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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

MPHIL. APPLIED EPIDEMIOLOGY AND DISEASE CONTROL

DETERMINANTS OF SURVIVAL AMONG HOSPITALIZED BREAST CANCER PATIENTS IN THE TAMALE TEACHING HOSPITAL, NORTHERN REGION IN GHANA, 2024

BY

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DECLARATION

I, **Felicia Aguba** hereby declare that aside from the references to other people's work, which have been duly acknowledged, this dissertation is my original work and has not been neither in whole or in part submitted to any institution for the award of a degree.

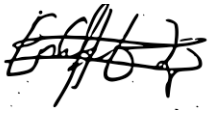


8th November 20242024

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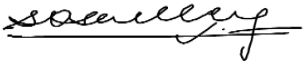


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DEDICATION

This work is dedicated to the Almighty God, in gratitude for guidance and strength.

It is also dedicated to the courageous women of Northern Ghana who have been affected by breast cancer, those who have survived, those who have passed on, and those who continue to fight. May God be your source of comfort and strength.



Felicia Aguba

November 2024

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God richly bless you all.

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ABSTRACT

Background: Worldwide, breast cancer poses a considerable threat to women's survival. In Ghana, there is limited research on hospitalized survival outcomes and determinants of survival among breast cancer patients, particularly in Northern Ghana. This study assessed determinants of hospitalized survival among breast cancer inpatients at the Tamale Teaching Hospital.

Methods: A retrospective cohort study was conducted using medical records of 463 hospitalized breast cancer patients admitted to the Tamale Teaching Hospital between 2014 and 2023. Data on sociodemographic, clinicopathological, and health system factors were extracted. Kaplan–Meier methods were used to estimate hospitalized survival, and Cox proportional hazards regression was applied to identify determinants of survival.

Results: Of the 463 patients reviewed, 11.2% died during hospitalization. The median hospitalized survival time was not reached, with 75% of patients staying beyond 29 days. Multivariate analysis identified farming occupation (HR = 0.053, 95% CI: 0.005–0.603), health insurance coverage (HR = 0.464, 95% CI: 0.23–0.92), and undergoing surgery (HR = 0.051, 95% CI: 0.01–0.37) as significant predictors of improved hospitalized survival.

Conclusion: This study found a 75% hospitalized survival rate among breast cancer patients in Northern Ghana. Improved survival was associated with occupation, surgical treatment, health insurance coverage, and absence of comorbidities. These findings highlight the need for targeted interventions to improve access to timely surgery and health insurance coverage to enhance survival outcomes.

Keywords: breast cancer, hospitalized survival, determinants, Northern Ghana, retrospective study.

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TABLE OF CONTENT

DECLARATION i

DEDICATION ii

ACKNOWLEDGEMENT iii

ABSTRACT iv

TABLE OF CONTENT 1

LIST OF TABLES 4

List of Figures 5

LIST OF ABBREVIATIONS 6

CHAPTER 1 7

1. INTRODUCTION 7

1.1. Background 7

1.2. Operational definition 8

1.3. Problem Statement 9

1.4. Conceptual Framework 11

1.5. Narrative 12

1.6. Justification 13

1.7. Research questions 13

1.8. General Objectives 14

1.9. Specific Objectives 14

CHAPTER 2 15

2.0. Literature Review 15

2.1. Breast Cancer burden and Prevalence 15

2.2. Survival outcomes of breast cancer patients 16

2.3. Socio-Demographic factors that affect survival time among breast cancer patients 19

2.1. Clinical-pathological factors that affect survival time among Breast cancer patients 25

University of Ghana http://ugspace.ug.edu.gh

2.2. Health facility factors affecting survival time among Breast cancer patients 28
CHAPTER 3 31
3. Methods 31
3.1. Study design 31
3.2. Study area 31
2.1. Study population 32
2.2. Sample size and Sampling 32
2.3. Study variables 33
2.3.1. Outcome Variables 33
2.3.2. Independent variables 33
2.1. Data collection technique 38
2.2. Quality assurance 39
2.3. Data Processing and analysis 39
2.4. Ethics and Protocol 39
CHAPTER 4 40
4.0. Results 40
4.1.1. Summary statistics of socio-demographic of Hospitalized BC patients, TTH, Northern Ghana, 2014-2023 40
4.1.2. Summary of Clinical Characteristics 42
4.1.3. Summary of Health system variables 45
4.2. Estimation of Survival outcomes of Breast cancer patients hospitalized at TTH 46
4.2.1. Overall hospitalized Survival outcomes for BC patients at TTH, (2014-2023) 46
4.3. Determinants of survival among BC hospitalized patients, TTH, 2014-2023 47
4.3.1. Demographic factors and hospitalized Survival 47
4.3.2. Clinical-pathological factors and hospitalized Survival 48
4.3.3. Health system factors and hospitalized survival 50
4.3.4. Multivariable Cox Regression Analysis of study variables associated with hospitalized Survival in Breast Cancer 51

University of Ghana http://ugspace.ug.edu.gh

CHAPTER 5 53

5.0. Discussion 53

5.1. Limitations 58

CHAPTER 6 59

6.0. Conclusion and Recommendation 59

6.1. Conclusion 59

6.2. Recommendations 60

References 61

Appendix 1 80

DATA COLLECTION TOOL 80

Appendix 2 86

ETHICAL APPROVAL LETTER 86

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

LIST OF TABLES

Table 1: Independent variables of hospitalised survival 34
Table 2: "Operational definition", scale of measure and data source of sociodemographic variables 35
Table 3a: Operational definition, type of variable, scale of measure, and data source of Clinical-pathological variables 36
Table 4: Operational definition, type, scale of measurement and data source of health system variables 37
Table 5: Socio-demographic characteristics of hospitalized BC Patients, TTH, 2014-2023 .41
Table 6a: Clinical characteristics of Hospitalized BC patients, TTH, 2014-2023..... 43
Table 7: Health System variables 45
Table 8: Univariate Cox regression analysis of Socio-demographic factors and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023) 48
Table 9: Univariate COX regression of Clinical characteristics and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023) 49
Table 10: Univariate COX regression of Health system factor and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023) 50
Table 11: Multivariate Cox Regression analysis of associations between factors and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023) 52

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

List of Figures

Figure 1: Conceptual Framework for Determinants of survival among BC patients in TTH, Northern Region.....12
Figure 2: Map of Northern Region showing TTH, Ghana.....32
Figure 3: Kaplan-Meier Survival Curve for Patients Admitted at TTH from 2014 to 2023, Northern Ghana.....46



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LIST OF ABBREVIATIONS

BC	Breast cancer
CHAG	Christian Health Association of Ghana
CHPS	Community Health Planning and Services
CI	Confidence Interval
DHIMS 2	District Health Information Management System 2
ER	Estrogen receptor
HDI	Human Development Index
HER-2	Human Epidermal growth factor receptor-2
HR	Hazard Ratio
ICU	Intensive Care Unit
LDCs	Less-Developed Countries
LHIMS	Light wave Health Information Management System
LMICs	Low and middle income countries
MBC	Metastatic breast cancer
MIR	Mortality-to-incidence ratio
MoH	Ministry of Health
NCCN	National Comprehensive Cancer Network
OS	Overall Survival
PR	Progesterone receptor
TTH	Tamale Teaching Hospital
TNBC	Triple-negative breast cancer
WHO	World Health Organization

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CHAPTER 1

1. INTRODUCTION

1.1.Background

Breast cancer is a malignant tumour originating in breast tissue and is the most commonly diagnosed cancer among women globally. In Africa, it represents one of the leading causes of cancer-related mortality among women, second only to cervical cancer (Adeoye, 2023). Despite having the smallest recorded incidence rates, Africa is said to have the world's highest mortality rate (Anyigba et al., 2021). In 2020, GLOBOCAN reported 186,598 breast cancer cases and 85,787 deaths in Africa (Anyigba et al., 2021; Global Cancer Observatory, 2023).

In Ghana, Cancer of the breast makes up 19.5% newly diagnosed tumours and 13.6% of carcinomas-related fatalities (Akakpo et al., 2023; Global Cancer Observatory, 2023). Evidence from Northern Ghana indicates an increasing burden of breast-related conditions. A ten-year review reported 1,913 breast-related cases, of which 62.3% were benign tumours and 37.7% were malignant breast cancers (Der & Abantanga, 2023).

Risk factors for breast cancer include increasing age, obesity, harmful alcohol use, family history, radiation exposure, reproductive history, tobacco use, and postmenopausal hormone therapy(Owolade et al., 2022; WHO, 2023). Educational status and marital status also influence mortality risk(Tesfay et al., 2021). Age significantly affects breast cancer survival, with higher mortality rates at older ages (Joko-Fru, Miranda-Filho, et al., 2020).

Breast changes that are said to be indicative of breast cancer includes “breast lumps”, “changes in size” or “shape”, dimpling, and abnormal nipple discharge (WHO, 2023). Treatment options depend on cancer subtype and extent of spread, with early detection being critical for timely initiation of appropriate therapy and improved survival outcomes (CDC, 2023; WHO, 2023).

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Radiotherapy is vital in treating breast cancer, reducing recurrence and mortality risk. Ghana's National Strategy for Cancer Control aims to address the increasing burden of non-communicable diseases, including breast cancer ("Ministry of Health NATIONAL STRATEGY FOR CANCER CONTROL IN GHANA, 2011"). However, despite rising incidence, there is a lack of explanatory studies documenting factors influencing breast cancer survival in Northern Ghana, particularly among patients treated at Tamale Teaching Hospital.

The objective of this investigation is to assess factors influencing breast cancer survival among patients treated at Tamale Teaching Hospital, addressing this critical knowledge gap.

1.2.Operational definition

Hospitalized survival: the length of time a patient survives from the time they are admitted to a hospital until they are discharged.

Time: the period which patients visit the hospital during the follow up period.

Minimum follow up time: The period that a patient who had two longitudinal measurements after start of the anti-cancer treatment.

Censoring: Observations are called censored if the information about their survival time is incomplete. An individual loss follow-up during the study period (drop out from the study) (Keele, 2022).

Kaplan–Meier estimator: a non-parametric statistic that estimates the probability of survival for a given time based on observed event times and censored data. It's also known as the product limit estimator.

Cox proportional hazards regression: a statistical method that estimates the effect of predictor variables on the time it takes for an event to occur.

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1.3. Problem Statement

Preferably, the factors that influence the length of time spent by individuals diagnosed with breast cancer as well as how long these patients lives until death occurs, should be known across all regions, as it is critical for understanding prognosis and treatment outcomes, as well as equal interventional attention or shared resources to all regions. However, Long-term survival outcomes for breast cancer vary significantly across Sub-Saharan Africa, with hospitalized patients facing unique challenges (Ssentongo "et al., 2019"). Despite the growing burden of breast-related conditions managed at the Tamale Teaching Hospital (TTH), hospital-based histopathological records indicate that between 2012 and 2021, a total of 1,913 breast-related cases were recorded, of which 722 were confirmed malignant breast cancers and 1,191 were benign tumours (Der & Abantanga, 2023). However, limited knowledge exists on the survival duration of hospitalized breast cancer patients in Northern Ghana.

