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Title Page

Effect of Health Education Interventions on Breast Cancer Awareness and Practices among Women in Low Socio-Economic Area of Mumbai

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Effect of Health Education Interventions on Breast Cancer Awareness and Practices among Women in Low Socio-Economic Area of Mumbai

Abstract

Objectives The present study aimed to improve breast cancer (BC) awareness and practices using Information, Education and Communication (IEC) modules and health educational sessions for women and primary healthcare providers in low socio-economic community of Mumbai.

Design: Pre-post quasi-experimental design.

Setting: The study was conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra. The baseline and endline survey was conducted using structured interview schedules.

Participants: 410 selected women aged between 18 to 55 years who are not pregnant, lactating or diagnosed with BC.

Interventions: A health education based intervention module was developed to educate women through group and individual sessions.

Outcomes: Summative indices were constructed to understand the net mean difference in knowledge of signs and symptoms and risk factors. ANNOVA and paired t-test were used to check the significant effect of intervention.

Results: Our results showed statistical significance in difference in mean knowledge score for both signs & symptoms (Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, P<0.00) and risk factors of breast cancer knowledge (M.D.: 5.64, S. D.: 4.00, P<0.00) among women after intervention. There was a marked improvement in the knowledge of BC among women with low education category. A significant improvement in knowledge of symptoms and risk factors among health workers was also observed. Our interventions resulted in positive change in breast examination practices. The breast self-examination practices improved from around 3 % to 65% and around 41% more women went for clinical breast examination after intervention.

Conclusions: This study found a significant improvement in knowledge of breast cancer signs & symptoms, risk factors and breast-self-examination practices among study participants following our health education interventions among these subpopulations. These evidences call for inclusion of similar interventions through capacity building of primary health care providers in national programmes.

Key Words: Breast cancer awareness, health education interventions, breast self-examination, India

Strengths and Limitations of the study

There are very few studies in India which focused on health education-based interventions for participants through sessions at primary health care facilities. Our study fills in such research gap in low socio-economic facilities of Mumbai.

The study found effective health education interventions enhance knowledge and practices of breast cancer among women.

Our study was limited to one low socio-economic region focused on a primary health centers run with limited human resources.

This is quasi-experiment time bound pre-post study and the results were compared between two-time periods without a control group which needs careful interpretation of the impact of intervention in general.

Introduction

Around 2.25 million estimated individuals are living with cancer and it contributed to around 8.3% estimated total deaths in India [1,2]. The incidences and mortality due to cancer has been doubled in India during 1990-2016 enormously contributing to overall Disability Adjusted Life Years (DALYs) and total deaths in the country [2]. According to GLOBOCAN (Global Cancer Incidence, Mortality and Prevalence) 2018 report, more women in India were vulnerable to cancer than men [3]. The cervical cancer cases dominated among all reproductive cancer cases among women for long duration in India. The last few decades saw rapid surge in breast cancer (BC) cases making it the leading cancer among women in India [4]. Although the Indian women are less prone to breast cancer than the women from western countries, the mortality rate among them are very high as compared to the women from western countries[3,5,6]. As per National Cancer Registry Programme of India and GLOBOCAN 2018, the mortality rates in India (17.1 per 100 thousand women) was more than the United Kingdom (UK) (12.7 per 100 thousand women) despite of a low incidence rate of breast cancer [7]. This high mortality is attributed to late detection of the breast cancer at locally advanced or at metastatic stages.

Several studies showed majority of breast cancers in western countries were reported in stage I or II of the disease, whereas in India around 46% of these were reported in advanced stages[6,8,9]. The importance of early diagnosis had been highlighted by most researchers as the pathways to save life and acts as an important method to improve the medical condition [10–13]. This scenario of late diagnosis arose due to different factors such as non-existence of high quality and primary level screening programme, lack of regional treatment center, overdependence on large tertiary cancer hospitals, high out of pocket expenditure and non-participation of women in the existing programme [5,13–17]. Studies have found that the awareness level of different signs, symptoms and risk factors of breast cancer among women in India is low contributing to late detection BCs among them[13,18–20].

The rapid rise in number of breast cancer cases has been associated with the growing urbanization and rapid lifestyle changes [21]. Many studies have found that women living in urban India were more vulnerable to breast cancer than the women from rural areas of India [22,23] with highest incidence rate in major metropolitan cities[24]. As per the latest available statistics, the age-adjusted incidence rate of breast cancer was high in bigger urban hubs like Hyderabad district (48 per 100,000 women) followed by Chennai (42.2), Bangalore (40.5), Delhi (38.6), Patiala (36.9), Thiruvananthapuram (35.6), Mumbai (34.4), and Bhopal (32.6)[24]. In the last few decades, India's transformative neo-liberal economic reform and development have brought a large chunk of population to bigger cities from rural areas in expectation of gainful employment in industries and services sectors. Although the echelon of privileged urban Indians have better access to knowledge and high quality of services about cancer care through private and specialized tertiary care facilities, the low socio-economic stratum has low access to primary screening or biomedical oncological expertise [25,26]. The existing social cleavages in access to and quality of cancer care in India among poor and non-poor in urban India is more acute due to the existing socio-economic and health system blockades[26].

The processes and pathways of accessing care are many a time confusing to a common man/women and their family as they generally prefer to go to a local untrained physician,

pharmacist or quack at the initial stage of the cancer who often don't recognize the malignancy [26]. Moreover, the wide spread public misunderstanding, extremely limited awareness in prevention, treatment and cancer symptomology, existing social stigma and existing structural inequalities across socio-cultural groups poses as barrier to early detection [13,26]. Many studies in India found the knowledge of breast cancer risk factors was low [13]. For example, some studies found awareness levels of risk factors related to age at menarche and age at menopause among women was limited between 1-28 percent [19,27–29]. Age at menarche and menopause is considered as two strongest risk factors of breast cancer[13]. A review by Gupta et al, 2015 suggested the awareness of different known risk factors such as overweight and obesity (11–51%), family history (13–58%), age at birth of first child (8–83%), lack of breastfeeding (17–88%) and tobacco smoking (20–74%) varied widely across location and different age groups of women in India[13,16,28–31]. Studies have found literacy deficit about breast cancer among health professionals at primary care centers, nurses and other health staffs as potential barrier in breast cancer prevention and early detection [13,32]. They are in the frontline for spreading awareness at the community level. Hence, capacity building of both primary health care providers and community education is essential to increase awareness about BC, promoting screening, early detection and treatment of breast cancer cases. Against this backdrop, the present study aimed to improve breast cancer awareness and practices among women using breast cancer Information, Education and Communication (IEC) module and health educational sessions for women and primary health care providers in low socio-economic community of Mumbai.

There are limited studies in India which used health education intervention to improve breast cancer knowledge and practices[18,29,32–35]. Most of these studies focused on health education interventions of women directly at community or individual level using power-point slides, videos, flipcharts and pamphlets and found significant change in breast cancer knowledge and breast self-examination (BSE) practices. To the best of our knowledge, there is no study from Mumbai, which focused on such interventions. Further, very few studies focused on capacity building of primary health facilities or community health workers for a better and sustainable health intervention for breast cancer screening [29,36]. Therefore, we focused capacity building of staff of the primary health facility and provided training sessions at the facilities in the current study.

Methods

Study Setting

The study was a pre-post intervention study conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra state. Mumbai has a mixed health care system with private and public health care facilities. The government health infrastructures are governed by both state government and Municipal Corporation of Greater Mumbai (MCGM). The MCGM runs three-tier system of primary, secondary and tertiary healthcare through different health posts, dispensaries, maternity homes, municipal general hospitals, specialty hospitals and medical college hospitals. The MCGM has a chain of four medical colleges and hospitals, six specialty hospitals, 16 peripheral hospitals, 29 municipal maternity homes, 26 specialty hospitals, 175 municipal dispensaries and 183 health posts [37]. The health posts and maternity

homes provide primary and maternal health care services at low socio-economic areas/slums respectively. Besides Mumbai has central government hospitals and dispensaries, which includes the main branch of Tata Memorial Centre (TMC), a national comprehensive cancer center for the prevention, treatment, education and research in cancer funded and controlled by Department of Atomic Energy, Government of India.

Our study is confined to catchment area of municipal maternity home and health post at Prabhadevi, Mumbai. As per Maharashtra Housing and Area Development Authority (MHADA), Government of Maharashtra, this health facility provides primary and maternity care to around 76 thousand low income group community population. The health facility was equipped with one Assistant Medical Officer (AMO), 1 Public Health Nurse (PHN), 3 Auxiliary Nurse Mid-wives (ANMs), 2 Health Coordinators, 14 Community Health Volunteers (CHVs), 2 Accredited Social Health Activists (ASHAs), 4 Staff Nurses, 1 *Ayha* (Traditional Birth Attendant) and 1 Data Entry Operator during the study period.

Interventions

This study was conducted among selected women aged between 18 to 55 years from the selected low socio-economic community. Pregnant women, lactating women and women diagnosed with breast cancer (BC) and/or under treatment were excluded from the study. An intervention based health education module was developed to educate women from the community. IEC material (pamphlets and flipchart) on Breast Cancer (BC) and BSE was developed by the research team in consultation with clinicians from department of Preventive Oncology, Tata Memorial Center, Mumbai. The content of IEC and training module included information about BC, risk factors, signs and symptoms, ways to detect BC and frequency and treatment seeking behavior. Group education on knowledge of signs and symptoms, risk factors and BSE was provided at the facility for 10-15 women per session using power point, flipcharts and MammaCare breast models by experts from Department of Preventive Oncology, Tata Memorial Center, Mumbai (Table 1). Individual sessions at households were provided by trained project staff to women who could not come to the facilities. MammCare breast models are typically designed breast dummies by the MammaCare Foundation, USA for CBE and/or BSE education. In addition, IEC materials (pamphlets) was distributed to them. They were informed about the clinical breast examination (CBE) camp at the health facility and were motivated to utilize the service.

Intervention for health workers: Half day training programme was arranged for the health care providers (CHVs, ASHAs, PHN, Nurses, ANMs, MPW, AMO) on BSE, CBE on 31st July 2019 at the Maternity Home. Experts preventive oncologists from the comprehensive tertiary cancer centre took the sessions on BSE and CBE for the paramedic staffs and Medical Officer. The sessions were arranged through audio-video presentations and discussion mode followed by breast examination practices using breast MammaCare breast model (Table1). Twenty-one health workers participated in the training.

Data

The baseline and endline surveys were conducted to see the effect of health education intervention on women's knowledge and practices on breast cancer. The baseline survey was

conducted during November 2018 to March 2019, the intervention was given during May-October 2019 and endline study was conducted from December 2019 to March 2020. The details of the study design and findings of baseline study has been published [19].

Sample Size and Sampling procedure: The study in low socio-economic setting Delhi found 53% of women between 14 to 74 years of age were aware about breast cancer [18]. Assuming 53% prevalence, 5% level of significance and 20% non-response rate during the follow up our sample size for baseline was approximately 480 (exactly 478) [19]. The response rate for endline survey was 85.4% (410 out of 480) excluding locked house, unavailability for longer time and non-responses. The study area is catered by 16 Community Health Volunteers/ASHAs at the health post and each section constitutes around 1000-1400 households. Thirty participants were selected from each sections using systematic random sampling procedure from the list of eligible women which is obtained through mapping and house listing of the selected area/community [19].

Data Collection Tools: Quantitative structured schedules were used to collect data in both baseline and endline survey. The baseline tools covered questions on socio-demographic characteristics of women, breast cancer awareness, questions on signs, symptoms, risk factors of breast cancer. The tools also covered questions on Breast Self-Examination (BSE), and Clinical Breast Examination (CBE) practices. The endline survey included similar questions on knowledge and practices of breast cancer and reasons for not conducting BSE and CBE. The tools were prepared using available literatures and a team of experts was consulted which consisted of oncologists, gynaecologist, public health specialist, and social scientist. The questions were translated to local languages i.e. Marathi and Hindi. The questions were validated in similar setting of Mumbai and results were used to modify the questionnaire. The data collectors were trained with the tools, protocols and ways of asking questions. Our data collectors conducted face-to-face interviews for collecting the information. Data monitoring was ensured through regular back-checks at office.

Structured questionnaires were also developed to know the knowledge of breast cancer among health care providers before and after intervention. While the pre-intervention tool covered socio-economic background and questions on breast cancer knowledge of signs and symptoms, risk factors and BSE and CBE practices. The post intervention covered questions only on breast cancer knowledge indicators and feedbacks about the programme. The data collection and health education intervention was directly moderated by the investigators of the study.

Data Analysis: The data analysis was done using IBM SPSS 26. Descriptive statistics like mean, standard deviation and percentage were used to understand the level of knowledge. ANNOVA and paired t-test were used to see net difference in mean scores and the level of significance. The data analysis for this research paper is done with 410 women for comparing baseline and endline data.

Dependent Variables: The women were asked whether they have heard about breast cancer. This is used as a proxy variable for breast cancer awareness. Different response related to specific signs and symptoms, risk factors of breast cancer were used to see the change in knowledge of different indicators during pre and post interventions. Separate summative

indices were constructed to understand the mean difference in knowledge of signs and symptoms and risk factors using 10 and 13 binary outcomes respectively. Those who were aware were given weight score of '1' for each outcome and those who were not aware were weighted '0' for each items. The summative indices were used to see the mean difference in pre-post intervention in knowledge scores.

Independent variables: Independent variable such as age of women, religion, caste, marital status, years of schooling, and employment status of women were used to see socio-economic differentials in net difference mean knowledge score before and after interventions using ANNOVA.

Ethical Considerations: The ICMR-National Institute for Research in Reproductive Health (ICMR-NIRRH) Ethics Committee for clinical studies, Mumbai which is recognized by Strategic Initiative for Developing Capacity in Ethical Review (SIDCER), Forum for Ethical Review Committees in the Asian and Western Pacific Region (FERCAP) has approved the study (Project No: 329/2018). Written consent from the participants were obtained before collecting the data. Confidentiality and privacy was ensured at all stages of data collection, management and analysis.

Results

Socio-demographic profile of the participants

The median age of the women was 40 years with a range between 18 to 55 years. Majority of them were educated and the median years of schooling was 12 years. Most of them were from Hindu religion (92%) and from upper caste (67%). Only 15% of the women were working and most of the women were married (85%).

Change in Knowledge of different signs and symptoms and risk factors among women

Only 51% had ever heard of breast cancer during the baseline whereas it improved to 100% after the interventions. Most of the women who were aware of breast cancer reported that they have heard about breast cancer through television (53%) and doctors (25%) whereas majority of the women post intervention told they were made aware through awareness campaign (77%). Figure 1 presents percentage of women with knowledge of different signs and symptoms of breast cancer before and after interventions. The results show noticeable improvement in knowledge of different signs and symptoms of breast cancer. Only 38% women considered 'A lump in breast' as a sign of breast cancer during the pre-intervention survey whereas during the post intervention survey 93% of women considered it as a sign of breast cancer. A very low percentage of women (23%) responded 'abnormal discharge or blood from nipple' as a symptom of breast cancer which was enhanced by 58 percentage points (81%) post health education interventions. Merely one-third of the women thought 'breast cancer is curable if detected early' which improved to 91% after the intervention programme.

The Figure 2 shows percentage of women having knowledge of risk factors of breast cancer before and after health education interventions. Less than 10 percent women considered menstruating at an early age (2.7%), late menopause (5.1%), hormone replacement therapy

(6.8%) and first baby after 30 years (8%) as risk factors of breast cancer during the baseline survey. Post intervention this knowledge improved substantially for these risk factors-menstruating at an early age (27.1%), late menopause (37.3%), hormone replacement therapy (49.5%) and first baby after 30 years (32%). During the pre-intervention phase, a very low percentage of women stated obesity (10%), nulliparity (12%), use of oral contraceptive pills (11%) and induced abortions (11.5%) as breast cancer risk factors which substantially improved after the health education sessions (see Figure 2). Only 15% of the women thought family history of breast cancer as a risk factor which increased to around 60% post intervention.

The Table -2 presents the result of paired t-test with mean difference in score of knowledge of signs & symptoms and risk factors of BC before and after the intervention. The paired t-test shows statistical significance in difference in mean knowledge score for both signs & symptoms (Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, $p<0.000$) and risk factors of breast cancer knowledge (M.D.: 5.64, S. D.: 4.00, $p<0.000$) of women in the community after intervention.

Socio-demographic differences in mean knowledge scores

The socio-economic difference in mean knowledge of scores of signs & symptoms (10 items) and risk factors (13 items) of women before and after intervention is presented in Table 3. The analysis shows that mean knowledge scores improved considerably among all socio-demographic groups of women. The mean knowledge score increase was greater among the primary and secondary education group than the higher educated group of women. Noticeable improvement is also found among Scheduled Caste or Scheduled Tribe (SC/ST) group of women who had very low knowledge of breast cancer before the intervention. The mean knowledge score of signs and symptoms was 0.82 (S.D.: 2.36) among the women belonging to SC/ST before the intervention which improved to 6.55 (S.D.: 2.65) post interventions. Similarly, the mean difference increased from 1.00 (S.D.: 2.27) to 6.59 (S.D.: 2.46). A statistically significance in net mean difference scores was observed among different religious categories, family types, employment status and marital status of women (Table 3). The mean score of signs and symptoms and risk factors for not working women was very low which showed promising improvement post health education interventions by 4.3 (2.46 vs 6.76) and 5.73 (1.49 vs 7.22) mean points.

