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HEALTH-RELATED QUALITY OF LIFE AND ECONOMIC BURDEN OF PEOPLE LIVING WITH LIVER CANCER IN GHANA

BY

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DECLARATION

I, Ebenezer Owiredu Nkansah, declare that this thesis is written by me and conducted under the supervision of Dr. Richmond Owusu. No academic degree in any university whatsoever has been obtained based on this thesis. Every source that has been used in the work has been acknowledged.

07-10-2025

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(Supervisor)

DEDICATION

This research is dedicated to the Almighty God, the source of my wisdom and strength. I also dedicate this work to my wife, Rosina Enyonam Daitey, and children: Leslie, Lisa, and Lyra, for their prayers, support, and encouragement throughout my master's Programme.

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LIST OF ABBREVIATIONS

CCTH:	Cape Coast Teaching Hospital
COI:	Cost of Illness
EORTC QLQ-HCC18:	European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire – Hepatocellular Carcinoma Module
EPI:	Expanded Programme of Immunisation
EQ-5D-5L:	Europol 5-Dimension 5-Level (questionnaire)
EQ-VAS:	EuroQol Visual Analogue Scale
FACT-G:	Functional Assessment of Cancer Therapy – General
FACT-Hep:	Functional Assessment of Cancer Therapy – Hepatobiliary
GHS:	Ghana Health Services
GLOBOCAN:	Global Cancer Observatory
GSS:	Ghana Statistical Services
HBV:	Hepatitis B Virus
HCC:	Hepatocellular Carcinoma
HIC:	High-Income Country
HRQoL:	Health-Related Quality of Life
KBTH:	Korle Bu Teaching Hospital
LMIC:	Low- and Middle-Income Country
MCID:	Minimal Clinically Important Difference
MoH:	Ministry of Health
NAFLD:	Non-Alcoholic Fatty Liver Disease
NHIS:	National Health Insurance Scheme
PVFLP:	Present Value of Future Lost Productivity
QALY:	Quality-Adjusted Life Year
QoL:	Quality of Life
SF-36:	36-Item Short Form Health Survey
TDABC:	Time-Driven Activity-Based Costing
TTH:	Tamale Teaching Hospital
WHO:	World Health Organization
WHOQOL-BREF:	World Health Organization Quality of Life – Brief Version
YLL:	Years of Life Lost

ABSTRACT

Introduction: Liver cancer is a leading cause of cancer-related mortality in Ghana, with a rising incidence that imposes significant clinical, economic, and humanistic burdens. The disease often presents at advanced stages, leading to poor prognosis and substantial healthcare costs, borne out-of-pocket. Concurrently, it severely impairs patients' health-related quality of life (HRQoL). However, comprehensive data on the economic burden and HRQoL of liver cancer patients in Ghana are limited. This study assessed the economic burden and HRQoL outcomes among persons living with liver cancer in selected teaching hospitals in Ghana.

Methods: A cross-sectional, prevalence-based cost-of-illness survey was conducted between April and July 2025. Data were collected from 121 liver cancer patients attending oncology clinics at Korle-Bu, Cape Coast, and Tamale Teaching Hospitals using structured questionnaires. Direct costs (medical and non-medical) and indirect costs (productivity losses) were estimated. HRQoL was measured using the EQ-5D-5L instrument and the EQ-VAS. Data were analyzed using descriptive statistics.

Results: The mean age of respondents was 48.8 years (SD = 12.2), with the majority being male (56.2%). The average monthly cost per patient was GHS 5,441.29 (US$529.91). Direct costs constituted 98.1% of the total economic cost, dominated by medical expenses such as imaging, laboratory tests, and medications. Indirect costs accounted for 1.9% of the total economic cost. HRQoL was markedly impaired, with 97.5% of patients reporting anxiety/depression and 83.5% reporting pain/discomfort. Mean EQ-5D utility scores were low (ranging from 0.48 to 0.62 across age groups), and scores declined significantly with advanced cancer stages (Stage 3 median EQ-5D = 0.12; EQ-VAS = 25).

Conclusion: Liver cancer imposes a substantial dual burden of high economic costs and significantly impaired HRQoL on patients in Ghana. The findings underscore the need for policy reforms to expand health insurance coverage for cancer care, strengthen early detection

and prevention programs, decentralize oncology services, and integrate psychosocial and palliative support into standard care to mitigate the economic and quality-of-life impacts of the disease.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter provides background to the study, problem statement, research objectives, research questions, significance of the study, conceptual framework, and organisation of the study. The chapter also looks at the scope of the research and organisation of the study.

1.1 Background of study

Liver cancer poses a significant global health challenge (Åberg, Jiang, & Ville, 2024). The disease ranks sixth in terms of cancer incidence and the second most prevalent cause of cancer-related death in males worldwide, with approximately 866,136 new cases and 758,725 deaths reported globally (McGlynn & London, 2011; Zou et al., 2022). This condition is most prevalent in the advanced economies, East Asia, and Northern Africa, where chronic hepatitis B virus (HBV) infection is a major risk factor (Younossi et al., 2023). In Africa, liver cancer accounts for about 7.8% of global cases, with sub-Saharan Africa facing the highest burden due to factors like late diagnosis and limited healthcare access (Zou et al., 2022).

The incidence of liver cancer in Ghana is significantly increasing and has become the leading cause of cancer-related mortality in the country, with approximately 3,452 new cases and 3,166 deaths reported annually (Younossi et al., 2023). Clinical epidemiological profile of liver cirrhosis and primary liver cancer patients in Ghana revealed that these patients are diagnosed at a relatively young age and often present at advanced stages of the disease (Ringehan et al., 2017).

Liver cancer represents a high economic burden in most healthcare systems around the world, due to both direct and indirect costs. The direct costs mainly emanate from hospitalization and

treatment costs. Studies have indicated that the cost of hospitalisation can reach up to US$7,863 per patient in some regions, with surgical interventions accounting for the highest share of these costs (Choi et al., 2023). In developed countries, such as the United States, these costs can be from US$21,282 to US$35,395 per month, mainly due to long hospitalization and various complex therapies. Gu et al. (2024) support this idea, while diagnostic processes also represent a considerable share of overall costs. Advanced imaging and laboratory tests comprised 20-25% of initial care expenses (McMahon et al., 2023). Indirect costs due to liver cancer are notably high in developing countries because of productivity loss caused by premature mortality.

Liver cancer is reported to result in 197,667 years of life lost for males and 98,215 YLLs for females in Egypt. These cause significant future losses in productivity valued at well over $232 million (Wahab et al., 2024). The median age of liver cancer death often falls within productive working years, further exacerbating economic losses (Nartey et al., 2022).These findings highlight the urgent need for effective public health strategies to address the growing economic burden of liver cancer as global incidence rates are projected to rise significantly by 2050 (Wahab et al., 2024).

Furthermore, the challenges of living with liver cancer extend beyond economic burden to include other related quality-of-life issues. Health-related quality of life (HRQoL) stems from the broader notion of Quality of Life (QoL) (Witts et al., 2024). There is no universally accepted definition of QoL due to its expansive nature. This current study adopts the World Health Organization's (WHO) definition, which describes QoL as *an individual's perception of their position in life, considering their cultural context, value systems, goals, expectations, and concerns* (WHO, 2023).

QoL is typically evaluated through health-related parameters rather than broader factors like economic status or environmental conditions, as these are less directly linked to health issues (Wohlleber et al., 2021b). This focus has led to the development of HRQoL, which spans a shift from negative outcomes such as mortality to positive experiences like functional abilities and happiness (Steel, Chopra, et al., 2007). Generally, HRQoL encompasses three primary dimensions: psychological functioning (including emotional well-being), social functioning, and physical functioning (Costa et al., 2021). This definition aligns with a clinical or patient-centered perspective, which is the focus of this study.

The assessment of health-related quality of life in patients with liver cancer must be cautiously weighed with both generic and disease-specific measurement tools. Fu et al. (2022) highlighted that a comprehensive evaluation requires both types of instruments, with generic tools such as the SF-36 and EQ-5D offering broad applicability across conditions, while disease-specific instruments like the EORTC QLQ-HCC18 effectively capture the unique symptoms and concerns associated with liver cancer. Wohlleber et al. (2021) further underlined some methodological challenges when assessing HRQoL; for example, when combined, these tools are most informative, but, at the same time, there may be barriers: response burden and timing of assessment. Their systematic review emphasizes that routine monitoring with questionnaires, which have already been through the validation process, leads to improved sensitivity to clinically significant change in patients.

Specific patterns of HRQoL impact were identified in liver cancer patients, with common symptoms including fatigue, abdominal pain, and hepatic encephalopathy significantly affecting daily life (Fu et al., 2022). Wohlleber et al. (2021) reinforced these findings by demonstrating that the complex symptomatology and treatment side effects create unique challenges for patients, necessitating targeted assessment and management strategies. Overall, these studies emphasize the importance of using appropriate HRQoL instruments to further

understand and address the specific needs of liver cancer patients, in view of the expected increase in liver cancer cases worldwide. This study thus seeks to examine health-related quality of life and economic burden borne by people living with liver cancer. This will help provide information on the cost of managing liver cancer as well as developing effective healthcare policies and support systems aimed at improving patient outcomes and alleviating the economic strain associated with liver cancer in Ghana.

1.2 Problem statement

Liver cancer, particularly hepatocellular carcinoma (HCC), is a leading cause of cancer-related mortality worldwide and presents a disproportionate burden in low- and middle-income countries (Rumgay et al., 2022). In Ghana, recent GLOBOCAN estimates reported 3,452 new cases and 3,166 deaths in 2020, making it the most common cause of cancer-related deaths nationally (Choi et al., 2023). Unlike in high-income settings, where early detection and advanced treatment options have improved survival outcomes, most patients in Ghana are diagnosed at relatively younger ages and at advanced stages of the disease, resulting in poor prognosis and high mortality (Agyei-Nkansah & Taylor-Robinson, 2021).

Beyond the clinical burden, liver cancer imposes a considerable economic strain on patients, families, and the health system. Direct costs, including hospitalization, diagnostic investigations, and medication, are typically borne out-of-pocket due to limited health insurance coverage for cancer care (Witts et al., 2024). Indirect costs, particularly loss of productivity from premature mortality and disability, are substantial since the disease often affects individuals in their economically active years (Zou et al., 2022). These costs frequently exceed household incomes, leading to catastrophic health expenditures for many patients.

In addition to financial strain, liver cancer profoundly affects patients' HRQoL, with symptoms such as fatigue, abdominal pain, and jaundice reducing physical, psychological, and social

functioning (Kura et al., 2024). While international studies have documented HRQoL outcomes using standardized instruments such as EQ-5D-5L and EORTC QLQ-HCC18 (Aaronson et al., 2018), there is limited evidence from Ghana. Existing local studies have primarily focused on clinical and epidemiological profiles of liver cancer Agyei-Nkansah and Taylor-Robinson, 2021), but the combined impact of economic burden and HRQoL remains poorly understood.

This evidence gap is significant because understanding the dual burden of economic costs and HRQoL outcomes is important for designing effective cancer policies, allocating resources, and strengthening patient support systems. Without such data, interventions risk being fragmented, focusing narrowly on clinical care while neglecting the broader socio-economic realities faced by patients and families.

Therefore, this study seeks to fill this gap by estimating both the direct and indirect costs of liver cancer and assessing HRQoL among patients in Ghana. The findings will provide much-needed empirical evidence to inform health policy, guide clinical practice, and enhance patient-centered cancer care in the country.

1.3 Research objectives

The general objective of this study is to assess health-related quality of life (HRQoL) and the economic burden borne by people living with liver cancer in Ghana.

The specific objectives of the study are to:

1. To estimate the direct cost borne by persons living with liver cancer in Ghana
2. To estimate the indirect cost incurred by persons living with liver cancer in Ghana
3. To determine the health-related quality of life among persons living with liver cancer in Ghana

1.4 Research question

1. What is the direct cost incurred by persons living with liver cancer in Ghana?
2. What is the indirect cost incurred by persons living with liver cancer in Ghana?
3. What is the health-related quality of life among persons living with liver cancer in Ghana?

1.5 Significance of the study

The importance of the study is considered through the lenses of policy, practice, and science.

In terms of policy, the study will provide data to inform healthcare policies on liver cancer treatment and prevention. The estimation of both direct costs, like hospitalization, medication, and surgical intervention, and indirect costs, such as the loss of productivity because of illness, will enable policymakers to allocate resources effectively. Understanding the full economic impact of liver cancer will help in prioritising funding and resources toward effective interventions, such as screening programs and public health campaigns aimed at prevention. The insights gained from this study can guide the design of specific policies that address the unique challenges faced by patients and their families, including financial assistance programs and support services. Again, showing the economic burden of liver cancer, this research may strengthen the push toward universal health coverage in Ghana, enabling everyone to access the healthcare they need without facing catastrophic expenditures.

In terms of practice, this study has significant implications for clinical practice in the management of liver cancer. The insights gained from estimating the economic burden will contribute to improved patient care. The understanding of financial burdens borne by patients may help healthcare providers to devise an approach to better support those affected by liver cancer. This may include offering financial counselling or assistance with navigating insurance claims. Moreso, knowledge of the economic burden may provide a basis for better decision-

making regarding treatment options. Clinicians may consider cost-effective therapies that maintain quality care while minimising financial strain on patients.

Finally, this research will contribute to the scientific community in terms of addressing the knowledge gaps in the literature on liver cancer. This study will add to the fast-growing literature on the economics of cancer by providing empirical data on the economic burden of liver cancer in Ghana. The work will thus be a useful reference for subsequent studies investigating similar themes in other contexts or regions.

1.6 Conceptual framework

The conceptual framework, as depicted in Figure 1 below, presents the integration of Wilson and Cleary's Health-Related Quality of Life model with Human Capital Theory to examine the relationships between disease characteristics, health outcomes, and economic burden among persons living with liver cancer in Ghana. This theoretical integration provides a foundation for understanding how liver cancer affects both patient quality of life and economic burden through distinct but interconnected pathways.

Independent Variables comprise clinical/biological factors and sociodemographic characteristics that serve as antecedent conditions influencing subsequent health and economic outcomes. Clinical factors, including cancer stage and treatment type, represent Wilson and Cleary's Level 1 (biological and physiological variables), while sociodemographic factors such as age, gender, education level, employment status, and NHIS membership provide contextual influences on disease experience and economic burden.

Mediating Variables reflect the progression pathways central to both theoretical frameworks. Wilson and Cleary's progression is captured through symptom status (Level 2), including fatigue, pain/discomfort, jaundice, and others, which subsequently influence functional status (Level 3) across physical, emotional, social, and cognitive domains. Simultaneously, Human

Capital Theory's pathway is represented through productivity losses, encompassing reduced work capacity, skill deterioration, employment disruption, and income reduction as health deteriorations.

Outcome Variables encompass both health-related quality of life and economic burden as primary study outcomes. Health-related quality of life represents Wilson and Cleary's Levels 4 and 5, operationalized through the EQ-5D-5L instrument's five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) and the visual analog scale for health perceptions. Economic burden reflects Human Capital Theory's conceptualization of disease-related costs, structured as direct costs (medical and non-medical expenditures) and indirect costs (productivity losses, work absence, and travel/waiting time).

Theoretical Pathways demonstrate the framework's integration of both theories. Wilson and Cleary's pathway show the progression from clinical factors through symptoms and functional status to overall health-related quality of life, acknowledging that disease effects cascade through increasingly complex levels of human experience. Human Capital Theory's pathway illustrates how health deterioration leads to productive capacity loss and subsequent economic burden through reduced ability to participate in economic activities.

Bidirectional Relationships between economic burden and health-related quality of life acknowledge the interconnected nature of these outcomes, reflecting the study's recognition that economic burden can affect quality of life through stress and limited treatment access, while poor health status can increase healthcare utilization and productivity losses, creating cumulative economic impact.

This integrated framework provides theoretical justification for examining both humanistic and economic outcomes as legitimate and interrelated consequences of liver cancer, supporting the

study's approach to disease burden assessment in the Ghanaian context, where patients must navigate both health deterioration and financial challenges simultaneously.

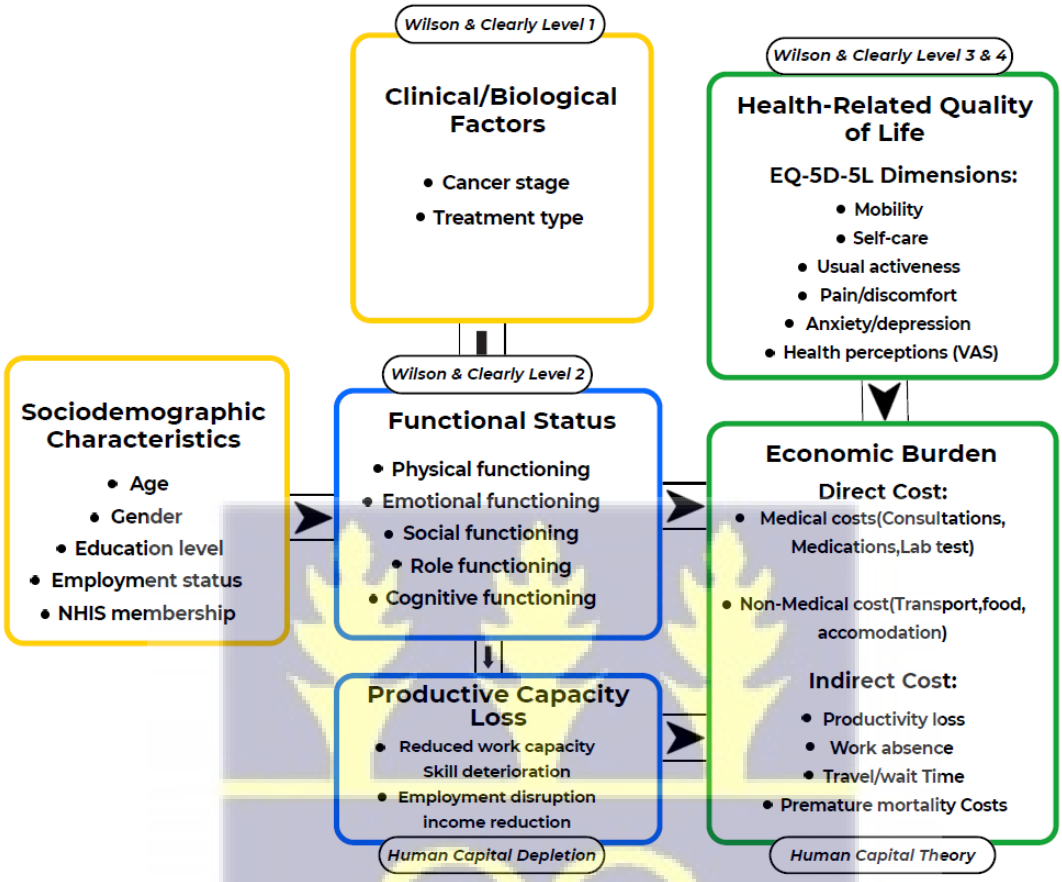

Figure 1.1: Health-Related Quality of Life and Economic Burden of People Living with Liver Cancer in Ghana

1.7 Organisation of the study

The study is organised into six chapters. Chapter one introduces the study by outlining the problem statement, objectives, and questions, besides highlighting the significance of the research and presenting the conceptual framework. Chapter two gives a review of relevant literature on the topic. The methodology, showing how the research is conducted, is presented in Chapter Three. The findings of the study are presented in Chapter Four. Chapter five

presents the discussions of the findings and limitations of the study. Chapter six, which is the final chapter, contains the conclusion, recommendations, and implications of the study to policy, practice, and future studies.