Recent studies have reported aggressive breast cancer presentations at the Tamale Teaching Hospital (Der & Abantanga, 2023) as well as high rates of treatment delay and discontinuation linked to socioeconomic constraints, cultural beliefs, and health system barriers documented in similar low-resource settings (Jedy-Agba et al., 2017; Unger-Saldaña, 2014). Comorbidities (Arneja & Brooks, 2021), socioeconomic status (Jiang et al., 2023), diagnosis stage (Feleke et al., 2022), age, marital status (Joko-Fru, Jedy-Agba, et al., 2020; Joko-Fru, Miranda-Filho, et al., 2020), treatment availability, and tumour characteristics(Mapanga et al., 2023) significantly impact breast cancer survival. However, specific factors influencing hospitalized breast cancer patients' survival at TTH remain unclear. Evidence suggests that the length of hospital stay until discharge or death is not well understood as well as the impact of socioeconomic, demographic, biologic, clinical, and health system factors on survival.

This knowledge gap hampers effective intervention and resource allocation, exacerbating emotional distress, financial burdens, and regional productivity losses. The consequences of

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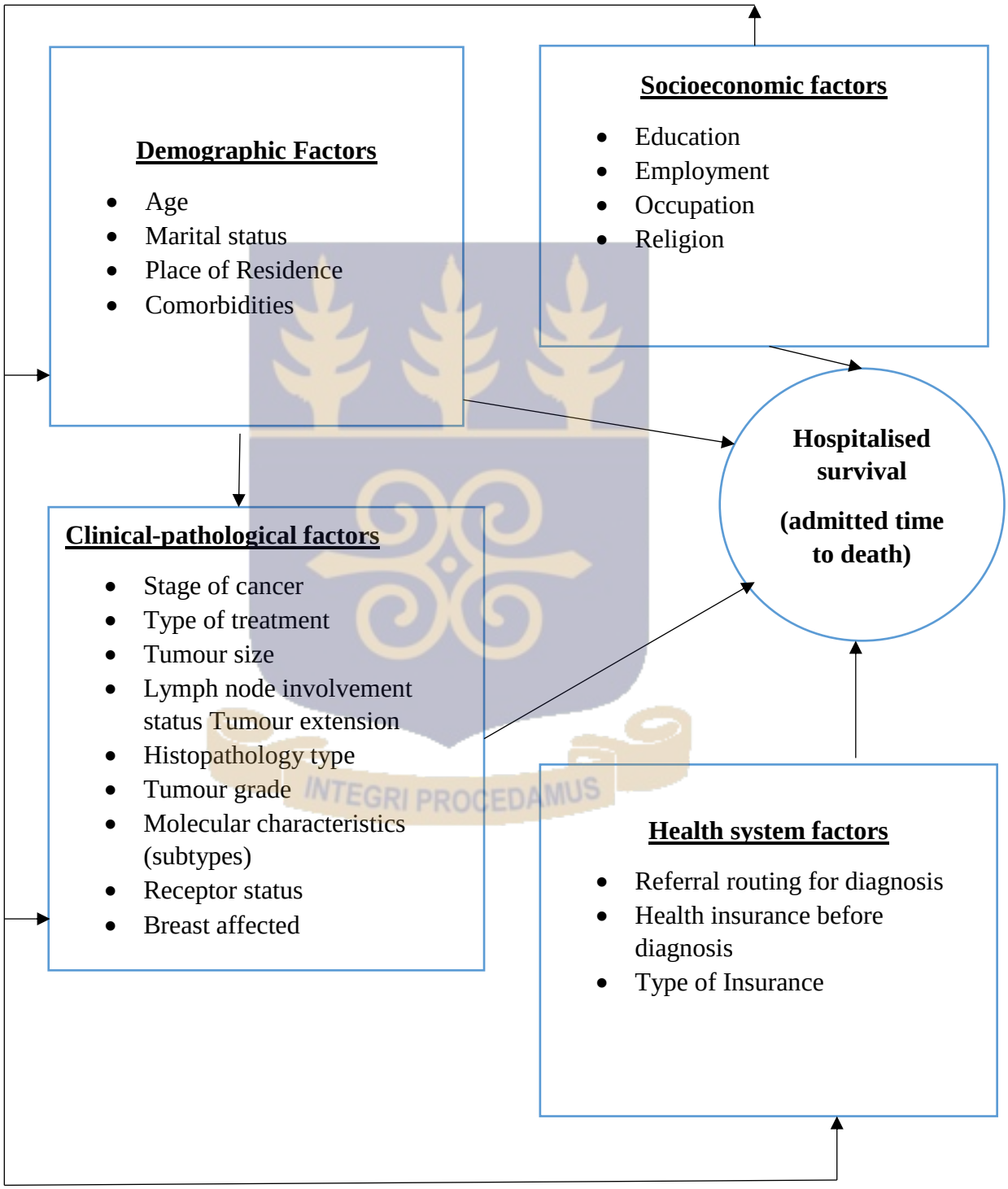
breast cancer in the Northern Region are profound, with high mortality rates and shorter survival times affecting affected families. Furthermore, knowledge disparities on survival may lead to uneven distribution of aid, while the financial burden of treatment strains healthcare resources. This, coupled with increasing demand for services, hampers the region's productivity and economic development (Kwabeng et al., 2020).

Overall, breast cancer adversely affects the public health profile in the Northern Region and has broader consequences for Ghana as a whole. This study aims to fill this knowledge gap by investigating survival determinants in hospitalized breast cancer patients at TTH, identifying key factors influencing patient outcomes. The findings will inform evidence-based interventions, improve breast cancer survival rates, and reduce the disease burden in the Northern Region. By understanding the factors that influence hospitalized breast cancer patients' survival, healthcare providers can implement targeted strategies to enhance patient care and outcomes.

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1.4.Conceptual Framework



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Figure 1: Conceptual Framework for Determinants of survival among BC patients in TTH, Northern Region

1.5.Narrative

The conceptual framework for this study assesses the multifaceted factors influencing the survival time of breast cancer inpatients at the Tamale Teaching Hospital. Sociodemographic characteristics, including age, education, occupation, religion, comorbidities, and marital status, play a crucial role in altering the likelihood and duration of life after a breast cancer diagnosis.

Aging, for instance, weakens the immune system, increasing vulnerability to severe illnesses like cancer. Awareness of these conditions prompts lifestyle changes, reducing risk; however, studies show lack of awareness heightens breast cancer risk. Rural residents often seek traditional healing due to limited access to medical care. Biological and clinical characteristics significantly predict survival. The stage of breast cancer at diagnosis influences survival probability, with advanced stages reducing chances due to cancer cell spread. Tumor size, extension, and pathology type further determine post-treatment survival. Treatment type at diagnosis also affects survival, as different methods vary in effectiveness. Health system factors, such as referral nature and insurance policies, influence survival.

In summary, sociodemographic, biological, clinical, and health system variables intertwine to determine breast cancer survival. Individuals with lower survival rates face higher mortality, while those with greater survival rates live longer. These factors have far-reaching implications, affecting not only patients but also the national economy and healthcare institutions due to high treatment costs.

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1.6.Justification

Breast cancer remains a pressing global health concern, affecting millions of women and causing significant morbidity and mortality. Regional disparities in breast cancer survival rates necessitate targeted research, particularly in underserved areas. This study focuses on determining the factors influencing survival among hospitalised breast cancer patients at Tamale Teaching Hospital in Ghana's Northern Region.

Notably, existing literature on breast cancer survival in Ghana predominantly originates from southern regions, leaving a significant knowledge gap in northern areas. To our knowledge, no hospitalization survival study has been conducted in the Northern Region, highlighting the urgency for context-specific research.

This study aims to address this gap by investigating the determinants of survival among breast cancer inpatients in a resource-limited setting. By examining individual factors contributing to survival disparities, this research will provide valuable insights for improving patient outcomes and bridging the survival gap in Northern Ghana.

Understanding these factors can inform targeted interventions, enhancing patient care and ultimately leading to better outcomes. Specifically, identifying key factors such as timely diagnosis, pathology type, treatment type, tumor size and extension, and access to healthcare will enable healthcare providers to implement evidence-based strategies, improving breast cancer survival rates in the Northern Region.

1.7.Research questions

1. How long does an individual hospitalised with breast cancer in the Tamale teaching hospital stay until death occurs?
2. What are the socio-demographic factors that are associated with the survival of breast cancer patients at TTH?

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3. What clinical and pathological factors are associated with the survival of individuals admitted with breast cancer at the Tamale Teaching Hospital?
4. What health system factors are associated with the survival of individuals admitted with breast cancer at TTH?

1.8.General Objectives

To estimate overall survival rate and determine the prognostic factors associated with hospitalisation survival among breast cancer (BC) patients treated at Tamale Teaching Hospital, Northern Region, Ghana.

1.9.Specific Objectives

1. To estimate the survival time of breast cancer inpatients in the TTH, Northern region
2. To determine demographic and socioeconomic factors associated with survival time among breast cancer inpatients at TTH, Northern Region.
3. To determine clinical and pathological factors associated with survival time among hospitalized breast cancer patients at TTH, Northern Region.
4. To assess health system factors associated with survival time among hospitalized breast cancer patients at TTH, Northern Region.

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CHAPTER 2

2. Literature Review

2.1.Breast Cancer burden and Prevalence

Breast cancer contributes significantly to Ghana's growing non-communicable disease burden. In 2020, Ghana reported 24,009 cancer cases and 15,802 cancer-related deaths (Global Cancer Observatory, 2023). Cancer of the breast makes up 19.5% newly diagnosed tumours and 13.6% of carcinomas-related mortalities in Ghana (Akakpo et al., 2023). Globally, Neoplasm of the breast is a predominant cancer in women, with 2.3 million new cases and 685,000 deaths in 2020 (WHO, 2023). Less developed countries (LDCs) confront synergistic challenges of non-communicable and infectious diseases, with half of all breast cancer patients residing in LDCs (Martei et al., 2018).

In Ghana, breast cancer incidence rates have increased, with 38.3 cases per 100,000 women in 2020 (GLOBOCAN). Factors contributing to this upward trend include altered lifestyles, enhanced cancer reporting, increased research interest, and population growth. Notably, Ghana reports a lower age-specific incidence of breast cancer compared to Western countries. The majority of cases occur in women under 50years of age (Agyemang et al., 2020; Joko-Fru, Jedy-Agba, et al., 2020; Naku Ghartey Jnr et al., 2016). This age distribution underscores the need for tailored early detection and prevention approaches targeting younger demographics.

Research highlights significant variations in treatment courses and tumor markers between Ghanaian and American women with breast cancer. Ghanaian women tend to present at younger ages, advanced stages, and with larger tumors(Okifo et al., 2021).

Delays in seeking therapy and diagnosis contribute to poor prognosis. Stigma and limited awareness are additional hurdles to effective breast cancer control in Ghana(Akuoko et al., 2017). Improving access to early detection methods, promoting breast self-examination, and

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culturally sensitive education and advocacy programs are crucial. Risk factors for breast cancer in Ghana include urbanization, unhealthy diets, delayed childbearing, reduced breastfeeding, hormonal contraceptives, obesity, and alcohol consumption(Osei-Afriyie et al., 2021; Owolade et al., 2022).

2.2.Survival outcomes of breast cancer patients

Survival times outside Africa

While the World Health Organization (WHO) aims to decrease global breast cancer deaths by 2.5% annually, preventing around 2.5 million deaths from 2020 to 2040(WHO, 2023), the reality is that survival rates differ significantly worldwide. Research indicates that the five-year survival rates for breast cancer patients vary across countries. In the United States, it's reported to be 84%, while in Australia, its 89.5% (Allemani et al., 2017). In Europe, according to the same study, the survival rate is 81% (Allemani et al., 2017), while a study by Abedi et al reported a survival rate of 69.55% in Iran (Abedi et al., 2016). Additionally, another study by Lan N et al found 74% survival rate in Vietnam (Lan et al., 2016). In Indonesia, it is reported to be 51.07%(Sinaga et al., 2018), while Abdullah et al also reported a survival rate in Malaysia to approximately 49%(Abdullah et al., 2018; Nordin et al., 2018), and in India, it's 66.1%(Allemani et al., 2018). Moreover, a study conducted in Central Iran reveals specific survival rates at a year interval. The study reported a 1-year survival rate of 98.0%, at two years, the survival rate was estimated to be 96.0%, at three years, its 92.0%, at four years it is 89.0%, and at an overall 5-year survival rate of 87.0 % (Fazeli et al., 2018). These variations emphasize the diverse experiences and challenges faced by individuals with breast cancer across different regions and countries.

