

## Assessment of clinical outcome and health insurance coverage among patients with breast cancer

Michael Addo Kwabeng,<sup>1</sup> Kofi Adesi Kyei,<sup>1,2</sup> Stephen Manortey,<sup>3</sup> Verna Vanderpuye,<sup>1</sup> Doris Kitson-Mills,<sup>2</sup> Joel Yarney,<sup>1</sup> Sharon Talboys<sup>3</sup>

<sup>1</sup>Korle-Bu Teaching Hospital, Accra;

<sup>2</sup>Department of Radiology University of Ghana; <sup>3</sup>University of Utah, West Africa Campus, Ghana

### Abstract

Breast cancer is a global health concern in terms of morbidity and mortality. Risk-sharing mechanisms such as health insurance provide resources and promote access to healthcare. The aim of the study was to assess the relationship between health insurance coverage and clinical outcome of breast cancer patients. The study employed retrospective design involving the use of secondary data from the patients diagnosed with breast cancer. Between the period of 2015 to 2019, 250 patients' records were reviewed from a sample size of 300 patients over 5 year patients' follow-up period. A descriptive and Kaplan Meier survival analysis was performed to determine the patients' survival rate. Seventy-two percent of the patients had health insurance cover at the time of diagnosis. Insurance status was found to be significantly associated with survival ( $p$ -values= 0.036). Insurance cover had 1.42 hazard ratio ( $p$ =0.036, 95% CI: 1.023-1.980). Patients with health insurance coverage at the time of diagnosis had a higher survival rate. No significant association was found among the demographic characteristics and the patients' clinical outcomes.

### Introduction

Globally, breast cancer is a major health concern in terms of morbidity and mortality,<sup>1,2</sup> and the most frequently diagnosed cancer and the leading cause of cancer-related deaths among women throughout the world.<sup>2</sup> In 2012, 522,000 (30.7%) out of an estimated 1.7 million women diagnosed with breast cancer died.<sup>2</sup> In Africa, over 100,000 cases of breast cancer are diagnosed annually with 49,000 deaths.<sup>3</sup> In

sub-Saharan Africa, 23.5 per 100,000 cases of breast cancer were recorded in 2013 in women aged 15 years and above and an estimated 35,427 resulted in mortality.<sup>4,5</sup> According to GLOBACAN the annual estimated incidence rate of breast cancer in Ghana is 25.8 cases per 100,000 women and mortality rate of 15.2 deaths per 100,000 women.<sup>6</sup> Again, 2,260 new cases of breast cancer are diagnosed annually in Ghana, with 1,021 deaths occurring constituting 45.2% of women diagnosed with breast cancer.<sup>7</sup>

Access to health services is the timely use of personal health services to achieve the best health outcomes. It covers one's overall physical, social, mental health status and quality of life.<sup>8</sup> Risk-sharing mechanisms such as social insurance provide resources to access healthcare and to promote health while protecting individuals and households against the potentially devastating direct financial costs of illness.<sup>8</sup> Comprehensive quality health care services are important for promoting and maintaining health, preventing and managing diseases, reducing unnecessary disability and premature death, and achieving health equity for all.<sup>9</sup> This requires gaining entry into the health care system usually through insurance coverage, accessing a location where needed health care services are provided, finding a health care provider whom the patient trusts and can communicate with.<sup>10</sup> In recent years there has been a trend for many developing countries to move towards a new or expanded role for various forms of Social Health Insurance (SHI), in the pursuit of Universal Health Care as championed by the World Health Organization.<sup>11</sup>

In recent times, many concerns have been raised regarding the increasing rate of breast cancer among young people in Ghana. In addition to the fact that the incidence of the disease appears to be increasing, late presentation with poor outcomes of treatment is a distinctive feature of breast cancer.<sup>12</sup> In most cases, patients without health insurance or underinsured have a greater likelihood of being diagnosed with breast cancer at an advanced stage of disease, in comparison to other patients with private or Medicare insurance as in the case of the United States.<sup>13,14</sup>

Up to 70% of women who are diagnosed with breast cancer in Ghana are in the advanced stages of the disease, resulting in a higher mortality rate compared to high-income countries.<sup>15</sup> In addition, Ghanaian women are more likely to be diagnosed with high-grade triple-negative breast tumors.<sup>16</sup> Reasons for the delayed presentation have been traced to cost and access to

Correspondence: Kofi Adesi Kyei, University of Ghana, P.O. Box KB 369, Korle-Bu, Accra, Ghana.