1.8 Summary

Liver cancer is a growing public health concern globally and in Ghana, where it is now the leading cause of cancer-related deaths. The disease not only imposes a significant economic burden through high treatment costs and productivity losses, but also affects patients' HRQoL, impacting their physical, psychological, and social well-being. In Ghana, most patients are diagnosed late and at a younger age, worsening outcomes.

Despite available clinical data, there is limited research on the economic and quality of life impacts of liver cancer on patients in Ghana. This study aims to fill that gap by estimating both the direct and indirect costs of liver cancer and assessing HRQoL among patients. The findings will inform health policy, guide clinical practice, and contribute to scientific knowledge. The study uses an integrated conceptual framework to examine how clinical and socioeconomic factors affect both economic burden and quality of life, supporting better interventions for liver cancer patients in Ghana.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the literature on the economic burden and health-related quality of life among people living with liver cancer. The review encompasses research findings from various scholarly works, focusing on the epidemiological aspects of liver cancer, its economic implications, and its impact on quality of life. The literature review specifically examines the direct, indirect, and intangible costs associated with liver cancer management, as well as the various dimensions of health-related quality of life among patients.

2.2 Epidemiology of Liver Cancer

2.2.1 Global Burden and Trends

Liver cancer represents a significant and growing global health challenge, characterized by stark geographical, demographic, and socioeconomic disparities that highlight the inequality in its burden (Guo et al., 2024). Current GLOBOCAN estimates indicate approximately 905,677 new cases and 830,180 deaths annually, with projections pointing to an increase over the next decade (World Cancer Research Fund, 2024). This increasing burden, however, is not distributed evenly.

The geographical distribution of liver cancer reveals a pronounced divide. Incidence rates are highest in Eastern Asia and Northern and Western Africa, while regions like South-Central Asia and Northern Europe report lower rates (World Cancer Research Fund, 2024). This variation goes beyond the issue of geography but is linked to the unequal distribution of risk factors and healthcare capacity. The primary driver of this disparity is the prevalence of chronic viral hepatitis, which accounts for approximately 80% of cases globally, particularly in

endemic regions (Lin et al.,2022). Furthermore, a demographic pattern is evident, with men facing a 2-4 times higher risk than women, a disparity attributed to a combination of hormonal factors and greater exposure to environmental and behavioral risk factors (Zhang et al. 2021).

A central theme in the global epidemiology of liver cancer is the divergence between high-income countries (HICs) and low- and middle-income countries (LMICs). As noted by Chen et al. (2023), many HICs are witnessing stabilizing or even declining incidence rates. This success is largely attributed to robust public health initiatives, including widespread vaccination against the hepatitis B virus (HBV), effective screening programs, and improved treatment access (Åberg et al. 2024). Conversely, many LMICs continue to experience rising incidence rates. This divergence is a direct consequence of disparities in healthcare infrastructure, limited access to vaccination and screening, and weaker capacity for risk factor management (Zhang et al. 2021).

Compounding this issue is an evolving risk factor profile. While viral hepatitis remains dominant in LMICs, developed nations are observing an emerging shift. In these settings, the rising prevalence of metabolic disorders is making Non-Alcoholic Fatty Liver Disease (NAFLD) and alcohol-related liver disease increasingly significant contributors to the liver cancer burden (Younossi et al., 2023). This shift suggests a future where LMICs may face a double burden of disease from both persistent infections and rising metabolic risks.

The economic implications of this burden are staggering, with global annual direct medical costs estimated to exceed $4.4 billion (Wilson, 2023). This economic strain is felt most acutely in healthcare systems of developing nations, which are least equipped to manage it. The ultimate expression of these disparities is found in survival outcomes. Survival rates exhibit a dramatic gradient, ranging from over 30% in countries with advanced healthcare systems to less than 5% in resource-limited settings (Sharma, 2020). This chasm in outcomes underscores

the profound impact of systemic factors from prevention and early detection to treatment access on patient prognosis.

In conclusion, the global burden of liver cancer is marked by inequality. It is a disease whose incidence, management, and outcomes are heavily dictated by geographic location, socioeconomic status, and the strength of the healthcare system. This context is important for understanding the specific challenges faced in a country like Ghana, where the convergence of high-risk factor prevalence and a resource-constrained healthcare system likely amplifies the economic cost of the disease, justifying the need for this focused investigation.

Wilson (2023) estimated global annual expenditures exceeding $4.4 billion in direct medical costs alone, creating challenges for healthcare systems in developing countries. Sharma (2020) documented significant variations in survival rates, ranging from less than 5% in resource-limited settings to over 30% in countries with advanced healthcare systems. Prevention efforts, particularly vaccination programs against the hepatitis B virus, have shown promising results in reducing liver cancer incidence among younger populations (Younossi et al., 2023). However, achieving global coverage remains challenging, especially in resource-limited settings where healthcare infrastructure is inadequate (Yousefi et al., 2018).

2.2.2 African Context

In the African context, liver cancer presents a particularly challenging public health issue, characterized by unique epidemiological patterns and substantial healthcare challenges (Kura et al., 2024). According to the Global Cancer Statistics (GLOBOCAN 2020), the incidence and mortality of liver cancer cases in Africa represent 7.8 and 8.1% of the global cases, respectively (Amadou et al., 2022). The disease pattern in Africa is distinguished by its earlier onset compared to other regions, with patients typically diagnosed at a younger age and presenting at more advanced stages.

The epidemiological landscape shows marked regional variations. Recent surveillance data indicate that countries in Western Africa have high age-standardized rates, with Northern Africa demonstrating comparably elevated incidence (Guo et al., 2024). This geographic variation closely mirrors patterns of HBV prevalence, with the WHO estimating overall HBsAg prevalence in the Africa region at 6.1% (95% uncertainty interval 4.6–8.5%) (Yousefi et al., 2018).

Subsequently, the burden of liver cancer in Africa is notably influenced by a complex interplay of risk factors specific to the region. Chronic hepatitis B virus (HBV) infection remains the predominant risk factor in sub-Saharan Africa, accounting for approximately 60-80% of cases, while hepatitis C virus (HCV) infection is more prevalent in North African countries (Id et al., 2022). Additionally, exposure to aflatoxins through contaminated foodstuffs, particularly in rural areas with poor food storage practices, significantly contributes to the liver cancer burden in many African countries (Wohlleber et al., 2021b).

Healthcare system challenges significantly impact liver cancer outcomes. Approximately 80% of patients present with advanced-stage disease, primarily due to limited access to screening programs and early diagnostic facilities (Rumgay et al., 2022). The median survival time from diagnosis is particularly shorter in African populations compared to global averages, with studies reporting median survival times of 2.5 to 3 months in some regions, compared to 6-8 months in developed countries.

Prevention efforts face challenges despite available interventions. As of 2019, only 10 of 47 African countries had incorporated the recommended routine hepatitis B birth dose vaccine into their Expanded Program on Immunization (EPI), with vaccine coverage reaching only 77% (Osman et al., 2022). Limited screening of pregnant women for HBV infection

compounds this challenge, with studies showing HBV infection rates of 5.3% among pregnant women in some African countries.

The economic implications of liver cancer in Africa are particularly severe, given the limited healthcare resources and competing health priorities in many countries (Osman et al., 2022). Wahab et al. (2023) report that treatment costs often exceed annual household incomes, with catastrophic health expenditure affecting 60-80% of cases. Limited health insurance coverage and substantial out-of-pocket expenses further restrict access to care. Treatment accessibility remains a significant concern.

Research indicates that less than 20% of liver cancer patients in Africa have access to potentially curative treatments (Schwambach et al., 2020). The limited availability of specialized centers, high treatment costs, and shortage of trained healthcare providers contribute to poor outcomes across the continent (Sung et al., 2021).

2.2.3 Ghanaian Context

The global disparities in liver cancer burden are starkly reflected in the Ghanaian context, where the disease constitutes a critical and escalating public health crisis (Duah et al., 2021). Liver cancer is the leading cause of cancer-related mortality in Ghana and the second most common cancer by incidence, with GLOBOCAN 2020 estimating 3,452 new cases and 3,166 deaths annually (Tuck et al., 2023). This high mortality-to-incidence ratio points to systemic challenges within the national healthcare response. A significant contributor to this poor outlook is the pervasive issue of late presentation, with many patients diagnosed at advanced stages when curative options are limited, leading to a dire prognosis (Ringehan et al., 2017).

The epidemiological profile of liver cancer in Ghana is distinctly shaped by specific etiological factors. Chronic hepatitis B virus (HBV) infection is the predominant risk factor, implicated in

48.8% of cases, underscoring its role as a primary driver of the epidemic (Duah et al., 2021). Hepatitis C virus (HCV) and alcohol-related liver disease are significant contributors, accounting for 7.0% and 10.0% of cases, respectively, while co-infections remain rare (Nartey et al., 2022). The population-level impact is severe, with liver-related causes accounting for 8.8% of all adult deaths, of which hepatocellular carcinoma (HCC) and cirrhosis represent 1.9% and 2.1%, respectively cc

This substantial disease burden is met with a healthcare system facing profound challenges. Diagnostic capabilities are often limited; diagnoses are frequently made through clinical examination and basic imaging at advanced stages, with histological confirmation remaining uncommon due to constrained pathology services (Amoako et al., 2019). The absence of organized screening programs exacerbates this problem, preventing early detection and intervention. Consequently, the financial toxicity of liver cancer care is devastating. Studies indicate that treatment costs routinely exceed annual household incomes, plunging 60-80% of affected families into catastrophic health expenditure (Duah et al., 2021). The lack of comprehensive coverage for cancer treatment under the National Health Insurance Scheme (NHIS) forces most patients to rely on out-of-pocket payments, often leading to treatment abandonment or financial ruin.

Prevention and control efforts, while initiated, demonstrate a critical implementation gap. Although HBV vaccination was integrated into the national immunization program in 2002, coverage remains suboptimal and uneven across regions, hindering its full preventive potential (Nartey et al., 2022). Public awareness of risk factors and prevention strategies is insufficient, and structured screening for high-risk populations is virtually nonexistent (Amoako et al., 2019). Promising initiatives, such as the establishment of the Kumasi Cancer Registry, demonstrate progress in data collection and monitoring but remain limited in their geographical coverage and capacity to inform nationwide policy (Awuku & Yeboah, 2018)

In conclusion, the Ghanaian liver cancer landscape is characterized by a high burden driven primarily by HBV, late diagnosis due to systemic weaknesses, and catastrophic financial consequences for patients. This situation epitomizes the challenges faced by many LMICs, where a high disease burden collides with constrained health system resources. The combination of high out-of-pocket costs and poor outcomes creates a vicious cycle that this study seeks to quantify, providing essential evidence to advocate for strengthened preventive, diagnostic, and financial protection mechanisms.

2.3 Theoretical Underpinning

2.3.1 Wilson and Cleary's Health-Related Quality of Life Model and Human Capital Theory

The theoretical foundation for this study draws upon Wilson and Cleary's conceptual model of health-related quality of life integrated with human capital theory to provide a comprehensive understanding of how liver cancer affects both patient well-being and economic outcomes. This integrated approach offers a robust framework for examining the complex relationships between disease characteristics, health outcomes, and economic burden among persons living with liver cancer in Ghana.

Wilson and Cleary's model, first proposed in 1995 and refined over subsequent decades, represents a seminal advancement in understanding health-related quality of life as a multidimensional construct that extends beyond traditional clinical measures (Ferrans et al., 2005; Wilson & Cleary, 1995).

The model conceptualizes health outcomes as a causal continuum progressing from biological and physiological variables through symptom status and functional status to general health perceptions and overall quality of life. This progression reflects the patient's subjective experience of illness, incorporating both objective clinical measures and subjective perceptions

of health impact. The model's strength lies in its recognition that disease effects cascade through increasingly complex levels of human experience, from basic physiological disruption to comprehensive life satisfaction (Bakas et al., 2012).

Within the context of liver cancer, Wilson and Cleary's framework elucidates how disease characteristics such as cancer stage, tumor burden, and hepatic dysfunction translate into specific symptoms, including fatigue, pain, jaundice, and ascites. These symptoms subsequently influence functional capacity across physical, emotional, and social domains, affecting patients' overall perception of their health status and quality of life. The model's emphasis on the subjective nature of health experiences proves particularly relevant for liver cancer patients, who often face complex symptom profiles that significantly impact daily functioning despite varying objective clinical measures (Steel et al., 2007; Wohlleber et al., 2021).

Human capital theory, originally developed by Becker (1964) and Schultz (1961), conceptualizes individuals' knowledge, skills, and health as productive assets that enable economic participation and wealth generation. The theory posits that health represents a fundamental form of capital that deteriorates through illness and can be restored through healthcare investments, though with diminishing returns over time (Grossman, 1972).

This theoretical perspective treats health not merely as a consumption good but as a productive asset that enables individuals to generate income and contribute to economic output. The theory's emphasis on health as capital provides a framework for understanding how disease creates economic losses through the depletion of productive capacity, extending beyond immediate medical costs to encompass broader societal impacts (Mushkin, 1962).

The integration of these theoretical perspectives creates a comprehensive framework that recognizes health-related quality of life and economic outcomes as interconnected dimensions of disease impact. This synthesis acknowledges that health deterioration affects both subjective well-being and productive capacity, while economic constraints may influence access to treatments that could improve quality of life outcomes. The combined framework provides theoretical justification for examining both humanistic and economic outcomes as legitimate and interrelated consequences of liver cancer.

This theoretical integration proves particularly relevant for liver cancer research, given the disease's tendency to affect multiple life domains simultaneously while imposing a substantial economic burden on patients and healthcare systems.

The framework supports a holistic approach to disease burden assessment that captures both the patient experience of illness and its broader economic implications, reflecting the reality that liver cancer patients must navigate both health deterioration and financial challenges concurrently.

2.3.2 Implications for the Current Study

The theoretical framework guides this research across three key dimensions: methodological justification, analytical approach, and interpretation of findings.

Methodologically, Wilson and Cleary's model validate the use of EQ-5D-5L for health-related quality of life assessment by providing theoretical support for measuring mobility, self-care, usual activities, pain/discomfort, and anxiety/depression as meaningful indicators of health status progression from symptoms to overall well-being. Human capital theory justifies the economic evaluation methodology, supporting the quantification of both direct and indirect

costs and productivity losses as legitimate measures of disease burden that reflect genuine individual costs.

Analytically, the integrated framework suggests specific relationships between study variables that inform statistical analysis approaches. The theoretical foundation predicts that clinical characteristics will influence health-related quality of life through symptom experience and functional status, while simultaneously affecting economic burden through healthcare utilization and productivity losses. These theoretical predictions guide the examination of correlations and mediation pathways between independent and dependent variables.

For interpretation, the framework emphasizes that findings should be understood within the context of patient-centered outcomes and societal economic impact.

The theoretical perspective supports the study's significance for healthcare policy by demonstrating that liver cancer burden encompasses both quality of life deterioration and economic losses, justifying a pragmatic approach to cancer care that addresses both dimensions simultaneously. This understanding proves relevant for resource-limited settings where interventions must balance quality of life optimization with economic sustainability.

2.4 Health-Related Quality of Life in Liver Cancer

Health-Related Quality of Life (HRQoL) represents a multidimensional construct extending beyond traditional clinical outcomes (Krawczyk-Suszek & Kleinrok, 2022). HRQoL measures the impact of health status on an individual's ability to live a fulfilling life, incorporating physical, mental, emotional, and social dimensions. In the same vein, Chuang et al. (2024) opined that HRQoL encompasses multiple domains that reflect how health status affects an individual's physical, mental, and social functioning. Their analysis highlighted that HRQoL measurement must capture both the direct effects of illness and its broader impacts on daily life.

Findings from Parimbelli et al. (2021) identified distinct dimensions of HRQoL through their systematic review. The physical dimension includes functional ability, symptom burden, and treatment side effects. Their analysis revealed that physical functioning significantly influences overall quality of life scores, particularly in cancer patients. The psychological dimension encompasses emotional well-being, anxiety, depression, and cognitive functioning, while the social dimension includes interpersonal relationships and role fulfillment.

The measurement of HRQoL in liver cancer presents specific considerations. Fautrel et al. (2020) evaluated various assessment approaches and found that both generic and disease-specific instruments are necessary for comprehensive evaluation. Their review of patient-reported outcomes showed that generic instruments like the SF-36 and EQ-5D provide broad assessments applicable across conditions, while disease-specific tools like EORTC QLQ-HCC18 capture liver cancer-specific symptoms and concerns. Methodological challenges in HRQoL assessment were highlighted by Wohlleber et al. (2021) through their systematic review of 32 studies. They found that combining generic and disease-specific instruments provides the most comprehensive assessment but noted challenges in implementation, including response burden and timing of assessments. Their analysis demonstrated that regular monitoring using validated instruments improves the detection of clinically meaningful changes in patient status.

2.4.1 Measurement Tools and Approaches

2.4.1.1 Generic Tools (SF-36, EQ-5D-5L)

Generic HRQoL instruments serve as standardised tools for measuring quality of life across various health conditions, enabling comparisons between different diseases and populations (Aaronson et al., 2018). The EuroQol 5-Dimension 5-Level (EQ-5D-5L) stands as one of the

most widely utilized generic instruments in health economic evaluations and clinical research (Aaronson et al., 2018).

This instrument examines five essential dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, with each dimension rated on a five-point scale ranging from no problems to extreme problems (Islam et al., 2023). The EQ-5D-5L has demonstrated robust psychometric properties in liver disease populations, with studies confirming its validity and reliability in capturing health status changes during treatment progression (Parimbelli et al., 2021).

The Short Form-36 (SF-36) Health Survey represents another comprehensive generic instrument widely validated across multiple populations and conditions (LoMartire et al., 2020). This tool evaluates eight distinct health domains through 36 questions: physical functioning, role limitations due to physical health, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health (LoMartire et al., 2020).

The SF-36's extensive validation history and availability in multiple languages have established it as a reliable measure in clinical research and practice (Rustgi et al., 2020). A significant advantage of the SF-36 lies in its ability to generate both physical and mental health summary scores, providing a comprehensive overview of patient health status while maintaining sensitivity to change over time (Barzi et al., 2024).

The World Health Organization Quality of Life Brief Version (WHOQOL-BREF) offers a cross-culturally validated approach to quality-of-life assessment, particularly valuable in diverse populations (Gagliardi et al., 2021). This 26-item instrument assesses four major domains: physical health, psychological health, social relationships, and environment. The

WHOQOL-BREF's development involved extensive international collaboration, ensuring its cultural relevance across different settings (Gagliardi et al., 2021). Its strength lies in its comprehensive coverage of environmental factors affecting quality of life, including access to healthcare, financial resources, and living conditions, making it especially relevant in health systems research and population health studies (Gagliardi et al., 2021).

Each generic instrument offers distinct advantages while also presenting specific limitations in application. The EQ-5D-5L's brevity and utility in economic evaluations make it particularly suitable for large-scale studies and health technology assessments, though it may not capture all nuanced aspects of quality of life(van Krugten et al., 2024). The SF-36's comprehensive nature provides detailed health status information but can present a higher respondent burden (LoMartire et al., 2020). WHOQOL-BREF's cultural sensitivity and environmental domain offer unique insights, particularly valuable in cross-cultural research, though its length may limit its use in some clinical settings.

2.4.1.2 Disease-Specific Tools

Disease-specific instruments for measuring HRQoL in liver cancer provide targeted assessment of symptoms, concerns, and impacts unique to this condition. The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Hepatocellular Carcinoma Module (EORTC QLQ-HCC18) represent a specialized tool designed specifically for patients with hepatocellular carcinoma.

This 18-item module complements the EQ-5D-5L core cancer questionnaire and addresses specific symptoms and concerns, including fatigue, jaundice, fever, abdominal pain, body image, nutrition, and sexual function (Bourke et al., 2024). Validation studies across multiple countries have demonstrated robust psychometric properties, with internal consistency reliability (Cronbach's α) ranging from 0.70 to 0.89 across different scales, and test-retest

reliability coefficients exceeding 0.80 for most domains (Bourke et al., 2024). The instrument's development involved patient interviews across 12 countries, ensuring comprehensive coverage of symptoms and concerns relevant to diverse patient populations.

