/breastcancerearlydetection/breast-cancer-early-detection-toc. Accessed on: 08/27/2015
3. Chen L, Li CI. Racial Disparities in Breast Cancer Diagnosis and Treatment by Hormone Receptor and HER2 Status. Cancer Epidemiol Biomarkers Prev. 2015; 24:1666–72. [PubMed: 26464428]
4. National Center for Health Statistics. Health, United States, 2012: With Special Feature on Emergency Care. Hyattsville, MD2013: Report No.: Catalog Number: 76-641496
5. Markovitz AR, Alexander JA, Lantz PM, Paustian ML. Patient-centered medical home implementation and use of preventive services: the role of practice socioeconomic context. JAMA Intern Med. 2015; 175:598–606. [PubMed: 25686468]
6. Martires KJ, Kurlander DE, Minwell GJ, Dahms EB, Bordeaux JS. Patterns of cancer screening in primary care from 2005 to 2010. Cancer. 2014; 120:253–61. [PubMed: 24166081]
7. Centers for Disease Control Prevention. Cancer screening - United States, 2010. MMWR Morb Mortal Wkly Rep. 2012; 61:41–5. [PubMed: 22278157]
8. Breen N, Rao SR, Meissner HI. Immigration, health care access, and recent cancer tests among Mexican-Americans in California. J Immigr Minor Health. 2010; 12:433–44. [PubMed: 19052868]
9. Watson-Johnson LC, DeGroff A, Steele CB, Revels M, Smith JL, Justen E, et al. Mammography adherence: a qualitative study. J Womens Health (Larchmt). 2011; 20:1887–94. [PubMed: 22023414]
10. Greaney ML, De Jesus M, Sprunck-Harrild KM, Tellez T, Bastani R, Battaglia TA, et al. Designing audience-centered interactive voice response messages to promote cancer screenings among low-income Latinas. Prev Chronic Dis. 2014; 11:E40. [PubMed: 24625364]
11. Engelman KK, Cizik AM, Ellerbeck EF, Rempusheski VF. Perceptions of the screening mammography experience by Hispanic and non-Hispanic White women. Womens Health Issues. 2012; 22:e395–401. [PubMed: 22658890]
12. Shi L, Lebrun LA, Zhu J, Tsai J. Cancer screening among racial/ethnic and insurance groups in the United States: a comparison of disparities in 2000 and 2008. J Health Care Poor Underserved. 2011; 22:945–61. [PubMed: 21841289]
13. Nuno T, Castle PE, Harris R, Estrada A, Garcia F, Team. YPT. Breast and cervical cancer screening utilization among Hispanic women living near the United States-Mexico border. J Womens Health (Larchmt). 2011; 20:685–93. [PubMed: 21428792]
14. Rauscher GH, Allgood KL, Whitman S, Conant E. Disparities in screening mammography services by race/ethnicity and health insurance. J Womens Health (Larchmt). 2012; 21:154–60. [PubMed: 21942866]
15. Martinez-Donate AP, Vera-Cala LM, Zhang X, Vedro R, Angulo R, Atkinson T. Prevalence and correlates of breast and cervical cancer screening among a Midwest community sample of low-acculturated Latinas. J Health Care Poor Underserved. 2013; 24:1717–38. [PubMed: 24185166]
16. Castaneda SF, Malcarne VL, Foster-Fishman PG, Davidson WS, Mumman MK, Riley N, et al. Health care access and breast cancer screening among Latinas along the California-Mexican border. J Immigr Minor Health. 2014; 16:670–81. [PubMed: 24150421]
17. Harmon BE, Little MA, Woekel ED, Ettienne R, Long CR, Wilkens LR, et al. Ethnic differences and predictors of colonoscopy, prostate-specific antigen, and mammography screening participation in the multiethnic cohort. Cancer epidemiol. 2014; 38:162–7. [PubMed: 24667037]
18. Gonzalez P, Borrayo EA. The role of physician involvement in Latinas' mammography screening adherence. Womens Health Issues. 2011; 21:165–70. [PubMed: 21232975]
19. Roman L, Meghea C, Ford S, Penner L, Hamade H, Estes T, et al. Individual, provider, and system risk factors for breast and cervical cancer screening among underserved Black, Latina, and Arab women. J Womens Health (Larchmt). 2014; 23:57–64. [PubMed: 24283674]
20. Kerrison RS, Shukla H, Cunningham D, Oyebode O, Friedman E. Text-message reminders increase uptake of routine breast screening appointments: a randomised controlled trial in a hard-to-reach population. Br J Cancer. 2015; 112:1005–10. [PubMed: 25668008]
21. Vidal C, Garcia M, Benito L, Mila N, Binefa G, Moreno V. Use of text-message reminders to improve participation in a population-based breast cancer screening program. J Med Syst. 2014; 38:118. [PubMed: 25073694]