Tel.: +233-302-676222 - Fax: +233-302-676221.

E-mail: kakyei@ug.edu.gh

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routine mammography screening, lack of awareness, and cultural attitudes.<sup>16</sup> It was against this background that the study was conducted to determine the association between health insurance status and five-year survival among the women with breast cancer presented at the study site. In doing this, disparities in breast cancer outcome following radiotherapy and chemotherapy were examined.

The intention was to reduce the high dependency on out-of-pocket payments in the form of user charges and co-payments,

which are regressive as they disproportionately affect the poorest, and therefore challenge the underlying tenets of equity within healthcare systems.

## Materials and Methods

Retrospective design involving the use of secondary data from female breast cancer patients' records at the study site from 2015 to 2019 was employed. Over the study period, trends and outcomes of breast cancer in relation to health insurance coverage in patients' records (folders) were reviewed. Extracted data for analysis was based on women diagnosed with breast cancer, treated and followed up retrospectively for a five-year period. Out of the total number of folders retrieved from the archives and records rooms of the department, only folders that met the selection criteria were used for data analysis.

The study site was selected because it is currently the third largest hospital in Africa and the leading national referral center in Ghana serving a total of 70% of all cancer cases seen in the country according to Kyei *et al.*<sup>17</sup> The folders of patients were reviewed taking into consideration their demographic and clinical history details such as age, ethnicity, occupation, cancer stage, date of diagnosis, surgery/ type of surgery, hormone receptors means of diagnosis, morphology, extent of disease, radiotherapy, chemotherapy, date of death status, and other co-morbidities.

The estimated sample size for the study was 300 breast cancer folders with a 5% margin of error on a recorded total patient's population. Using the concept of equiprobability, researchers assigned equal probabilities to the selection of folders and progression through the list was done circularly. A systematic sampling method was used in the folder selection to minimize the level of selection bias. The medical records of the population were arranged in ascending order in Microsoft Excel with regards to the assigned but unique numerical identifier and qualified folders were picked at constant intervals.

Data on survival and death of patients were followed up from the department's registry and verification on the status of patients was done. The survival time was calculated in years, considering the dates at initial diagnosis. The data was obtained from patients' medical records, recruited on their review appointment days. Information such as the type of insurance status and when it was used for care were also retrieved as it provided evidence about whether the patients were alive or not. It

again supported the data because not every death was reported and subsequently entered into the Registry.

Double entries of all extracted data were validated using Microsoft Excel compared for inconsistency in data entry, and corrected before exporting to STATA statistical software package for analysis. To ensure confidentiality, only the investigators had access to the data. Both descriptive analysis and inferential analysis were performed on the study variables. The descriptive analyses were reported on the frequencies, percentages, means and standard deviations. The determination of associations among variables was done by using chi-square with a statistical significance of  $p$ -value  $< 0.05$ . The Kaplan-Meier test was used to perform the survival analysis to determine a five-year period mean survival of cases from breast cancer. The accumulated survival curves between the different categories of study variables were compared using the log-rank method. To substantiate the effect of independence of the study variables representing a statistical significance in a log-rank test, the model of Cox proportional risks multivariate (Hazard ratio) was used as well as calculating the Cox regression power.

Ethical approval was sought from the Ethics and Protocol Review Committee of a higher institution and the head of the unit of the study site before data collection. The use of this secondary data reduced the burden on respondents and ensured replicability of study findings allowing greater trans-

parency of this research procedure and integrity of data collected. Patients whose folders were reviewed were all contacted either in person or on phone to seek their consent before the study began.

## Results

Out of 300 patients' files reviewed, 250 met the inclusion criteria representing 83.3% with the average age of 27 years ( $\pm 11.1$ ). The majority of the cases were within 37-49 years whereas only 8% fell below the age of 37 years. In all, 58% of the cases were 50 years and above. Cases identified as working in the informal sector formed the majority (54.0%), followed by those in the formal sector (26.8%) (Table 1). The unemployed and retired workers constituted 19.2%. Married cases constituted the majority (61.2%), whilst single or divorced formed 15.2% and 23.6% respectively. A family history of breast cancer was only traced with 17.2% of the cases. Health insurance enrollment before the diagnosis of breast cancer was found among the majority (72.0%) and among them, the majority was on the NHIS (Table 1).