The EORTC QLQ-HCC18 has shown strength in detecting clinically significant changes during treatment. Recent studies have demonstrated its responsiveness to changes in disease status, with effect sizes ranging from moderate (0.5) to large (0.8) for various symptom scales following therapeutic interventions (Krugten et al., 2024). The tool's ability to capture liver cancer-specific symptoms has made it especially valuable in clinical trials evaluating new treatments. Longitudinal studies have shown significant correlations between changes in HRQoL scores and objective clinical measures, including tumour response ($r=0.68$, $p<0.001$) and survival outcomes (HR=1.42, 95% CI: 1.15-1.75) (Chuang et al., 2024)

The Functional Assessment of Cancer Therapy-Hepatobiliary (FACT-Hep) provides another comprehensive disease-specific measure for liver cancer patients(Calderon et al., 2021). This instrument builds upon the FACT-General (FACT-G) framework by adding specific concerns relevant to hepatobiliary cancers. The FACT-Hep encompasses 45 items across multiple domains, including physical well-being (7 items), social/family well-being (7 items), emotional well-being (6 items), functional well-being (7 items), and additional hepatobiliary cancer-specific concerns (18 items) (van Krugten et al., 2024). Validation studies have confirmed its excellent internal consistency (Cronbach's $\alpha = 0.94$) and test-retest reliability (ICC = 0.85) across all domains (Steel et al., 2021). The tool demonstrates strength in assessing quality of life impacts during different treatment modalities, including surgical interventions, systemic therapy, and palliative care.

Recent multicentre studies have established the FACT-Hep's sensitivity to clinical changes, with minimal clinically important differences (MCIDs) identified for various subscales:

physical well-being (2-3 points), functional well-being (2-4 points), and hepatobiliary cancer subscale (5-6 points). These thresholds have proven valuable in interpreting treatment outcomes and informing clinical decision-making. The instrument has also demonstrated strong correlations with performance status measures ($r=0.72$, $p<0.001$) and liver function parameters (Child-Pugh score correlation $r=-0.65$, $p<0.001$) (Kumar et al., 2024).

Both instruments incorporate assessment of liver cancer-specific symptoms that significantly impact daily functioning. The EORTC QLQ-HCC18 includes a detailed evaluation of ascites-related symptoms, with specific items addressing abdominal distention, early satiety, and dietary restrictions (Calderon et al., 2021). The FACT-Hep provides comprehensive coverage of treatment-related side effects, including items specifically addressing fatigue patterns characteristic of liver disease, gastrointestinal symptoms, and concerns about weight loss (Bourke et al., 2024). Comparative studies have shown that while both instruments effectively capture disease-specific concerns, the EORTC QLQ-HCC18 may be more sensitive to physical symptoms, while the FACT-Hep provides a more detailed assessment of emotional and social impacts (Llovet et al., 2023).

Implementation studies have revealed practical considerations in using these instruments. The EORTC QLQ-HCC18's shorter length (18 items) makes it particularly suitable for routine clinical monitoring, with average completion times of 5-7 minutes. The FACT-Hep's more comprehensive coverage (45 items) typically requires 10-15 minutes to complete but provides more detailed information for research purposes and comprehensive clinical assessments. Both instruments have been validated in multiple languages and demonstrate good acceptability among patients, with completion rates exceeding 90% in most clinical settings (Serrano et al., 2022).

2.4.2 Application in Liver Cancer Research

The application of HRQoL measurement in liver cancer research has evolved significantly, providing crucial insights into patient experiences and treatment outcomes beyond traditional clinical endpoints (Krugten et al., 2024). Studies have demonstrated the value of HRQoL assessment across various stages of liver cancer care, from diagnosis through different treatment modalities to palliative care (Narnaware et al., 2023).

Longitudinal research utilizing both generic and disease-specific instruments has revealed significant patterns in quality-of-life trajectories among liver cancer patients, with particular emphasis on the impact of different therapeutic approaches (Narnaware et al., 2023).

Clinical trials investigating new treatments for liver cancer increasingly incorporate HRQoL measures as primary or secondary endpoints. These assessments have proven particularly valuable in comparing different treatment modalities (Llovet et al., 2023). For instance, studies comparing surgical resection with minimally invasive procedures have utilized HRQoL data to demonstrate that while both approaches might show similar survival outcomes, they can have markedly different impacts on patients' quality of life during recovery periods (Grobet-Jeandin et al., 2023)

The integration of HRQoL measures has also enhanced understanding of the relationship between symptom burden and treatment adherence in liver cancer patients. Studies employing regular quality of life assessments have identified critical periods during treatment where targeted interventions might improve patient outcomes (Grobet-Jeandin et al., 2023). Thomas et al. (2022) demonstrated that early detection of declining HRQoL scores, particularly in domains related to physical functioning and fatigue, could predict treatment discontinuation with 78% accuracy. This finding has led to the development of proactive supportive care protocols at key treatment points.

The application of HRQoL measures has also revealed important cultural variations in the impact of liver cancer and its treatment. Cross-cultural studies utilizing validated instruments have shown how different populations experience and cope with the disease differently (Narnaware et al., 2023). This understanding has led to more culturally sensitive approaches to supportive care and patient education. Younossi et al. (2024) found significant variations in the reporting of emotional distress and social support needs across different ethnic groups, emphasizing the importance of culturally adapted interventions.

In health services research, HRQoL data have informed the development and evaluation of supportive care programs for liver cancer patients. Studies incorporating regular quality of life assessments have helped identify gaps in current service provision and guided the development of more patient-centred care models (Acharya, 2025).

Research focusing on the economic evaluation of liver cancer treatments has also benefited from HRQoL assessment. Quality-adjusted life years (QALYs) derived from HRQoL measures have become crucial in cost-effectiveness analyses of new therapeutic options (Acharya, 2025; Beaudart et al., 2023). These studies have helped healthcare systems make evidence-based decisions about resource allocation and treatment accessibility.

2.5 Economic Burden of Disease and Estimation Methods

2.5.1 Concept of Economic Burden of Disease

The economic burden of disease represents the total financial impact imposed on society, healthcare systems, and individuals (Essue et al., 2018). Understanding this burden is important for healthcare policy development and resource allocation. Fautrel et al. (2020) noted that economic burden includes direct costs (healthcare-related expenditures for patient care, encompassing both medical and non-medical costs). Medical costs include physician visits, diagnostic procedures, medications, and hospitalizations, while non-medical costs cover

elements like transportation and home healthcare services. Jo (2018) further elaborates that these direct costs represent immediate resource consumption in treating or managing the condition.

Indirect costs encompassed productivity losses and related economic impacts. According to ASLAN (2018), these costs can be measured through human capital and the friction cost method. The human capital method values all potential future earnings lost due to illness, while the friction cost method considers only the temporary productivity loss until a worker is replaced. Tan et al. (2024) emphasize that indirect costs often extend beyond the patient to include caregiver burden and broader societal impacts.

Mattingly and Weathers (2022) indicated that intangible costs represent the non-monetary burden associated with pain, suffering, and reduced quality of life. While these costs are challenging to quantify, Tan et al. (2024) argue they are essential for understanding the full impact of illness. These costs can be partially captured through quality-adjusted life years (QALYs) or willingness-to-pay methods. Fautrel et al. (2020) note that these costs can be assessed from different perspectives - payer, societal, or patient - depending on the assessment's objectives, with each perspective offering unique insights into the economic burden of disease.

The societal perspective of economic burden analysis has gained prominence. Krawczyk-Suszek and Kleinrok (2022) demonstrated how diseases impact not only individual patients but also families, communities, and the broader economy through mechanisms such as lost tax revenue and reduced economic growth. Kristina (2021) particularly emphasized the significance of economic burden analysis in resource-limited settings, where healthcare systems face additional challenges in resource allocation and sustainability.

2.5.2 Methods of Measuring Economic Burden

The measurement of economic burden in healthcare requires systematic approaches to quantify both direct and indirect costs associated with illness (Tremmel et al., 2017). These methods have evolved significantly over time, with different approaches offering varying perspectives on cost estimation (Tremmel et al., 2017).

2.5.2.1 Human Capital Approach

The human capital approach represents one of the fundamental methods for estimating indirect costs, particularly productivity losses due to morbidity and premature mortality (Pike & Grosse, 2018). This approach values health outcomes in terms of their impact on an individual's productive capacity, typically measured through lost earnings, with the underlying principle that an individual's value to society can be measured by their market earnings, discounted to present value (Kinge et al., 2024). Applications in health economics have demonstrated their utility in capturing the full economic impact of illness, with studies showing that productivity losses can account for 50-80% of total disease costs in working-age populations (Łyszczarz, 2024).

The human capital method encompasses several key components in its estimation process. For short-term morbidity, calculations include both absenteeism (time away from work) and presenteeism (reduced productivity while at work), with studies indicating that presenteeism can reduce productivity by 20-60% depending on the condition severity (Zou et al., 2022). Implementation research has revealed specific methodological challenges, including the accurate measurement of presenteeism and the valuation of unpaid work.

Studies in oncology settings have developed standardised approaches for measuring presenteeism through validated tools like the Work Productivity and Activity Impairment Questionnaire, showing reliability coefficients exceeding 0.85 (Shan et al., 2021).

Premature mortality calculations within the human capital approach have evolved to incorporate sophisticated modelling techniques. Current methodological practices consider age and gender-specific earnings trajectories, with labour force participation rates varying significantly from 45% to 85% across different demographic groups. Future wage growth estimations, typically projected at 1-2% annually, are integrated alongside calculations of disability-adjusted life years lost (Shuranova et al., 2023). Research across various healthcare systems has demonstrated that these methodological refinements can substantially impact final cost estimates, with variations of 30-40% observed depending on the specific parameters employed (Butler et al., 2021).

Recent methodological advances have further enhanced the approach's accuracy through several key developments. These include the integration of multiplier effects, which typically range from 1.2 to 1.8, accounting for how individual absence affects team productivity (Saranya et al., 2024).

The approach now incorporates sophisticated modelling of job-specific replacement costs and career progression patterns, while also considering broader macroeconomic factors that influence future earnings potential. These refinements have significantly improved the precision of economic burden estimates (Kinge et al., 2024).

2.5.2.2 Friction Cost Approach

The friction cost approach posits that productivity losses are limited to the time required for the economic system to restore the initial production level - the "friction period" (Pike & Grosse, 2018). Studies across different healthcare systems have documented friction periods ranging from 2.5 months in highly dynamic labour markets to 6 months in more specialized sectors, with vacancy duration significantly influencing total cost estimates (Hanly et al., 2023).

Analysis of friction periods has revealed significant variations across different economic sectors and contexts. Service industries typically experience friction periods of 1.8 to 4.2 months, while specialized technical fields often require 3.5 to 6.0 months for workforce replacement. These periods fluctuate with economic conditions, generally shortening during periods of high unemployment (Rissanen et al., 2021).

Geographical variations also emerge due to different labour market dynamics, while skill level requirements significantly influence replacement periods, with highly specialized positions requiring longer friction periods. Methodological developments have refined the friction cost approach through several important innovations. Modern implementations now integrate dynamic labour market modelling with sophisticated analysis of skill-specific replacement patterns (Hanly et al., 2021). Consideration of regional unemployment rates and detailed examination of internal versus external replacement strategies have enhanced the approach's ability to capture real-world economic impacts (Butler et al., 2021). These methodological refinements have significantly improved the precision of productivity loss estimates across various healthcare contexts.

Comparative analyses between the two methods have revealed systematic differences in results across various contexts. Reviews of economic evaluations have shown that while human capital estimates consistently exceed friction cost calculations, the magnitude of this difference varies considerably across different scenarios (Pike & Grosse, 2018). Disease type emerges as a significant factor, with differences ranging from 15-30% for acute conditions to 300-500% for chronic conditions.

Patient age plays a crucial role, with larger disparities observed in working-age populations. Treatment duration and prevailing labour market conditions also significantly influence these comparative outcomes (Blouin & Blouin, 2018). Implementation challenges have spurred

continuous methodological innovation in both approaches. Contemporary developments include enhanced standardization of productivity loss measurement tools and sophisticated statistical methods for uncertainty analysis (Rissanen et al., 2021).

The integration of quality-adjusted life year calculations has improved outcome measurement, while advanced approaches to valuing non-market production have broadened the scope of economic assessment (Pike & Grosse, 2018). These methodological advances have substantially improved the accuracy and reliability of economic burden estimates, though debate continues regarding the most appropriate approach for different evaluation contexts (Hanly et al., 2021).

2.5.3 Cost Assessment Frameworks

Cost assessment frameworks in healthcare provide structured approaches for evaluating the economic burden of diseases through systematic identification, measurement, and valuation of relevant costs (Rowen et al., 2019). These frameworks have evolved to encompass multiple perspectives and methodological considerations essential for comprehensive economic evaluation (Tchouaket et al., 2022). The societal perspective represents the most comprehensive framework, incorporating all costs regardless of who bears them, while other frameworks might focus on specific stakeholder viewpoints such as healthcare systems, third-party payers, or individual patients.

The bottom-up micro-costing framework offers one of the most detailed approaches to cost assessment. This method involves identifying and measuring all relevant cost components at the individual patient level, providing highly accurate estimates of resource utilization (García-Mochón et al., 2022). Research in oncology settings has shown that micro-costing can identify cost differences of 15-30% compared to more aggregated approaches, particularly in complex

treatment protocols where resource utilization varies significantly among patients (Senanayake et al., 2023)

Top-down macro-coasting frameworks, conversely, utilize aggregated data from healthcare systems or national accounts to estimate average costs per patient. While potentially less precise than micro-costing, this approach proves particularly valuable for large-scale economic evaluations and health policy planning(García-Mochón et al., 2022). Applications in health systems research have demonstrated its efficiency in estimating population-level economic burden, though other studies indicate potential underestimation of costs by 10-20% compared to micro-costing approaches, particularly in complex chronic conditions (Leusder et al., 2022)

The activity-based costing (ABC) framework has gained prominence in healthcare cost assessment, particularly for institutional-level analyses. This approach identifies specific activities within the care process and assigns costs based on resource consumption patterns (Busschaert et al., 2024). Various studies have shown that ABC can reveal hidden costs and inefficiencies in healthcare delivery, with analyses identifying cost variations across similar services delivered in different settings (Busschaert et al., 2024; Leusder et al., 2022; Usman et al., 2023). The framework's strength lies in its ability to link specific healthcare activities with their associated resources, enabling more accurate cost allocation and identification of cost drivers (Busschaert et al., 2024).

Time-driven activity-based costing (TDABC) represents an advanced framework that incorporates time as a primary cost driver. This method has proven particularly valuable in understanding the cost implications of clinical pathways and process variations (Senanayake et al., 2023). Studies implementing TDABC in surgical settings have demonstrated its ability

to identify cost-saving opportunities through process optimization, while maintaining or improving the quality of care.

The framework's detailed temporal analysis helps identify bottlenecks and inefficiencies in healthcare delivery processes (Busschaert et al., 2024).

Phase-of-care costing frameworks have emerged as important tools for understanding how costs vary across different stages of illness. This approach categorizes costs according to distinct phases such as diagnosis, initial treatment, continuing care, and end-of-life care (Jang et al., 2023). According to Leusder et al. (2022), utilizing this framework in cancer care has revealed significant variations in resource intensity and costs across different disease phases, with initial treatment and end-of-life care typically showing the highest cost concentration. Studies indicate that costs can vary by factors of 3-5 across different phases of care, highlighting the importance of phase-specific resource planning (Usman et al., 2023).

Recent methodological advances have led to the development of hybrid frameworks that combine elements from multiple approaches. These integrated frameworks aim to balance the precision of micro-costing with the practicality of macro-coasting approaches (Busschaert et al., 2024; Yip et al., 2022).

Implementation studies have shown that hybrid frameworks can achieve 90-95% of the accuracy of pure micro-costing while requiring significantly fewer resources for data collection and analysis. These frameworks have proven particularly valuable in settings where detailed cost data may be partially available or where resource constraints preclude full micro-costing analysis(Gold et al., 2022).

2.6 Economic Burden of Liver Cancer

2.6.1 Direct Costs

The direct costs associated with liver cancer care impose a considerable economic burden on healthcare systems and patients worldwide, with significant variations across regions and healthcare settings (Rustgi et al., 2020). Hospitalisation costs form a major component of these expenses, as evidenced by Choi et al. (2023) in their analysis of inpatient costs in Beijing, where average hospitalisation costs reached approximately US$7,863 per patient, with surgical interventions and complications management representing nearly 45% of total inpatient expenditure. Hofmarcher et al. (2023) revealed that in the United States, median per-patient monthly direct medical costs range from US$21,282 to US$35,395, particularly in advanced disease stages.

These costs escalate primarily due to extended hospital stays and the increasing use of innovative targeted therapies. The diagnostic and monitoring aspects of liver cancer care also contribute to the overall cost burden. Through a population-based study, Hassan et al. (2023) demonstrated that advanced imaging techniques and laboratory investigations account for approximately 20-25% of initial phase costs. These diagnostic expenses, coupled with ongoing surveillance requirements, create a sustained financial burden throughout the patient's care journey.

Studies have documented significant variations in expenses across different treatment modalities and healthcare settings, with intensive care unit admissions potentially tripling standard hospitalisation costs (Choi et al., 2023; Essue et al., 2018; Rustgi et al., 2020). Their findings emphasise how the intensity of care and length of hospital stays directly influence the financial impact on both healthcare systems and patients.

2.6.2 Indirect Costs

The indirect costs associated with liver cancer represent an extensive economic burden, particularly in developing nations. According to Wahab et al. (2023), in Egypt alone, liver cancer resulted in significant productivity losses measured through years of life lost (YLL) and the present value of future lost productivity (PVFLP). The study found that liver cancer led to 197,667 YLL for males and 98,215 YLL for females, with a corresponding PVFLP of $168,523,881 for males and $64,139,588 for females.

The economic impact is particularly severe due to the age at which liver cancer typically affects individuals. Nartey et al. (2022) reported that liver cancer deaths often occur during patients' productive working years, with a median age of approximately 51.3 years. This premature mortality creates substantial economic losses as it affects individuals during their peak earning and productivity years. The burden extends beyond just mortality-related productivity losses. According to Hofmarcher et al. (2023), in a study of nine countries in the Middle East and Africa, the total economic burden of cancer was found to be $1,119 million ($11 per capita), with indirect costs comprising a significant portion of this burden. The study emphasizes how productivity losses due to premature mortality create long-term economic impacts that affect both households and national economies.

The WHO cancer burden projections cited in Wahab et al. (2023) indicate that these indirect costs are likely to increase substantially in the coming years, with global cancer cases expected to rise by 77% by 2050. This projected increase emphasizes the urgency of addressing both the direct and indirect economic impacts of liver cancer.

2.6.3 Intangible Costs and Health-Related Quality of Life

The intangible costs associated with liver cancer represent a significant but often undervalued dimension of its economic burden, encompassing the psychological, emotional, and quality of life impacts that cannot be directly monetized (Parimbelli et al., 2021). These aspects of burden extend beyond conventional economic measures to include pain, anxiety, depression, psychological distress, and reduced quality of life that affects both patients and their families (Krawczyk-Suszek & Kleinrok, 2022).

The psychological burden of liver cancer is particularly pronounced due to its tendency to affect individuals during their economically active years (Nartey et al., 2022). The timing of disease impact creates significant distress for both patients and families, compounded by the substantial economic pressures of treatment costs. Additionally, the high cost of treatment combined with reduced earning capacity creates significant psychological stress for both patients and families, compounding the emotional toll of the disease (Parimbelli et al., 2021).

