



## NON-COMMUNICABLE DISEASE

# Diagnostic delay among symptomatic breast cancer patients: a study in Sudanese women

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## Key words

Breast cancer • Diagnosis, Delay • Prevalence

## Summary

**Background.** Early diagnosis of breast cancer is essential for effective treatment and improved survival rates. A longer gap between the appearance of symptoms and the initiation of therapy results in advanced disease and lower survival.

**Objectives:** to assess factors associated with diagnosis delay among Sudanese women with breast cancer.

**Methods.** A prospective, descriptive cross-sectional study conducted at Radiation and Isotope Centre of Khartoum (RICK) in Khartoum, Sudan. Relationship between the independent variables and the main outcome of the study was determined by multivariate regression analysis.

**Results.** A total number of 149 women participated in the study. A total of 58.4% of patients delayed seeking medical advice for more than three months after noticing symptoms. The delay was associ-

ated with patient's area of residence and age. Women coming from outside Khartoum had a higher odd of having delayed diagnosis of breast cancer (AOR = 3.283, 95% CI: 1.113 9.687,  $p = .031$ ). Likewise, older age was another predictor of delayed diagnosis of breast cancer among the study participants (AOR = 101.664, 95% CI: 4.839 - 2135.883,  $p = .003$ ).

**Conclusions.** The present study showed that more than half of the women who participated had experienced delays in seeking medical attention for their breast cancer symptoms. This finding highlighted the impact of limited access to healthcare services as a contributing factor to such delays. These findings show the need for collaborative approaches to address the challenges surrounding breast cancer in Sudan.

## Background

Breast cancer is the most prevalent cancer in women and one of the leading causes of cancer death among women, with nearly 2.26 million new cases of breast cancer diagnosed in women worldwide in 2020 [1-3]. Amongst women, breast cancer accounts for approximately one in four cancer diagnoses and one in six cancer-related deaths globally [4]. Regarding breast cancer survival, significant disparities exist across countries [3]. The sub Saharan Africa region faces a unique set of challenges related to managing breast cancer, largely due to socioeconomic factors and health systems. These include delays in starting standard treatments due to insufficient patient education, limited access to care, and high financial burdens, making it even more difficult to effectively combat the disease [2].

Early diagnosis of breast cancer is essential for effective treatment and improved survival rates as timely detection and treatment offer the best chance of improving breast cancer outcomes [4]. A longer gap between the appearance of symptoms and the initiation of therapy results in advanced disease and lower survival rates [5]. Higher mortality and late stage of the disease are seen with delay in diagnosis and treatment of breast cancer. However, prompt treatment within three months can

significantly increase a woman's chances of surviving breast cancer [6, 7].

In developing countries, delayed presentation of breast cancer is a common problem. While more than 70% of breast cancer patients in high-income countries are diagnosed in stage 1 and 2, the corresponding proportion in low- and middle-income countries is about 20–50% [8,9]. Studies show that delayed presentation is significantly affected by the patients' health-seeking behaviour and several factors are related to delay in diagnosis including age, educational level, breast cancer awareness, economic status, and the nature of first symptoms noted by the patients [10].

While breast cancer rates are rising in Sudan, data about this problem in the country are scarce [11]. The rarity of such studies in this population highlights the existing knowledge gap. Moreover, conducting such a study could help identify the reasons for patients' delays and the factors associated with it, which will provide information for stakeholders to adapt strategies to shorten the time of delay. By studying this delay, researchers can identify areas for targeted improvement in the healthcare system and patient education to increase early detection rates, which can ultimately contribute to a reduction in breast cancer mortality rates. The aim of this study was to assess and investigate factors associated with the delayed presentation of breast cancer.

## Methods

### STUDY DESIGN AND SETTINGS

A prospective, hospital based, descriptive cross-sectional study conducted at Radiation and Isotope Centre of Khartoum (RICK) in Khartoum, Sudan during the period between 1st January and 15th February 2018. The setting main referral hospital and one of the only two public centres in Sudan specialized in oncology services and cancer care [11]. The hospital provides a host of therapeutic and diagnostic services for a significant portion of the population in Khartoum state, as well as, to citizens coming from all other states of the country.