Knowledge on breast cancer detection methods

The figure 3 represents knowledge of detection methods of BC among women before and after interventions. A very low percentage (6.1) of women knew BSE is a screening method for BC. Post intervention around 58% told that breast cancer can be detected through BSE. Less than half (44%) of the women knew about CBE which improved to 83% post intervention sessions. Around 22 % of the women told Mammography as a breast cancer detection technique during post intervention survey.

Change in Knowledge scores of different signs and symptoms and risk factors among Health care providers

The median (Maximum-Minimum) age of the participants was 43 (27-64) years, years of schooling was 12 (7-17) years and duration of service was 17 (1-33) years. Results indicated that there was an increase in correct knowledge of symptoms like; lump in breast (from 76.2 to 95.2%) and risk factors like menstruation at an early age (from 38.1 to 85.7%). The mean difference in pre-post intervention scores suggested significant improvement in knowledge of symptoms and risk factors (Table 4). The mean difference scores were 2.67 (S.D.: 2.44) and 4.04 (S.D.:4.63) for signs & symptoms and risk factors of breast cancer respectively.

Change in Breast Examination (BSE) Practices

BSE technique was demonstrated to the participants using MammaCare breast model. Only 2.8% of the total 410 women were practicing BSE before intervention session and post intervention around two-thirds (65%) of the women reported practicing BSE (Figure 4). Out of those women who are practicing three-fourths (75%) of them were practicing it monthly and around 90% of them followed IEC materials given through the awareness programme. About 4% of women detected any lump or found any symptoms of breast cancer. Those who are not practicing BSE, majority of them told that they don't get time to practice the same (55%) or they don't feel it is needed (32%). Around 147 (36%) women reported that they have gone for CBE recently and 61 (41%) of the women have gone for CBE after interventions (Figure 5). The women who have not done CBE believed it is not needed (46%) for them now. Around 13% of them told they are either scared or embarrassed to see a doctor for the CBE.

Three camps for CBE were organized with experts from Tata Memorial Centre after the interventions. The camps were organized at the Maternity Home on third week of every month and continued till February 2020. Fifty-nine women attended the camps organized between December 2019 to February 2020 and 55 of them were study participants. Of these 59 women, 6 women were advised for mammography and 7 were advised for sonography or further consultation. There was a huge demand for such CBE camps among women as the attendance was more than our capacity in the fixed day monthly camps. The camps were put on hold following the outbreak of COVID19 pandemic and lockdown in India from March 2020.

Discussion

This study aimed to improve knowledge and practices about breast cancer among women in the low socio-economic community of Mumbai. Only half of the women were aware about breast cancer before the interventions, post interventions all the participants were aware of it. Our health education interventions were grounded in behavioral change theories, practical community-based adult education training modules and BSE practices which lead to strengthening of perceived susceptibility to breast cancer and decline the perceived barriers through knowledge enhancement. The post-intervention results revealed statistical significant improvement in mean knowledge scores of different signs and symptoms and risk factors among women in the study area. Similar targeted education based intervention studies in different settings of India and elsewhere found increase in breast cancer knowledge and awareness among the study population [10,33–36,38–40]. A similar intervention study using flipchart and video slide on LCDs in an Urban Health Centers of Ahmedabad found that group session

of 20-25 subjects in each session resulted in statistical significant impact on knowledge of screening methods before and after health education interventions [29]. The study in semi-urban Madhya Pradesh and rural Tamil Nadu found health education interventions for women led to improved knowledge and breast cancer screening practices among the participants [33,35]. Interestingly, studies in Iran and urban slums Egypt also observed dramatic improvement in participants' breast cancer knowledge following health education interventions among women with low level education[10,38]. Two studies on college going students in India and New York city also found similar results [39,40].

Our baseline survey results found knowledge of the risk factors was very low among women [19]. A very low percentage of women considered mensuration at an early age (3%), late menopause (5%), first baby after 30 years (8%) as important risk factors before the interventions. There was a noteworthy improvement in knowledge about such risk factors after our health education interventions, but the knowledge of risk factors remains low among women. The findings suggest noticeable net difference in mean knowledge score of signs and symptoms and risk factors among the women across all socio-economic groups of women after interventions. Before the interventions, women with primary and secondary education had a very low mean knowledge score of signs and symptoms than the higher educated group of women. Our analysis shows that there is improvement across all educational groups but marked improvement is observed among low education categories of women. The results of ANNOVA showed statistically significant net difference ($p<0.01$) in mean score before and after interventions. Similar intervention studies in urban slums of Egypt and rural Turkey also found notable improvement in breast cancer knowledge even among illiterate women after their health education interventions [38,41]. Our analysis also found statistically significant difference in mean scores of signs and symptoms and risk factors among women by family type, employment and marital status of women.

The healthcare workers at primary care centers plays an important role in demonstrating IEC to the community. Studies had shown that training based on health education modules to community health workers had resulted in increased knowledge of breast cancer and it's practices among the health workers [34,36]. A South Indian study found that training to ANMs on breast cancer knowledge and practices resulted in positive change in knowledge and breast cancer practices in the community. Our intervention sessions conducted by experts from TMC, Mumbai found statistical significant difference in mean knowledge score of signs and symptoms and risk factors among the health care workers at the municipal maternity home. The community workers have very good interactions with the women in local community and they were provided leaflets to spread awareness in the community.

Our interventions resulted in positive change in breast examination practices. The BSE practices improved from around 3 % to 65% and around 41% more women went for CBE after intervention. Although efficiency of BSE remains debatable, it's a cost-effective and non-invasive tool for women who wish to perform monthly BSE to recognise early signs of abnormal breast changes if any[42]. Similar interventions studies in India and Iran observed improvement in breast cancer practices among the participants of the studies[10,29,33,35]. Our findings suggest that there is need for such interventions to improve breast cancer knowledge

and capacity building of healthcare providers at primary health centers in government health programmes at the grassroots for screening and early detection of breast cancers.

Conclusion

In conclusion, we found that knowledge of signs and symptoms and risk factors among women were low in the study area. This study found a significant improvement in knowledge of breast cancer signs & symptoms, risk factors and breast-self-examination practices among study participants following our health education interventions among these subpopulations. Although our finding is confined to low-socioeconomic areas of Mumbai but available evidences calls for inclusion of similar interventions through capacity building of primary health care providers in national programmes. The Government of India launched National Programme for Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke in 2010 as an umbrella programme for non-communicable diseases. The programme aimed to provide community based cost effective screening for all high burden cancers including breast cancer through CBE s. However, this remains a challenge due to lack of trained human resources and limited training modalities. In the present scenario, the finding from our study calls for community empowerment through capacity building of available primary and community level health care providers for better understanding of etiology of breast cancer and improved BSE practices. The national programmes may use effective media platform like Television and IEC at the primary healthcare facilities to improve breast cancer awareness and BSE practices.

Limitations

This study was limited to one low socio-economic region and there were certain operational difficulties the authors would like to acknowledge. It was difficult for some participants to attend the training sessions at the facilities as they were engaged in job or child care. We provided in-house sessions for them. Such primary health centers run with limited human resources thereby putting extra burden on them. For example, the health facility had on one male doctor who couldn't be trained for CBE at TMC due to burden of work on him. We also found some women are uncomfortable in talking to male doctor. In addition to the operational issues, this is quasi-experiment pre-post study and the results were compared between two-time periods without a control group which needs careful interpretation of the impact of intervention in general. Further, the responses related to breast cancer knowledge of signs & symptoms and risk factors depend on comprehension capability of the participants and is subject to recall bias during the data collection.

Declaration

Contributors SB, AP & RKP have contributed to study design. DDN, SP and GM have contributed to interventions and implementation of the study. RKP performed data extraction, analyses, and prepared the first draft of the manuscript. SB, AP, DDN, SP and GM have read and contributed to finalization of the manuscript. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement: The participants were women from the catchment area of Prabhadevi Maternity Home and health workers of the facility. However, the participants were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Data availability statement The raw data used in this research is not publicly available and is accessed by the researchers only. Please send your inquiries to the corresponding author for the data.

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Table 1: The Health Education Interactive session plans for participants

Content	Methods	Intervention Details	Duration (Women)	Duration (Health Workers)
Pre-test Survey	Questionnaire	Not Applicable (NA)	NA	10 Mins
Introduction	Power point	What is breast cancer? Prevalence and Mortality. Causes.	10 Mins	10 Mins
Signs and Symptoms, risk factors	Power point, flipcharts and discussion	All common signs, symptoms and risk factors of breast cancer	15 mins	20 Mins
Diagnosis techniques	Power point, flipcharts and discussion	Diagnosis Techniques Such as BSE, CBE, Mammography, Sonography and biopsy	15 Mins	20 Mins
Importance of Early Diagnosis	Power point and discussion	Early diagnosis benefits and Treatment	5 Mins	5 Mins
Myths and Facts about Breast cancer	Discussion	Common Myths and Facts about Breast cancer	10 Mins	10 Mins
Breast Self-Examination Demonstrations	Visual aid and Group Interaction using MammaCare breast Models	Breast Self-Examination Demonstration using visual aid and MammaCare Breast Models	30 Mins	30 Mins
Q & A Session	Discussion	Discussion and doubt clearing session	10 Mins	10 Mins
Post-test Survey	Questionnaire	NA	NA	10 Mins

Table 2: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among women in the study area, 2018-20

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of risk factors of BC before Intervention	1.63				
Knowledge of risk factors of BC after Intervention	7.27	5.64	4.00	5.26-6.03	0.000
Knowledge of Signs and symptoms of BC before Intervention	2.68				
Knowledge of Signs and symptoms of BC after Intervention	6.77	4.09	4.05	3.70-4.48	0.000

Table 3: Socio-economic difference in mean knowledge score of signs & symptoms (10 items) and risk factors (13 items) of women in the low socio-economic community of Mumbai before and after interventions,2018-20

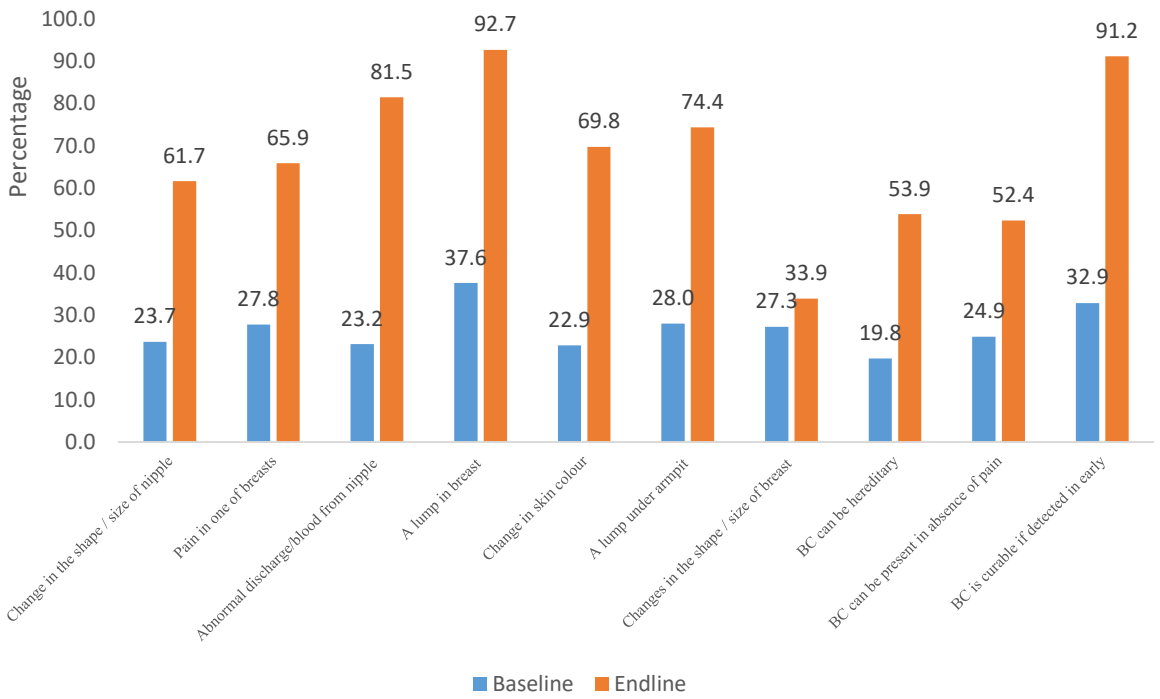
Characteristics	Mean (S.D.) Knowledge Score						N
	Signs & symptoms (10 items)			Risk factors(13 items)			
	Baseline	Endline	P value	Baseline	Endline	P value	
Age Group (Years)			ns			ns	
18-24	2.74 (3.86)	7.02 (1.87)		1.63 (3.30)	7.65 (2.28)		43
25-34	2.83 (3.64)	6.72 (2.03)		2.00 (2.97)	7.14 (2.76)		87
35-44	2.50 (3.63)	7.04 (2.01)		1.47 (2.82)	7.22 (2.54)		137
45-55	2.80 (3.73)	6.48 (1.80)		1.59 (3.03)	7.31 (2.86)		140
Schooling			P<0.01			ns	
Primary	1.23 (3.06)	5.96 (1.96)		0.46 (1.22)	6.68 (2.73)		22
Secondary	1.48 (2.86)	6.90 (1.93)		1.12 (2.46)	7.19 (2.87)		168
Higher	3.74 (3.96)	6.76 (1.92)		2.13 (3.33)	7.39 (2.50)		220
Religion			P<0.01			P<0.01	
Hindu	2.77 (3.71)	6.73 (1.92)		1.67 (2.97)	7.25 (2.68)		387
Non-Hindu	2.70 (3.12)	6.78 (2.14)		1.64 (3.03)	7.28 (2.61)		29
Caste			ns			ns	
SC/ST	0.82 (2.36)	6.55 (2.65)		1.00 (2.27)	6.59 (2.46)		22
OBC	2.90 (3.58)	7.02 (1.72)		1.87 (2.96)	7.15 (2.57)		111
Others	2.77 (3.77)	6.69 (1.94)		1.60 (3.02)	7.39 (2.73)		274
Family type			P<0.01			P<0.01	
Nuclear	2.80 (3.80)	6.87 (1.93)		1.57 (2.71)	7.36 (2.81)		326
Joint/extended	2.31 (3.14)	6.42 (1.94)		1.93 (3.03)	6.95 (2.63)		81
Employment			P<0.01			P<0.01	
Not working	2.46 (3.58)	6.76 (1.90)		1.49 (2.86)	7.22 (2.65)		348
Working	3.90 (3.99)	6.86(2.10)		2.42 (3.39)	7.57 (2.75)		62
Marital status			P<0.01			P<0.01	
Unmarried	2.64(3.73)	7.12(1.72)		1.46 (2.96)	7.89 (2.16)		61
Married	2.69(3.67)	6.71(1.96)		1.66 (2.97)	7.16 (2.74)		349

Note: a) N is Sample Size b) SC: Scheduled Caste; ST: Scheduled Tribe; OBC: Other Backward Classes.

Table 4: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among heath care providers at the study facility.

