

Critical Assessment of Three Decades of Breast Cancer Research in Yemen: Systematic Review

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Abstract

Objective: The aim of this review is to critically assess three decades (1989 to 2019) of breast cancer research in Yemen and to identify the gaps in, and need for, breast cancer research in Yemen.

Methodology: A search was performed in Web of Science, EMBASE, PubMed, Google Scholar and Ovid to identify articles on breast cancer research in Yemen that were published in the last three decades. The articles were selected and reviewed by experts in this field, based on clinical relevance and future research implications.

Results: This review comprised 19,031 participants, extracted from 27 articles that were included and analyzed. Breast cancer patients in Yemen were commonly diagnosed at an early age of 50 years or younger. Overall, awareness of breast cancer among Yemeni women was very poor. Some studies reported that a low rate of only 11%-17.4% of Yemeni women practiced breast screen examination. Only 1.6% of the Yemeni women had been screened by a mammogram test. The highest performed surgery was a modified radical mastectomy (N=211). The highest cases of breast cancer were reported in Hadramout (N=956) and the most common histological subtype was invasive ductal carcinoma (N=2695).

Conclusions: Yemen is characterised by three decades of scattered, fragmented and poor quality breast cancer research. Therefore, there is a need to establish a breast cancer research center in Yemen to research all aspects of breast cancer in Yemen, and to build bridges for collaborations in breast cancer research globally.

Keywords: Breast cancer, Yemen, review, screening, diagnosis, treatment, Sana'a, Aden.

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Introduction

Breast cancer is the most diagnosed cancer, with a high mortality rate, globally. In 2015 there were about 1.7 million confirmed cases of breast cancer, resulting in some 521,900 deaths, worldwide¹. In Yemen, breast cancer is recorded as the commonest cancer among women (30.3%) and the most common of all cancers (16.6%)^{2,3}.

Breast cancer risk factors including age, hormone therapy, family history, extensive exposure to radiation and benign breast tumor need to all be well understood among the female population. Early detection of breast cancer will provide the patient with better diagnosis and survival⁴. It has been shown that about 30% of all cancer cases can be avoided yearly by following prevention strategies through a healthy lifestyle and a satisfactory working environment⁵. There is strong evidence that obesity, tobacco smoking, diet, drinking alcohol, stress, pollution, sun exposure, physical activity, and infections have an implication for the onset of breast cancer (World Cancer Research Fund, 2007).

The most available literature on different aspects of breast cancer is reported from developed and Western countries. Such research, undertaken in other countries, may not automatically apply in Yemeni settings. Few studies from Yemen have investigated the special risk factors and other aspects of breast cancer research. Therefore, there is a need to conduct a systematic review to establish the gaps and the needs for Breast cancer research in Yemen.

Methodology

Search Strategy: Articles indexed in PubMed, Ovid, EMBASE, Web of Science and Google Scholar were systematically and scientifically searched using the keywords and MeSH terms [Breast Neoplasms” OR “Breast Cancer” OR “Breast Tumor” OR “Breast Tumors” OR “Breast Carcinoma” OR “Breast Carcinomas”) and Yemen]. The references of the included articles were searched manually for further articles. Articles published from 1st January 1989 until 30th March 2019 were included.

Two authors [RAA & HA] separately screened the titles and abstracts of all studies using the inclusion and exclusion criteria. Appropriate studies were retrieved in full-text. Divergences were addressed through discussion with all authors.

Eligibility: The following study designs: case-control, cross-sectional, RCTs, non-randomized controlled trials and pre-post were included in this systematic review. Only articles written in the English language were included. Only original, primary articles were included. Review articles, editorials, comments, and letters to authors without information about study details were excluded.

