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Promoting Breast Cancer Awareness and Screening Practices for Early Detection in Low-Resource Settings

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ABSTRACT

Objective: Breast cancer is the most common type of cancer among women in the Philippines. Philippines has one of the highest breast cancer mortality rate and the lowest mortality-to-incidence ratio in Asia. This study has three objectives: 1) explore Filipino women's knowledge, attitudes toward, and practices of breast cancer and cancer screening, 2) examine if an educational program increases women's intention to seek future breast cancer screening, and 3) examine associations between demographic variables and breast cancer screening practices.

Materials and Methods: A total of 944 women from two urban areas (Calasciao and Tacloban City) and one rural area (Sogood) of the Philippines participated in this cross-sectional study. Study participants attended an educational program and completed study questionnaires regarding demographics, knowledge about, and practices of breast self-exams, clinical breast exams and mammography as well as reported barriers toward future screening.

Results: The results showed a disparity between knowledge of routine breast cancer screening and actuals screening behaviors. Following breast health education and screening programs, participants reported greater intention to adhere to recommended breast cancer screening guidelines. The multivariate analyses showed that education level is a significant predictor for CBE and mammography uptake in current study.

Conclusion: This study has implications for breast cancer control among women in low-resources settings. Designing and implementing effective educational programs that increase women's awareness about breast cancer and promote screening uptake are important steps to reduce the burden affected by breast cancer among women in the Philippines and other South Asian low- to middle-income countries.

Keywords: Breast neoplasms, breast cancer screening, clinical breast exams, mammography, health education

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Introduction

Breast cancer is the most common type of cancer among women worldwide, accounting for 25% of all cancers diagnosed (1), and a similar trend is observed in the Philippines. Indeed, the most recent Philippine Cancer Society report (2) revealed 20,267 new breast cancer cases in 2015 (33% of all cancers), and more worryingly, estimated 7,384 deaths from breast cancer in the same year (3rd leading cause of cancer-related deaths). According to the International Agency for Research on Cancer (IARC), Filipino women face comparatively higher risks of developing breast cancer with 1 out of 13 Filipino women expected to develop breast cancer in her lifetime with an age-standardized rate (ASR) of 47 per 100,000 women (3). Similarly, a Global Cancer Report which surveyed 15 Asian countries summarized that Philippines has the highest breast cancer mortality rate and the lowest mortality-to-incidence ratio (4).

The observed disparity may be because breast cancer is typically diagnosed in later stages (defined as Stage III and Stage IV) among low- and middle-income countries (LMCs). In the Philippines, 53% of breast cancers were diagnosed in Stages III and IV, while only 2%-3% of cases were diagnosed in Stage I (5, 6). These findings are particularly problematic as improvements in breast cancer survival rates are underpinned by timely and effective treatments made possible by early detection and screening (7).

Improvements in survival from breast cancer in high-income countries (HIC) have been attributed to early detection by screening and timely and effective treatment (7). Mammography has remained the main modality of breast cancer screening throughout the world; a report from IARC showed that while the benefits in women aged 40 to 49 years are less certain, screening women aged 50 to 69 years with mammography is associated with a 25% reduction in breast cancer mortality (8). Unfortunately, population-based mammography screening programs are not available in most low- to middle income countries (LMICs) due to lack of resources and capacity in extant health system infrastructures.

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The unavailability of national mammography screening programs in most LMICs prompted the assessment of breast self-examination (BSE) and clinical breast examination (CBE) as alternative approaches. However, results from the studies of CBE in LMCs are mixed (9-13). For example, a randomized clinical trial conducted in Shanghai, China showed that intensive instruction in BSE did not reduce breast cancer mortality (12). Nevertheless, other studies have found increased detection of early-stage breast cancer (11) following CBE training of nurses and other healthcare workers. Moreover, CBE reduced by half the percentage of late-stage presentation for breast cancer (13).

While prevention and early detection programs are cost effective for reducing cancer mortality in HIC (14), translation of these interventions to LMICs is challenging. Established in 2002, Breast Health Global Initiative (BHGI) is an international health alliance that advocates resource-sensitive guidelines for screening, early detection, diagnosis and treatment of breast cancer in LMICs. According to BHGI, breast cancer screening in LMICs should be adopted within the local context and it should take available resources into account (15). Currently, no nationwide breast cancer screening program is available in the Philippines. The Philippines Breast Cancer Control Program (BCCP) emphasizes the importance of annual CBE from healthcare professionals (e.g., nurses, public health physicians, midwives) and monthly BSE (6). Educating the public about the signs and symptoms of cancer and adapting health care systems to facilitate prompt cancer diagnosis and early detection may be cost-effective and feasible cancer control strategies for treatable cancers (16).