The tumor subtypes presented by breast cancer patients at the time of diagnosis showed that the presence of ER (Estrogen Receptor) was high among participants (46%) and 36% had PR (Progesterone Receptor) present. Regarding the status of HER2 (Human Epidermal Growth Factor receptor), the majority (56%) were negative

**Table 1. Demographic characteristics of cases.**

Variables	Categories	Frequencies (%)
Occupational status	Formal	67 (26.8)
	Informal	135 (54.)
	Unemployed	22 (8.8)
	Retired	26 (10.4)
Ethnicity	Ga/Adangbe	44 (17.6)
	Akan	117 (46.8)
	Ewe	58 (23.2)
	Hausa/Others	31 (12.4)
Marital status	Married	153 (61.2)
	Single	38 (15.2)
	Divorced/Separated	59 (23.6)
Region of Residence	Greater Accra Region	189 (75.6)
	Eastern Region	27 (10.8)
	Central Region	15 (6.0)
	Volta Region	11 (4.4)
	Northern Ghana	8 (3.2)
Family History of breast cancer	Yes	43 (17.2)
	No	174 (69.6)
	Unknown	33 (13.2)
Insurance before Diagnosis	Yes	180 (72.0)
	No	70 (28.0)
Type of Insurance	NHIS	165 (91.7)
	Private insurance	15 (8.3)

whiles those who tested positive were only 29% and 15% were unknown. Trend analysis to asses the number of cases presented to the facility over the period 2015-2019 revealed a decline of about 8% in the presented number of cases.

Figure 1 showed a graphical presentation of the survival rate by health insurance coverage with Kaplan-Meier survival estimates. It was observed that over the years patients with insurance cover had a higher surviving rate than those without insurance coverage. At the third year (36 months), those with insurance cover had a 40% survival rate than those without insurance cover (25%). Mortality rates (Table 2) were estimated as per 1,000population for the total person-time at risk of dying for the 250 breast cancer patients. The mortality rate was higher in middle-aged cancer patients (37-49 years), which were 396.40 (233.54–538.65) per 1,000, and lower in the old aged group (50-60 years), representing 348.25 per 1,000. Unemployed patients had a higher mortality rate of 452.38 per 1,000 whilst retired workers had a lower mortality rate of 318.84per 1,000.

Patients with other related diseases (comorbidity) had a higher mortality rate of 388.53 per 1,000 while those with no known diseases other than breast cancer had a lower mortality rate of 343.65 per 1,000

and longer survival times (314) years. Again, patients undergoing radiotherapy had the highest mortality rate 394.73 per 1,000 than those who had chemotherapy (376.06 per 1000) or combinations of the treatment (362.61 per 1,000). Patients with

no insurance coverage had a shorter surviving time and a higher mortality rate 396.75 per, 1000 (Table 2).

Patient survival following chemotherapy, radiotherapy or combination of treatment was determined using the Cox propor-

