Breast Cancer: Targets and Therapy

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Barriers to Early Breast Cancer Diagnosis in Sudanese Women Before the War

Hana Eltayeb Salih Elamin[1], Hind Eltayeb Salih Elamin[2], Ghada Omer Hamad Abd El-Raheem[3], Mounkaila Noma[1]

[1]High Diploma in Research Methodology and Biostatistics, University of Medical Sciences and Technology UMST, Khartoum City, Khartoum State, Sudan; [2]Clinics, Abu Dhabi Telemedicine Centre, Abu Dhabi, United Arab Emirates; [3]Pharmacy, Soba University Hospital, Khartoum City, Khartoum State, Sudan

Correspondence: Hana Eltayeb Salih Elamin, Email hana_elamin@outlook.com

Background: Breast cancer in African women is characterized by early onset, late presentation, and consequently poor prognosis. The reason for the late presentation was the delay by patients, due to ignorance, superstition, a skeptical attitude towards western medicine, and dependency on traditional medicine.

Objective: The aim of our study was to assess the factors of late presentation at Khartoum Oncology hospital of women suffering from breast cancer.

Methods: A hospital based cross-sectional study was implemented to assess the causes related to late presentation of women with breast cancer. Statistical analysis tests done to assess associations among variables were performed through chi^2. A multi-nominal regression analysis assessed the factors associated to late presentation. All statistical tests were considered significant when $p<0.05$.

Results: 250 females with breast cancer were studied, their age ranged between 22 years and 77 years with a median of 50 years. Barriers to early presentation were the duration of the condition before presentation ($p=0.003$) and most importantly the lack of education ($p=0.048$). As well as having low financial status ($p= 0.045$) and favouring alternative treatments such as herbal medicine ($p=0.041$) and Quran therapy ($p=0.047$). Other reasons were the fear of doctor and surgery ($p=0.021$) and the fear of diagnosis with a serious condition ($p=0.009$). Breast cancer was prevalent in all states of Sudan especially Northern state.

Conclusion: Fear and seeking treatment alternatives strongly contributed to late presentation. The lack of education and the unawareness about breast self-examination (BSE) are issues needed to be addressed by authorities.

Keywords: factors, late presentation, breast cancer, oncology, pathological stage

Introduction

Breast cancer is the most prevalent malignancy among women, with an estimated 2.1 million new cases diagnosed annually.[1–4] While the incidence of breast cancer in Sub-Saharan African countries has historically been lower than that observed in developed regions, both incidence and mortality rates have been increasing, particularly among younger populations. In African countries, breast cancer is frequently diagnosed at advanced stages, which is associated with a poorer prognosis. The delayed diagnosis is primarily attributed to the limitations of healthcare systems and the scarcity of resources.[2–14] On the other hand, in the industrialized world, early detection by mammographic screening and greater awareness of women had resulted in early presentation.[2,9,14,15] The diagnosis of breast cancer in most cases is delayed due to various factors including lack of awareness about the symptoms of breast cancer, lack of resources, disease stigma, use of alternative medicine, and poor access to healthcare facilities.[4,16–19] Clinical breast examination (CBE) and breast self-examination (BSE) are the detection strategies recommended by oncologists and the Breast Global Health initiative (BGHI) for low and middle-income countries (LMIC), because these strategies play a part in the early detection of BC and they are cost-effective. BSE improves the awareness of females towards breast cancer early detection. The benefit of various interventions on BC prevention/control and early detection for women in most developed countries were well documented.[20] The use of continuing education programs such as breast cancer education (BCE), (BSE), and (CBE) have reduced the incidence, delayed presentation, and mortality rates of BC among women.[6–8,21–26]

Received: 15 November 2024
Accepted: 11 February 2025
Published: 20 May 2025

In Sudan, breast cancer is still, the most prevalent cancer among females. Sudanese women were of premenopausal age, typically under 50, and were diagnosed with larger tumors at more advanced stages of breast cancer, such as stage III or IV, and higher histological grades. The mean age of breast cancer presentation in Sudan as in Africa generally is low compared with developed countries.[21]

The healthcare system in Sudan is significantly weakened by limited resources and reduced human capacity. Resources available for healthcare were predominantly spent on infectious diseases, such as malaria, diarrheal diseases, and tuberculosis. The challenges that should be addressed in order to develop nationwide cancer detection and screening initiatives are limited financial and human resources, as well as, the psychosocial factors of the women.[24,27–30] The aim of our study was to assess the status of breast cancer and the barriers to early presentation among Sudanese females. The prevalence of breast cancer across each state of Sudan and the stages of breast cancer on presentation will give a clear path for the concerned authorities to potentiate educational programs and establish cancer care institutions. This would fulfil parts of the African Union's Agenda 2063 "An integrated, prosperous and peaceful Africa, driven by its own citizens, representing a dynamic force in the international arena".

Methods

A prospective hospital based descriptive cross-sectional study was implemented in Khartoum Oncology Hospital, devoted to cancer treatment. This oncology hospital is comprised of 7 Units and 14 clinics per week. All cancer patients visit the referral clinic from all states of Sudan. A systematic random sampling technique was used to select 250 participants. After selecting randomly, the first patient, every two patients who provided their verbal well informed consent were included in the study. The data was collected during a period of 3 months; November 2022–January 2023.

The data were collected in two parts. The first part collected data from the files of the patients; such as age, stage of the disease, the date of presentation at hospital, the duration of the condition, the diagnosis, and the factors related to late presentation. The second part collected data through a standardized questionnaire validated by a research specialist to collect the data from the participants. Researcher-administered questionnaire was used; these data included the perception of participants about breast cancer if they knew it when they had symptoms, also symptoms on presentation were collected from the participants. Awareness about BSE and how it is done was also assessed along with the attitude of participants regarding treatment. The data were computerized through Epi-Info 7. The statistical package for social sciences (SPSS version 23) was used to summarize the data graphically in the form of frequency tables and bar charts. As well as, numerically, through calculating the mean, standard deviation and median. Chi-square test was used to determine the association between variables. A multi-nominal regression analysis was performed to assess the factors associated to late presentation. All statistical tests were considered significant when $p \leq 0.05$. The Geographic Information System ArcGIS version-10.8 was used to develop the risk map for breast cancer across the states of Sudan. The shp. file of the Sudan base map was obtained from the open access organization DIVA-GIS (https://www.diva-gis.org/gdata). The prevalence of breast cancer was calculated as number of cases per million populations.