Limited research is devoted to awareness and early detection for breast cancer in low-resource settings (17); more research in this area is needed for LIMCs with specific contexts at national levels. Currently, there is a gap in the literature examining women's knowledge and attitudes about breast cancer and their screening practices in the Philippines. The objectives of this cross-sectional intervention were to: 1) examine women's knowledge, perceptions, and practices of breast cancer screening with an academic-community partnership that provided breast health education and screening program in the Philippines, 2) explore participants' intention for obtaining future breast cancer screening after the education program, and 3) identify associations between demographic variables and breast cancer screening practices (i.e., CBE and mammography).

Materials and Methods

Study setting & breast health education program

The study was conducted under the auspices of Eastern Michigan University Heath Asian Americans Project (HAAP) International Breast Health Initiative (IBHI). Launched in 2012, HAAP's IBHI has deployed and implemented a breast cancer awareness and screening program in China (2012-present) and recently expanded to the Philippines in 2017. The IBHI-Philippines program curriculum consisted of a comprehensive breast cancer education and screening program delivered in community settings (e.g., community center, church, schools, etc.) by trained short-term medical mission (STMM) volunteers. Prior to their medical mission trips, all STMM volunteers (who are of Filipino descent and are bilingual) attended an all-day training with presentations on breast health education and breast cancer vital statistics and a hands-on session wherein experienced women's health clinicians instructed STMM volunteers on how to administer CBE and teach BSE.

During the project period (Jan. 2017-Mar. 2017), a total of 32 STMM health care providers (18 nurses, 8 physicians, 2 medical assistants, and 4 medical technology staff) from Michigan were trained and deployed as breast health ambassadors. They delivered breast health education and provide CBE in three Philippine regions: Calasciao (urban area in Pangasinan, Region 1), Tacloban City (urban area in Samar, Region 8), and Sogood (rural area in Southern Leyte, Region 8). The population for each of three areas and participation ratio of study sample can be found in Table 1.

The breast cancer education and screening program was sponsored and advertised with the assistance from local governments as well as community organization. The program was held in a barangay in collaboration with the Office of the Mayor/Vice Mayor. The staff in local city government and community partners used various channels used various channels (i.e., radio, newspapers, flyers) to publicize the breast cancer program events and recruited volunteers to staff at these events. The volunteers received training prior to the events by STMM members on site. During the program, each participant received breast health education and was offered a clinical breast exam by STMM trained providers and provided with breast health educational materials. The STMM providers worked with local clinicians (e.g., physicians, surgeons, etc.) to ensure that the required follow-up screening and procedures (e.g., diagnostics, treatment, etc.) were provided and referred women who were found to have breast abnormalities to local hospitals. As results of STMM's program, three women were diagnosed of breast cancer with appropriate diagnostic tests and follow-treatment.

Study participants & data collection

The inclusion criteria for study participants were women over 20 years of age, not diagnosed with breast cancer, and willing to participate in the current study. It is recommended that breast cancer awareness and early detection that can be performed by women starting in their 20's (18).

The study protocol was reviewed and approved by Eastern Michigan University Review Board. Informed consent was obtained from study participants before enrollment. The participants were informed about the voluntary nature of their participation and that they could discontinue at any time. After explaining the study, participants were invited to self-complete study questionnaires. For participants who needed additional assistance (e.g., illiterate, elderly, etc.), trained volunteers were available. The questionnaire took an average of 15-20 minutes for participants to complete.

Data collection tool

Participants completed the study tool, Knowledge, Attitudes, and Practice of Breast Cancer Screening Questionnaire validated and used in previous studies (19, 20). The questionnaire included four sections: 1) socio-demographic information (age, insurance, education levels, income) and personal and familial history of cancer; 2) reproductive factors (age at menarche and menopause, hormone replacement use, breast surgery and/or biopsy); 3) knowledge about breast cancer screening modalities; and 4) practices of BSE, CBE, and mammography, and intention to be screened for breast cancer. The tool also included open-ended questions about reasons why the participants did not plan to obtain CBE, mammography, and/or perform monthly BSE.