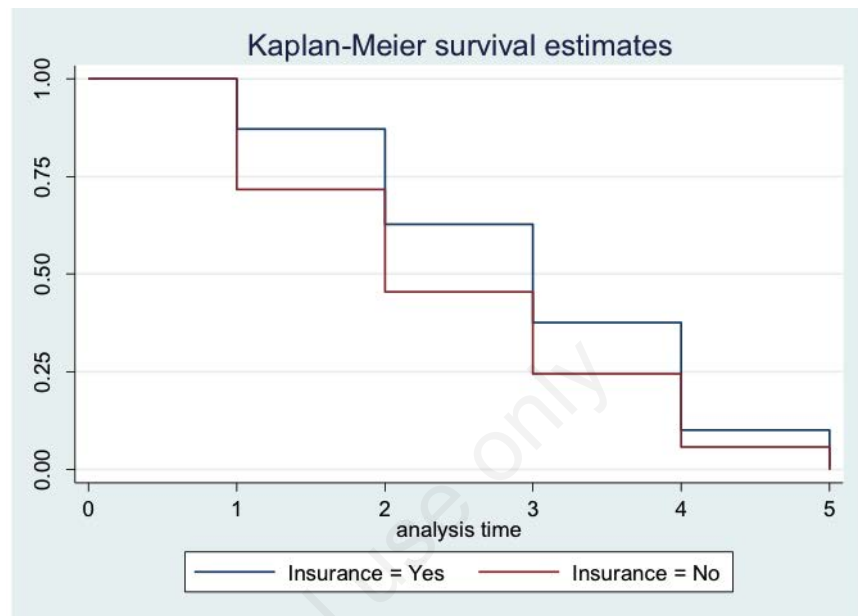


Figure 1. Survival estimate by insurance cover (Kaplan Meier estimate).

Table 2. Mortality rate (incident rate) per 1,000 breast cancer patients over a five-year period.

Variable	Person-time	No. of subjects	Incidence rate/1000	Survival time	
				50%	75%
<b>Age</b>					
27-36	45	20	355.56	2	4
37-49	222	95	396.40	2	3
50-60	201	84	348.25	2	4
61-78	131	51	351.14	2	4
<b>Occupation</b>					
Formal	158	67	392.41	2	3
Informal	330	135	354.54	3	4
Unemployed	42	22	452.38	2	3
Retired	69	26	318.84	3	4
<b>Breast cancer stage</b>					
IIA	148	57	364.86	3	4
IIB	105	46	380.95	2	4
IIIA	204	81	367.64	3	4
IIIB	93	40	354.83	2	4
IV	35	19	342.57	2	3
Unknown	14	7	428.57	2	4
<b>Comorbidity</b>					
None	314	140	343.65	2	3
Yes	285	110	388.53	3	4
<b>Treatment type</b>					
Both	444	176	362.61	2	4
Chemotherapy	117	54	376.06	2	4
Radiotherapy	38	20	394.73	2	3
<b>Insurance</b>					
No	168	70	396.75	3	4
Yes	431	180	291.66	2	3

tional hazard model. The results of the analysis are present in Table 3 and the measurement is significant at  $p < 0.05$ .

The cancer stage diagnosed at IIA and IIB were not associated with survival of patients within the model  $p = 0.698$  and  $0.990$  with a hazard ratio of  $1.085$  ( $0.718-1.640$ ) and  $0.998$  ( $0.697-1.427$ ) respectively. Not all the other stages were significant. The presence of co-morbidity was also not associated with the survival of patients ( $p = 0.104$ ) with a hazard ratio of  $0.796$  ( $0.604-1.048$ ). Having health insurance at the time of diagnosis was the only factor associated with the survival of patients with breast cancer ( $p = 0.036$ ). With reference to the treatment types offered, those who received only radiotherapy had a 45% higher risk of dying compared to those who had both treatments, *i.e.* holding all other covariates constant.

## Discussion

The aim of the study was to determine the relationship between health insurance coverage and clinical outcomes among women with breast cancer presented at the study site. This study found that the average age of reviewed breast cancer cases was 51 years with the majority (38%) between the ages of 37 and 49 years. In an earlier study done in Ghana in 2016 on the survival outcome of breast cancer patients on 1,022 women, the average age was 48 years with 59.69% of presented number of cases between 40-49 years.<sup>18</sup> The age features given by the previous and current study give an indication of a high prevalence of the disease in the late thirties to the late forties. This also indicates that Ghanaian

women present breast cancer at a significantly younger age as compared to women in the some other countries.<sup>19</sup> This present study found out the majority (69.6%) of the breast cancer cases had no family history of breast cancer. This is in contrast to other studies,<sup>20</sup> which reported that family history of first-degree relatives cannot be ruled out and accounted for 17% of women with breast cancer. Concerning insurance cover among patients with breast cancer, this current study found that most (72.0%) of the participants were covered with either private insurance (8.3%) or the National Health Insurance Scheme (NHIS 91.7%) before diagnosis.