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Survival in Africa

According to survival analysis studies conducted in Africa, Breast cancer survival rates vary significantly across Sub-Saharan Africa regions. Five-year survival rates range from 11.9% in Gambia to 53.4% in South Africa (Weiner et al., 2018). A study conducted in Ethiopia reported a a five-year survival rate of 25.8% (Tiruneh et al., 2021), while a meta-analysis reveals survival rates of 33% in Nigeria, 40% in Ghana, and 48% in sub-Saharan Africa(Ssentongo et al., 2019). According to Azubuike in 2018, Western Africa has the highest mortality rate of 20.1 deaths per-100,000, and Mortality rates in Nigeria is said to surpass those of other African nations, reaching 25.9 deaths per 100,000, exceeding the global average of 12.9 deaths per 100,000 (Azubuike et al., 2018). In Ghana, survival studies are limited with few studies reporting varied survival across regions especially along Ghana's southern coastline. A survival assessment conducted in the Eastern region of Ghana by Ssentongo et al reported a 52% three-year survival rate (Ssentongo et al., 2022), while a study conducted in the Korle-Bu teaching Hospital, Greater Accra reported a 47.9% five-year survival rate (Mensah et al., 2016).

African countries with mixed-race or colours, research have highlights significant disparities in survival rates among these specific populations. A study found different survival rates among black and white African women. In Namibia, Survival rates range from 90% for white women to 56% for black Namibian women. Also in South Africa, a 76% survival rate was reported for mixed-race women to 59% for black women (Mccormack et al., 2020). Early diagnosis and treatment access significantly affect survival rates, with variations tied to countries' human development indices (HDI) (Joko-Fru, Miranda-Filho, et al., 2020).

Hospitalization survival outcomes

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Hospitalized breast cancer patients often face poor survival outcomes due to advanced disease, comorbidities, and aggressive treatment. Research has consistently shown that these patients have poor survival rates, with Adamu et al. (2019) reporting a 5-year survival rate of 24.6% for breast cancer patients in North Eastern Nigeria(Adamu et al., 2019), and Alabi et al. (2022) finding a survival rate of 43.8% at 5 years in Nigerian breast cancer patients(Alabi et al., 2022). Brewster et al. (2011) reported that 30-day mortality rates for breast cancer patients in Scotland ranged from 10.3% to 15.1% (Brewster et al., 2011). In-hospital mortality rates for breast cancer patients vary across studies. Lee et al. (2019) reported an in-hospital mortality rate of 21.1% for stage IV cancer patients receiving cardiopulmonary resuscitation (Lee et al., 2019). Park et al. (2021) found an in-hospital mortality rate of 14.1% for breast cancer patients with comorbid heart failure (Park et al., 2021). Heo et al. (2015) reported an in-hospital mortality rate of 35.1% for advanced cancer patients, including breast cancer, after ICU admission (Heo et al., 2015). Puxty et al. (2014) found an in-hospital mortality rate of 41.9% for solid cancer patients admitted to the ICU (Puxty et al., 2014).

Prolonged hospital stays are common among breast cancer patients, with Kamaraju et al. (2022) finding a median length of stay of 7 days for solid tumour oncology patients, including breast cancer (Kamaraju et al., 2022). Park et al. (2021) reported that breast cancer patients with comorbid heart failure had longer hospital stays (median 10.5 days) and higher hospital costs. Median survival time varies significantly across studies, with Gashu et al. (2024) reporting a median survival time of 24.5 months for breast cancer patients in Northwestern Ethiopia, and Heo et al. (2015) finding a median survival time of 12.6 months for advanced cancer patients, including breast cancer, after ICU admission(Gashu & Ehetie, 2024; Heo et al., 2015).

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2.3.Socio-Demographic factors that affect survival time among breast cancer patients

Breast cancer, being a global concern, has an array of patient outcomes. Numerous factors influence whether or not someone survives breast cancer. According to research, they include a person's age, location either rural or urban setting, marital status, underlying illness, educational level, as well cultural beliefs.

Age

As a patient-related factor, age can have a major effect on how well you do when you have breast cancer. Younger people are more likely to get a kind of breast cancer that is faster developing and more difficult to treat (Brandt et al., 2015; Chen et al., 2016; Tesch & Partridge, 2022). However, they do have a better chance of survival because they are usually healthier and can withstand therapies better. According to studies, older people may experience other health issues in addition to their breast cancer. This can complicate matters and reduce their odds of completing the task (Chen et al., 2016; Herck et al., 2021; Tesch & Partridge, 2022). Individuals' immune systems decrease as they age, which may reduce their ability to resist invading microorganisms and, as a result, may lead to serious illnesses such as cancer. According to a study on disparities and Survival among breast cancer patients found a risks among women ages 20–49 and 50 and older (Field et al., 2005). Another study conducted to identify the factors that are associated with five-year overall survival (OS) among patients with breast cancer at a local tertiary hospital in Indonesia found that patients' age at diagnosis was the only significant prognostic factor for the patients' survival (Sinaga ES et al., 2018). According to Wu et al 2020, a study to determine the survival rate of patients with invasive breast cancer and identify the prognostic factors related to all-cause mortality during a 10-year follow-up, indicated that advanced age was associated with an increase in the risk of mortality (Wu et al., 2020). In their study, the HR of patients who developed breast cancer at an age of

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≥50 years relative to those who developed breast cancer at an age of ≤50 was 1.56 (95% CI: 1.11–2.21)(Wu et al., 2020). A study on Breast cancer survival and its prognostic factors in the United Arab Emirates by Elobaid et al 2021 reported an average age at diagnosis of women was 48 years supporting other studies in the Arab region claiming that women at young age are more likely to develop breast cancer (Elobaid et al., 2021; Najjar & Easson, 2010). A study conducted in the Eastern Region of Ghana also reported a similar finding where patients at 40years or younger age reporting rural settings forms half of the cases recorded in their study(Ssentongo et al., 2022).

Marital status

Numerous studies have found a link between marital status and breast cancer survival. According to research, married people outlive those who are single, divorced, or widowed (Ding "et al., 2021"; "Li et al., 2020"; Zhai et al., 2019). According to a population-based study conducted to assess prognostic significance of marital status in breast cancer survival, show that breast cancer patients who were unmarried at diagnosis had a significantly higher risk of dying of all causes compared with those who were married (Martínez et al., 2017). Another population-based study also revealed that, "unmarried patients had a 15.5% increased risk of breast cancer-specific mortality and a 19.0% increased risk of overall mortality compared with married patients with metastatic breast cancer (MBC)". In terms of breast cancer specific survival and overall survival, marriage was said to emerge as a predictor of better outcomes across most subcategories analysed. Marital status in the study was reported to be an independent prognostic indicator for survival in patients with MBC and was associated with significant survival benefits (Zhu & Lei, 2023).The consequences of this link extend beyond mere correlation, emphasising the importance of emotional and financial support during the breast cancer journey.

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Place of residence

Ssentongo P et al. discovered considerable variations in survival rates across different regions and sites of residency in their investigation (Ssentongo et al., 2019). Emerging evidence suggests that where a person lives can profoundly influence their breast cancer survival outcomes (Jeuken et al., 2022; Kene et al., 2010; Ssentongo et al., n.d.). Studies have consistently revealed differences in survival rates among patients residing in various regions and locations (Anie et al., 2021). According to research, the site of residency significantly correlate with the risk of breast cancer. Women who lived in urban regions had a 0.84-fold minimized risk compared with those in rural areas (Tasfa Marine & Mengistie, 2023). A study conducted in five Sub-Saharan African countries to investigate the influence of distance to health facilities on clinical breast cancer screening behaviour among women revealed disparities in breast examination behaviour across women's places of residence. According to the study, women living in rural areas were less likely to utilise breast cancer screening than those in urban settings(Addo et al., 2023). The lower likelihood of breast cancer screening attendance in rural areas is not surprising and could be due to disparities in access to healthcare or a lack of adequate hospitals and other healthcare facilities to offer breast cancer screening services (Addo et al., 2023).

However, a systematic review and meta-analysis conducted, contradict the above findings, which shows that living in urban regions is linked to a greater risk of breast cancer as compared to women staying in rural areas (Rodríguez Bautista et al., 2018). This might be a result of disparities in the population's economic standing, levels of education, and knowledge of risk factors in urban area.

These disparities frequently represent variations in the quality of breast cancer treatment as well as access to screening programmes and healthcare resources. Research has shown that

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there is a difference between urban and rural locations. In general, urban dwellers have easier access to medical facilities, treatment alternatives, and specialised breast cancer care institutes (Tesfay et al., 2021)

Socioeconomic factors

Studies have revealed that a person's socioeconomic status, such as educational level and income, is a critical driver of survival. According to an Ethiopian study, people with higher levels of education have better health results (Jiang et al., 2023; Tesfay et al., 2021). They tend to have a better understanding of their condition, the importance of early detection, and access to healthcare resources (Tesch & Partridge, 2022). This knowledge empowers them to take proactive steps in managing their health, including seeking timely medical attention and adhering to treatment plans. Furthermore, educated people may have better access to knowledge on clinical trials and the most recent advancements in breast cancer treatment, which can improve their prognosis. Individuals with lower levels of education, however, may experience challenges comprehending their diagnosis and understanding the complex healthcare system, according to Tesfay et al 2021. This can result in delays in diagnosis and treatment, lowering their chances of survival. Healthcare disparities often connect with educational disparities, emphasising the importance of health education and equal access to care for all people.

Studies have shown that having a good income is an important socioeconomic factor associated with breast cancer prognosis, as financial resources significantly influence an individual's ability to access timely and high-quality healthcare (Iddrisu et al., 2021). Breast cancer treatment can be expensive, involving surgery, chemotherapy, radiotherapy, and other supportive pharmacological treatments (Blumen et al., 2016). From a study conducted, having sufficient financial resources and good health insurance can help cover these costs and ensure

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individuals receive the best care available (Qu et al., 2020). Conversely, financial limitations can lead to delays in diagnosis and treatment initiation. Individuals without adequate insurance or financial resources may face difficult choices, such as forgoing recommended treatments due to the high costs involved. Patients with limited access to quality healthcare, those from lower socioeconomic backgrounds, often experience poorer survival outcomes due to delayed diagnosis and treatment. Disparities in access to healthcare services persist as a critical concern (Adam & Koranteng, 2020; Fasano et al., 2022; Ssentongo et al., 2019)

Religious Belief

Studies have shown that although culture can bring people together and be a source of strength, it can also have negative effects. Cultural norms combined with traditional practices play a major role in late-stage breast cancer diagnoses because they create taboos around talking about health issues, especially those pertaining to reproductive organs, which delays seeking medical attention. Certain Ghanaians consider breast cancer as a curse or punishment from the lesser gods (Alex Addae-korankye, 2016). Some women believe that an extramarital immoral lifestyle causes the punishment for the development of breast cancer (Bonsu & Ncama, 2019). Some believe it is an ancestor punishment for the woman's failure to bear children in order to preserve the ancestral bloodline (Agbokey et al., 2019) and as a result, they are given spiritual new-borns to suckle the breast, which causes cancer (Agbokey et al., 2019). It is also believed that some women have been cursed because of their wrongdoings (Asobayire & Barley, 2015). Due to cultural beliefs, some women prayed to their ancestors in the hopes that traditional medicine would cure them of breast cancer (Asoogo & Duma, 2015)(Asoogo & Duma, 2015)

Some studies conducted in Greater Accra, Tamale, and Kumasi have reported that breast cancer is perceived by some individuals as a spiritual affliction attributed to malevolent actions by other persons or supernatural forces, while others associate the disease with harmful spiritual

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powers (Bonsu & Ncama, 2019; Iddrisu et al., 2021; Salisu et al., 2022) . Some study participants believe that breast cancer is caused by spiritual or supernatural powers (Kugbey et al., 2020; Opoku et al., 2012) and can only be cured through spiritual means(Opoku et al., 2012) . Due to their spiritual convictions, some women sought therapy from traditional healers (Asoogo & Duma, 2015) (Salisu et al., 2022). According to a study conducted in the northern part of Ghana, women suffering from breast cancer are witches (Asobayire & Barley, 2015b) and they have ritualistically used their breasts, whereas some participants in the southern region of Ghana thought that witchcraft was the cause of breast cancer. (Alex Addae-korankye, 2016).

