Characterizing Breast Cancer Treatment Pathways in Kumasi, Ghana from Onset of Symptoms to Final Outcome: Outlook towards Cancer Control

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Abstract

BACKGROUND—Cancer rates are increasing in Africa, including Ghana. Breast cancer is the second most common cancer in incidence and mortality in Ghana.

OBJECTIVE—We outlined both breast cancer patient characteristics and management at the Komfo Anokye Teaching Hospital (KATH), the main cancer management hospital in central Ghana. Moreover, we identified the treatment interventions predictive of patient outcome.

METHODS—Medical records of 597 breast cancer patients seen in 2008–2011 were abstracted to investigate management and treatment patterns. Abstracted variables included type and extent of surgery, number and cycles of chemotherapy and radiotherapy, as well as the course of treatment completed.

RESULTS—Late stage at diagnosis was common, treatment plans of the study hospital were relatively standardized according to disease severity, and defaulting/interrupting treatment in the records was also common. Patients diagnosed with late stage cancer who received adjuvant therapy and patients with hormone status evaluation were more likely to have complied with

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treatment guidelines and continued oncotherapy at the study hospital than those who never had hormone status requested or reported.

CONCLUSIONS—Our study lends support to improving patient outcomes in low- and middle-income countries through raising knowledge and reporting of tumor hormonal status and providing appropriately tailored treatment. Achieving improved outcomes should also consider enhancing public understanding of the importance of early detection and completion of treatment.

Keywords

breast cancer; health systems navigation; developing countries (LMIC); Ghana

INTRODUCTION

As a result of increased life expectancies, globalization, and lifestyle changes, the burden of cancer in Sub-Saharan Africa is increasing [7]. This is evident in the case of Ghana, where the incidence of cancer is steadily increasing each year [24]. Breast cancer in particular is of major concern, ranking second in overall age-standardized incidence and third in overall mortality [11]. Though no population-level cancer registry exists in the country, GLOBOCAN estimates the incidence of breast cancer at approximately 25.5 /100,000 individuals, or 14.3% of all cancer cases [11]. While this figure is relatively low compared to high-income countries, it marks a steady increase in both incidence and proportion of the breast cancer burden compared to estimates from the 2000s [5, 24]. Ghana -- a low middle income country (LMIC) -- faces financial and infrastructure challenges that affect the ability to deal with the cancer burden [25].

Numerous barriers exist to successful treatment outcomes for breast cancer in Ghana. As is common in LMICs, care-seeking behavior is frequently delayed, leading to high proportions of late-stage disease and lower survival rates [4, 8, 19, 21]. By the time individuals seek organized cancer care, the majority of cases are diagnosed as stage III or IV, thus limiting the number of treatment options and negatively affecting long-term prognosis [4, 5, 19, 21]. Suggested factors for late-stage diagnosis include ignorance of the disease, preference for alternative/traditional remedies, and financial and geographical barriers [4, 21, 25]. Pathology infrastructure for detecting hormone receptor status is deficient [19]. Only two public hospitals -Korle Bu Teaching Hospital in Accra and Komfo Anokye Teaching Hospital in Kumasi- possess the necessary equipment and staff for cancer management [8, 17, 21]. Since both public hospitals are located in the southern, more urban regions of the country, many individuals must travel long distances at significant financial cost to seek diagnosis and treatment [21]. Private medical centers do exist but this care is unaffordable to many patients [3]. While all procedures related to breast cancer diagnosis and treatment are covered by the national health insurance program (NHIS), the latest reports indicate that only 34–50% of the population possess an active NHIS membership [23].

Previous studies have documented the factors external to medical care that affect treatment-seeking behaviors and outcome. However, less attention has been paid to the treatment history of patients once diagnosed, and its effects on outcomes. In fact, little formal documentation exists on breast cancer treatment protocols in Ghana. The goal of this study,

therefore, was to delineate the pathways that breast cancer patients at the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana follow from onset of symptoms to final outcome, and to identify factors predictive of patient outcome.

METHODS

Study Population

The study population comprised of 597 breast cancer patients who attended the Medical Oncology/Radiation therapy, Surgery, and/or Pathology department at KATH in 2008–2010. Using a database developed by a previous study [18], we identified most of the unique patients admitted to these departments during this time period. 394 of the 597 total patient records contained all referenced data and complete treatment information and were used for the logistic regression analysis.

Data Collection/Exposure Variables

In order to construct the patient navigation pathways for diagnosis and/or treatment, information from onset of symptoms to final outcome was collected from the three departments. Basic demographic and pathological data, including cancer stage (*AJCC Cancer Staging Manual, 7th edition*) at presentation and age of disease at diagnosis were collected.

Type of symptoms upon diagnosis, time interval between onset of symptoms and seeking care, type, and place of diagnosis (KATH or other hospitals), and last medical center of referral were abstracted.