Statistical Analysis

Data were entered and analyzed with The Statistical Package for the Social Sciences (SPSS) version 24 statistics software (IBM Corp.; Armonk, NY, USA). Descriptive statistics were computed for univariate analyses. Chi-square tests were used to examine relationships between

Table 1. Population and age distribution of women in the three regions of study sites

	Sogod, Salvacion Southern Leyte	Tacloban City	Calasciao Pangasinan
Total population	44.986	24.2069	95.154
Population (age 17+)	29.918	63.926	53.412
Female population (age 17+)	14.825	63.926	27.227
Age distribution of females			
17-34	6.944	29.542	12.373
35-44	2.692	12.302	5.425
45-54	2.230	10.205	4.234
55-64	1.644	7.025	3.027
65+	1.315	4.852	2.168
Study sample (n)/% of female population	378/~2.5%	362/~0.56%	303/~1.1%

Data source: 1. 2015 Census in the Philippines; A. Link for the Province of Pangasinan (Includes Calasiao & other towns & municipalities) http://122.54.214.222/population/MunPop.asp?prov=PAN&province=Pangasinan and B. Link for the Province of Leyte (Consist of Sogod, Salvacion and Tacloban City), http://122.54.214.222/population/MunPop.asp?prov=LEY&province=Leyte. 2. 2015 Registered Voters in the Philippines: Voters Profile & Registration, http://www.comelec.gov.ph/php-tpls-attachments/2016NLE/Statistics/Philippine2016VotersProfile/Philippine_2016_Voter_Profile_by_Provinces_and_Cities_or_Municipalities_including_Districts.xlsx

demographic variables (age, insurance status, education, and income) and breast cancer screening practices. A multivariable logistic regression model was performed with screening behaviors (i.e., clinical breast exam and mammography) as the outcome. Stepwise variable selection strategy identified demographic variables independently associated with screening behaviors. The Hosmer-Lemeshow test determined fit of the final multivariable logistic model. All statistical tests used two-sided with the level of significance set at 0.05.

Results

Participants Characteristics

A total of 1043 women attended the STMM-hosted breast awareness and screening program, 979 met the age eligibility (i.e., 64 women were under age 20) and 944 women completed the self-administered surveys (response rate of 96%). The mean age was 47.1 (SD=14.3) years (ranging from 20-84 years). Participant education levels varied widely; 40% had completed high school while 30% had completed college or postgraduate education. Among those who reported their annual income, 57% reported their annual income was 50,000 Philippine Pesos or less (equal to $979 U.S. dollars). Only 14% reported a top annual income of 100,000 Philippine Pesos (USD 1,958) or more. More than half the participants did not provide their annual income (N=549). This may have been due to feeling uncomfortable about providing this information. The majority (69%) of participants reported not having health insurance (Table 1). The population for the three areas of Participants' reproductive history and family history of breast cancer is detailed in Table 1. The mean age at menarche was 13.6 years (SD=2.0, ranges from 9 to

Table 2. Population and age distribution of women in the three regions of study sites

Characteristic	Frequency	%
Age, years (N=944)		
20-39	313	33
40-4	234	25
50-59	181	19
60+	216	23
Insurance (N=911)		
Insured	285	31
Not insured	626	69
Annual Income, Peso (N=395)		
<10.000	118	30
10.001-50.000	105	27
50.001-100.000	116	29
100.001-150.000	36	9
150.000+	20	5
Years of Formal Schooling Completed (N=692)		
<5	73	11
6-12	420	61
13-15	172	25
16+	27	4
Highest Degree/Schooling Completed (N=921)		
<High school	257	28
High school	362	40
College/University	279	30
Graduate School (Masters and/or Doctoral degree)	23	2
Age at menopause (M=48.5; SD=5.0; Range: 28-59		
Menopausal Status (N=918)		
Currently in Menopause	386	42
Not in Menopause	532	58
Hormonal Therapy Status (N=926)		
Currently in Hormone Therapy	106	11
Not in Hormone Therapy	820	89
Age at menarche (M=13.6; SD = 2.0; Range: 9-33)		
<=13	480	53
>13	431	47
Family history of cancer (N=148)		
Other types of cancer	59	40
Breast cancer	89	60
--first degree relative	42	48
--not first degree relative	46	52

Table 3. Knowledge beliefs and practices of breast cancer screening

Characteristic	Frequency	%
Breast self-exam		
Heard of breast self-exams (n=933)		
Yes	462	49
No	471	51
How often breast self-exams needs to be performed (n=595)		
Once a month	356	60
Once every three months	80	13
Once every six months	70	12
Once a year	89	15
Practicing breast self-exams (n=920)		
Never	551	60
Once a month	231	25
Once every three months	75	8
Once every six months	36	4
Once a year	27	3
Clinical Breast Exam (CBE)		
Heard of CBE (n=933)		
Yes	312	33
No	621	67
Obtaining CBE (n=893)		
Never done it before	757	85
Yes	136	15
Duration of last CBE (n=133)		
Within last 3 years	85	64
3-5 years ago	15	11
5-10 years ago	10	8
>10 years ago	23	17
Mammogram (MAM)		
Heard of MAM (n=923)		
Yes	264	29
No	659	71
Obtaining MAM (n=887)		
Never done it before	818	92
Yes	69	8
Duration of last MAM (n=64)		
Within last 3 years	35	55
3-5 years ago	12	19
5-10 years ago	6	9
>10 years ago	11	17