The research proposal was reviewed by the Institutional Review Board of UMST (Approval number: 2022/RM17) and submitted for approval to Khartoum State Ministry of Health to obtain an ethical approval. All methods were performed in accordance with the relevant guidelines and regulations of the Declarations of Helsinki. Authorization to implement the research was obtained from the administration of Khartoum Oncology Hospital. Written informed consent was signed by the participants after explaining to them the objectives and all details of the research. Participants were also informed about their right to withdraw from the research at any time they wish and they are free not to address a question if they not feel to do so. Their confidentiality was ensured through the use of anonymous questionnaire and it was ensured that the data collected would not be used for any other purpose than the research objective.

Results

Characteristics of the Study Participants

The study participants were 250 females diagnosed with breast cancer. Their age ranged between 22 years and 77 years with a median age of 50 years. 78.8% were aged 40 years and above. 74.4% were married. The majority were housewives (79.2%). More than half (59.6%) lived in urban areas. 20.4% reported a family history of breast cancer; the family member the most frequently reported to have a breast cancer was cousin (46.9%); health insurance was held by 53.6% of the participants, Table 1.

Table 1 Characteristics of the Study Participants (n=250)

Characteristics	n	%	Characteristics	n	%
Age in years (n=250)			**Family history of BC (n=250)**		
Median	50		No	199	79.6
Min-Max	22–77		Yes	51	20.4
< 40 years	53	21.2	**Family member affected (n=49)**		
≥40 years	197	78.8	Cousin	23	46.9
Marital Status (n=250)			Aunt	9	18.4
Married	186	74.4	Sister	8	16.3
Widowed	30	12.0	Mother	6	12.2
Divorced	17	6.8	Father	1	2.0
Unmarried	17	6.8	Grandfather	1	2.0
Education level (n=250)			Grandmother	1	2.0
Illiterate	104	41.6	**Health Insurance holder (n=250)**		
Below university	97	38.8	No	116	46.4
University	49	19.6	Yes	134	53.6
Total	250	100	**Type of Health Insurance (n=134)**		
Occupation (n=250)			Government	122	91.0
Housewife	198	79.2	Private	12	9.0
Working	52	20.8			
Residence (n=250)					
Urban	149	59.6			
Rural	101	40.4			

First Symptoms Noticed among Breast Cancer Females

51.2% of the participants had their BC located in the right breast, 47.2% had breast cancer in the left breast and 1.6% presented bilateral tumors. The most common symptom firstly noticed was painful lump, which was reported by 49.2% of the patients, painless lump was reported by 36.4%, 11.2% had nipple discharge and 10.8% noticed breast swelling at first presentation, Figure 1.

Clinical Characteristics of Breast Cancer

According to TNM classification and staging criteria, BC has 4 stages. Stage I was defined in 1.6% of the participants, while patients with stage II BC were 21.2%. On the other hand, 48% of the patients presented with late stage III breast cancer and 29.2% presented with distant metastasis stage IV. Chemotherapy was the most common BC treatment approach used in 96.4% of patients, followed by surgery 63.6%, endocrine therapy (29.8%) and radiotherapy (16%).

Regarding the duration of the disease, 24.4% of the patients had BC for <3 months, while 75.6% had ≥3 months' duration. Table 2 illustrates the clinical characteristics of BC among participants.

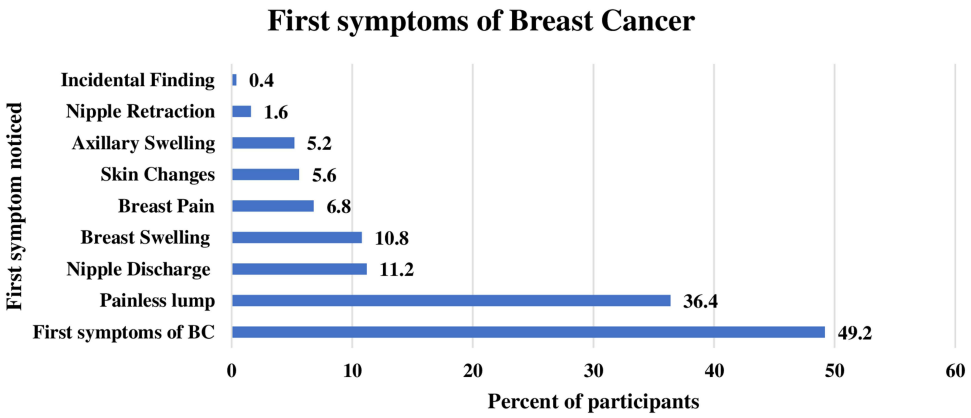

Figure 1 First symptoms noticed among Breast Cancer females (n=250).

https://doi.org/10.2147/BCTT.S506724

Table 2 Clinical Characteristics of Breast Cancer Among Study Participants (n=250)

Clinical characteristics	n	%	Clinical Characteristics	n	%
Site of the tumor			**Treatments Modality**		
Right breast	128	51.2	Chemotherapy	241	96.4
Left breast	118	47.2	Surgery	159	63.6
Bilateral breast	4	1.6	Endocrine Therapy	52	20.8
Pathological Stage			Radiotherapy	40	16.0
Stage III	120	48.0	**Duration of BC condition**		
Stage IV	73	29.2	< 3 months	61	24.4
Stage II	53	21.2	≥3 months	189	75.6
Stage I	4	1.6	Total	250	100

Association Between the Pathological Stage of Breast Cancer and the Demographic Characteristics

At presentation the majority of the patients (48%) presented at stage III. 29.2% presented at stage IV, while 21.2% presented at stage II, and 1.6% presented at stage I. Their age, marital status and occupation were not statistically associated to the stage of BC and presentation. However, the education level (p=0.048), duration of the breast cancer (p=0.003) and the modality of the treatment (p=0.000) were statistically associated to the stage of breast cancer. Table 3 presents the association between pathological stage of BC and demographic characteristics of the participants.

