



Educational Opportunities for Down-Staging Breast Cancer in Low-Income Countries: an Example from Tanzania

Kristen Yang¹ · Khadija Msami² · Rose Calixte¹ · Julius Mwaeselage² · Joan Dorn¹ · Amr S. Soliman¹ 

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Abstract

While more than 90% of breast cancer patients in western countries survive for at least 5 years, the survival rate in Tanzania is less than 45% because of late stage at presentation. The aim of this study was to identify patient and health system factors related to early or late stages of a breast cancer diagnosis. The study was conducted at the Ocean Road Cancer Institute (ORCI) in Dar es Salaam, Tanzania, and included interviews with 196 breast cancer patients diagnosed with early (stage I/II, $n = 44$) or late (stage III/IV, $n = 152$) stage who were referred to ORCI from January 2016 to August 2018. The questionnaire elicited information regarding disease history, sociodemographics, barriers to navigating the health system, and patient attitudes towards breast cancer. More early-stage patients (54.5%) stated history of previous breast examinations before their initial diagnosis compared to late-stage patients (19.7%) ($p < 0.001$). Financial restraints were cited more often as barriers to diagnosis among late-stage presentation patients (55.7%) compared to early-stage patients (35.5%) ($p = 0.047$). Patients who were diagnosed at late-stage (47.5%) were also more likely to state time restraints as significant barriers to their diagnosis than early-stage patients (25.8%) ($p = 0.041$). Although the late diagnosis of breast cancer will take immense efforts of policy workers to resolve, this study offers significant opportunities for making immediate health system changes through patient and physician education that can aid in reducing diagnosis delay in Tanzania other low-income developing countries, and low-income communities within the USA.

Keywords Breast cancer · Education · Down-staging · Delayed diagnosis · Tanzania · Developing countries

Introduction

According to the worldwide cancer database GLOBOCAN (Global Cancer Incidence, Mortality, and Prevalence), over 2.1 million women were newly diagnosed with breast cancer worldwide in 2018 [1, 2]. While developed regions have experienced relatively stable breast cancer incidence and mortality rates throughout the past two decades, there has been a rapid increase in incidence and mortality rates among low-income regions, including Sub-Saharan Africa and South Asia. A combination of increases in screening programs, aging populations, adoption of Western lifestyles, and lack of treatment resources have contributed to the increase in

incidence and mortality rates in these low-income regions [1, 3, 4]. The 5-year survival rates decrease significantly with advancing breast cancer stage from approximately 100% for stage 0/I, to 93% for stage II, to 72% for stage III, and to 22% for patients diagnosed with stage IV breast cancer [5]. Although early detection is essential for favorable breast cancer prognosis, late presentation of breast cancer has increasingly contributed to the high breast cancer mortality rates in low-income countries [6].

Low-income countries generally experience lower incidence rates of breast cancer; however, there is a disproportionately 50% higher mortality rate relative to incidence rates in these countries [1]. For instance, Central Africa's mortality to incidence ratio of 0.55 compared to the USA's ratio of 0.16 demonstrates significant disparities in breast cancer outcomes. The high ratio, in part, reflects the significant proportion of women in low-income countries presenting with advanced stage breast cancer when treatment is less effective [7, 8]. Countries in Sub-Saharan Africa, such as Kenya, have reported that 70–80% of breast cancer patients are diagnosed as stage III or stage IV [9]. A study analyzing the stage

✉ Amr S. Soliman
asoliman@med.cuny.edu

¹ Department of Community Health and Social Medicine, City University of New York School of Medicine, New York, NY, USA

² Ocean Road Cancer Institute, Dar es Salaam, Tanzania

distribution in Nigeria, Uganda, and Zambia also found that 64–89% of women with breast cancer were diagnosed at late stages [10]. Especially as these countries become more westernized, appropriate diagnostic and treatment methods must be implemented to accommodate for the rising incidence of breast cancer in low-income countries. Thus, there is significant urgency in identifying the specific patient and health provider factors involved in delaying breast cancer diagnosis in developing countries.