Table 4. Intention after education program to take CBE and mammogram: For women age 40 and older)

Characteristic	Frequency	%
Plan to do CBE in the future (n=616)		
Yes	551	89
No	65	11
Barriers for not planning to do CBE (n=55)		
Financial concern	34	62
Not necessary (Feel OK, no symptoms, etc.)	8	15
No insurance	7	13
Fear	3	6
Preferred mammogram (MAM)	2	4
Too old	1	2
Plan to do MAM in the future (n=592)		
Yes	412	70
No	180	30
Barriers for not planning to do MAM (n=144)		
Financial concern	117	81
No insurance	12	8
Not necessary (Feel OK, no symptoms, etc.)	8	6
Too old	4	3
Fear	1	1
Painful	2	1

CBE: Clinical Breast Exam; MAM: mammogram

33); more than 50% had their first menstruation by 13 years of age or younger. The mean age at menopause was 48.5 years (SD=5.0; ranges from 28-59). For family history of cancer, 148 participants reported they had one or more family members diagnosed with cancer and 89 participants reported that they had a family member diagnosed with breast cancer.

Knowledge and practices of breast cancer screening

Table 2 documents participants' knowledge and practice of BSE, CBE, and mammography. The majority of participants (51%) had heard of BSE; however, comparatively less reported knowledge of CBE (33%) or mammograms (29%). While 60% (N=356) of the participants reported that they knew BSEs needed to be performed monthly, only 25% (N=231) actually performed BSE monthly. For CBE, over 80% of participants never received this service. Of those who received CBE (15%, N=136), 36% reported their CBE was done more than three years ago. Regarding mammograms, only a small percentage of participants (8%) reported ever having had one. Similar to CBE, women who reported having had a mammogram generally received it more than three years ago, and it was generally done for diagnostic rather than screening purposes. In other words, participants solicited these services only when they noticed symptoms (e.g., lumps/mass, pain, etc.).

Intention for obtaining future breast cancer screening

Results in Tables 3 and 4 show that participants reported high levels of intention to obtain breast cancer screening (for CBE, mammogra-

Table 5. Intention after education program to take CBE and monthly BSE: For women age less than 40

Characteristic	Frequency	%
Plan to do CBE (n=314)		
Yes	274	87
No	40	13
Barriers for not planning to do CBE (n=55)		
Financial concern	16	52
Scared	9	29
Not necessary	3	10
Shamed	1	3
CBE does not work	1	3
No insurance	1	3
Plan to perform monthly breast awareness check-up and self-exam (n=302)		
Yes	257	85
No	45	15
Barriers for not planning to do monthly check-ups (n=38)		
Financial concern	17	45
No insurance	1	3
Not necessary (Feel OK, no symptoms, etc.)	1	3
Does not work	1	3
Does not know how	16	42
Scared	2	5

CBE: Clinical Breast Exam; BSE: Breast self-exam

phy and/or BSE) after STMM breast health education. For participants aged 40 years and older, more than two-thirds planned to obtain CBE and mammography. For those who did not plan to proceed, financial concern was cited as the top reason. Some participants did not feel it was necessary to proceed with CBE or mammography in the absence of symptoms (Table 3). For participants under 40 years of age, more than 85% reported planning to obtain CBE and perform BSE (Table 4).

Multivariate Analyses: Demographic variables and breast cancer screening

The results from Chi-square tests showed significant differences among four demographic variables and mammography uptake; having insurance, being older, and having a higher income and education were all associated with ever having had a mammogram (Table 5). Based on the statistically significant results ($p<0.05$) from Chi-square tests, these four demographic variables were included as independent variables for multivariate analyses with the outcome variable of mammography uptake using logistic regression. For the mammography uptake, the model with insurance, education level, income level, and age as predictors fit the data (Hosmer-Lemshow $\chi 2$ (8)=10.78, p=0.21) and accounted for 38% of the variability in receipt of mammograms. Results from the application of the logistic regression model showed that education was the only significant predictor after taking the relationships of the four demographic variables into account. Filipino women with a college or higher education were about seven times (OR=7.25, 95% CI=1.37–38.23) more likely than women with less education to ever having had a mammogram while the other three demographic variables, i.e., insurance coverage, age, and income levels were no longer associated with mammography uptake.