Table 3 Association Between Pathological Stage of BC and Demographic Characteristics of the Participants

Variables	Pathological Stages								Total	%	*p*-value
	I	%	II	%	III	%	IV	%			
Age Group (n=250)											
< 40 years	0	0	11	20.8	28	52.8	14	26.4	53	21.2	0.491
≥40 years	4	2	42	21.3	92	46.7	59	29.9	197	78.8	
Total	4	1.6	53	21.2	120	48	73	29.2	250	100	
Education (n=250)											
Illiterate	1	1	17	16.3	56	53.8	30	28.8	104	41.6	0.048*
Below university	3	3.1	24	24.7	48	49.5	22	22.7	97	38.8	
University	0	0	12	24.5	16	32.7	21	42.9	49	19.6	
Total	4	1.6	53	21.2	120	48	73	29.2	250	100	
Marital Status (n=250)											
Married	4	2.2	41	22	90	48.4	51	27.4	186	74.4	0.334
Not married	0	0	12	18.8	30	46.9	22	34.4	64	25.6	
Total	4	1.6	53	21.2	120	48	73	29.2	250	100	
Occupation (n=250)											
Working	2	3.8	14	26.9	18	34.6	18	34.6	52	20.8	
Housewife	2	1	39	19.7	102	51.5	55	27.8	198	79.2	0.116
Total	4	1.6	53	21.2	120	48	73	29.2	250	100	
Duration of BC Condition (n=250)											
<3 months	0	0	17	27.9	36	59	8	13.1	61	24.4	
≥ 3 months	4	2.1	36	19	84	44.4	65	34.4	189	75.6	0.003*
Total	4	1.6	53	21.2	120	48	73	29.2	250	100	
Treatment modality (n=242)											
Single treatment	0	0	6	8.7	29	42	34	49.3	69	28.5	0.000*
Multiple treatments	4	2.3	46	26.6	89	51.4	34	19.7	173	71.5	
Total	4	1.7	52	21.5	118	48.8	68	28.1	242	96.8	

Note: *Statistically significant.

Knowledge of Women About Breast Cancer Self-Examination (BSE)

The knowledge of breast self-examination (BSE) among participants was assessed based on the Simple formulated question. 35.6% of the participants had heard about breast self-examination, whereas the majority, 64.4% of the participants, had never heard about BSE. Amongst the 35.6% participants who said they had heard about BSE only 12.4% actually were performing it and only 10% knew that BSE should be performed during the week after menstruation. More than half (55.2%) had no idea if their condition would be prevented and 25.6% answered by yes. Majority of the women (86.8%) knew that their condition does not contaminate other people, while 10.8% had no idea regarding contamination. Table 4 shows the details of knowledge of women about breast cancer self-examination.

Attitude of Women Towards Breast Cancer and the Duration of Condition on Presentation

Attitude of women towards BC was assessed, regarding the reasons for late presentation, financial issues among participants was assessed, 85.6% had no financial issues, while 14.4% had financial problems and among those with financial problems, 88.9% had late presentation. There was a statistically significant association (p=0.045) between having financial problems and late presentation. Fear of doctors/surgery was reported by 7.6% of participants and 94.7% of these patients presented with late duration of BC on presentation (p=0.021). Fear of diagnosis of serious condition was also a reason for late presentation, 4.8% had fear of diagnosis and all had late presentation (p=0.009 between fear of diagnosis and duration of BC on presentation). Table 5 illustrates all the reasons. Association between knowledge of women about BC and duration of the disease on presentation is detailed in Table S1.

Practice of Women Towards Breast Cancer and the Duration of Condition on Presentation

On assessing practice of women toward BC, participants were asked to report if they had first consultation from a healthcare member prior to cancer specialized facility. There was no statistically significant association (p=0.078) between first referral before health service and duration of BC on presentation. Alternative treatments used by our study participants were studied, traditional treatment was used by 26.4% of participants and 84.8% of them had late

Table 4 Knowledge of Women About Breast Cancer Self-Examination (n=250)

Variables	n	%	Variables	n	%
Have you heard of BSE			**How often should BSE be done**		
No	161	64.4	No idea	222	88.8
Yes	89	35.6	Monthly	25	10.0
Do you do BSE			Weekly	2	0.80
No	219	87.6	Yearly	1	0.40
Yes	31	12.4	**What is the best time to do BSE**		
Have you been taught BSE			No idea	221	88.4
No	197	78.8	A week after period	29	11.6
From TV	27	10.8	**Do you think your condition preventable**		
Yes	23	9.2	No Idea	138	55.2
Do you know that BSE is useful			Yes	64	25.6
No	191	76.4	No	48	19.2
Yes	59	23.6	**Do you think your condition contagious**		
At what age should BSE be started			No	217	86.8
No Idea	226	90.4	No Idea	27	10.8
Puberty	20	08.0	Yes	9	3.60
30 years	2	0.80			
20 years	1	0.40			
After menopause	1	0.40			

Table 5 Association Between Attitude of Women Towards BC and Duration of the Disease on Presentation (n=250)