Treatment-related information included original goal of therapy (e.g., adjuvant, neo-adjuvant, palliative), eventual changes to therapy goal/type, the first oncotherapy (e.g., radiotherapy, chemotherapy, hormone therapy) administered to patients at KATH, hormone receptor status, number of chemotherapy cycles received, whether patient finished chemotherapy without interruption, and time spent on neoadjuvant therapy. The time interval between onset of symptoms and seeking care was defined as the period between the patient's initial observation of symptom(s) and her seeking initial diagnosis or treatment at any facility.

The goal of therapy and changes in therapy were abstracted from notes in the records in consulting with medical staff. Since hormone status was frequently requested but rarely reported, we dichotomized the "unknown" category based on whether the hormone status report had been requested.

Data was also collected on treatment barriers, whether a patient interrupted oncotherapy, alternative therapies sought prior to or during organized cancer care, and whether a patient received a "sufficient" amount of oncotherapy (defined as at least one cycle of chemotherapy, all of radiotherapy, or successfully continuing hormone therapy).

It is important to note that the most common chemotherapy treatment used in the study hospital is Doxorubicin and cyclophosphamide for 4 to 6 cycles plus 4 cycles of Paclitaxol

in either neoadjuvant or adjuvant settings. Occasionally, CMF and FAC or Xeloda and Paclitaxol are also administered. The exact numbers of patients receiving certain treatments was hard to estimate as not all patients complete treatment. However, neoadjuvant and adjuvant cyclophosphamide and 5-FU, with or without Adriamycin were commonly prescribed to patients with advanced disease stages. The regimen most commonly used is 266 centigrays per fraction for 16 fractions to the chest wall and supraclavicular nodes for patients who have had mastectomies. Patients treated by breast conservation are given an additional 180 to 200 centigrays for 5 to 7 fractions to the surgical scar.

Data Collection: Outcome Variables

Final outcome was measured by whether a patient had up-to-date medical records, was still seeking medical consultations, and follow-up. Confirmed deaths and referrals to other hospitals were coded separately. Those who had missed recent medical appointments, but had previously appeared to be attending KATH for treatment were labeled as defaulting.

Data Management and Statistical Analysis

Logistic models were constructed to predict the final patient outcome as defined by the status of their medical records, which was coded dichotomously. In the dichotomized form, patients were defined to lack current medical records if they had not attended KATH within the past six months (despite having an appointment explicitly made), or were confirmed as deceased. Additionally, according to this definition, patients referred to other hospitals were excluded, as were patients who had been referred to other KATH departments, but whose records could not be located. Only patients who had attended a scheduled appointment at KATH within the past six months were defined as having current medical records.

Two forms of logistic regression were performed: one using a single variable, adjusted for stage and age, to predict the dichotomized outcome, and a final, full model consisting of all statistically significant predictors of patient outcome, adjusted for age and stage. Tested predictors included region of residence, predominant initial symptoms, method of diagnosis, referral pattern before attending KATH, facility of first diagnosis, whether hormone status test was requested and/or returned, initial therapy goal, changes to therapy goal, number of chemotherapy cycles received, type of oncotherapy administered initially, whether patient received a sufficient amount of oncotherapy (as defined above), type of surgery patient first received, types of surgery patient received overall, barriers to therapy, and overall length of treatment. Predictors for the latter (full) model were identified using stepwise selection in SAS version 9.3.

RESULTS

Patient and tumor characteristics by place of residence, symptoms at presentation, and tumor type

Table 1 depicts demographic and disease characteristics of the total study population. Late stage disease at diagnosis was common, with 64.1% of patients presenting with stage III or IV disease, although over one-fifth (21.9%) of patients were never formally staged.

Approximately 48% of all patients were under 50 upon presentation, with a weak, positive trend between age and stage of disease at diagnosis.

Care-Seeking Behaviors and Diagnostic Procedures

Aspects of diagnosis, including stage of disease, predominantly reported symptoms, geographical location and basis of diagnosis are summarized in Table 2. Breast lumps were the predominant symptoms reported (62.2% of total reported data), regardless of stage of disease at diagnosis, although many patients (16.4%) reported no symptoms or no symptoms were recorded in the various patient records. On average, 10.8 months passed between onset of symptoms and initial diagnosis.

An approximately equal proportion of patients attended KATH directly compared to those referred to KATH from another medical center, with no significant (p=.84) differences seen when stratified by unknown, early, and late stage disease. Histopathological-based (73.8%) diagnoses predominated, even after adjusting for stage of disease at diagnosis (p<.0001). Diagnoses often did not include hormone status (87.8% of all patients), usually because a hormone status report was never requested (72.8% of unknown hormone statuses), though sometimes (27.2% of unknown hormone statuses) this report was requested but never returned.