22. Mishuris RG, Linder JA. Racial differences in cancer screening with electronic health records and electronic preventive care reminders. J Am Med Inform Assoc. 2014; 21:e264–9. [PubMed: 24637955]
23. Fortuna RJ, Idris A, Winters P, Humiston SG, Scofield S, Hendren S, et al. Get screened: a randomized trial of the incremental benefits of reminders, recall, and outreach on cancer screening. J Gen Intern Med. 2014; 29:90–7. [PubMed: 24002626]
24. Atlas SJ, Ashburner JM, Chang Y, Lester WT, Barry MJ, Grant RW. Population-based breast cancer screening in a primary care network. Am J Manag Care. 2012; 18:821–9. [PubMed: 23286611]
25. Romaire MA, Bowles EJ, Anderson ML, Buist DS. Comparative effectiveness of mailed reminder letters on mammography screening compliance. Prev Med. 2012; 55:127–30. [PubMed: 22627089]
26. Glenn B, Bastani R, Reuben D. How important are psychosocial predictors of mammography receipt among older women when immediate access is provided via on-site service? American journal of health promotion : AJHP. 2006; 20:237–46. [PubMed: 16562348]
27. Davis TC, Arnold CL, Bennett CL, Wolf MS, Liu D, Rademaker A. Sustaining mammography screening among the medically underserved: a follow-up evaluation. J Womens Health (Larchmt). 2015; 24:291–8. [PubMed: 25692910]
28. Palmer RC, Samson R, Batra A, Triantis M, Mullan ID. Breast cancer screening practices of safety net clinics: results of a needs assessment study. BMC Womens Health. 2011; 11:9. [PubMed: 21457575]
29. Elkin EB, Snow JG, Leoce NM, Atoria CL, Schrag D. Mammography capacity and appointment wait times: barriers to breast cancer screening. Cancer Causes Control. 2012; 23:45–50. [PubMed: 22037904]
30. Martinez-Gutierrez J, Jhingan E, Angulo A, Jimenez R, Thompson B, Coronado GD. Cancer screening at a federally qualified health center: a qualitative study on organizational challenges in the era of the patient-centered medical home. J Immigr Minor Health. 2013; 15:993–1000. [PubMed: 22878911]
31. Taplin SH, Anhang Price R, Edwards HM, Foster MK, Breslau ES, Chollette V, et al. Introduction: Understanding and influencing multilevel factors across the cancer care continuum. Journal of the National Cancer Institute Monographs. 2012; 2012:2–10. [PubMed: 22623590]
32. Clauser SB, Taplin SH, Foster MK, Fagan P, Kaluzny AD. Multilevel intervention research: lessons learned and pathways forward. Journal of the National Cancer Institute Monographs. 2012; 2012:127–33. [PubMed: 22623606]
33. Washington State Office of Financial Management. Office of Financial Management: Get county & city data 2012. Available from: http://ofm.wa.gov. Accessed on: 08/27/2015
34. Coronado GD, Jimenez R, Martinez-Gutierrez J, McLerran D, Ornelas I, Patrick D, et al. Multi-level Intervention to increase participation in mammography screening: Fortaleza Latina! study design. Contemp Clin Trials. 2014; 38:350–4. [PubMed: 24952281]
35. O'Brien MJ, Halbert CH, Bixby R, Pimentel S, Shea JA. Community health worker intervention to decrease cervical cancer disparities in Hispanic women. J Gen Intern Med. 2010; 25:1186–92. [PubMed: 20607434]
36. Livaudais JC, Coronado GD, Espinoza N, Islas I, Ibarra G, Thompson B. Educating Hispanic women about breast cancer prevention: evaluation of a home-based promotora-led intervention. J Womens Health (Larchmt). 2010; 19:2049–56. [PubMed: 20849288]
37. Coronado GD, Gutierrez JM, Jhingan E, Angulo A, Jimenez R. Patient and clinical perspectives on changes to mammography screening guidelines. The breast journal. 2014; 20:105–6. [PubMed: 24261968]
38. Corsino L, Rocha-Goldberg MP, Batch BC, Ortiz-Melo DI, Bosworth HB, Svetkey LP. The Latino Health Project: pilot testing a culturally adapted behavioral weight loss intervention in obese and overweight Latino adults. Ethn Dis. 2012; 22:51–7. [PubMed: 22774309]
39. Rocha-Goldberg Mdel P, Corsino L, Batch B, Voils CI, Thorpe CT, Bosworth HB, et al. Hypertension Improvement Project (HIP) Latino: results of a pilot study of lifestyle intervention for lowering blood pressure in Latino adults. Ethn Health. 2010; 15:269–82. [PubMed: 20379894]