In Tanzania, breast cancer is the second most common cancer among women, following cervical cancer; however, it often remains undiagnosed until advanced stages [11]. The Tanzania Breast Care 2017 Assessment reports a projected increase of 82% in newly diagnosed breast cancer cases by 2030. Breast cancer is fatal for over 56% of women in Tanzania who are diagnosed and the lifetime risk for women developing breast cancer is 1 in 20 [11]. Although breast cancer screening programs have been initiated recently in Tanzania, delayed diagnosis has continually contributed to the increasingly high-mortality rates of the disease [12–14]. Approximately, 80% of female breast cancer patients in Tanzania are diagnosed at stage III or IV [15]. However, factors that result in late presentations of breast cancer among women in Tanzania remain unclear [12, 16, 17].

Therefore, the purpose of this study was to identify patient and health system factors that predict the presentations of the early or late stages of breast cancer among female patients in Tanzania.

Methods

Study Design

The Ocean Road Cancer Institute (ORCI) is Tanzania's first and only specialized center for cancer treatment that provides services including chemotherapy, radiotherapy, and palliative care.

Eligible participants in this study consisted of female breast cancer patients, 18 years of age and older, and who were newly referred to ORCI for treatment from January 2016 to August 2018. Patients diagnosed with stage I or II breast cancer were included in the early presentation group and patients diagnosed with stage III or IV breast cancer were included in the late presentation group. Interviewer-administered questionnaires conducted by a trained nurse elicited information regarding the sociodemographic background of patients and patient and health system factors related to the timing of breast cancer diagnosis.

Study Population

The study population consisted of 196 participants. All eligible female breast cancer patients referred to ORCI for treatment from January 2016 to August 2018 were included in the study. Participants were recruited and informed consent was received

in-person from the chemotherapy clinic, outpatient wards, and insurance clinics. There was a 100% participation rate.

Data Collection

The nurse interviewer administered a one-time 15-min questionnaire in Swahili. The questionnaire was reviewed by ORCI's breast cancer nurses to ensure cultural competency and included questions regarding patients' screening attendance, financial restraints, travel time to the nearest breast cancer facility, medical history, and attitudes towards breast cancer screening. After each interview, each participant's medical record was reviewed to validate the date of breast cancer diagnosis and referral history.

Statistical Analyses

Characteristics of breast cancer patients were summarized using appropriate descriptive statistics such as mean, standard deviation, median (interquartile range), and frequency (percent). The characteristics of early-stage and late-stage diagnosis of breast cancer were compared using two-sample *t* test, Wilcoxon rank sum test, and the chi-square test of independence, with exact *p* value computed for the chi-square test. To find independent predictors of late stage of breast cancer at diagnosis, purposeful selection (PS) method of variables in logistic regression was utilized [18–20]. The PS method was implemented using the SAS macro [20]. All Statistical analyses were performed utilizing SAS 9.3® (SAS Institute, Inc., Cary, NC, USA).

This study was approved by the City College of New York's Institutional Review Board and Ethics Committee of the Ocean Road Cancer Institute (ORCI).

Results

Sociodemographic characteristics of participants ($n = 196$) by early and late-stage presentations of breast cancer are represented in Table 1. The distribution of stage of diagnosis was 22.44% for early (stage I/II) and 77.56% for late (stage III/IV) stage. The mean age between early (51.5 ± 10.3) and late presentation groups (51.6 ± 12.9) was not significantly different. Education level ($p = 0.538$), marital status ($p = 0.057$), religion ($p = 0.861$), family history of breast cancer ($p = 0.352$), and distance from residence to ORCI ($p = 0.373$) were found to be nonsignificant between the early- and late-stage presentation groups. The late-stage presentation group exhibited notable longer time elapsed in months from first symptom recognition to first physician visit than the early-stage presentation ($p = 0.015$). Among the late-stage group, 59.9% waited < 1 month, 12.5% waited 1–2 months, and 27.6% waited ≥ 3 months before visiting a physician, whereas among the early-stage group, 70.5% waited < 1 month, 20.5% waited 1–2 months, and 9.1% waited ≥ 3 months before their