Treatment Characteristics: Interventions Administered, Outcomes, and Barriers/Interruptions

Overall, total treatment length (not shown) was 419 days (SD=628) and increased in length with increased severity of disease (p=.0013). Table 3 depicts initial and final therapy intents, notable treatments administered to patients, surgeries, type of oncotherapy first received, and number of chemotherapy cycles received. A statistically significant association was found between treatment intent and stage of disease at diagnosis (Table 3 comparing unknown, early, or late stage, p<.0001). Over one-third (33.5%) of patients –mostly with unknown or late stage disease-never received therapy at KATH. Neoadjuvant therapies were the next most common treatment goal (31.2% of all patients), particularly amongst those with late stage of disease. Changes to therapy were uncommon (16.9%), but approximately evenly split between changing to adjuvant (usually from neoadjuvant, Table 3, 52.5% of changes) therapy and changing to palliative care (47.5%).

Oncotherapy type first received varied according to stage (p<.0001); patients, especially those with late stage disease, frequently first received chemotherapy (Table 3, 42.4%). Most patients (51.8%) never received any therapeutic surgery; among those that did, most received only mastectomies (53.1% of surgeries) or only lumpectomies (39.9%). Chemotherapy interruptions were common, as shown in Table 4, which also depicts treatment barriers, alternatives sought, and the final outcome. In fact, 86.4% of all patients reported barriers that interrupted or completely stopped treatment. Only 12.2% of patients reported seeking alternative therapies, so this does not appear to be a major explanation. Regardless, only 16.0% of patients are known to still attend KATH, with a statistically significant variation by stage of disease (Table 4, p<.0001).

Significant predictors identified in the logistic regression model containing a single covariate, adjusted for age and stage, are identified in Table 5. In this model, total duration of therapy (p=.0003), initial intent of therapy (p<.0001), knowledge of hormone status (p<.0001), type of therapeutic surgery first administered (p<.0001), all types of surgeries received during treatment (p<.0001), administration of sufficient therapy (p<.0001), barriers encountered (p<.0001), and changes to treatment intent (p<.0001) were found to be statistically sufficient predictors of patient outcome at the a=0.05 level. All other covariates were non-significant, with the exception of the number of chemotherapy cycles received (p<.0001, not shown), which displayed quasi-complete separation in the model.

Significant predictors in the full model, adjusted for age and stage, are identified in Table 6. After adjusting for stage and age, using stepwise selection, total duration of therapy (p=.01), initial therapy intent (p<.0001), presence of hormone status report (p=.01), administration of sufficient therapy (p=.02), barriers encountered (p<.0001), and eventual changes in therapy intent (p=.0004) were found to be statistically significant predictors of patient outcome. All other predictors were non-significant.

DISCUSSION

Our study sought to determine what interventions were provided to patients upon reaching KATH, and whether these interventions were associated with patient outcome. We found that over 60% of patients attending KATH for breast cancer management were initially diagnosed with late stage disease and, in accordance with the population age distribution for Ghana, were younger overall than would be found in high income countries with more aged populations. This is partly due to patients waiting on average almost 11 months between initial detection of symptoms and seeking organized cancer care. While this finding is consistent with previous studies in Ghana, it is elevated compared to both other LMICs and high income countries, and has a significant effect on patient prognosis and available treatment options [4, 10, 12, 15, 20].

It is important to understand the factors that contribute to this potentially lethal care-seeking delay. It is likely that financial, geographical, and sociocultural values, such as distrust for the health care system play a role [4, 8, 21, 25]. While our study did not directly associate these barriers with behavior prior to entering the medical system, we did find that fewer than 14% of patients were able to receive their treatment without unplanned interruption and/or without defaulting, which is consistent with previous studies [4, 5]. In addition, it appears that many patients interrupted treatment due to the side effects which usually developed during chemotherapy, which may be partly explained by the drug regimens most commonly prescribed (data not shown). These drugs commonly generate side effects that require close monitoring and patient support in addition to the use of other, sometimes costly drugs to alleviate side effects. Moreover, the elevated prevalence of malnutrition -in particular, anemia [2]- among women in Ghana may also contribute to treatment delays, given the suppressive effect of chemotherapy on blood cell counts [2, 13].

Previous studies have indicated that alternative/traditional therapies are a major cause in the delays in seeking organized cancer care, with around or greater than 50% of patients

reporting consulting traditional healers. However, our study found that only 12.2% of patients sought alternative therapies before or during organized cancer care [4, 17]. Indeed, given the low physician-to-patient ratio in Ghana, the relative omnipresence of traditional healers in the country, and the fact that alternative therapies are usually more affordable, less invasive, and involve more intimate patient-practitioner relationships, it would be expected that a high proportion of patients would seek alternative therapies [8, 16, 17, 19, 21, 23]. Our findings may reflect a shift away from the heavy involvement of traditional healers in the treatment of cancer conditions as a result of traditional healer educational programs [17]. However, as our data was obtained directly from the medical records, our findings may also reflect incomplete record-keeping (e.g. oral transmission of findings), treating physicians' not asking patients questions about alternative therapies, or patients being possibly afraid or ashamed to admit to seeking such care.