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of Signs and symptoms of BC before Intervention	6.76	2.67	2.44	1.56-3.78	0.000
Knowledge of Signs and symptoms of BC after Intervention	9.43				
Knowledge of risk factors of BC before Intervention	7.00	4.05	4.63	1.94-6.16	0.001
Knowledge of risk factors of BC before Intervention	11.05				

Figure 1: Percentage of women with knowledge of different signs and symptoms of breast cancer before and after interventions, 2018-20



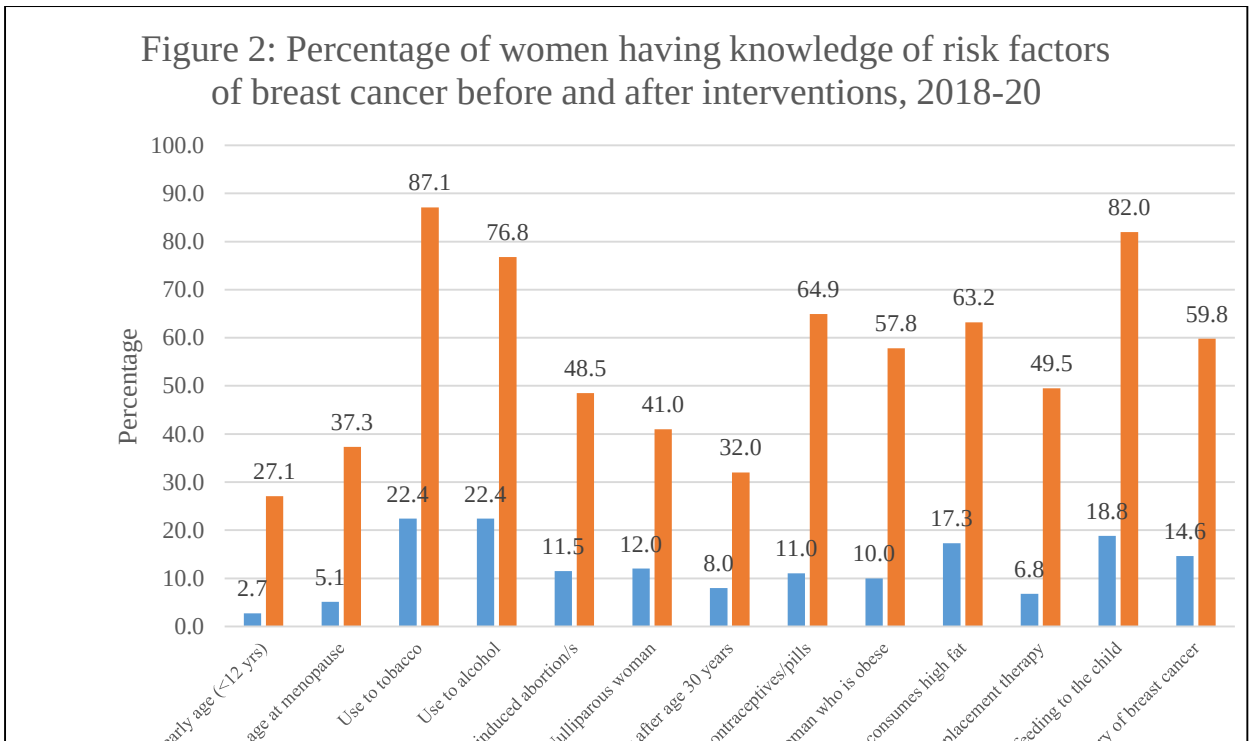


Figure 3: Knowledge of breast cancer detection methods among women in the community before and after interventions, 2018-20

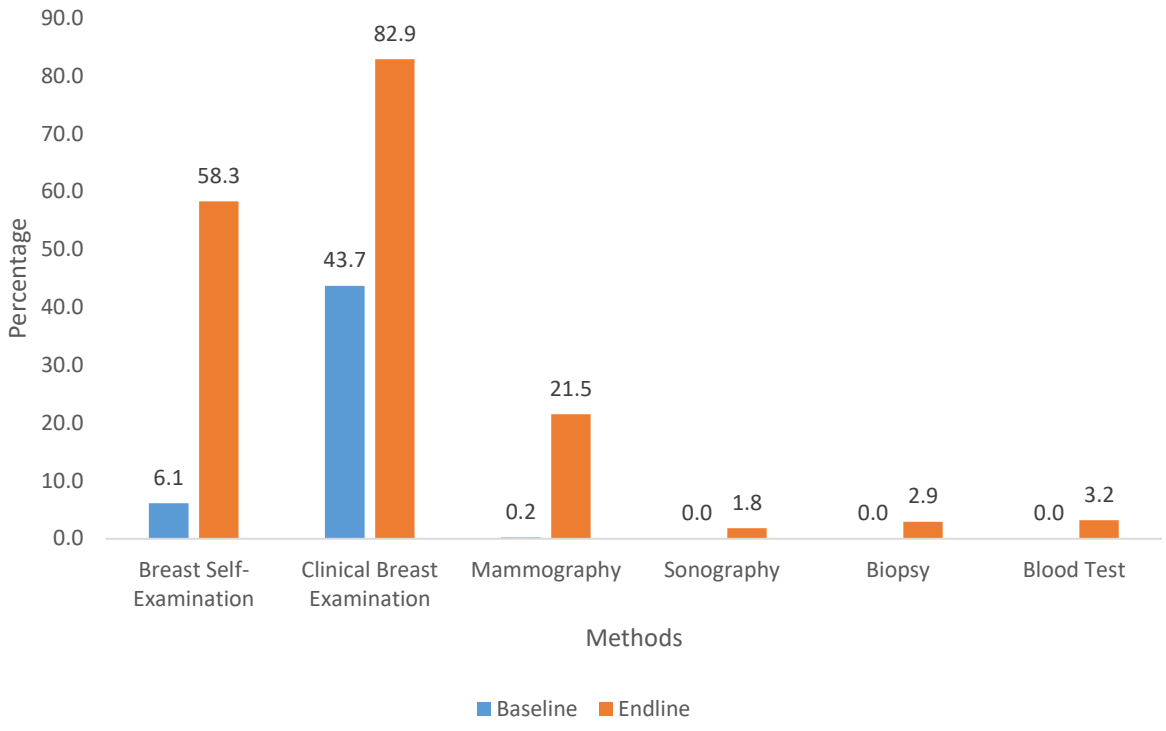


Figure 4: Breast-self-examination practices after intervention among the women participants.

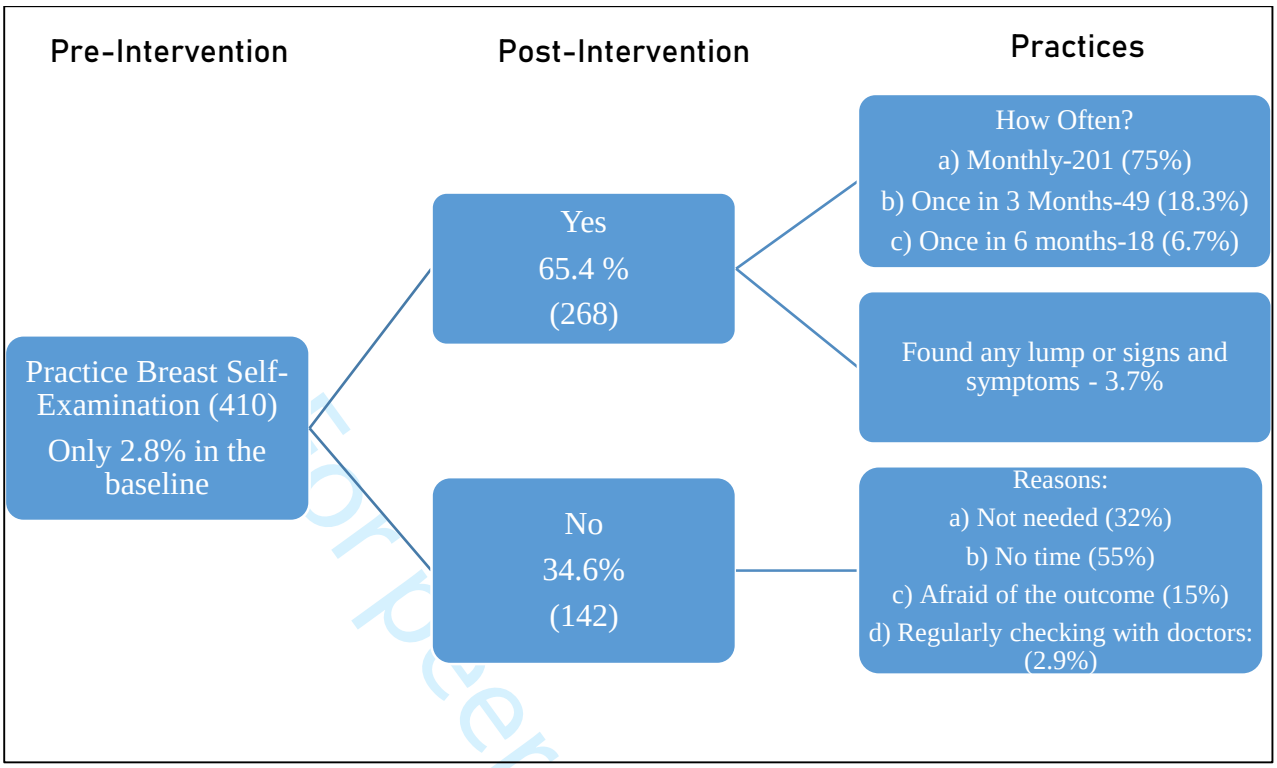
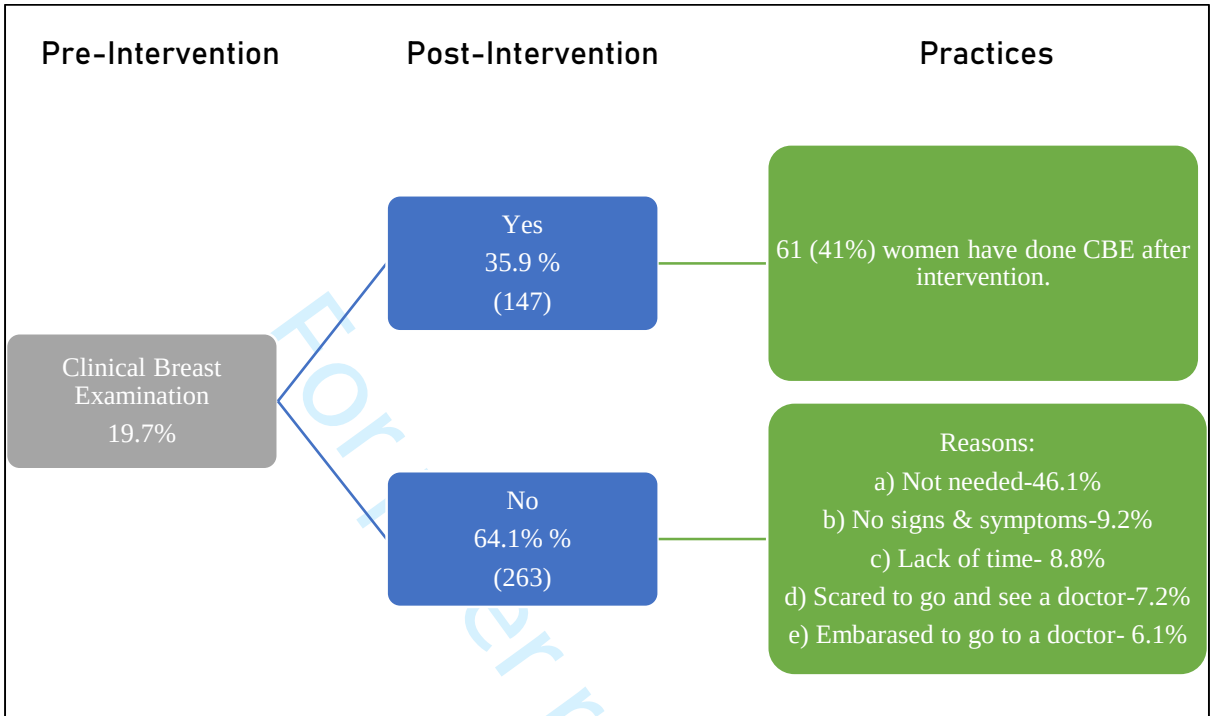


Figure 5: Clinical Breast Examination practices after intervention among the women participants.



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Title Page

Increasing Breast Cancer Awareness and Breast Examination Practices among Women through Health Education and Capacity Building of Primary Healthcare providers: A Pre-Post Intervention Study in Low Socio-Economic Area of Mumbai, India

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Increasing Breast Cancer Awareness and Breast Examination Practices among Women through Health Education and Capacity Building of Primary Healthcare providers : A Pre-post Intervention Study in Low Socio-Economic Area of Mumbai, India

Abstract

Objectives The present study aimed to improve breast cancer (BC) awareness and practices using Information, Education and Communication (IEC) modules and health educational sessions for women and primary healthcare providers in low socio-economic community of Mumbai.

Design: Pre-post quasi-experimental design.

Setting: The study was conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra. The baseline and endline survey was conducted using structured interview schedules.

Participants: 410 selected women aged between 18 to 55 years who are not pregnant, lactating or diagnosed with BC.

Interventions: A health education based intervention module was developed to educate women through group and individual sessions.

Outcomes: Summative indices were constructed to understand the net mean difference in knowledge of signs and symptoms and risk factors. ANNOVA and paired t-test were used to check the significant improvement of intervention.

Results: Our results showed statistical significance in difference in mean knowledge score for both signs & symptoms (Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, P<0.00) and risk factors of breast cancer knowledge (M.D.: 5.64, S. D.: 4.00, P<0.00) among women after intervention. There was a marked improvement in the knowledge of BC among women with low education category. A significant improvement in knowledge of symptoms and risk factors among health workers was also observed. Our interventions resulted in positive change in breast examination practices. The breast self-examination practices improved from around 3 % to 65% and around 41% more women went for clinical breast examination after intervention.

Conclusions: This study found a significant improvement in knowledge of breast cancer signs & symptoms, risk factors and breast-self-examination practices among study participants following our health education interventions among these subpopulations. These evidences call for inclusion of similar interventions through capacity building of primary health care providers in national programmes.

Key Words: Breast cancer awareness, health education interventions, breast self-examination, India

Strengths and Limitations of the study

There are very few studies in India which focused on health education-based interventions for participants through sessions at primary health care facilities. Our study fills in such research gap in low socio-economic facilities of Mumbai.

The study found effective health education interventions enhance knowledge and practices of breast cancer among women but found there are several barriers in implementing breast cancer screening at primary healthcare level.

Our study was limited to one low socio-economic region focused on a primary health centers run with limited human resources.

This is quasi-experiment time bound pre-post study and the results were compared between two-time periods without a control group which needs careful interpretation of the impact of intervention in general.

Introduction

Around 2.25 million estimated individuals are living with cancer and it contributed to around 8.3% estimated total deaths in India (1,2). The incidences and mortality due to cancer has been doubled in India during 1990-2016 enormously contributing to overall Disability Adjusted Life Years (DALYs) and total deaths in the country (2). According to GLOBOCAN (Global Cancer Incidence, Mortality and Prevalence) 2018 report, more women in India were vulnerable to cancer than men (3). The cervical cancer cases dominated among all reproductive cancer cases among women for long duration in India. The last few decades saw rapid surge in breast cancer (BC) cases making it the leading cancer among women in India (4). Although the Indian women are less prone to breast cancer than the women from western countries, the mortality rate among them are very high as compared to the women from western countries(3,5,6). As per National Cancer Registry Programme of India and GLOBOCAN 2018, the mortality rates in India (17.1 per 100 thousand women) was more than the United Kingdom (UK) (12.7 per 100 thousand women) despite of a low incidence rate of breast cancer (7). This high mortality is attributed to late detection of the breast cancer at locally advanced or at metastatic stages.

Several studies showed majority of breast cancers in western countries were reported in stage I or II of the disease, whereas in India around 46% of these were reported in advanced stages(6,8,9). The importance of early diagnosis had been highlighted by most researchers as the pathways to save life and acts as an important method to improve the medical condition (10–13). This scenario of late diagnosis arose due to different factors such as non-existence of high quality and primary level screening programme, lack of regional treatment center, overdependence on large tertiary cancer hospitals, high out of pocket expenditure and non-participation of women in the existing programme (5,13–17). Studies have found that the awareness level of different signs, symptoms and risk factors of breast cancer among women in India is low contributing to late detection BCs among them(13,18–20). The Government of India launched National Programme for Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke in 2010 as an umbrella programme for non-communicable diseases in selected 100 districts(2). The programme aimed to provide community based cost effective screening of men and women above 30 years for all high burden cancers including breast cancer through checklist collected by village health worker like ASHAs (Accredited Social Health Activists). As part of it women were asked and screened for lump in breast, blood stained discharge from the nipple and change in shape and size of the blood in each five years. The ASHAs were advised to refer to nearest available facilities. However, this remains a challenge due to lack of trained human resources and limited training modalities.

The rapid rise in number of breast cancer cases has been associated with the growing urbanization and rapid lifestyle changes (21). Many studies have found that women living in urban India were more vulnerable to breast cancer than the women from rural areas of India (22,23) with highest incidence rate in major metropolitan cities(24). As per the latest available statistics, the age-adjusted incidence rate of breast cancer was high in bigger urban hubs like Hyderabad district (48 per 100,000 women) followed by Chennai (42.2), Bangalore (40.5), Delhi (38.6), Patiala (36.9), Thiruvananthapuram (35.6), Mumbai (34.4), and Bhopal (32.6)(24). In the last few decades, India's transformative neo-liberal economic reform and

development have brought a large chunk of population to bigger cities from rural areas in expectation of gainful employment in industries and services sectors. Although the echelon of privileged urban Indians have better access to knowledge and high quality of services about cancer care through private and specialized tertiary care facilities, the low socio-economic stratum has low access to primary screening or biomedical oncological expertise (25,26). The existing social cleavages in access to and quality of cancer care in India among poor and non-poor in urban India is more acute due to the existing socio-economic and health system blockades(26).

The processes and pathways of accessing care are many a time confusing to a common man/women and their family as they generally prefer to go to a local untrained physician, pharmacist or quack at the initial stage of the cancer who often don't recognize the malignancy (26). Moreover, the wide spread public misunderstanding, extremely limited awareness in prevention, treatment and cancer symptoms understanding, existing social stigma and existing structural inequalities across socio-cultural groups poses as barrier to early detection (13,26). Many studies in India found the knowledge of breast cancer risk factors was low (13). For example, some studies found awareness levels of risk factors related to age at menarche and age at menopause among women was limited between 1-28 percent (19,27–29). Age at menarche and menopause is considered as two strongest risk factors of breast cancer(13). A review by Gupta et al, 2015 suggested the awareness of different known risk factors such as overweight and obesity (11–51%), family history (13–58%), age at birth of first child (8–83%), lack of breastfeeding (17–88%) and tobacco smoking (20–74%) varied widely across location and different age groups of women in India(13,16,28–31). Studies have found literacy deficit about breast cancer among health professionals at primary care centers, nurses and other health staffs as potential barrier in breast cancer prevention and early detection (13,32). They are in the frontline for spreading awareness at the community level. Hence, capacity building of both primary health care providers and community education is essential to increase awareness about BC, promoting screening, early detection and treatment of breast cancer cases.

There are limited studies in India which used health education intervention to improve breast cancer knowledge and practices(18,29,32–35). Most of these studies focused on health education interventions of women directly at community or individual level using power-point slides, videos, flipcharts and pamphlets and found significant change in breast cancer knowledge and breast self-examination (BSE) practices. To the best of our knowledge, there is no study from Mumbai, which focused on such interventions. Further, very few studies focused on capacity building of primary health facilities or community health workers for a better and sustainable health intervention for breast cancer screening at the primary care level (29,36). Therefore, the present study aimed to improve breast cancer awareness and practices among women using breast cancer Information, Education and Communication (IEC) module and health educational sessions for women and primary health care providers using a health system approach in low socio-economic community of Mumbai. We focused capacity building of staff of the primary health facility and provided training sessions at the facilities and understand the barriers in implementing CBE practices at primary care level.