The nature of these intangible costs, though difficult to quantify, plays a crucial role in understanding the comprehensive impact of liver cancer on patients (Essue et al., 2018).

2.6.4 Total Economic Cost

The assessment of total economic cost in healthcare requires systematic integration of various cost components and their broader economic implications (Pradhan et al., 2024). This holistic approach encompasses not only the combination of direct and indirect costs but also considers the ripple effects through healthcare systems and broader economies (Jones & Burns, 2021). Methodological frameworks have established standardized approaches for evaluating these total costs, emphasizing the importance of considering both immediate financial impacts and long-term economic consequences (Pradhan et al., 2024). The assessment of total economic cost typically involves three key aspects: the integration of direct and indirect costs, analysis

of broader economic impacts, and comprehensive estimation of cost burden across different stakeholders and systems (Gold et al., 2022).

2.6.4.1 Integration of Direct and Indirect Costs

The integration of direct and indirect costs represents a crucial methodological step in assessing the economic burden of diseases. This integration process requires careful consideration of various methodological challenges to avoid double-counting while ensuring all relevant costs are captured (Franklin et al., 2024). Studies have shown that comprehensive cost integration can reveal total economic burdens 40-60% higher than assessments focusing solely on direct medical costs (Jones & Burns, 2021).

Methodological advances have established systematic approaches for cost integration. The process typically begins with careful categorization of costs to ensure clear delineation between direct and indirect components (Franklin et al., 2024). Research has demonstrated that overlapping cost categories, particularly in areas such as informal care and productivity losses, can lead to estimation errors if not properly addressed. Advanced accounting frameworks now incorporate specific protocols for identifying and eliminating potential overlap, particularly in cases where direct healthcare utilization impacts productivity losses (Pereda et al., 2022).

Temporal considerations play a crucial role in cost integration. Studies have shown that direct and indirect costs often follow different temporal patterns throughout the course of illness (Kennedy et al., 2024). Analysis of chronic disease patterns reveals that while direct medical costs may peak during acute episodes or interventions, indirect costs often show more gradual accumulation over time (Franklin et al., 2024).

The integration process must also consider the interdependencies between direct and indirect costs. For instance, investments in direct medical care often influence subsequent indirect costs through their impact on recovery time and return to work (Gennep et al., 2021).

Methodological challenges in cost integration include addressing various discount rates for different cost components. While direct costs are typically assessed at current values, indirect costs often extend into future periods, requiring appropriate discounting (Goyanka, 2021). Current best practices recommend using differentiated discount rates that reflect the distinct nature of direct and indirect cost components.

The integration process must also account for regional and demographic variations in both direct and indirect cost patterns. Studies across different healthcare systems have revealed that the ratio of indirect to direct costs can vary significantly in some settings, depending on factors such as healthcare system structure, labour market conditions, and social support systems (Togha et al., 2021). These variations necessitate context-specific approaches to cost integration, particularly in international comparative studies.

Advanced statistical methods have enhanced the accuracy of integrated cost assessments. Sensitivity analyses incorporating Monte Carlo simulations have become standard practice, allowing researchers to quantify uncertainty in integrated cost estimates (Velikova et al., 2024). These analyses typically reveal confidence intervals of ±15-25% around point estimates, highlighting the importance of considering uncertainty in economic burden assessments (Velikova et al., 2024). Studies employing these methods have improved the reliability of integrated cost estimates while providing valuable insights into the relative contribution of different cost components.

2.6.4.2 Economic Impact Analysis

Economic impact analysis in healthcare extends beyond direct and indirect cost assessment to examine broader economic consequences across multiple sectors and stakeholders. This analytical approach considers ripple effects through economies, including impacts on healthcare systems, labour markets, and societal productivity (Nymark et al., 2022)

The analysis typically employs input-output modelling to capture intersectoral effects. Research has shown that healthcare expenditures create significant multiplier effects through economic systems, with studies estimating that every dollar spent in healthcare generates an additional $0.70-$1.20 in economic activity across other sectors. These multiplier effects vary significantly by region and healthcare system structure, with larger effects observed in more integrated healthcare economies (Velikova et al., 2024).

Labour market analysis forms a crucial component of economic impact assessment. A study by Szymczak and Wolszcza (2022) demonstrated that major diseases affect not only individual productivity but also broader labour market dynamics; multiple healthcare systems have shown that significant disease burdens can reduce labour force participation rates by 2-5 percentage points and affect wage growth in affected populations. These effects often persist beyond individual recovery periods, creating longer-term economic implications.

Macroeconomic modelling approaches have revealed significant impacts on regional and national economies. Advanced econometric analyses have demonstrated that substantial disease burdens can affect GDP growth by 0.3-0.7 percentage points annually through combined effects on workforce participation, productivity, and healthcare system resources (Chen et al., 2023). These impacts show particular significance in regions with limited healthcare infrastructure or aging populations (Poledna et al., 2024). Subsequently, the analysis of healthcare system impacts reveals complex interconnections between disease burden and system capacity.

Major diseases can create systemic effects through resource allocation patterns, affecting service availability and efficiency across healthcare systems (Darvas et al., 2022). Methodological advances have incorporated dynamic economic modelling to capture temporal

variations in economic impacts. These approaches consider how economic effects evolve, including adaptive responses in healthcare systems and labour markets.

2.6.4.3 Cost Burden Estimation

Cost burden estimation represents a systematic approach to quantifying the comprehensive financial impact of diseases across different stakeholders and healthcare systems. This methodological framework incorporates multiple analytical levels, from individual patient burden to societal-level impacts, providing crucial insights for healthcare policy and resource allocation (Strilciuc et al., 2021).

Recent advances in estimation techniques have enhanced the accuracy and comprehensiveness of burden calculations, revealing that traditional approaches often underestimate total cost burden by failing to capture certain indirect and long-term impacts (Henderson et al., 2021).

The estimation process employs stratified analysis to examine cost distributions across different population segments and healthcare settings (Evison et al., 2024). Studies have revealed significant variations in cost burden based on socioeconomic status, with evidence showing that lower-income households often bear disproportionate financial burdens relative to their income (Shamsuddin et al., 2024). Research across multiple healthcare systems has documented that out-of-pocket healthcare expenses can consume 15-40% of household income in severe cases, with catastrophic health expenditure affecting 20-30% of affected families in some regions (Samsudin et al., 2022).

Healthcare system burden estimation requires consideration of both immediate resource utilization and long-term capacity implications (Quisoboni, 2023). Analysis of system-level costs has demonstrated that chronic diseases create sustained pressure on healthcare resources, with studies showing that managing complex conditions can increase system-wide costs by 25-35% through increased demand for specialized services and support infrastructure. These

systemic effects often persist beyond individual treatment episodes, creating long-term resource allocation challenges (Henderson et al., 2021).

Geographic variations in cost burden present significant challenges for estimation approaches (Laughter et al., 2021). Studies across different healthcare systems have revealed cost variations for similar conditions, reflecting differences in healthcare delivery systems, pricing structures, and resource availability (Jacobs et al., 2022). These variations necessitate context-specific estimation approaches and careful consideration of local economic factors in burden calculations. Research has shown that standardized estimation frameworks must incorporate regional adjustment factors to account for these systematic differences (Chen et al., 2023).

The integration of multiple data sources has emerged as a crucial element in accurate burden estimation. According to Quisoboni (2023), combining administrative data, patient surveys, and clinical records has demonstrated that comprehensive data integration can improve estimation accuracy compared to single-source approaches. This integrated approach enables better capture of both direct healthcare costs and broader societal impacts, though it requires careful attention to data standardization and quality control (Evison et al., 2024).

2.7 Conclusion

The literature reviewed shows that although there is considerable research on liver cancer's epidemiology, risk factors, and clinical care globally and across Africa, there are still notable gaps in knowledge specific to Ghana. Little is known about how liver cancer affects both the financial costs and HRQoL of patients. Most existing studies have focused on medical and epidemiological details, paying less attention to the financial strain and emotional challenges the disease imposes on individuals. Additionally, many cost studies from other regions use data from healthcare systems rather than directly measuring the expenses and productivity losses

experienced by patients themselves, which limits understanding of the true economic impact in low- and middle-income countries like Ghana.

This research aims to address these shortcomings by offering evidence on both the direct and indirect costs of liver cancer treatment and by assessing HRQoL among affected Ghanaians using the validated EQ-5D-5L tool. By combining Wilson and Cleary's HRQoL framework with Human Capital Theory, the study captures both the personal well-being and economic challenges patients face. The results will inform policies, funding decisions, and clinical practices that better support patients in managing both the costs and quality of life impacts of liver cancer.

CHAPTER THREE

METHODS

3.0 Introduction

This section describes the methodology that was used in this research. It comprises study design, study population, study areas, sampling procedure, and sample size, the instrument for data collection, data processing and analysis, as well as ethical considerations.

3.1 Research Approach

The choice of any research design is generally dependent on the type of approach adopted in the study because of its significance to any scientific study, irrespective of the research area (Mulisa, 2022). The research approach employed in this study is quantitative research. According to Weyant (2022), a quantitative research approach/method is a type of approach in which quantitative techniques in the form of descriptive and inferential statistics are used to describe issues in the study.

This approach allows the study to collect and analyze data in quantitative/numerical terms. It is suitable for examining the strength and magnitude of relationships, such as the effect or impact of a variable on another. Renjith et al. (2021) revealed that this approach allows generalizations of a study's outcome since findings are more objective than subjective. The current study employed this approach because the study sought to assess HRQoL and the economic burden borne by people living with liver cancer in Ghana.

3.2 Epistemology

The positivist paradigm was employed in this study. This paradigm asserts that reality is objective and can be quantified through observation and experimentation (Maksimovic & Evtimov, 2023). This paradigm is characterised by its objective, empirical, and quantitative

research approach, emphasising systematic observation, measurement, and variable analysis (Turin et al., 2024).

One of the strengths of the positivist approach is its use of rigorous study designs, including representative sample sizes and standardized data collection tools, which help ensure that findings are reliable, replicable, and generalizable. By minimising researcher bias and focusing on measurable data, positivist research aims to produce objective conclusions that reflect true causal or correlational relationships.

In this study, which assesses health-related quality of life (HRQoL) and the economic burden borne by people living with liver cancer in Ghana, the positivist paradigm guides the use of quantitative methods to collect and analyze data. Variables such as medical costs, non-medical costs, and productivity losses will be estimated statistically to determine the economic burden borne by persons living with liver disease.

This approach allows the study to draw clear, evidence-based conclusions that can inform healthcare policy and improve liver cancer treatment in Ghana (Khanday et al., 2024). In the positivist paradigm, the study ensures methodological rigor and produces findings that are both objective and applicable to the wider population, supporting efforts to reduce the economic burden borne by patients living with liver cancer and their quality of life.

3.2.1 Ontology

This study adopts a realist perspective aligned with the positivist approach, asserting that objective reality exists and can be observed and measured (Turin et al., 2024). It treats economic burden and HRQoL as concrete and measurable phenomena. The study collects and analyzes data to estimate the direct, indirect, and HRQoL related to patients receiving liver cancer. It assumes these events exist independently of individual opinions and systematically estimates the economic burden and HRQoL of persons living with liver cancer.

3.2.2 Axiology

This study maintains a neutral stance by minimizing researcher bias and emphasizing objectivity throughout the research process (Klakegg & Tvedt, 2024). It systematically gathers and analyzes empirical data on the economic burden and HRQoL of liver cancer to obtain unbiased and accurate information. The study ensures validity and reliability by grounding findings in observable evidence rather than subjective interpretation. It focuses on producing reliable insights into demographic, cost, and HRQoL associated with persons living with liver cancer, thereby supporting the study objective and conclusions.

3.3 Study Design

This study employed a quantitative research approach underpinned by a positive paradigm. A cross-sectional, prevalence-based cost-of-illness (COI) design was adopted to estimate both direct and indirect costs of liver cancer and to assess the HRQoL of patients. According to Jo (2014), a prevalence-based cost of illness design calculates the economic burden of a condition over a given time frame. This method offers a cross-sectional view of all expenses (direct and indirect) related to managing and living with a condition for all afflicted persons (Errico et al., 2022). This design was appropriate because it enabled systematic collection of cost and HRQoL data at a single point in time, reflecting the economic and health burden of patients during the study period (Kristina, 2021). According to Amissah et al. (2019), this approach is usually helpful in estimating the cost of public health problems that seem less prevalent.

3.3 Study area

The study was conducted in Ghana, one of the 16 countries in West Africa. It is divided into sixteen administrative regions and 261 districts/municipalities/metropolises. It is bordered by the Ivory Coast to the West, Burkina Faso to the North, Togo to the East, and, to the South, the Gulf of Guinea as part of the Atlantic Ocean. The population of Ghana in 2021 was 30,792,608,

with females making up 50.7% of the population and males 49.3%, giving a national sex ratio of 97 males for every 100 females (Ghana Statistical Services, 2021). The Greater Accra Region is the most populous in Ghana. Ashanti Region closely follows as the second most populous region. These regions are both almost twice (1.9) the size of the third most populous region, the Eastern Region (Ghana Statistical Services, 2021).

Ghana is divided into three geographical zones: northern, middle, and southern, each with distinct economic activities and landmarks. The Northern Belt is primarily agricultural, focusing on crops such as sorghum, maize, and groundnuts, and is historically significant for trade due to its trading routes. The Middle Belt, comprising the Ashanti Region, is known for its cocoa production. The Southern Belt is more urban and diversified in terms of the economy.

In the Northern Belt, Tamale Teaching Hospital plays a role as a healthcare facility, providing specialised services and acting as a referral center for patients from northern Ghana.

Cape Coast Teaching Hospital is a prominent institution in the Southern Belt, with a dedicated oncology unit that provides comprehensive care for various cancers, including hepatocellular carcinoma. The Korle-Bu Teaching Hospital (KBTH) stands as Ghana's largest teaching hospital and serves as the primary national referral center.

3.3.1 Study setting

The study was conducted in the oncology departments of Korle-Bu, Cape Coast, and Tamale teaching hospitals. This setting was chosen because it provides specialized cancer care services and serves as a referral point for cases across the country, making it ideal for capturing a wide spectrum of liver cancer patients.

3.4 Study Population

The target population from whom data was collected was adult (18+ years) persons living with liver cancer enrolled at the cancer unit or the oncology department of the three selected teaching hospitals across the country.

3.4.1 Inclusion Criteria

All adult (18+ years) patients accessing liver cancer treatment at the cancer unit or oncology department at the study setting, irrespective of sex, culture, background, and religious belief, were recruited. Persons living with liver cancer and receiving treatment at the facility for at least one (1) month at the time of data collection were included.

This was important to establish relevant costs incurred over a short period, as the survival of patients with the condition of interest is short (Nartey et al., 2022), and to ensure relevant costs are well captured compared to missing out on important relevant costs of the participants for receiving treatment over a relatively longer period.

3.4.2 Exclusion Criteria

Participants who met the inclusion criteria but were unable or unwilling to take part were excluded from the study. This included patients who declined to give written consent, those who were too ill to be interviewed, or had communication or cognitive difficulties that made it hard to respond reliably. Individuals below 18 years of age and those who took part in the pre-test were also excluded. These measures ensured that only participants who could provide informed and reliable information were included in the study.

3.5 Study Variables

The independent variables in the study are direct medical and non-medical costs, indirect costs, NHIS status, and stage of cancer. Medical costs encompass expenditures for the treatment and diagnosis of liver cancer, including the cost of scans, laboratory tests, and others. Non-medical

costs cover expenses such as transportation, feeding, and other miscellaneous costs incurred during the process of seeking liver cancer treatment.

Indirect costs are associated with the loss of productivity due to time spent receiving liver cancer treatment. The outcome variable in the study was economic burden, which encompasses the total direct and indirect costs, and HRQoL.

Table 3.1: Description of variables of interest and their components

Type of Variable	Cost Type	Cost Category	Description
Independent	Direct cost	Medical Cost	Consultation
			Medication
			Laboratory investigation
			Imaging test
		Non-Medical Cost	Transportation
			Food and drink
			Others
	Indirect Cost	Productivity losses	Productivity loss (working hours lost)
			Waiting time
			Travelling time
Dependent	Total cost	Total cost	Summation of all costs for managing liver cancer
	HRQoL	HRQoL	Mobility
			Self-care
			Usual activities
			Pain
			Anxiety

3.6 Sampling and Sampling Technique

The study adopted a 2-stage sampling technique to select both study participants and facilities. The first stage was purposive sampling of KBTH, CCTH, and TTH. Purposeful sampling of a

facility involves the selection of a specific healthcare facility for inclusion in a study based on certain attributes that make it pertinent to the research aims (Campbell et al., 2020).

The researcher's judgment is used in this non-probability sampling technique to select a facility that can offer rich, pertinent, and in-depth information about the study issue (Thomas, 2022). These institutions were purposively selected for their expertise in liver cancer treatment and dedicated oncology services. These facilities also serve as a vital referral center in Ghana. Their strategic locations across the country ensured a representative sample of patients, facilitating a comprehensive understanding of the economic burden of persons living with liver cancer and health-related quality of life in diverse populations.

The study employed a census approach in the second stage, which involved the inclusion of all patients (18+ years) diagnosed with liver cancer and receiving treatment within the study area who met the inclusion criteria. A census was conducted for 4 months (April– July 2025) to capture the population of interest who visited the three (3) TH oncology department/center, specifically the gastro clinic for treatment or review each day of the data collection period.

A census is a complete enumeration of a population, where all members of a defined group are included in the study (Ruggles et al., 2024). This comprehensive sampling method is often used when the population is relatively small, and it is feasible to collect data from every individual (Shah, 2023). In this study, the census approach is deemed appropriate due to the manageable number of patients (18+ years) diagnosed with liver cancer in the study area.

By including all patients living with liver cancer in the study area, the study aims to assess the health-related quality of life and the economic burden experienced by individuals living with liver cancer in Ghana, minimising potential selection bias and ensuring representativeness of the findings (Karunarathna et al., 2024). One hundred and twenty-one (121) persons living with

liver cancer were interviewed. This comprised 34, 51, and 36 participants from CCTH, KBTH, and TTH, respectively.

3.7 Data Collection Method and Tools

Data was collected from respondents using structured questionnaires, which capture the variables described in Table 3.1. Participants were interviewed one-on-one to gather data. The questionnaire captures information on participants' demographics, economic burden (direct and indirect costs), and health-related quality of life of persons living with liver cancer.

The questionnaire was designed in the English language, and interviews were conducted in English and local dialects (Ga and Akan). This ensured that respondents had a clear understanding of the questions. The questionnaire was divided into five sections. Section 1 captured sociodemographic information of the respondents, Section 2 captures health status and treatment information, Section 3 captures direct cost information, Section 4 captures indirect cost information, and Section 5 captures quality of life information. The data collected was double-checked to minimise errors and ensure completeness.

Eligible participants who were recruited were informed about the study's purpose, potential benefits, and voluntary participation, and informed consent was obtained from willing participants by either signing or thumbprinting the consent form, as preferred by the participant. The structured questionnaire was then administered to participants through face-to-face interviews by the trained research assistants.

The questionnaires were administered from April to July 2025, utilising structured costing instruments that were programmed into the electronic data capture platform, KoboToolBox. KoboToolBox is a free, secure, web-based tool specifically designed to facilitate data collection for research purposes. The field activities by the trained research assistants were

supervised by the Principal Investigator (PI). Privacy and comfort were ensured during the interviews.

3.8 Quality Control

To ensure data quality, the following measures were adopted:

3.8.1 Training Research Assistants

A team of three (3) tertiary level graduates who have research experience in field data collection with demonstrable ability to speak at least one local language in addition to English was recruited and provided with a one-day training. The training focused on the data collection tools and ethics of research.