The inclusion criteria for this study were all female patients with breast cancer presented to the hospital during the study period, with the exclusion of those refusing to participate in the study. This represents a census of the eligible population within that timeframe. However, we performed sample size calculation based on a power analysis to ensure adequate statistical power and generalizability of the findings. The sample size was determined by the following formula ( $n = z^2 \cdot p \cdot q / d^2$ ); where  $n$  is the sample size,  $z$  is the standard deviation (1.96),  $p$  is the prevalence (89%),  $q$  is 1 minus the prevalence, and  $d$  is the margin of error. The sample size was estimated with 5 % margin of error and 95% confidence. Since no similar published study was available in Sudan at the time of this research, a study conducted in Uganda was referenced, where the prevalence of delaying presentation of breast cancer was 89% [12]. Therefore, this proportion was used to estimate the sample size for the current study. A total of twenty-five patients were excluded from the study because they refused to consent to participate.

### DATA COLLECTION

The data collection process was done by using a questionnaire during the interview with the participants. The questionnaire, which took approximately 10 minutes to complete, was designed based on the literature and study objectives to collect information about participants' demographics, their experiences with breast cancer diagnosis, and the factors that may have contributed to any delays in seeking medical consultation. Diagnosis time variable was calculated as the interval between the date of the first symptoms reported by the patient and the date of the medical consultation with a specialized breast cancer doctor (surgeon or oncologist). For further analysis, we categorized patients according to the presentation time into two groups: those diagnosed within three months of their first symptoms and those diagnosed after three months. We defined a "delay in diagnosis" as a situation where a patient took longer than three months from noticing symptoms to seeking medical attention and receiving a breast cancer diagnosis [13-16].

Several socio-demographic and health characteristics were considered potential determinants of diagnosis delay and were considered independent variables in this study. These factors included age; residence (Khartoum,

outside Khartoum); educational level (illiterate, primary school, secondary school, university degree); monthly income in SDG (less than 1000, 1000-2000, more than 2000); occupation (employed, unemployed); marital status (married, single, widow, divorced); practicing breast self-examination (no, yes); first symptoms noticed (pain, paraesthesia, breast lump, skin changes and edema, ulcer); family history of breast cancer (no, yes); and stated reasons for delayed presentation after noticing the symptoms.

### DATA ANALYSIS

Sample baseline characteristics were presented with descriptive statistics in terms of the frequency and percentage of data. Because the continuous variables in our study showed a skewed distribution, as indicated by the results of Kolmogorov-Smirnov and Shapiro-Wilk tests, we presented continuous variables in form of median and interquartile range. In addition, linear correlation analysis, by using Spearman's rho correlation test, was done to show association between continuous variables. To investigate the potential associations between the postulated risk factors and the outcome, the analysis was done in two parts. In the first part, we performed the bivariate analyses for intergroup comparison to identify factors that have significant correlation with the outcome. Then, variables that showed a statistically significant relationship at the bivariate analyses level were further entered into the multivariate regression models. The results of regression analysis were reported as adjusted Odds Ratios (OR) along with their corresponding 95% Confidence Interval (95% CI). Data analysis was performed using the SPSS software version 20 (SPSS Inc., Chicago, IL, USA). The  $p$ -value of  $< .05$  was set as the significance level for all analyses of the study.

### ETHICAL CONSIDERATION AND CONSENT

Before study initiation, permission for conducting this research was obtained from the institutional review board of Faculty of Medicine, University of Khartoum, as well as from the general director of RICK hospital. Additionally, ethical clearance was obtained from the State Ministry of Health in Khartoum state, Sudan. Each participant was provided with a thorough explanation of the study, and informed consent was obtained before their participation. Participants were also assured of their right to withdraw from the study at any time, even after giving consent. The confidentiality of all study participants was maintained. All data pertaining to patients and hospital staff were kept secure throughout the research process, ensuring the privacy and confidentiality of the collected information.