Methods

Study Setting

The study was a pre-post intervention study conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra state. Mumbai has a mixed health care system with private and public health care facilities. The government health infrastructures are governed by both state government and Municipal Corporation of Greater Mumbai (MCGM). The MCGM runs three-tier system of primary, secondary and tertiary healthcare through different health posts, dispensaries, maternity homes, municipal general hospitals, specialty hospitals and medical college hospitals. The MCGM has a chain of four medical colleges and hospitals, six specialty hospitals, 16 peripheral hospitals, 29 municipal maternity homes, 26 specialty hospitals, 175 municipal dispensaries and 183 health posts (37). The health posts and maternity homes provide primary and maternal health care services at low socio-economic areas/slums respectively. Besides Mumbai has central government hospitals and dispensaries, which includes the main branch of Tata Memorial Centre (TMC), a national comprehensive cancer center for the prevention, treatment, education and research in cancer funded and controlled by Department of Atomic Energy, Government of India.

Our study is confined to catchment area of municipal maternity home and health post at Prabhadevi, Mumbai. As per Maharashtra Housing and Area Development Authority (MHADA), Government of Maharashtra, this health facility provides primary and maternity care to around 76 thousand low income group community population. The health facility was equipped with one Assistant Medical Officer (AMO), 1 Public Health Nurse (PHN), 3 Auxiliary Nurse Mid-wives (ANMs), 2 Health Coordinators, 14 Community Health Volunteers (CHVs), 2 Accredited Social Health Activists (ASHAs), 4 Staff Nurses, 1 *Ayha* (Traditional Birth Attendant) and 1 Data Entry Operator during the study period.

Interventions

This study was conducted among selected women aged between 18 to 55 years from the selected low socio-economic community. Pregnant women, lactating women and women diagnosed with breast cancer (BC) and/or under treatment were excluded from the study. An intervention based health education module was developed to educate women from the community. IEC material (pamphlets and flipchart) on Breast Cancer (BC) and BSE was developed by the research team in consultation with clinicians from department of Preventive Oncology, Tata Memorial Center, Mumbai. The content of IEC and training module included information about BC, risk factors, signs and symptoms, ways to detect BC and frequency and treatment seeking behavior. Group education on knowledge of signs and symptoms, risk factors and BSE was provided at the facility for 10-15 women per session using power point, flipcharts and MammaCare breast models by experts from Department of Preventive Oncology, Tata Memorial Center, Mumbai (Table 1). Individual sessions at households were provided by trained project staff to women who could not come to the facilities. MammaCare breast models are typically designed breast dummies by the MammaCare Foundation, USA for CBE and/or BSE education. In addition, IEC materials (pamphlets) was distributed to them. They were informed about the clinical breast examination (CBE) camp at the health facility and were motivated to utilize the service.

Intervention for health workers: Half day training programme was arranged for the health care providers (CHVs, ASHAs, PHN, Nurses, ANMs, MPW, AMO) on BSE, CBE on 31st July 2019 at the Maternity Home. Experts preventive oncologists from the comprehensive tertiary cancer centre took the sessions on BSE and CBE for the paramedic staffs and Medical Officer. The sessions were arranged through audio-video presentations and discussion mode followed by breast examination practices using breast MammaCare breast model (Table1). Twenty-one health workers participated in the training.

Data

The baseline and endline surveys were conducted to see the changes of health education intervention on women's knowledge and practices on breast cancer. The baseline survey was conducted during November 2018 to March 2019, the intervention was given during May-October 2019 and endline study was conducted from December 2019 to March 2020. The details of the study design and findings of baseline study has been published (19).

Sample Size and Sampling procedure: The study in low socio-economic setting Delhi found 53% of women between 14 to 74 years of age were aware about breast cancer (18). Assuming 53% prevalence, 5% level of significance and 20% non-response rate during the follow up our sample size for baseline was approximately 480 (exactly 478) for estimating baseline prevalence objective (19). For intervention part, assuming 10% (63% from 53%) increasing in knowledge of breast cancer at 5% level of significance, 80% power and 10% lost to follow up, the sample of 446 women were needed. Hence, a total of 480 women were fulfilling both the objectives of the study. The response rate for endline survey was 85.4% (410 out of 480) excluding locked house, unavailability for longer time and non-responses. The study area is catered by 16 Community Health Volunteers/ASHAs at the health post and each section constitutes around 1000-1400 households. Thirty participants were selected from each sections using systematic random sampling procedure from the list of eligible women which is obtained through mapping and house listing of the selected area/community (19).

Data Collection Tools: Quantitative structured schedules were used to collect data in both baseline and endline survey. The baseline tools covered questions on socio-demographic characteristics of women, breast cancer awareness, questions on signs, symptoms, risk factors of breast cancer. The tools also covered questions on Breast Self-Examination (BSE), and Clinical Breast Examination (CBE) practices. The endline survey included similar questions on knowledge and practices of breast cancer and reasons for not conducting BSE and CBE. The tools were prepared using available literatures and a team of experts was consulted which consisted of oncologists, gynaecologist, public health specialist, and social scientist. The questions were translated to local languages i.e. Marathi and Hindi. The questions were validated in similar setting of Mumbai and results were used to modify the questionnaire. The data collectors were trained with the tools, protocols and ways of asking questions. Our data collectors conducted face-to-face interviews for collecting the information. Data monitoring was ensured through regular back-checks at office.

Structured questionnaires were also developed to know the knowledge of breast cancer among health care providers before and after intervention. While the pre-intervention tool covered

socio-economic background and questions on breast cancer knowledge of signs and symptoms, risk factors and BSE and CBE practices. The post intervention covered questions only on breast cancer knowledge indicators and feedbacks about the programme. The data collection and health education intervention was directly moderated by the investigators of the study.

Data Analysis: The data analysis was done using IBM SPSS 26. Descriptive statistics like mean, standard deviation and percentage were used to understand the level of knowledge. ANOVA and paired t-test were used to see net difference in mean scores and the level of significance. The data analysis for this research paper is done with 410 women for comparing baseline and endline data.

Dependent Variables: The women were asked whether they have heard about breast cancer. This is used as a proxy variable for breast cancer awareness. Different response related to specific signs and symptoms, risk factors of breast cancer were used to see the change in knowledge of different indicators during pre and post interventions. Separate summative indices were constructed to understand the mean difference in knowledge of signs and symptoms and risk factors using 10 and 13 binary outcomes respectively. Those who were aware were given weight score of '1' for each outcome and those who were not aware were weighted '0' for each items. The summative indices were used to see the mean difference in pre-post intervention in knowledge scores.

Independent variables: Independent variable such as age of women, religion, caste, marital status, years of schooling, and employment status of women were used to see socio-economic differentials in net difference mean knowledge score before and after interventions using ANOVA.

Ethical Considerations: The ICMR-National Institute for Research in Reproductive Health (ICMR-NIRRH) Ethics Committee for clinical studies, Mumbai which is recognized by Strategic Initiative for Developing Capacity in Ethical Review (SIDCER), Forum for Ethical Review Committees in the Asian and Western Pacific Region (FERCAP) has approved the study (Project No: 329/2018). Written consent from the participants were obtained before collecting the data. Confidentiality and privacy was ensured at all stages of data collection, management and analysis.

Patient and public involvement: The participants were women from the catchment area of Prabhadevi Maternity Home and health workers of the facility. However, the participants were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Results

Socio-demographic profile of the participants

The median age of the women was 40 years with a range between 18 to 55 years. Majority of them were educated and the median years of schooling was 12 years. Most of them were from Hindu religion (92%) and from upper caste (67%). Only 15% of the women were working and most of the women were married (85%).

Change in Knowledge of different signs and symptoms and risk factors among women

Only 51% had ever heard of breast cancer during the baseline whereas it improved to 100% after the interventions. Most of the women who were aware of breast cancer reported that they have heard about breast cancer through television (53%) and doctors (25%) whereas majority of the women post intervention told they were made aware through awareness campaign (77%). Figure 1 presents percentage of women with knowledge of different signs and symptoms of breast cancer before and after interventions. The results show noticeable improvement in knowledge of different signs and symptoms of breast cancer. Only 38% women considered 'A lump in breast' as a sign of breast cancer during the pre-intervention survey whereas during the post intervention survey 93% of women considered it as a sign of breast cancer. A very low percentage of women (23%) responded 'abnormal discharge or blood from nipple' as a symptom of breast cancer which was enhanced by 58 percentage points (81%) post health education interventions. Merely one-third of the women thought 'breast cancer is curable if detected early' which improved to 91% after the intervention programme.

The Figure 2 shows percentage of women having knowledge of risk factors of breast cancer before and after health education interventions. Less than 10 percent women considered menstruating at an early age (2.7%), late menopause (5.1%), hormone replacement therapy (6.8%) and first baby after 30 years (8%) as risk factors of breast cancer during the baseline survey. Post intervention this knowledge improved substantially for these risk factors- menstruating at an early age (27.1%), late menopause (37.3%), hormone replacement therapy (49.5%) and first baby after 30 years (32%). During the pre-intervention phase, a very low percentage of women stated obesity (10%), nulliparity (12%), use of oral contraceptive pills (11%) and induced abortions (11.5%) as breast cancer risk factors which substantially improved after the health education sessions (see Figure 2). Only 15% of the women thought family history of breast cancer as a risk factor which increased to around 60% post intervention.

The Table -2 presents the result of paired t-test with mean difference in score of knowledge of signs & symptoms and risk factors of BC before and after the intervention. The paired t-test shows statistical significance in difference in mean knowledge score for both signs & symptoms (Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, $p<0.000$) and risk factors of breast cancer knowledge (M.D.: 5.64, S. D.: 4.00, $p<0.000$) of women in the community after intervention.

Socio-demographic differences in mean knowledge scores

The socio-economic difference in mean knowledge of scores of signs & symptoms (10 items) and risk factors (13 items) of women before and after intervention is presented in Table 3. The analysis shows that mean knowledge scores improved considerably among all socio-demographic groups of women. The mean knowledge score increase was greater among the primary and secondary education group than the higher educated group of women. Noticeable improvement is also found among Scheduled Caste or Scheduled Tribe (SC/ST) group of women who had very low knowledge of breast cancer before the intervention. The mean knowledge score of signs and symptoms was 0.82 (S.D.: 2.36) among the women belonging to SC/ST before the intervention which improved to 6.55 (S.D.: 2.65) post interventions. Similarly, the mean difference increased from 1.00 (S.D.: 2.27) to 6.59 (S.D.: 2.46). A statistically significance in net mean difference scores was observed among different religious

categories, family types, employment status and marital status of women (Table 3). The mean score of signs and symptoms and risk factors for not working women was very low which showed promising improvement post health education interventions by 4.3 (2.46 vs 6.76) and 5.73 (1.49 vs 7.22) mean points.

Knowledge on breast cancer detection methods

The figure 3 represents knowledge of detection methods of BC among women before and after interventions. A very low percentage (6.1) of women knew BSE is a screening method for BC. Post intervention around 58% told that breast cancer can be detected through BSE. Less than half (44%) of the women knew about CBE which improved to 83% post intervention sessions. Around 22% of the women told Mammography as a breast cancer detection technique during post intervention survey.

Change in Knowledge scores of different signs and symptoms and risk factors among Health care providers

The median (Maximum-Minimum) age of the participants was 43 (27-64) years, years of schooling was 12 (7-17) years and duration of service was 17 (1-33) years. Results indicated that there was an increase in correct knowledge of symptoms like; lump in breast (from 76.2 to 95.2%) and risk factors like menstruation at an early age (from 38.1 to 85.7%). The mean difference in pre-post intervention scores suggested significant improvement in knowledge of symptoms and risk factors (Table 4). The mean difference scores were 2.67 (S.D.: 2.44) and 4.04 (S.D.:4.63) for signs & symptoms and risk factors of breast cancer respectively.

Change in Breast Examination (BSE) Practices

BSE technique was demonstrated to the participants using MammaCare breast model. Only 2.8% of the total 410 women were practicing BSE before intervention session and post intervention around two-thirds (65%) of the women reported practicing BSE (Figure 4). Out of those women who are practicing three-fourths (75%) of them were practicing it monthly and around 90% of them followed IEC materials given through the awareness programme. About 4% of women detected any lump or found any symptoms of breast cancer. Those who are not practicing BSE, majority of them told that they don't get time to practice the same (55%) or they don't feel it is needed (32%). Around 147 (36%) women reported that they have gone for CBE recently and 61 (41%) of the women have gone for CBE after interventions (Figure 5). The women who have not done CBE believed it is not needed (46%) for them now. Around 13% of them told they are either scared or embarrassed to see a doctor for the CBE.

Three camps for CBE were organized with experts from Tata Memorial Centre after the interventions. The camps were organized at the Maternity Home on third week of every month and continued till February 2020. Fifty-nine women attended the camps organized between December 2019 to February 2020 and 55 of them were study participants. Of these 59 women, 6 women were advised for mammography and 7 were advised for sonography or further consultation. There was a huge demand for such CBE camps among women as the attendance was more than our capacity in the fixed day monthly camps. The camps were put

on hold following the outbreak of COVID19 pandemic and lockdown in India from March 2020.

Discussion

This study aimed to improve knowledge and practices about breast cancer among women in the low socio-economic community of Mumbai. Only half of the women were aware about breast cancer before the interventions, post interventions all the participants were aware of it. Our health education interventions were grounded in behavioral change theories, practical community-based adult education training modules and BSE practices which lead to strengthening of perceived susceptibility to breast cancer and decline the perceived barriers through knowledge enhancement. The post-intervention results revealed statistical significant improvement in mean knowledge scores of different signs and symptoms and risk factors among women in the study area. Similar targeted education based intervention studies in different settings of India and elsewhere found increase in breast cancer knowledge and awareness among the study population (10,33–36,38–40). A similar intervention study using flipchart and video slide on LCDs in an Urban Health Centers of Ahmedabad found that group session of 20-25 subjects in each session resulted in statistical significant impact on knowledge of screening methods before and after health education interventions (29). The study in semi-urban Madhya Pradesh and rural Tamil Nadu found health education interventions for women led to improved knowledge and breast cancer screening practices among the participants (33,35). Interestingly, studies in Iran and urban slums Egypt also observed dramatic improvement in participants' breast cancer knowledge following health education interventions among women with low level education(10,38). Two studies on college going students in India and New York city also found similar results (39,40).

Our baseline survey results found knowledge of the risk factors was very low among women (19). A very low percentage of women considered mensuration at an early age (3%), late menopause (5%), first baby after 30 years (8%) as important risk factors before the interventions. There was a noteworthy improvement in knowledge about such risk factors after our health education interventions, but the knowledge of risk factors remains low among women. The findings suggest noticeable net difference in mean knowledge score of signs and symptoms and risk factors among the women across all socio-economic groups of women after interventions. Before the interventions, women with primary and secondary education had a very low mean knowledge score of signs and symptoms than the higher educated group of women. Our analysis shows that there is improvement across all educational groups but marked improvement is observed among low education categories of women. The results of ANOVA showed statistically significant net difference ($p<0.01$) in mean score before and after interventions. Similar intervention studies in urban slums of Egypt and rural Turkey also found notable improvement in breast cancer knowledge even among illiterate women after their health education interventions (38,41). Our analysis also found statistically significant difference in mean scores of signs and symptoms and risk factors among women by family type, employment and marital status of women.

The healthcare workers at primary care centers plays an important role in demonstrating IEC to the community. Studies had shown that training based on health education modules to

community health workers had resulted in increased knowledge of breast cancer and it's practices among the health workers (34,36). A South Indian study found that training to ANMs on breast cancer knowledge and practices resulted in positive change in knowledge and breast cancer practices in the community. Our intervention sessions conducted by experts from TMC, Mumbai found statistical significant difference in mean knowledge score of signs and symptoms and risk factors among the health care workers at the municipal maternity home. The community workers have very good interactions with the women in local community and they were provided leaflets to spread awareness in the community.

Our interventions resulted in positive change in breast examination practices. The BSE practices improved from around 3% to 65% and around 41% more women went for CBE after intervention. Although efficiency of BSE remains debatable, it's a cost-effective and non-invasive tool for women who wish to perform monthly BSE to recognise early signs of abnormal breast changes if any(42). Similar interventions studies in India and Iran observed improvement in breast cancer practices among the participants of the studies(10,29,33,35). Our findings suggest that there is need for such interventions to improve breast cancer knowledge and capacity building of healthcare providers at primary health centers in government health programmes at the grassroots for screening and early detection of breast cancers.

Conclusion

In conclusion, we found that knowledge of signs and symptoms and risk factors among women were low in the study area. This study found a significant improvement in knowledge of breast cancer signs & symptoms, risk factors and breast-self-examination practices among study participants following our health education interventions among these subpopulations. Although our finding is confined to low-socioeconomic areas of Mumbai but available evidences calls for inclusion of similar interventions through capacity building of primary health care providers in national programmes. In the present scenario, the finding from our study calls for community empowerment through capacity building of available primary and community level health care providers for better understanding of etiology of breast cancer and improved BSE practices. The national programmes may use effective media platform like Television and IEC at the primary healthcare facilities to improve breast cancer awareness and BSE practices.