According to several studies conducted in Ghana's north and south, participants prayed for cure because they believed their illness was a test from God (Iddrisu et al., 2021). Some people also thought that God possessed supernatural abilities that might melt the breast mass (Bonsu & Ncama, 2019) (Kugbey et al., 2020) and completely cure them (Kugbey et al., 2020). Some women also thought that developing breast cancer was inevitable for them (Salisu et al., 2022). Some women have to attend prayer camps in order to find healing because of these religious beliefs, which caused a delay in the detection and treatment of breast cancer. (Asoogo & Duma, 2015).

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2.4. Clinical-pathological factors that affect survival time among Breast cancer patients

Biologic factors

Various biologic factors can influence a tumours metastatic potential and its impact on mortality. A study conducted by Mensah et al found subjects with the triple negative subtype, ER/PR and HER2-neagive, had the worst overall survival of 50.80% as compared with the other subtype (Mensah et al., 2016). The poor prognosis found in Ghanaians with breast cancer may be due in part to tumours with low hormone-receptor positivity frequencies. This is significant because breast tumours that are positive for the oestrogen receptor (ER) and progesterone receptor (PR) have a better prognosis than triple-negative breast cancer (TNBC), which lacks Steroid hormones (ER, PR) and growth factor receptor (HER2)(Thomas et al., 2017). According to Thomas et al, TNBC was found to be three times more common in Ghanaians than in African Americans or white Americans. According to studies, 82% of Ghanaians were diagnosed with TNBC in the study's cohort, compared to 26% of African Americans and 16% of white Americans. TNBC, which is most frequent in premenopausal women, has been linked to a poor prognosis (Thomas et al., 2017)(Nwagu et al., 2021). A study at Korle Bu Teaching Hospital analysing carcinoma subtypes of the breast with a focused on hormone receptor and HER2 expression profiles discovered that 49.4% of the tumours studied lacked hormone receptors, with TNBC being the most common subtypes (Seshie et al., 2015).

Clinical-pathological factors

Studies have shown that the intrinsic features of the tumour also affect survival in breast cancer. Survival is greatly influenced by the stage of breast cancer diagnosis, which includes factors such as tumour size, lymph node involvement, and distant metastases(Akakpo et al., 2023; Jedy-Agba “et al., 2017”) (Mensah “et al., 2016”; Mohammed et al., 2013). Early-stage breast

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cancers enjoy higher survival rates compared to advanced-stage tumours (Jeuken et al., 2022). Tumour grade, indicative of the abnormality of cancer cells, is another critical determinant of survival. High-grade tumours, with their aggressive nature, is said to be linked to reduced poorer survival (Anie et al., 2021; Bacha et al., 2021; Jeuken et al., 2022). In contrast, low-grade tumours are linked to a more favourable prognosis. Lymph node involvement, denoting the presence of cancer in nearby lymph nodes, serves as a key indicator of the likelihood of metastasis. Extensive lymph node involvement correlates with poorer prognosis and diminished survival rates (Feleke et al., 2022; Tesfay et al., 2021)(Mohammed et al., 2013).

According to studies conducted, the type of treatment strategies have a significant influence on breast cancer survival (Eldridge, n.d.; Okifo et al., 2021). Treatment modalities, including surgery, radiation therapy, chemotherapy, hormonal therapy, targeted therapy, and immunotherapy, are chosen based on tumour characteristics and stage(Blumen et al., 2016; Miller et al., 2022). These therapies can significantly affect survival outcomes. Timeliness in initiating treatment is imperative for improving survival. Delays in diagnosis and treatment may allow the cancer to progress, leading to lower survival rates (Agodirin et al., 2021). Early diagnosis and swift intervention are essential for better prognosis (Qu et al., 2020). Adherence to prescribed treatment regimens is a crucial factor in determining success. Patient compliance with medications and adherence to follow-up appointments are essential for improving survival rates (Abdul Rashid Timtoni, 2023). A lack of adherence can compromise the effectiveness of treatment. Response to treatment, notably the achievement of a complete response, is another pivotal element. Patients who respond well to treatment, particularly those who achieve complete remission, tend to have prognoses that are more favourable and improved survival rates.

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Comorbidities

From research conducted, having other health problems alongside breast cancer, known as comorbidities, can make it much harder to treat the cancer and could reduce the chances of surviving(Arneja & Brooks, 2021) (Arneja & Brooks, 2021). Conditions such as diabetes or cardiovascular disease can complicate the administration of treatments such as chemotherapy and radiotherapy, potentially making breast cancer management and treatment outcomes more challenging (Zullig et al., 2022). Women with multimorbidity had shorter overall survival at 3 years than women without multimorbidity, according to a cohort study done in South Africa to evaluate the impact of multimorbidity (two other chronic illnesses) on overall survival among women with breast cancer (Ayeni et al., 2023). Another study, Maini et al, 2020, to analyse survival among breast cancer patients with cardiac comorbidities, discovered that breast cancer patients with pre-existing Heart Failure had a 6.35-fold higher risk of mortality than those without Heart Failure (Ruby Maini et al., 2020). Patients who had more than one comorbidity were shown to have a 1.36-fold increased chance of death. Their findings suggested the necessity for risk factor reduction, which may assist improve survival in breast cancer patients. Patnaik et al. (2011) discovered thirteen individual comorbid conditions (e.g., Myocardial infarction, Congestive heart failure, Peripheral vascular disease, Cerebrovascular disease, etc.) to be associated with decreased overall survival and increased mortality (Patnaik et al., 2011).

According to a study that analysed the comorbidities of breast cancer patients and examined if the quantity of comorbidities significantly affects survival, women with a wide range of comorbidities have a lower chance of surviving breast cancer (Woelfel et al., 2018).

Anwar et al. (2021) found that metabolic comorbidities were common in breast cancer patients and were associated with higher risks to develop recurrent metastatic disease, especially in

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post-menopausal women (Anwar et al., 2021). Their study focused on the association between metabolic comorbidities and risks of recurrent metastatic disease in breast cancer survivors.

2.5.Health facility factors affecting survival time among Breast cancer patients

Health policy, access, quality, and service delivery challenges in LMICs include limited diagnostic capacity, weak referral networks, suboptimal access to treatment, and insufficient human resources. The timely use of personal health services to obtain the optimal health outcomes is referred to as access to health services. It addresses a person's overall physical, social, and mental health, as well as their overall quality of life. “Risk-sharing” schemes, such as “social insurance”, is said to provide resources for access to healthcare and health promotion while shielding people and households from the potentially devastating direct financial implications of disease (Kwabeng et al., 2020).

Health Insurance coverage

Studies have consistently shown that health insurance significantly influences breast cancer survival rates. A study by Kwabeng et al. (2020) found that individuals with health insurance prior to diagnosis had a 42% survival rate (p-value=0.036), significantly higher than those without insurance. Notably, insured individuals had a 40% higher chance of survival after three years compared to those without insurance (25%). Sanuade et al. (2021), who identified a strong link between economic burden and survival, with health insurance holders experiencing significantly lower economic burdens, reported similar findings(Sanuade et al., 2021)

Further research supports these findings. Hahn et al. (2007) found that individuals with health insurance presented with less advanced disease stages at diagnosis, associated with longer survival. Halpern et al. (2007) also reported similar trends, highlighting the positive relationship between health insurance and survival rates in breast cancer patients (Halpern et al., 2007).

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Referral system

In Ghana, the healthcare system comprises approximately 3,500 medical care centres, categorized as public, faith-based (managed by the Christian Health Association of Ghana, CHAG), and private (Wang H et al., 2017). The Ministry of Health funds public institutions through government and donor partners. The healthcare infrastructure includes regional referral hospitals for secondary care, district hospitals for basic and emergency care, and community services (clinics, health centres, and community health planning and services/CHIPS compounds) (Asamani et al., 2021; Wang H et al., 2017). However, community services primarily focus on preventing and treating communicable diseases, lacking expertise in recognizing non-communicable diseases like cancer. Cancer care is mainly provided in major referral centres in Accra, Kumasi, Tamale, and Cape Coast, with most expertise concentrated in larger facilities (Asamani et al., 2021). Community and district-level services often lack sufficient expertise to identify and refer suspected cancer patients.

According to Asamani et al. 2021, the settings of a healthcare system and the pathway of patient referral can pose challenges that may affect the quality of care and can contribute to the cancer burden (Asamani et al., 2021). Tuck et al. (2002) describe the patient's route of referral as a dynamic process involving need identification, navigation, access, and treatment acceptance(Tuck et al., 2022). The referral procedure varies locally but typically includes inter-departmental referrals and diagnostic tests, potentially incurring additional costs (Tuck et al., 2022). An effective referral system is crucial, ensuring close relationships between healthcare levels and providing optimal care (Seyed-Nezhad et al., 2021)

Workforce

In Ghana, cancer care faces significant challenges due to gaps in workforce in institutions providing health care and support and uneven allocation of resources. According to Asamani

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in 2021, offering intensive and expert cancer care is largely concentrated in urban areas (Asamani et al., 2021), exacerbating the lack of expertise in low-resource areas. Ayandipo O et al. 2020 in Nigeria attributed this to insufficient oncology training across regions (Ayandipo O et al., 2020) and general human resource gaps in cancer care (Asamani et al., 2021). A health workforce gap analysis revealed alarming vacancies in the Ghana Health Service, with 47,000 unfilled positions (41% vacancy rate) in 2018 (Asamani et al., 2021). Regional disparities are stark, with well-resourced regions boasting twice the staffing levels, concentrated in regional hospitals and metropolitan centres. Under-resourced districts and regional hospitals lack high-cadre professionals like physicians and chemists.

To meet minimum personnel requirements, Asamani et al. estimate a 57% budget gap ($300 million USD in 2021). However, redistributing personnel more equitably could reduce this gap by 30% (Asamani et al., 2021).

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CHAPTER 3

3. Methods

3.1.Study design

A facility-based retrospective cohort study design was employed at the Tamale Teaching Hospital (TTH). In this design, medical records of breast cancer patients admitted between 2014 and 2023 were retrospectively reviewed and constituted the study cohort. Patients were followed from the date of hospital admission (baseline) until the occurrence of the outcome of interest (death), discharge, or the end of the study period.