Data extraction and quality assessment: A data extraction form was used to extract the required information for this systematic review. The data extraction form included: study name, first author’s name, publication year, study design, and number of participants. Two authors [RAA & HA] autonomously assessed the quality of the included studies using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist. Studies were then classified into three categories (A, B or C) according to the percentage of criteria met: A >80%, B 50-80%, and C <50% of criteria met. Interventional studies were assessed based on their quality using the Effective Public Health Practice Project Quality Assessment Tool. Any differences in the quality assessment were resolved by discussion among all authors.

The flow of the data collection:

1. Records identified through PubMed, Ovid, EMBASE, Web of Science (N=42)
2. Records search for inclusion (N=42)
3. Excluded due to non-relevant (N=25) [Review articles=4; Lab study=13; reports=2, Not relevant=6]
4. Full text included [N=17]
5. Further reads identified through hand search in bibliography lists [N=33]
6. Excluded due to non-relevant [N= 23] [Arabic abstract only=10; Lab study=5; reports=6, thesis=2]
7. Full text included [N=10]
8. The total number included [N=27]

Result

Characteristics of research studies: In total, 27 articles were included in the final analyses for this review, comprising a total of 19,031 participants. The characteristics of the studies included are listed in Table 1. The majority of articles had less than 4 authors (N=18). The 27 articles were written by 21 different first authors and published in 17 different medical journals.

The included studies on breast cancer were all published between 1989 and 2018. Most of the studies were conducted in Sana’a (N=12), the most common study design was retrospective (N=9). None of the articles scored an A using the STROBE checklist, only 12 articles were awarded B scores (Table 1).

Table 1. The details of selected studies of breast cancer research in Yemen (N=27)

No.	First author, Year, Quality#	Study design	Year	Number of participants	Governorate	Age (Mean±SD/Range)
1	Bawazir et al. 1998 C	Retrospective	1989-1993	85	Aden	40-49
2	Al-Thobhani et al. 2001 C	Retrospective	1996-2000	116	Sana'a	(44±12)
3	Hamid et al. 2001 C	Retrospective	1989-1996	227	Aden	40-49
4	Bawazir, 2002 C	Descriptive	1997	22	Aden	NA
5	Homesh et al. 2005 B	Randomized Controlled Trial	1998-2002	296	Sana'a,	(33±11)
6	Harhra, 2005 C	Descriptive	1998-2002	74	Aden	NA
7	Al-Thobhani et al. 2006 C	Descriptive	1997-2001	773	Sana'a	(31±12)
8	Barbaa et al. 2009 C	Capture-recapture	All old cases until 2008	134	Hadhrumout	NA
9	Ghouth, 2009 C	Retrospective	2006	48	Hadhrumout	(45±12)
10	Al-Naggar et al. 2009 B	Cross-sectional	2008- 2009	105	Sana'a	(32±7)
11	BaSaleem et al. 2010 B	Secondary data	2002-2006	334	Aden	50-54
12	Bafakeer et al. 2010 C	Prospective	2006-2009	142	Hadhrumout	40-49
13	Ahmed, 2010 B	Cross-sectional		425	Hadhrumout	(21.4±1.6)
14	Al-Kahiry, 2011 C	Retrospective	2007 -2009.	176	Aden	40-49
15	Al-Naggar et al. 2011 B	Cross-sectional	2008-2011.	106	Sana'a	<55

No.	First author, Year, Quality#	Study design	Year	Number of participants	Governorate	Age (Mean±SD/Range)
16	Ahmed et al. 2011 B	Case-control	2010	137	Sana'a	16-80(43.75)
17	Harhra, 2012 C	Retrospective	1989 -2007	476	Aden	19-88
18	El-Zaemey et al. 2012 B	Descriptive	2004-2010	2654	Sana'a	(46±12)
19	Alhaj, 2012 B	Case-control	April-June 2009	60 cases 60 control	Sana'a	40-49
20	Badheeb, 2013 C	Retrospective	2006-2011	494	Hadhrumout	(48.87)
21	Al-Madhaji, 2014 C	Retrospective	2006-2010	245	Sana'a	30-50(49±8)
22	Alsanabani, 2015 C	Retrospective	2011-2013	160	Sana'a	(44.3)
23	Al-Sakkaf 2016 B	Cross-sectional		400	Aden	(26±5)
24	Alwabr 2016 B	Case-control	2011	103 case 103 control	Sana'a	20-70
25	Al-Nabhi et al. 2017 C	Descriptive	2007-2017	3782	Sana'a	40-49
26	Bawazir et al. 2018 B	Cross-sectional		317	Hadhrumout	(31±10)
27	Bawazir 2018 B	Descriptive	1997-2011	6974	Aden, Lahej, Abyan, and Al Dhale	45-49