Regardless of the cause of the treatment-seeking delay, we identified many deficiencies in diagnoses, treatment, and record keeping. Over one fifth of individuals who attended KATH were never formally staged; while most of these patients in turn never received further treatment at KATH, up to 29% of these un-staged individuals did start some form of cancer therapy, under the assumption that the diagnosis was inferred from the clinical presentation. The distribution of initially prescribed therapies for this group without pathologic diagnosis showed a greater proportion received adjuvant and palliative therapy versus neoadjuvant or treatment for recurrent disease; we surmise that this is due mainly to either primary surgery of an obvious tumor mass (resulting in adjuvant therapy) or obvious inoperable disease. In recent years, there have been efforts at KATH to standardize treatment procedures and improve record-keeping of cancer cases.

Although record keeping has improved in recent years, we found a high proportion of defaulting patients. Default rates, as measured by the presence of up-to-date medical records, was high; only 16% of patients were known to be still attending KATH, with 4.2% confirmed dead, 6.7% known to have been referred elsewhere, and the rest (73.1%) had missing data or otherwise had not been seen in over six months. This is in contrast to previous studies suggesting that only 10% of patients abscond after diagnosis and 10% do not complete treatment [4, 5]. As this study did not actively track missing patients, we are less confident in labeling them as defaulters. In the absence of continued treatment however, it is fair to presume that many of the defaulting patients are dead.

In addition to the high rate of defaulting, other limitations of the dataset warrant discussion. Due to inconsistent record-keeping and communication both within and between KATH departments as well as the use of multiple names, it is possible that we are overestimating the absence of diagnosis, treatment, and outcome data. For example, physicians may have communicated orally between each other about staging and treatment protocols. Moreover, departments vary with regards to their policies about storage and sharing of the original medical records, with some allowing record distribution and others allowing only on-site consultation. Older, inactive records may be transferred to remote storage, thereby impairing the tracking down data. Due to all these factors, it is likely that more patients received full treatment at KATH than were found in this study.

In spite of these limitations, in both single-variable and full logistic regression models, important aspects of the treatment pathway were identified as significant predictors to the dichotomized patient outcome. The financial, geographical, and sociocultural pressures that patients with breast cancer face in Ghana affect compliance with therapy regimens and ultimate patient outcome. Indeed, the types of barriers encountered by patients were found to be a highly statistically significant predictor of patient outcome in this study. Somewhat paradoxically, patients experiencing barriers, whether financial or physical, were more likely to finish treatment than those not reporting any barriers. However, this is likely a reflection of coding in the study, since barriers could only be known if the patient interrupted treatment but later returned and if the barrier was recorded. In a comparison of the dichotomized outcome to barriers encountered, it was found that 96.7% of patients who reportedly did not encounter barriers to treatment also appeared to have defaulted, thus lending support to this explanation.

Overall, in both models, initial intent of treatment, receiving a sufficient amount of oncotherapy, knowledge of hormone status, and eventual changes in treatment intent were identified as statistically significant predictors of patient outcomes. This may be a reflection of behaviors prior to attending KATH, standardized treatment protocols, and compliance with the administered treatments. Perhaps more importantly in the context of our study, knowledge of hormone status (only 9.3% of patients) generally indicated sustained attendance at KATH. As KATH and Ghana have limited facilities for clinical pathology and, until recently, the hormone test was not routinely performed in the first histopathological exam, most patients would not have had hormone status evaluation unless they underwent another surgical procedure [19]. Moreover, while the hormone test is requested for all breast cancer patients at KATH, it must be paid for by patients and that presents a barrier to lower income patients. Regardless, since patients tended to be diagnosed with late stage cancer and required significant amounts of oncotherapy prior to therapeutic surgery, patients with hormone status evaluation were more likely to have complied with treatment guidelines and still be attending KATH than those who never had hormone status requested or reported. Ascertaining hormone receptor status would not be beneficial unless the proper treatment is offered. Tamoxifen is available at our study hospital and prescribed to patients with hormone receptor-positive status. For those who do not get tested, most of them are offered the treatment blindly. Not receiving full treatment is usually because of other reasons such as affordability, transportation to and from the hospital, and/or seeking alternative treatment options such as herbal medicine or spiritual healing. We have added this text to the revised version the manuscript.

Previous studies identified factors for delaying, interrupting, and/or defaulting treatment for breast cancer in low resource settings. These factors –usually financial, geographical, and sociocultural- have also been implicated in motivating patients to seek alternative therapies [3–8, 12, 14–17, 19–22]. Fear of mastectomy has been singled out as one of the major causes for delaying care and/or seeking alternative therapies; given that many women die shortly after mastectomy (due to late stage at presentation), there is a commonly perceived link between the procedure and death [4, 16, 21]. Alleviating these fears and improving affordability and accessibility are likely to improve patient outcomes by reducing delays in seeking care, interruptions in treatment, and default rates.