Sociodemographic, clinical-pathological, and health system-related variables documented at admission and during hospitalization were extracted and used as exposure variables, while time to death during hospitalization was the primary outcome. This design enabled the assessment of associations between patient characteristics and survival time among hospitalized breast cancer patients at TTH.

3.2.Study area

This research was undertaken at the Tamale Teaching Hospital (TTH), a major referral centre located in Tamale Metropolitan, the Northern Region's largest city. TTH serves Ghana's five northern regions (Northern, Savannah, North East, Upper East, and Upper West), as well as neighbouring regions of Ahafo, Bono and Burkina Faso. As the country's third-largest Teaching hospital and tertiary referral centre, TTH work closely with the University for Development Studies to provide medical, nursing, and nutrition programs. Notably, it is the only teaching hospital in northern Ghana providing oncological services but it is yet to establish an independent-population based cancer registry. Situated 2 km southeast of Tamale's city centres, TTH delivers critical healthcare services to over 5.2 million people, with females comprising approximately 51% of the population.

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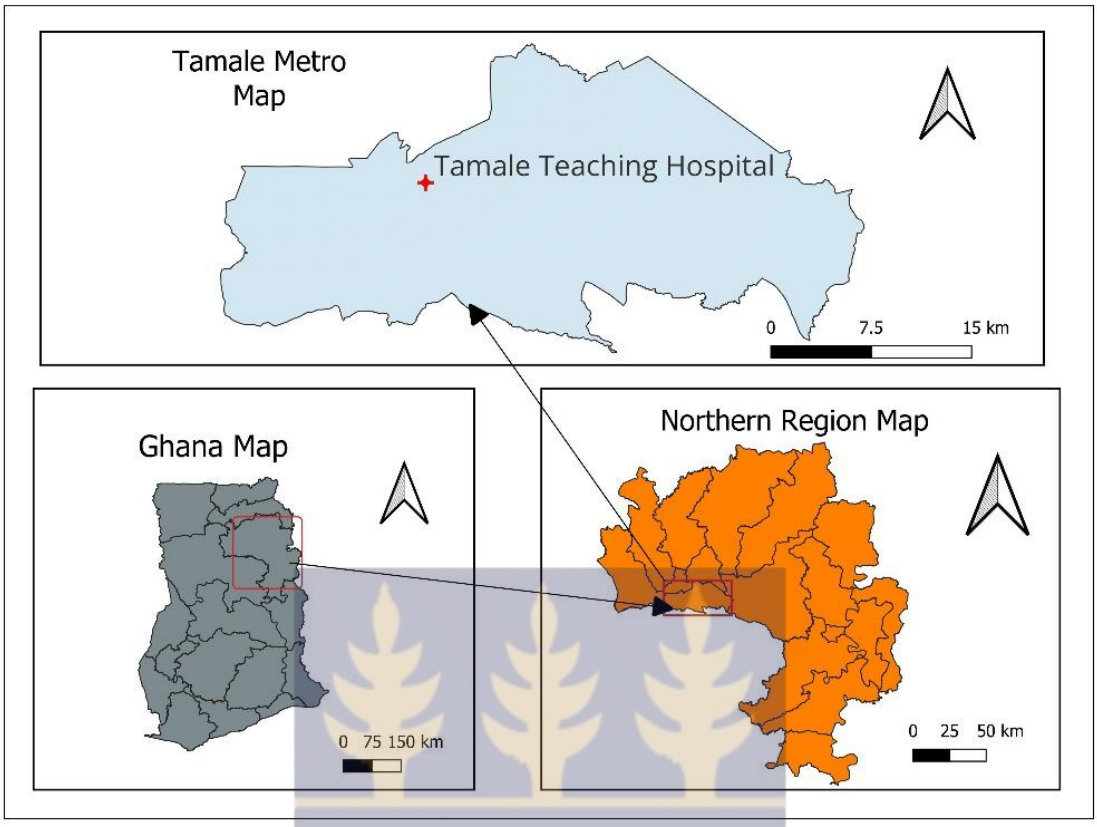


Figure 2: Map of Northern Region showing TTH, Ghana, (constructed using QGIS 3.4.7)

3.3.Study population

The study population included all breast cancer patients hospitalised and were receiving anti-cancer treatment at the Tamale Teaching Hospital (TTH) from January 1, 2014 to December 31, 2023. Patients with missing key study variables such as age, date of diagnosis, stage of disease, treatment information, or survival status were excluded from the study. Additionally, individuals who died from causes unrelated to breast cancer (e.g., accidents) during the study period were also excluded.

3.4.Sample size and Sampling

This study employed a census sampling method, utilizing all breast cancer in-patients' records from the Tamale Teaching Hospital database, a tertiary care center delivering oncology services to Northern Ghana and beyond. Given its reputation, most cancer patients from this

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region sought treatment at this hospital. The study focused on female breast cancer cases hospitalised from January 2014 to December 2023. All women hospitalised with a confirmed diagnosis of breast cancer during the study period were included in the study. Patients were excluded if they did not meet the inclusion criteria, specifically those with incomplete medical records (missing key variables such as age, stage of disease, treatment details, or survival status), unconfirmed breast cancer diagnoses, or deaths resulting from causes unrelated to breast cancer, including accidents.

3.5. Study variables

3.5.1. Outcome Variables

The primary outcome variable was time admitted to the hospital to event (death). Breast cancer inpatient records were retrospectively reviewed from admission until the date of death, discharge, or the end of the study period. Patients who were discharged against medical advice, absconded, or had no available information on survival status were right-censored. Hospitalised survival time was calculated in days, measuring the period between admission dates and event dates (death) or censoring dates.

3.5.2. Independent variables

Independent variables of interest were collected based on information availability on patients' records. Available variables were grouped into socio-demographics, clinic-pathological variables, and health system variables. The table below highlights specific variables collected under each groups.

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Table 1: Independent variables of hospitalised survival

Sociodemographic factors	Clinical-pathological factors	Health System Factors
Age	Presence of comorbidities	Health Insurance status
Employment status	Stage of cancer	Health system bill received
Occupation type	Tumour size	
Region of residence	Histopathology type	
	Molecular subtypes	
	Tumour grade	
	Receptor types	
	Oestrogen and Progesterone presence	
	Metastasis	
	Surgery performed	
	Chemotherapy	

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Table 2: "Operational definition", scale of measure and data source of sociodemographic variables

Variable	Description	Type of Variable	Scale	Data source
Age	Patients age at admission in years, Age was grouped based on clinical relevance, early onset <40 and Average onset of BC >=40	Continuous	ratio	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Employment status	Patients employment status at the time of admission, yes=employed, No=unemployed, Unknown=missing	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Occupation	Mother's principal work or business, especially as a means of earning a living: Farming, Trader/business woman, Artisan, Gov. work/private formal job, housewife, unemployed	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Place of residence	Location where patient resides before admission, grouped o=into regions, Upper East, Upper West, Northern, Northeast, Savannah, Greater Accra, Ashanti, etc	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module

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Table 3a: Operational definition, type of variable, scale of measure, and data source of Clinical-pathological variables

Variable	Description(How it was measured)	Type of Variable	Scale	Data source
Presence of comorbidities	presence of any underlying conditions, yes/No	Categorical	Binary	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Stage of cancer	stage at which tumour is diagnosed, using the TNM stage system, Stage I, II, III and IV	Categorical	Ordinal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Tumour size	size of tumour measured in centimetres, grouped into, <2cm. 2-5cm and >5cm	Continuous	Ordinal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Histopathology type	Microscopic examination of tumour characteristics, Invasive ductal carcinoma, ductal carcinoma in-situ, etc	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Molecular subtypes	breast cancers that share characteristics, hormone receptor status, measured as presence or absence of estrogen, progesterone and HER 2, and grouped as Luminal A, Luminal B HER2-enriched, TNBC,	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Tumour grade	how normal or abnormal cancer cells look under a microscope, measured as, well differentiated, poorly differentiated, moderately differentiated	Categorical	ordinal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Receptor types	Categorical	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module

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Table 3b 1: Operational definition, type, scale of measurement and data source of clinical variables

Variable	Description	Type of variable	Scale	Data source
Receptor status	Estrogen and Progesterone presence, Yes/No	Categorical	Binary	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Breast affected	Side of breast tumour detected, Measure as left, right and bilateral.	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Metastasis	secondary malignant growths at a distance from a primary site of cancer, Yes/No	Categorical	Binary	Patient records in electronic databases, LHIMS and DHIMS 2 event module
type of treatment	Treatment patient is undergoing or have received, Chemotherapy, surgery, palliative care	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Lymph node involvement	The presence of cancer cells in the lymph nodes, Yes/No	Categorical	Binary	Patient records in electronic databases, LHIMS and DHIMS 2 event module

Table 4: Operational definition, type, scale of measurement and data source of health system variables

Variable	Description	Type	Scale	Data Source
Health Insurance status	Patients being insured or not	Categorical	Nominal	Patient records in electronic databases, LHIMS and DHIMS 2 event module
Ability to pay Health system bill	Whether patient able to pay bill on admission, Yes/No	Categorical	Binary	Patient records in electronic databases, LHIMS and DHIMS 2 event module

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3.6.Data collection technique

Data for this study were obtained from patient medical records at TTH using a facility-based retrospective approach. Eligible records were identified from the hospital's electronic databases, namely the LHIMS and DHIMS 2 event module.

First, a list of all patients admitted with a diagnosis of breast cancer between January 2014 and December 2023 was generated from the LHIMS database using the hospital diagnosis coding system. Each identified record was cross-checked with the DHIMS 2 event module to confirm diagnosis, admission dates, and outcome status.

A standardized data extraction form was designed using Epi Info and used to systematically collect study variables. Socio-demographic variables, including age, sex, occupation, employment status, and insurance status, were extracted from the patient registration and admission records. Clinical and pathological variables, such as tumour stage, tumour size, histopathological findings, treatment modalities (surgery, chemotherapy, radiotherapy), and presence of comorbidities, were extracted from clinicians' notes, pathology reports, and treatment records documented in LHIMS.

Health system-related variables, including ability to pay for services and insurance coverage during admission, were obtained from billing and administrative records linked to each patient file. Outcome data, including survival status (death or discharge) and dates of admission and discharge or death, were extracted from ward records and discharge summaries. Time to event (death) was calculated as the duration from date of admission to date of death, discharge, or end of the study period.

All extracted data were entered into the Epi Info data collection form. To ensure data quality, records were checked for completeness, duplicates were removed, and inconsistencies were verified by cross-referencing LHIMS and DHIMS 2 entries. Patient identifiers were removed,

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and unique study codes were assigned to ensure confidentiality and anonymity throughout the data collection process.

3.7.Quality assurance

To ensure errors-free data, the data collected were checked for misspellings and incompleteness. Data cleaning was performed, and any inconsistencies, duplicates or missing values were addressed before evaluation.

3.8.Data Processing and analysis

The collected data were exported into Microsoft Excel as a line list. Descriptive data analysis was conducted, including frequencies, proportions, and percentages. Measures of central tendencies (mean, standard deviation, median) were computed, statistical associations between survival time and each selected independent variable was analysed using univariate Cox proportional hazards regression. Variables with limited information, particularly clinical pathology variables, were excluded from the Cox proportional model and only presented as counts and proportions. Survival data were analysed using Kaplan-Meier curves to estimate hospitalised survival time among breast cancer patients. Multivariate Cox proportional hazards regression was performed to assess variables that independently showed significant association with survival among hospitalised BC patients. The data was visualized using survival curves and tables to help convey findings.