The aim and objectives of the study, the role of the interviewer, and study procedures were presented through PowerPoint. Other topics on ethics of research, facility entry strategies, and how to obtain informed consent from potential study participants were presented. Again, practical sessions including role plays and mock interviews in English and local languages were carried out to ensure that the research assistants are well equipped to deliver the task.

3.8.2 Pre-Testing and Review of Instrument

The purpose of the pretesting was to review and revise the data collection instruments, evaluate their effectiveness, and assess the difficulties the researcher encountered in advancing the study objectives to find appropriate solutions before the main study. The outcome of the exercise was to shape the question format, wording, and order, and to identify if the intended participants understood the questions.

After the process, participants were allowed to give their views. Audio recording and note-taking during the process were done. Pretesting of the study instruments was done in Komfo

Anokye Teaching Hospital, involving seven (7) participants. The process helped to redesign the instrument to include the sequencing of the variables to be included in the questionnaire.

3.8.3 Lessons learnt from the pretesting phase

The study revealed that patients living with liver cancer are seen at the gastroenterologist clinic within the oncology department of the hospital. The clinic is held once a week, and most patients are booked for review on those days. The study also revealed that the researcher must collaborate with the consultant doctors who oversee the gastro clinic before data can be collected.

These doctors were found to give their consent even though the Institutional Review Board (IRB) of the hospital had granted ethical clearance. Therefore, during the main study, the researcher included these doctors as collaborators who then granted access to the unit to administer the questionnaire.

In addition, the researcher observed that the structure and wording of some of the questions on the questionnaire did not elicit the right responses; hence, these questions were reviewed. In the pretest, the researcher learnt how to build rapport to facilitate data collection and gained practical insights on how to administer questionnaires.

3.9 Data Processing

This study utilized primary data collected from study participants from the three (3) TH. The data collected was double-checked to ensure there were no missing values. The data was captured into Microsoft Excel, cleaned to correct errors, coded, and exported into STATA'17 (StataCorp. 2023. Stata Statistical Software: Release 17. College Station, TX: StataCorp LLC). This minimized errors during the data analysis.

3.10 Data Analysis

All cost estimations in this study were standardized to one month. This time horizon was selected for several key reasons. Firstly, given the poor prognosis and low survival rates associated with liver cancer in Ghana Tuck et al., 2023), a longer costing horizon was deemed less representative, as a significant portion of the patient cohort may not survive a period. A one-month prevalence-based approach provides a more consistent and reliable snapshot of the economic burden across the entire sample. Secondly, a shorter recall period minimizes potential recall bias and enhances the accuracy of self-reported expenditure data from patients and caregivers. Finally, this standardization allows for valid comparisons between patients with different clinic visit frequencies and provides policymakers with a tangible measure of the immediate, recurring financial pressure on households.

3.10.1 Background Information of Participants

To provide an overview of the background information of respondents, the data were summarized in the form of descriptive statistics as frequencies and percentages, mean, and standard deviation. Frequencies and percentages were calculated for participants' sex, insurance status, facility name, education level, marital status, and employment status. For continuous variables such as age and monthly income, means and standard deviations were computed.

3.10.2: Estimation of Direct Cost

This was estimated by summing all direct medical and non-medical costs of managing liver cancer. The direct medical cost was estimated by summing all costs of consultation, medicines/drugs, laboratory investigation, and tests during the last visit to the health facility for treatment or review over the last month.

Again, direct non-medical cost was estimated by summing all costs of transportation to and from the health facility, the cost of food and drink, and other related costs due to the disease conditions. The costs for consultation, medicines, laboratory tests, imaging, and admission were reported by patients for their last visit to the facility. To estimate a monthly cost, each of these cost components was multiplied by the patient's reported average number of clinic visits per month. Transportation costs covered the cost of caregivers and patients conveying to and from the hospital for regular review and treatment. The total direct cost was then obtained by the summation of all components of medical and non-medical expenses incurred by the respondent due to liver cancer treatment.

3.10.3: Estimation of Indirect Cost

The human capital method was adopted to estimate the indirect cost. This method was used to place monetary value on the lost value of economic productivity due to liver cancer (Jo, 2018). Human capital is the economic wealth that a person gains from their experience, skills, and knowledge. The concept encompasses the capacity of the labour force for production and the investments made in individuals to improve their competencies (Angrist et al., 2021).

The estimation was done by summing (i.e, the waiting time at the hospital and travel time to and from the hospital, and absenteeism) over one month, and it was multiplied by the national minimum wage to get the total indirect cost. Productivity loss was valued using the income of the patient and the 2025 Ghana national minimum wage, which is GHS19.97 (WageIndicator.org, 2025). Economic burden was then obtained by summing all the components of direct cost and indirect cost. That is, economic cost direct cost + indirect cost.

3.10.4 Estimation of Total Economic Burden

The total economic burden borne by people living with liver cancer was estimated monthly. First, the total cost per hospital visit was calculated for each patient by summing their direct and indirect costs. To extrapolate this to a monthly burden, the per-visit cost was then multiplied by the individual's specific number of visits per month. This approach standardized the cost horizon across all participants, accounting for different appointment schedules (e.g., weekly or monthly). The average monthly cost per patient was subsequently determined by dividing the overall monthly cost by the total number of patients sampled.

3.10.5: Estimation of HRQoL among people living with liver cancer

HRQoL was measured using the EQ-5D-5L instrument. Responses from each of the five domains—mobility, self-care, usual activities, pain/discomfort, and anxiety/depression—were combined to generate a five-digit health state profile for each participant. A Likert scale with five levels was used, where participants scored statements under each dimension as follows: 1 = No problems, 2 = Slight problems, 3 = Moderate problems, 4 = Severe problems, and 5 = Unable to/Extreme problems. The EQ-VAS was also used as a self-rating of overall health on a scale ranging from 0 (worst imaginable health) to 100 (best imaginable health).

The coding and scoring process followed these steps. First, EQ-5D-5L responses were entered into Stata version 17 for cleaning and coding. Each health state was then matched to its corresponding weight using the Ghana valuation set developed through time trade-off and discrete choice experiments. The Ghana value set provides coefficients for each health dimension and severity level, which were summed with the constant term to obtain a utility value for each participant. These utility scores were anchored on a scale where one represented full health, 0 represented death, and negative values indicated health states valued worse than death.

Responses in each of the five EQ-5D-5L dimensions were summarized in frequency tables to show the distribution of patients across the five severity levels—no problem, slight, moderate, severe, and extreme. This provided a clear profile of the impairments affecting patients' physical, social, and psychological functioning. The EQ-5D-5L responses were then converted into health utility index values using the Ghanaian EQ-5D-5L value set to ensure locally relevant estimates.

For both the utility index and the EQ-VAS, descriptive statistics including means, standard deviations, medians, interquartile ranges, and percentiles (25th and 75th) were computed. Scores were disaggregated by age groups. Further analysis was carried out across cancer stages to determine the extent of deterioration in quality of life with advancing disease. As the data were not normally distributed, non-parametric tests (Kruskal–Wallis) were applied to assess statistical significance, and results were reported using test statistics and p-values. Findings are presented in tables.

3.10.6 Sensitivity Analysis

Sensitivity analysis (SA) was conducted to evaluate the robustness of the study's cost estimates by varying key parameters and examining their effect on the overall results. In this study, the costs of imaging, medicines, laboratory services, and the national minimum wage were identified as major cost drivers and, therefore, selected for testing.

The selection of the parameters was based on their role as primary cost drivers identified in the base-case analysis. Imaging and medicines constituted the largest components of direct medical costs, while laboratory services also represented a significant and variable expense. These costs are subject to fluctuation due to factors such as hospital-specific pricing, changes in supplier costs, and variations in diagnostic requirements based on disease progression. The national minimum wage was selected because it serves as the central metric for valuing productivity losses in the human capital approach. A ±25% variation was applied to all parameters to model

a realistic range of uncertainty, reflecting potential changes in government wage policy, market prices for medical resources, and the inherent variability in healthcare costing within the Ghanaian context.

This range allows for a robust test of the study's conclusions against plausible economic shifts. The results of the sensitivity analysis provided insights into how variations in these parameters could influence both direct and indirect costs, thereby testing the stability of the study's conclusions.

3.11 Ethical Considerations

The study ensured compliance with all ethical issues in research by the following means:

3.11.1 Ethical clearance

A letter of introduction was acquired from the Department of Health Policy, Planning, and Management, School of Public Health, to obtain permission and approval from the teaching hospitals where the study was conducted. Ethical approval was obtained from the Institutional Review Board of Cape Coast Teaching Hospital (CCTHERC/EC/2025/052), see appendix D, Korle Bu Teaching Hospital (KBTH-STC 00016/2025), see appendix E (1& 2), and Permission to conduct research in Tamale Teaching Hospital (TTH/R&D/SR/25/133), see appendix F

3.11.2 Access and Approval of the Study Site

The head of the department of the various oncology departments and the consultant doctor in charge of the gastro clinic of the selected teaching hospitals were contacted, approval and permission were obtained, and they were well informed about the conduct of the study in their clinics.

3.11.3 Privacy and Confidentiality

The questionnaire was coded, and the names of respondents were not required to fill out the questionnaire. This was done to ensure privacy and confidentiality. The interview was conducted in privacy, and information obtained from patients was kept confidential.

3.11.4 Risks and Benefits

There were no risks or expenses involved with taking part in the study, except for the time study participants had to spend answering questionnaires. There were no immediate advantages for participants. Nonetheless, it was anticipated that the study's findings would influence Ghanaian policymakers' decisions on the expense of treating liver cancer patients.

3.11.5 Voluntary Withdrawal

Study participation was entirely voluntary. At any time during the study, participants had the freedom to leave. However, to guarantee that the study's conclusions accurately represented the financial strain of treating liver cancer in Ghana, participants were urged to engage completely.

3.11.6 Informed Consent

Before the start of the study, all patients were given a questionnaire outlining the goals, advantages, risks, confidentiality, and the procedure for gathering data, after which they were given the chance to provide their consent. A consent form with clear information on the data collection procedure was signed by the participants. Refusing to participate in the study had no bearing on the patient's or participant's care and treatment because participation was entirely voluntary.

3.11.7 Compensation

Study respondents were not given any compensation for participating in the study. This was made known to participants before they were recruited.

3.11.8 Conflict of Interest

There was no conflict of interest for the researcher in the study. The researcher was financed by WHO; however, WHO did not have any influence over the research topic, the data analysis, or the presentation of findings.

3.12 Summary

The study employed a quantitative, cross-sectional, prevalence-based cost-of-illness design underpinned by a positivist paradigm. Data were collected from adult liver cancer patients at oncology departments of three teaching hospitals in Ghana: Korle-Bu, Cape Coast, and Tamale. Inclusion criteria focused on patients receiving treatment for at least one month. The study variables included direct medical and non-medical costs, indirect costs due to productivity loss, and HRQoL measures. Data collection involved structured questionnaires, with costs estimated using the human capital approach and HRQoL assessed via the EQ-5D-5L instrument. Data were cleaned and analyzed using descriptive and inferential statistics, including sensitivity analyses to test cost estimate robustness. Ethical protocols were strictly followed, with approvals from institutional review boards and confidentiality assured.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the findings of the study. The analysis is structured around socio-demographic and clinical characteristics, the direct and indirect costs of care, the total economic burden, and HRoL status of participants, using the EQ-5D-5L instrument and EQ-VAS scores. Finally, the analysis explores how HRoL varies by age group and cancer stage, with statistical tests used to determine the significance of observed differences. The cost incurred by persons living with liver cancer was estimated for a period of one month. The results are presented using descriptive and inferential statistics, with the aid of tables for clarity.

4.2 Socio-demographic and Clinical Characteristics of Participants

Table 4.1 shows the socio-demographic and clinical characteristics of the study participants.

The study included 121 participants across three teaching hospitals: CCTH (28.1%), KBTH (42.1%), and TTH (29.8%). The gender distribution revealed a predominance of males (56.2%) compared to females (43.8%). Most participants were married (69.4%), with a smaller proportion being never married (14.9%), widowed (8.3%), or divorced (7.4%). The average age of participants was 48.8 years (SD = 12.2), with most patients between 40 and 59 years (59.5%). The median monthly income was GHS 3000 (IQR 3300), though a considerable proportion (22.7%) earned less than GHS 1000, reflecting income disparities.

Education levels varied among participants across the study facilities. While 19.0% of respondents had no formal education, 31.4% attained basic education, and half progressed to secondary (19.8%) and tertiary (29.8%) education. Employment was high, with 62.3% employed, and unemployment was at 22.8%.

Regarding insurance, 92.6% were insured, while 7.4% were uninsured. Clinically, most patients were diagnosed at early stages, with 70.3% diagnosed at stage one and 24.8% at stage two. A small proportion (4.9%) presented at stage three.

Table 4.1: Patient socio-demographics and clinical characteristics

Variable	CCTH n (%) 34 (28.10)	KBTH n%) 51 (42.4)	TTH n % 36(29.8)	Total n (%) 121 (100)
Sex (n-121)				
Female	20 (58.8)	22 (43.1)	11 (30.6)	53 (43.8)
Male	14 (41.2)	29 (56.9)	25 (69.4)	68(56.2)
Marital Status (n=121)				
Married	21 (61.8)	34 (68.4)	29 (80.5)	84 (69.4)
Never Married	8 (23.5)	5 (10.2)	5 (13.9)	18 (14.9)
Divorced	3 (8.8)	5 (10.2)	1 (2.8)	9 (7.4)
Widowed	2 (5.9)	7 (12.2)	1 (2.8)	10 (8.3)
Level of Education (n=121)				
No Formal Education	1 (2.9)	8 (16.3)	14 (38.9)	23 (19.0)
Basic Education	12 (35.3)	19 (38.8)	7 (19.4)	38 (31.4)
Secondary Education	10 (29.4)	9 (17.6)	5 (13.9)	24 (19.8)
Tertiary Education	11 (32.4)	15 (30.6)	10 (27.8)	36 (29.8.7)
Age group (years) Age (No/%)				
25-39	6 (17.6)	11 (21.6)	11 (4.8)	28 (23.1)
40-59	21 (61.8)	32 (62.8)	19 (52.9)	72 (59.5)
60-85	7 (20.6)	8 (15.7)	6 (16.7)	21 (17.4)
Mean age 48.8 SD 12.2 (95% CI: 45.70-50.37)				
Employment status (n=121)				
Employed	25 (73.5)	31 (60.8)	21 (58.3)	71 (62.3)
Retired	5 (14.7)	4 (7.8)	2 (5.6)	10 (8.8)
Student	1 (2.9)	2 (3.9)	4 (11.1)	7 (6.1)
Unemployed	3 (8.8)	14 (27.5)	9 (25)	26 (22.8)
Income Status (n=)				
<1000	3 (13.3)	3 (9.4)	11 (52.4)	17 (22.7)
1000-3900	9 (40.9)	16 (50.0)	6 (28.6)	31(41.3)
4000+	10 (45.5)	13 (40.6)	4 (19.1)	27 (36.0)
Median 3000 IQR 3300				
Insurance Status (n=121)				
Insured	33 (97.1)	44 (86.3)	35 (97.2)	112 (92.6)
Uninsured	1 (2.9)	7 (13.7)	1 (2.8)	9 (7.4)
Total	34 (100)	51(100)	36(100)	121(100)
Cancer Stage (n=121)				
First stage	32(94.1)	32 (62.7)	21 (58.3)	85 (70.3)

Second stage	2 (5.9)	17 (33.3)	11 (30.6)	30 (24.8)
Third stage	0	2 (3.9)	4 (11.1)	6 (4.9)
Total	34 (100)	51 (100)	36 (100)	121 (100)

CCTH= Cape Coast Teaching Hospital; KBTH= Korle-Bu Teaching Hospital; TTH= Tamale Teaching Hospital; SD=Standard Deviation, CI= Confidence Interval; IQR=Interquartile Range

4.3 Direct Cost of Managing Liver Cancer

Table 2 presents the distribution of direct costs across the three hospitals. The direct cost was estimated for one month, and this comprises two main components: medical costs and non-medical costs incurred by patients during treatment. Direct medical costs included expenses related to consultation, laboratory investigations, medicines, hospital admission, and imaging. Direct non-medical costs, on the other hand, covered transportation, food, drinks, and other out-of-pocket expenses incurred by both patients and caregivers while seeking care. It is important to note that all the direct cost components were estimated monthly to standardize comparisons across facilities.

The total direct cost for one month was estimated at GHS 640,805 (US$62,432.39). Medical costs accounted for 88.3% (GHS 565,916; US$55,147.47) of the total financial cost, while non-medical costs represented 11.7% (GHS 74,889; US$7,284.92). Among medical expenses, imaging services were the leading cost driver, constituting 34.7% at CCTH and KBTH and 33.8% at TTH. Patients at KBTH spent GHS 84,789 (US$6,978.52) on imaging, while those at TTH spent GHS 79,146 (US$6,514.07). Similarly, laboratory tests made up 35.8% of medical costs at KBTH (GHS 87,790; US$7,225.51). Medicines were another significant component, accounting for 24.5%, 20.0%, and 18.9% of medical costs at CCTH, KBTH, and TTH, respectively. Notably, medicine expenditures were highest at TTH (GHS 86,245; US$7,098.35) compared with KBTH (GHS 48,370; US$3,981.07) and CCTH (GHS 21,555;

US$1,774.07). Admissions and consultations contributed less, ranging between 0.04% and 10.6% across hospitals.

The mean medicine cost was GHS 2,395.69 (US$233.04) with a 95% CI of 1,893.30 – 2,897.56. Similarly, the mean imaging cost was GHS 2,198.50 (US$213.92) (95% CI: 1,953.87 – 2,443.10), while laboratory investigations averaged GHS 692.94 (US$67.39) (95% CI: 538.25 – 847.63). Consultation costs were lower, with a mean of GHS 228.24 (US$22.20) (95% CI: 125.80 – 330.67). Admission costs were estimated at GHS 688.33 (US$66.95) (95% CI: 345.86 – 1,030.81).

Non-medical costs for a month summed to GHS 74,889 (US$7,284.92), representing 11.7% of the direct burden. Transportation was the most significant non-medical component, constituting 56.0% at CCTH, 62.6% at KBTH, and 75.5% at TTH. The mean transport cost was GHS 327.94 (US$31.90) at CCTH (95% CI: 248.67 – 407.21), GHS 531.76 (US$51.70) at KBTH (95% CI: 424.12 – 639.41), and GHS 244.72 (US$23.80) at TTH (95% CI: 153.31 – 336.13). Food and drink costs averaged GHS 179.85 (US$17.49) at CCTH (95% CI: 138.48 – 265.76), GHS 229.24 (US$22.30) at KBTH (95% CI: 192.72 – 265.76), and GHS 65.14 (US$6.34) at TTH (95% CI: 51.74 – 78.53). Other incidental expenses were the smallest, with mean costs ranging between GHS 14.44 (US$1.41) and GHS 88.19 (US$8.58) across facilities.

In conclusion, medical costs, imaging and medicines, drove the bulk of the direct economic burden, while transportation dominated the non-medical expenditures.