#STROBE

Breast Cancer Diagnoses: The highest number of cases of breast cancer diagnoses were reported in Hadramout (N=956) and the lowest was in Shabawah (N=3) (Table 3). For breast cancer stages, the highest

was stage 2 (N=160). In terms of tumor size, patients presented with large size of tumor (Table 3). For type of surgery, the highest was modified radical mastectomy (N=211) (Table 2).

Table 2. Characteristics of breast cancer in different institutions in Yemen

Breast cancer characteristics		Study 1: Harhra and Basaleem (2012) N	Study 2: Alsanabani et al. (2015) N	Study 3			Total
Type of surgery	Modified radical mastectomy	97	114	-			211
	Simple mastectomy	53	-	-			53
	Lumpectomy	10	33	-			43
	Radical Mastectomy	21	9	-			30
	No surgery	13	-	-			13
Breast cancer based on geographical locations		Study 1: El-Zaemey et al (2012); No (%)	Study 2: Hamid et al. (2001) No (%)	Radheeb (2013)	Bafakeer et al. (2010)	Bawazir et al (2018)	Total
Governorates	Hadramout	-	3	494	142	317	956
	Sana'a	454	-	-	-	-	454
	Taiz	403	-	-	-	-	403
	Aden	218	171	-	-	-	389
	Ibb	238	-	-	-	-	238
	Al-Hodidah	273	-	-	-	-	273
	Lahej	-	29	-	-	-	29
	Abyan	-	17	-	-	-	17
	Shabwa	-	3	-	-	-	3
	Others	1068	4	-	-	-	1068
Breast cancer based on the stage of presentations		Study 1: Al-Kahiry et al. (2011)	Study 2: Harhra and Basaleem (2012)	Study 3: Ahmed et al. (2011)			Total
Stage of cancer	Stage 1	18	20	22			60
	Stage 2	40	72	48			160
	Stage 3	54	84	17			155
	Stage 4	64	16	-			80

In terms of the common breast affected with cancer, 1005 patients were affected in the left breast. In comparison, 787 patients were affected in the right breast. Only 26 patients were affected in both breasts (Table 3).

Table 3. Common Breast affected with cancer among Yemeni women

Study	Left breast N (%)	Right breast N (%)	Bilateral N (%)
Bafakeer et al. (2010)	76 (total 142)	63	3
Alsanabani et al. (2015)	77 patients (48.1%)	81 (50.6%)	2 (1.3%)
El-Zaemey et al. (2012)	408 (43.7%)	393 (42.1%)	19 (2.0%)
Homesh et al. (2005)	147 (49.7%)	149 (50.3%)	NA
Al-Thobhani et al. (2006)	92 (59.4%)	63 (40.6%)	NA
Al-Madhaji et al. (2014)	205 (83.67%)	38 (15.5%)	2 (0.82%)
Total	1005	787	26

The most common histological subtypes were invasive ductal carcinoma (N=2695), followed by invasive lobular carcinoma (N=120) (Table 4).