Table 1 Comparison of sociodemographic characteristics of breast cancer patients at Ocean Road Cancer Institute by stage, 2016–2018

	Early stage (<i>n</i> = 44, 22.4%)	Late stage (<i>n</i> = 152, 77.6%)	<i>p</i> value
Mean age in years ± SD	51.5 ± 10.3	51.6 ± 12.9	0.982
Number of children	3.0 (2.0–5.0)	3.0 (2.0–5.0)	0.923
Time from symptoms to ORCI (months)	7.0 (5.0–10.0)	11.0 (5.0–19.0)	0.024*
Time from first physician visit to ORCI (months)	6.0 (3.0–10.0)	7.0 (3.0–15.0)	0.591
Travel time to nearest health center (min)	30.0 (10.0–60.0)	30.0 (10.0–52.5)	0.499
Travel time to ORCI (h)	6.0 (1.5–12.0)	9.0 (2.0–12.0)	0.360
Previous breast exam (<i>N</i> , %)	24 (54.5%)	30 (19.7%)	< 0.001*
Time elapsed to first physician visit			0.015*
< 1 month	31 (70.5%)	91 (59.9%)	
1–2 months	9 (20.5%)	19 (12.5%)	
≥ 3 months	4 (9.1%)	42 (27.6%)	
Family history of BC (<i>N</i> , %)	9 (20.5%)	22 (14.5%)	0.352
Location			0.373
Away from Dar es Salaam	9 (20.5%)	51 (33.6%)	
Dar Es Salaam	12 (27.3%)	37 (24.3%)	
Near Dar es Salaam	10 (22.7%)	24 (15.8%)	
Unknown	13 (29.6%)	40 (26.3%)	
Source of learning about breast cancer			0.954
Healthcare workers	9 (20.5%)	33 (21.7%)	
Other sources	3 (6.8%)	8 (5.3%)	
TV/radio	32 (72.7%)	111 (73.0%)	
First symptoms of breast cancer			0.125
Breast mass with other symptoms	5 (11.4%)	13 (8.6%)	
Breast mass with pain	8 (18.2%)	52 (34.2%)	
Breast mass without pain	31 (70.5%)	87 (57.2%)	
Religion			0.861
Islamic	18 (40.9%)	58 (38.2%)	
Christian	26 (59.1%)	94 (61.8%)	
Employment status			0.212
Employed	9 (20.5%)	18 (11.8%)	
Unemployed/housewife	35 (79.6%)	134 (88.2%)	
Marital status			0.057
Married	22 (50.0%)	93 (61.2%)	
Widowed/separated	20 (45.5%)	42 (27.6%)	
/Divorced			
Never married	2 (4.6%)	17 (11.2%)	
Education level			0.538
No formal/informal education	6 (13.6%)	34 (22.4%)	
Some formal education	36 (81.8%)	113 (74.3%)	
University	2 (4.6%)	5 (3.3%)	

*Statistical comparison of demographic and clinical characteristics of patients presenting in early vs. late stage of breast cancer were done using two-sample *t* test, the Wilcoxon rank sum test, and the chi-square test of independence. Results with *p* value < 0.05 are considered significant

first physician visit. In addition, the late-stage presentation group [11.0 (5.0–9.0) months] had a greater median (interquartile range) time in months from first symptom recognition to first visit ORCI for treatment (*p* = 0.024) compared to the early-stage group [7.0 (5.0–10.0) months]. There were also significant differences in the number of early-stage (54.5%) and late-stage

(19.7%) participants who cited to have breast self or clinical examination prior to their first symptom recognition (*p* = <0.001). A greater percentage of late-stage presentation patients (34.2%) also cited that the symptom that encouraged them to visit a physician was “breast mass with pain” compared to those who were diagnosed early (18.2%).