However, few studies have investigated whether the interventions themselves predict patient outcome, particularly within the context of LMICs. Our study is the first one that rigorously indicates that several treatment interventions are predictive of patient outcome, though more work needs to be done to elucidate the interactions between these interventions and factors external to medical care. Such factors may interfere with the well-standardized treatment protocols implemented at KATH for breast cancer management. Our study lends support to improving patient outcomes in low- and middle-income countries through raising knowledge and reporting of tumor hormonal status and providing appropriately tailored treatment. Achieving improved outcomes should also consider enhancing public understanding of the importance of early detection and completion of recommended treatment [1, 4, 6, 9, 19, 22].

Acknowledgments

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Table 1

Demographic Information, both crude and stratified by stage of disease at diagnosis (*n*=597)

	Crude	Stage					
		Unknown	0	I	II	III	IV
Counts	597	131 (21.9)	3 (0.5)	8 (1.3)	72 (12.1)	347 (58.1)	36 (6.0)
Mean Patient Age in Years (SD)	50.8 (14.5)	48.4 (14.2)	51.7 (6.1)	49.4 (11.2)	51.1 (13.0)	51.3 (15.0)	54.2 (14.1)
Number of Females (% of stage)	585 (98.0)	128 (97.7)	3 (100)	8 (100)	71 (98.6)	341 (98.3)	34 (94.4)
Region of Residence (%[a])							
Unknown	165 (27.6)	79 (47.9)	0 (0.0)	0 (0.0)	13 (7.9)	67 (40.6)	6 (3.6)
Ashanti	307 (51.4)	35 (11.4)	1 (0.3)	8 (2.6)	53 (17.3)	190 (61.9)	20 (6.5)
Greater Central and Northern Ghana[b]	76 (12.8)	9 (11.8)	2 (2.6)	0 (0.0)	4 (5.3)	52 (68.4)	9 (11.8)
Southern Ghana and External Areas[c]	49 (8.2)	8 (16.3)	0 (0.0)	0 (0.0)	2 (4.1)	38 (77.6)	1 (2.0)
Occupation (%[a])							
Unknown	30 (5.0)	10 (7.6)	0 (0.0)	0 (0.0)	2 (2.8)	17 (4.9)	1 (2.8)
Business	5 (.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (40.0)	3 (60.0)	0 (0.0)
Farming/Agriculture	140 (23.5)	38 (27.1)	1 (0.7)	0 (0.0)	9 (6.4)	82 (58.6)	10 (7.1)
Civil Servants and Secretaries	18 (3.0)	1 (5.6)	0 (0.0)	2 (11.1)	4 (22.2)	10 (55.6)	1 (5.6)
Professional Occupations	56 (9.4)	13 (23.2)	1 (1.8)	2 (3.6)	12 (21.4)	28 (50.0)	0 (0.0)
Service (Low-Income)	265 (44.4)	55 (20.8)	1 (0.4)	3 (1.1)	29 (10.9)	162 (61.1)	15 (5.7)
Unemployed[d]	83 (13.9)	14 (16.9)	0 (0.0)	1 (1.2)	14 (16.9)	45 (54.2)	9 (10.8)

[a] Percents reflect that of crude (crude cell) or row percent (within stages)

[b] Includes Brong Ahafo, Eastern, Northern, Upper East, Upper West Regions, and Volta Regions

[c] Includes Central, Greater Accra, Western Regions, and areas outside of Ghana

[d] Includes Students, Retired/Pensioners, and Unemployed

Table 2

Characteristics Both Prior to Seeking Care at KATH and the Subsequent Diagnosis, Crude and Stage-Stratified