Table 4. Distribution of breast cancer cases according to Histological subtypes of breast cancer in Yemen

Histological subtypes of breast cancer	Study 1	Study 2	Study 3	Study 4	Study 5	Study 6	Total
Invasive ductal carcinoma	92	124	123	147	185	2024	2695
Invasive lobular carcinoma	5	13	-	7	13	82	120
Intraductal papillary carcinoma	4	-	-	-	-	-	4
Infiltrating ductal & lobular carcinoma	1	-	-	-	-	-	1
Ductal carcinoma in situ	2	-	-	5	3	29	39
Adenocarcinoma	3	-	-	-	-	11	14
Medullary carcinoma	3	-	-	-	2	20	25
Adenoid cystic carcinoma	1	-	-	-	-	-	1
Carcinoma NOS	60	-	-	-	2	-	62
Malignant phyllodes	-	-	-	1	6	-	7
Mucinous	-	-	-	-	2	-	2
Unspecified	-	-	-	-	14	488	502

1:Badheeb et al. (2013); 2: Ahmed et al. (2011); 3:Bafakeer, Banafa, Aram (2010); 4:Alsanabani, Gilan, AlSaadi (2015), 5: Hamid, Tayeb, Bawazir (2001); 6: El-Zaemey et al. (2012)

Breast Awareness: Five of the 27 studies looked at awareness of breast cancer in Yemen. The total participants were 1435 women. Two studies were conducted in Sana'a, another two studies were conducted in Hadhramout and one study took place in Aden.

Overall, the awareness of breast cancer in all studies was very poor. Only 11%-17.4% of Yemeni women practiced BSE in some studies. Only 1.6% of women had been screened by a mammogram test (Table 5).

Table 5. Characteristics and outcome of Breast awareness studies in Yemen

Author/s	No of participants	Study Design	Study location	Age (Mean±SD/Range)	Findings
Bawazir et al. (2018)	317	Cross-sectional	Hadhramout	31.9±10.2	Only 30.3% were practicing self-breast examination. Only 1.6% had been screened by a mammogram test.
Al-Sakkaf and Basaleem (2016)	400	Cross-sectional	Aden	26.5±5.6	89% never performed any screening.
Ahmed (2010)	425	Cross-sectional	Hadhramout	21.4±1.6	Only 17.4% were performing BSE.
Al-Naggar et al. (2009)	105	Cross-sectional	Sana'a	32.13±7.17	About 24.7% of female physician sent the patients for mammogram screening every year regardless of the patients' history or symptoms.
Alwabr (2016)	103 case 103 control	Case-control	Sana'a	20-70	In the control group 83.5% of women not practiced BSE. 66% practiced in the intervention group.

Discussion

Breast cancer in Yemen: Breast cancer is the most common cancer and the foremost cause of cancer death among women in Yemen. Breast cancer is the most common cancer (16.6%) of all cancers and of all female cancers (30.3%) in Yemen^{2,3}. Local studies from the Sana'a, Aden and Hadhramaut regions of Yemen reported that breast cancer was classified as the number one cancer among Yemeni women.

In Sana'a-Yemen, Al-Thobhani et al. (2001) reported that breast cancer ranked first among Yemeni women and accounted for 8% of all cancers. Another study from the National Oncology Centre (NOC) in Sana'a reported that breast cancer was the commonest cancer among Yemeni women (21%)⁶. A large study, which included 2654 breast cancer patients from all governorates in Yemen reported that breast cancer represented 22% of all women's cancer⁷. Yet another study from Sana'a found that breast cancer represented 26.9% of women's cancer⁸.

A study reported that the incidence of breast cancer was 23.3%⁹. A study about breast cancer in Aden-Yemen found the breast to be the most prominent site of cancer among women in Aden⁹. Another population study by the Aden Cancer Registry found 334 women breast cancer patients in Aden². A more recent study from Aden, which analyzed data from across 15-years, reported that breast cancer was top cancer among women with an incidence rate of 30.0%¹⁰. A study from Hadhramut-Yemen reported that breast cancer accounts for 22.4% of cancer cases in women¹¹. Ghouth and Bafageer (2006) reported that breast cancer accounted for 14.37 % of all cancer cases registered in Hadhramut, Yemen.