40. Deci EL, Ryan RM. Self-determination theory in health care and its relations to motivational interviewing: a few comments. The international journal of behavioral nutrition and physical activity. 2012; 9:24. [PubMed: 22385839]

41. Moyers, TB.; Martin, JK.; Miller, WR.; Ernst, D. Revised Global Scales: Motivational Interviewing Treatment Integrity (MITI 3.1.1). 2010. 12/1/2015]; Available from: http://casaa.unm.edu/download/MITI3_1.pdf

42. Moyers TB, Martin T, Manuel JK, Hendrickson SM, Miller WR. Assessing competence in the use of motivational interviewing. Journal of substance abuse treatment. 2005; 28:19–26. [PubMed: 15723728]

43. Nuno T, Martinez ME, Harris R, Garcia F. A Promotora-administered group education intervention to promote breast and cervical cancer screening in a rural community along the U.S.-Mexico border: a randomized controlled trial. Cancer Causes Control. 2011; 22:367–74. [PubMed: 21184267]

44. Larkey LK, Herman PM, Roe DJ, Garcia F, Lopez AM, Gonzalez J, et al. A cancer screening intervention for underserved Latina women by lay educators. J Womens Health (Larchmt). 2012; 21:557–66. [PubMed: 22416791]

45. Fiscella K, Humiston S, Hendren S, Winters P, Idris A, Li SX, et al. A multimodal intervention to promote mammography and colorectal cancer screening in a safety-net practice. J Natl Med Assoc. 2011; 103:762–8. [PubMed: 22046855]

46. Atlas SJ, Grant RW, Lester WT, Ashburner JM, Chang Y, Barry MJ, et al. A cluster-randomized trial of a primary care informatics-based system for breast cancer screening. J Gen Intern Med. 2011; 26:154–61. [PubMed: 20872083]

47. Levy AR, Bruen BK, Ku L. Health care reform and women's insurance coverage for breast and cervical cancer screening. Prev Chronic Dis. 2012; 9:E159. [PubMed: 23098646]

48. Jones RM, Mongin SJ, Lazovich D, Church TR, Yeazel MW. Validity of four self-reported colorectal cancer screening modalities in a general population: differences over time and by intervention assignment. Cancer Epidemiol Biomarkers Prev. 2008; 17:777–84. [PubMed: 18381476]

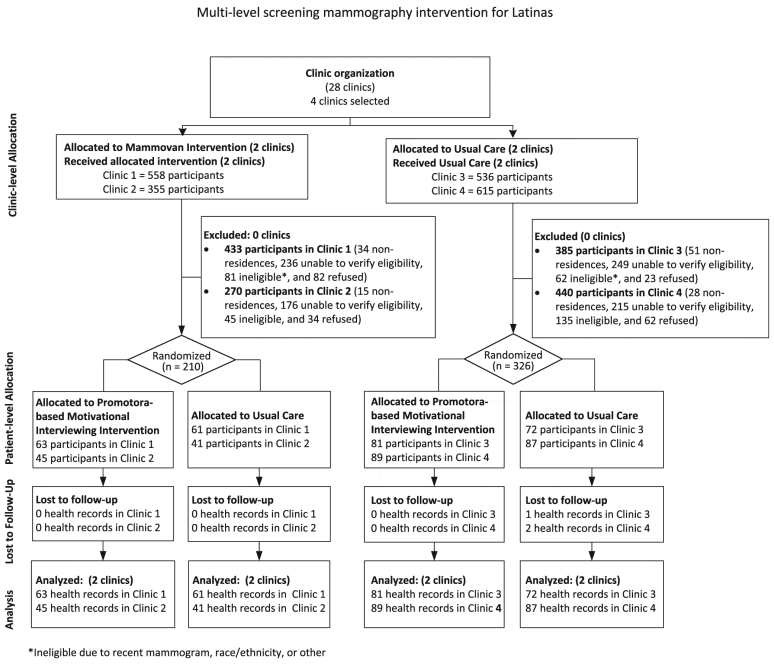



**Figure 1. Consolidated Standards of Reporting Trials (CONSORT) diagram for ¡Fortaleza Latina!**

Numbers of clinics and patients allocated to either arm of the intervention, lost to follow-up, and included in the final analytic dataset.