## Results

### FEATURES OF THE STUDY PARTICIPANTS

A total number of 149 women participated in the study (response rate = 100%). The median and interquartile

range age of the participants was  $49.9 \pm 12.0$  years. Most of the participants were unemployed (77.9%) and near half of them (49%) had a monthly income of less than 1000 SDG (with one SDG equivalent to 0.0278 US dollars at the time of data collection). Additionally, 41.6% of the women had attended secondary school. More than half of the participants (58.4%) lived outside Khartoum state (Tab. I).

A total of 25.5% of the participants reported having a family history of breast cancer. Regarding self-examination prior to the onset of symptoms, 16.1% indicated that they performed self-examinations, whereas 83.9% did not. The first symptom noticed by 58.4% of the patients was a breast lump, while 20.1% initially experienced pain. Additionally, 24.8% of the women reported a lack of social support from family and spouses upon the appearance of symptoms. The baseline characteristics of the participants are presented in table I. The median and IQR for time between noticing a symptom and consulting a medical doctor was  $7.0 \pm 17.0$  months. A total of 58.4% of patients delayed seeking

medical advice for more than 3 months. There were several reasons stated by the respondents that affect their decision to seek medical advice. Most of the patients (83.9%) reported delaying seeking medical attention because they either underestimated the significance of their breast symptoms or did not believe they could actually have breast cancer. The other common reasons stated were seeking traditional healing instead of formal medical consultation (14.1%), lack of financial support (11.4%), previous misdiagnosis (19.5%), fear of stigma (10.1%), fear of treatments side effect (19.5%) (Tab. II).

#### PRESENTATION DELAY AND ITS ASSOCIATED FACTORS

Results of bivariate analysis showed a significant difference in proportion of delaying diagnosis between groups of residence outside Khartoum ( $X^2 = 14.27$ ,  $p < 0.001$ ), seeking traditional healing ( $X^2 = 17.42$ ,  $p < 0.001$ ), lack of financial support ( $X^2 = 13.67$ ,  $p < 0.001$ ), fear of stigma ( $X^2 = 11.89$ ,  $p < 0.001$ ), fear of embarrassment ( $X^2 = 5.17$ ,  $p = 0.026$ ), fear of

Tab. I. baseline characteristics of the respondents.

Variable		Number	Percent %
Age group	30-39 years	12	8.10
	40-49 years	64	43.0
	50-59 years	46	30.9
	> 60 years	27	18.1
Residence	Khartoum	62	41.6
	Outside Khartoum	87	58.4
Educational level	Illiterate	24	16.1
	Primary school	34	22.8
	Secondary school	62	41.6
	University	29	19.5
Monthly income	Less than 1000	73	49.0
	1000-2000	62	41.6
	More than 2000	14	9.4
Occupation	Employed	33	22.1
	Unemployed	116	77.9
Marital status	Married	86	57.7
	Single	8	5.4
	Widow	24	16.1
	Divorced	31	20.8
Practicing Breast self-examination	No	125	83.9
	Yes	24	16.1
First symptoms noticed	Pain	30	20.1
	Paraesthesia	8	5.4
	Breast lump	87	58.4
	Skin changes and edema	17	11.2
	Ulcer	7	4.7
Family history of breast cancer	No	111	74.5
	Yes	38	25.5

**Tab. II.** Reasons for delayed presentation of breast cancer among the participants.

Variable		Number	Percent %
Traditional healing was sought	No	128	85.9
	Yes	21	14.1
Lack of financial support	No	132	88.6
	Yes	17	11.4
Fear of stigma	No	134	89.9
	Yes	15	10.1
Fear of embarrassment	No	138	92.6
	Yes	11	7.4
Fear of treatments side effect	No	120	80.5
	Yes	29	19.5
Partner constrains	No	142	95.3
	Yes	7	4.7
Underestimating the condition	No	24	16.1
	Yes	125	83.9

treatment side effects ( $X^2 = 25.66$ ,  $p < 0.001$ ), previous misdiagnosis ( $X^2 = 14.49$ ,  $p < 0.001$ ), and family history of breast cancer ( $X^2 = 16.99$ ,  $p < 0.001$ ) (Tab. III). In addition, the correlation analysis showed a significant positive correlation between women age and time taken for presenting to the hospital with breast cancer ( $r = 0.28$ ,  $p = 0.001$ ), indicating that older people tend to have delaying diagnosis of breast cancer.