Limitations

This study was limited to one low socio-economic region and there were certain operational difficulties the authors would like to acknowledge. It was difficult for some participants to attend the training sessions at the facilities as they were engaged in job or child care. We provided in-house sessions for them. Such primary health centers run with limited human resources thereby putting extra burden on them. For example, the health facility had on one male doctor who couldn't be trained for CBE at TMC due to burden of work on him. We also found some women are uncomfortable in talking to male doctor. In addition to the operational issues, this is quasi-experiment pre-post study with one limited session intervention and the results were compared between two-time periods without a control group which needs careful interpretation of the impact of intervention in general. Further, the responses related to breast

cancer knowledge of signs & symptoms and risk factors depend on comprehension capability of the participants and is subject to recall bias during the data collection.

Declaration

Contributors SB, AP & RKP have contributed to study design. DDN, SP and GM have contributed to interventions and implementation of the study. RKP performed data extraction, analyses, and prepared the first draft of the manuscript. SB, AP, DDN, SP and GM have read and contributed to finalization of the manuscript. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient consent for publication Not required.

Data availability statement The raw data used in this research is not publicly available and is accessed by the researchers only. Please send your inquiries to the corresponding author for the data.

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Table 1: The Health Education Interactive session plans for participants

Content	Methods	Intervention Details	Duration (Women)	Duration (Health Workers)
Pre-test Survey	Questionnaire	Not Applicable (NA)	NA	10 Mins
Introduction	Power point	What is breast cancer? Prevalence and Mortality. Causes.	10 Mins	10 Mins
Signs and Symptoms, risk factors	Power point, flipcharts and discussion	All common signs, symptoms and risk factors of breast cancer	15 mins	20 Mins
Diagnosis techniques	Power point, flipcharts and discussion	Diagnosis Techniques Such as BSE, CBE, Mammography, Sonography and biopsy	15 Mins	20 Mins
Importance of Early Diagnosis	Power point and discussion	Early diagnosis benefits and Treatment	5 Mins	5 Mins
Myths and Facts about Breast cancer	Discussion	Common Myths and Facts about Breast cancer	10 Mins	10 Mins
Breast Self-Examination Demonstrations	Visual aid and Group Interaction using MammaCare breast Models	Breast Self-Examination Demonstration using visual aid and MammaCare Breast Models	30 Mins	30 Mins
Q & A Session	Discussion	Discussion and doubt clearing session	10 Mins	10 Mins
Post-test Survey	Questionnaire	NA	NA	10 Mins

Table 2: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among women in the study area, 2018-20

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of risk factors of BC before Intervention	1.63				
Knowledge of risk factors of BC after Intervention	7.27	5.64	4.00	5.26-6.03	0.000
Knowledge of Signs and symptoms of BC before Intervention	2.68				
Knowledge of Signs and symptoms of BC after Intervention	6.77	4.09	4.05	3.70-4.48	0.000

Table 3: Socio-economic difference in mean knowledge score of signs & symptoms (10 items) and risk factors (13 items) of women in the low socio-economic community of Mumbai before and after interventions,2018-20

Characteristics	Mean (S.D.) Knowledge Score						
	Signs & symptoms (10 items)			Risk factors(13 items)			
	Baseline	Endline	P value	Baseline	Endline	P value	N
Age Group (Years)			ns			ns	
18-24	2.74 (3.86)	7.02 (1.87)		1.63 (3.30)	7.65 (2.28)		43
25-34	2.83 (3.64)	6.72 (2.03)		2.00 (2.97)	7.14 (2.76)		87
35-44	2.50 (3.63)	7.04 (2.01)		1.47 (2.82)	7.22 (2.54)		137
45-55	2.80 (3.73)	6.48 (1.80)		1.59 (3.03)	7.31 (2.86)		140
Schooling			P<0.01			ns	
Primary	1.23 (3.06)	5.96 (1.96)		0.46 (1.22)	6.68 (2.73)		22
Secondary	1.48 (2.86)	6.90 (1.93)		1.12 (2.46)	7.19 (2.87)		168
Higher	3.74 (3.96)	6.76 (1.92)		2.13 (3.33)	7.39 (2.50)		220
Religion			P<0.01			P<0.01	
Hindu	2.77 (3.71)	6.73 (1.92)		1.67 (2.97)	7.25 (2.68)		387
Non-Hindu	2.70 (3.12)	6.78 (2.14)		1.64 (3.03)	7.28 (2.61)		29
Caste			ns			ns	
SC/ST	0.82 (2.36)	6.55 (2.65)		1.00 (2.27)	6.59 (2.46)		22
OBC	2.90 (3.58)	7.02 (1.72)		1.87 (2.96)	7.15 (2.57)		111
Others	2.77 (3.77)	6.69 (1.94)		1.60 (3.02)	7.39 (2.73)		274
Family type			P<0.01			P<0.01	
Nuclear	2.80 (3.80)	6.87 (1.93)		1.57 (2.71)	7.36 (2.81)		326
Joint/extended	2.31 (3.14)	6.42 (1.94)		1.93 (3.03)	6.95 (2.63)		81
Employment			P<0.01			P<0.01	
Not working	2.46 (3.58)	6.76 (1.90)		1.49 (2.86)	7.22 (2.65)		348
Working	3.90 (3.99)	6.86(2.10)		2.42 (3.39)	7.57 (2.75)		62
Marital status			P<0.01			P<0.01	
Unmarried	2.64(3.73)	7.12(1.72)		1.46 (2.96)	7.89 (2.16)		61
Married	2.69(3.67)	6.71(1.96)		1.66 (2.97)	7.16 (2.74)		349

Note: a) N is Sample Size b) SC: Scheduled Caste; ST: Scheduled Tribe; OBC: Other Backward Classes.

Table 4: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among heath care providers at the study facility.

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of Signs and symptoms of BC before Intervention	6.76	2.67	2.44	1.56-3.78	0.000
Knowledge of Signs and symptoms of BC after Intervention	9.43				
Knowledge of risk factors of BC before Intervention	7.00	4.05	4.63	1.94-6.16	0.001
Knowledge of risk factors of BC after Intervention	11.05				

Figure 1: Percentage of women with knowledge of different signs and symptoms of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 2: Percentage of women having knowledge of risk factors of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 3: Knowledge of breast cancer detection methods among women (in %) in the community before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 4: Breast-self-examination practices after intervention among the women participants. Those who were practicing BSE were asked how often they are practicing. Once in 3 months mean at least once in 3 months but not regularly in every month. Once in 6 months means not regularly but rarely in last 4-6 months. The reasons were given for those who are not practicing Breast Self-examination.

Figure 5: Clinical Breast Examination practices after intervention among the women participants. The reasons were given for those who are not practicing Clinical Breast examination.

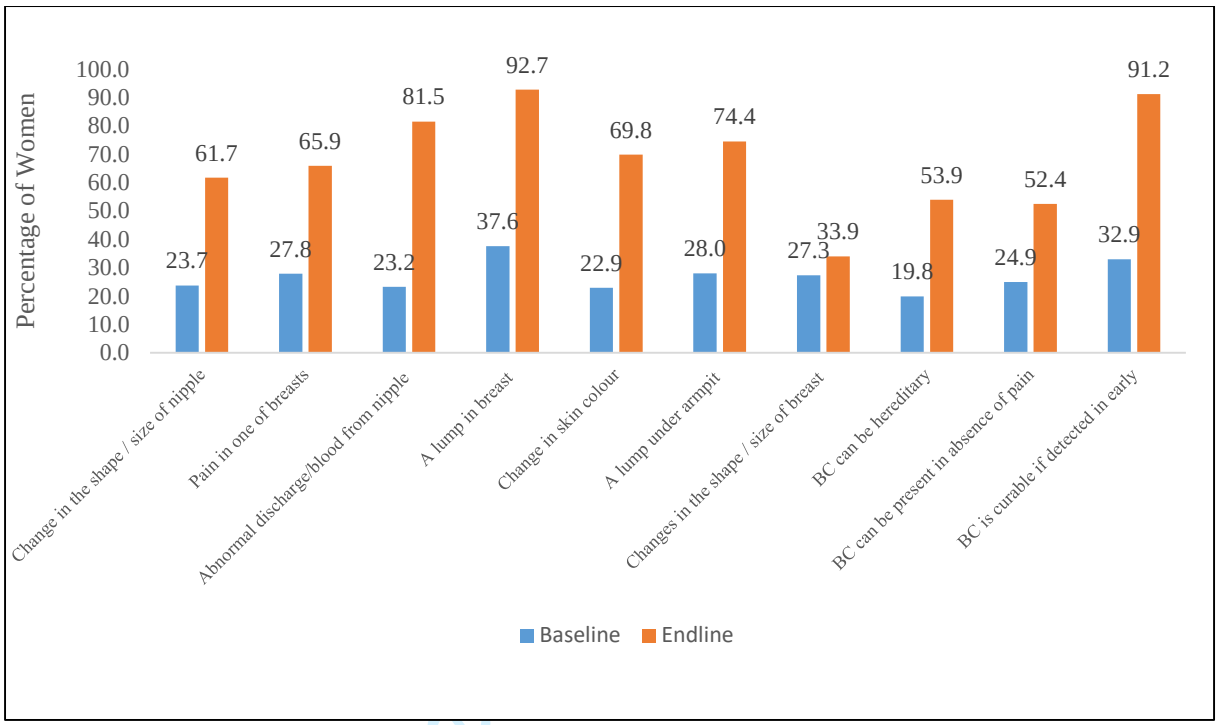


Figure 1: Percentage of women with knowledge of different signs and symptoms of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

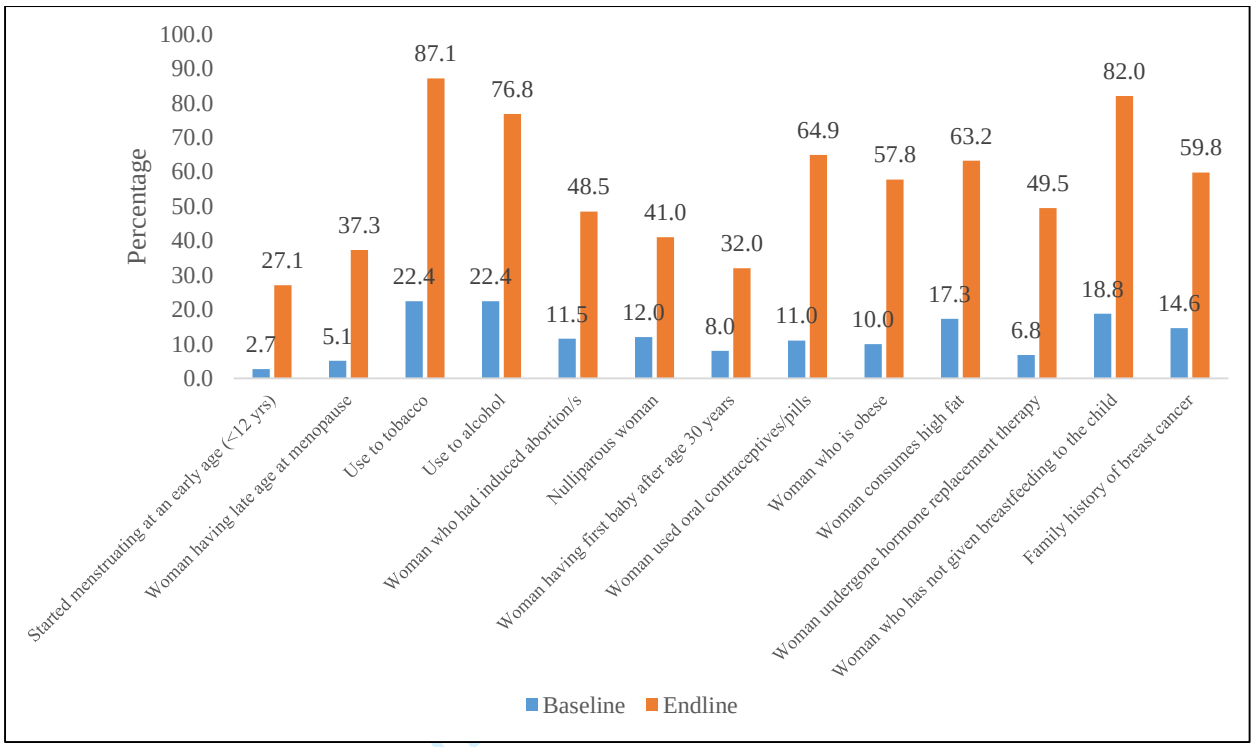
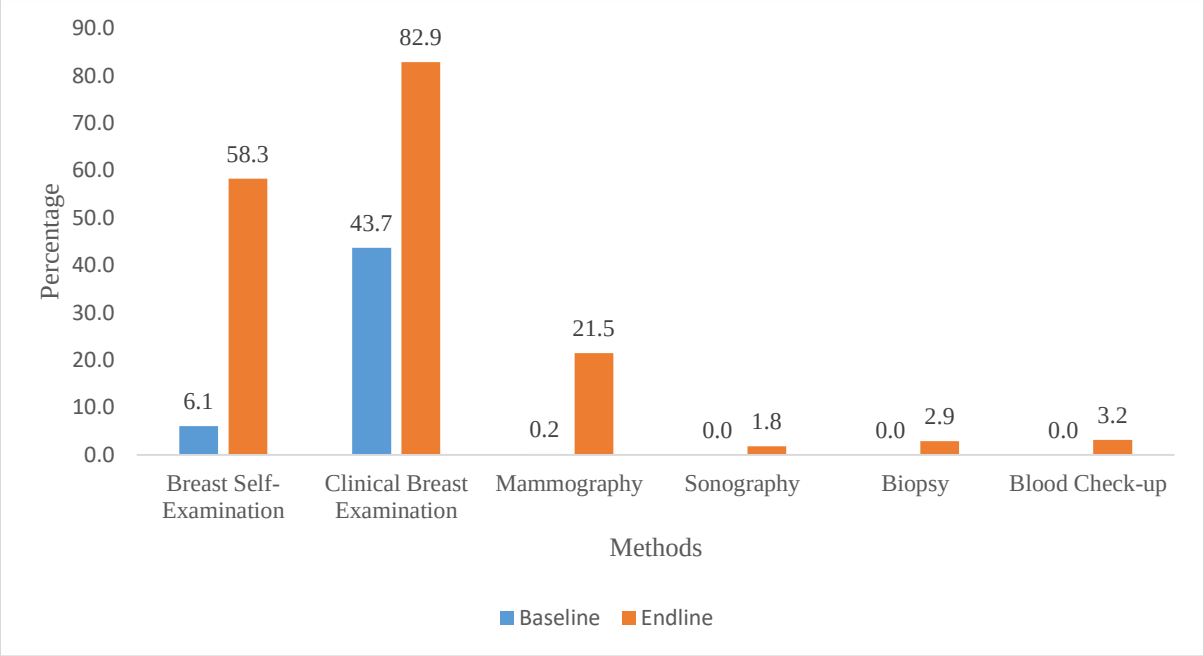


Figure 2: Percentage of women having knowledge of risk factors of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20



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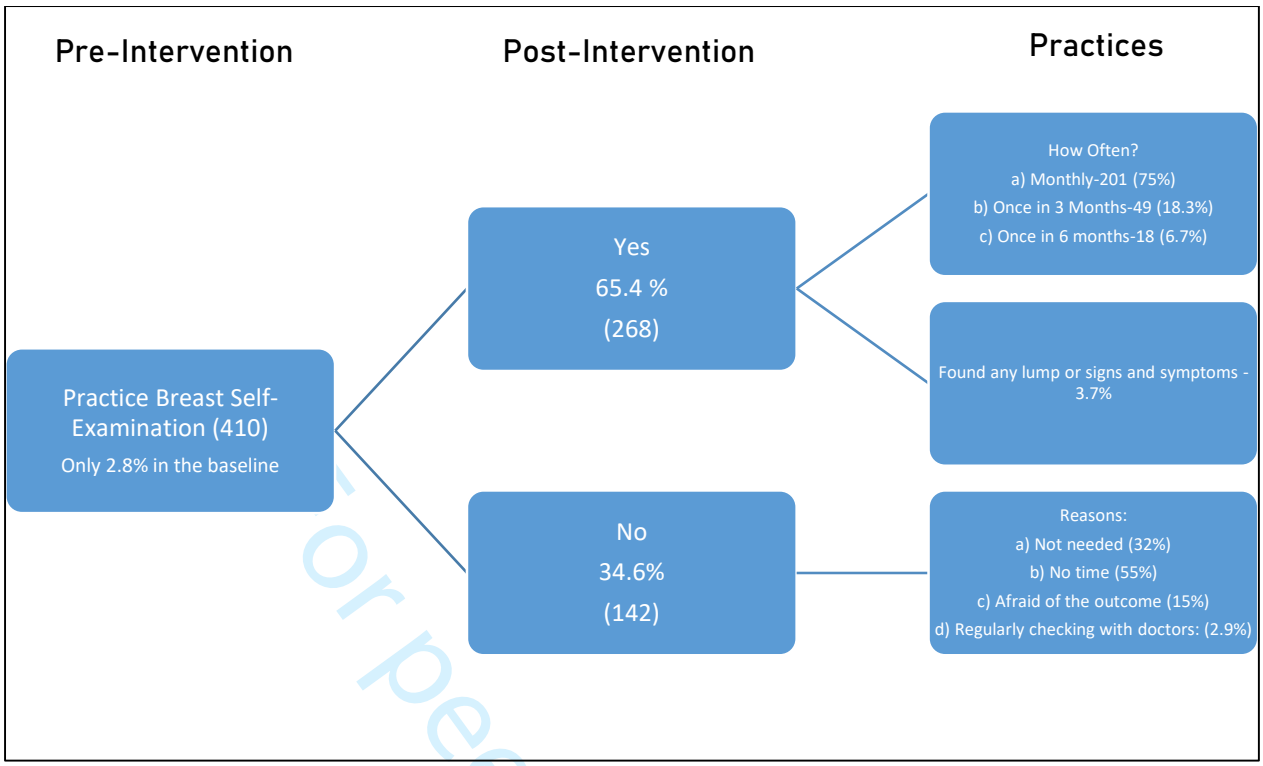