In Table 2, we present additional patient and health-system factors that are associated with early- or late-stage of diagnosis of patients. Late-stage presentation patients (55.7%) cited financial restraints ($p = 0.047$) more often as barriers to diagnosis compared to early-stage patients (35.5%). Women who were diagnosed late (47.5%) were also more likely to state time restraints ($p = 0.041$) as significant barriers to their diagnosis than early-stage patients (25.8%). No significant differences were found in the effect of health system factors on diagnosis delay between the early- and late-stage groups.

In Table 3, the multivariable logistic model is utilized to identify the significant factors that contributed to the late diagnosis of breast cancer patients. According to the model, a patient can be predicted to have late-stage breast cancer if they had never had a routine breast exam conducted prior to their diagnosis (OR = 4.40; 95% CI = 2.09–9.25).

Discussion

This is the first study to investigate the patient and health system factors related to early and late presentations of breast cancer among women in Tanzania. Our results indicate that a history of previous breast screening examinations was

Table 3 Multivariable logistic model for predicting late-stage breast cancer diagnosis at Ocean Road Cancer Institute

Factors	OR (95% CI)	<i>p</i> value
No previous breast exam	4.40 (2.09–9.25)	< 0.001*
Initial symptoms were not taken seriously	2.10 (0.96–4.58)	0.064
No fear of breast cancer death	1.81 (0.85–3.89)	0.013
Time restraints	1.83 (0.74–4.55)	0.19

*Multivariable logistic regression for predicting late-stage breast cancer diagnosis. Final model is based on purposeful selection method implemented in Bursac, Z. et al. [20]. Results with p value < 0.05 are significant

instrumental in reducing late presentations of breast cancer. Patients who had experiences with breast cancer screenings or conducted self-breast examinations were significantly more likely to seek earlier care and thus present with early stages of breast cancer [21]. A study analyzing the factors related to delayed breast cancer diagnosis in Nigeria showed similar results in those patients who performed self-breast examinations were more likely to present at early disease stages [22].

We also found that late-stage patients were more likely than early-stage patients to state time restraints as barriers to their breast cancer diagnosis. These findings are also consistent with previous studies. For instance, our previous study from Egypt revealed that patients who reported social and time

Table 2 Comparison of patient and health system factors related to late breast cancer treatment at Ocean Road Cancer Institute

	Early stage (<i>n</i> = 44)	Late stage (<i>n</i> = 152)	<i>p</i> value
	(<i>N</i> , %)	(<i>N</i> , %)	
Patient factors:			
Fear of stigmatization	3 (9.7%)	7 (5.7%)	0.424
Time restraints	8 (25.8%)	58 (47.5%)	0.041*
Required permission from a family member	4 (12.9%)	26 (21.3%)	0.447
Financial restraints	11 (35.5%)	68 (55.7%)	0.047*
Household obligations	6 (19.4%)	33 (27.0%)	0.491
Initial symptoms were not taken seriously	16 (51.6%)	84 (68.9%)	0.091
Fear of breast cancer death	20 (64.5%)	59 (48.4%)	0.158
Fear of being medically examined	6 (19.4%)	17 (13.9%)	0.415
Feelings of discomfort towards healthcare professionals	4 (14.3%)	16 (12.4%)	0.759
Health system factors:			
Hospital's failure to inform of biopsy requirements	21 (75.0%)	88 (68.2%)	0.651
Difficulty with navigating the referral system	21 (75.0%)	91 (70.5%)	0.818
Lack of knowledge	15 (53.6%)	76 (58.9%)	0.675
Healthcare professional's misinterpretation of biopsy results	20 (71.4%)	93 (72.1%)	0.999
Initial prescription of antibiotics	7 (25.0%)	28 (21.7%)	0.802
No referral for further care upon initial presentation	7 (25.0%)	33 (25.6%)	0.999
Misdiagnosis	1 (3.6%)	6 (4.7%)	0.999
Delay in receiving biopsy results	11 (39.3%)	53 (41.4%)	0.999

*Patients factors and health system factors affecting presentation in early vs. late stage of breast cancer were compared using Fisher's exact test. Results with p value < 0.05 are considered significant

restraints increased their probabilities of being diagnosed with late-stage breast cancer [23].