#### RESULTS OF MULTIVARIATE REGRESSION ANALYSIS

The finding of this analysis revealed that delayed diagnosis of breast cancer was only significantly associated with women age and residence. The other factors examined did not demonstrate a significant relationship. Regarding the area of residence, women coming from outside Khartoum had a higher odd of having delayed diagnosis of breast cancer (AOR = 3.283, 95% CI: 1.113 9.687,  $p = .031$ ). Likewise, older age was another predictor of delayed diagnosis of breast cancer among the study participants (AOR = 101.664, 95% CI: 4.839-2135.883,  $p = .003$ ) (Tab. IV).

#### Discussion

The study shed light on the barriers Sudanese women face in relation to breast cancer presentation. The main finding of this study was the high proportion of women delaying seeking medical attention for breast cancer symptoms, exceeding three months for over half the participants, which is higher than those reported by studies from Ethiopia and Nigeria [16, 17]. The median time interval for presentation in this study was longer than those of studies conducted in Tunisia and Iran [7, 18]. This delay can have potential negative consequences and harmful impact on the clinical outcomes of breast cancer, including increased tumor

size and stage at diagnosis, leading to more complex and aggressive treatments, and lower chances of successful treatment and survival.

Sudanese women face unique challenges in accessing healthcare, including financial barriers and cultural factors. The current study showed that residing outside the capital city of Khartoum was one of the factors associated with delayed presentation of breast cancer cases. This finding can be attributed to several potential contributing factors, such as the scarcity of public facilities that provide oncology services and cancer care [11]. Additionally, limited access to healthcare facilities and specialists in rural areas, financial constraints and difficulty accessing healthcare services, and the long travel times required to reach Khartoum for consultations due to transportation challenges in the country could contribute to the finding. Another factor related to rural residence is the populace of traditional healing practices. These cultural beliefs and practices related to health and illness can further limit access to evidence-based healthcare services [8].

Impact of the older age on the delayed presentation can be attributed to complex interplay of social, cultural, and personal factors. Stigma surrounding breast cancer can make women reluctant to discuss symptoms with family or friends and limited their access to support groups or counseling services. In addition, local cultural norms and expectations discourage open communication about health concerns of the women. Limited awareness and knowledge about breast cancer symptoms can lead to misinterpretation, with women dismissing symptoms as harmless or temporary, as shown by a previous study revealed lack of awareness of breast cancer among Sudanese women and clear ignorant attitude practiced by a significant proportion of them [19]. Lastly, old age could trigger fear and denial, making women hesitant to seek medical attention, particularly if they have witnessed the financial strain or treatment side effects experienced by relatives or family members.

Although routine mammography screening is recommended by the World Health Organization for early detection of symptoms to improve timely diagnosis and prognosis, the feasibility is significantly challenged by numerous factors related to limitation in resources and infrastructure, as well as, personal and socio-economic factors. A previous study assessed 110 Sudanese women showed poor practices regarding breast cancer screening and reveal that none of the participants ever did routine mammography screening [20].

There are implications that can be drawn from the study findings. From clinical perspective, knowledge and deeper understanding of the factors contributing to delayed breast cancer presentation in Sudanese women help the healthcare workers tailor their communication and interventions to address specific concerns and barriers. Since the emotional issues are significant factors for delaying presentation, healthcare providers need to prioritize clear and empathetic communication with patients, addressing their anxieties and concerns about breast cancer and its treatment.