Attitude of BC Women	Duration of BC Condition				Total	%	*p*-value
	< 3 months	%	≥ 3 months	%			
Causes of delay and late presentation:							
Importance of condition							
Important	19	32.2	40	67.8	59	23.6	0.11
Unimportant	42	22.0	149	78.0	191	76.4	
Total	61	24.4	189	75.6	250	100	
Financial issues							
No	57	26.6	157	73.4	214	85.6	0.045*
Yes	4	11.1	32	88.9	36	14.4	
Total	61	24.4	189	75.6	250	100	
Fear of Doctor/Surgery							
No	60	26.0	171	74.0	231	92.4	0.021*
Yes	1	5.3	18	94.7	19	7.6	
Total	61	24.4	189	75.6	250	100	
Fear of diagnosis of a serious condition							
No	61	25.6	177	74.4	238	95.2	0.009*
Yes	0	0.0	12	100.0	12	4.8	
Total	61	24.4	189	75.6	250	100	
Fear of side effects of treatment							
No	61	24.6	187	75.4	248	99.2	0.289
Yes	0	0.0	2	100.0	2	0.8	
Total	61	24.4	189	75.6	250	100	
Shyness							
No	61	24.5	188	75.5	249	99.6	0.454
Yes	0	0.0	1	100.0	1	0.4	
Total	61	24.4	189	75.6	250	100	
Reasons why did not inform the family:							
Did not want to worry her family							
No	55	23.8	176	76.2	231	92.4	0.461
Yes	6	31.6	13	68.4	19	7.6	
Total	61	24.4	189	75.6	250	100	
Did not want to bother her family							
No	53	24.9	160	75.1	213	85.2	0.67
Yes	8	21.6	29	78.4	37	14.8	
Total	61	24.4	189	75.6	250	100	
Fear for her children							
No	58	24.5	179	75.5	237	94.8	0.909
Yes	3	23.1	10	76.9	13	5.2	
Total	61	24.4	189	75.6	250	100	

Note: *Statistically significant.

presentation of BC (p=0.041 was found between using traditional treatment and duration of BC on presentation). Another alternative treatment used was reading Quran, 18.4% of participants utilized reading Quran as a treatment, of those who used Quran as BC therapy, 87% had late presentation (p=0.047) Herbal medicine was used by 12.4% of BC women. From those who used herbal medicine for treating BC, 90.3% were presented late (p=0.041), Table 6.

Barriers to Early Presentation of Breast Cancer Condition Among Participants

Association between different factors and the duration of breast cancer on presentation is detailed in Table 7. Different factors were related to late presentation; either therapeutic factors, financial factors or psychological factors. The pathological stage of

Table 6 Association Between Practice of BC Women and Duration of the Disease on Presentation

Practice of BC Women	Duration of BC Condition				Total	%	*p*-value
	< 3 months	%	≥3 months	%			
First referral before Health service (n=248)							
Did not consult healthcare provider	51	26.8	139	73.2	190	76.6	0.078
Consulted healthcare provider	9	15.5	49	84.5	58	23.4	
Total	60	24.2	188	75.8	248	99.2	
Traditional treatment (n=250)							
No	51	27.7	133	72.3	184	73.6	0.041*
Yes	10	15.2	56	84.8	66	26.4	
Total	61	24.4	189	75.6	250	100.0	
Quran therapy (n=250)							
No	55	27.0	149	73.0	204	81.6	0.047*
Yes	6	13.0	40	87.0	46	18.4	
Total	61	24.4	189	75.6	250	100.0	
Herbal medicines (n=250)							
No	58	26.5	161	73.5	219	87.6	0.041*
Yes	3	9.7	28	90.3	31	12.4	
Total	61	24.4	189	75.6	250	100.0	
Went to a Sheikh (n=250)							
No	59	25.8	170	74.2	229	91.6	0.097
Yes	2	9.5	19	90.5	21	8.4	
Total	61	24.4	189	75.6	250	100.0	

Note: *Statistically significant.

Table 7 Association Between Patients' Factors and Duration of Breast Cancer on Presentation

Characteristics	Duration of breast cancer on presentation				Total	%	p-value
	< 3 Months	%	≥ 3 Months	%			
Pathological stage of BC							
Stage I	0	0	3	100	3	1.2	0.008*
Stage II	14	32.6	29	67.4	43	17.2	
Stage III	28	28.6	70	71.4	98	39.2	
Stage IV	5	9.4	48	90.6	53	21.2	
Total	47	23.9	150	76.1	197	78.8	
Treatment model							
Single treatment	6	12.2	43	87.8	49	19.6	0.030*
Multiple treatments	39	27.5	103	72.5	142	56.8	
Total	45	23.6	146	76.4	191	76.4	
Having False negative results of FNAC							
No	61	25.5	178	74.5	239	95.6	0.012*
Yes	0	0	11	100	11	4.4	
Total	61	24.4	189	75.6	250	100	
Financial issues							
No	57	26.6	157	73.4	214	85.6	0.045*
Yes	4	11.1	32	88.9	36	14.4	
Total	61	24.4	189	75.6	250	100	
Fear of Doctor/Surgery							
No	60	26	171	74	231	92.4	0.021*
Yes	1	5.3	18	94.7	19	7.6	
Total	61	24.4	189	75.6	250	100	

(*Continued*)

Table 7 (Continued).

Characteristics	Duration of breast cancer on presentation				Total	%	p-value
	< 3 Months	%	≥ 3 Months	%			
Fear of diagnosis of a serious condition							
No	61	25.6	177	74.4	238	95.2	0.009*
Yes	0	0	12	100	12	4.8	
Total	61	24.4	189	75.6	250	100	

Note: *Statistically significant.

breast cancer had a statistically significant association (p=0.008) to the duration of breast cancer on presentation. 90.6% of the cases with stage IV were presented after 3 months duration. Regarding treatment model, multiple treatments were applied to 72.5% of the patients with late presentation (p=0.030). Having false negative results of FNAC was prevalent in all late presentation cases (p=0.012). Furthermore, 88.9% of the females with financial issues were presented late (p=0.045). Psychological factors such as fear of doctors or surgeries had a statistically significant association with the duration of breast cancer presentation (p=0.021), with 94.7% of patients who fear doctors having late presentation. 100% of patients who had fear of diagnosis with a serious condition presented with late duration of breast cancer (p=0.009), Table 7. Association between patient characteristics and duration of BC disease on presentation is detailed in Table S2.