Table 4.2: Direct Cost of Managing Liver Cancer

Cost item	Cost		Mean (GHS)	Confidence interval (95%) (GHS)	Cost profile (%)
	GHS	USD			
Direct Medical Cost					
Cape Coast TH:					
Consultation	7,760	754.86	228.24	125.80, 330.67	*8.8*
Lab Tests	23,560	2,291.83	692.94	538.25, 847.63	*26.8*
Medicines	21,555	2,096.79	633.97	412.04,855.90	*24.5*
Admission	4,480	435.80	131.76	-32.34, 295.87	*5.1*
Imaging	30500	2,966.93	897.06	672.52, 1121.59	*34.7*
Subtotal	**87,855.00**	**8,546.21**	**2583.97**	**1954.6, 3213.4**	**15.5[a]**
Korle-Bu TH:					
Consultation	10,225	994.65	200.49	171.91, 229.07	*4.2*
Lab Tests	87,790	8539.88	1,721.37	1188.79, 2253.9	*35.8*
Medicines	48,370	4705.25	948.43	722.72, 1174.14	*19.7*
Admission	14,050	1366.73	275.49	105.89. 445.09	*5.7*
Imaging	84789	8247.96	1662.53	1267.89, 2057.1	*34.7*
Subtotal	**245224**	**23854.47**	**4804.31**	**3700.9, 7307.9**	**43.3[a]**
Tamale TH:					
Consultation	100	9.73	100	-2.72, 8.28	*0.04*
Lab Tests	42,566	4140.66	1,182	866.47,1498.31	*10.2*
Medicines	86,245	8389.59	2395.69	1893.3, 2897.56	*18.9*
Admission	24.78	2.41	688.33	345.86, 1030.81	*10.6*
Imaging	79146	7699.03	2198.5	1953.87, 2443.1	*33.8*
Subtotal	**233837**	**22746.79**	**6467.7**	**5627.5, 7307.9**	**41.2[a]**
Total direct medical cost	**565916[a]**	**55,147.47**	**4676.99**	**4061.51, 5292.4**	**88.3[c]**
Direct non-medical cost					
Cape Coast TH:					
Travel cost	11150	1084.63	327.94	248.67, 407.21	*56*
Food and drinks	6115	594.84	179.85	138.48, 265.76	*30.7*
Others	2640	256.81	77.75	34.34, 120.95	*13.3*
Subtotal	**19905**	**1936.28**	**585.44**	**457.39, 713.84**	**26.6[b]**
Korle-Bu TH:					
Travel cost	27120	2638.13	531.76	424.12, 639.41	*62.6*

Food and drinks	11691	1137.26	229.24	192.72, 265.76	*26.9*
Others	4498	437.55	88.19	70.95, 105.43	*10.4*
Subtotal	**43309**	**4212.94**	**848.19**	**701.66, 996.74**	**57.8[b]**
Tamale TH:					
Travel cost	8810	857.00	244.72	153.31, 336.13	*75.5*
Food and drinks	2345	228.11	65.14	51.74, 78.53	*20.1*
Others	520	50.58	14.44	6.69, 22.19	*4.4*
Subtotal	**11675[b]**	**1135.70**	**324.31**	**217.04, 431.57**	**15.6[b]**
Total direct non-medical cost	**74889**	**7284.92**	**618.92**	**531.33, 706.51**	**11.7[c]**
Total	**640805[c]**	**62,432.39**	**5295.91**	**4656.62, 5935.2**	**100**

USD 1 = GHS 10.28 **Bank of Ghana Interbank rate as of June 2025 (www.bog.gov.gh)**

4.4 Indirect Cost of Managing Liver Cancer

Table 4.3 presents the breakdown of indirect costs across the hospitals. Indirect costs referred to the productivity losses experienced by both patients and caregivers due to liver cancer by applying the Human Capital approach. The analysis was based on the national daily minimum wage of Ghana (GHS19.97 as of June 2025), Ramco system (2025) as a standard, with all estimates converted into US dollars using an exchange rate of US$1 = GHS 10.28 as of June 2025 (Bank of Ghana, 2025).

In total, the monthly indirect cost was estimated at GHS 12,259 (US$1,192.7), resulting from 613.9 lost productive days. Patients' productivity loss accounted for the majority, contributing 481.9 days (equivalent to GHS 9,623; US$936.3), while caregivers lost 132 days (valued at GHS 2,636; US$256.4).

On average, each patient lost 31.9 hours of productive time per month, valued at GHS 79.5. The amount of time lost varied across hospitals. At CCTH, patients lost an average of 34.1 hours per month (worth GHS 85.2). At KBTH, patients lost about 38.7 hours (worth GHS 96.6), while at TTH, the figure was 20.0 hours (worth GHS 50.0).

Caregivers also lost productive time, though to a lesser extent. On average, they forfeited 8.7 hours per month, with an estimated cost of GHS 21.8. The breakdown by facility shows that caregivers at CCTH lost 6.8 hours (valued at GHS 16.9), at KBTH, they lost 9.5 hours (GHS 23.8), and at TTH, 9.5 hours (GHS 23.6).

The causes of productivity loss differed between patients and caregivers. For patients, absenteeism from work emerged as the main contributor, accounting for 79.7% of total losses at CCTH, 65.6% at KBTH, and 72.1% at TTH. In contrast, all productivity losses among caregivers were linked to travel and waiting times, reflecting the time spent accompanying patients to health facilities and waiting for treatment to be completed.

The variation across hospitals suggests that factors such as clinic scheduling, patient flow, and waiting time may influence the extent of productivity loss. These results highlight the importance of interventions aimed at improving service efficiency and reducing the time burden associated with seeking care.

Table 4.3: Indirect Cost of Managing Liver Cancer

Item	Category	Total Days Lost	Total Hours Lost	Average Hours Lost	Cost (GHS)	Mean Cost (GHS)	Cost (USD)	Cost profile (%)
Patients:								
Cape Coast TH:	Travel time	17.8	142.4	4.2	355.5	10.5	34.6	12.3
	Waiting time	13.3	106.4	3.1	265.5	7.8	25.8	8.9
	Absenteeism	114.0	912.0	26.8	2,276.6	67.0	221.5	78.8
Subtotal		**145.1**	**1,160.8**	**34.1**	**2,897.6**	**85.2**	**282.0**	**30.1**
Korle-Bu TH:	Travel time	37.9	303.2	5.9	756.9	14.8	73.6	15.4
	Waiting time	26.8	214.4	4.2	535.2	10.5	52.1	10.9
	Absenteeism	182.0	1,456.0	28.5	3,634.5	71.3	353.6	73.8
Subtotal		**246.7**	**1,973.6**	**38.7**	**4,926.6**	**96.6**	**479.3**	**51.2**
Tamale TH:	Travel time	15.5	124.0	3.4	309.5	8.6	30.1	17.2
	Waiting time	18.6	148.8	4.1	371.4	10.3	36.1	20.6
	Absenteeism	56.0	448.0	12.4	1,118.3	31.1	108.8	62.2
Subtotal		**90.1**	**720.8**	**20.0**	**1,799.3**	**50.0**	**175.0**	**18.7**
Total Patient		**481.9**	**3,855.2**	**31.9**	**9,623.4**	**79.5**	**936.3**	**100.0**

Caregivers:								
Cape Coast TH:	Travel time	16.5	132.0	3.9	329.5	9.7	32.1	57.5
	Waiting time	12.2	97.6	2.9	243.5	7.2	23.7	42.5
Subtotal		**28.7**	**229.6**	**6.8**	**573.0**	**16.9**	**55.8**	**21.8**
Korle-Bu TH:	Travel time	35.7	285.6	5.6	712.8	14.0	69.3	58.8
	Waiting time	25.0	200.0	3.9	499.3	9.8	48.6	41.2
Subtotal		**60.7**	**485.6**	**9.5**	**1,212.1**	**23.8**	**117.9**	**46.0**
Tamale TH:	Travel time	20.0	160.0	4.4	399.4	11.1	38.9	47.0
	Waiting time	22.6	180.8	5.0	451.3	12.5	43.9	53.0
Subtotal		**42.6**	**340.8**	**9.5**	**850.7**	**23.6**	**82.8**	**32.2**
Total Caregiver Cost		**132.0**	**1,056.0**	**8.7**	**2,635.8**	**21.8**	**256.4**	**100.00**
Total Indirect Cost		**613.9**	**4,911.2**	**40.6**	**12,259.3**	**101.3**	**1,192.7**	**100**

4.5 Total Economic Cost of Managing Liver Cancer

As shown in Table 4.4, the total monthly economic burden of managing liver cancer across the three teaching hospitals was estimated at GHS 653,064.3 (US$63,524.9), with a mean monthly cost of GHS 5,446 (US$530) per patient.

Among the study facilities, KBTH recorded the highest share of the total cost, reflecting its role as the national referral centre. The cost at KBTH was estimated at GHS 293,460 (US$28,547), representing 45.7% of the total, with a mean monthly cost of GHS 5,754 (US$560). The second largest share was observed at TTH, where the cost was GHS 252,311 (US$24,547), accounting for 39.3% of the total, with a mean of GHS 7,009 (US$682). The lowest expenditure was recorded at CCTH, estimated at GHS 111,231 (US$10,820), which made up 17.3% of the overall cost, with a mean monthly cost of GHS 3,271 (US$318).

When disaggregated into cost categories, direct costs dominated the economic burden, contributing 98.1% of the total (GHS 640,805; US$62,335.12), with a mean of GHS 5,295.91 (US$515.62). In contrast, indirect costs were small, accounting for only 1.9% (GHS 12,259.3; US$1,192.53), with a mean of GHS 145.38 (US$14.14). This pattern was consistent across

facilities. At KBTH, direct costs formed the entire burden (99.1%) with a mean of GHS 5,657.51 (US$550.29), while indirect costs contributed only 1.2% (mean = GHS 70.63; US$7.22). A similar trend was observed at TTH, where direct costs accounted for 97.3% (mean of GHS 6,792.00; US$660.70) and indirect costs contributed 2.7% (mean of GHS 186.51; US$18.15). At CCTH, direct costs made up 93.7% of the total (mean GHS 3,169.41; US$308.14), while indirect costs accounted for 6.3% (mean GHS 213.97; US$21.27).

The results demonstrate the economic burden of liver cancer care in Ghana. The bulk of the burden is concentrated in direct medical costs, particularly imaging, laboratory tests, and medicines, while indirect costs, although smaller in proportion, reflect the hidden impact of productivity losses among patients and caregivers.

Table 4.4: Total Cost of Managing Liver Cancer

Cost category	Cost		Mean (GHS)	Cost profile (%)
	GHS	USD		
Cape Coast TH:				
Direct cost	107,760	10,482.49	3,169.41	**93.68**
Indirect cost	3,470.57	337.66	102.08	**6.32**
Subtotal	**111,230.57**	**10,820.15**	**3,271.49**	***17.32***
Korle-Bu TH:				
Direct cost	288,533	28,067.41	5,657.51	**99.14**
Indirect cost	4,926.60	479.24	96.60	**1.69**
Subtotal	**293,459.60**	**28,546.65**	**5,754.11**	***45.70***
Tamale TH:				
Direct cost	245,512	23,885.21	6,819.78	**97.33**
Indirect cost	6,799.28	661.41	188.87	**2.70**
Subtotal	**252,311.28**	**24,546.62**	**7,008.65**	***39.29***
Total Direct cost	**640,805**	**62,435.12**	**5,304.17**	**98.1**
Total Indirect cost	**12,259.3**	**1,192.53**	**142.12**	**1.9**
Total Cost	**653,064.3**	**63,527.65**	**5,446.29**	**100**

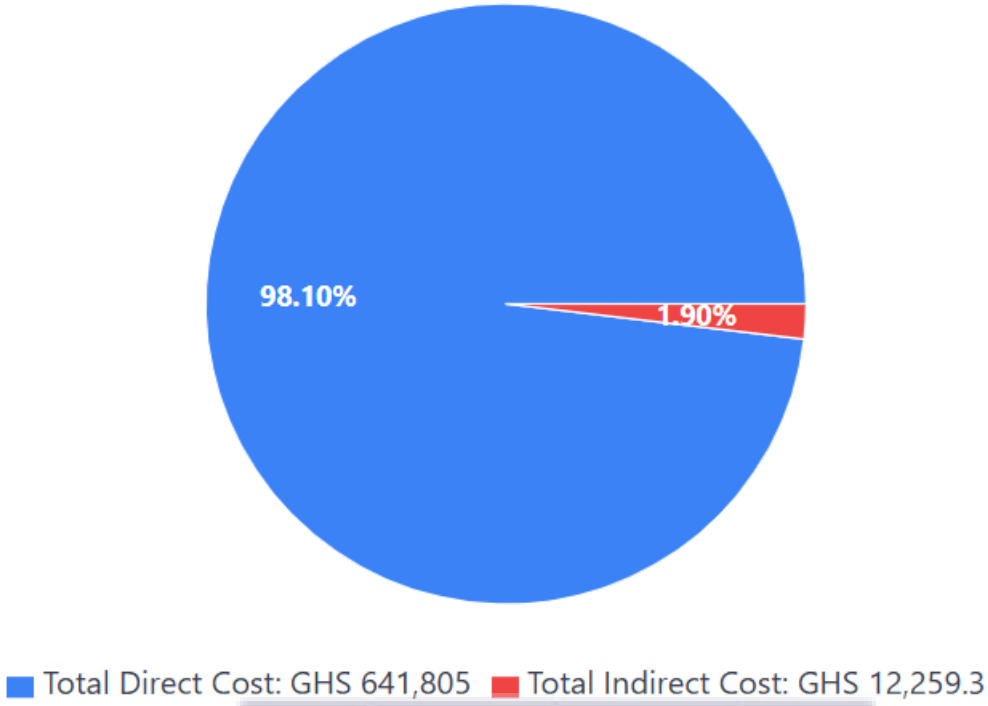

Figure 4.1: Pie Chart Showing the Distribution of total direct and indirect cost incurred by Liver Cancer Patients for one month.

4.9 Sensitivity Analysis

A multiple-way sensitivity analysis was conducted by simultaneously varying the costs of imaging, medicines, and the national minimum wage (GHS 19.97) by 25% to examine the robustness of the estimated costs of managing liver cancer. These components were selected because they represent major drivers of direct medical and indirect costs and are particularly sensitive to fluctuations in hospital charges, diagnostic demand, drug pricing, and wage levels.

In the base scenario, the total cost of managing liver cancer across all hospitals was GHS 653,064.3 (US$63,527.7). When the costs of imaging, medicines, and the minimum wage were simultaneously increased by 25%, the total cost rose to GHS 746,345.7 (US$72,013.4), representing a 13.3% increase in the overall cost. At the hospital level, increases were observed. At CCTH, the total cost increased from GHS 115,034.9 (US$8,967.4) to GHS 129,042.0

(US$10,274.6), reflecting a 12.2% rise. At KBTH, the total cost rose from GHS 291,021.9 (US$23,952.4) to GHS 324,019.7 (US$26,875.1), representing an 11.3% increase. At TTH, costs increased from GHS 251,226.4 (US$20,250.3) to GHS 293,284.1 (US$23,351.7), reflecting the largest change, a 16.8% rise.

When the minimum wage alone was increased by 25%, the total cost rose from GHS 653,064.3 to GHS 662,794.3, representing a 0.67% increase in the economic burden. This demonstrates that, although indirect costs are a small fraction of the overall burden, wage variation directly inflates monetized productivity losses and therefore measurably affects the estimated economic burden, especially at facilities or for patient groups where indirect costs are a larger component of the facility's total.

Table 4.8: Multiple-way Sensitivity Analysis (Medicine, Imaging, and Minimum Wage all +25%)

Item / Facility	Cost Component	Scenario	Total Cost (GHS)	Total Cost (USD)	% Change in Total Cost
All hospitals	–	**Base**	653,064.3	63,624.93	–
All hospitals	Imaging + Medicines + Minimum Wage	**+25%**	746,345.70	72,013.38	+13.34%
CCTH	–	**Base**	115,034.91	8,967.39	–
CCTH	Imaging + Medicines + Minimum Wage	**+25%**	129,041.98	10,274.56	+12.18%
KBTH	–	**Base**	291,021.90	23,952.42	–
KBTH	Imaging + Medicines + Minimum Wage	**+25%**	324,019.65	26,875.14	+11.34%
TTH	–	**Base**	251,226.35	20,250.28	–
TTH	Imaging + Medicines + Minimum Wage	**+25%**	293,284.07	23,351.67	+16.76%

4.6 Self-Reported Health Profile of Persons Living with Liver Cancer

The health status of respondents was assessed using the EQ-5D-5L descriptive system, which measures impairments in five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Table 4.5 presents the distribution of self-reported health problems across these dimensions. In the mobility dimension, 20.7% of respondents reported no difficulty walking. 44.6% reported slight problems, 23.1% moderate problems, and 10.8% severe problems. One participant (0.8%) indicated being unable to walk.

For self-care, 22.3% of participants had no problems. Slight problems were reported by 38.8%, moderate problems by 28.1%, and 9.9% experienced severe difficulties. One respondent (0.8%) reported being unable to care for themselves. Problems with usual activities were widespread. 18.2% reported no problem, 39% experienced slight difficulties, 31.4% moderate problems, and 11.6% severe problems, while none reported being completely unable to engage in usual activities. Pain and discomfort emerged as prevalent complaints. 5.8% of participants reported no pain, while 34.7% reported moderate pain, 18.2% severe pain, and 2.5% reported extreme pain.

The highest levels of impairment were observed in the anxiety and depression domain, where 2.5% of participants reported no problems. Most respondents (97.5%) experienced psychological distress to varying degrees: 27.5% reported slight problems, 37.2% moderate, 27.3% severe, and 6.6% extreme anxiety or depression.

Table 4. 5: Frequency of self-reported health profile of persons living with liver cancer

Health Profile	Mobility (Walking) n (%)	Self-Care N (%)	Regular Activities N (%)	Pain/discomfort N (%)	Anxiety/depression N (%)
No problem	25 (20.7)	27 (22.3)	22 (18.2)	7 (5.8)	3 (2.5)
Slight problem	54 (44.6)	47 (38.8)	47 (38.8)	47 (38.8)	32 (27.5)
Moderate problem	28 (23.1)	34 (28.1)	38 (31.4)	42 (34.7)	45 (37.2)
Severe problem	13 (10.8)	12 (9.9)	14 (11.6)	22 (18.2)	33 (27.3)
Unable/extreme problem	1 (0.8)	1 (0.83)	0 (0.0)	3 (2.5)	8 (6.6)

4.7 EQ-5D-5L and EQ-VAS Scores by Age Groups

EQ-VAS and EQ-5D utility index were assessed using disaggregation by age groups. The highest mean VAS score was observed among respondents aged 30–39 years (57.5, SD = 20.1), followed by those aged 50–59 years (54.5, SD = 15.2). Respondents aged 18–29 years (47.2, SD = 20.5) and 60 years and above (47.1, SD = 17.7) reported the lowest health ratings. The median VAS scores reflected this trend, ranging from 45 in the oldest age group to 60 among those aged 30–39 years.

The EQ-5D utility scores also revealed age-related differences. The youngest respondents (18–29 years) had the lowest mean utility (0.48, SD = 0.22), while higher values were reported among middle-aged groups (0.61–0.62). In the oldest group (60+ years), the mean utility score declined to 0.50 (SD = 0.34). Median utility scores followed a similar pattern, peaking among 50–59-year-olds (0.71) and declining among the youngest and oldest age groups.

Table 4.6: EQ-5D-5L and EQ VAS score of Persons living with liver cancer by age groups (years)

Health Status	Age (Years)				
	18-29	30-39	40-49	50-59	60+
EQ-VAS Score; mean (SD)	47.2 (20.5)	57.5 (20.1)	51.7 (20.8)	54.5 (15.2)	47.1 (17.7)
Median	50	60	55	58	45
25th percentile	40	42.5	40	45	30
75th percentile	60	75	65	65	60
EQ-5D utility					
Mean (SD)	0.48 (0.22)	0.62 (0.26)	0.61 (0.29)	0.61 (0.29)	0.50 (0.34)
Median	0.47	0.63	0.67	0.71	0.6
25th percentile	0.40	0.52	0.46	0.55	0.45
75th percentile	0.53	0.79	0.80	0.77	0.67

4.8 Health-Related Quality of Life by Cancer Stage

Patients diagnosed at stage one reported the highest health status, with a median EQ-5D utility of 0.71 (IQR = 0.21) and a median EQ-VAS score of 60 (IQR = 25). At stage two, health outcomes were lower, with a median utility of 0.47 (IQR = 0.26) and a VAS score of 47.5 (IQR = 30). Those at stage three reported the most impaired health status, with a median utility of 0.12 (IQR = 0.06) and a VAS score of 25 (IQR = 25). Statistical analysis confirmed significant differences across stages. The Kruskal-Wallis test for the EQ-5D index yielded a test statistic of 41.3 ($p < 0.0001$), while the EQ-VAS score produced a test statistic of 15.9 ($p = 0.0003$). These results demonstrate a clear and statistically significant deterioration in quality of life with advancing cancer stage.