## Table 1

Sea Mar clinics in Western Washington participating in ¡Fortaleza Latina!, 2011

| | *Allocated to clinic-level intervention* | | | *Allocated to clinic-level usual care* | |
|---|---|---|---|---|---|
| ***Characteristic for 2011*** | ***Clinic 1*** | ***Clinic 2*** | | ***Clinic 3*** | ***Clinic 4*** |
| | | | | | |
| No. patients seen at clinic | 11,657 | 7,471 | | 6,571 | 6,853 |
| On-site mammography available | Yes | Yes | | No | No |
| % patients uninsured | 46.6 | 48.6 | | 35.6 | 38.9 |
| % patients Latino | 71.3 | 58.9 | | 42.2 | 55.7 |
| % patients Spanish speakers | 72.4 | 58.8 | | 37.7 | 32.8 |
| % patients at federal poverty level >100% | 51.7 | 54.8 | | 64.6 | 58.9 |
| No. women ages 40–74 seen at clinic | 1,740 | 1,169 | | 1,159 | 1,271 |
| Mammography rate [a] | 22.0 | 14.8 | | 14.5 | 19.4 |

[a] number of women with a mammogram performed in 2011/ number of women ages 40-74 seen at clinic.

## Table 2

Characteristics of Latina study participants ages 42–74 who had been seen for primary care at one of four Sea Mar clinics within the previous 5 years, had not had a mammogram in the previous 2 years, and had EMR mammography information (n = 533)

| | *Individual-level n (%)* | | | | |
|---|---|---|---|---|---|
| | *Allocated to clinic-level intervention* | | *Allocated to clinic-level usual care* | | *Overall* |
| ***Characteristic*** | ***Clinic 1*** | ***Clinic 2*** | ***Clinic 3*** | ***Clinic 4*** | |
| | **N = 125** | **N = 85** | **N = 151** | **N = 175** | **N = 536** |
| **Age** | | | | | |
| 42–49 years | 54 (43.2) | 45 (52.9) | 79 (52.3) | 90 (51.4) | 268 (50.0) |
| 50–64 years | 53 (42.4) | 27 (31.8) | 57 (37.7) | 69 (39.4) | 206 (38.4) |
| 65–74 years | 18 (14.4) | 13 (15.3) | 15 (9.9) | 16 (9.1) | 62 (11.6) |
| **Language** | | | | | |
| Spanish | 108 (87.1) | 81 (95.3) | 143 (94.7) | 159 (90.9) | 491 (91.8) |
| English or other | 16 (12.9) | 4 (4.7) | 8 (5.3) | 16 (9.1) | 44 (8.2) |
| **Birthplace** | | | | | |
| Mexico | 86 (69.9) | 59 (69.4) | 128 (84.8) | 160 (90.9) | 432 (80.9) |
| United States or other | 37 (30.1) | 26 (30.6) | 23 (15.2) | 16 (9.1) | 102 (19.1) |
| **Education** | | | | | |
| ≤4$^{th}$ grade | 34 (27.6) | 24 (28.9) | 35 (23.3) | 63 (36.0) | 156 (29.4) |
| 5$^{th}$–8$^{th}$ grade | 32 (26.0) | 25 (30.1) | 54 (36.0) | 57 (32.6) | 168 (31.6) |
| ≥9$^{th}$ grade no high school diploma | 17 (13.8) | 9 (10.8) | 10 (6.7) | 22 (12.6) | 58 (10.9) |
| High school diploma or GED | 22 (17.9) | 12 (14.5) | 24 (16.0) | 17 (9.7) | 75 (14.1) |
| At least some college | 18 (14.6) | 13 (15.7) | 27 (18.0) | 16 (9.1) | 74 (13.9) |
| **Marital status** | | | | | |
| Married or living with partner | 66 (53.2) | 43 (51.2) | 105 (69.5) | 105 (60.0) | 319 (59.7) |
| Unmarried[a] | 58 (46.8) | 41 (48.8) | 46 (30.5) | 70 (40.0) | 215 (40.3) |
| **Currently employed** | | | | | |
| Yes | 66 (54.1) | 42 (49.4) | 66 (43.7) | 72 (41.1) | 246 (46.2) |
| **Household income** [b] | | | | | |
| <$10,000 | 31 (32.0) | 26 (38.8) | 47 (37.9) | 48 (32.0) | 152 (34.7) |
| $10,000 to $30,000 | 45 (46.4) | 27 (40.3) | 61 (49.2) | 83 (55.3) | 216 (49.3) |
| >$30,000 | 21 (21.6) | 14 (20.9) | 16 (12.9) | 19 (12.7) | 70 (16.0) |
| **Time in United States** | | | | | |
| 0–9 years | 23 (20.0) | 21 (26.3) | 22 (20.2) | 14 (8.6) | 80 (17.2) |
| 10–19 years | 51 (44.3) | 26 (32.5) | 44 (40.4) | 61 (37.7) | 182 (39.1) |
| ≥20 years | 41 (35.7) | 33 (41.3) | 43 (39.4) | 87 (53.7) | 204 (43.8) |
| **Health insurance** | | | | | |