		Crude Values (SD)	Stage (SD)			
			Unknown	Early Stage (0,I,II)	Late Stage (III, IV)	p-value
Mean Time Between Onset of Symptoms and Diagnosis, in Months (n=473)		10.8 (26.6)	6.6 (10.2)	13.1 (45.1)	11.6 (24.7)	0.2227[a]
		Crude Values (column %)	Stage (row %)			
			Unknown	Early Stage (0,I,II)	Late Stage (III, IV)	P-value
Predominant Symptom when Cancer was First Noticed (n=596)	None Listed	98 (16.4)	35 (35.7)	16 (16.3)	47 (48.0)	0.0008[b]
	Painful or Painless Breast Lump	371 (62.2)	69 (18.6)	60 (16.2)	242 (65.2)	
	Breast Swelling[c]	33 (5.5)	6 (18.2)	1 (3.0)	26 (78.8)	
	Ulceration	31 (5.2)	8 (25.8)	0 (0.0)	23 (74.2)	
	Other[d]	63 (10.6)	13 (20.6)	6 (9.5)	44 (69.8)	
	Unknown	5 (0.8)	2 (40.0)	0 (0.0)	3 (60.0)	
Referral Pattern before Attending KATH (n=594)	Directly attended KATH	311 (52.4)	66 (21.2)	46 (14.8)	199 (64.0)	0.8372[e]
	Referred to KATH	278 (46.8)	62 (22.3)	37 (13.3)	179 (64.4)	
Cancer Diagnosis as Abstracted from Records (n=594)	Ductal	330 (55.6)	53 (16.1)	57 (17.3)	220 (66.7)	<.0001[5]
	Other Adenocarcinomas[f]	47 (7.9)	9 (19.1)	11 (23.4)	27 (57.4)	
	Non-Specific Cancer Diagnosis	212 (35.7)	65 (30.7)	13 (6.1)	164 (63.2)	
	Benign	5 (0.8)	2 (40.0)	2 (40.0)	1 (20.0)	
Method of Diagnosis (n=596)	Unknown	57 (9.6)	22 (38.6)	4 (7.0)	31 (54.4)	<.0001[b]
	Histology	381 (63.9)	70 (18.4)	63 (16.5)	248 (65.1)	
	Cytology	59 (9.9)	6 (10.2)	8 (13.6)	45 (76.3)	
	Clinical	86 (14.4)	28 (32.6)	4 (4.7)	54 (62.8)	
	Other	13 (2.2)	5 (38.5)	4 (30.8)	4 (30.8)	
Hormone Status Report (n=597)	Not Requested	381 (63.8)	109 (28.5)	48 (12.6)	225 (59.1)	<.0001[b]
	Results Not Returned	142 (23.8)	17 (12.1)	19 (13.5)	105 (73.9)	

	Crude Values (SD)	Stage (SD)			
		Unknown	Early Stage (0,I,II)	Late Stage (III, IV)	p-value
Mean Time Between Onset of Symptoms and Diagnosis, in Months (*n*=473)	**10.8 (26.6)**	**6.6 (10.2)**	**13.1 (45.1)**	**11.6 (24.7)**	**0.2227**[a]

	Crude Values (column %)	Stage (row %)			
		Unknown	Early Stage (0,I,II)	Late Stage (III, IV)	P-value
Results Returned	74 (9.3)	5 (6.8)	16 (21.6)	53 (71.6)	

[a] ANOVA, including unknown;

[b] Chi-square comparing unknown, early (0,I,II) and late (III, IV) stage disease;

[c] Painless or no pain noted;

[d] Includes breast pains without lump, lumps located outside of breast tissue, mastitis, breast lesions, skin changes, breast itching or hardening, nipple discharge, pain localized outside of breast, painful breast swelling, swelling of non-breast tissue, breast 'heaviness,' and 'other' symptoms;

[e] Fisher's test comparing unknown, early (0,I,II) and late (III, IV) stage disease;

[f] Includes unspecified adenocarcinoma diagnoses

Table 3

Characteristics of Treatment Pathway, including Initial Intent of Therapy, Significant Interventions performed, and Eventual Changes in Treatment Intent

		Crude (SD or %)	Stage (row %)			p-value
			Unknown	Early Stage (0, I, II)	Late Stage (III, IV)	
Initial Intent of Treatment (*n*=597)	None	200 (33.5)	93 (46.5)	20 (10.0)	87 (43.5)	<.0001[a]
	Neoadjuvant	186 (31.2)	9 (4.8)	17 (9.1)	160 (86.0)	
	Adjuvant	116 (19.4)	12 (10.3)	39 (33.6)	65 (56.0)	
	Palliative	79 (13.2)	11 (13.9)	1 (1.3)	67 (84.8)	
	Other	16 (2.7)	6 (37.5)	6 (37.5)	4 (25.0)	
Type of Oncotherapy First Administered (*n*=597)	Unknown	16 (2.7)	4 (25.0)	2 (12.5)	10 (62.5)	<.0001[b]
	None	184 (30.8)	89 (48.4)	18 (9.8)	77 (41.8)	
	Chemotherapy	253 (42.4)	25 (9.9)	25 (9.9)	203 (80.2)	
	Radiotherapy	90 (15.1)	7 (7.8)	27 (30.0)	56 (62.2)	
	Hormone Therapy	52 (8.7)	6 (11.5)	11 (21.2)	35 (67.3)	
	Other	2 (0.3)	0 (0.0)	0 (0.0)	2 (100)	
Total Chemotherapy Received (*n*=597)	Unknown	13 (2.2)	4 (30.8)	2 (15.4)	7 (53.9)	<.0001[b]
	None Prescribed	297 (49.8)	101 (34.0)	46 (15.5)	150 (50.5)	
	<3 Cycles	76 (12.7)	11 (14.5)	7 (9.2)	58 (76.3)	
	4–12 Cycles	189 (31.7)	12 (6.4)	28 (14.8)	149 (78.8)	
	13+ Cycles	22 (3.7)	3 (13.6)	0 (0.0)	19 (86.4)	
Type of Surgery First Performed (*n*=597)	Unknown	15 (2.5)	4 (26.7)	2 (13.3)	9 (60.0)	<.0001[b]
	None	309 (51.8)	79 (25.6)	19 (6.1)	211 (68.3)	
	Mastectomy	146 (24.5)	14 (9.6)	21 (14.4)	111 (76.0)	
	Lumpectomy	126 (21.1)	34 (27.0)	41 (32.5)	51 (40.5)	
	Other	1 (0.2)	0 (0.0)	0 (0.0)	1 (100)	
Total Surgeries Received (*n*= 597)	Unknown	15 (2.5)	4 (26.7)	2 (13.3)	9 (60.0)	<.0001[b]
	None	309 (51.8)	79 (25.6)	19 (6.2)	211 (68.3)	