Financial restraints were also cited more often as barriers to diagnosis among late-stage breast cancer patients than early-stage patients. This finding is consistent with a similar breast cancer study conducted in Rwanda [24]. Researchers observed that expenses involving transportation to healthcare facilities and cost of care were significant barriers to breast cancer diagnosis delay among women in Rwanda [24].

With an increase in breast cancer awareness over the past few years in Tanzania, there has also been an increase in identifying early-stage patients, enabling us to obtain a reasonable proportion of early-stage breast cancer patients. The majority of patients were diagnosed at Muhimbili National Hospital (MNH) and medical record copies of the histopathology of the diagnosis from MNH were included in the patients' records, allowing for accurate confirmation of stage and date of diagnosis. This study provides a comprehensive representation of the various factors that may contribute to breast cancer diagnosis delay in Tanzania; however, the limitations must be noted. Since this study relied on patient interviews, this may have included recall bias. Although medical records were reviewed upon each interview to ensure accurate reporting of each patient's breast cancer diagnosis history, the medical records do not contain information regarding the previous primary care visits that may have been made.

The comparison of patients with early and late presentations of breast cancer allows for several opportunities for educating patients and physicians in improving early diagnosis and treatment of breast cancer. Greater patient education on the importance of regular breast examinations is essential in reducing late-stage diagnosis. Previous breast cancer studies have also demonstrated the significance of promoting screening practices in low-resource settings in downstaging [25, 26]. Breast cancer patients, especially those in low-income countries tend to have the misconception that breast cancer is always symptomatic and unaware that pain is often a rare symptom that generally arises during late stages of breast cancer. For instance, a breast cancer study in Ethiopia observed that the most common initiating factor that motivated patients to seek professional care was having multiple symptoms such as palpable masses, itching, and/or pain [27]. These findings demonstrate the urgency for patient programs that focus on educating women to immediately address their initial symptom.

Although financial support may not be directly addressed through education programs, recommendations to the Tanzanian government can be made in expanding their insurance support. Currently, the Tanzanian government provides insurance that covers the costs of breast cancer treatment only with the confirmed diagnosis; however, since financial restraints have been found to be significant barriers to breast cancer diagnosis, it would be advisable to expand the funding to include costs of diagnosis as well.

In addition to patient education, this study found that education programs for healthcare practitioners in peripheral clinics on proper breast cancer referral, diagnostic, and treatment have significant potential in decreasing early and late presentations of breast cancer. A breast cancer study in Botswana similarly found that physicians in lower-level facilities contributed to diagnosis delay by a misdiagnosis of cancer symptoms as sexually transmitted diseases or tuberculosis [28]. Although this current study did not find significant differences in health system factors between the early- and late-stage groups, a significant number of patients in each respective stage group cited issues such as physician's misinterpretation of biopsy results or prescription of nonspecific medical treatment for their symptoms as contributing factors to their diagnosis delays. This study demonstrates several opportunities for physician education in reducing the influence of healthcare system factors in delaying breast cancer treatment. Implementation of cancer education at the patient, community, and healthcare levels can facilitate more immediate improvements in early diagnosis and treatment of breast cancer.

Future studies should further investigate the knowledge of breast cancer diagnosis and referral among women and physicians in rural communities throughout Tanzania, in addition to increase focus on the referral process and how healthcare professionals may contribute to diagnosis delay through biopsy results delay and misdiagnosis.

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Compliance with Ethical Standard Informed consent was received by all participants of the study in compliance with the Ocean Road Cancer Institute's Bioethics Committee and the City College of New York's Institutional Review Board.

There are no potential conflicts of interest.

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