**Tab. III.** Bivariate analysis of factors associated with delayed diagnosis of breast cancer.

Variable		Total No.	No. of patients with delayed diagnosis	$\chi^2$	p value
Age group	30-39 years	12	6	20.12	< .001
	40-49 years	64	34		
	50-59 years	46	21		
	> 60 years	27	26		
Residence	Khartoum	62	25	14.27	< .001
	Outside Khartoum	87	62		
Educational level	Illiterate	24	14	0.43	.94
	Primary school	34	19		
	Secondary school	62	38		
	University	29	16		
Monthly income	Less than 1000	73	37	3.51	.17
	1000-2000	62	41		
	More than 2000	14	9		
Occupation	Employed	33	17	0.82	.36
	Unemployed	116	70		
Marital status	Married	86	21	14.4	.02
	Single	8	1		
	Widow	24	20		
	Divorced	31	15		
Practicing Breast self-examination	No	125	77	3.29	.07
	Yes	24	10		
First symptoms noticed	Pain	30	22	4.97	.29
	Paraesthesia	8	6		
	Breast lump	87	46		
	Skin changes and edema	17	9		
	Ulcer	7	4		
Family history of breast cancer	No	111	45	16.99	< .001
	Yes	38	33		
Traditional healing was sought	No	128	66	17.42	< .001
	Yes	21	21		
Lack of financial support	No	132	70	13.67	< .001
	Yes	17	17		
Fear of stigma	No	134	72	11.89	< .001
	Yes	15	15		
Fear of embarrassment	No	138	77	5.17	.026
	Yes	11	10		
Fear of treatments side effect	No	150	58	25.66	< .001
	Yes	28	28		
Partner constrains	No	142	80	5.23	.042
	Yes	7	7		
Underestimating the condition	No	24	12	0.83	.369
	Yes	125	75		

The findings highlight the need for developing targeted screening programs and outreach initiatives to reach women, particularly those residing in underserved areas and allocation of resources to improve access

to healthcare services in rural areas, including the establishment of more primary care clinics and specialized breast cancer centers. A previous program of implementing screening using local volunteers showed

**Tab. IV.** Multivariate regression results of factors associated with delayed diagnosis of breast cancer.

Variable		AOR	CI	p value
Age group	30-39 years	Ref.	-	-
	40-49 years	2.147	0.220-20.939	.511
	50-59 years	1.713	0.164- 17.947	.653
	> 60 years	101.664	4.839-2135.883	.003
Residence	Khartoum	Ref.	-	-
	Outside Khartoum	3.283	1.113-9.687	.031

promising results regarding detection of breast cancer in rural areas of Sudan, demonstrating the potential impact of community-based initiatives in improving healthcare outcomes [21]. In addition, the findings also highlight importance of investing in community-based health programs, particularly those focused on breast cancer awareness, screening, and education, to actively challenge cultural norms and perceptions that contribute to stigma can have a significant impact on early detection.

The findings of this study should be interpreted within the context of certain limitations. Due to the specific location of the study, generalizing the findings to the broader population may be restricted. While our multivariate logistic regression analysis identified two significant factors associated with the outcome, it is important to acknowledge that the study's relatively small sample size may have limited our ability to detect other potential associations. With a larger sample, we might have observed statistically significant relationships for additional factors that were not identified in this analysis. Delayed breast cancer presentation in Sudan is a substantial problem that warrants further research with a larger sample size to explore the influence of all potential factors and to confirm the findings of this study. Lastly, the self-reported nature of the data could raise potential for recall bias or inaccurate reporting.

## Conclusions

The present study showed that more than half of the women who participated had experienced delays in seeking medical attention for their breast cancer symptoms. This finding highlighted the impact of limited access to healthcare services as a contributing factor to such delays. These findings indicate the role limited access to healthcare services in contributing to this delay. The study shows the need for a collaborative and comprehensive approaches to address the challenges surrounding breast cancer in Sudan.

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international health directorate, Federal Ministry of Health, Sudan) is greatly acknowledged for his valuable notes.

## Availability of data and materials

The dataset generated during this study are available from the corresponding author on reasonable request.

## Consent for publication

Not applicable.