	Crude (SD or %)	Stage (row %)			p-value
		Unknown	Early Stage (0, I, II)	Late Stage (III, IV)	
One or More Mastectomy	145 (24.3)	14 (9.7)	21 (14.5)	110 (75.9)	
One or More Lumpectomy	109 (18.3)	31 (28.4)	37 (34.0)	41 (37.6)	
Combination	19 (3.2)	3 (15.8)	4 (21.1)	12 (63.2)	
Unknown	20 (3.4)	5 (25.0)	3 (15.0)	12 (60.0)	<.0001[a]
Eventual[c] Changes in Treatment Intent (n=597) None	476 (79.7)	122 (25.6)	73 (15.3)	281 (59.0)	
Adjuvant	53 (8.9)	2 (3.8)	7 (13.2)	44 (83.0)	
Palliative	48 (8.0)	3 (4.2)	0 (0.0)	46 (95.8)	

[a] Chi-square comparing unknown, early (0,I,II) and late (III, IV) stage disease

[b] Fisher's test comparing unknown, early (0,I,II) and late (III, IV) stage disease

[c] Patients may have undergone multiple changes in treatment intent (e.g., from neoadjuvant to adjuvant to palliative)

Table 4

Interruptions to Treatment, Barriers and Alternative Therapies Sought, Crude and Stage-Stratified

	Crude (SD or column %)	Stage (row %)			p-value
		Unknown	Early Stage (0, I, II)	Late Stage (III, IV)	
Patients Finishing Chemotherapy with Interruption (n=597)					
No Chemotherapy Administered	287 (48.1)	100 (34.8)	44 (15.3)	143 (49.8)	<.0001 [a]
Unknown	23 (3.9)	5 (21.7)	4 (17.4)	14 (60.9)	
Yes	209 (35.0)	16 (7.7)	21 (10.1)	172 (82.3)	
No	78 (13.1)	10 (12.8)	14 (18.0)	54 (69.2)	
Sufficient Therapy Administered (n=597)					
No Oncotherapy Administered	178 (29.8)	88 (19.4)	17 (9.6)	73 (41.0)	<.0001 [a]
Unknown	36 (6.0)	7 (19.4)	7 (19.4)	22 (61.1)	
No	114 (19.1)	11 (9.7)	11 (9.7)	92 (80.7)	
Yes	269 (45.1)	25 (9.3)	48 (17.8)	196 (72.9)	
Barriers (n=597)					
Unknown[b]	314 (52.6)	99 (31.5)	38 (12.1)	177 (56.4)	<.0001 [a]
None	81 (13.6)	18 (22.2)	26 (32.1)	37 (45.7)	
Financial as a Component or by Itself	34 (5.7)	4 (11.8)	3 (8.8)	27 (79.4)	
All Physical Conditions without a Financial Component	168 (28.3)	10 (6.0)	16 (9.5)	142 (84.5)	
Alternative Therapies Sought (n=574)					
None	504 (87.8)	113 (22.4)	73 (14.5)	318 (63.1)	.2390[c]
Herbal Medicine	65 (11.3)	9 (13.9)	7 (10.8)	49 (754)	
Other[d]	5 (0.9)	3 (60.0)	0 (0.0)	2 (40.0)	
Currently Attending KATH (n=595)[e]					
Unknown[f]	17 (2.9)	8 (47.1)	2 (11.8)	7 (41.2)	<.0001 [a]
No	418 (70.3)	101 (24.2)	43 (10.3)	274 (65.6)	
Yes	95 (16.0)	9 (9.5)	31 (32.6)	55 (57.9)	
Referred[g]	40 (6.7)	8 (20.0)	7 (17.5)	25 (62.5)	
Confirmed Dead	25 (4.2)	4 (16.0)	0 (0.0)	21 (84.00)	

[a] Chi-square comparing unknown, early (0,I,II) and late (III, IV) stage disease

[b] Interruptions and/or defaults in treatment occurred, but no explanation was ever recorded

[c]Fisher's test comparing unknown, early (0,I,II) and late (III, IV) stage disease

[d]Includes Olive Oil, Urine Therapy, Prayer Camps, and Unspecified Drugs or Topical Agents