Multinomial Logistic Regression Model Predicting Barriers of Early Presentation of Breast Cancer

The multinomial logistic regression model was built for predicting the late presentation of breast cancer in all our participants, they were classified into two groups, late presentation (>3 months) and early presentation (≤3 months) according to the cut-off of 3 months. 75.6% of our participants were late presentation, on the other hand, 24.4% were early presented. Our equation for the regression mode fitted perfectly the model (p=0.027). The equation was as follows:

Presentation of breast cancer = −0.118+ (−0.016*Age) + (0.109*Marital Status) + (0.341*Residence) + (0.421* Histopathology findings) + (0.761*First referral before Health service) + (0.102*Having Children) + (−0.098*Family history of BC) + (−0.702*Heard about BSE) + (0.994*Reading Quran).

The model revealed that reading Quran was of statistical significance (p=0.038) followed by the Histopathology findings (p=0.041) and the heard about BSE (p=0.045). Although, the family history and the age were not statistically significant predictors (p=0.801, 0.247), they had a considerable negative effect (B=−0.098, −0.016) on duration of the condition and the late presentation, Table 8.

Table 8 Multinomial Logistic Regression Model Predicting Factors That Determine Delay of the Presentation

Variable	B	S. E.	Wald	df	*P*-value	OR	95% CI of OR	
							Lower	Upper
Intercept	−0.118	1.214	0.01	1	0.922			
Age	−0.016	0.014	1.341	1	0.247	0.984	0.958	1.011
Marital Status	0.109	0.181	0.366	1	0.545	1.116	0.782	1.591
Residence	0.341	0.332	1.056	1	0.304	1.406	0.734	2.693
Histopathology findings	0.421	0.206	4.165	1	0.041	1.523	1.017	2.28
First referral before Health service	0.761	0.42	3.289	1	0.070*	2.141	0.94	4.876
Having Children	0.102	0.412	0.062	1	0.803	1.108	0.495	2.482
Family history of BC	−0.098	0.388	0.063	1	0.801	0.907	0.424	1.939
Heard about BSE	−0.702	0.35	4.026	1	0.045*	0.495	0.249	0.984
Reading Quran	0.994	0.48	4.293	1	0.038*	2.703	1.055	6.925

Note: *Statistically significant.

Prevalence of Breast Cancer Among Females Across the Country

The predictive risk map was also developed through Kriging method to present the population at risk as presented in Figure 2. The direct link to the base map is as follows: https://www.diva-gis.org/datadown. This is an open access organization for geographic data called DIVA-GIS.

Discussion

Breast cancer is a global condition that was understudied in Sudan. Majority of Sudanese females who suffered breast cancer arrived with late stages after suffering for more than 3 months before reaching healthcare. According to Khartoum Oncology Hospital statistics department records, in 2019 there were 1404 breast cancer new cases and 1526 new cases in 2018. In this study, the Sudanese breast cancer women had a median age of 50 years consistent with previous studies.[2,28,30] Positive family history was lower (20.4%) among Sudanese females compared with published literature.[28,31] Late presentation was defined as advanced stage of the disease on diagnosis. Among our participants; 77.2% presented as the late stage III and stage IV breast cancer, as late presentation was defined in the published literature.[31–33] Unfortunately, 75.6% of patients had breast cancer for 3 months or more, which was defined as late presentation.[31,34,35] As education and awareness programs play an important role in encouraging early detection of breast cancer, 53.8% of the illiterate had stage III breast cancer and a statistically significant association was found (p=0.048) between educational level and stage of BC disease.[3,28,36] The knowledge of breast self-examination[14,22,23] among participants was assessed, the majority 64.4% of the participants never heard about BSE, that leads us again to the importance of breast cancer educational programs and raising the awareness in the community.[36,37]

Treatment modality for each patient was assessed with regards to their pathological stage, and a strong statistically significant association was found (p=0.000) between the treatment modality and the stage of the disease. Stage IV was more prevalent in the group receiving single treatment (49.3%) compared with 19.7% in the group receiving multiple treatment approach. Multiple treatment approach is the main approach as mentioned in literature.[38,39]

Alternative treatments[4,40–43] had a strong effect on duration of BC presentation, in our study, traditional treatments, Quran therapy and herbal medicine were associated to late presentation (p=0.041, 0.047, 0.041 respectively). A regression model revealed that reading Quran was of statistical significance (p=0.038) followed by the histopathology findings (p=0.041) and whether heard about BSE (p=0.045). Although, the family history and the age were not statistically significant predictors (p=0.801, 0.247), they had a considerable negative effect (B=−0.098, −0.016) on duration of the condition and the late presentation. National financial supportive programs should be developed to help the patients with low financial support,[1,40] as presented by this study, 14.4% had financial problems and among those with financial problems, 88.9% had late presentation with a statistically significant association (p=0.045) between having financial problems and late presentation. Psychological support is of great influence on early presentation[18,28,32,44] because fear is a reason not to go and check, fear of doctors/surgery was reported by 7.6% of participants, of those, 94.7% came with late duration of BC on presentation (p=0.021). Fear of diagnosis of serious condition was also a reason for late presentation, 4.8% had fear of diagnosis and all had late presentation (p=−0.009).

All patients were asked to provide their state of origin in order to graphically present the prevalence of BC disease across the states of Sudan, the state with the highest prevalence was Northern state with a prevalence of 4.4 cases per 1 million population, the state with the lowest prevalence was Red Sea with a prevalence of 0.1 cases per 1 million people, other studies that studied prevalence of breast cancer were in Sudan[29] reporting prevalence as cases per 100,000.

Our study was not without limitations, the assessment of awareness of the participants was not graded and Likert scale was not applied for assessing the knowledge status as good or poor.