## Ethics approval and consent to participate

Before study initiation, permission for conducting this research was obtained from the institutional review board of Faculty of Medicine, University of Khartoum, as well as from the general director of RICK hospital. Additionally, ethical clearance was obtained from the State Ministry of Health in Khartoum state, Sudan. Each participant was provided with a thorough explanation of the study, and informed consent was obtained before their participation. Participants were also assured of their right to withdraw from the study at any time, even after giving consent. The confidentiality of all study participants was maintained. All data pertaining to patients and hospital staff were kept secure throughout the research process, ensuring the privacy and confidentiality of the collected information.

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## Conflicts of interest statement

The authors declare that they have no competing interests.

## Authors' contributions

M.M.: conceptualized the research idea. M.M. and M.A.: made the study design and undertook data collection. M.M. and S.M.: undertook data analysis. M.M., M.A., K.A., I.E., H.M.S., D.M., A.A., A.H., and S.M.: interpreted the results and drafted the manuscript. All authors revised, read, and approved the final manuscript.

## References

- [1] Shinden Y, Kamimura K, Hayashi N, Nomoto Y, Nagata A, Eguchi Y, Yano H, Saho H, Nakajo A, Minami K, Hirashima

- T, Sasaki K, Yoshinaka H, Owaki T, Tanimoto A, Nakamura M, Otsuka T. Relationship between Delayed Breast Cancer Diagnosis and Behavioral Economic Factors and Personality Characteristics. *Asian Pac J Cancer Prev* 2023;24:3437-40. <https://doi.org/10.31557/APJCP.2023.24.10.3437>.
- [2] Twahir M, Oyeseun R, Yarney J, Gachii A, Edusa C, Nwogu C, Mangutha G, Anderson P, Benjamin E, Müller B, Ngoh C. Real-world challenges for patients with breast cancer in sub-Saharan Africa: a retrospective observational study of access to care in Ghana, Kenya and Nigeria. *BMJ Open* 2021;11:e041900. <https://doi.org/10.1136/bmjopen-2020-041900>.
- [3] Lv L, Zhao B, Kang J, Li S, Wu H. Trend of disease burden and risk factors of breast cancer in developing countries and territories, from 1990 to 2019: results from the Global Burden of Disease Study 2019. *Front Public Health* 2023;10:1078191. <https://doi.org/10.3389/fpubh.2022.1078191>.
- [4] Retell JD, Cameron JK, Aitken JF, Youl P, Pyke C, Dunn J, Chambers S, Baade PD. Individual and area level factors associated with the breast cancer diagnostic-treatment interval in Queensland, Australia. *Breast Cancer Res Treat* 2024;203:575-86. <https://doi.org/10.1007/s10549-023-07134-4>.
- [5] An D, Choi J, Lee J, Kim JY, Kwon S, Kim J, Lee S, Jeon S, Lee C, Lee S, Woo H. Time to surgery and survival in breast cancer. *BMC Surg* 2022;22:388. <https://doi.org/10.1186/s12893-022-01835-1>.
- [6] Ho PJ, Cook AR, Binte Mohamed Ri NK, Liu J, Li J, Hartman M. Impact of delayed treatment in women diagnosed with breast cancer: A population-based study. *Cancer Med* 2020;9:2435-44. <https://doi.org/10.1002/cam4.2830>.
- [7] Dianatinasab M, Fararouei M, Mohammadianpanah M, Zare-Bandamiri M. Impact of social and clinical factors on diagnostic delay of breast cancer: A Cross-sectional Study. *Medicine* 2016;95:e4704. <https://doi.org/10.1097/MD.0000000000004704>.