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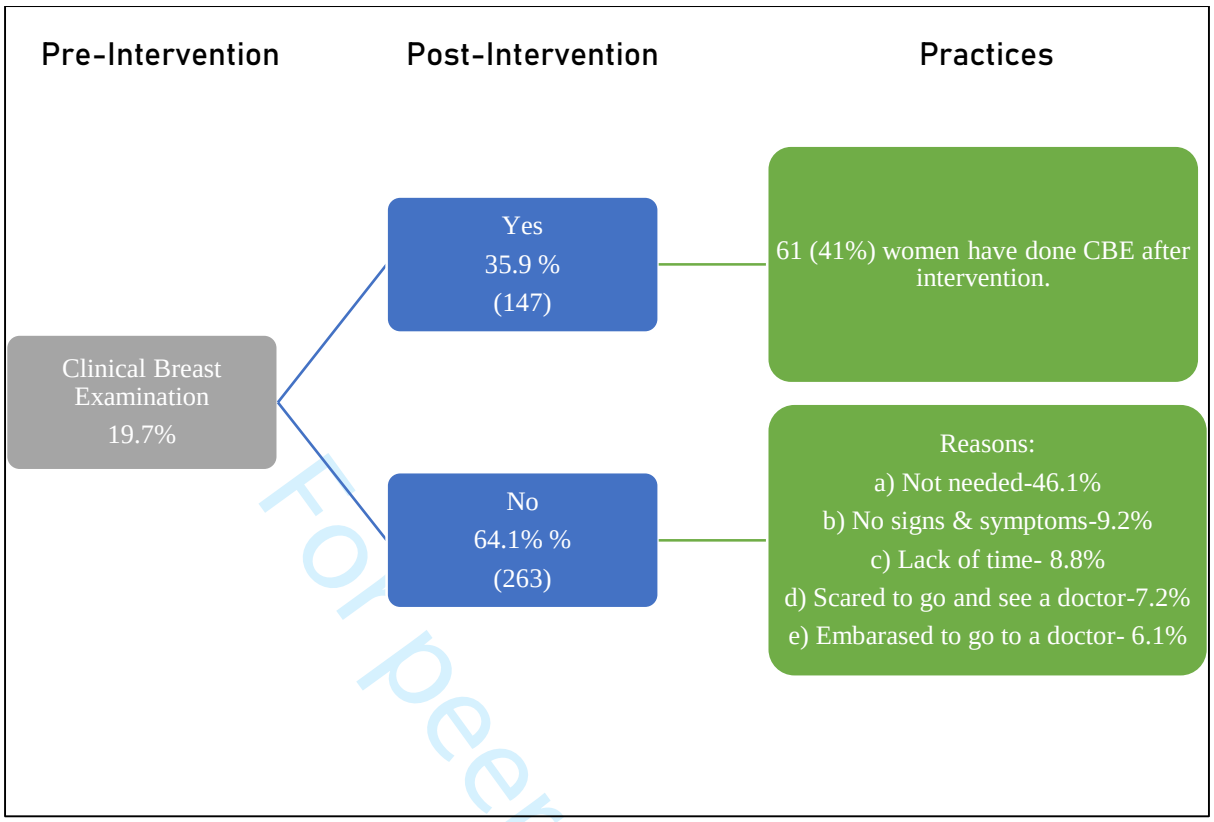

Figure 5: Clinical Breast Examination practices after intervention among the women participants. The reasons were given for those who are not practicing Clinical Breast examination.

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any pre-specified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Pre-post design 5-6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8-9*
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	

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		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	10-11
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Increasing Breast Cancer Awareness and Breast Examination Practices among Women through Health Education and Capacity Building of Primary Healthcare providers: A Pre-Post Intervention Study in Low Socio-Economic Area of Mumbai, India

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Title Page

Increasing Breast Cancer Awareness and Breast Examination Practices among Women through Health Education and Capacity Building of Primary Healthcare providers: A Pre-Post Intervention Study in Low Socio-Economic Area of Mumbai, India

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Increasing Breast Cancer Awareness and Breast Examination Practices among Women through Health Education and Capacity Building of Primary Healthcare Providers: A Pre-post Intervention Study in Low Socio-Economic Area of Mumbai, India

Abstract

Objectives The present study aimed to improve breast cancer (BC) awareness and practices using Information, Education and Communication (IEC) modules and health educational sessions for women and primary healthcare providers in low socio-economic community of Mumbai.

Design: Pre-post quasi-experimental design.

Setting: The study was conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra. The baseline and endline survey was conducted using structured interview schedules.

Participants: 410 women were selected, aged between 18 to 55 years who were not pregnant, lactating or diagnosed with BC.

Intervention A health education based intervention module was developed to educate women through group and individual sessions.

Outcomes: Summative indices were constructed to understand the net mean difference in knowledge of signs, symptoms and risk factors. ANNOVA and paired t-test were used to check the significant improvement of intervention.

Results: Our results showed statistical significance in difference in mean knowledge score for both signs & symptoms [Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, P<0.00)] and risk factors of breast cancer knowledge (M.D.: 5.64, S.D.: 4.00, P<0.00) among women after intervention. There was a marked improvement in the knowledge of BC among women with low education category. A significant improvement in knowledge of symptoms and risk factors among health workers was also observed. Our interventions resulted in positive change in breast examination practices. The breast self-examination practices improved from around 3% to 65% and around 41% additional women went for clinical breast examination after intervention.

Conclusions: This study found a significant improvement in knowledge of BC signs & symptoms, risk factors and breast-self-examination practices among study participants following our health education interventions among these subpopulations. This evidence calls for inclusion of similar interventions through health education and capacity building of primary health care providers in national programmes.

Key Words: Breast cancer awareness, health education intervention, breast self-examination, India

Strengths and Limitations of the study

This study is one of the few studies in India focusing on health education-based intervention at urban primary health care facility thus filling a research gap.

The study focused on pre-post intervention design and the participants were recruited randomly using robust a sampling design.

In this study, PowerPoint Presentations (PPT), Flipcharts and Pamphlets with visual aids and breast models were used for intervention sessions to improve breast cancer knowledge and practices. These interventions were provided to small groups using local languages (Marathi and Hindi).

Our study was limited to primary health center run with limited human resources in one low socio-economic region.

This was quasi-experiment, time bound, pre-post study. The results were compared between two-time periods without a control group, which requires careful interpretation of the impact of intervention in general.

Introduction

Around 2.25 million estimated individuals are living with cancer and it contributes to 8.3% of total deaths in India (1,2). The incidence and mortality due to cancer doubled in India during 1990-2016, enormously contributing to overall Disability Adjusted Life Years (DALYs) and total deaths in the country (2). According to GLOBOCAN (Global Cancer Incidence, Mortality and Prevalence) 2018 report, women in India were more vulnerable to cancer than men (3). In India, cervical cancer cases have dominated among all female reproductive cancer cases for long time. The last few decades saw a rapid surge in breast cancer (BC) cases making it the leading cancer among women in India (4). Though Indian women are less prone to breast cancer than the women from western countries, the mortality rate among them is very high compared to women from western countries (3,5,6). As per National Cancer Registry Programme of India and GLOBOCAN 2018, the mortality rate in India (17.1 per 100,000women) was more than the United Kingdom (UK) (12.7 per 100,000 women) despite of low incidence rate of breast cancer (7). This high mortality is attributed to late detection of the breast cancer at locally advanced or metastatic stages.

Several studies showed that in western countries, majority of breast cancers cases were reported in stage I or II of the disease, whereas in India, around 46% of these were reported in advanced stages (6,8,9). The importance of early diagnosis has been highlighted by most researchers as a pathway to save life and it acts as an important method to improve the medical condition (10–13). This scenario of late diagnosis arose due to different factors such as non-existence of high quality primary level screening programmes, lack of regional treatment centers, overdependence on large tertiary cancer hospitals, high out–of-pocket expenditure and non-participation of women in existing programmes (5,13–17). Studies have found that the awareness about different signs & symptoms and risk factors of breast cancer among women in India is low, contributing to late detection of BCs among them (13,18–20). The Government of India launched National Programme for Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke in 2010 as an umbrella programme for non-communicable diseases in selected 100 districts (2). The programme aimed to provide community based cost effective screening of men and women above 30 years of age for all high burden cancers including breast cancer through a checklist collected by village health workers like ASHAs (Accredited Social Health Activists). As a part of this program, women were asked and screened for lumps in breast, bloody discharge from the nipple and change in shape and size of the breast. But this screening is conducted for a woman in at five year duration. The ASHAs were advised to refer all suspected cases to the nearest available facility. However, this remains a challenge due to lack of trained human resources and limited training modalities.

The rapid rise in number of BC cases has been associated with growing urbanization and rapid lifestyle changes (21). Many studies have found that women living in urban India were more vulnerable to breast cancer than those from rural areas (22,23) with highest incidence rate in major metropolitan cities (24). As per the latest available statistics, the age-adjusted incidence rate of BC was high in urban hubs like Hyderabad district (48 per 100,000 women) followed by Chennai (42.2), Bangalore (40.5), Delhi (38.6), Patiala (36.9), Thiruvananthapuram (35.6), Mumbai (34.4), and Bhopal (32.6) (24). In the last few decades, India's transformative neo-

liberal economic reform and development have brought a large chunk of population to bigger cities from rural areas in expectation of gainful employment in industries and services sectors. Although the echelon of privileged urban Indians have better access to knowledge and high quality of services about cancer care through private and specialized tertiary care facilities, the low socio-economic stratum has low access to primary screening or biomedical oncological expertise (25,26). The existing social cleavages in access and quality of cancer care among poor and non-poor in urban India is more acute due to the existing socio-economic and health system blockades (26).

The processes and pathways of accessing care are many a time confusing to common citizens as at the initial stage of cancer they generally prefer to go to a local untrained physician, pharmacist or quack, who often don't recognize the malignancy (26). Moreover, widespread public misunderstanding, extremely limited awareness in understanding of cancer symptoms, prevention, treatment, existing social stigma and structural inequalities across socio-cultural groups pose as barriers to early detection (13,26). Many studies in India found that the knowledge of breast cancer risk factors was low (13). For example, some studies found that the awareness levels of risk factors related to age at menarche and menopause among women was limited between 1-28% (19,27–29). Age at menarche and menopause is considered as two strongest risk factors of breast cancer (13). A review by Gupta et al, 2015 suggested that the awareness of different risk factors such as overweight and obesity (11–51%), family history (13–58%), age at birth of first child (8–83%), lack of breastfeeding (17–88%) and tobacco smoking (20–74%) varied widely across different locations and age groups of women in India (13,16,28–31). Studies have found literacy deficit about BC among health professionals at primary care centers, nurses and other health staffs as a potential barrier in BC prevention and early detection as they are on the frontline for spreading awareness at the community level (13,32).. Hence, capacity building of both primary health care providers and community education are essential to increase awareness about BC, promoting screening, early detection and treatment of BC cases.

There are limited studies in India which used health education intervention to improve BC knowledge and practices (18,29,32–35). Most of these studies focused on health education interventions of women directly at community or individual level using power-point presentations, videos, flipcharts and pamphlets and report significant change in BC knowledge and breast self-examination (BSE) practices. To the best of our knowledge, there is no study from Mumbai, which focused on such intervention. Further, very few studies focused on capacity building of primary health facilities or community health workers for a better and sustainable health intervention for breast cancer screening at the primary care level (29,36). Therefore, the present study aimed to improve BC awareness and practices among women using BC Information, Education and Communication (IEC) modules and health educational sessions for women and primary health care providers using a health system approach in low socio-economic community of Mumbai. We focused on capacity building of staff of the primary health facility, provided training sessions at the facilities and identified the barriers in implementing clinical breast examination (CBE) practices at primary care level.

Methods

Study Setting

The study was a pre-post intervention study conducted in a lower socio-economic area of G-South ward of Mumbai, Maharashtra state. Mumbai has a mixed health care system with private and public health care facilities. The government health infrastructure is governed by both state government and Municipal Corporation of Greater Mumbai (MCGM). The MCGM runs a three-tier system of primary, secondary and tertiary healthcare through different health posts, dispensaries, maternity homes, municipal general hospitals, specialty hospitals and medical college hospitals. The MCGM has a chain of four medical colleges and hospitals, six specialty hospitals, 16 peripheral hospitals, 29 municipal maternity homes, 26 specialty hospitals, 175 municipal dispensaries and 183 health posts (37). The health posts and maternity homes provide primary and maternal health care services at low socio-economic areas/slums. Besides, Mumbai has central government hospitals and dispensaries, which includes the main branch of Tata Memorial Centre (TMC), a national comprehensive cancer center for the prevention, treatment, education and research in cancer, funded and controlled by Department of Atomic Energy, Government of India.

Our study was confined to catchment area of municipal maternity home and health post at Prabhadevi, Mumbai. As per Maharashtra Housing and Area Development Authority (MHADA), Government of Maharashtra, this health facility provides primary and maternity care to around 76 thousand low-income group population. During the study period, the health facility was equipped with one Assistant Medical Officer (AMO), 1 Public Health Nurse (PHN), 3 Auxiliary Nurse Mid-wives (ANMs), 2 Health Coordinators, 14 Community Health Volunteers (CHVs), 2 Accredited Social Health Activists (ASHAs), 4 Staff Nurses, 1 *Ayha* (Traditional Birth Attendant) and 1 Data Entry Operator.

Interventions

This study was conducted among women aged between 18 to 55 years from the selected low socio-economic community. Pregnant women, lactating women and women diagnosed with BC and/or under treatment were excluded from the study. An intervention based health education module was developed to educate these women. IEC material (pamphlets and flipchart) on BC and BSE were developed by the research team in consultation with clinicians from department of Preventive Oncology, Tata Memorial Center, Mumbai. The content of IEC and training module included information about BC, risk factors, signs & symptoms, ways to detect BC, frequency and treatment seeking behavior. Group education on knowledge of signs & symptoms, risk factors and BSE was provided at the facility for 10-15 women per session using PowerPoint slides, flipcharts and MammaCare breast models by experts from Department of Preventive Oncology, Tata Memorial Center, Mumbai (Table 1). MammaCare breast models are typically designed breast dummies by the MammaCare Foundation, USA for CBE and/or BSE education. Individual sessions at households were provided by trained project staff for women who could not come to the facilities. In addition, pamphlets were distributed to the women. They were also informed about the CBE camp at the health facility and were motivated to utilize this service.

Intervention for health workers: Half-day training programme was organised for the health care providers (CHVs, ASHAs, PHN, Nurses, ANMs, MPW, AMO) on BSE, CBE on 31st July 2019 at the maternity home. Preventive oncology experts from the comprehensive tertiary cancer centre took the sessions on BSE and CBE for the paramedic staff and the Medical Officer. The sessions were arranged using audio-video presentations and interactions, followed by breast examination practices using MammaCare breast model (Table1). Twenty-one health workers participated in this training.

Data

The baseline and endline surveys were conducted to see the change induced by health education intervention on women's knowledge and practices related to BC. The baseline survey was conducted from November 2018 to March 2019, the intervention was given between May-October 2019 and endline study was conducted from December 2019 to March 2020. The details of the study design and findings of baseline study have been published (19).

Sample Size and Sampling procedure: A study in low socio-economic setting in Delhi found that 53% of women between 14 to 74 years of age were aware about BC (18). Assuming 53% prevalence, 5% level of significance and 20% non-response rate during the follow up, our sample size for baseline was approximately 480 (exactly 478) for estimating baseline prevalence objective (19). For intervention part, assuming 10% (63% from 53%) increase in knowledge of breast cancer at 5% level of significance, 80% power and 10% lost to follow up, the sample of 446 women were needed. Hence, 480 women fulfilled both the objectives of the study. The response rate for endline survey was 85.4% (410 out of 480) excluding locked house, unavailability for long time and non-response. The study area was catered by 16 CHVs/ASHAs at the health post and each section constitutes around 1000-1400 households. Thirty participants were selected from each section using systematic random sampling procedure from a list of eligible women which was obtained through mapping and house listing of the selected area/community (19).

Data Collection Tools: Quantitative structured schedules were used to collect data in both baseline and endline survey. The baseline tool covered questions on socio-demographic characteristics of women, awareness, signs, symptoms and risk factors of BC. The tool also covered questions on BSE, and CBE practices. Women were asked about their awareness of BC and those who were aware were asked in detail about their knowledge of BC signs & symptoms, risk factors and current practices using closed-response questions. The questionnaire was prepared using available literature and a team of experts which consisting of oncologist, gynaecologist, public health specialist, and social scientist was consulted. The questions were translated to local languages i.e. Marathi and Hindi for the convenience of the participants. These questions were pre-tested with 20 participants (10 questionnaires each for Hindi and Marathi) at a similar socio-economic setting in Mumbai. The results from this pilot testing were used to modify the words for easy comprehension of the participants. The endline survey included similar questions on knowledge and practices of BC and reasons for not conducting BSE and CBE. The data collectors were trained with the tools, protocols and ways of asking questions. Our data collectors conducted face-to-face interviews for collecting the information. Data monitoring was ensured through regular back-checks at the office.