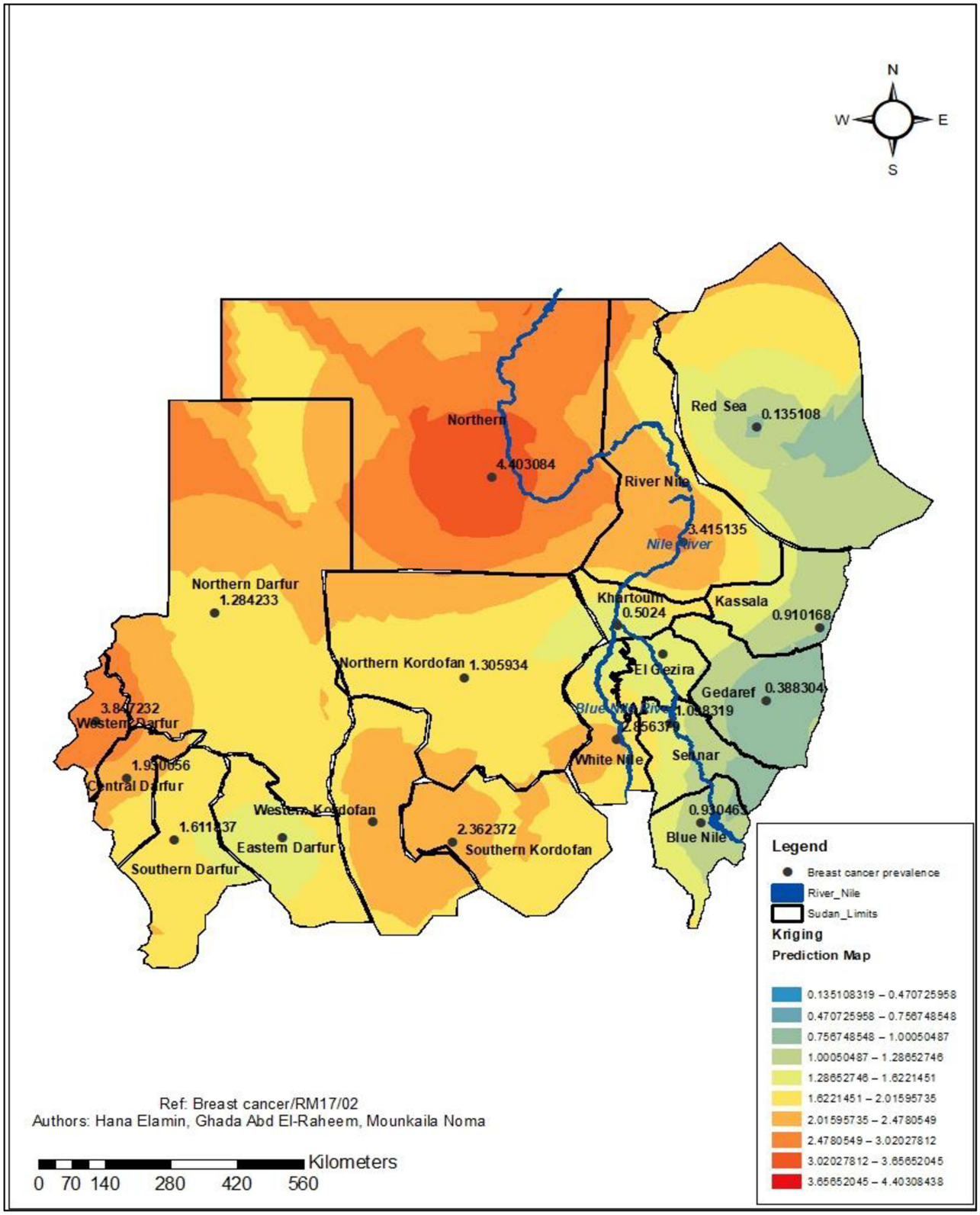

Figure 2 Risk map of breast cancer cases per million across the states of Sudan, base map layer direct link: https://www.diva-gis.org/datadown.

Conclusions

Breast cancer is widespread among the Sudanese population across all states of Sudan; especially northern parts of the country, Northern state and River Nile state. A significant majority of women diagnosed with breast cancer presented at advanced stages, often after a delay in seeking medical attention. Behavioral factors also influenced late presentation, with many women perceiving their symptoms as benign. Fear of diagnosis and treatment played as a strong contributing factor for late presentation along with seeking alternative treatments. Healthcare education plays a crucial role in addressing this issue, as a lack of awareness about breast self-examination (BSE) was identified as a major barrier to early detection. Additionally, poverty is a well-established obstacle for many African populations, and socio-economic factors significantly contributed to the late presentation of breast cancer cases. The findings of this study aim to enhance healthcare education in Sudan, helping to fulfil the goals of the African Union's Agenda 2063, which prioritizes the improvement of the quality of life for Africans, with a particular focus on poverty reduction, education, and health.

Supporting Information

Supporting information: PDF accompanying the manuscript.

Abbreviations

BC, Breast Cancer; BCE, Breast Cancer Education; BSE, Breast Self-Examination; CBE, Clinical Breast Examination; BGHI, Breast Global Health Initiative; LMIC, Low and Middle Income Countries; TNM, Tumor, Nodes and Metastases; FNAC, Fine needle aspiration cytology.

Data Sharing Statement

All data are available and supportive information provided along with the manuscript on submission.

Consent for Publication

All authors have read the final manuscript and gave their approval for publication.

Acknowledgments

The authors are grateful to the patients, doctors and nurses of the Khartoum Oncology Hospital who enabled this study to be completed.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

No funding was applied for this study.

Disclosure

The authors declared that there are no competing interests.