| Characteristic | Individual-level n (%) | | | | |
|---|---|---|---|---|---|
| | Allocated to clinic-level intervention | | Allocated to clinic-level usual care | | Overall |
| | Clinic 1 | Clinic 2 | Clinic 3 | Clinic 4 | |
| | N = 125 | N = 85 | N = 151 | N = 175 | N = 536 |
| Medicaid | 3 (2.5) | 4 (4.7) | 1 (0.7) | 9 (5.2) | 17 (3.2) |
| Medicare | 5 (4.1) | 4 (4.7) | 8 (5.4) | 10 (5.8) | 27 (5.1) |
| Uninsured | 88 (72.7) | 60 (70.6) | 119 (80.4) | 120 (69.8) | 387 (73.6) |
| Private | 20 (16.5) | 13 (15.3) | 16 (10.8) | 17 (9.9) | 66 (12.5) |
| Other government (e.g. Veterans Administration) | 6 (5.0) | 5 (5.9) | 5 (3.4) | 22 (12.8) | 38 (7.2) |
| **No. clinic visits in past year** | | | | | |
| 0 | 25 (20.3) | 15 (17.9) | 32 (21.2) | 43 (24.7) | 115 (21.6) |
| 1 | 26 (21.1) | 22 (26.2) | 33 (21.9) | 34 (19.5) | 115 (21.6) |
| 2–5 | 52 (42.3) | 29 (34.5) | 64 (42.4) | 71 (40.8) | 216 (40.6) |
| ≥6 | 20 (16.3) | 18 (21.4) | 22 (14.6) | 26 (14.9) | 86 (16.2) |
| **Breast cancer screening behaviors** | | | | | |
| Clinic breast exam in past year | 25 (20.3) | 15 (17.6) | 30 (19.9) | 44 (25.1) | 114 (21.3) |
| Previous mammogram, ever | 103 (83.1) | 58 (69.0) | 94 (63.1) | 139 (79.9) | 394 (74.2) |
| Ever had mammogram in mobile mammography van | 14 (11.3) | 13 (15.3) | 10 (6.6) | 4 (2.3) | 41 (7.7) |
| **Psychosocial characteristics** | | | | | |
| **Quality of life** | | | | | |
| Physical component | 49.7 (10.1) | 50.6 (10.4) | 49.8 (10.2) | 49.9 (9.7) | 49.9 (10.0) |
| Mental component | 51.0 (9.7) | 48.9 (9.7) | 49.0 (10.3) | 50.5 (10.1) | 49.9 (10.0) |
| **Mental health Inventory** | 18.4 (4.3) | 17.4 (4.6) | 18.0 (4.4) | 18.4 (4.4) | 18.1 (4.4) |
| **Social norms** | | | | | |
| Mammogram recommended by provider | 72 (70.6) | 41 (70.7) | 63 (66.3) | 111 (79.9) | 287 (72.8) |
| Mammogram recommended by family/friend | 52 (41.9) | 25 (29.4) | 55 (36.4) | 50 (28.6) | 182 (34.0) |
| **Perceived susceptibility** | | | | | |
| Highly likely to get breast cancer | 16 (14.3) | 12 (16.7) | 22 (16.8) | 30 (20.1) | 80 (17.2) |
| Highly or moderately likely to get breast cancer | 52 (46.4) | 44 (61.1) | 76 (58.0) | 98 (65.8) | 270 (58.2) |
| More likely than others to get breast cancer | 10 (8.8) | 10 (13.0) | 18 (13.2) | 11 (7.1) | 49 (10.2) |
| **Cancer worry** | | | | | |
| Often worry about getting cancer | 26 (21.0) | 14 (16.5) | 25 (16.6) | 24 (13.8) | 89 (16.7) |
| **Interaction with healthcare system** | | | | | |
| Doctor explained things in a way you could understand (% usually /always) | 74 (75.5) | 48 (69.6) | 80 (68.4) | 106 (80.9) | 308 (74.2) |
| Doctor spent enough time with you (% usually /always) | 78 (79.6) | 57 (82.6) | 83 (69.7) | 107 (82.3) | 325 (78.1) |