Breast cancer geographical distribution: In terms of breast cancer cases based on geographical location, the highest cases were reported in Hadramout (N=956), followed by Sana'a (N=454), then Taiz (403), while only three cases were reported in Shabawah. This substantial variation in the numbers of breast cancer cases reported across Yemen may be explained by where most of the research was undertaken and where the cancer registries are located. More specifically, 12 of the studies were conducted in Sana'a, 9 studies were conducted in Aden and 6 studies were conducted in Hadramout.

Breast cancer incidence: Accurate cancer incidence in Yemen is unknown due to lack of pathological and

epidemiological resources, as well as the shortage and poor quality of medical records. Furthermore, political uncertainty, civil war and armed fights, have all contributed to the ambiguity of breast cancer incidence. However, studies have estimated the age-standardized rate (ASR) of breast cancer. For instance, Aden's Cancer Registry reported the five years (2002-2006) age-standardized rate (ASR) of breast cancer as 9.6/100,000 females². The higher rate was reported according to the International Agency for research on cancer that breast cancer incidence rates in Yemen are (20.8/100,000)¹². The Globocan has estimated a higher rate of 27.4/100,000 Yemeni females¹. Jordan has shown a more gradual increase in breast cancer incidence, from 32.8/100,000 to 40.1/100,000 to 61/100,000^{13,14}. ASR rates were higher [55.9/100,000] among women in Bahrain, 50.1/100,000 women in Kuwait. The lowest ASR was reported in Mongolia (8.0 cases per 100,000).

Cancer registry in Yemen: Cancer registry remains as the main challenge in Yemen, in the absence of national cancer surveillance. In Yemen there are four cancer registries, each working separately without full coordination and collaboration: the Aden Cancer Registry (ACR), the cancer registry at the National Oncology Center (NOC) (Sana'a), Hadhramout Cancer Registry (Hadhramout), and Taiz Cancer Registry (Taiz). No comprehensive national study has been conducted in Yemen that includes all of the cancer registries, teaching hospitals and other oncology centers that treat breast cancer patients. No national cancer-specific statistics are available and studies on cancer patterns are urgently needed. Furthermore, there is no accurate data-base for breast cancer incidence. Most of the studies conducted in Yemen are hospital-based or in a single cancer registry. Further challenges in Yemen are the advanced stage at presentation, the financial burden of treatment, insufficient medical staff training, and the psychological support of cancer patients. Cancer registries in Yemen often struggle with insufficient health services, transient populations, lack of finances, lack of qualified workforces, inadequate or imprecise data, and difficulty in establishing a trustworthy and reasonable cancer registry in the nation⁵. The average age at first birth among Yemeni women have their first baby at 20 years old, which is approximately a decade younger than women in developed countries¹⁵.

Yemen culture and breast cancer: There are special and unique reproductive factors among Yemeni women that may act as breast cancer-protective factors: age

married, parity and length of time spent breastfeeding. Yemeni women, as a socially accepted practice, tended to marry at a young age. Yemeni women had higher parity, with an average of 6 children per woman, compared to countries like Australia, the USA and the UK where the parity was approximately 2 children per woman¹⁶. The average woman in Yemen breastfed her child for about 22 months¹⁵. Much evidence-based research supported our argument here, that these reproductive factors among Yemeni women may have a protective effect against breast cancer. These differences in fertility may also result in differences in lifetime duration of breastfeeding which have a protective effect. It has been reported that breastfeeding 12 months reduces the risk of breast cancer by 4%¹⁷. Furthermore, Ma et al. (2006) found that each birth will reduce the risk of breast cancer by 11%.