[e]As evidenced by having attended an appointment at KATH within the past 6 months

[f]Medical Records was blank, or no appointments had been explicitly made

[g]Patient was referred to an external hospital or a department in KATH that was not included in the study

Table 5

Logistic Regression, adjusting for age and stage, of each diagnosis and treatment covariates to Predict presence of up-to-date medical records, adjusted for age and stage (*n*=394)

		Counts (%)	OR (95% CI)	p-value[a]
Total Duration of Treatment		394	1.001(1.00, 1.002)	0.0003[b]
Initial Intent of Therapy	None	38 (9.6)	**ref**	<0.0001[b]
	Neoadjuvant	166 (42.1)	12.1 (1.6, 92.5)	0.0695
	Adjuvant	104 (26.4)	28.6 (3.7, 219)	<0.0001
	Palliative	70 (17.8)	3.2 (0.36, 29.3)	0.1011
	Other	16 (4.1)	13.9 (1.4, 136)	0.1708
Hormone Status Report	Known	66 (16.8)	**ref**	<0.0001[b]
	Never Requested	214 (54.3)	0.36 (0.19, 0.7)	<0.0001
	Results Not Returned	114 (28.9)	0.09 (0.05, 0.18)	0.5432
Type of Surgery First Performed	None	172 (43.7)	**ref**	<0.0001[b]
	Mastectomy	124 (31.5)	9.6 (4.7, 19.6)	<0.0001
	Lumpectomy	98 (24.9)	4.7 (2.1, 10.5)	0.1877
All Surgeries Received	None	172 (43.7)	**ref**	<0.0001[b]
	One or More Mastectomy	123 (31.2)	9.4 (4.6, 19.2)	0.0006
	One or More Lumpectomy	83 (21.1)	4.3 (1.9, 9.8)	0.8984
	Combination	16 (4.1)	9.4 (2.8, 31.5)	0.0621
Sufficient Therapy Received	No Therapy Received	108 (27.4)	**ref**	<0.0001[b]
	Unknown	9 (2.3)	12.2 (1.0, 144)	0.1184
	No	108 (27.4)	1.9 (0.2, 16.7)	0.0551
	Yes	242 (61.4)	19.3 (2.6, 146)	<0.0001
Total Barriers Encountered	None	165 (41.9)	**ref**	<0.0001[b]
	Unknown	35 (8.9)	82.2 (24.1, 280)	<0.0001
	Financial as a Component or by Itself	34 (8.6)	20.3 (6.2, 66.7)	0.2092
	All Physical Conditions without a Financial Component	160 (40.6)	19.3 (7.1, 52.4)	0.1247
Eventual[c] Changes in Treatment Intent	None	299 (75.9)	**ref**	<0.0001[b]
	Adjuvant	48 (12.2)	6.7 (3.4, 13.2)	<0.0001
	Palliative	47 (11.9)	0.9 (0.4, 2.3)	0.0279

[a]P-values are derived from Wald Chi-Square parameter estimates unless otherwise specified

[b]Overall Type III Analysis of Effects

[c]As Individuals may undergo more than one change in therapy goal, this accounts for the last change made

Table 6

Full logistic model of statistically significant predictors[a], adjusted for age and stage (*n*=394)

		OR (95% CI)	p-value[b]
Total Duration of Treatment		1.001 (1, 1.002)	0.0126[c]
Initial Intent of Therapy	Other	ref	<.0001[c]
	Neoadjuvant	1.2 (0.18, 8.7)	0.8261
	Adjuvant	7.3 (1.2, 44.2)	0.0319
	Palliative	0.46 (0.05, 4.1)	0.4876
Hormone Status Requested	Yes	ref	0.0091[c]
	Requested, not received	0.65 (0.26, 1.6)	0.3565
	Never Requested	0.23 (0.09, 0.62)	0.0037
Sufficient Therapy Administered	Unknown	ref	0.0213[c]
	No	0.55 (0.02, 13.9)	0.7149
	Yes	3 (0.14, 63.2)	0.4773
Total Barriers Encountered	None	ref	<.00001[c]
	Unknown	87.3 (19.8, 385.3)	<.0001
	Financial as a Component or by Itself	10.8 (2.4, 48)	0.0018
	All Physical Conditions without a Financial Component	21.3 (6.3, 71.9)	<.0001
Eventual[d] Changes in Treatment Intent	None	ref	0.0004[c]
	Adjuvant	3.3 (1.1, 10)	0.0391
	Palliative	0.25 (0.08, 0.83)	0.023

[a]Note that the reference category for "Initial Intent of Therapy" and "Sufficient Therapy Administered" were changed due to the addition of other predictors in the model

[b]P-values are derived from Wald Chi-Square parameter estimates unless otherwise specified

[c]Overall Type III Analysis of Effects

[d]As Individuals may undergo more than one change in therapy goal, this accounts for the last change made