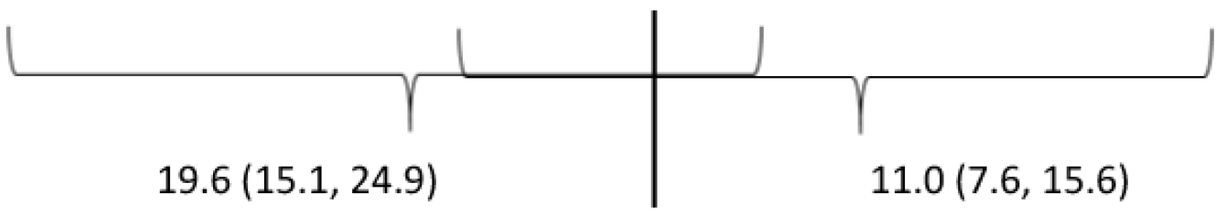
| Characteristic | Individual-level n (%) | | | | |
|---|---|---|---|---|---|
| | Allocated to clinic-level intervention | | Allocated to clinic-level usual care | | Overall |
| | Clinic 1 | Clinic 2 | Clinic 3 | Clinic 4 | |
| | N = 125 | N = 85 | N = 151 | N = 175 | N = 536 |
| Needed someone to help understand doctor (% Yes) | 39 (32.0) | 33 (38.8) | 80 (53.0) | 92 (52.6) | 244 (45.8) |
| Needed health care, but could not get it (% Yes) | 27 (21.8) | 20 (23.5) | 24 (15.9) | 31 (17.7) | 102 (19.1) |
| **Perceived discrimination** | | | | | |
| Treated badly/unfairly because of race/ethnicity (% Often) | 12 (9.7) | 5 (6.0) | 6 (4.0) | 6 (3.4) | 29 (5.4) |
| Would have received better care if different race/ethnicity (% Yes) | 26 (21.3) | 19 (22.9) | 38 (25.9) | 30 (17.6) | 113 (21.6) |

[a] Includes never married, widowed, divorced, or separated.

[b] A total of 97 responses were missing (27 in Clinic 1, 18 in Clinic 2, 27 in Clinic 3, and 25 in Clinic 4).

**Table 3**

EMR-verified screening mammography receipt within 1-year following randomization in ¡Fortaleza Latina!, by intervention clinic-level and individual-level assignments (n = 536)

| | % had mammogram within 1-year following randomization | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Allocated to clinic-level intervention | | | | Allocated to clinic-level usual care | | | | p-value |
| | Clinic 1 | | Clinic 2 | | Clinic 3 | | Clinic 4 | | |
| Individual-level assignment | *Interv* [a] | *UC* [b] | *Interv* [a] | *UC* [b] | *Interv* [a] | *UC* [b] | *Interv* [a] | *UC* [b] | |
| N Participants | 63 | 62 | 44 | 41 | 80 | 71 | 89 | 86 | |
| Observed % | 25.4 | 12.9 | 18.2 | 4.9 | 20.0 | 8.4 | 15.7 | 15.1 | |
| Observed % (N is denominator) | 22.4 (107) | | 9.7 (103) | | 17.8 (169) | | 12.1 (157) | | |
| Adjusted [c] % (95% CI) | 20.6 (14.1, 29.1) | | 11.7 (7.3, 18.2) | | 18.9 (13.6, 25.6) | | 10.6 (6.9, 16.1) | | |
| Intervention effect (individual-level) |  | | | | | | | | P<0.01 |

[a] intervention involving motivational interviewing delivered by *promotoras*

[b] usual care

[c] adjusted for clinic or individual intervention assignment level as appropriate (fixed effect) and randomization block nested within age group and clinic (random effects)