In other hands, there is evidence that cultural concerns among Yemeni women regarding breast cancer included fear and worry, shyness, seeking traditional medicine, inability to fund travel expenses for treatment abroad and lack of awareness. Other cultural norms in Yemen for not seeking the treatment earlier seem to be illiteracy, cultural shame and the male-dominant culture. For instance, a woman may hide her illness from her husband because of fearing that he may divorce her. The influence of these cultural norms are worthy of further investigation.

Age: The dominant age of Yemeni women with breast cancer is less than 50 years. This is similar to the mean age of women in Pakistan was 48.6 years¹⁸. A similar finding reported that 75% of Arabic women, following a similar pattern to that reported in our systematic review, have presented with breast cancer before 50 years of age. However, only a third of women in developed countries are diagnosed before the age of 50 years¹⁹. A possible explanation is a larger proportion of younger age groups in developing countries.

In developed countries, 50% of all women with newly diagnosed breast cancer are older than 63 years, while in many developing countries women with breast cancer are predominately younger than 50 years of age²⁰. This shows that breast cancer presents on average 10 years earlier among women in developing countries, including Arabic countries, compared with women in developed countries.

Lifestyle and genetic risk factors: There was only one study conducted in Yemen looking at the risk

factor of breast cancer patients²¹. Early menarche, late menopause, family history, stressful life events, and smoking were the risk factors identified. Furthermore, a reduction in breast cancer risk was found among women who breastfed their babies for two years²¹. Many breast cancer risk factors are well-known and well-established in the existing literature such as menarche at an early age, late age at first birth, nulliparity, low parity and late menopause²². Long duration of breastfeeding has been confirmed as being protective against breast cancer²³. Physical activity has also been shown to reduce the risk of breast cancer²⁴. However, drinking alcohol is one of the risk factors²⁵. Furthermore, there is a well-established association between high socioeconomic status women and the risk of breast cancer^{26,27}.

Other risk factors are dietary fat intake, hormone replacement therapy and oral contraceptives^{23,28}. However, the most significant risk factors for breast cancer are being a woman and growing older. Also, exposure to artificial light at night is one of the risk factors for breast cancer²⁹.

Diagnosis and pathology: The highest stage of breast cancer among Yemeni patients was stage II and the lowest was stage I. Two of the studies reported that the patients presented with a large size tumor^{30,31}. Similar findings reported that advanced stages are commonly seen among Gulf women³².

Two studies investigated the pathology of breast cancer in Yemen. The first study was conducted in Aden, Yemen. A total number of 118 patients were investigated in this study with late stages, stage III (n=54) and stage IV (n=64), of breast cancer. The majority of the patients were in their reproductive age, from 30 to 49 years old³³.

The second Yemeni study included data from all fine needle breast biopsies, excisional breast biopsies, and biopsies of mastectomies. The highest case diagnoses were fibroadenoma (30.1%), followed by fibrocystic disease (27.4%), then invasive carcinoma (20.1%) and lastly breast inflammation (13.1%). Fibroadenoma had the highest incidence among younger ages group 11–20. However, carcinoma cases reported the highest incidence in the older age group 41–50 years (34.2%)³⁴.

Left breast vs. right breast cancer: This review shows that the more common breast affected with cancer is the left breast, with 1005 patients affected. Comparatively, 787 patients were affected in the right breast. Only 26 patients were affected in both breasts. A

global pattern showed that breast cancer more commonly occurs in the left compared to the right breast³⁵ and several publications have supported these findings^{36,37}. The possible explanation is not clear, however, different sizes of breasts, nurses favoring examination of the left breast, greater convenience for a woman to check her left breast compared to her right breast, brain structure and detection.

Treatment: This review reported that the most common type of surgery performed on breast cancer patients in Yemen was the modified radical mastectomy (N=211), financial constraints tend to result in lower use of breast conservative surgery in Yemen. Mastectomy remains an effective surgery in metastatic breast cancer. This is shown by a study that breast surgery lowers the risk of death by 28%³⁸. Most Yemeni women are diagnosed with breast cancer at a late stage, so mastectomy is an essential surgery. As mastectomy is a scarring surgery, immediate reconstruction surgery may help Yemeni women to cope with their diseases in terms of body image and feminism. However, a few barriers to constructive surgery are of concern such as access to the health care system, cost of surgery and the most painful and important barrier is fear of further surgery.