For CBE uptake, the results from Chi-square showed two demographic variables (i.e., insurance status and education levels) are statistically associated with ever having had a CBE. In terms of education, 68% of Filipino women with a college or higher education reported having CBE while only 23% of the respondents with high school or lower education reported having CBE done. A similar trend was observed in the comparison between women with insurance and those without (Table 6). These two demographic variables were entered into the logistic regression model and this model fit the data (Hosmer-Lemshow $\chi 2$ (2)=0.21, p=0.94), thus accounting for 20% of the variability in receiving a CBE. The results from logistic regression indicated that the odds of reporting having had a CBE were almost six times higher (OR=5.89, 95% CI 3.56–9.74) for women who had a college or higher education relative to women with a lower education. For women who had insurance, the odds of having had a CBE were nearly two times higher (OR=1.77, 95% CI 1.08–2.89) compared to women who did not have insurance.

Discussion and Conclusion

Philippines has one of the highest breast cancer mortality rates in both Asia and world-wide (2, 21, 22). Although the Philippine government developed a national Breast Cancer Control Program (BCCP) in 1998, the implementation has been suboptimal. Indeed, heightened incidence and poor survival rates are believed to be underpinned by inadequate breast cancer detection resources and low health literacy among the general population (23). The Philippines can place itself in a prime position to reduce the disease burden related to breast cancer by investing and implementing cost-effective programs for cancer control and early detection, such as a population-based screening program.

The absence of a population-based screening program is a notable treatment barrier as the accurate and timely diagnoses of breast cancer primarily depends on the "opportunist approach." Given the challenges associated with low-resource settings, it has been suggested that improving breast cancer awareness and utilization of CBE is a practical alternative for early detection and cancer control (15). While the effectiveness of BSE remains mixed (12, 24), it still warrants further consideration as breast health awareness can still be important to a country with non-existent population screening practices (e.g., Philippines).

In an attempt to address this health disparity, the goal of this study was to examine Filipino women's knowledge of and perceptions toward breast cancer screening and their intention for obtaining future breast cancer screening following receipt of breast health education from short-term medical mission (STMM) providers through academic-community partnership. The breast health content was informed by current breast cancer statistics and recommendations from the Philippines Cancer Society and tailored to meet the local Filipino women's needs. In addition, participants were provided with opportunities for engaging in BSE demonstrations using silicone breast models and were allowed time for questions and answers. Our findings are similar to results from other studies on breast awareness programs in LMICs and show the benefit of community-based intervention improved knowledge and attitudes among women from rural Ghana (25) and Malaysia

Table 6. Analyses of demographic variables and behavioral outcomes (i.e., ever having CBE and mammogram)

Demographic	CBE		x^2 value (df) p	Mammogram		x^2 value (df) p
	Yes (%)	No (%)		Yes (%)	No (%)	
Insurance						
Yes	55	45	19.98 (1)	59	31	19.46 (1)
No	31	61	p<0.001	41	69	p<0.001
Income						
<$15000	5	15		0	13	
$15000-24999	13	16	5.69 (3)	0	15	17.75 (3)
$25000-49999	45	49	p=0.13	41	46	p<0.001
>$100000	37	21		59	26	
Age						
40-49 years	35	38		25	37	
50-59 years	22	30	6.00 (3)	14	29	21.77 (3)
60-69 years	28	23	p=0.11	40	24	p<0.001
≥70 years	15	9		21	10	
Education						
High school or lower	32	75	68.32 (1)	15	74	88.91 (1)
College or higher	68	25	p<0.001	85	26	p<0.001

(26). In addition, training and involving local health workers reinforces the sustainability of future education and screening program and strengthened the linkage for medical assistance and referrals (27).

Initially, more than half of the Filipino women participants were not aware of BSE, CBE, and mammography. Not surprisingly, the practice of BSE, CBE, and mammography among these participants were comparatively lower than rates found in other parts of Asia such as China (28), Hong Kong (29), Malaysia (30), Singapore (31), Taiwan (32), and Turkey (33). Notably, less than 20% of this study's participants has ever had a CBE, and an even lower percentage of women (<10%) reported having completed a mammography in the past. At baseline, despite the fact that more than 60% of the participants were aware of BSE, only one-third were aware that this was recommended as a monthly check-up. Moreover, 60% of the participants had never performed a BSE. After the STMM education programs, it is noted that the majority of participants reported plans to obtain subsequent breast cancer screening.