References

1. World Health Organization (WHO). Cancer. *Breast Cancer*. Available from https://www.who.int/cancer/prevention/diagnosis-screening/breast-cancer/en/. Accessed May 09, 2025.
2. Elgaili EM, Abuidris DO, Rahman M, Michalek AM, Mohammed SI. Breast cancer burden in central Sudan. *Int J Women's Health*. 2010;2:77–82. doi:10.2147/ijwh.s8447 PMID: 21072300; PMCID: PMC2971742.
3. Lodhi FB, Ahmad B, Shah IH, et al. Determinants of delayed presentation in breast cancer. *APMC*. 2010;4(2):9–16.

4. Fatima Ayaz, Saeed Bin Ayaz, Muhammad Farrukh. Reasons for delayed presentation of women with breast cancer. *J Islamabad Med Dent Coll*. 2016;5:187.
5. Mordang JJ, Gubern-Mérida A, Bria A, et al. The importance of early detection of calcifications associated with breast cancer in screening. *Breast Cancer Res Treat*. 2018;167(2):451–458. doi:10.1007/s10549-017-4527-7
6. Sathian B, Nagaraja SB, Banerjee I, et al. Awareness of breast cancer warning signs and screening methods among female residents of Pokhara valley, Nepal. *Asian Pac J Cancer Prev*. 2014;15(11):4723–4726. doi:10.7314/apjcp.2014.15.11.4723 PMID: 24969910.
7. Surdyka JA, Surdyka D, Stanisławek A, Starosławska E, Patyra KI. Selected breast cancer risk factors and early detection of the neoplasm in women from Lublin region attending screening program in St. John's Cancer Center, years 2005–2006. *Ann Agric Environ Med*. 2014;21 (4):792–798. doi:10.5604/12321966.1129935
8. Suwankhong D, Liamputtong P. Early detection of breast cancer and barrier to screening programmes amongst Thai Migrant Women in Australia: a qualitative study. *Asian Pac J Cancer Prev*. 2018;19(4):1089–1097. doi:10.22034/APJCP.2018.19.4.1089
9. Black E, Richmond R. Improving early detection of breast cancer in sub-Saharan Africa: why mammography may not be the way forward. *Global Health*. 2019;15(1). doi:10.1186/s12992-018-0446-6
10. Jedy-Agba E. Breast cancer in Sub-Saharan Africa: determinants of stage at diagnosis and diagnostic delays in women with symptomatic breast cancer. 2017.
11. Dafaallah Awadelkarim K, Elhaj A, Aceto G, Mariani-Costantini R, Abdalla Eltayeb E. Hereditary breast cancer in Sub-Saharan Africa. *Current Women s Health Rev*. 2012;8:44–54. doi:10.2174/157340412799079219
12. Tsoka-Gwegwenia JM, Cumber SN, Nchanji KN. Breast cancer among women in sub-Saharan Africa: prevalence and a situational analysis. *Southern Afr J Gynaecol Oncol*. 2017;9(2):28–30. doi:10.1080/20742835.2017.1391467
13. Anyanwu SN. Temporal trends in breast cancer presentation in the third world. *J ExpClin Cancer Res*. 2008;27(1):17. doi:10.1186/1756-9966-27-17
14. Manzoor S, Anwer M, Soomro S, Kumar D. Presentation, diagnosis and management of locally advanced breast cancer: is it different in low/middle income countries? *Pak J Med Sci*. 2019;35(6):1554–1557. doi:10.12669/pjms.35.6.165
15. Esan D, Fasoro A, Olatoye O, Ojo E, Esan T. Breast cancer trend: a case study of a tertiary health institution in Nigeria. *Middle East J Cancer*. 2018;9(4):311–317. doi:10.30476/mejc.2018.42143
16. Nwaneri A, Osuala EO, Okpala PU, Emesowum AC, Iheanacho P. Knowledge and awareness of breast cancer among rural women in UmuowaOrlu Local Government Area Imo State, South East, Nigeria. *Niger J Clin Pract*. 2017;20(4):489–494. doi:10.4103/1119-3077.204374
17. Gulzar F, Akhtar MS, Sadiq R, Bashir S, Jamil S, Baig SM. Identifying the reasons for delayed presentation of Pakistani breast cancer patients at a tertiary care hospital. *Cancer Manag Res*. 2019;11:1087–1096. doi:10.2147/CMAR.S180388
18. Baig M, Sohail I, Altaf HN, Altaf OS. Factors influencing delayed presentation of breast cancer at a tertiary care hospital in Pakistan. *Cancer Reports*. 2018;2:e1141. doi:10.1002/cnr2.1141
19. Memon ZA, Shaikh AN, Rizwan S, Sardar MB. Reasons for patient's delay in diagnosis of breast carcinoma in Pakistan. *Asian Pac J Cancer Prev*. 2013;14(12):7409–7414. doi:10.7314/apjcp.2013.14.12.7409
20. Bonsu AB, Ncama BP. Evidence of promoting prevention and the early detection of breast cancer among women, a hospital-based education and screening interventions in low- and middle-income countries: a systematic review protocol. *Syst Rev*. 2018;7(1):234. doi:10.1186/s13643-018-0889-0 PMID: 30547842; PMCID: PMC6293627.
21. Elamin A, Ibrahim ME, Abuidris D, Mohamed KE, Mohammed SI. Part I: cancer in Sudan—burden, distribution, and trends breast, gynecological, and prostate cancers. *Cancer Med*. 2015;4(3):447–456. doi:10.1002/cam4.378 Epub 2015 Jan 30. PMID: 25641872; PMCID: PMC4380970.
22. Akhtari-Zavare Mehrnoosh, Muhamad Hanafiah Juni, Rosliza Abdul Manaf, Zarina-Ismail Irmi. Knowledge on breast cancer and practice of breast self examination among selected female university students in Malaysia. *Med Health Sci J*. 2011;7:1804–1884. doi:10.15208/mhsj.2011.132
23. Joyce C, Ssenyonga LVN, Iramiot JS. Breast self-examination among Female Clients in a Tertiary Hospital in Eastern Uganda. *Int J Afr Nurs Sci*. 2020;12:100186. doi:10.1016/j.ijans.2019.100186
24. Abuidris DO, Elsheikh A, Ali M, et al. Breast-cancer screening with trained volunteers in a rural area of Sudan: a pilot study. *Lancet Oncol*. 2013;14(4):363–370. doi:10.1016/S1470-2045(12)70583-1
25. Ramathuba DU, Ratshirumbi CT, Mashamba TM. Knowledge, attitudes and practices toward breast cancer screening in a rural South African community. *Curationis*. 2015;38(1):1172. doi:10.4102/curationis.v38i1.1172
26. Solikhah S, Promthet S, Hurst C. Awareness level about breast cancer risk factors, barriers, attitude and breast cancer screening among Indonesian women. *Asian Pac J Cancer Prev*. 2019;20(3):877–884. doi:10.31557/APJCP.2019.20.3.877 PMID: 30912407; PMCID: PMC6825774.
27. Mariani-Costantini R, Elhassan MM, Aceto GM, Mohamedani AA, Awadelkarim KD. Epidemiology, pathology, management and open challenges of breast cancer in Central Sudan: a prototypical limited resource African setting. *Breast Cancer Biol Med*. 2017;2:3–14. doi:10.5772/67175
28. Salih AM, Alfaki MM, Alam-Elhuda DM, Nouradyem MM. Factors delaying presentation of Sudanese breast cancer patients: an analysis using andersen's model. *Asian Pac J Cancer Prev*. 2016;17(4):2105–2110. doi:10.7314/apjcp.2016.17.4.2105
29. Elbasheer MMA, Alkhidir AGA, Mohammed SMA, et al. Spatial distribution of breast cancer in Sudan 2010-2016. *PLoS One*. 2019;14(9): e0211085. doi:10.1371/journal.pone.0211085 PMID: 31525202; PMCID: PMC6746353.
30. Saeed ME, Cao J, Fadul B, et al. A five-year survey of cancer prevalence in Sudan. *Anticancer Res*. 2016;36(1):279–286.
31. Odongo J, Makumbi T, Kalungi S, Galukande M. Patient delay factors in women presenting with breast cancer in a low income country. *BMC Res Notes*. 2015;8:467. doi:10.1186/s13104-015-1438-8
32. Donkor A. Factors contributing to late presentation of breast cancer in Africa: a systematic literature review. *Arch Med*. 2015;8:2.
33. Alhurishi S, Lim JNW, Potrata B, West R. Factors influencing late presentation for breast cancer in the Middle East: a systematic review. *Asian Pacific J Cancer Prevention*. 2011;12:1597–1600.
34. Montazeri A, Ebrahimi M, Mehrdad N, Ansari M, Sajadian A. Delayed presentation in breast cancer: a study in Iranian women. *BMC Women's Health*. 2003;3(1):4. doi:10.1186/1472-6874-3-4 PMID: 12846932; PMCID: PMC166160.
35. Burgess CC, Ramirez AJ, Richards MA, Love SB. Who and what influences delayed presentation in breast cancer? *Br J Cancer*. 1998;77 (8):1343–1348. doi:10.1038/bjc.1998.224 PMID: 9579844; PMCID: PMC2150175.