Quality of life studies: Only one study investigated the quality of life among breast cancer patients in Yemen. This study was a cross-sectional study of 106 female breast cancer patients who were chosen randomly from the National Oncology Centre (NOC) Sana'a, Yemen. The study showed that educational status, BMI, income, histological grade, years after diagnosis, surgery and radiotherapy significantly impacted the quality of life of women with breast cancer³⁹.

Histological characteristics: This review showed that the most common type of breast cancer among Yemeni women is invasive ductal carcinoma, followed by invasive lobular carcinoma. Similarly, for Arabic women, invasive ductal carcinoma is the most frequent pattern followed by invasive lobular carcinoma. This pattern is also reported in developed countries.

Biomarkers: Only two studies investigated the biomarkers and hormones among breast cancer women in Yemen. A study found that there was a significant increase of the prolactin level in breast cancer patients compared to those healthy women in the control. The study suggested a relationship between prolactin levels and breast cancer among Yemeni women⁴⁰. The second

study assessed the Her2/neu, ER, PR, and P53 among cases compared to the control group. The study found that there are high rates of positive expression of ER, PR, Her2/neu, and P53 among ductal carcinoma patients³¹. This systematic review showed that there are high rates of positive expression of ER, PR, Her2/neu and P53 among Yemeni women. The prevalence of HER2 in Yemen was 30.6%³¹. A higher prevalence of HER2 (40%) reported in Emirati women⁴¹. Lower prevalence of HER2 reported in the US [7.1%], 5% in Europe and 13.7% in Asia⁴².

Addressing the delay: A recent study using data for the period 2007-2009 from the cancer center in Aden indicated that the case fatality rate over that two years was 8.5/100 breast cancer patients with a late-stage presentation. This study suggested several factors that may have contributed to a high percentage of delayed presentation (stage III and IV): low socio-economic status, miss-diagnosed cases, the belief that it is better to ignore the symptoms, seeking traditional medicine, and insufficient facilities and specialists in Yemen³³.

Interventional studies: Two intervention studies were found related to breast cancer in Yemen. The first study was an interventional education among Yemeni female. Improvement in knowledge was reported among the group who received the intervention. That means education significantly improves women's knowledge of breast cancer⁴³. The second study is a respective randomized controlled clinical trial to compare two method, FNAC and CNB, among Yemeni breast cancer patients. The study showed that CNB showed higher diagnostic accuracy than FNAC⁴⁴.

Screening and early detection: The results of this review showed that awareness and knowledge among Yemeni women were very poor regarding breast cancer. Only 11%-17.4% of Yemeni women practiced BSE in some studies. Only 1.6% of women performed the mammogram test, and only 24.7% of female physicians sent their patients for mammogram screening every year regardless of the patients' history or symptoms. Similar findings from neighboring countries reported that the motives for less use of breast cancer screening services were inadequate knowledge, stigma and cultural beliefs⁴⁵.

Early detection is the foremost determinant factor of survival, which is reliant on awareness of and screening for breast cancer. However, breast cancer awareness is

very poor in Yemen^{10,46,47} and limited studies have been conducted in different parts of Yemen.

Conclusion and Recommendations

Yemen has been characterised by three decades of scattered, fragmented and poor quality of breast cancer research. Therefore, there is a need to establish a breast cancer research center in Yemen to cover all breast cancer research aspects in Yemen and to build bridges for collaborations globally. Poor knowledge and late presentation are the major issues. Therefore, there is an urgent need to educate the public through all available and reachable media and improve the basic oncology services for cancer patients.

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