3.9.Ethics and Protocol

The Ghana Health Service Ethical Review Committee granted approval for ethical clearance, reference number **GHS-ERC: 028/03/24**, preceding data collection. Administrative protocols were adhered to through the Research and Development unit of TTH, and formal minuted permission letters from the hospital administration were submitted to relevant departments at the Tamale Teaching Hospital. Patient confidentiality was ensured, and no identifiable patient

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information was included. As this study employed a retrospective design, data collection did not require interviews. Instead, data were extracted exclusively from the hospital's databases and records.



CHAPTER 4

4. Results

4.1.1. Summary statistics of socio-demographic of Hospitalized BC patients, TTH, Northern Ghana, 2014-2023

Four Hundred and sixty three (463) medical records of hospitalized breast cancer (BC) patients in the Tamale Teaching Hospital from 2014 to 2023 were reviewed. Among the 463, 11.2%

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(52/463) had succumbed to the disease. The mean age of BC patients admitted to the Tamale Teaching Hospital in Northern Ghana from 2014-2023 was 46±16 years. As shown in Table 5, the age group 40years and above accounted for 58.5% (270/463) of the total. In terms of employment status, 49.5% (229/463) of the patients were employed with 51.5% (118/229) being traders or business owners among the employed patients. The regional distribution of hospitalized BC patients revealed that, 59.2% (274/463) resided in the Northern Region.



Table 5: Socio-demographic characteristics of hospitalized BC Patients, TTH, 2014-2023

Characteristic	Total Observation (n)	Number, n (%)
Survival Outcome	463	
Alive		411(88.8)
Died		52(11.2)
Age (±*SD*years)	463	46 (±16)
Age group (years)	463	
< 40		192 (46.7)
≥40		270 (58.3)

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Characteristic	Total Observation (n)	Number, n (%)
Employment Status	463	
Employed		229 (49.5)
Unemployed		129 (27.9)
Unknown		105 (22.7)
Occupation type	229	
Artisan		14 (6.1)
Farming		80 (34.9)
Public Servant/Administrative		17 (7.4)
Trader/Business		118 (51.5)
Region	463	
Upper East Region		73 (15.8)
Ashanti Region		4 (0.9)
Bono East Region		7 (1.5)
Eastern Region		1 (0.2)
Greater Accra Region		8 (1.7)
North-East Region		28 (6.0)
Northern Region		274 (59.2)
OTI Region		4 (0.9)
Savannah Region		22 (4.8)
Upper West Region		33 (7.1)
Missing		9(1.90

[1]Mean (±SD); n (%)

4.1.2. Summary of Clinical Characteristics

Seventy six percent 76.0% (352/463) of patients admitted for BC, did not undergo surgery, while the breast affected was predominantly the left breast, accounting for 52.0% (92/177), as shown in Table 6a below. Tumor size was mainly greater than 5 cm, with 75.4% (49/65), while among 88 patients with information on their tumor stage, stage IV was the most frequent with 51.1% (45/88). Among 100 hospitalized patients' records with information on histopathology type, invasive ductal carcinoma, accounted for 84.0% (84/100). Lymph nodes were involved in 91.3% (94/103) of patients, while only 17 medical records had information on tumor grade with 41.2% (7/17) of tumor well differentiated.

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Out of 14 records with tumor subtypes, triple-negative breast cancer (TNBC), accounted for 64.3% (9/14). Chemotherapy was administered to 18.6% (86/463) of patients. Metastasis occurred in 79.1% (72/91) of patients. Comorbidities were present in 11.2% (52/463) of patients with limited information on specific underlying conditions.

Table 6a: Clinical characteristics of Hospitalized BC patients, TTH, 2014-2023

Characteristic	Total Observation (N)	Number, n (%)
Surgery performed	463	
No Surgery		352 (76.0)
Surgery		111 (24.0)
Chemotherapy	463	
No		377 (81.4)
Yes		86 (18.6)
Comorbidities	463	
No		411 (88.8)
Yes		52 (11.2)
Breast affected	177	
Bilateral		18 (10.2)
Left		92 (52.0)
Right		67 (37.9)
Tumour Size	65	
< 2		2 (3.1)
2-5		14 (21.5)
> 5		49 (75.4)
Tumour Stage	88	
I		3 (3.4)
II		19 (21.6)
III		21 (23.9)
IV		45 (51.1)
Histopathology type	100	
Ductal Carcinoma In situ		3 (3.0)
Inflammatory Breast Cancer		3 (3.0)

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Characteristic	Total Observation (N)	Number, n (%)
Invasive Ductal Carcinoma		84 (84.0)
Invasive Lobular Carcinoma		3 (3.0)
Medullary Carcinoma		1 (1.0)
Metaplastic Carcinoma		1 (1.0)
Mucinous carcinoma		1 (1.0)
Others-Cribriform carcinoma		1 (1.0)
Papillary carcinoma		3 (3.0)

Table 6b 1: Clinical characteristics of Hospitalized BC patients, TTH, 2014-2023

Characteristic	Total Observation (N)	Number, n (%)
Tumor grade	17	
Moderately differentiated		3 (17.6)
Poorly differentiated		6 (35.3)
Undifferentiated		1 (5.9)
Well differentiated		7 (41.2)
Tumor subtypes	14	
HER2-enriched		2 (14.3)
Luminal A		1 (7.1)
Luminal B (HER2 Negative)		1 (7.1)
Luminal B (HER2 Positive)		1 (7.1)
TNBC		9 (64.3)
Receptors	9	
Negative (ER−/PR−)		5 (55.6)
Positive (ER+/PR+, ER−/PR+, ER+/PR−)		4 (44.4)
Estrogen	9	
Negative (ER-)		6 (66.7)
Positive (ER+)		3 (33.3)
Progesterone	9	
Negative (PR-)		7 (77.8)
Positive (PR+)		2 (22.2)
Metastasize	91	
No		19 (20.9)
Yes		72 (79.1)
Lymph nodes	103	

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No	9 (8.7)
Yes	94 (91.3)

[1]n (%)

4.1.3. Summary of Health system variables

The analysis of health system variables revealed significant characteristics among the study participants. Insurance status showed that 91.4% (423/463) of the patients were insured, while 8.6% (40/463) were non-insured. Regarding payment of health system bills on admission, the majority, 94.4% (437/463), were able to pay, whereas 5.6% (26/463) were unable to pay. These findings indicate that a substantial proportion of breast cancer patients admitted to Tamale Teaching Hospital had health insurance coverage and were able to pay their hospital bills, suggesting access to financial resources or protection through insurance

Table 7: Health System variables

Characteristic	Total Observation N=463	Percentage (%)
Insurance status		
Non-Insured	40	8.6
Insured	423	91.4
Able to pay health System bill on admission		
Not able to pay	26	5.6
Able to pay	437	94.4

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4.2. Estimation of Survival outcomes of Breast cancer patients hospitalized at TTH

4.2.1. Overall hospitalized Survival outcomes for BC patients at TTH, (2014-2023)

Figure 1 displays the Kaplan-Meier survival curve for patients admitted from 2014 to 2023 (n = 463). As shown in the figure below, the Overall hospitalization survival rate is 75%. The analysis revealed that 25% of patients died within 29 days (95% CI: 20, 38) upon admission, while 75% survived beyond 29 days. This indicates sustained survival beyond the median, suggesting a favorable outcome for this admitted patient population.

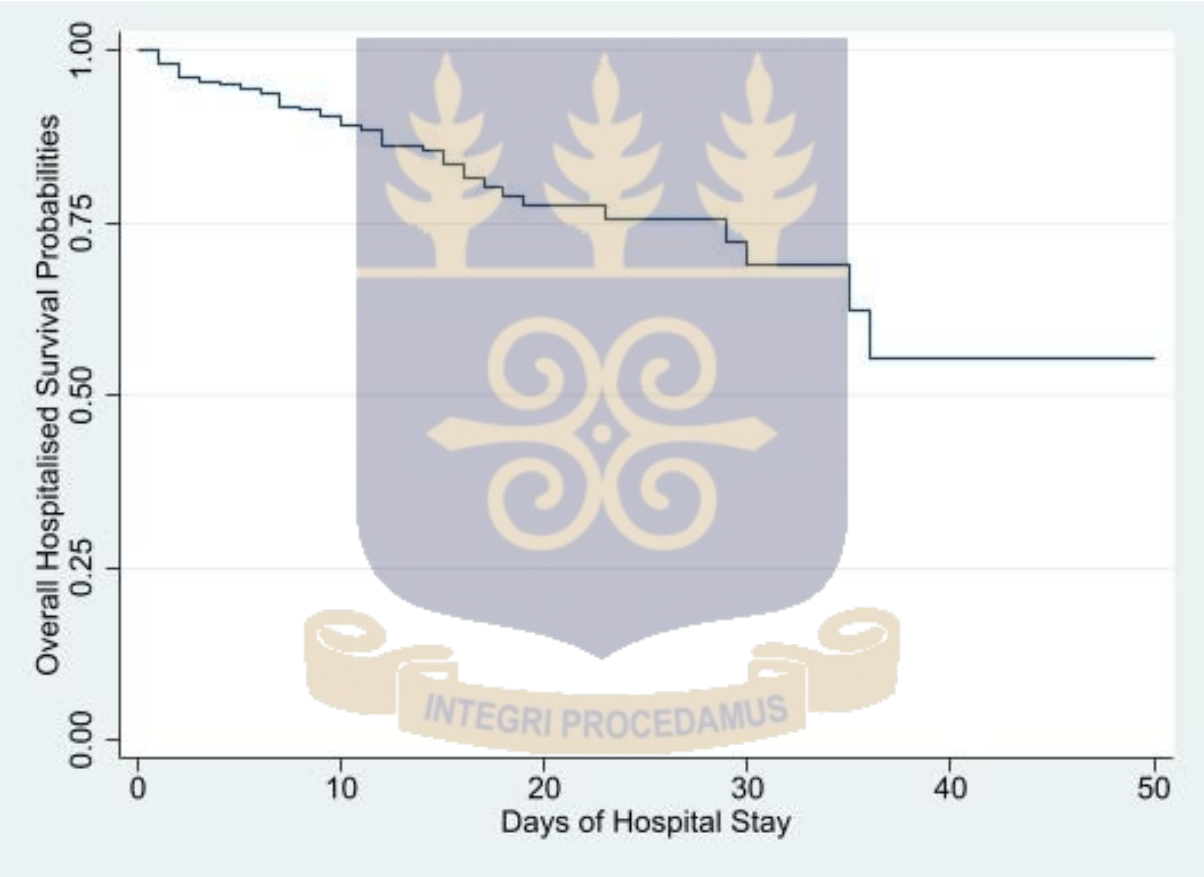


Figure 3: Kaplan-Meier Survival Curve for Patients Admitted at TTH from 2014 to 2023, Northern Ghana.

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4.3. Determinants of survival among BC hospitalized patients, TTH, 2014-2023

4.3.1. Demographic factors and hospitalized Survival

The univariate Cox regression analysis showing associations between demographic characteristics and hospitalized survival outcomes is shown in Table 8 below. Patients aged 40years and older had a hazard ratio (HR) of 0.96 (95% CI: 0.55, 1.66, p-value = 0.876) compared to those under 40years, indicating a 4% reduced risk of death, although this was not statistically significant. Employment status was significantly associated with hospitalized survival, with unemployed patients having a higher risk of death (HR = 1.97, 95% CI: 1.04, 3.73, p-value = 0.037) compared to employed patients, indicating a 97% increased risk of death. Being a farmer was significantly associated with surviving on admission with 95% reduced hazard of death as compared to being an artisan (HR = 0.05, 95% CI: 0.004, 0.50, p-value = 0.012).