### Factors affecting the survival of patients with breast cancer

This study revealed a number of patient clinical factors associated with an outcome whether the patient is dead or alive. It was observed that a patient stage of diagnosis was a significant factor to determine survival ( $p\text{-value} = 0.006$ ). A higher mortality rate was found among those in stage IV (36.8%) compared to those in stage IIA (5.4%). This finding is supported by Mensah *et al.*<sup>18</sup> in a previous study done in Ghana. The study again revealed that the health insurance status of patients at the time of diagnosis was significantly associated with the health outcome of breast cancer patients ( $p < 0.001$ ). A similar study by Hahn *et al.*<sup>21</sup> reported the observed differences between African-American and White women in breast cancer stage at diagnosis could be substantially reduced by addressing poverty and improving health insurance coverage. Lack of health insurance is an ongoing problem for many African-American women as noted in many earlier

studies.<sup>21</sup> This factor influences a late stage and high mortality rate of breast cancer diagnosis and is consistent with a study done in the United States among white and African-American Women.<sup>21</sup>

The treatment of cancers has been found to be highly costly and brings a huge financial burden on patients.<sup>16</sup> The financial cost of cancer has also been found to be associated with a high mortality rate in the developing world since most patients cannot afford their medical bills without insurance coverage.<sup>22,23</sup> In the United States of America and Ghana, cancer treatment has been found to be among the highest items to healthcare experience with an increasing burden on patients.<sup>23,24</sup> The study also found a significant association between the treatment method and the survival of breast cancer patients ( $p = 0.025$ ). A higher mortality rate was found among those who received only radiotherapy (25%) with the least mortality rate among those who received both chemotherapy and radiotherapy (8.5%). In a similar study among breast cancer patients in Ghana reported same Mensah *et al.*<sup>18</sup>

### Survival estimate by insurance coverage

This study found a strong predictive power of health insurance and breast cancer survival. For those with health insurance cover, the study found that those who had health insurance before diagnosis had a significant at  $p\text{-value} = 0.036$  survival rate of 42% as determined by the Cox Proportional estimate (Table 3). Similarly, a study done on the causes of breast cancer treatment delays in Ghana found a high association between the cost burden on patients and survival, thus, health insurance bearer experi-

**Table 3. Survival following radiotherapy and chemotherapy treatment (Cox Proportional Model).**

Variable	Haz. ratio	Std. Err	P>[Z]	(95% CI)	Log-rank test for equality
<b>Stage</b>					
IIA	Ref				
IIB	1.085	0.228	0.698	0.718-1.640	0.66 (0.985)
IIIA	0.998	0.181	0.990	0.697-1.427	
IIIB	1.045	0.232	0.840	0.676-1.612	
IV	1.091	0.357	0.792	0.574-2.073	
Unknown	0.965	0.447	0.938	0.394-2.362	
<b>Comorbidity</b>					
No	Ref				3.55 (0.059)
Yes	0.796	0.113	0.104	0.604-1.048	
<b>Insurance</b>					
No	Ref				6.39 (0.012)
Yes	1.416	0.235	0.036	1.023-1.980	
<b>Treatment type</b>					
Both	Ref				1.13 (0.569)
Chemotherapy	1.072	0.194	0.701	0.752-1.528	
Radiotherapy	1.445	0.425	0.209	0.813-2.571	

ence much lesser burden.<sup>25</sup> The study further found that at every stage of the disease, those on health insurance had a higher survival rate than those who were not. For instance, after the third year, the study found that those who with health insurance had a 40% survival rate than those who were not (25%). This is consistent with Hahn *et al.*<sup>21</sup> and Halpern *et al.*<sup>22</sup> who found similar trends in Health insurance and survival rate.

There are also likely to be many confounding factors why health insurance is associated with worse outcome measures for breast cancer. One key reason is that uninsured people are less likely to undergo screening or see a doctor at an early stage. In the Ghanaian setting, many women are concerned about the cost implications for health screening, but will not also make any attempt to get under health insurance coverage.

## Conclusion

With the increasing financial burden on patients, the study found that health insurance coverage had a significant association with patient survival. Thus, a patient who had health insurance at the time of diagnosis was more likely to exhibit a higher survival rate. This again, confirms the importance of structured health financing mechanisms in the fight against disease conditions. Treatment using both radiotherapy and chemotherapy were found to be significantly associated with patient survival; with patients who received both treatments having a higher survival rate. Further studies to look at the correlation between the economic burden of breast cancer and the quality of life of the patients will further support the study's findings. The success of these projections will eventually improve patient care and the delivery of health care in Ghana.

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