Participants highlighted financial concerns as a major barrier to obtaining more expensive screening procedures, such as mammograms. Participants also reported a number of negative psychological impacts associated with screening procedures (e.g., fear and pain) and myths about screening (e.g., feeling OK therefore screening is not needed). For younger participants (i.e. 40 years and younger), the study results suggested that additional instructions can strengthen their confidence to perform BSE. In line with these findings, participants' level of education was a significant factor to breast cancer screening uptake in both mammogram and CBE (above and beyond other demographic variables). This suggests that general educational attainment may promote health equity and that more intensive interventions may be required for individuals with lower education levels.

Although our findings suggest a possible correlation between knowledge of available breast screening methods and actual screening behaviors, it should be noted that the majority of literature on this topic indicates only a weak or negligible relationship. For instance, Dey's review on the status of breast cancer screening/practices in low- and middle-income countries revealed that knowledge regarding breast cancer screening does not have a strong relationship with actual screening behaviors (34). However, as we note above, there may be a number of intervening factors (e.g., negative psychological impact associated with screening behaviors) which may weaken the relationship between the two variables. Moreover, a review article on breast cancer in Iran (35) highlighted that healthcare providers were often not at the top of a participants' list in terms of their importance as source of information; examining the possible moderating role of the "importance" of the information's source on the relationship between knowledge of screening practices and actual screening behaviors may be a possible avenue of future research.

As the Department of Health in the Philippines continues to place emphasis on CBE and BSE as a part of the BCCP components, efforts to raise breast cancer awareness may follow the programmatic strategies in the current study. For example, the public-private collaboration model implemented in the current study may be useful and can potentially extend to training health professionals in primary care for delivering similar community-based education sessions and integrating breast cancer screening into existing women's health services. Training front-line health professionals in CBE as a screening method

for breast cancer and appropriate referral linkages has the potential to increase detection of breast cancer at an early stage in LMCs like the Philippines.

To our knowledge, the current study is the first to document women's knowledge and practices of breast cancer screening in the Philippines. In addition, this study is the first to implement short-term medical mission (STMM) breast health and screening programs in both urban and rural areas of the Philippines. Taken together, our findings provide insight on how STMM healthcare providers may best work with local communities to improve breast cancer awareness and screening practices.

Limitations of this study include a sample drawn from only three cities/provinces in the Philippines. Consequently, the results cannot be generalized to other settings. Relatedly, the inherent bias in our study's sampling method (e.g., convenience sampling) means that our participants are unlikely to represent the population being studied. Furthermore, our study did not differentiate if participants sought out mammography due to an existing complaint (e.g., pain, mass, etc.) or for screening purpose. This is an important distinction to make as a population-based screening program is predicated on routine screenings, regardless of the presence of symptoms. In addition, our findings cannot determine any causal inference about the relationship between the educational program and actual screening behaviors due to its non-experimental study design. Future research should implement a pre- and post-intervention design to evaluate the effectiveness of the program. Lastly, the collected data were based on self-report and not verifiable medical records. Self-reports are often susceptible to inaccurate perceptions of one's attitudes, feelings, or behaviors (36) which may raise questions about its reliability and validity.

Despite these limitations, our study provides information that may be useful for both researchers and policy makers involved in public health programs. Increasing breast cancer awareness and promoting screening behaviors, by designing and implementing effective educational programs, may reduce the economic and societal burden of breast cancer among women in the Philippines and other countries in low-resource settings.

Ethics Committee Approval: Ethics committee approval was received for this study from Eastern Michigan University Human Subjects Review Committee (UHSRC).

Informed Consent: Verbal informed consent was obtained from patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - T.W., J.L.; Design - T.W., J.L.; Supervision - T.W.; Resources - T.W.; Materials - T.W, J.L.; Data Collection and/or Processing - T.W., J.L.; Analysis and/or Interpretation - T.W., J.L.; Literature Search - T.W., J.L.; Writing Manuscript - T.W., J.L.; Critical Review - T.W., J.L.