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Table 8: Univariate Cox regression analysis of Socio-demographic factors and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023)

Characteristic	Observations (N)	Event(died) (n)	HR[1]	95% CI[1]	p-value
Age(years)	463	52	1.00	0.98, 1.017	0.960
Patient Age group (years)	463				
< 40	193	25	**Ref**	—	—
≥40	270	27	0.96	0.55, 1.66	0.876
Employment Status					
Employed	229	19	**Ref**	—	—
Unemployed	129	19	1.97	1.04, 3.73	**0.037***
Unknown	105	14	1.48	0.74, 2.95	0.271
Occupation type	463				
Artisan	14	2	**Ref**	—	—
Farming	80	1	0.05	0.004 0.50	**0.012***
Public Servant/Administrative	17	2	0.44	0.06 3.18	0.418
Trader/Business	118	14	0.50	0.11 2.22	0.36
Unemployed	129	19	0.65	0.15 2.85	0.57
Unknown	105	14	0.49	0.11 2.20	0.35

4.3.2. Clinical-pathological factors and hospitalized Survival

The univariate Cox regression analysis revealed significant associations between clinical characteristics and hospital survival outcomes as shown in Table 9 below. Patients who underwent surgery maintained a significant reduction in mortality (HR = 0.05, 95% CI: 0.01, 0.34, p-value = 0.002) compared to those who did not undergo surgery, indicating a 95% reduced risk of death. The laterality of breast affected was not significantly associated with survival outcomes, with HRs of 0.61 (95% CI: 0.20, 1.80, p-value = 0.4) for left-sided and 0.89

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(95% CI: 0.30, 2.60, p-value = 0.8) for right-sided breast cancer compared to bilateral breast cancer.

Chemotherapy was not significantly associated with survival outcomes (HR = 1.33, 95% CI: 0.66, 2.67, p-value = 0.4), indicating a 33% increased risk of death, although this was not statistically significant. Patients with comorbidities had a significantly higher risk of death (HR = 2.01, 95% CI: 1.01, 4.02, p-value = 0.047) compared to those without comorbidities, indicating that patients with comorbidities have a risk of death that is approximately 2 times higher than those without comorbidities.

Table 9: Univariate COX regression of Clinical characteristics and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023)

Characteristic	Total Observation (N)	Event(died) (n)	HR	95% CI	p-value
Surgical operation	463				
No Surgery		51	**Ref**	—	
Surgery		1	0.05	0.01, 0.34	**0.003***
Chemotherapy	463				
No		42	**Ref**	—	
Yes		10	1.33	0.66, 2.67	0.4
Comorbidities	463				
No		42	**Ref**	—	
Yes		10	2.01	1.01, 4.02	**0.047***
Breast affected	177				
Bilateral		5	**Ref**	—	
Left		10	0.61	0.20, 1.80	0.4
Right		11	0.89	0.30, 2.60	0.8

HR = Hazard Ratio, CI = Confidence Interval, *p-value<0.005-significance

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4.3.3. Health system factors and hospitalized survival

Table 10 presents the univariate Cox regression analysis of health system factors and survival among hospitalized breast cancer patients at Tamale Teaching Hospital (TTH) in Northern Ghana, from 2014 to 2023. The analysis revealed that insurance status was a significant predictor of survival. Specifically, patients with insurance presented a 65% reduced risk of death (HR=0.35, 95% CI: 0.18-0.67, p=0.002) compared to those without insurance.

Additionally, the ability to pay health system bills on admission was found to be a significant predictor of survival. Patients who were unable to pay had more than two (2) times higher risk of death (HR=2.82, "95% CI": 1.98-6.64, p=0.018) compared to those who were able to pay.

Table 10: Univariate COX regression of Health system factor and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023)

Characteristic	Observation N=463	Event(Died) N=52	HR[1]	95% CI[1]	p-value
Insurance status					
Non-Insured	40	12	**Ref**	—	—
Insured	423	40	0.35	0.18, 0.67	**0.002***
Able to pay Health system bill on admission					
Able to pay	437	46	**Ref**		
Not Able to pay	26	6	2.82	1.98, 6.64	**0.018***

HR = Hazard Ratio, CI = Confidence Interval, *p-value<0.005-significance

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4.3.4. Multivariable Cox Regression Analysis of study variables associated with hospitalized Survival in Breast Cancer

Table 11 below shows the Multivariate Cox regression analysis for all variables that independently demonstrated statistically significant associations with the length of time a patient admitted with breast cancer stays. Although the ability to pay health system bills on admission showed a significant association with survival in univariate analysis, it was not included in the multivariate Cox regression model. This was due to its interaction with insurance status, as most insured patients were also able to pay additional charges, resulting in multicollinearity and making it unsuitable for simultaneous inclusion in the model.

As seen in Table 11 below, occupation type emerged as a significant predictor of hospitalized survival time, with farming associated with improved survival (HR=0.053, 95% CI: 0.005, 0.603; p = 0.018). Specifically, breast cancer patients engaged in farming activities had a 95% lower risk of death upon admission. Additionally, insurance status was a key predictor of hospitalized survival time, with insured patients experiencing a reduced mortality risk (HR= 0.464, 95% CI: 0.23, 0.92; p = 0.028), indicating a 97% higher chance of being discharged alive.

Furthermore, undergoing surgery was a strong predictor of improved hospitalization survival, with a significantly reduced risk of in-hospital mortality of 95% (HR=0.051, 95% CI: 0.01, 0.37; p = 0.004). This underscores the critical role of surgical intervention in breast cancer management. Although employment status did not reach statistical significance, unemployed patients had a slightly lower risk of mortality (HR=0.83, 95% CI: 0.19, 3.64). In contrast, comorbidities did not significantly affect survival time (HR=1.051, 95% CI: 0.50, 2.22; p = 0.888), suggesting that effective breast cancer management may be more critical than underlying health conditions.

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Table 11: Multivariate Cox Regression analysis of associations between factors and Survival among Hospitalized BC patients at TTH, Northern Ghana (2014-2023)

Characteristic	Total observation	Event (n)	aHR	95% CI	p-value
Employment Status	463	52			0.091
Employed		19	Ref	—	
Unemployed		19	0.83	0.19, 3.64	0.8
Unknown		14	1.74	0.62, 4.90	0.3
Occupation type	463	52			**0.015***
Artisan		2	Ref	—	—
Farming		1	0.053	0.005, 0.603	**0.018***
Public Servant/Administrative		2	0.384	0.05, 2.86	0.351
Trader/Business		14	0.721	0.16, 3.22	0.669
Unemployed		19	1		
Unknown		14	1		
Insurance status	463				**0.034***
Non-Insured		12	Ref	—	
Insured		40	0.464	0.23, 0.92	**0.028***
Surgery performed	463				**0.003***
No Surgery		51	Ref	—	
Surgery		1	0.051	0.01,0.37	**0.004***
Comorbidities	463				0.808
No		42	Ref	—	
Yes		10	1.051	0.50, 2.22	0.888

aHR = adjusted Hazard Ratio, CI = Confidence Interval, *p-value<0.005-significance

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CHAPTER 5

5. Discussion

In Ghana, Teaching Hospitals serve as the primary healthcare systems capable of admitting and providing inpatients and outpatient services for cancer diagnosis and treatment (Ayandipo O et al., 2020). This study assessed survival determinants of hospitalized breast cancer patients in Northern Ghana. Our analysis revealed an in-hospital mortality rate of 11.2% among breast cancer patients admitted to Tamale Teaching Hospital (TTH) from 2014 to 2023. This mortality rate is approximately four-fold lower than the 30-day mortality rate of 43.8% reported by Brewster et al. (2011) among breast cancer patients in Scotland. Conversely, Destrebecq et al. (2016) found a higher hospitalization mortality rate of 28% in their study. However, our results align closely with Alabi et al.'s (2022) reported in-hospital mortality rate of 12.5% among breast cancer patients in Nigeria. The relatively low mortality rate observed in our study may be attributed to improved healthcare services and timely interventions at TTH, potentially enhanced by support from nongovernmental organizations, such as the provision of subsidized chemotherapy drugs and breast cancer awareness programs.

Estimating hospitalization survival for this study revealed 29 days length of overall survival, with 75% of admitted patients surviving beyond this period. Conversely, 25% of patients did not survive beyond 29 days on admission. This finding compares positively with a study conducted in Northern Nigeria, which reported an overall survival time of only 6 days for 75% of cancer patients at a University Teaching Hospital, indicating substantially poorer survival compared with the 29-day survival time for 75% of participants observed in the present study. (Adamu et al., 2019). Although their study was not specific to breast cancer, it highlights the poor prognostic factor associated with hospitalization for cancer. The authors in their study attributed the lower hospital stay survival to inadequate investment in health facilities and

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disparities in regional health management (Adamu et al., 2019). Remarkably, Northern Nigeria and Northern Ghana share similarities in religious composition and resource allocation disparities. However, these two studies demonstrate distinct differences in healthcare management and outcomes, with Northern Ghana exhibiting more favourable survival outcomes for cancer patients.

In contrast, a study in southwestern Nigeria found an overall cumulative probability of 17.5% and a mean time to death of 28.75 weeks (Alabi et al., 2022). Geographical disparities in healthcare may contribute to the differences in hospital stay and patient well-being (Wilkerson et al., 2024). Another study reported a significantly shorter ICU stay of 4 days and overall hospital stay of 18 days (Wei et al., 2023). This disparity may be attributed to emergency admissions and patients presenting at terminal disease stages with cardiopulmonary issues (Heo et al., 2015; Wei et al., 2023). A study examining post-discharge survival for stage IV breast cancer patients found that 82.8% of patients did not survive until discharge, with 10.1% of discharged patients surviving for 22 days (Lee et al., 2019).

Survival analysis for breast cancer patients in Ghana has been limited, with existing studies primarily focusing on the southern region and emphasizing the time from diagnosis to death. Consequently, comparative insights into the outcomes of admitted breast cancer patients receiving oncology services in northern and southern Ghana are scarce.

Particularly, the median hospitalization survival in this study could not be reached, indicating favourable conditions for survival. This outcome may be attributed to the relatively few deaths occurring and a possible high quality of care provided to these breast cancer patients. In contrast, other studies focusing on admitted breast cancer patients have reported reachable median hospital survival rates, suggesting a higher frequency of deaths (Mitchell et al., 2024; van der Padt-Pruijsten et al., 2022). Demographically, the majority (58.3%) of admitted breast

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cancer patients were 40 years old or above, with a mean age of 46 years. This finding aligns with previous research indicating a peak incidence of breast cancer among women in their 50s and 60s (Jedy-Agba et al., 2017). Similarly, a South African study found that most breast cancer patients were aged 40 years or above (Mashele et al., 2023). The higher proportion of admitted breast cancer patients in this age group may be attributed to factors such as increased exposure to risk factors, hormonal changes, and decreased immune function associated with aging(Coelingh Bennink et al., 2023; Kluttig & Schmidt-Pokrzywniak, 2009).

The multivariate Cox regression analysis revealed that age was not a significant predictor of survival among breast cancer patients admitted to the hospital. These outcomes are compatible with previous research conducted in Nigeria, which found no association between patient age and likelihood of being discharged alive (Alabi et al., 2022). In contrast, occupation emerged as a significant predictor of survival. This finding diverges from previous research that found no association between occupation and hospital survival outcomes among breast cancer patients. However, studies examining survival from diagnosis to event have highlighted occupation as a significant determinant of survival, suggesting that certain occupations may increase exposure to carcinogenic conditions or may reduce your risk.