36. Toan DTT, Son DT, Hung LX, Minh LN, Mai DL, Hoat LN. Knowledge, attitude, and practice regarding breast cancer early detection among women in a mountainous area in Northern Vietnam. *Cancer Control*. 2019;26(1):1073274819863777. doi:10.1177/1073274819863777 PMID: 31331185; PMCID: PMC6651667.
37. Scheel JR, Molina Y, Anderson BO, et al. Breast cancer beliefs as potential targets for breast cancer awareness efforts to decrease late-stage presentation in Uganda. *J Glob Oncol*. 2018;4:1–9. doi:10.1200/JGO.2016.008748 Epub 2017 Jul 17. PMID: 30241166; PMCID: PMC6180808.
38. Gangane N. Breast cancer in rural India: knowledge, attitudes, practices; delays to care and quality of life [Internet] [PhD dissertation]. [Umeå]: umeåuniversitet; 2018. (UmeåUniversitymedicaldissertations). Availablefrom:http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-145427. Accessed May 9, 2025.
39. Cheng ML, Ling DY, Kp NP, Nording H, Lim CH. Factors influencing late stage of breast cancer at presentation in a district Hospital - Segamat Hospital, Johor. *Med J Malaysia*. 2015;70(3):148–152.
40. Lim JN, Potrata B, Simonella L, et al. Barriers to early presentation of self-discovered breast cancer in Singapore and Malaysia: a qualitative multicentre study. *BMJ Open*. 2015;5(12):e009863. doi:10.1136/bmjopen-2015-009863 PMID: 26692558; PMCID: PMC4691764.
41. Brinton L, Figueroa J, Adjei E, et al. Factors contributing to delays in diagnosis of breast cancers in Ghana, West Africa. *Breast Cancer Res Treat*. 2017;162:105–114. doi:10.1007/s10549-016-4088-1
42. Binder M, Roberts C, Spencer N, Antoine D, Cartwright C. On the antiquity of cancer: evidence for metastatic carcinoma in a young man from Ancient Nubia (*c*. 1200BC). *PLOSONE*. 2014;9(3):e90924. doi:10.1371/journal.pone.0090924
43. MohdMujar NM, Dahlui M, Emran NA, et al. Complementary and alternative medicine (CAM) use and delays in presentation and diagnosis of breast cancer patients in public hospitals in Malaysia. *PLoS One*. 2017;12(4):e0176394. doi:10.1371/journal.pone.0176394 PMID: 28448541; PMCID: PMC5407802.
44. Akuoko CP, Armah E, Sarpong T, Quansah DY, Amankwaa I, Boateng D. Barriers to early presentation and diagnosis of breast cancer among African women living in sub-Saharan Africa. *PLoS One*. 2017;12(2):e0171024. doi:10.1371/journal.pone.0171024 PMID: 28192444; PMCID: PMC5305236.