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References

1. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA Cancer J Clin 2015; 65: 87-108. (PMID: 25651787). [CrossRef]
2. Laudico AV, Mirasol-Lumague MR, Medina V, Mapua CA, Valenzuela FG, Pukkala E. 2015 Philippine cancer facts and estimates, Philippine Cancer Society, Manila, 2015. Available from: URL: http://www.philcancer.org.ph/wp-content/uploads/2017/07/2015-PCS-Ca-Facts-Estimates_CAN090516.pdf (Accessed December 16, 2017).
3. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F. GLOBOCAN 2012, v1.0, 2013. Cancer Incidence and Mortality Worldwide. International Agency for Research on Cancer: IARC Cancer Base No. 11. Available from: URL: http://globocan.iarc.fr (accessed December 12, 2016).
4. Pfizer. The burden of cancer in Asia. Available from: URL: http://www.pfizer.com/files/products/cancersin_asia.pdf, 2008 (accessed July 10, 2017).
5. De Leon Matsuda ML, Liede A, Kwan E, Mapua CA, Cutiongco EM, Tan A, Borg A, Narod SA. BRCA1 and BRCA2 mutations among breast cancer patients from the Philippines. Int J Cancer 2002; 98: 596-603. (PMID: 11920621). [CrossRef]
6. Ngelangel CA, Wang EH. Cancer and the Philippine cancer control program. Jpn J Clin Oncol 2002; 32 (Suppl): S52-S61. (PMID: 11959878). [CrossRef]
7. Van Schoor G, Moss SM, Otten JDM, Donders R, Paap EDEN, Den Heeten GJ, Holland R, Broeders MJ, Verbeek AL. Increasingly strong reduction in breast cancer mortality due to screening. Br J Cancer 2011; 104: 910-914. (PMID: 21343930). [CrossRef]
8. Lauby-Secretan B, Scoccianti C, Loomis D, Benbrahim-Talla L, Bouvard V, Bianchini F, Straif K. International Agency for Research on Cancer Handbook Working Group. Breast-cancer screening-viewpoint of the IARC Working Group. N Engl J Med 2015; 372: 2353-2358. (PMID: 26039523). [CrossRef]
9. Pisani P, Parkin DM, Ngelangel C, Esteban D, Gibson L, Munson M, Reyes MG, Laudico A. Outcome of screening by clinical examination of the breast in a trial in the Philippines. Int J Cancer 2006; 118: 149-154. (PMID: 16049976). [CrossRef]
10. Mittra I, Mishra GA, Singh S, Aranke S, Notani P, Badwe R, Miller AB, Daniel EE, Gupta S, Uplap P, Thakur MH, Ramani S, Kerkar R, Ganesh B, Shastri SS. A cluster randomized, controlled trial of breast and cervix cancer screening in Mumbai, India: methodology and interim results after three rounds of screening. Int J Cancer 2010; 126: 976-984. (PMID: 19697326).
11. Sankaranarayanan R, Ramadas K, Thara S, Muwonge R, Prabhakar J, Augustine P, Venugopal M, Anju G, Mathew BS. Clinical breast examination: preliminary results from a cluster randomized controlled trial in India. J Natl Cancer Inst 2011; 103: 1476-1480. (PMID: 21862730). [CrossRef]
12. Thomas DB, Gao DL, Ray RM, Wang WW, Allison CJ, Chen FL, Porter P, Hu YW, Zhao GL, Pan LD, Li W, Wu C, Coriaty Z, Evans I, Lin MG, Stalsberg H, Self SG. Randomized trial of breast self-examination in Shanghai: Final results. J Natl Cancer Inst 2002; 94: 1445-1457. (PMID: 12359854). [CrossRef]
13. Devi BC, Tang TS, Corbex M. Reducing by half the percentage of late-stage presentation for breast and cervix cancer over 4 years: A pilot study of clinical downstaging in Sarawak, Malaysia. Ann Oncol 2002; 18: 1172-1176. (PMID: 17434897). [CrossRef]