- [8] Foroozani E, Ghiasvand R, Mohammadianpanah M, Afrashteh S, Bastam D, Kashefi F, Shakarami S, Dianatinasab M. Determinants of delay in diagnosis and end stage at presentation among breast cancer patients in Iran: a multi-center study. *Sci Rep* 2020;10:21477. <https://doi.org/10.1038/s41598-020-78517-6>.
- [9] Rai A, Sharda P, Aggarwal P, Ravi B. Study of Diagnostic Delay among Symptomatic Breast Cancer Patients in Northern India: A Mixed-Methods Analysis from a Dedicated Breast Cancer Centre. *Asian Pac J Cancer Prev* 2022;23:893-904. <https://doi.org/10.31557/APJCP.2022.23.3.893>.
- [10] Sobri FB, Bachtar A, Panigoro SS, Ayuningtyas D, Gustada H, Yuswar PW, Nur AA, Putri RCRA, Widihiyati AD. Factors Affecting Delayed Presentation and Diagnosis of Breast Cancer in Asian Developing Countries Women: A Systematic Review. *Asian Pac J Cancer Prev* 2021;22:3081-92. <https://doi.org/10.31557/APJCP.2021.22.10.3081>.
- [11] Abdalla Elhassan SI. The five-year survival rate of breast cancer at Radiation and Isotopes Centre Khartoum, Sudan. *Heliyon* 2020;6:e04615. <https://doi.org/10.1016/j.heliyon.2020.e04615>.
- [12] 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. <https://doi.org/10.1186/s13104-015-1438-8>.
- [13] Montazeri A, Ebrahimi M, Mehrdad N, Ansari M, Sajadian A. Delayed presentation in breast cancer: a study in Iranian women. *BMC Womens Health* 2003;3:4. <https://doi.org/10.1186/1472-6874-3-4>.
- [14] Tesfaw A, Demis S, Munye T, Ashuro Z. Patient Delay and Contributing Factors Among Breast Cancer Patients at Two Cancer Referral Centres in Ethiopia: a Cross-Sectional Study. *J Multidiscip Healthc* 2020;13:1391-401. <https://doi.org/10.2147/JMDH.S275157>.
- [15] Soh JY, Yahya MM, Bachok N, Wan Zain WZ, Wong MP, Zakaria Z, Hashim Isa Merican SR, Md Hashim MN, Wan Mokhter WM, Ramely R, Zakaria AD, Mohamad IS. Factors associated with delay in seeking care for breast symptoms. *BMC Womens Health* 2022;22:316. <https://doi.org/10.1186/s12905-022-01898-5>.
- [16] Olarewaju SO, Oyekunle EO, Bamiro AO. Effect of Sociodemographic Variables on Patient and Diagnostic Delay of Breast Cancer at the Foremost Health Care Institution in Nigeria. *J Glob Oncol* 2019;5:1-8. doi: 10.1200/JGO.19.00108.
- [17] Gebremariam A, Addissie A, Worku A, Assefa M, Pace LE, Kantelhardt EJ, Jemal A. Time intervals experienced between first symptom recognition and pathologic diagnosis of breast cancer in Addis Ababa, Ethiopia: a cross-sectional study. *BMJ Open* 2019;9:e032228. <https://doi.org/10.1136/bmjopen-2019-032228>.
- [18] Balhi S, Khiari H, Hsairi M. Factors Associated with Diagnostic Delays among Tunisian Breast Cancer Patients. *Asian Pac J Cancer Prev* 2023;24:471-7. <https://doi.org/10.31557/APJCP.2023.24.2.471>.
- [19] Rafat Munir Lawis M, Sabir M. Breast cancer awareness among Sudanese females in Omdurman city: 2021. *BMC Public Health* 2023;23:1907. <https://doi.org/10.1186/s12889-023-16833-y>.
- [20] Altirifi HI, Elsanousi OM, Bedri S. Very poor practices regarding breast cancer screening among Sudanese female workers at a secondary-level hospital: a cross-sectional study. *Pan Afr Med J* 2022;41:43. <https://doi.org/10.11604/pamj.2022.41.43.30179>.
- [21] Abuidris DO, Elsheikh A, Ali M, Musa H, Elgaili E, Ahmed AO, Sulieman I, Mohammed SI. Breast-cancer screening with trained volunteers in a rural area of Sudan: a pilot study. *Lancet Oncol* 2013;14:363-70. [https://doi.org/10.1016/S1470-2045\(12\)70583-1](https://doi.org/10.1016/S1470-2045(12)70583-1).

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