Structured questionnaires were also developed to find out the level of knowledge of BC among the health care providers before and after intervention adopting a process similar to that of the women's questionnaire. While the pre-intervention tool covered socio-economic background and questions on knowledge of signs & symptoms, risk factors of BC, BSE and CBE practices, the post intervention tool covered questions only on BC knowledge indicators and feedback about the programme. The data collection and health education intervention was directly moderated by the investigators of the study.

Data Analysis: The data analysis was done using IBM SPSS 26.0. Descriptive statistics like mean, standard deviation and percentage were used to understand the level of knowledge. ANOVA and paired t-test were used to see net difference in mean scores and the level of significance. The data analysis for this research paper wass done with 410 women for comparing baseline and endline data.

Dependent Variables: The women were asked whether they had heard about BC. This was used as a proxy variable for BC awareness. Different responses related to specific signs & symptoms and risk factors of BC were used to see the variation in knowledge using different indicators during pre and post interventions. Separate summative indices were constructed to understand the mean difference in knowledge of signs & symptoms and risk factors using 10 and 13 binary outcomes respectively. Those who were aware were given weight score of '1' for each outcome and those who were not aware were weighted '0' for each items. The summative indices were used to see the mean difference in pre-post intervention in knowledge scores.

Independent variables: Independent variable such as age of women, religion, caste, marital status, years of schooling and employment status of women were used to see the socio-economic differentials in net difference in mean knowledge score before and after interventions using ANOVA.

Ethical Considerations: The ICMR-National Institute for Research in Reproductive Health (ICMR-NIRRH) Ethics Committee for Clinical Studies, Mumbai, which is recognized by Strategic Initiative for Developing Capacity in Ethical Review (SIDCER) and Forum for Ethical Review Committees in the Asian and Western Pacific Region (FERCAP) approved this study (Project No: 329/2018). Written consent from the participants were obtained before collecting the data. Confidentiality and privacy was ensured at all stages of data collection, management and analysis.

Patient and public involvement: The participants were women from the catchment area of Prabhadevi Maternity Home and health workers of the facility. However, the participants were not involved in the design, conduct, reporting or dissemination plans of this research.

Results

Socio-demographic profile of the participants

The median age of the women was 40 years ranging between 18 to 55 years. Majority of them were educated and the median years of schooling was 12 years. Most of them were from Hindu

religion (92%) and from upper caste (67%). Only 15% of the women were working and majority of the women were married (85%).

Change in knowledge of different signs & symptoms and risk factors among women

Only 51% of the women had ever heard of BC during the baseline survey. This number improved to 100% post interventions. Most of the women who were aware of BC reported that they had heard about it through television (53%) and doctors (25%) whereas majority of the women post intervention told that they were made aware through awareness campaigns (77%). Figure 1 represents the percentage of women with knowledge of different signs & symptoms of BC before and after interventions. The results show noticeable improvement in knowledge of different signs & symptoms of BC. Only 38% women considered 'a lump in breast' as a sign of BC during the pre-intervention survey whereas post intervention survey revealed that 93% of women recognized it as a sign of BC. A very low percentage of women (23%) responded 'abnormal discharge or blood from nipple' as a symptom of BC, which was enhanced by 58 percentage points (81%) post health education interventions. Merely one-third of the women thought that 'breast cancer is curable if detected early', which improved to 91% after the intervention programme.

The Figure 2 shows the percentage of women having knowledge of risk factors of BC before and after health education interventions. It was found that less than 10% women considered early menarche (2.7%), late menopause (5.1%), hormone replacement therapy (6.8%) and first baby after 30 years (8%) as risk factors of breast cancer during the baseline survey. Post intervention this knowledge improved substantially for these risk factors- menstruating at an early age (27.1%), late menopause (37.3%), hormone replacement therapy (49.5%) and first baby after 30 years (32%). During the pre-intervention phase, a very low percentage of women stated obesity (10%), nulliparity (12%), use of oral contraceptive pills (11%) and induced abortions (11.5%) as BC risk factors which substantially improved after the health education sessions (see Figure 2). Only 15% of the women thought that family history of BC as a risk factor, which increased to around 60% post intervention.

The Table 2 shows the result of paired t-test with mean difference in score of knowledge of signs & symptoms and risk factors of BC before and after the intervention. The paired t-test shows statistical significance in difference in mean knowledge score for both signs & symptoms of women in the community after intervention (Mean Difference (M.D.): 4.09, Standard Deviation (S.D.): 4.05, $p<0.000$) and risk factors of breast cancer knowledge (M.D.: 5.64, S. D.: 4.00, $p<0.000$).

Socio-demographic differences in mean knowledge scores

The socio-economic difference in mean knowledge of scores of signs & symptoms (10 items) and risk factors (13 items) of women before and after intervention is tabulated in Table 3. The analysis shows that mean knowledge scores improved considerably among all socio-demographic groups of women. The rise in mean knowledge score was greater among the primary and secondary education group than the group of women with higher education. Noticeable improvement was also found among Scheduled Caste or Scheduled Tribe (SC/ST) women who had very low knowledge of BC before intervention. The mean knowledge score

of signs & symptoms was 0.82 (S.D.: 2.36) among the women belonging to SC/ST before the intervention which improved to 6.55 (S.D.: 2.65) post interventions. Similarly, the mean difference increased from 1.00 (S.D.: 2.27) to 6.59 (S.D.: 2.46). A statistical significance in net mean difference scores was observed among different religious categories, family types, employment status and marital status of women (Table 3). The mean score of signs & symptoms and risk factors for women who did not go out to work was very low which showed promising improvement post health education interventions by 4.3 (2.46 vs 6.76) and 5.73 (1.49 vs 7.22) mean points.

Knowledge on BC detection methods

The Figure 3 represents knowledge of detection methods of BC among women before and after interventions. A very low percentage (6.1) of women knew that BSE as a screening method for BC. Post intervention around 58% told that breast cancer could be detected through BSE. Less than half (44%) of the women knew about CBE which improved to 83% post intervention sessions. Around 22% of the women considered mammography as a BC detection technique during post intervention survey.

Change in Knowledge scores of different signs & symptoms and risk factors among Health care providers

The median (maximum-minimum) age of the participants was 43 (27-64) years, years of schooling were 12 (7-17) years and duration of service was 17 (1-33) years. Results indicated that there was an increase in correct knowledge of symptoms like; lump in breast (from 76.2 to 95.2%) and risk factors like menstruation at an early age (from 38.1 to 85.7%). The mean difference in pre-post intervention scores suggested significant improvement in knowledge of symptoms and risk factors (Table 4). The mean difference scores were 2.67 (S.D.: 2.44) and 4.04 (S.D.:4.63) for signs & symptoms and risk factors of BC respectively.

Change in BSE Practices

BSE technique was demonstrated to the participants using MammaCare breast model. Only 2.8% of the total 410 women practiced BSE before intervention session and post intervention around two-thirds (65%) of the women reported practicing BSE (Figure 4). Out of these women, three-fourths (75%) practiced it monthly and around 90% of them adhered the guidelines of IEC material given during the awareness programme. About 4% of women detected any lump or found any symptoms of breast cancer. Among those who did not practice BSE, majority told that they did not get time to practice it (55%) or they did not feel it was needed (32%). Around 147 (36%) women reported that they went for CBE recently and 61 (41%) of the women went for CBE after interventions (Figure 5). Among women who did not go for CBE, 46% believed that it was not required. Around 13% of them told that they were either scared or embarrassed to see a doctor for CBE.

Three camps for CBE were organized with experts from Tata Memorial Centre after the interventions. The camps were organized at the maternity home on the third week of every month and continued till February 2020. Fifty-nine women attended the camps organized between December 2019 and February 2020 and became the study participants. Of these 59

women, 6 were advised for mammography and 7 were advised for sonography or further consultation. There was a huge demand for such CBE camps among women as the attendance was more than our capacity in the fixed-day monthly camps. The camps were put on hold following the outbreak of COVID-19 pandemic and lockdown in India from March 2020.

Discussion

This study aimed to improve the knowledge and practices related toBC among women in the low socio-economic community of Mumbai. Only half of the women were aware about BC before the interventions. Post interventions, all the participants were aware of it. Our health education interventions were grounded in behavioral change theories, practical community-based adult education training modules and BSE practices, which lead to strengthening of perceived susceptibility to BC and breaking the perceived barriers through knowledge enhancement. The post-intervention results revealed statistically significant improvement in mean knowledge scores of different signs & symptoms and risk factors among women in the study area. Similar targeted education based intervention studies in different settings of India and elsewhere found increase in BC knowledge and awareness among the study population (10,33–36,38–40). A similar intervention study using flipchart and video slides on LCDs in an Urban Health Centers of Ahmedabad found that group session of 20-25 subjects, in each session, resulted in statistical significant impact on knowledge of screening methods before and after health education interventions (29). The study in semi-urban Madhya Pradesh and rural Tamil Nadu found that health education interventions for women led to improved knowledge and BC screening practices among the participants (33,35). Interestingly, studies in Iran and urban slums of Egypt also observed dramatic improvement in participants' b knowledge about BC following health education interventions among women with low level education (10,38). Two studies on college going students in India and New York city also found similar results (39,40).

Our baseline survey results revealed that the knowledge of risk factors was very low among women (19). A very low percentage of women considered menstruation at an early age (3%), late menopause (5%), first baby after 30 years (8%) as important risk factors before the interventions. There was a noteworthy improvement in knowledge about such risk factors after our health education interventions, but the knowledge of risk factors remains low among women. The findings suggest noticeable net difference in mean knowledge score of signs & symptoms and risk factors among the women across all socio-economic groups of women after interventions. Before the interventions, women with primary and secondary education had a very low mean knowledge score of signs & symptoms than the women with higher education. Our analysis shows that there was improvement across all educational groups but marked improvement was observed among low education categories of women. The results of ANOVA showed statistically significant net difference ($p<0.01$) in mean score before and after interventions. Similar intervention studies in urban slums of Egypt and rural Turkey also found notable improvement in BC knowledge even among illiterate women after health education interventions (38,41). Our analysis also found statistically significant difference in mean scores of signs & symptoms and risk factors among women by family type, employment and marital status.

The healthcare workers at primary care centers play an important role in demonstrating IEC to the community. Studies have shown that training based on health education modules to community health workers resulted in increased knowledge of BC and it's practices among the health workers (34,36). A South Indian study found that training ANMs on BC knowledge and practices resulted in positive change in knowledge and BC practices in the community. Our intervention sessions conducted by experts from TMC, Mumbai found statistically significant difference in mean knowledge score of signs & symptoms and risk factors among the health care workers at the municipal maternity home. The community workers had very good interaction with the women in local community and they provided pamphlets to spread awareness in the community.

Our interventions resulted in positive change in breast examination practices. The BSE practices improved from around 3% to 65% and around 41% additional women went for CBE after intervention. Although efficiency of BSE remains debatable, it is a cost-effective and non-invasive tool for women who wish to perform monthly BSE to recognise early signs of abnormal breast changes if any (42). Similar interventional studies in India and Iran observed improvement in BC practices among the participants of the studies (10,29,33,35). Our findings suggest that to improve BC knowledge and capacity building of healthcare providers in primary health centers under government health programmes such interventions are needed at the grassroot level for screening and early detection of BC.

Conclusion

In conclusion, we found that knowledge of signs & symptoms and risk factors among women was very low in the study area. This study found a significant improvement in knowledge of BC signs & symptoms, risk factors and BSE practices among study participants following our health education interventions among these subpopulations. Although our findings are confined to low-socioeconomic areas of Mumbai, but available evidences call for inclusion of similar interventions through capacity building of primary health care providers under national programmes. In the present scenario, findings from our study necessitates for community empowerment through capacity building of available primary and community level health care providers for better understanding of etiology of BC and improved BSE practices. National programmes may use effective media platforms like Television and IEC at the primary healthcare facilities to improve BC awareness and BSE practices.

Limitations

This study was limited to one low socio-economic region and there were certain operational difficulties the authors would like to acknowledge. It was difficult for some of the participants to attend the training sessions at the facilities as they were engaged in a job or childcare. We provided in-house sessions for them. Primary health centers run with limited human resources thereby putting extra burden on them. For example, one of the health facility had on one male doctor who could not be trained for CBE at TMC due to burden of work on him. We also found that some women were uncomfortable in talking to a male doctor. In addition to the operational issues, this was quasi-experiment pre-post study with one limited session intervention and the results were compared between two-time periods without a control group, which needs careful

interpretation of the impact of intervention in general. Further, the responses related to BC knowledge of signs & symptoms and risk factors depend on comprehension capability of the participants and is subject to recall bias during data collection.

Declaration

Contributors SB, AP & RKP have contributed to study design. DDN, SP and GM have contributed to interventions and implementation of the study. RKP performed data extraction, analyses, and prepared the first draft of the manuscript. SB, AP, DDN, SP and GM have read and contributed to finalization of the manuscript. All authors read and approved the final manuscript.

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Competing interests None declared.

Patient consent for publication Not required.

Data availability statement The raw data used in this research is not publicly available and is accessed by the researchers only. Please send your inquiries to the corresponding author for the data.

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Table 1: The health education interactive session plans for participants

Content	Methods	Intervention Details	Duration (Women)	Duration (Health Workers)
Pre-test Survey	Questionnaire	Not Applicable (NA)	NA	10 Mins
Introduction	Power point	What is breast cancer? Prevalence and Mortality. Causes.	10 Mins	10 Mins
Signs & Symptoms, risk factors	Power point, flipcharts and discussion	All common signs, symptoms and risk factors of breast cancer	15 mins	20 Mins
Diagnosis techniques	Power point, flipcharts and discussion	Diagnosis Techniques Such as BSE, CBE, Mammography, Sonography and biopsy	15 Mins	20 Mins
Importance of Early Diagnosis	Power point and discussion	Early diagnosis benefits and Treatment	5 Mins	5 Mins
Myths and Facts about Breast cancer	Discussion	Common Myths and Facts about Breast cancer	10 Mins	10 Mins
Breast Self-Examination Demonstrations	Visual aid and Group Interaction using MammaCare breast Models	Breast Self-Examination Demonstration using visual aid and MammaCare Breast Models	30 Mins	30 Mins
Q & A Session	Discussion	Discussion and doubt clearing session	10 Mins	10 Mins
Post-test Survey	Questionnaire	NA	NA	10 Mins

Table 2: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among women in the study area, 2018-20

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of risk factors of BC before Intervention	1.63				
Knowledge of risk factors of BC after Intervention	7.27	5.64	4.00	5.26-6.03	0.000
Knowledge of signs & symptoms of BC before Intervention	2.68				
Knowledge of Signs and symptoms of BC after Intervention	6.77	4.09	4.05	3.70-4.48	0.000

Table 3: Socio-economic difference in mean knowledge score of signs & symptoms (10 items) and risk factors (13 items) of women in the low socio-economic community of Mumbai before and after interventions,2018-20

	Mean (S.D.) Knowledge Score						
	Signs & symptoms (10 items)			Risk factors(13 items)			
Characteristics	Baseline	Endline	P value	Baseline	Endline	P value	N
Age Group (Years)			ns			ns	
18-24	2.74 (3.86)	7.02 (1.87)		1.63 (3.30)	7.65 (2.28)		43
25-34	2.83 (3.64)	6.72 (2.03)		2.00 (2.97)	7.14 (2.76)		87
35-44	2.50 (3.63)	7.04 (2.01)		1.47 (2.82)	7.22 (2.54)		137
45-55	2.80 (3.73)	6.48 (1.80)		1.59 (3.03)	7.31 (2.86)		140
Schooling			P<0.01			ns	
Primary	1.23 (3.06)	5.96 (1.96)		0.46 (1.22)	6.68 (2.73)		22
Secondary	1.48 (2.86)	6.90 (1.93)		1.12 (2.46)	7.19 (2.87)		168
Higher	3.74 (3.96)	6.76 (1.92)		2.13 (3.33)	7.39 (2.50)		220
Religion			P<0.01			P<0.01	
Hindu	2.77 (3.71)	6.73 (1.92)		1.67 (2.97)	7.25 (2.68)		387
Non-Hindu	2.70 (3.12)	6.78 (2.14)		1.64 (3.03)	7.28 (2.61)		29
Caste			ns			ns	
SC/ST	0.82 (2.36)	6.55 (2.65)		1.00 (2.27)	6.59 (2.46)		22
OBC	2.90 (3.58)	7.02 (1.72)		1.87 (2.96)	7.15 (2.57)		111
Others	2.77 (3.77)	6.69 (1.94)		1.60 (3.02)	7.39 (2.73)		274
Family type			P<0.01			P<0.01	
Nuclear	2.80 (3.80)	6.87 (1.93)		1.57 (2.71)	7.36 (2.81)		326
Joint/extended	2.31 (3.14)	6.42 (1.94)		1.93 (3.03)	6.95 (2.63)		81
Employment			P<0.01			P<0.01	
Not working	2.46 (3.58)	6.76 (1.90)		1.49 (2.86)	7.22 (2.65)		348
Working	3.90 (3.99)	6.86(2.10)		2.42 (3.39)	7.57 (2.75)		62
Marital status			P<0.01			P<0.01	
Unmarried	2.64(3.73)	7.12(1.72)		1.46 (2.96)	7.89 (2.16)		61
Married	2.69(3.67)	6.71(1.96)		1.66 (2.97)	7.16 (2.74)		349

Note: a) N is Sample Size b) SC: Scheduled Caste; ST: Scheduled Tribe; OBC: Other Backward Classes.