14. Beaglehole R, Bonita R, Magnusson R. Global cancer prevention: an important pathway to global health and development. Public Health 2011; 125: 821-831. (PMID: 22019360). [CrossRef]
15. Anderson BO, Yip CH, Smith RA, Shyyan R, Sener SF, Eniu A, Carlson RW, Azavedo E, Harford J. Guideline implementation for breast healthcare in early low- and middle-income countries: overview of the Breast Health Global Initiative Global Summit 2007. Cancer 2008; 113(Suppl 8): 2221-2243. (PMID: 18816619). [CrossRef]
16. Anderson BO, Ilbawi AM, El Saghir NS. Breast cancer in low and middle income countries: A shifting tide in global health. Breast J 2015; 21: 111-118. (PMID: 25444441). [CrossRef]
17. Lodge M and Corbex M. Establishing an evidence-base for breast cancer control in developing countries. Breast 2011; 20 (Suppl 2): S65-S69. (PMID: 21440846). [CrossRef]
18. Smith RA, Cokkinides V, Brawley OW. Cancer screening in the United States, 2008: A review of current American Cancer Society guidelines and cancer screening issues. CA Cancer J Clin 2008; 58: 161-179. (PMID: 18443206) [CrossRef]
19. Lee C and Wu TY. The Impact of Breast Cancer Educational Workshop on Knowledge and Breast Self-Examination Practice Among Korean-American Women. J Nurs Care 2014; 3: 176.
20. Wu TY, Lin CM, Chen SL, Jung Y. A community-based intervention to promote breast cancer awareness and screening among Asian American women. Int Q Community Health Educ 2014; 34: 171-185. (PMID: 24928609). [CrossRef]
21. Jemal A, Bray F, Center MM, Ferlay J, Ward E, Forman D. Global cancer statistics. CA Cancer J Clin 2011; 61: 69-90. (PMID: 21296855). [CrossRef]
22. Youlden DR, Cramb SM, Yip CH, Baade PD. Incidence and mortality of female breast cancer in the Asia-Pacific region. Cancer Biol Med 2014; 11: 101-115. (PMID: 25009752).
23. Laudico AV, Mirasol-Lumague MR, Mapua CA, Uy GB, Toral JA, Medina VM, Pukkala E. Cancer incidence and survival in Metro Manila and Rizal province, Philippines. Jpn J Clin Oncol 2010; 40: 603-612. (PMID: 20385654). [CrossRef]
24. Nelson H, Tyne K, Naik A, Bougatsos C, Chan BK, Humphrey L. Screening for breast cancer: Systematic evidence review update for the U.S. Preventive Services Task Force, Agency for Healthcare Research and Quality. Rockville: 2009.
25. Mena, M., Wiafe-Addai, B., Sauvaget, C., Ali, I.A., Wiafe, S.A., Dabis, F., Anderson, B.O., Malvy, D. and Sasco, A.J., 2014. Evaluation of the impact of a breast cancer awareness program in rural Ghana: a cross-sectional survey. Int J Cancer; 134: 913-924. (PMID: 23913595) [CrossRef]
26. Hadi MA, Hassali MA, Shafie AA, Awaisu A. Evaluation of breast cancer awareness among female university students in Malaysia. Pharm Pract (Granada) 2010; 8: 29-34. (PMID: 25152790) [CrossRef]
27. Wadler BM, Judge CM, Prout M, Allen JD, Geller AC. Improving breast cancer control via the use of commu- nity health workers in South Africa: a critical review. J Oncol 2011; 2011: 150423. (PMID: 20936151)
28. Wu TY, Liu YL, Chung S. Improving breast cancer outcomes among women in China: Practices, knowledge and attitudes related to breast cancer screening. Int J of Breast Cancer 2012; 2012: 921607. (PMID: 23304529)
29. Kwong A, Cheung PS, Wong AY, Hong GT, Lo G, Tsao M, Chan EW, Wong T, Ma M. The acceptance and feasibility of breast cancer screening in the east. Breast 2008; 17: 42-50. (PMID: 17720500). [CrossRef]
30. Parsa P and Kandiah M. Predictors of adherence to clinical breast examination and mammography screening among Malaysian women. Asian Pac J Cancer Prev 2010; 11: 681-688. (PMID: 21039036).
31. Chong PN, Krishnan M, Hong CY, Swah TS. Knowledge and practice of breast cancerscreening amongst public health nurses in Singapore. Singapore Med J 2002; 43: 509-516. (PMID: 12587705).
32. Wu TY, Chung S, Yeh MC, Chang SC, Hsieh HF, Ha SJ. Understanding breast cancer screening practices from Taiwan: A country with universal health care. Asian Pac J Cancer Prev 2012; 13: 4289-4294. (PMID: 23167330). [CrossRef]
33. Hocaoğlu M, Erşahin AA, Akdeniz E. Evaluation on the practice and behaviour of women applied for gynecology outpatient clinics about screening methods for early diagnosis of breast cancer. Eur J Health 2017; 13: 150-155. (PMID: 28894855). [CrossRef]
34. Dey S. Preventing breast cancer in LMICs via screening and/or early detection: The real and the surreal. World J Clin Oncol 2014; 5: 509-519. (PMID: 25114864) [CrossRef]
35. Montazeri A, Vahdaninia M, Harirchi I, Harirchi AM, Sajadian A, Khaleghi F, Ebrahimi M, Haghighat S, Jarvandi S. Breast cancer in Iran: need for greater women awareness of warning signs and effective screening methods. Asia Pac Fam Med 2008; 7: 6. (PMID: 19099595) [CrossRef]
36. Heppner P, Kavilighan DM, Wampold BE. Research design in counseling. Pacific Grove, CA: Brooks/Cole Publishing Company.