Table 4.7: Houl of Persons living with liver cancer by cancer stage.

Variable (Cancer stage)	N (%)	EQ-5D-5L Median (IQR)	Test Statistic	P-value	EQ-VAS Score Median (IQR)	Test Statistic	P-value
Cancer stage 1	85 (70.3)	0.71 (0.21)	41.3	0.0001	60 (25)	15.9	0,0003
Cancer stage 2	30 (24.8)	0.47 (0.26)			47.5 (30)		
Cancer stage 3	6 (4.9)	0.12 (0.06)			25 (25)		

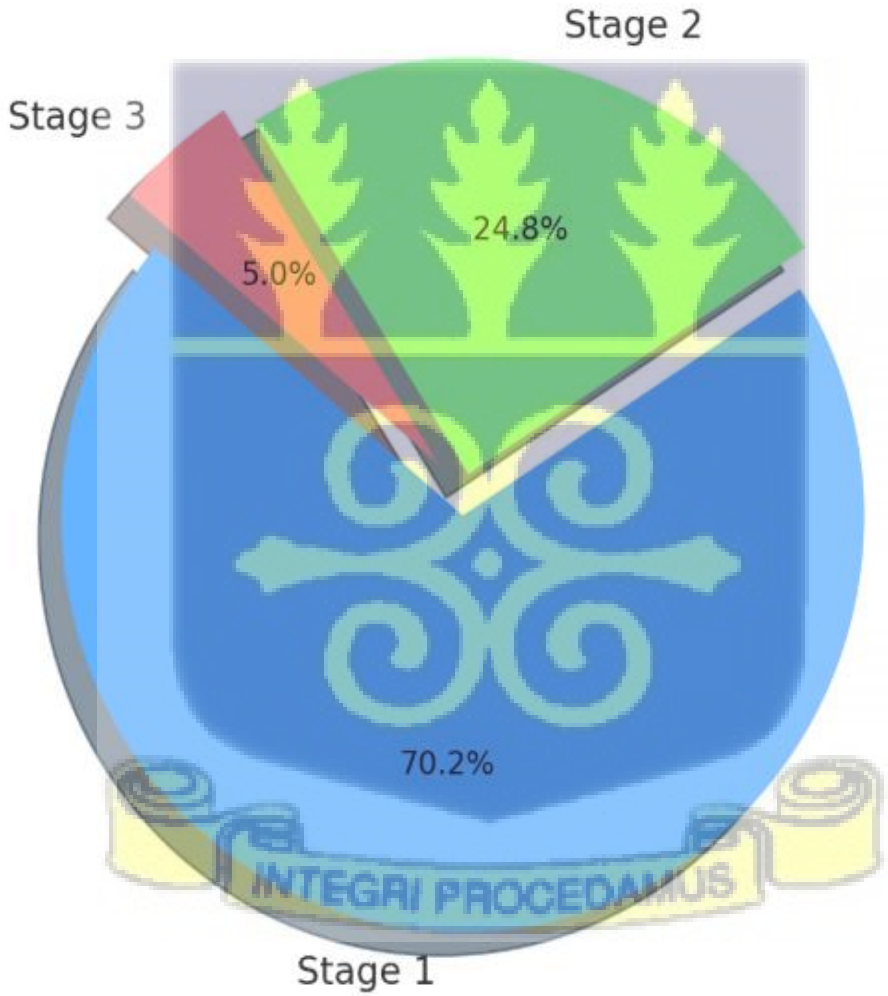

Figure 4.2: Distribution of Liver Cancer Patients by Cancer Stage

4.10 Summary

In summary, this chapter presents the study results, highlighting participants' socio-demographic and clinical characteristics, economic costs, and HRQoL outcomes. The sample comprised 121 patients, male, mostly married, and diagnosed at preliminary stages of liver cancer. The total economic burden, averaging GHS 5,441.29 (about USD 529.91) per patient monthly, was driven by direct medical costs, including imaging, medicines, laboratory tests, and hospital admissions. Non-medical costs like transportation also contributed significantly. Indirect costs, representing productivity losses, were smaller but notable. HRQoL assessment revealed substantial impairments, especially in anxiety/depression and pain/discomfort domains, worsening with advanced cancer stage.

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter discusses the findings of the study, considering existing literature on the economic burden of liver cancer. The discussion is organized according to the study objectives, focusing first on the direct cost of managing liver cancer, followed by indirect costs, total economic cost, and the associated health-related quality of life outcomes. By comparing the findings of this study with evidence from Ghana and other settings, the discussion highlights similarities and differences in cost drivers, contextual factors influencing expenditures, and the broader implications for health policy and clinical practice in resource-constrained settings.

5.2 Summary of Findings

In summary, a total of 121 liver cancer patients participated in the study across three teaching hospitals, with 42.1% recruited from KBTH, 28.1% from CCTH, and 29.8% from TTH. The gender distribution showed a predominance of males (56.2%) compared to females (43.8%). Patients aged 40–49 years constituted 23.1%, 36.4% were between 50–59 years, while 23.1% were aged 60 years and above. The mean age was 48.8 years (SD = 12.2), which suggests that liver cancer is most common among middle-aged and elderly patients. Most participants were married (69.4%) and employed (62.3%), with a median monthly income of GHS 3000 (IQR = 3300), although about 22.7% earned less than GHS 1000. In terms of education, 19.0% of participants had no formal education, 31.4% attained basic education, 19.8% had secondary education, and 29.8% had tertiary education. Clinically, 70.3% were diagnosed at stage one, 24.8% at stage two, and only 4.9% at stage three, showing that most patients were diagnosed at early to intermediate stages.

The economic analysis showed that the total direct monthly cost of managing liver cancer was GHS 640,805 (US$62,432.39). Of this, medical costs constituted 88.3% (GHS 565,916; US$55,147.47), while non-medical costs represented 11.7% (GHS 74,889; US$7,284.92). Imaging and laboratory services emerged as the major cost drivers among medical expenses, with medicines also contributing significantly, averaging GHS 2,395.69 (US$233.04) per patient. Non-medical costs were dominated by transportation, accounting for more than half of patient expenses, with mean monthly transport costs ranging from GHS 244.72 (US$23.80) at TTH to GHS 531.76 (US$51.70) at KBTH.

In terms of productivity losses, the total monthly indirect cost was estimated at GHS 12,259 (US$1,192.7). Patients lost 582 productive days, valued at GHS 14,469 (US$1,454.70), while caregivers lost 132 days, valued at GHS 2,637 (US$256.51). Absenteeism was the main contributor, accounting for more than 65% of patient time lost. Altogether, the combined monthly economic burden of liver cancer was GHS 653,064.3 (US$63,624.93), with a mean monthly cost of GHS 5,441.29 (US$529.91) per patient. While some global studies report higher proportions of indirect costs (Ferlay et al., 2021; Rumgay et al., 2022), our relatively lower estimates can be explained by the monthly costing horizon and the valuation method using the national minimum wage, both of which tend to reduce the weight of productivity losses (Choi et al., 2023).

About HRQoL, the EQ-5D-5L revealed that 83.5% of patients experienced pain/discomfort and 79.3% reported anxiety/depression. Mobility problems were reported by 65.3%, difficulties with usual activities by 61.2%, and self-care limitations by 52.1%. The mean EQ-VAS score was 57.3 (SD = 18.7), indicating a poor self-rated health status. These findings align with global and regional studies, which identify pain and psychological distress as the most common impairments in liver cancer patients (Younossi et al., 2023).

5.3 Direct cost of managing liver cancer

The total direct cost of managing liver cancer in this study was estimated at GHS 640,805 (US$62,335.12), with direct medical costs (88.3%) outweighing non-medical costs (11.7%). This confirms earlier findings that hospital-based expenditures, particularly diagnostics and medicines, constitute the bulk of cancer costs (Schwambach et al., 2020; Thomas et al., 2022).

A major driver of expenditure was diagnostic services, with imaging and laboratory tests accounting for 38.4% of medical costs. This aligns with Wilson (2023), who noted that diagnostics contribute 20–25% of initial care costs worldwide, and with Wahab et al. (2023), who highlighted the high burden of diagnostics in LMICs where patients pay out-of-pocket. The prominence of diagnostics in this study reflects both the need for repeated investigations to confirm diagnosis and stage the disease, and the fact that many patients present late with advanced cancer (Nartey et al., 2022; Kristina, 2021)

Medicine costs represented 21.2% of direct medical expenditure. Unlike in high-income countries, where therapies such as sorafenib and immunotherapies account for over half of direct costs Hofmarcher et al., 2023; Wahab et al., 2023, the smaller medicine costs observed in this study stem from limited use of cancer-specific drugs. Many patients were still in the investigative phase or receiving treatment for underlying conditions such as hepatitis B, which is the leading cause of liver cancer in Ghana (Amoako et al., 2019; Tuck et al., 2023). This finding is consistent with Rumgay et al. (2022), who reported that in LMICs, pharmaceutical costs appear lower not because drugs are affordable, but because advanced therapies remain largely inaccessible.

Direct non-medical costs, though smaller in proportion, also imposed a substantial burden. Travel, food, and incidental expenses were significant, reflecting the concentration of oncology

services in urban tertiary hospitals. This mirrors findings from Witts et al. (2024), who emphasized that transport and subsistence are critical components of cancer care costs in LMICs, but contrasts with high-income settings where such expenses are relatively modest and sometimes subsidized (Jang et al., 2023; Kristina, 2021).

In conclusion, this study shows that the direct cost of managing liver cancer in Ghana is driven by diagnostics, with medicine costs appearing smaller because most patients had not yet initiated cancer-specific treatment. Compared with high-income countries, where advanced drugs dominate expenditure, Ghana's cost profile reflects systemic barriers to therapy access, coupled with heavy reliance on out-of-pocket payments for investigations and non-medical expenses.

5.4 Indirect Cost of Managing Persons Living with Liver Cancer

The management of liver cancer has economic implications that extend beyond the direct costs of diagnosis and treatment, encompassing productivity losses for both patients and their caregivers. In this study, the total indirect cost was estimated at GHS 12,259 (US$1,192.7) per month, representing 2.7% of the overall economic burden. Patients bore the greater share, losing an estimated 4,653.73 hours (582 days; 84.6%), while caregivers lost 1,056.38 hours (132 days; 15.4%). These losses stemmed primarily from absenteeism, followed by travel to tertiary facilities, with waiting time contributing the least. The findings demonstrate that although indirect costs represent a smaller fraction of the total, they nonetheless impose a significant financial strain on households already struggling with out-of-pocket payments for medical care.

This study's findings are in agreement with Islam et al. (2023) and Quisoboni (2023), who emphasized that in LMICs, travel to centralized oncology centers contributes significantly to productivity losses. Similarly, the predominance of absenteeism observed here is consistent

with Hofmarcher et al. (2023) and Wahab et al. (2023), who reported that time away from work is the main driver of indirect cancer costs globally, and also aligns with Tan et al. (2024) and Zou et al. (2022), who highlighted that indirect costs such as lost income can exceed direct expenditures in certain cancer contexts.

At the same time, this study's results disagree with Wahab et al. (2023), who found that indirect costs account for a much larger share of the total cancer care burden in LMICs. One probable reason for this discrepancy is that the present study reports monthly indirect costs, whereas other studies have estimated productivity losses over six months to a year. Longer time horizons, such as those used in Zou et al. (2022), naturally result in higher absolute and proportional indirect cost estimates. Thus, while the monthly framing used here improves comparability across facilities in Ghana, it underestimates the longer-term financial consequences for households.

Moreover, the relatively lower indirect burden observed in this study may also be linked to the limited use of advanced systemic therapies in Ghana, as noted by Nartey et al. (2022), which shortens the intensity and duration of treatment-related absenteeism compared with high-income settings where immunotherapies and targeted therapies are more accessible. This contrasts with findings from Younossi et al. (2023) and Zou et al. (2022), who observed that the adoption of new therapies in high-income countries significantly increases both direct and indirect costs due to extended treatment regimens and associated productivity losses.

5.5 Total Economic Cost of Managing Liver Cancer

The total economic cost of managing liver cancer in this study was estimated at GHS653,064.3 (US$63,624.93) per month, with the direct cost component accounting for 97.3% of the overall burden, while indirect costs represented only 2.7%. This uneven distribution underscores that the financial weight of liver cancer in Ghana is overwhelmingly borne through hospital-based

expenditures rather than productivity losses. Within direct costs, diagnostic services and medicines were the dominant contributors, reflecting both the clinical complexity of confirming and staging the disease, and the late presentation of most patients with advanced hepatocellular carcinoma (Younossi et al., 2023; Zou et al., 2022)

The high share of diagnostics is consistent with evidence from Kale et al. (2024), who found that imaging and laboratory tests consume between 20–30% of cancer care costs in LMICs. Similarly, Rumgay et al. (2022) reported that diagnostic procedures place a disproportionate burden on patients in resource-limited settings, where out-of-pocket financing predominates. Unlike in high-income countries, where systemic therapies such as sorafenib, lenvatinib, and immunotherapies can account for over half of treatment costs Cao et al., 2023), medicines in this study contributed a smaller fraction. This finding resonates with Mattila et al. (2021), who showed that lower pharmaceutical expenditures in LMICs are often due not to affordability but to limited access to advanced therapies.

By contrast, the relatively low share of indirect costs diverges from findings of Rumgay et al. (2022), who demonstrated that productivity losses may constitute 15–30% of the total cancer burden in some LMIC contexts. In this study, indirect costs were reduced by two main factors. First, the estimates were standardized monthly, unlike studies that used six- or twelve-month horizons, which naturally inflate the absolute and proportional figures (Choi et al., 2023). Second, waiting time costs were relatively low, a finding that contrasts with Wahab et al. (2023), who emphasized that prolonged waiting in congested clinics is a major driver of indirect burden in LMICs. Structured appointment systems in Ghanaian oncology clinics may therefore mitigate some of these losses, though the impact of travel remained substantial, especially for caregivers.

These findings indicate that the economic burden of liver cancer in Ghana is dominated by diagnostics and medicines, while indirect costs, though smaller in proportion, still impose meaningful hardship. The cost profile both supports prior evidence that cancer care in LMICs is heavily shaped by out-of-pocket diagnostic expenditures Mattila et al., 2021) and diverges from literature reporting higher productivity losses (Cheng, 2023). This suggests that methodological framing (monthly vs annual cost capture) and systemic barriers to accessing advanced therapies Duah al., 2022) jointly explain Ghana's lower share of indirect costs compared with regional peers.

These findings underline the urgency of policy reforms that expand diagnostic subsidies, decentralize oncology services to reduce travel-related losses, and incorporate cancer medicines into national health insurance schemes to mitigate the dual direct and indirect burdens on households.

5.6 Health-Related Quality of Life of Persons Living with Liver Cancer

The study examined the HRQoL of persons living with liver cancer using EQ-5D-5L, EQ-VAS, and self-reported health dimensions.

Pain/discomfort and anxiety/depression were the most frequently reported problems among respondents, followed by difficulties in mobility and usual activities. This finding supports evidence from Malik et al. (2021), who showed that pain, fatigue, and mental distress were key contributors to impaired HRQoL in LMICs, where supportive care is often limited. Similarly, Younossi et al. (2023) demonstrated that in high-income countries, pain and depression are also central to reduced HRQoL in hepatocellular carcinoma patients. The current study results confirm global patterns but suggest greater intensity, as access to psychosocial and palliative services is more constrained than in high-income settings (Zou et al., 2022).

A decline in both EQ-5D utility and EQ-VAS scores was observed with increasing age, indicating that older patients reported lower perceived health and well-being. This finding corroborates Du et al. (2024), who reported that older cancer patients in LMICs often present with comorbidities and functional decline that reduce HRQoL. It is also consistent with findings by Zhou et al. (2021), who emphasized that age significantly influences HRQoL outcomes globally, though the effect is more pronounced in contexts with limited geriatric and supportive services. In high-income countries, Fei et al. (2025) also observed lower scores among older patients, but highlighted that structured supportive care systems help mitigate the impact.

The sharper decline observed in this current study in Ghana, therefore, reflects systemic barriers, late presentation, and fewer resources for age-appropriate care Witts et al., 2024). Patients diagnosed at advanced stages of liver cancer reported lower EQ-5D and EQ-VAS scores compared to those at earlier stages. This is consistent with Zhou et al. (2021), who found that disease severity is a key determinant of quality of life in HICs, and with Du et al. (2024), who reported similar results in LMICs. In Ghana, the predominance of advanced-stage cases at diagnosis reflects limited access to early detection and routine surveillance for high-risk groups such as hepatitis B carriers (Duah al. 2022). This supports the argument by Du et al. (2024) that late-stage presentation in LMICs significantly worsens patient quality of life compared to HICs, where screening and early treatment are more readily available.

The results also echo Fei et al. (2025), who noted that HRQoL in cancer patients is heavily context dependent, shaped not only by biological disease burden but also by systemic and socioeconomic determinants. While these results are consistent with global findings, they demonstrate greater severity compared to high-income contexts, underscoring the need for early detection, expanded access to treatment, and integration of psychosocial support services into liver cancer care in Ghana.

5.7 Theoretical Application: The Wilson & Cleary Model and Human Capital Theory

The findings of this study validate the utility of both Wilson & Cleary's HRQoL model and Human Capital Theory in understanding the dual burden of liver cancer in Ghana. The observed relationships between clinical status, patient-reported quality of life, and economic costs confirm that the impact of liver cancer is multidimensional, requiring frameworks that capture both humanistic and economic outcomes.

Application of the Wilson & Cleary model

The Wilson & Cleary model provided a useful lens for interpreting HRQoL outcomes in this study. Advanced disease stage and treatment type were strongly associated with worsening symptoms and reduced HRQoL, supporting Ferrans et al. (2005)and Wilson and Cleary (1995), who argued that biological severity cascades into broader health perceptions. Symptoms such as fatigue, pain, and jaundice emerged as dominant determinants of well-being, confirming the model's proposition that symptom burden mediates the pathway between disease and functioning (Wohlleber et al., 2021).

These symptoms translated into observable limitations in mobility, self-care, and social participation, as reflected in EQ-5D-5L responses, thereby demonstrating the model's emphasis on the link between symptom status and functional capacity (Aaronson et al., 2018). The low EQ-VAS scores further illustrated how patients integrate symptoms and functional restrictions into overall health perceptions, echoing findings by Fei et al. (2025).

Applications of Human Capital Theory

The Human Capital Theory also provided a robust framework for interpreting the economic burden associated with liver cancer in Ghana. The high out-of-pocket expenditures on diagnostics, hospitalization, and treatment illustrated the erosion of household financial resources through healthcare consumption, a finding consistent with Jo (2018), who noted that cancer treatment costs often exceed household incomes in LMICs. Substantial productivity losses due to premature mortality and reduced work participation confirmed the theory's assertion that health is a form of capital whose deterioration directly undermines economic output (Grossman, 1972).

The concentration of indirect costs among patients in economically active age groups (40-50) highlighted significant foregone income and societal losses, echoing findings from Kinge et al. (2024). Moreover, the heavy economic dependency observed among families supports Mushkin's (1962) argument that health capital underpins household stability and national productivity.

5.8 Limitations of the Study

The limitations of this study span several key areas that may influence the interpretation and generalizability of the findings. Firstly, the small sample size of liver cancer patients drawn from three tertiary hospitals may not fully represent the broader population of individuals affected by the disease in Ghana. Given that liver cancer prevalence and care-seeking patterns vary by region, the cost estimates reported here should be interpreted with caution when applied to other contexts beyond the study sites.

Secondly, much of the cost information was derived from self-reported data provided by patients and caregivers, which raises the possibility of recall bias and under- or over-estimation of certain expenditure categories. While efforts were made to triangulate this information with

hospital records where available, inconsistencies in medical billing systems and the lack of standardized cost documentation across facilities may have influenced the accuracy of the estimates.

Another limitation concerns the period of estimation. Costs were standardized to a monthly basis to allow for comparability across facilities. While this approach provides valuable insights into short-term cost estimates, it underestimates the cumulative long-term economic burden of liver cancer, particularly for patients who undergo extended treatment or experience recurrent hospitalizations. Studies such as Cheng (2023) and Fei et al. (2025) have highlighted that multi-month or annual assessments capture a more complete picture of productivity losses and direct care expenditures.

In addition, the study faced challenges in identifying a wide body of published cost-of-illness research specific to liver cancer in sub-Saharan Africa. This limited the scope for deeper comparison and contextualization with regional data, although parallels were drawn from cancer cost studies in other LMICs. This gap in the literature underscores the urgent need for more comprehensive cost analyses to inform evidence-based policy and financing strategies for cancer care in the region.

Despite these limitations, this study makes an important contribution as one of the few to quantify both the direct and indirect economic burden of liver cancer in Ghana. To the best of the author's knowledge, it is the first study in the Ghanaian context to provide empirical estimates of monthly household costs of managing liver cancer across multiple tertiary facilities. By doing so, it fills a critical gap in understanding the financial challenges faced by patients and their caregivers and provides a foundation for future research to build upon.

5.9 Chapter Summary

The chapter discusses the findings in relation to existing literature, emphasizing that liver cancer imposes an economic and HRQoL burden on patients in Ghana. The direct costs of treatment represent a high financial strain, often exceeding household incomes, while productivity losses add to the economic impact. The HRQoL results align with prior studies demonstrating significant physical, psychological, and social challenges faced by liver cancer patients. These findings reveal the need for health policies that address both financial protection and supportive care. The chapter also highlights study limitations, such as cross-sectional design constraints, and suggests directions for future research to enhance cancer care and economic support mechanisms in resource-limited settings like Ghana.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusions of the study and the recommendations that arise from the findings. The conclusions highlight the significance and implications of the research in relation to HRQoL and the economic burden of liver cancer in Ghana. The recommendations are directed towards policymakers, health practitioners, and researchers to strengthen liver cancer prevention, improve patient care, and reduce the financial impact on households.

6.2 Conclusion

This study provides evidence that liver cancer imposes a dual burden on patients in Ghana, characterized by financial costs and impaired HRQoL. The findings respond to the specific objectives: the direct cost is driven by out-of-pocket expenditures on diagnostics (imaging, laboratory tests) and medicines, placing a burden on households. While indirect costs from productivity loss are a smaller share of the total, they represent a significant burden for individuals in their economically active years. At the same time, the patient's HRQoL is affected, with anxiety/depression (97.5%) and pain/discomfort (83.5%) deteriorating with advanced cancer stages.

This work makes a scientific contribution by providing the first comprehensive, empirical dataset on the economic and humanistic burden of liver cancer in Ghana, validating the integrated Wilson & Cleary and Human Capital framework in a resource-constrained setting. The public health implications are urgent and clear; policy reforms, including expanding NHIS coverage for essential diagnostics and treatments, decentralizing oncology services to reduce travel costs, and integrating mandatory psychosocial and palliative support into standard care

to directly address the poor quality of life impacts identified in this study. These interventions are vital not only to ease the financial burden on patients and their families but also to improve their well-being and dignity throughout the course of the disease.

6.3 Recommendations

1. The National Health Insurance Scheme should expand coverage for cancer care to include diagnostic investigations, essential medicines, and treatment services for liver cancer. This will protect patients and households from catastrophic expenditures and ensure equitable access to care.
2. The Ministry of Health and Ghana Health Service should strengthen liver cancer prevention and early detection by intensifying HBV vaccination, expanding routine screening for high-risk groups, and rolling out public awareness campaigns. Early detection will reduce late-stage presentation and improve survival outcomes.
3. The government should decentralize oncology services. Cancer treatment and diagnostic services should be made available in regional and selected district hospitals to reduce the non-medical costs of travel and accommodation. This will bring care closer to patients and reduce delays in treatment.
4. Health facilities should integrate psychosocial and pain management protocols into standard oncology care. This will improve HRQoL by addressing anxiety, depression, and pain among patients.
5. Health facilities should implement hospital-specific strategies such as adopting structured appointment systems and telemedicine services to reduce waiting times, travel costs, and indirect economic losses to patients and caregivers.
6. Future studies should examine the role of psychological therapies, the cost-effectiveness of various treatment methods in Ghana, and the longitudinal HRQoL

trends among liver cancer patients to capture the long-term economic burden and the lived experiences of patients.

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APPENDIX A: PARTICIPANT INFORMATION SHEET

Title of Research: Health-Related Quality of Life and Economic Burden of People Living with Liver Cancer in Ghana

Name(s) and affiliation(s) of researcher(s)

Mr Ebenezer is conducting this study Owiredu Nkansah of the University of Ghana, School of Public Health.

Background

Ebenezer Owiredu is conducting this research study Nkansah of the University of Ghana, School of Public Health. This study aims to assess health-related quality of life (HRQoL) and the economic burden borne by people living with liver cancer in Ghana. It will involve administering a questionnaire that will estimate the direct and indirect costs incurred by persons living with liver cancer, as well as determine the health-related quality of life among persons living with liver cancer in Ghana. No identifying information, such as names, will be taken, ensuring anonymity. The results from the research will enable policymakers to allocate resources effectively.

Participants' Involvement: The principal investigator will explain the purpose of the study to the respondents, give them the information sheet, and answer any questions they may have. A face-to-face interview using a structured questionnaire will be carried out. One participant would be interviewed at a time.

Duration/ What is involved: Each interview will last between 20 and 30 minutes on average. The interview will be conducted in isolated places with the individual patients to ensure privacy.

Benefits: There would be no direct benefit to the respondents; however, the results of the study will contribute towards policy decisions on the cost of caring for people living with liver cancer in Ghana.

Costs: There shall be no direct cost, but there will be an opportunity cost of their time.

Confidentiality: Information provided will be handled with strict confidentiality and will be used purely for the research process. Confidential information, such as the name of the respondent, will not be collected. Any publication from this study will not include any of the respondents' information that may identify them.

Withdrawal from the research:

You may choose to withdraw from the research at any time without having to explain yourself. You may also choose not to answer any question you find uncomfortable or private.

Consequence of Withdrawal:

There will be no consequence, loss of benefit, or care to you if you choose to withdraw from the study. Please note, however, that some of the information that may have been obtained from you without identifiers (name, etc) before you chose to withdraw, may have been modified or used in analysis reports and publications. These cannot be removed anymore. The researcher promises to make a good-faith effort to comply with your wishes as much as practicable.

Feedback to participant: There will be no direct feedback to the individual participant.

Funding information: This study is an academic work with funding support from the World Health Organization (WHO) – Ghana office.

Sharing of participant information: Data generated from this study will be owned by the principal investigator and will not be shared with any individual, organization, or the state.

Provision of information and consent for participants: A copy of the information sheet and consent form will be given to you after it has been signed or thumb-printed to keep.

Risk(s):

1. Time – the questionnaires may take some time to complete and will therefore result in some loss of time for participants.

2. Fatigue – participants may experience some fatigue during data collection. Efforts will be made to limit this as much as possible.

APPENDIX B: CONSENT FORM

Statement of the person giving consent

I have read the information on this study/research or have had it translated into a language I understand. I have also talked it over with the interviewer to my satisfaction. I understand that my participation is voluntary. I know enough about the purpose, methods, risks, and benefits of the research study to decide that I want to take part in it. I understand that I may freely stop being part of this study at any time without having to explain myself. I have received a copy of this information leaflet and consent form to keep for myself.

Your Signature/thumbprint_____

Date:_____

Your Name_____

Witness

Your Signature/thumbprint_____

Date:_____

Your Name_____

Consent obtained by

Your Signature_____

Date:_____

Your Name_____

Contacts For Further Clarification and Questions

For further information about the study, please contact:

1. Mr. Ebenezer Owiredu Nkansah

   P.O. Box MB197

   Ministries. Tell +233 54809954

APPENDIX C: QUESTIONNAIRE

This is research conducted on people living with liver cancer accessing care at tertiary facilities in Ghana. I would like to take a few minutes of your time to answer these questions. You are assured of strict confidentiality, and your name will not be mentioned in my response.

Qn No.	Questions	Responses
Respondent ID		
Section 1	**Socio-demographic information**	
1	What is your sex?	1. Male
		2. Female
2	What is your age in years	In completed years
3	What is the highest level of school you completed?	1. No Formal Education
		2. Primary
		3. JSS/JHS
		4.SHS/SSS/Technical/Vocational
		5. Tertiary
4	Marital Status	1. Never married
		2. Married
		3. Co-habiting
		4. Widowed
		5. Divorced/Separated
5	What is your employment status?	1. Employed
		2. Unemployed
		3. Retired/Pension

		4. Student/Apprentice
6	If employed, in which sector is you employed?	1. Formal sector
		2. Informal sector
8	What is your average monthly income (including money from other sources)? In Ghana cedis	GHC
9	How many people in your household do you cater for with this income?	
Section 2	**Health Status and Treatment Information**	
10	How long have you been diagnosed with liver cancer? In days	
11	What is the stage of your cancer	1st 2nd 3rd
12	What type of intervention have you received during the past 6 months	1. Surgical
		2. Chemotherapy
		3. Radiotherapy
		4. Surgical + chemotherapy
		5. Surgical + radiotherapy
		6. No treatment

12	Do you use the default treatment?	1. Yes 2. No
13	On average, in the last 1 month, how many times did you default on treatment?	
14	What are the reasons for defaulting on treatment? **(Choose all that apply)**	a. Cost
		b. Distance to hospital
		c. No caregiver
		d. Lengthy time spent at the hospital
		e. Work
		f. Side effects of medications
		g. Others, please specify……
15	Who pays for your liver cancer treatment?	1. Self
		2. Relatives
		3. Parent/Guardian
		4. National Health Insurance Scheme
		5. Private Health Insurance
		6. Free (government)
		7. Employer
16	What is your insurance status?	1. Insured 2. Uninsured

Section 3	**Direct Cost of Treatment Information**	
17	How many times do you visit the clinic in a month?	
18	**Direct Medical Cost information (GHC)**	
	How much did you spend during your last visit in the past 1 month on	
	a. OPD Consultation	GHC
	b. Laboratory test	GHC
	c. Imaging test (X-rays, MRI, CT scan)	GHC
	d. Prescribed medicines	GHC
	e. Surgeries	GHC
	f. In-patient stays/ Admissions	GHC
	g. medical devices and equipment (BP Monitor, glucose monitor, glucose test strips)	GHC
19	**Direct non-medical cost information (GHC)**	
	How much did you spend on yourself and the accompanying caretaker during your last visit in the past 1 month on:	

	(a) Travel cost	
	(b) Food and drink cost	
	(c) Other cost	
Section 4	**Indirect Cost Information**	
20	Typically, in the last 1 month, how many days have you been absent from work (if applicable) because of Liver cancer (i.e., complication, treatment, recovery)?	**Days**
21	How many hours of work do you miss when you seek health? (HOURS)	
22	On average, in the last 1 month, how many visits did you make to the hospital for treatment or review because of your condition (liver cancer)?	
23	On average, how many minutes do you spend traveling to and from the hospital?	

24	On average, how much time do you spend waiting to be cared for? (Waiting time)	
25	Does anyone accompany you to the clinic?	1. Yes 2. No
26	On average, in the last 1 month, how many times did the person accompany you while visiting the clinic because of your condition?	
27	How long is the estimated waiting time experienced by your caregiver or the person accompanying you during your medical consultations?	
28	How many hours of work does the caregiver miss when they accompany you to seek health?	
29	What is his/her employment status?	1. Unemployed 2. Employed
30	Which sector is he/she employing in?	1. Formal sector 2. Informal
31	How much are you willing to pay for someone to do your	GHS

	work while you are seeking care? (GHS)	
32	Do you pay for someone to care for your dependents during any of your consultations (Childcare or otherwise)	Yes No
33	If yes, how much do you pay per session? (Amount in GHS	
Section 5: Quality of Life Questionnaire		
Dimension	**Response Options**	**Rating**
1. Mobility	I have no problems walking about.	1
	I have some problems walking about.	2
	I am unable to walk about.	3
	I have severe problems walking about	4
	I am unable to walk about	5
2. Self-Care	I have no problems with self-care.	1
	I have some problems washing or dressing myself.	2
	I have moderate problems washing or dressing myself	3

	I have severe problems washing or dressing myself	4
	I am unable to wash or dress myself.	5
3. Usual Activities	I have no problems performing my usual activities.	1
	I have some problems performing my usual activities.	2
	I have moderate problems performing my usual activities	3
	I have severe problems performing my usual activities	4
	I am unable to perform my usual activities.	5
4. Pain/Discomfort	I have no pain or discomfort.	1
	I have slight pain or discomfort.	2
	I have moderate pain or discomfort.	3

	I have severe pain or discomfort.	4
	I have extreme pain or discomfort.	5
5. Anxiety/Depression	I am not anxious or depressed	1
	I am slightly anxious or depressed	2
	I am moderately anxious or depressed	3
	I am severely anxious or depressed	4
	I am extremely anxious or depressed	5
Visual Analogue Scale (EQ-VAS)	Please rate your overall health today:	
	0 (Worst imaginable health state) ---------- 100 (Best imaginable health state)	

Appendix D Ethical Clearance Letter

In case of reply the reference number and the date of this letter be quoted

Our Ref.: CCTHERC/EC/2025/052

Your Ref.:

P. O. Box CT.1363
Cape Coast
CC-071-9967
Tel: 03321-34010-14
Fax: 03321-34016
Website: www.ccthghana.org
email:info@ccthghana.com

10th April, 2025

Mr. Ebenezer Owiredu Nkansah,
Department of Health Policy Planning and Management,
University of Ghana,
Accra.

Dear Mr. Nkansah,

FEDERALWIDE ASSURANCE NUMBER (FWA): IRB00014450
ETHICAL CLEARANCE – REF: CCTHERC/EC/2025/052

The Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC) is pleased to inform you that your research proposal on the case study has undergone review and has received approval with effect from 10th April, 2025 to 9th April, 2027.

TITLE OF PROTOCOL	**"HEALTH RELATED QUALITY OF LIFE AND ECONOMIC BURDEN OF PEOPLE LIVING WITH LIVER CANCER IN GHANA".**
PRINCIPAL INVESTIGATOR	**Mr Ebenezer Owiredu Nkansah**

The CCTHERC requires that you submit periodic review of the protocol and a final full review to the ERC on completion of the research. The CCTHERC may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the CCTHERC for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the CCTHERC within ten (10) days in writing. Also note that you are to submit a copy of your final report to the CCTHERC office.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours sincerely,

Prof. Ganiyu A. Rahman
Chairman, ERC

In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. KBTH/MD/G3/25
Your Ref. No.....

KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: Info@kbth.gov.gh
pr@kbth.gov.gh
Website: www.kbth.gov.gh

28th March, 2025

EBENEZER OWIREDU NKANSAH
SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF GHANA, LEGON

"HEALTH RELATED QUALITY OF LIFE AND ECONOMIC BURDEN OF PEOPLE LIVING WITH LIVER CANCER IN GHANA"

KBTH-IRB /00016/2025

INVESTIGATOR: **EBENEZER OWIREDU NKANSAH**

The Korle Bu Teaching Hospital Institutional Review Board (KBTH IRB) reviewed and granted approval to the study entitled: **"Health Related Quality of Life and Economic Burden of People Living with Liver Cancer in Ghana"**

Please note that the Board requires you to submit a final review report on completion of this study to the KBTH-IRB.

Kindly, note that, any modification/amendment to the approved study protocol without approval from KBTH-IRB renders this certificate invalid.

Please report all serious adverse events related to this study to KBTH-IRB within seven days verbally and fourteen days in writing.

This IRB approval is valid till 28th February, 2026. You are to submit annual report for continuing review.

Sincere regards,

DR DANIEL ANKRAH
VICE CHAIR (KBTH-IRB)
FOR: CHAIR (KBTH-IRB)

Cc: The Chief Executive Officer, KBTH
The Director of Medical Affairs, KBTH

In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. KBTH/IMA/03/25
Your Ref. No.....

KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: Info@kbth.gov.gh
pr@kbth.gov.gh
Website: www.kbth.gov.gh

2nd April, 2025

EBENEZER OWIREDU NKANSAH
SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF GHANA, LEGON

INSTITUTIONAL APPROVAL: KORLE BU TEACHING HOSPITAL-SCIENTIFIC AND TECHNICAL COMMITTEE/INSTITUTIONAL REVIEW BOARD (KBTH-STC/IRB/00016/2025

Following approval of your study entitled "**Health Related Quality of Life and Economic Burden of People Living with Liver Cancer in Ghana**" by the Korle Bu Teaching Hospital-Scientific and Technical Committee/Institutional Review Board.

I am pleased to inform you that institutional approval has been granted for the conduct of your study in Korle Bu Teaching Hospital.

Please contact the **Head of Department** to discuss the commencement date of the study.

Please note that, this institutional approval is rendered invalid if the terms of the Institutional Reviewed Board/Scientific and Technical Committee approval are violated.

Sincere regards,

Dr. Harry Akoto
Ag. Director of Medical Affairs

Cc: The Chief Executive, Korle Bu

DEPARTMENT OF RESEARCH & DEVELOPMENT
TAMALE TEACHING HOSPITAL

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

Tamale Teaching Hospital
P. O. Box 16
Tamale
E-mail: info@tth.gov.gh
Digital Address:NT-0101-5331
Website: www.tth.gov.gh

Te:03720-00180
Our Ref: TTH/R&D/SR/25/133
Your Ref:

9th April, 2025.

THE SUB-BMC/UNIT HEAD

PERMISSION TO CONDUCT RESEARCH IN TAMALE TEACHING HOSPITAL

I hereby introduce to you **Mr Ebenezer Owiredu Nkansah,** a Master of Health Economics student of the Department of Health Policy Planning and Management, School of Public Health, University of Ghana.

Mr Nkansah has provided evidence of ethical clearance from the Korle Bu Teaching Hospital (KBTH/MD/G3/25) and has been granted permission to conduct a study title **"Health Related Quality of Life and Economic Burden of People Living with Liver Cancer in Ghana".**

Please provide him with the necessary assistance to enable him to complete the study. If you have any doubts or concerns, kindly contact the Research Unit on the second floor of the administration block or on Telephone 0209281020. Additionally, please report any misconduct of the Researcher(s) promptly to the Research department for appropriate action.

As part of this authorization, PI(s) is/are required to adhere to the following guidelines and conditions during the research process.

1. Adhere to all the hospital policies and applicable research convention
2. Always maintain confidentiality and security of patient information
3. Liaise with the department head/ward staff to obtain necessary approvals before initiating any research activities
4. Report any unexpected incidences or deviations from the research protocol promptly to the research department

Furthermore, the candidate(s) is/are required to submit a copy of the final report to the hospital upon completion of the study

Please note that this approval is valid for a period of six months, from 10th April, 2025 to 9th October, 2025.

Thank you.

ALHASSAN MOHAMMED SHAMUDEEN.
(DEPUTY DIRECTOR AND HEAD, RESEARCH & DEVELOPMENT)

2 Clinical Coordinator
for your action please.
We recommend a
Collaborator within
department.