Table 4: Paired t-test showing mean difference in knowledge of signs & symptoms and risk factors of BC before and after the intervention among heath care providers at the study facility.

Knowledge Indicators	Mean	Mean Difference	S.D. of Difference	95% C.I of Difference	Significance
Knowledge of Signs and symptoms of BC before Intervention	6.76	2.67	2.44	1.56-3.78	0.000
Knowledge of Signs and symptoms of BC after Intervention	9.43				
Knowledge of risk factors of BC before Intervention	7.00	4.05	4.63	1.94-6.16	0.001
Knowledge of risk factors of BC after Intervention	11.05				

Figure 1: Percentage of women with knowledge of different signs and symptoms of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 2: Percentage of women having knowledge of risk factors of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 3: Knowledge of breast cancer detection methods among women (in %) in the community before (baseline survey) and after (endline survey) interventions, 2018-20

Figure 4: Breast-self-examination practices after intervention among the women participants. Those who were practicing BSE were asked how often they are practicing. Once in 3 months mean at least once in 3 months but not regularly in every month. Once in 6 months means not regularly but rarely in last 4-6 months. The reasons were given for those who are not practicing Breast Self-examination.

Figure 5: Clinical Breast Examination practices after intervention among the women participants. The reasons were given for those who are not practicing Clinical Breast examination.

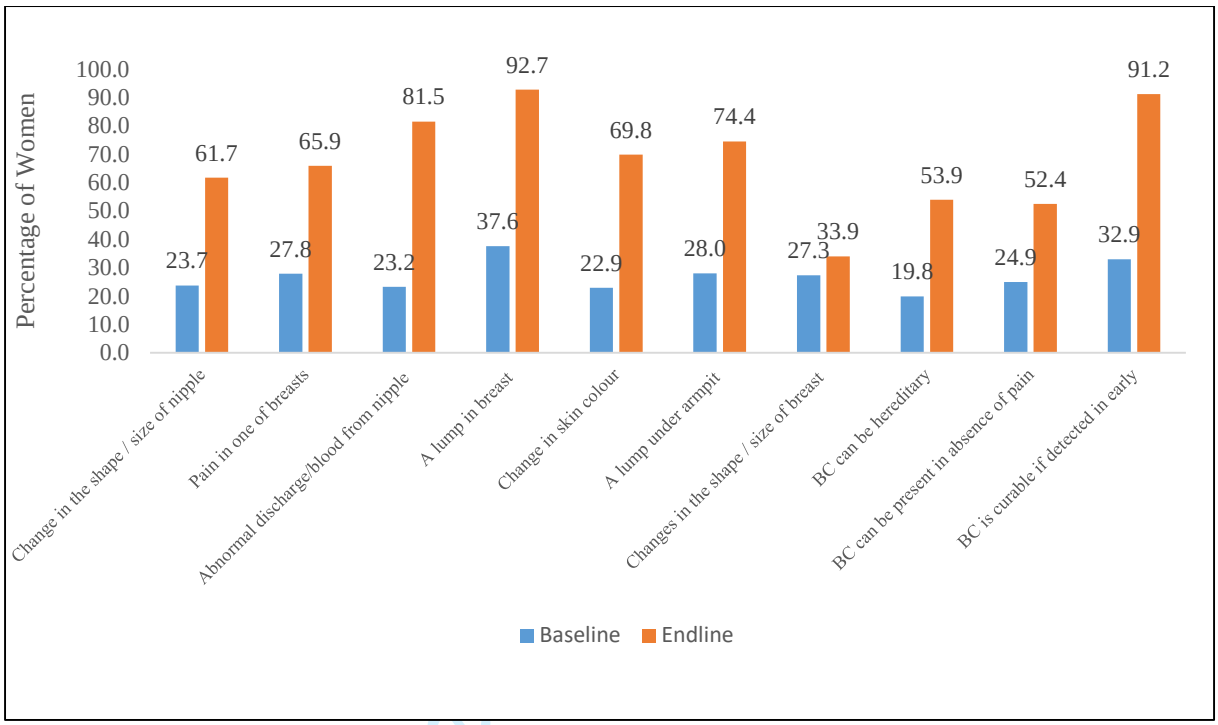

Figure 1: Percentage of women with knowledge of different signs and symptoms of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

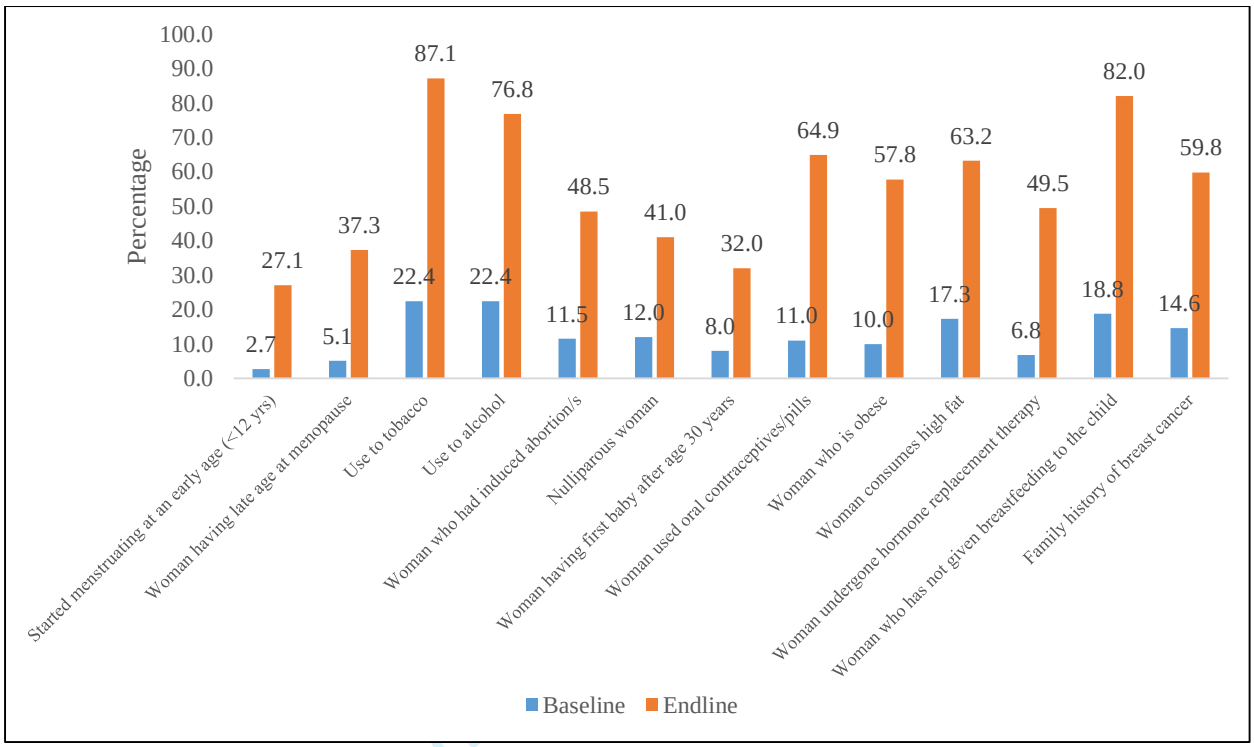

Figure 2: Percentage of women having knowledge of risk factors of breast cancer before (baseline survey) and after (endline survey) interventions, 2018-20

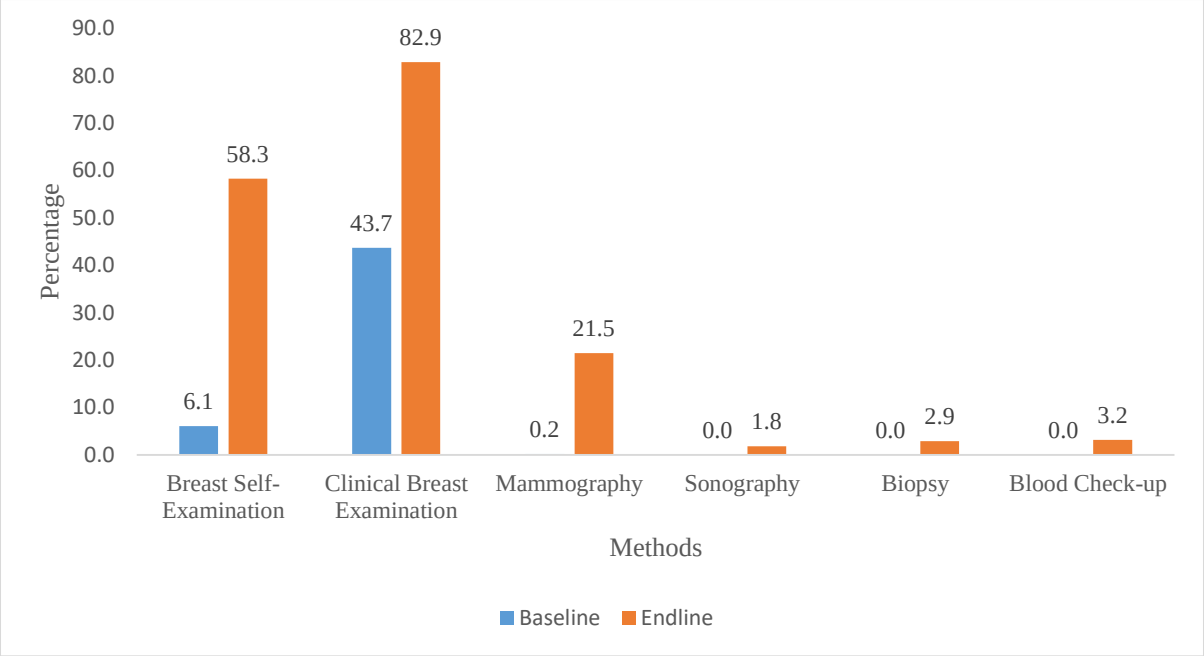

Figure 3: Knowledge of breast cancer detection methods among women (in %) in the community before (baseline survey) and after (endline survey) interventions, 2018-20

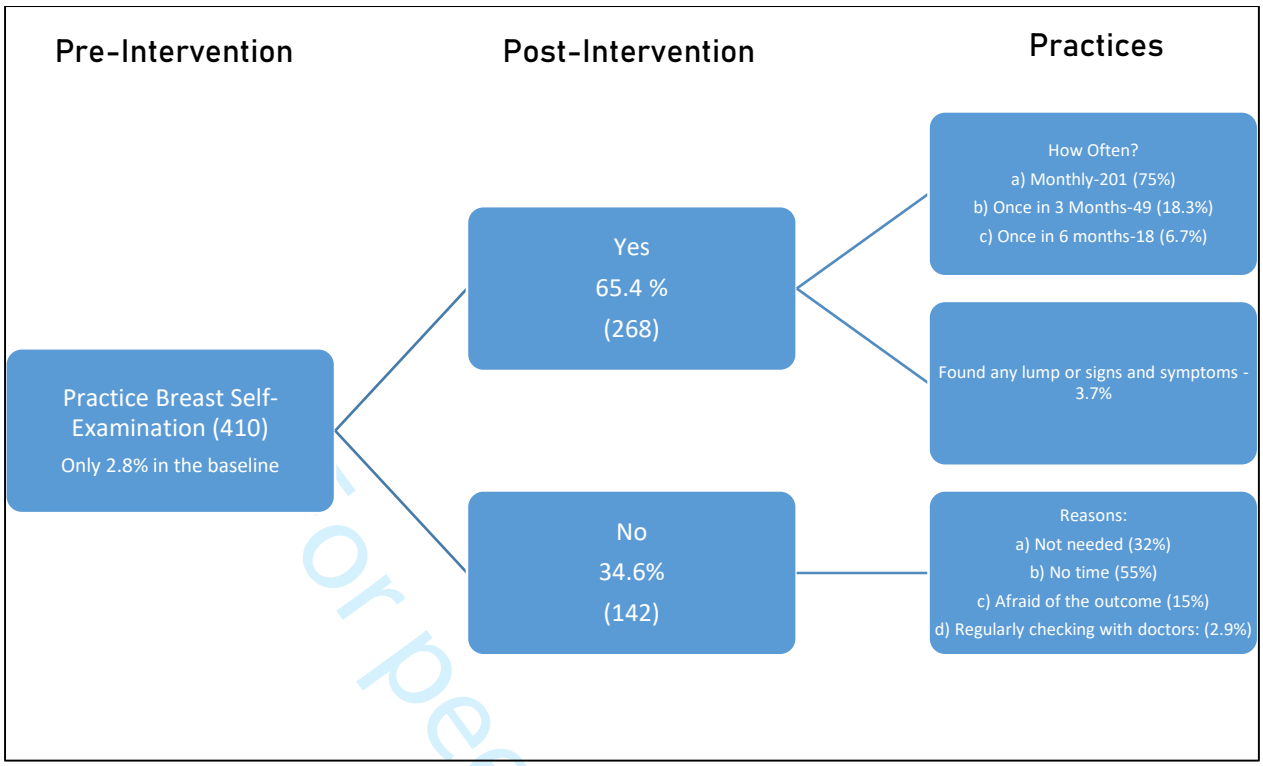

Figure 4: Breast-self-examination practices after intervention among the women participants. Those who were practicing BSE were asked how often they are practicing. Once in 3 months mean at least once in 3 months but not regularly in every month. Once in 6 months means not regularly but rarely in last 4-6 months. The reasons were given for those who are not practicing Breast Self-examination.

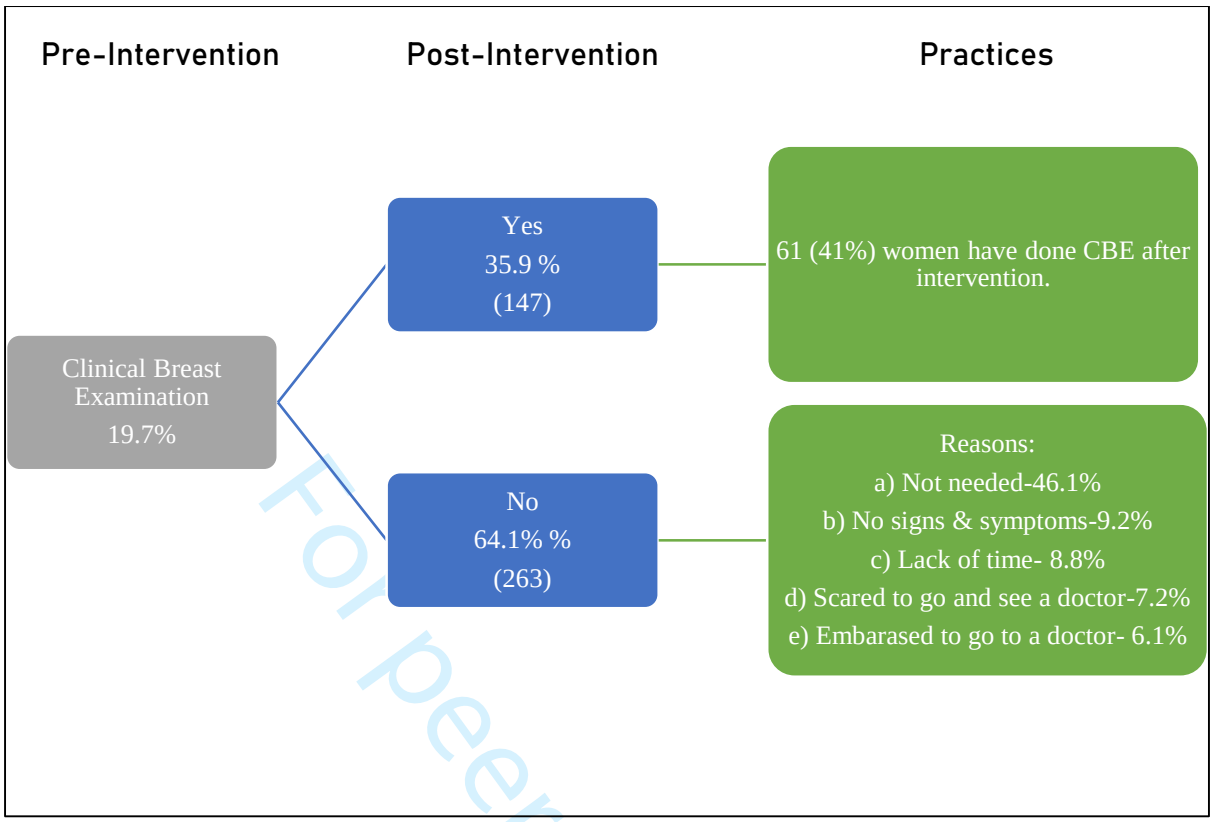

Figure 5: Clinical Breast Examination practices after intervention among the women participants. The reasons were given for those who are not practicing Clinical Breast examination.

STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology*

Checklist for cohort, case-control, and cross-sectional studies (combined)

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any pre-specified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	Pre-post design 5-6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8-9*
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed	

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		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9-10
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	10-11
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	
		Cross-sectional study—Report numbers of outcome events or summary measures	
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-11
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.