Notably, patients engaged in farming activities had a significantly lower risk of death upon admission, with a 95% reduced risk compared to those in other occupations. This finding underscores the importance of socioeconomic factors in determining breast cancer survival, particularly in Northern Ghana where farming is a primary source of economic stability. The majority of admitted patients resided in this region, where farming is predominantly a labour-intensive activity, especially for women. This association between farming occupation and improved survival may be attributed to factors such as increased physical activity, healthier lifestyle choices, and reduced stress levels (Khalifa et al., 2024; Palesh et al., 2018). Supporting this notion, studies have consistently demonstrated the significance of socioeconomic factors

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in breast cancer survival (Iddrisu et al., 2021; van Maaren et al., 2022). A South African study found that patients with higher socioeconomic status experienced better survival outcomes (van Maaren et al., 2022).

Advanced stage breast cancer has been consistently identified as a poor prognostic factor for hospitalized patients (Bos et al., 2015; Roberts et al., 2023). Our investigation found most patients with available staging information to be in the late stage. However, we were unable to analytically link stage to hospitalized survival due to limited data. Previous research has established late-stage presentation as a significant predictor of poor breast cancer survival, often attributed to inadequate health-seeking behaviour and lack of education on early signs of breast cancer (Agbokey, 2016; Caplan, 2014; Opoku et al., 2012).. Specifically, in Northern Ghana, cultural beliefs and reliance on traditional healers contribute to late-stage presentations (Abdul Rashid Timtoni, 2023; Asobayire & Barley, 2015). “Invasive ductal carcinoma” was the most common histopathology type among breast cancer patients at Tamale Teaching Hospital, consistent with previous research (Der & Abantanga, 2023). Lymph node involvement and metastasis were prevalent among patients with available information on tumour extension. These factors have been shown to significantly influence breast cancer survival (Anwar et al., 2021; Weiner CM et al., 2018).

Notably, undergoing surgery was associated with a 95% reduced risk of in-hospital mortality ($p=0.004$), aligning with previous research emphasizing the importance of surgical interventions in improving breast cancer survival (Brewster “et al., 2011”; Cahill et al., 2011). “The National Comprehensive Cancer Network (NCCN) guidelines” establish surgery as a crucial component of breast cancer treatment, particularly in early-stage disease (NCCN, 2024). Comorbidities did not significantly affect survival time ($p>0.050$), contrasting with previous research suggesting a significant impact on breast cancer survival (Arneja & Brooks, 2021; Patnaik et al., 2011; Tasfa et al., 2023). However, our finding is supported by a Nigerian

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study that found no significant association between comorbidities and breast cancer survival (Alabi et al., 2022). This highlights the importance of surgery in improving breast cancer survival and underscores the need for early diagnosis and treatment. Education and awareness campaigns on breast cancer early signs are crucial in improving survival outcomes, particularly in regions with cultural beliefs and traditional healing practices that contribute to late-stage presentations.

The national health insurance policy in Ghana mandates universal coverage, enabling citizens to access subsidized healthcare. Studies have consistently demonstrated that health insurance significantly influences healthcare access and survival outcomes (Halpern “et al., 2007”; Kwabeng et al., 2020). Our findings support this notion, revealing that insured patients experienced a 53% reduced mortality risk (p=0.028). This association underscores the critical role of access to healthcare in determining breast cancer survival (Park et al., 2021). Previous research has shown that uninsured individuals are more likely to present with late-stage breast cancer, highlighting the importance of timely access to diagnostic and therapeutic services (Halpern et al., 2007). Health insurance coverage bridges this gap, ensuring that patients receive prompt and adequate care.

Our study's results align with existing literature emphasizing the significance of health insurance in improving breast cancer survival. While we were unable to assess the specific type of insurance providing optimal medical care, our findings underscore the importance of universal health coverage in reducing mortality risk.

The finding that patients able to pay health system bills on admission had a significantly lower risk of death underscores the critical role of financial accessibility in healthcare. This result aligns with previous studies demonstrating that financial constraints hinder timely access to healthcare services, exacerbating poor outcomes (Halpern et al., 2007; Kwabeng et al., 2020).

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A study conducted in Nigeria reported similar findings, where patients with financial difficulties had a higher risk of mortality (Alabi et al., 2022). Conversely, research in South Africa highlighted the benefits of medical aid coverage, showing improved survival rates among breast cancer patients (van Maaren et al., 2022).

The significant hazard ratio of 2.82 observed in this study emphasizes the vulnerability of patients unable to pay for healthcare services. This disparity is particularly concerning in low-resource settings, where financial barriers may lead to delayed or foregone care.

5.1. Limitations

This study had several limitations. Firstly, the retrospective design and reliance on existing hospital records limited the availability and accuracy of data, particularly regarding pathological characteristics and staging information as records were lacking detailed information on pathology. The study's sample size was also limited to patients admitted to Tamale Teaching Hospital, which may not be representative of all breast cancer patients in Northern Ghana.

Furthermore, the study's focus on in-hospital mortality and survival outcomes also limited the generalizability of findings to overall breast cancer survival in Northern Ghana. Lastly, the study's reliance on secondary data limited the ability to collect detailed information on potential confounding variables, such as lifestyle factors and specific underlying conditions.

These limitations highlight the need for further research using prospective designs, larger sample sizes, and more comprehensive data collection to better understand breast cancer survival outcomes in Northern Ghana.

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CHAPTER 6

6. Conclusion and Recommendation

6.1. Conclusion

In conclusion, the study estimated the hospitalised survival time of breast cancer inpatients, revealing a favorable overall hospitalized survival rate of 75%. The study also assessed sociodemographic factors affecting survival, revealing that occupation type, particularly farming, and employment status, specifically being employed, emerged as significant predictors of improved survival. Furthermore, the investigation into clinical-pathological factors affecting survival highlighted the importance of undergoing surgery and the absence of comorbidities in improving survival outcomes.

Additionally, the assessment of health system factors affecting survival underscored the significance of insurance status, with insured patients demonstrating improved survival rates. These findings contribute significantly to the understanding of breast cancer survival outcomes in Northern Ghana, highlighting areas for improvement in healthcare policy and practice.

Overall, this study's results have important implications for breast cancer management and patient outcomes in the region. The findings suggest that targeted interventions focusing on early surgical intervention, health insurance coverage, and occupation-specific factors may enhance survival outcomes. Future research should build upon these findings to further explore the complex interplay between sociodemographic, clinical-pathological, and health system factors influencing breast cancer survival in Northern Ghana.

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6.2. Recommendations

The findings of this study highlight significant gaps in breast cancer data quality in the Tamale Teaching hospital, we propose the following recommendations to address gaps identified;

1. Tamale Teaching Hospital (TTH) should ensure that clinicians prioritize comprehensive and accurate data entry in the electronic health record system. Special attention should be given to documenting patients' complete health profiles, including underlying conditions, by thoroughly completing all fields, particularly the additional diagnosis section, to improve data quality and support informed decision-making.
2. MoH, in collaboration with teaching hospitals (particularly TTH), should develop and implement standardized training programs for clinical staff on the importance of data in Public Health, ensuring proficiency in electronic health record systems and data-driven decision-making.
3. TTH should establish a data audit team to review breast cancer patient records quarterly, assessing survival trends and identifying areas for improvement.
4. TTH should integrate routine risk profiling into patient management, conducted at diagnosis, to proactively allocate resources and tailor interventions for high-risk patients.

By implementing these recommendations, healthcare providers, researchers, policymakers, and stakeholders can work towards improving breast cancer care, outcomes, and research in Northern Ghana.

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Appendix 1

DATA COLLECTION TOOL

DETERMINANTS OF SURVIVAL AMONG BREAST CANCER PATIENTS IN THE TAMALE TEACHING HOSPITAL, NORTHERN REGION, 2024

I am Felicia Aguba, a final year student of the School of Public Health, University of Ghana**,** conducting a study on **Determinants of survival among Breast Cancer patients at the Tamale Teaching Hospital.** This is a record review and does not require contact with participants for any information. All names will be excluded during the review. All the information is strictly for academic purposes and will be highly treated with the greatest level of confidentiality.

Survival Status: Alive [ ] Dead [ ]

If dead, Date of Death: ……

Date of first Diagnosed: …….

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Section A: Demographic and socioeconomic characteristics of respondents				
1	Age of respondents	……years	Comments:	Age
2	Place of Residence	……..		location
3	Type of residence	○ Rural ○ Urban		Type
4	Educational level of respondents	○ Primary ○ Secondary ○ Tertiary ○ No education		Education
5	Marital status	○ Married ○ Single ○ Divorced ○ Others		Marital
6	Employment	○ Civil servant ○ Nongovernmental employee ○ Self-employed ○ Student ○ Retired		Employment

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		○ Unemployed		
7	Comorbidities	○ Yes ○ No If yes, the type of condition ……		Underlying illness
8	Religion	○ Christian ○ Muslim ○ Others		

	SECTION B: Biological factors			
9	Molecular subtypes	○ Luminal A(the presence of hormone receptors (estrogen and progesterone receptors) and absence of HER2 overexpression) ○ Luminal B(HER2 Positive)(the presence of hormone receptors and the overexpression of HER2) ○ Luminal B(HER2 Negative)(tumors typically exhibiting hormone receptor positivity without overexpression of HER2)		molecular characteristics

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		○ HER2-enriched(HER2 overexpression without significant hormone receptor expression) ○ TNBC(Tumors that lack expression of hormone receptors (ER/PR) and do not overexpress HER2		
10	Receptor status	○ Positive (ER+/PR+, ER−/PR+, ER+/PR−) ○ Negative : (ER−/PR−)		Hormone receptors
11	Breast affected	○ Left ○ Right ○ Bilateral Sister		Side of breast affected
	Section C: Clinico-pathological factors			
12	Tumour size	○ <2 ○ 2-5 ○ >5		primary tumor
13	Stage of cancer at diagnosis	○ Stage I ○ Stage II ○ Stage III ○ Stage IV		Cancer staging

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14	Type of treatment	○ Chemotherapy ○ Radiotherapy ○ Surgery ○ Hormonotherapy ○ Others…….		treatment received
15	Histopathology type	○ Ductal Carcinoma In situ ○ Invasive Ductal Carcinoma ○ Invasive Lobular Carcinoma ○ Inflammatory breast cancer ○ Mucinous Carcinoma ○ Metaplastic carcinoma ○ Medullary Carcinoma ○ Papillary Carcinoma ○ Others…….		tissue characteristics
16	Lymph node involvement status	○ Positive(The presence of cancer cells in the lymph nodes indicates "lymph node-positive" status) ○ Negative(If there is no evidence of cancer cells in the lymph nodes, it is termed "lymph node-negative)		the presence or absence of cancer cells in lymph node
17	**Section D: Health System factors**			

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	Referral routing for diagnosis	○ Direct from primary to tertiary ○ Indirect- primary to secondary to tertiary		Pathway through which the patient was referred
18	Health insurance before diagnosis	○ Yes ○ No		Presence or absence of health insurance
19	Type of Insurance	○ NHIS ○ Private Insurance		Specific type

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Appendix 2

ETHICAL APPROVAL LETTER

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

My Ref. GHS/RDD/ERC/Admin/App/24/188
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-960628
Email: ethics.research@ghs.gov.gh
9th May 2024

Felicia Aguba
C/O Robert A. Aguba
P.O. Box CT 276
Cantonments-Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 028/03/24**
Study Title	Determinants of Survival Among Breast Cancer Patients in The Tamale Teaching Hospital, Northern Region, Ghana, 2024
Approval Date	9th May, 2024
Expiry Date	8th May, 2025
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Mr. Kofi Wellington
(GHS ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra