Availability, Affordability, and Pricing of Anti-cancer Medicines in Selected Low and Middle-Income Countries in Africa

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Abstract

Introduction: Cancer is a leading cause of morbidity and mortality in Low-and Middle-Income Countries (LMICs). Health outcomes may improve with early detection and treatment. In several African countries including Ghana and South Africa, due to the absence of a clear medicine pricing policy, cancer medicines have high price variations due to forex fluctuations, and import tariffs, which impact access.
Aim: This research aimed to assess the availability, affordability, prices, and price components of cancer medicines in South Africa and Ghana.
Method: A systematic literature review was undertaken on the availability, pricing, affordability, and access to cancer medicines in LMICs. An adapted World Health Organization (WHO) and Health Action International (HAI) methodology was used to determine the availability, prices, and affordability of cancer medicines in South Africa and Ghana, including a case study to assess the price components in the Ghana distribution chain. Also, affordability according to the impoverishment of the population after procuring cancer medicines in South Africa was determined.
Results: The literature review showed that in LMICs, there are wide differences in cancer medicine availability and prices amongst medicine brands in different countries, with low-income earners abandoning treatment because of unaffordability. This research showed similar findings of very low availability of cancer medicines beneath the WHO target of 80%, substantial differences in the prices of different cancer medicine brands due to high markups for both generics and branded medicines in all sectors, originator brands having higher markups than generic products, high medicine prices in private facilities compared to the public facilities and unaffordability of cancer medicines by low-income earners with some impoverished after buying cancer medicines.
Conclusion: This research contributes to academic knowledge and the findings can support quality pricing data, comprehensive policies, regulations, and innovative interventions by governments and stakeholders to improve affordable access to cancer medicines.

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External Outputs

The thesis chapters include published materials in peer-reviewed journals. Three publications emanated from the thesis, I am the author of this thesis: and the corresponding and first author for all the following publications. The first author solely prepared (100%) the publications, and a small number of editorial revisions were made according to the supervisors' (co-authors) feedback (~5-10%). The first author addressed all questions raised by journal editors and obtained approved of the supervisory team prior to publication.

Publications

1. Ocran Mattila P, Ahmad R, Hasan SS and Babar Z-U-D (2021). Availability, Affordability, Access, and Pricing of Anti-cancer Medicines in Low- and Middle-Income Countries: A Systematic Review of Literature. Front. Public Health 9:628744. doi: 10.3389/fpubh.2021.628744.

2. Mattila, P.O., Babar, ZUD. & Suleman, F. (2021). Assessing the prices and affordability of oncology medicines for three common cancers within the private sector of South Africa. BMC Health Serv Res 21, 661. https://doi.org/10.1186/s12913-021-06627-6.

3. Ocran Mattila P, Biritwum RB, Babar ZUD (2023). A comprehensive survey of cancer medicines prices, availability, and affordability in Ghana. PLoS ONE 18(5): e0279817. https://doi.org/10.1371/journal.pone.0279817.

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List of abbreviations

AGHE	Annual Government Health Expenditure
CATAG	Council of Australian Therapeutic Advisory Group
C&C	Cash-and-Carry
CCTH	Cape Coast Teaching Hospital
CIF	Cost Insurance Freight
CIMS	Current Index of Medical Specialties
CPI	Consumer Price Indices
DDD	Daily Defined Dose
EMC	Electronic Medicines Compendium
EML	Essential Medicines List
EMLc	Essential Medicines List for Children
ERC	Ethics Review Committee
ERP	External Reference Price
ERP	External Reference Pricing
ESMO	European Society for Medical Oncology
GDP	Gross Domestic Product
Gh	Ghana
GHS	Ghana Health Service
GICC	Global Initiative for Childhood Cancer
GICR	Global Initiative for Cancer Registries
GNI	Gross National Income
GoG	Government of Ghana
HAI	Health Action International
HER2 +	Human Epidermal Growth Factor Receptor 2 positive
HHFCE	Household Final Consumption Expenditure
HICs	High Income Countries
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HPM	Highest-Priced Medicine
HSS	Health System Strengthening

HTA	Health Technology Assessment
IARC	International Agency for Research on Cancer
INN	International Nonproprietary Name
IPC	Income Per Capita
Ipost	Income post-payment
IPR	International Price Ratio
Ipre	Income prepayment
IRP	International Reference Price
IRP	International Reference Pricing
KATH	Komfo Anokye Teaching Hospital
KBTH	Korle Bu Teaching Hospital
LIC	Lower-Income Country
LMICs	Low- and Middle-Income Countries
LMIS	Logistics Management Information System
LP	Lowest Priced
LPG	Lowest Priced Generic
LPGs	Lowest Priced Generics
LPGW	Lowest Paid Government Worker
LPM	Lowest-Priced Medicine
MAP	Medicine Access Program
MDA	Ministries Departments and Agencies
MIC	Middle Income Country
MICs	Middle Income Countries
MMR	Mediscor Medicines Review
MOH	Ministry of Health
MPC	Medicine Pricing Committee
MPP	Medicines Patent Pool
MPR	Median Price Ratio
MSH	Management Sciences for Health
MSP	Manufacturer Selling Price
MUP	Median Unit Price

NCCN	National Comprehensive Cancer Network
NCD	Non-Communicable Disease
NDP	National Drug Policy
NEML	National Essential Medicines List
NGO	Non-Governmental Organization
NHI	National Health Insurance
NHIS	National Health Insurance Scheme
NLEM	National List of Essential Medicines
NML	National Medicines List
NMP	National Medicines Policy
NMPC	National Medicines Pricing Committee
NMRL	National Medicines Reimbursable List
NOS	Newcastle-Ottawa Scale
NRML	National Reimbursable Medicines List
OB	Originator Brand
OBs	Originator Brands
OOP	Out-of-pocket
PAP	Patient Access Program
PL	Poverty Line
PMB	Prescribed Minimum Benefit
PPP	Purchasing Power Parity
PR	Price Ratio
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta- Analyses
PSP	Patient Support Program
R&D	Research and Development
SEP	Single Exit Price
SHI	Social Health Institution
SIOP	International Society of Pediatric Oncology
STG	Standard Treatment Guidelines
TTH	Tamale Teaching Hospital
UC	Universal Coverage

UICC	Union for International Cancer Control
UK	United Kingdom
UMIC	Upper Middle-Income Country
US	United States
USD	United State Dollar
VAT	Value Added Tax
WAHO	West African Health Organization
WB	World Bank
WDIs	World Development Indicators
WHA	World Health Assembly
WHO	World Health Organization
ZAR	South African Rand

Foreword from the Author

This PHD thesis shows the efforts in understanding the factors affecting cancer medicine's access in Low-Middle-Income Countries (LMICs). This PHD studies helped me to improve on my research skills in research design, writing research protocols, research methodologies, developing research tools, methods, data analysis and reporting. This made it possible for me to contribute original knowledge to ensure cancer medicine's access in LMICs.

As a public health pharmacist by profession and a supply chain specialist, I am well conversant with pharmaceuticals including cancer medicines and the health supply chain. My professional and personal background helped to conceptualize the research.

The conduct of the systematic review was a good way for me to become familiar with the topic. It broadened my knowledge of already existing literature in LMICs on affordability, availability, pricing, and cancer medicine's access. This also helped me to know the methodologies and limitations within the studies. The work on the South African pricing study, gave me more insight on how to conduct pricing studies, and this helped in the research design for the Ghana pricing study.

The scoping assessment of the cancer pricing scenario in Ghana briefly explored the landscape cancer medicines. This clarified the cancer pricing situation in Ghana, and helped in the development of the questionnaires, as well as knowing which facilities were providing cancer treatment in Ghana.

The comprehensive pricing survey in Ghana was the first study to be done in Ghana on adult cancer medicines pricing and the second study on pediatric cancer medicines pricing in Ghana. There was so much information and research write up needed by 4 various scientific and ethical review committees before granting me ethical clearance to conduct the studies. I had to develop various research protocols as per the requirements of each ethical clearance committee. The field work started from August 2020 and ended in November 2020. The data collection was done in the Covid-19 pandemic period, and thus strict covid protocols and prevention measures had to be adhered to. With the earlier closed borders in Ghana due to covid 19, I was concerned that I wouldn't have enough data on cancer medicines, but this wasn't the case, as the wholesalers and importers of cancer medicines had enough stocks in country prior to

the pandemic. Also, the borders had been opened throughout the period of collecting data. The price components case study was a sequel to the comprehensive pricing survey, and it enabled me to comprehend the various mark ups in the supply chain of cancer medicines in Ghana. I have learnt a lot in terms of research, developing data collection tools, seeking ethical clearances, conducting research, and publishing the research work in good academic journals.

Structure of Thesis

This thesis presents research findings to broaden the understanding of the issues affecting availability, pricing, access, and affordability of cancer medicines in LMICs, especially Ghana and South Africa, and some recommendations for equitable affordability and access to cancer medicines.

Chapter 1: This is the introduction to the PHD thesis built on policy documents desk review and peer reviewed literature on the cancer burden, mortality, and factors such as availability, affordability and pricing that affects the access to cancer medicines. This chapter shows the gaps, so it can be addressed by the research.

Chapter 2: Following the desk review of evidence, a systematic review of literature was conducted to form the basis for the research topic. This review of literature systematically identified and evaluated, peer-reviewed literature in LMICs, on access, pricing, availability, and affordability of cancer medicines and was published in a peer reviewed journal (Ocran Mattila et al., 2021). The results were synthesized, and a narrative was presented from the various methodologies of the identified studies to arrive at conclusions, which constituted the groundwork for the original research that ensued.

Chapter 3: This describes the methodology used in the research work to accomplish the identified goals and objectives. It includes ethical clearance considerations. It showcases the meaning of a research, research philosophy, research design, and the advantages and disadvantages of several research methods and their capacity to produce authentic results that conform to the aims and objectives of the thesis. The applied research methodology based on an adapted WHO/HAI methodology (WHO & HAI, 2020) is briefly mentioned in this chapter.

Chapter 4: This presents the introduction, objectives, methods, and findings from the research conducted in South Africa, to evaluate the medicines for three common cancers (breast, prostate and colorectal) affordability and prices.

Chapter 5: This presents the introduction, objectives, methods, and results from the scoping assessment of the pricing scenario in Ghana and the quantitative comprehensive research survey conducted in Ghana, on evaluating the availability, affordability, and prices of oncology medicines.

Chapter 6: This describes the introduction, objectives, methods, and findings from the case study of the price component costs of three cancer medicines (Epirubicin 50mg vial, Cyclophosphamide 50mg tab, Bevacizumab 400mg vial in Ghana.

Chapter 7: This presents a general discussion of the research outcomes in view of global literature and the research objectives. This discussion involves all three studies and the study limitations. A review of the comparisons and variances in the Ghana pricing study and the South Africa pricing study was presented.

Chapter 8: This shows the overall conclusion of the research findings and discussion, with an elaboration on the recommendations arising out of this research and possible future research to be explored.

Chapter 9: References and Appendices.

CHAPTER 1: Introduction

Chapter 1: Introduction

1.1 Burden of cancer disease

Cancer refers to ailments that can affect any part of the body and can result in death (WHO, 2022). Other terms used are neoplasms and malignant tumors. Cancer has a significant characteristic of quickly created irregular cells, growing, invading different body parts, and spreading to other organs, the end process is called metastasis. Metastases causes majority of death from cancer (WHO, 2018a).

The worldwide burden of cancer was assessed to have increased to 19.3 million new instances of cancer with close to 10.0 million, or nearly one in six deaths in 2020 (Ferlay et al., 2020; WHO, 2022). The most prevalent in 2020 were breast cancer (2.26 million cases), lung cancer (2.21 million cases), colo-rectum cancer (1.93 million cases), prostate cancer (1.41 million cases), skin cancer (non-melanoma) (1.20 million cases), and stomach cancer (1.09 million cases) (Ferlay et al., 2020; WHO, 2022). About 400,000 children develop cancer each year (WHO, 2022). The commonly occurring cancers in children encompass leukemias, brain cancers, lymphomas, and solid tumors, such as neuroblastoma and Wilms tumors (WHO, 2018e; WHO, 2021c). The International Agency for Research on Cancer (IARC) has forecasted that the worldwide tally of new cancer diagnoses will reach 30.2 million, unless more efforts are made to modify the disease progression, deaths caused by cancer will rise to 16.3 million, (Ferlay et al., 2020). In High-Income Countries (HICs), with generally accessible comprehensive services, childhood cancer cure rates are more than 80%. Cure rates are below 30% in LMICs (Lam et al., 2019; WHO, 2021b), due to resource limitations, impediments in accessing care, and abandonment of treatment (Lam et al., 2019; Renner et al., 2018; WHO, 2021b). The WHO Global Initiative for Childhood Cancer (GICC), by 2030, aspires to have a survival rate of 60% globally (WHO, 2018e). Improving access to childhood cancer treatment, with vital cancer medicines is achievable, highly cost effective and can increase the survival of children in all settings (WHO, 2020a; WHO, 2018e).

In LMICs, only less than a third of cancer patients survive, whereas in HICs, the number of cancer survivors are high (Gelband et al., 2016). In LMICs, low cure rates of 10%

have been observed in children with cancer, whilst in HICs, cure rates above 80% are seen in children diagnosed as having cancer (WHO, 2018b). There is inadequate access in LMICs, to affordable medicines, even though LMICs have about 90% of the global recorded childhood cancers. (Bhakta et al., 2019).

Globally, cancer is next to cardiovascular diseases in causing morbidity and untimely death and is quickly developing into a substantial health problem in LMICs, particularly in Africa (Ferlay et al., 2020); WHO, 2022; Wild et al., 2020). According to Globocan data, deaths, and new cancer cases in Africa was 711,429 and 1,109,209 respectively in 2020 (Ferlay et al., 2020). New cases of common cancers were breast (16.8%), cervix uteri (10.6%), prostate (8.4%), liver (6.4%) and colo rectum (6%) (Ferlay et al., 2020).

Historically, Africa had low cancer cases, but recently, there is an increase in the incidence of cancers in Africa due to ageing populations, obesity, decrease in mortality from other causes and a growing prevalence of risk behaviors. These risk behaviors include unhealthy diet consumption, a sedentary lifestyle, drinking too much alcohol, smoking, exposure to infections and ultraviolet radiation (Ferlay et al., 2020; Wild et al., 2020; WHO, 2019; WHO, 2022).

Early diagnosis and effective treatment have been shown to minimize the cancer burden and mortality. A considerable number of cancer patients get healed by radiotherapy, surgery, or chemotherapy contingent on having access to affordable and available cancer medicines (Ferlay et al., 2020; WHO, 2022).

1.2 Global health expenditures related to cancer.

In 2010, the overall yearly monetary costs of cancer were $1.16 trillion United States Dollar (USD) in value (World Cancer Report, 2014). The yearly universal cost of cancer is around $2.5 trillion USD after including the long-term costs to patients and their families, making cancer an important public health illness and hence the urgent need to reduce the burden of cancer (World Cancer Report, 2014). Healthcare spending on cancer medication in 2018, was estimated at $150 billion USD globally, increasing by 12.9% from the preceding year (IQVIA, 2019). A review of literature demonstrated high prices of novel cancer medicines with high expenses on cancer medication in

comparison with other therapeutic categories of medicines in the medical field (Barron & Wilsdon, 2016; Truong et al., 2019). Even though accounting for roughly 80% of the disease burden as determined by the disability-adjusted life years, LMICs possess no more than 5% of resources universally available for battling cancer (WHO, 2018b).

For the implementation of low cost-effective interventions to reduce suffering and premature death from cancer before 2030, African countries would need about 1.7 million USD annual expenditure per capita, with greater improvements in later decades (Gelband et al., 2015). In South Africa, about 1% of the pharmaceutical market consists of the oncology sector even though it formed 53.6% of the total specialty medicine spending in 2019, with people on Prescribed Minimum Benefit (PMB) constituting only 36.1%. The management of cancer entails patients having to make excessive Out of Pocket (OOP) payments (Meyer et al., 2021).

The Mediscor Medicines Review (MMR) report shows that oncology medicines even though it forms only 1% of the pharmaceutical market, is the next highest therapeutic category, constituting 6.6% of the total expenditure. Within a year, a cancer medicine, pembrolizumab, made a big move from grade 223 to 11 in position, and joined the top 15 specialty cancer medicines. This indicates the financial crisis faced by the cancer patient due to expensive cancer medicines (Meyer et al., 2021).

Pharmaceutical expenditures have grown exponentially and exceeded economic growth and health sector growth in many countries (Babar et al., 2015; WHO, 2011). Health financing is not dissimilar to financing pharmaceuticals. To guarantee access to cancer drugs, pharmaceutical financing for all sectors of the population is critical. The financial sustainability of a healthcare system is reached when resources are in equilibrium with expenses and is enough to sustain a certain level of demand for minimal quality of healthcare service (Babar et al., 2015).

General funding opportunities for pharmaceuticals includes user fees (e.g., fee for service that is payment made by patients), public sources (national and local government revenues), health insurance (including public and private insurance), voluntary financing (like healthcare provisions from employers), development loans and aid financing (for instance, multilateral, bilateral and grants) (De Lima Lopes et al., 2013).

The ability of healthcare systems to offer affordable access to cancer medicines for the entire population is weakened by the soaring prices of cancer medicines (WHO, 2018b). Due to other needs and numerous competing health urgencies, cancer care is of less importance on the health agenda in Africa. Most African countries cannot afford the excessive prices of cancer medicines on their own, as they are heavily reliant on donor funding for medicines. The international donors and African governments low health investments and inadequate funding of cancer medicines pose a challenge for cancer patient's access to cancer medicines in low-resource settings (WHO 2018b; Wild et al., 2020).

1.3 Pharmaceutical sector in LMICs

In low-resource settings, cancer patients are faced with challenges when accessing cancer medicines. This includes systemic pharmaceutical supply chain weaknesses in procurement and distribution of cancer medicines, contributing to suboptimal inventory management and underutilization of these medicines (WHO, 2018b).

In some African countries, there is often a mix of parallel actors who are uncoordinated in funding, procurement, storage, and delivery of cancer drugs and related diagnostics. The uncoordinated system has no standardized procedures or processes to enable people obtain the needed cancer medicines, and they lack a way to capture the flow of medicines and money. This leads to replicated efforts and a wastage of medicines and resources. As a basic requirement, countries must ensure that all cancer medicines on the Essential Medicines List (EML) of WHO, are in full supply. A comprehensive strategy to strengthen structures, systems, and processes in good pharmaceutical practice, logistics information management system, forecasting, quantification, procurement, warehousing, and inventory management should be developed and implemented by the pharmaceutical sector to ensure increased access. Several sides of the medicine supply chain including access, affordability, and quality of medicines can be enhanced through Health System Strengthening (HSS) in LMICs (Babar, 2021).

1.4 Inadequate health systems and trained oncology health workers in Africa

Services for treating cancer are accessible in fewer than 30% of Low-Income Countries (LICs) compared to over 90% of HICs (WHO, 2018b). Health systems in Africa are usually not furnished to manage the detection and treatment of cancers. Treatment for some types of cancer many involve surgery, radiotherapy, chemotherapy, and targeted (e.g., endocrine) therapy. It is essential that all components of care including accurate diagnosis by competent health professionals are accessible by patients in Africa when needed. According to a published paper in the Global Oncology Journal 2015, Africa has only one hundred and two cancer treatment centers (The Cancer Atlas, 2019). This is significantly insufficient for the expanding population of the continent. Pathology capacity and services to accurately diagnose and stage cancers are often insufficient or non-existent, leading to instances where patients receive inappropriate treatment without a proper pathological diagnosis. In sub-Saharan African regions, including Malawi, cancers are generally identified at an advanced or terminal phase (Bates & Mijoya 2015). This late-stage detection in African patients contributes to more adverse outcomes. For instance, the five-year relative survival rates for female breast cancer are just 46% in Uganda and 12% in Gambia, as opposed to 90% in the United States (Dent et al., 2017). As per the Cancer Atlas, in sub-Saharan Africa, 80% of cancer diagnoses are made when the disease is already at an advanced stage, and less than 10% of these individuals receive pain management, chemotherapy, or radiotherapy (The Cancer Atlas, 2019).

In Ethiopia, cancer care services are critically inadequate. There is no established cancer registry, and a sole cancer center, staffed with a limited number of medical practitioners, is strained to serve the nation's entire population. This leads to an inaccessible cancer treatment scenario for the vast majority, resulting in extensive waiting times and allowing many tumors, potentially curable at an early stage, to advance to incurable stages (Federal Ministry of Health [FMOH], 2016; Woldeamanuel et al., 2013). The lack of efficient and trustworthy pathology services may cause diagnostic delays for patients or lead to prescriptions of costly yet ineffectual medications for their cancer. In situations where countries are unable to test for hormone receptor expression in breast tumors, patients are indiscriminately given

hormonal therapies (such as tamoxifen, aromatase inhibitors, or luteinizing hormone-releasing hormone agonists), even though only a fraction of these patients might benefit from this treatment.

1.5 Access to cancer medicines in LMICs

Roughly 22% of the 54 nations in Africa lack access to cancer treatments, which encompass medicines (such as hormonal therapy, molecularly targeted therapy, and chemotherapy), surgical oncology procedures, and radiotherapy. Men and women with cancer in LMICs, particularly in Africa, face multiple challenges because of poor health-care structures, inadequate access to treatment, untimely intervention and alternative health beliefs resulting in high case mortality rates (Clegg-Lamptey et al., 2009a; Clegg-Lamptey et al., 2009b); Wild et al., 2020). Studies conducted in Ghana, Nigeria, Egypt, Kenya, and Libya of women who presented late with breast cancer, showed that more than half of the women presented with advanced disease due to health care access limitations (Donkor et al., 2015).

In over 20% of African countries, the soaring prices of cancer medicines, affects access to off patent and new cancer medicines. In South Africa, 85% of the population have access to public healthcare services, whilst only 15% access private healthcare like that of high-income countries (Meyer et al., 2021). In some nations, availability is irregular and constrained, because of the healthcare system's inadequacies such as the prohibitive cost of definitive diagnosis, expensive cancer medicines which are unaffordable and often not readily available to the patients (Dent et al., 2017; WHO, 2018b).

The prohibitive cost of chemotherapeutic agents which impacts on access is a major factor in survival rate differences in LMICs (Minister of Health, 2016). In LMICs, due to the lack of reimbursements by governments or any special access schemes, the full cost of cancer treatments must be borne by many patients through substantial out- of -pocket payments, which are unaffordable and leads to their early demise, deprivation, and poverty.

As stated in a study, above 80% of a population encountered challenges when accessing cancer medicines (Moye-Holz et al., 2018). The access barriers include

insurance schemes disparities, geographic coverage, coverage of health care (by types of cancer medications), regional differences and by institutions (such as the Ministry of Health (MoH) providing less for an insured population than the private). This may be because of the variations in the budget, allocated resources, burden of disease, buying power, disease priorities and changes in capacity within the system of health care (Cherny et al, 2017; Moye-Holz et al., 2018; Oomen & Karuranga, 2017). Countries should consider these issues when evaluating formulary decisions, negotiating procurement conditions for cancer medicines, and when formulating policies for cancer and health (Cuomo et al., 2017).

1.6 Pharmaceutical pricing policies in LMICs

The WHO has advised countries to have a common framework for formulating and implementing a national pharmaceutical policy to address pharmaceutical challenges. For the past 30 years, increasing affordability, availability, and improved use of quality medicines has resulted due to successful implementation of pharmaceutical policies. For example, in Tanzania, Kenya Uganda, Burundi and Rwanda, the National Medicine Policy (NMP) was adopted as the policy instrument guiding the pharmaceutical sector (Babar, 2017).

Policy makers can adjust the volume, price, and mix of products centered on the policies of pharmaceutical pricing in that country. A good pricing policy ensures that quality efficacious cancer medicines are available and affordable and that patients get their medicines in a timely manner. It promotes transparency, through price information sharing to ensure efficiency and accountability. It should offer financial incentives to guarantee returns on investments by the pharmaceutical industry and encourage research on new potent cancer medicines. Pricing policies should encourage competition to avoid market dominance by few suppliers who may set soaring prices or cause shortage of supplies. Pricing policies such as tendering and negotiations, rebates, maximum “ceiling” price, reference pricing, substitution policies for generics, international benchmarking, value-based pricing, managed entry agreements” or “risk-share agreements”, procurement policies, cost-based pricing, and pharmacoeconomic

analyses can be used to influence the price of cancer medicines (Gray et all., 2015; WHO, 2018b).

The WHO in 2018, published a study showing cancer medicine prices to be excessively higher in comparison to other types of therapies and pharmaceuticals. Evidence shows that without rules and uniform pricing policies, the cancer medicine prices increased significantly due to differences in medicine prices, which resulted in potential inequity and unproductive cost-shifting activities. It was shown that improved access and lower prices can be obtained with increased levels of price control (WHO, 2018b). Attaining equitable access to affordable health care, including specialized cancer medicines and good pharmaceutical policies is a challenge (Gray et al., 2015), especially in Africa, where the OOP to obtain medicines is used by majority of the general population.

In healthcare systems such as outpatient facilities and hospitals, varying pricing policies can lead to limited control on medicine prices, inequitable access, and unproductive cost-shifting activities for patients in service delivery settings (WHO, 2018b).

For example, a study conducted in Mozambique showed that due to lack of oversight on the execution of policy initiatives and conspiracy amongst pharmacies and wholesalers, an uneven application of the government's policy on stipulating cost ceilings and fixed statutory profit for medicines in 2004–2005 was observed across the supply chain (Russo & McPake, 2010). This resulted in a bigger proportion of the final medicine price being more than the policy had originally intended (62–78% vs 56–58%), because of high mark-ups from pharmacies and wholesalers (Russo & McPake, 2010).

It is known that the absence of effective and reliable policies for managing prices of medicine within the supply chain (i.e., taxes and mark-up amounts) can lead to highly dispersed and unrestrained prices with time for a particular medicine.

Especially countries that classify medicines as identical to other consumer goods for taxation, do charge different taxes on medicines. The charges include an application of import tariffs and Value Added Tax (VAT). Nigeria, South Africa, and Ghana have a 5%, 14% and 12.5% VAT respectively added to the cost of medicines (MOH, 2017c; WHO, 2018b).

Governments intervention on prices of medicine through tax regulations and the various markups in the pharmaceutical supply chain (e.g., wholesale price, manufacturer price,

dispensed price, retail price) can reduce the financial burden on consumers significantly (Gray et al., 2015; Babar et al., 2015). South Africa authorities have applied regulations on mark-ups along the supply and distribution chains in a bid to control medicine prices (WHO, 2018b).

The lack thereof or current policies on pricing have contributed to substantial variability in cancer medicines prices across regions and within a country. Published studies shows that the price variability observed does not seem equal to the demand or the purchasing power of a given country. This weakens the capacity of health care systems to offer reasonably priced coverage of essential cancer medicines to the entire population. It may result in delays in patient's accessing medicines and will restrict the achievement of best likely patient health outcomes within the system (WHO, 2018b). A big limitation in developing a robust and transparent pricing strategy in LMICs is the lack of affordability or pricing data. To formulate pricing policies which will enhance the affordability and availability of medicines in countries, requires an understanding, measuring, and monitoring of medicine prices (Babar et al., 2015).

The Ghana NMP has a chapter on pricing policy which aims to enhance pricing procedures and assure the affordability of drugs (MOH, 2017c). The National Drug Policy (NDP) was published in 1996, as part of post-apartheid initiatives to reform the South African healthcare sector (NDoH, 1996). The economic objective of this policy was to lower the cost of drugs in both the public and private sectors (NDoH, 1996). To achieve these objectives, an important part of the policy was the formation of a 'Pricing Committee' with the mandate to regulate and monitor the pricing of medicines. Complete transparency in the wholesalers, pharmaceutical manufacturers, service providers, including those who dispense medicines, as well as private hospitals and clinic's pricing structure was emphasized in the policy (NDoH, 1996). Public sector medicines procurement involved a nationwide competitive bidding process, restricted to products registered locally, thus these policies were intended to apply exclusively to the private sector (Gray & Suleman, 2015).

Inequalities in the private and public health sectors were evident during South Africa's apartheid era (Harris et al., 2011). By 1990, about 80% of the nation's total medicine expenditure was controlled by the private sector (NDoH, 1996). In 1994, the new

democratically elected government decided to solve issues such as inequity in access to essential medicines and increasing drug prices, methodically through the formulation and execution of the NDP (NDoH, 1996). The South Africa government In December 1997, promulgated legislation to lower the cost of medicines for all South Africans (South African Government, 1997). The Medicine Pricing Committee (MPC) was formed through legislation to make suggestions and advise on the implementation of a pricing system for all medicines sold in South Africa that is transparent (South African Government, 1997).

Earlier noteworthy challenges in the unregulated medicines market of the private sector included price inflation of medicines, uniformity of medicine prices, and transparency of medicine prices (Carapinha & Company, 2016). There were serious apprehensions in the National Department of Health (NDoH) because the actual price of a medicine could not be determined easily because of the high discounts and incentives being paid within the supply chain of pharmaceuticals, which resulted in the loss of benefits to consumers (Bangalee & Suleman, 2016). Pricing interventions of medicine were instituted by the government to regulate and decrease the mark-ups introduced by several parties within the supply chain from the producer to the last dispenser of the medicine. This resulted in the exclusion of compulsory offering of generic replacement; rebates and discounts in the pharmaceutical sector; and the use of a Single Exit Price (SEP) from the producers, inclusive of a logistics fee for providers of logistical services such as wholesalers or distributors; and retailers' distinct dispensing fee (Bangalee & Suleman, 2015; Gray & Suleman, 2015; Williams, 2007).

New rules and regulations regarding a clear-cut pricing system for medications and scheduled substances was enacted in 2004 (South African Government 1965). These new rules and regulations sought to improve medicine price transparency with the introduction of the SEP mechanism. The main goal of the SEP was to lower and regulate the generic and branded medicine price increases, to enhance access to medicines (South African Government 1965).

Regulation of medicine prices with the SEP, meant the price of scheduled substance or medicine that could be offered by a manufacturer to a wholesaler, importer, or distributor. Every medicine's SEP was calculated using the net value of sales, inclusive

of previous year's discounts (Gray, 2009, Gray & Suleman, 2015). Manufacturers of pharmaceuticals make submissions of new medicines SEPs to the NDoH. The manufacturer determines this price, which is a price fixed for manufacturers and importers to trade medicines, and not have any prospect of offering rebates (Republic of South Africa, 1965). The SEP comprises of the logistics fee, VAT, and ex-manufacturer price. The pharmacy will include a dispensing fee to the SEP price of the medicine obtained from the wholesaler or distributor, before selling it to a patient. (Republic of South Africa, 1997). The SEP is revised annually with a maximum permissible increase in the SEP, by the Minister of Health, acting on the Pricing Committee's advice (Republic of South Africa, 1997; Pretorius, 2011). This cap on the annual increase varies from year to year. Manufacturers may lower their prices each year, make use of the maximum increase, make use of part of the increase, not increase prices at all (Republic of South Africa, 1997).

The NDoH website lists the prices inclusive of the final logistics fee, stated in the manufacturer's application for SEP or SEP modifications. The manufacturer or importer negotiates with the logistic service provider to set the logistics fee (Republic of South Africa, 1965). The process involved and contracts made are not disclosed publicly. The manufacturers pay the wholesalers and distributors a logistics fee from the SEP; however, negotiations vary as all logistic service providers cannot negotiate for the same fee. The reflection of this fee in the medicines database is not clear (Gray & Suleman, 2015). From 2004, about 22% reduction in medicine prices was achieved with the introduction of the SEP, resulting in medicine expenditure savings of approximately ZAR 319 million annually with the scheme (Discovery Health, 2012). The introduction of the SEP mechanism and the annual publication of changes has equipped the state with an effective method for private sector pricing. The SEP's impact on affordability is uncertain (Gray & Suleman 2015; Suleman & Gray 2017).

1.7 Global pricing of cancer medicines

A report from the WHO showed that in comparison to other types of therapies and pharmaceuticals, cancer medicines had unreasonably high prices. With non-uniform pricing policies and nonexistence of regulations, price increase resulted in potential

inequity and unproductive cost-shifting activities. Access can be improved with more price control to reduce the prices (WHO, 2018b).

Pricing of cancer medicines includes a range of approaches such as reference pricing, which involves fixing the price of medicines in accordance with similar prices in countries/organizations of reference. Cost-based pricing, which involves the price of a medicine being set according to the costs of inputs with an added mark-up percentage or amount, value-based pricing, which involves a determination of the medicine price based on a comparison of the value of comparable medicines with the differentiated value of the medicine for patient groups, maximum “ceiling” price and pricing through tendering and negotiation, which involves prices determination using the best offer from tenderers (WHO, 2018b).

Others include special measures with manufacturers such as rebates or discounts based on payment according to health outcomes or the magnitude of sales to improve access to cancer medicines subject to stated conditions. These arrangements are called “risk-share agreements” or “managed entry agreements”. Agreed upon private terms between the buyer and the manufacturer sets the conditions of such arrangements (WHO, 2018b). To ensure access, in some countries, medicine prices are routinely monitored to control prices during the life cycle of the medicine and at different time points within the supply chain. Measures such as mark-up amount regulation, reassessment of prices with changes in market situations or when there is need for a medicine change, introduction of biosimilar and generic products (WHO, 2018b).

To have higher system efficiencies and increase access to cancer medicines, other strategies with an indirect effect on prices includes the implementation of policies to enhance cancer medicines generic or biologically similar products prescribing and substitution for more competition, exemption or reduction of taxes on medicines, clinicians being required to obtain approvals from the purchaser before prescribing or dispensing any high-cost and specialized cancer medicines, and attaining economies of scale and better negotiations using a combination of financial and non-financial resources from multiple procuring entities, to ensure efficient purchasing of medicines through a pooled procurement modality (WHO, 2018b).

Comparative studies carried out on cancer medicine prices indicates that health technology assessments resulting in pricing regulation, standard price negotiations and consistent revision of prices could reduce the price and cost of medicines.

The inconspicuousness of cancer medicine prices does prevent effective national negotiations with manufacturers. This is an acute challenge for national programs operating with limited budgets (Babar, 2018). Pharmaceutical companies are known to set prices in accordance with their commercial aims, to have the highest amount that a purchaser wants to pay for a medicine. This pricing method often makes cancer medicines too expensive, consequently obstructing the full therapeutic potential of these medicines from being attained (WHO, 2018b).

In Africa, there is absence of information on how cancer medicines prices are determined. In several African countries, pharmaceutical prices are composites of high retail markups, and high price variations, probably caused by the lack of a clear policy on pricing of medicines (Gray et al., 2015). The price paid for cancer medicine has several pricing components, when they move within the chain of supply, beginning with the producer to the end user (WHO & HAI, 2020). Extra prices are included in the Manufacturer's Selling Price (MSP). Pricing parts have direct and collective bearing on the overall costs of cancer medicines and thus cancer medicines access (WHO & HAI, 2020). Mostly cancer medicines are imported from abroad amidst forex fluctuations with fast devaluing national currency, which influences the price (Gray et al., 2015).

Most governments do not have direct control of the prices, which are largely determined by manufacturers, retailers, and suppliers. There are enormous differences in prices of individual medicines and medicine categories, across regions and in countries (Cuomo et al., 2017). For instance, the 4-weekly prices of bevacizumab ranged from USD 543 to USD 6,827 among HICs and USD 4,364 to USD 19,006 among LMICs (Goldstein et al., 2017). There are changes in pricing based on the type of cancer medicine, and the geographic location, with African countries paying higher price for a set of vital cancer drugs, when compared to Latin American counties (Cuomo et al., 2017). Countries when assessing formulary choices, negotiating terms for drug procurement, and developing cancer and health policies should consider the effect of price variations on

affordability, availability, and accessibility to essential cancer medicines (Cuomo et al., 2017).

1.8 Global price transparency of cancer medicines

Price transparencies assist policymakers and researchers with the provision of reliable price information, enables improvement in economic efficiency, allows buyers to have strategic negotiations, and ensures price accountability with pharmaceutical firms (Kemp & Schondelmeyer, 2000).

The absence of price transparency with cancer medicines poses a big challenge. Oftentimes the publicly portrayed 'list price' of a medicine doesn't show its real price. Manufacturers hardly ever share good information on the actual selling price of their medicines, especially with the global proliferation of discounts in the past twenty years. Most leading medicine-price databases contain the listed price only and thus present a false picture (Babar, 2018). The implementation of external reference pricing initiatives by countries, shows that the actual prices paid by reference countries are artificially inflated, and thus offer no baseline for comparison.

The vagueness of cancer medicine prices, prevents effective negotiations with manufacturers. This is problematic especially for national programs with limited funding resources (Babar, 2018). Certainly, the lack of price transparency is an issue in the generic medicines market as well, with higher prices paid over the production cost by government buyers. This is partly because of the dearth of useful information on what is paid by other countries (Babar, 2018). Stakeholders will not be well informed on the factors contributing to higher prices, if there is no clearness on the production cost, costs of clinical trials, cost of Research and Development (R&D), who pays for the R&D costs and the actual medicine prices for effective targeted interventions (Babar, 2018). Especially in Africa, the burden of high generic prices could be lowered through price transparency (Babar, 2018).

Lack of transparent medicine prices may compromise the principle of good governance and clear accountability may be compromised by confidential agreements. Absence of process and price transparency may encourage corruption in weak health care systems with poor governance (WHO, 2018b).

To curtail the rising cost of healthcare, price transparency when embedded in the NMP will bolster national health systems of governments to negotiate for more reasonably priced cancer medicines for people, thereby ensuring universal access to medicines (WHA, 2019). A World Health Assembly (WHA) resolution 72, encouraged member states to put in place systems that will show prices and reimbursement cost of medicines publicly (WHA, 2019).

1.9 Affordability of cancer medicines in LMICs

Health care policy makers in LMICs, are confronted with ensuring affordable access to cancer medicines for the public in need, whilst keeping public health care expenditures to a bare minimum. Questions are raised regarding the OOP payments or copayments (micro level affordability) made by people in accessing health care including how to ensure sustainable public funding with taxes and premiums (macro level affordability) for the health care sector (Cameron et al., 2009; van Doorslaer et al., 2006). Most of the population in LMICs don't have health insurance (Dror et al., 2002), Purchases made from OOP, constitutes a major source for financing health care. A greater part of the total health expenditures is from the medicine expenditures made from OOP payments (Cameron et al., 2009; Niëns et al., 2010; van Doorslaer et al., 2006; WHO, 2000; WHO, 2004).

Big populations burdened with unfavorable socio-economic conditions in LMICs, cannot access the new cancer medicines and new treatments including monoclonal antibodies, immunotherapy, and targeted therapy. The older cytotoxic agents can be afforded by minority of patients. Medicines like Herceptin (trastuzumab) as an example, have traditionally been unaffordable for patients and healthcare systems in regions like sub-Saharan Africa, without assistance from government or national insurance programs (Dent et al., 2017). In Uganda, most patients and families cannot afford the expensive cancer treatments. About 20% of Ugandans subsist on less than USD $1.25 daily, and over 40% of the 36 million population is vulnerable to financial ruin due to unforeseen expenses (Kwesiga et al., 2018). In Cameroon, soaring user fees, increased the chances of patients not returning for cancer surgery (Ilbawi et al., 2013).

Most cancer patients who don't have an insurance cover, enough funding, or access to government reimbursements, cannot afford the cost of treatment (Niens et al., 2012; WHO, 2018b). The exorbitant cost of cancer medicines, results in financial hardships for patients with limited insurance coverage, causing them to reduce their treatment dosage, partly fill prescriptions, or even skip treatment entirely (Niens et al., 2012; WHO, 2018b).

Generally, cancer treatment is expensive and is either paid by the patients themselves, insurers or the government reimbursement and funding agencies (Howard et al., 2016). Patients not having insurance, reimbursements or access to exclusive schemes must pay for the full cost of treatment, which leads to poverty, deprivation, or early demise (Cherny et al., 2017; Niens et al., 2012). A comparison of the exact affordability in countries is challenging, as there are differences in medicines reimbursed publicly, or whether the individual bears the cost (Cuomo et al., 2017).

Estimating affordability is done using different approaches. The concepts of catastrophic spending and impoverishment as created and used by eminent health economists Wagstaff and van Doorslaer are the two most well used approaches (Wagstaff & Van Doorslaer, 2001; Wagstaff & Van Doorslaer, 2003). A retrospective assessment of the number of people who experienced catastrophic or impoverishment payments because of health care expenditures is a common way to use these methods (Wagstaff & Van Doorslaer, 2001; Wagstaff & Van Doorslaer, 2003). These approaches can be used to prospectively determine the percentage of the population which cannot afford the required commodities. It shows the subset of the population at risk of making catastrophic payments or being impoverished when goods or services are procured (Niëns et al., 2010).

One relies on the ratio of expenditures to total household resources. When a certain fraction of the household resources is exceeded due to payments made for a product, this can be viewed as "catastrophic" (unaffordable), especially for poor people (Niëns et al., 2012). The fraction of the population paying for goods or services by spending more than X percent of their income is used to calculate for catastrophic spending (Niëns & Brouwer, 2013). This method fixes the threshold based on a relinquished proportion of income. The underlying principle is that if a household devotes a bigger part of its

income other than the stated proportion for specific goods or services, the consumption will need to be reduced in other areas to an unsuitable extent (Niëns & Brouwer, 2013). Another approach, the “impoverishment” method considers the residual salary remaining after a payment, considering the absolute availability of resources before and after payments are made for a product. Households are deemed “impoverished” if payment of a product caused them to fall below the poverty line that they were initially above (Niëns et al., 2012).

The method used in calculating the percentage population under the poverty line because of payments made for good or services is referred to as the Impoverishment method (Niëns & Brouwer, 2013).

In the impoverishment method, the poverty line is employed as a benchmark, rooted in the understanding that individuals necessitate a fundamental minimum income level to meet essential commitments (Niëns & Brouwer, 2013). The impoverishment method when applied prospectively or retrospectively shows the population pushed under the poverty line because of procuring medicines or health (the rate of impoverishment) and, thus shows the fraction of the population who are impoverished or can become impoverished (Niëns & Brouwer, 2013).

With the innate difficulties in measuring affordability, another approach by the WHO and HAI, entails a method of calculating the medicines affordability using the unskilled Lowest Paid Government Worker’s (LPGW) number of days’ wages to buy a course of treatment with a specific drug (Cameron et al., 2009; WHO & HAI, 2020). There are big variances in affordability patterns of countries. A comparison of cancer medicines affordability in the United Kingdom (UK), Australia, China, Israel, the United States (US), India, and South Africa showed that as compared to other countries, cancer medicines are significantly more expensive India than in the other countries by a huge margin. Furthermore, medicines in South Africa and China and are more expensive in comparison to all HICs, inclusive of the US with considerably higher prices. These variations are because of the low levels of wealth in Middle Income Countries (MICs), (Goldstein et al., 2017). Medicines used for cancer treatment including generics on the EML of WHO, are often not affordable in most LMICs (Islam et al., 2015; WHO, 2021a; WHO, 2021b).

Cancer treatment is needed over a long time, thus questioning affordability, as it incurs higher medicine costs (Faruqui et al., 2018; Islam et al., 2015). The cancer medicines approximated cost of treating an adult with colorectal cancer requires 32.5 days wages for the LPGW (Mattila et al., 2021). To treat a child weighing 30kg with Hodgkin's lymphoma and standard risk leukemia, a LPGW's 55-day's and 88- day's wages respectively is estimated as the cost of cancer medicines (Faruqui et al., 2018). The related costs for treating children with cancer such as the dosage of the medicine, supportive care needs, instances of infection, food, accommodation, and transportation depends on the weight and age of the child.

With monthly earnings of 70–285 USD, majority of families cannot bear the hefty expenses of treatment and thus abandon treatment (Islam et al., 2015). People cannot afford cancer medicines due to the rising cost of living, high inflation, and low income per capita. A study carried out in Pakistan revealed that cancer medicines were less affordable to patients from lower income brackets compared to those from higher income classes and because of high prices, prescribers were hesitant to prescribe new cancer medicines. (Sarwar et al., 2018).

In many LMICs, essential medicines including medicines for cancer treatment are unaffordable, even though medicines form most of the health care consumption (Cameron et al., 2009; Niëns et al., 2010). In Africa, majority of people use out-of-pocket payments for healthcare (Vanderpuye & Dadzie, 2016). Some manufacturers have no or very little competition, thus enjoying long periods of exclusiveness. This is often due to governments incomprehensible regard on this by giving patent rights and longer-term exclusiveness to foreign and national companies, and a pharmaceutical industry that depends on a patent system to protect the market at all costs. This leads to unexplainable huge profits, and a monopolistic system (Meyer et al., 2021).

1.10 Availability of cancer medicines in LMICs

A technical report by WHO revealed the very low availability of cancer medicines, with cancer medicines availability associated with high OOP payments by patients, for expensive medicines and targeted therapies in lower income countries (WHO, 2018b). A 2001 country-level survey by WHO showed only 22% of African countries had

available cancer medicines. In LICs and LMICs, a study reported that 57.7% and 32.0% respectively of cancer medicines were in the EML, only if full costs were being borne by the patients.

Countries, notably those in Africa, with lower national incomes suffered from low cancer medicines availability. The availability of expensive medicines, inclusive of targeted therapies is dependent on high out-of-pocket patient expenditures because of limited accessibility caused by unreliable supply and budget capitation as depicted in Ghana, Kenya, Bangladesh, India, Afghanistan, Burkina Faso, Myanmar, and Pakistan (Cherny et al., 2017; Faruqui et al., 2019; WHO, 2018b).

There is lack of 'free' quality cancer drugs in the public sector in LMICs, often the private sector with very high prices is where people are made to purchase their medicines (Cameron et al., 2009). The new medicines for treating cancer are not easily available in public and private sectors. There seems to be low availability for Lowest Priced Generics (LPGs) whilst the Originator Brands (OBs) are more prevalent, and there is less availability in the public sector in comparison to the private sector (Faruqui et al., 2019; Sarwar et al., 2018).

Reasons such as untrustworthy or nonexistent suppliers, ineffective supply chains, the nonexistence of cancer medicines on the EML, and budgetary limitations results in the low availability of medicines used to treat cancer, thus preventing cancer patients from having access to affordable treatment (Cherny et al., 2017; Vanderpuye & Dadzie, 2016; WHO,2018b). Some traditional inexpensive cancer medicines, e.g., cisplatin and tamoxifen were sometimes routinely unavailable mainly due to issues of governance, production, and supply (Cherny et al., 2016; Faruqui et al., 2018). Cancer medicines with limited availability may be favorably sold to countries offering bigger profits (Cherny et al., 2016). Thus, contributing to patients' inequity in accessing care and treatment (Cherny et al., 2017).

The notion of essential medicines is internationally known to be an instrument for improving the utilization of medicines and access to enhance the use of health resources cost-effectively. It guides countries to manage well healthcare services using inadequate resources and provides a means to maximize limited available resources (Wirtz et al., 2017). The careful choice of a smaller subset of essential medicines

contributes to improved care quality and better management of medicines. Countries are guided in the purchasing and supply processes by using an important tool such as the EML, leading to a reduction in health care costs to the patient and the health sector. The WHO's EML includes medicines considered to be not dangerous and efficient in addressing the healthcare system's requirements. The WHO EML is used by numerous countries in prioritizing medicines to be listed on the National Essential Medicines List (NEML). This is a fundamental step of enhancing access to all medicines including cancer medicines. Nonetheless, listing a medicine on the WHO EML does not mean it will be included in the NEMLs or ensure availability at the point of healthcare service delivery. (Robertson et al., 2016). The WHO EML conventionally lists generic hormonal and cancer treatments, however, novel, and more expensive cancer medicines are included in the revised EMLs, as data from clinical trials show their high efficacy even though their cost is high (Martei et al., 2018; Medicines Patent Pool, 2020; Shulman et al., 2016; WHO, 2019, WHO 2021a; WHO 2021b).

In 1977, the WHO produced the model list of essential medicines, which was supplemented in 2007 by the model list of Essential Medicines for Children (EMLc), to help countries and regional experts in the selection of quality, harmless, efficacious, and less costly medicines for NEMLs (WHO, 1977). The goal is to help define which medicines are essential, as countries create national formularies designed to meet the vital healthcare requirements of their populace (WHO, 1977). The national and subnational decision makers using the evidence provided by the WHO EML and EMLc, can set priorities for medicines with high value.

Choosing medicines for NEMLs helps to improve cancer outcomes. Currently, access to simple cancer medicines, such as traditional chemotherapies, is challenging for a lot of countries (Fundytus et al., 2021). As a result of these limitations, the WHO Expert Committee and the working group on cancer medicines have improved processes ensuring that only high valued medicines are listed on the WHO EMLs (Jenei et al.,2022). The EML is updated every 2 years and lists 62 cancer medicines categorized as hormonal treatments, antineoplastic agents, targeted therapies and immunomodulators (Jenei et al.,2022; WHO, 1977, WHO, 2021a; WHO, 2021b). Over 150 countries use this list to form their own list of national essential medicines.

Essential medicines should be readily available, of the right quality, and at affordable prices for the health system and individuals (Dare et al., 2023). The considerations underlying the EML includes burden of disease, health impact of the population, safety, efficacy, and its cost-effectiveness when compared to others. A fundamental principle of the EML is that medicines should not be excluded because of its price if it will enhance the population health or disease outcomes considerably (WHO, 1977, WHO, 2021a; WHO, 2021b). Thus, if a medicine is classified as essential in the WHO EML, there should be a reduction in price to make it accessible in high-priced markets (Jenei et al.,2022). In spite of this, an estimated 50% of cancer medicines included in the WHO EML were not available in LMICs in 2021 (Fundytus et al., 2021). Policies on essential medicines are vital in the attainment of sustainable development goals on health (Quick et al., 2002; Wirtz et al., 2017).

Listing is essential to guide public sector procurements to ensure availability of medicines even though it doesn't measure availability directly (Barr & Robertson, 2016). Studies conducted in 37 African countries and LMICs using the WHO EML showed that, thirteen and eighteen respectively was the number of cancer drugs listed on the NEML, and a significant number of countries did not have many cancer medications listed in the NEML (Barr & Robertson, 2016; Robertson et al., 2016; WHO, 2018b).

Cancer medicines listed in the National Medicines List (NML), are significantly linked with the annual health expenditure of governments, the number of doctors per 1000 population and the Gross National Income (GNI) per-capita (Robertson et al., 2016). Low economically developed countries especially in the LMICs showed minimal listings on their NML and discrepancies in the essential cancer medicines availability in formularies and their existent availability (Barr & Robertson, 2016; Robertson et al., 2016; Cherny et al., 2016; Cherny et al., 2017).

The cost of expensive novel cancer therapies contributed considerably to these variations (Kolasani et al., 2016). Decisions to include medicines in national or state formularies and for compensation is influenced by prices instead of its efficacy (Gelband et al., 2016; Howard et al., 2016). Some countries such as Botswana, still have lots of essential medicines even though they have resource limitations. Their cancer medicines in the NEML are aligned by 80·5% to the WHO EML and thus they may be in a good

position to ensure high value medicines are prioritized and included in the WHO EML (Martei et al., 2018).

A study conducted in 2011 at a Tanzanian cancer clinic encapsulates the conditions in numerous treatment facilities throughout Africa. Only approximately 50% of the prescribed medicines were available, resulting in over 70% of patients not receiving the drugs required from the clinic (Dent et al., 2017). Similarly, in Kenya, access to and the availability of cost-effective aromatase inhibitors are restricted, as well as ensuring quality and consistent supply of generic, low-cost tamoxifen to every patient (Dent et al., 2017).

As chemotherapy is given in hospitals, pediatric cancer medicines listed on the EMLc should be well stocked in hospital pharmacies. Low average availability (<80%) of cancer medicines in hospital pharmacies may be because of low demand for cancer medicines, suboptimal supply chain system, high costs of storage (like refrigerators), a poorly funded public health sector, and an inaccurate medicine demand forecasting (Faruqui et al., 2018; Prinja et al., 2015). There is need to improve medicine purchasing, distribution, and supply chain systems in public hospitals, to improve on the availability of essential medicines (Faruqui et al., 2018).

Medicine access programs and initiatives have been created by some manufacturers, but these seem to be for a short time, as catering to particular patient groups (Dent et al., 2017).

1.11 Data on cancer control, pricing, accessibility, or affordability

Overall, there is shortage of comprehensive information on the mortality and incidence of cancer in Africa. Publicly accessible data related to the availability of oncology medicines is scarce. The precise number of men, women, and children succumbing to cancer without proper diagnosis, treatment, early detection, or palliative care remains unknown. This is a big challenge in developing a pricing policy in Africa, that is an effective and visible. According to Global Initiative for Cancer Registries (GICR), only one in five LMICs have the information needed to influence the policy on cancer (WHO, 2018d).

In certain African countries, there is absence of population-based cancer registries providing precise data that could form the basis for solid national cancer control strategies and policies. As of 2014, only 2% of the continent's population was covered by registries compliant with the IARC standards, and there's evidence suggesting that certain cancers are underreported (Dent et al., 2017).

In Africa, there are very limited cancer registries, and few countries collect information on the necessary statistics, which is a limitation for assessing the cancer burden and allocation of resources (Parkin et al., 2012). The few cancer registries are usually situated in the urban areas, while most Africans dwell in countryside, and thus does not capture most of the rural statistics (Mikkelsen et al., 2015). In Ethiopia, a comprehensive cancer monitoring system is lacking, and population-based cancer registries are currently confined to the Addis Ababa region (FMOH, 2016).

Additionally, there is insufficient infrastructure to facilitate research on Africa's unique cancer situation, which would lead to a better understanding of the disease and inform cancer control strategies and support clinical trials to evaluate the effectiveness and safety of currently available cancer treatments in African patients and environments (Dent et al., 2017). For instance, cancer research in Ethiopia is hampered by insufficient funding and lack of training facilities for cancer research, a situation that does not correspond to the scale of the issue (FMOH, 2016).

A WHO Non-Communicable Disease (NCD) Country Capacity Survey was done to collect thorough data on the methods used by member countries in managing the NCDs with a focus on cancer control in 2015 (Maisonneuve & Martins, 2013). Out of 194-member countries, 177 participated in the survey. The study showed the variations and big gaps in how cancer was being controlled in the member countries. Majority of the member countries had policies to control cancer, and yet a lot of effort was expected to ensure the operationalization of these policies. The survey recommended that member countries should strengthen their national cancer registry and national health information structures. These were necessary for controlling cancer patterns, policy making, access to health and quality (Bangalee & Suleman, 2016).

To establish just and transparent pricing for cancer medications, it is essential to generate and supply strong, high-quality data (based on local epidemiological patterns)

on pricing interventions, affordability, and accessibility of cancer medicines. This data will aid decision-makers in determining a very effective pricing model for cancer treatments.

1.12 Socio cultural factors affecting cancer treatment

The advanced stage of cancer cases is mostly presented in health facilities, due to the attitude, limited knowledge, and the superstitious beliefs about cancer treatment and medications. Treatment efforts and access to medicines are often limited by sociocultural norms and traditions including employing native and/or spiritual resolutions (Vanderpuye & Dadzie, 2016).

Almost 90% of patients who completely discontinued hospital treatment instead sought out alternative therapies (Clegg-Lamptey, 2009a; Clegg-Lamptey, 2009b). Traditional and alternative medical providers represent a substantial portion of the healthcare system in Ghana. Traditional medicines, due to their accessibility, cost-effectiveness, and cultural significance, constitute a critical element of the health service delivery system. These practitioners often serve as the initial contact for many health concerns, frequently correlating with late-stage cancer diagnoses (Clegg-Lamptey, 2009a; Clegg-Lamptey, 2009b). The widespread belief in spiritual origins of chronic conditions and the cultural approval of traditional healers as authorities in conditions with spiritual roots underscore their role in cancer management (de-Graft Aikins, 2005; de-Graft Aikins et al., 2010).

Many women do employ spiritual and/ or traditional health care, as many cannot pay for the expensive cost of cancer medicines. They omit cycles of cancer treatment only to show up with more advanced cancer disease, as they return to seek the standard medical advice and healthcare (Okifo et al., 2021). Access to medicine is restricted in rural areas, where there are few or no pharmacies, thus people do self- medicate for longer periods sometimes running into years before consulting a physician. The lowest salary per day is about USD $2 in Ghana. Thus, the OOP payments on cancer medicines and care are very high and unaffordable, forcing most patients and their caregivers to find alternative healthcare from unconventional care providers such as herb doctors or divine healers resulting in delayed diagnosis, delayed treatment, and

treatment abandonment (Cherny et al., 2017; Mensah et al., 2021; Vanderpuye & Dadzie, 2016).

To address Africa's growing cancer crisis and provide African cancer patients with access to health care, African leaders and the international community must cooperate to devise lasting solutions, including having functioning pharmaceutical systems with pricing policies, based on pharmacoeconomic evaluation. This will ensure that those in need of cancer treatment get the appropriate medicines at affordable cost with good health outcomes.

1.13 Rationale of the study

The development of national policies and programs when based on facts can increase the affordability and availability of essential cancer medicines.

In LMICs, and especially in Africa, there is lack of cancer pricing data in various settings. The obstacles in obtaining accurate data on the prices of cancer medicine and its availability, hinders African governments from having cancer medicine pricing policies and programs. Another difficulty lies in assessing the comparability of medicines expenditures to that of similar countries. Because there is no foundational knowledge on which to start negotiations, purchasers of medicines cannot obtain less expensive deals. Most of the published studies on affordability, pricing and availability of cancer medicines are mostly on essential medicines, and some cancer medicine studies are conducted mostly in the developed countries and a few African countries. For the studies conducted in developed countries, there are different cultural, political, and socioeconomic perspectives, which cannot be generalized to Africa. Thus, it was necessary to conduct the study in South Africa and Ghana to provide price transparency, information on factors impacting on access and an evidence-based price comparison of oncology medicines.

Few studies have been done on pricing and cancer medicines accessibility in South Africa. The published studies includes; a) 'Towards a transparent pricing system in South Africa in pharmaceutical logistics fees' (Bangalee & Suleman, 2016), b) 'Medicine pricing interventions, the South African experience' (Gray, 2009), c) 'Pharmaceutical pricing in South Africa' which is a chapter in 'P*harmaceutical prices in the 21st century*'

(Gray & Suleman, 2015), and d)‘Evaluating the impact of SEP on medicine product withdrawal from the private healthcare market in South Africa’ (Naidoo & Suleman, 2021).

These studies conducted in South Africa did not show the cancer medicines affordability and pricing landscape in South Africa. Thus the research the assessed the factors of affordability and pricing impacting access to cancer medicines within the private sector.

Some studies have been done on the affordability, price, and availability of medicines in Ghana. A study conducted in Ghana during the PHD research study, evaluated ‘the essential medicines for treating childhood cancers, availability, price, and affordability’ (Mensah et al., 2021). This study was only on childhood cancer medicines and did not include adult cancer medicines.

Another study was conducted on ‘health system determinants of access to essential medicines for children with cancer in Ghana’ (Boateng et al., 2020). This study excluded adults and focused on access to pediatric cancer care. A public sector pharmaceutical pricing study was conducted in 2002 in Ghana (Huff-Rousselle & Azeez, 2002). This study was limited to the public sector and was conducted 21 years ago, thus necessitating the need to have a current pricing study that is comprehensive and involves all sectors of public and private.

A study from Ghana showed the cost effectiveness of cancer treatment for pediatrics in sub-Saharan Africa (Renner et al., 2018). This study did not include issues on availability, affordability, and access. It only focused on examining institution-level costs and how a pediatric cancer program in Ghana can be cost-effective.

In general, no published data is available, and very little has been done to comprehensively show the cancer medicines landscape in Africa including Ghana and South Africa. This research, to the best of the knowledge, was the first comprehensive national survey to be conducted in Ghana assessing adult’s cancer medicines pricing, affordability, availability, and access. The research also evaluated the pediatrics’ cancer medicines availability, affordability, and pricing due to the scarcity of information on what it cost to provide cancer medicines for pediatric programs. The cancer price component case study conducted in Ghana was to further broaden the knowledge on the factors affecting cancer medicines access.

The research conducted in South Africa also provided data on cancer medicines pricing, affordability in the South African private pharmaceutical sector.

The research findings will add to academic and scientific knowledge, expand the awareness and equity contemplations on factors affecting the availability, access, pricing, and affordability of oncology remedies globally especially in LMICs such as Ghana and South Africa. Emerging themes could lead to further research work and interventions. It is envisaged that the research findings will generate discussions among policymakers, academia, the pharmaceutical industry, civil society, and cancer care workers to find innovative ideas to develop and implement pharmaceutical policies, strategies, interventions, and pricing models to ensure access, availability, affordability, and equitable pricing of essential cancer medicines, which will enhance the quality of life and survival of cancer patients.

1.15 Aims and Objectives

The study's aim was to investigate the availability, affordability, and prices of cancer medicines and price components with a goal to enhance access to affordable medicines in South Africa and Ghana.

1.15.1 Objectives of study

1. To conduct a systematic review of literature in LMICs on access, affordability, pricing, and availability of cancer medicines.
2. To evaluate medicines for three common cancers (breast, prostate and colorectal), affordability and prices in South Africa using an adapted WHO/HAI medicines pricing methodology.
3. To conduct a scoping assessment of the pricing scenario in Ghana by interviewing key stakeholders.
4. To evaluate availability, affordability, and prices of oncology medicines in Ghana through a comprehensive survey with an adapted WHO/HAI methodology on medicines pricing.
5. To identify the price component costs of three cancer medicines (Epirubicin 50mg vial, Cyclophosphamide 50mg tab, Bevacizumab 400mg vial).

1.15.2 Research Questions

1. What price people pay for cancer medicines?
2. In separate sectors (public sector and private sector), are there differences in the prices and availability of the same medicines?
3. What is the change in availability and prices of medicines that are generically equivalent and the originator brands?
4. In the same sector, are there price differences between the type of products (e.g., generics and originator brands and)?
5. What is the comparison of international reference prices with national prices?
6. What is the change in prices of generic and originator brands cancer medicines?
7. What is the number of days' salary needed to offset the treatment cost for individual patients. For ordinary people, are the medicines affordable?
8. Are the chosen cancer medicines listed in the national list of essential medicines and are they readily available in the health facilities?
9. What are the factors influencing the availability, affordability, and accessibility of cancer medicines and what potential opportunities could enhance the accessibility, affordability, and availability of cancer medicines?
10. What are the duties and levies charged for cancer medicines and what mark-ups influence their selling and public sector prices.

1.16 Overview/Structure of the research

This PhD Thesis comprised of five phases as shown in Table 1 below. Below is the progress of these phases.

Table 1: Showing research phases, activities and progress made

Phases	Activity	Progress
Phase 1	• Systematic Literature Review of Cancer Medicines in LMICs.	Completed and published in Frontiers in Public Health.
Phase 2	• South African Pricing Study.	Completed. Published in BMC Health Services Research.
Phase 3	• Scoping assessment of the pricing scenario in Ghana by interviewing key stakeholders using a semi-structured interview guide.	Completed
Phase 4	• Ghana Pricing study.	Completed and published in PLOSONE.
Phase 5	▪ Case Study: Evaluating Price Components of three Cancer Medicines in Ghana.	Completed

CHAPTER 2: Systematic Review of the Literature

Chapter 2: Systematic review of literature

2.1 Introduction

In LMICs, a significant part of the populace faces constraints in accessing medications, due to either a lack of availability or the necessity for individuals to shoulder the expense of their prescriptions (Dent et al., 2017; Cherny et al., 2017; WHO 2018b). Without the support of governmental compensation, insurance plans, or any specialized access programs in LMICs, numerous patients are obliged to cover the financial burden of their treatment. This accordingly thrusts them into situations of hardship, impoverishment, or premature mortality (Dent et al., 2017; Cherny et al., 2017; WHO 2018b).

The ability for patients in LMICs to obtain drugs is hindered by governmental insufficiency in funding for drugs and structural deficiencies within the pharmaceutical field, affecting procurement and distribution. These issues lead to ineffective inventory management and perhaps less-than-ideal use of these medicinal products (WHO, 2018b). The prevailing pricing strategies, or absence thereof, have created significant fluctuations in the cost of cancer drugs both within a nation and among various regions (WHO, 2018b). A shortage of information regarding pricing or the affordability of these medicines stands as a substantial obstacle in crafting efficacious and transparent pricing regulations in LMICs. To achieve equitable and clear-cut pricing for cancer treatments, it is essential to establish systems that furnish dependable and high-quality information, directing the selection of the most suitable pricing framework for these critical medications.

Before developing effective strategies to enhance access to anti-cancer therapies, a comprehension of the elements influencing the access, pricing, affordability, and availability of cancer drugs is required. Even though some research has been conducted in various LMICs concerning these aspects, this information hasn’t been collectively examined or synthesized to present a comprehensive picture. It was noted that, there was no systematic review(s) done concerning the affordability, availability, and pricing of anti-cancer treatments in the context of LMICs. In this review, a methodical examination of the literature was undertaken with the goal of offering a

broad perspective on the access, pricing, affordability, and availability of anti-cancer medications in the existing literature within the framework of LMICs

2.2 Methods

This systematic review was registered with the International Prospective Register of Systematic Reviews, PROSPERO and was assigned the following registration number, CRD42020214365 (National Institute of Health Research [NIHR], 2020).

2.2.1 Search Strategy

The guidelines set forth by the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines for conducting systematic reviews were adhered (Moher et al., 2009). The search was carried out in May 2020 across six distinct databases, specifically: Medline/CINAHL EBSCO, PUBMED, Web of Science, Google Scholar, Springer Link, and Scopus, to locate published scholarly articles in the English language. Articles released between January 2015 and May 2020 were incorporated into this review. The search key terms were availability, affordability, prices, pricing, cancer medicines, cancer medication, anticancer medicines, oncology medicines, low-income countries, developing countries, middle-income countries, LMICS, access, and accessibility, namely, (availability AND affordability AND prices OR pricing AND cancer drugs OR cancer medication OR anti cancer drugs OR anti cancer medicines OR oncology medicines OR oncology drugs AND (low-income countries or developing countries) AND middle income countries OR LMICS AND Access or Accessibility).
An earlier search was performed using PubMed Advanced Search Builder - Medline, CINAHL to supplement the 2020 search findings, employing key terms such as; (Availability AND Affordability AND Prices OR Pricing AND Cancer Drugs OR Cancer Medication OR Oncology Medicines OR Oncology Drugs OR Anti Cancer Medicines OR Anti Cancer Drugs AND Low Income Countries AND Middle Income Countries). In the course of this search, "Boolean Operator" principles were applied. The terms were linked using 'AND' to merge the specified keywords, and 'OR' was used to eliminate redundant search results where feasible.

Various permutations and combinations of the above-mentioned search expressions were utilized. Additionally, the references of the obtained articles were examined to uncover pertinent articles that might have been overlooked during our initial searches.

2.2.2 Inclusion/Exclusion Criteria

Studies that focused on the aspects of availability, affordability, accessibility, and pricing were deemed suitable for inclusion (that is, the criteria that a study needed to meet to be incorporated into the systematic review), in line with the subsequent definitions found in scholarly literature. Affordability was understood as the capacity to buy a required amount of a product or degree of service without incurring excessive financial strain. Consideration for affordability also encompassed an evaluation of the product's worth, contextualized within the budgets of healthcare systems and an assessment of whether products are economically feasible in each country, considering various financial elements (Cherny et al, 2017; Niëns et al., 2012; Tordrup et al., 2020; WHO, 2018b; WHO & HAI, 2020).

Availability: This refers to the patient's ability to secure, either without charge or for a specified cost, a pharmaceutical item that appears on the national list of approved medicines (Tordrup et al., 2020; WHO, 2018b). Price: This term encompasses the individual elements of cost, whether apparent or calculated, along the supply chain starting from the manufacturer, passing through the distributor and service providers, and ending with the patients. Pricing also pertains to the amount disbursed by various entities such as the government, wholesalers, retailers, other buyers, and end-users to obtain the medications (Tordrup et al., 2020; WHO, 2018b).

Access/Accessibility refers to the capability of a person to obtain care when required (Wirtz et al., 2016). Low and Middle-Income Countries: In the context of the 2021 fiscal year, low-income economies are classified as those having a GNI per capita of $1,035 or less in 2019, as determined using the World Bank (WB) Atlas method. Lower-middle-income economies fall within the range of a GNI per capita from $1,036 to $4,045, while upper-middle-income economies are defined as those with a GNI per capita spanning from $4,046 to $12,535 (WB, 2021).

Inclusion criteria encompassed: (a) investigations concerning the availability of anti-cancer drugs; (b) studies into the affordability of anti-cancer medications; (c) studies of the pricing structure for anti-cancer treatments; (d) assessments of the accessibility of anti-cancer therapies; (e) research within the context of LMICs (WB, 2021); (f) works published as original scholarly articles; (g) studies released between January 2015 and May 2020, focusing on the most pertinent and up-to-date information reflecting the present conditions in various nations; (h) studies written in English; (i) research for which the complete text is accessible. The search was confined to original research articles that were featured in peer-reviewed academic journals.

Exclusion criteria: Items such as magazines, review articles, editorial correspondence, lectures, and other forms of publication that failed to supply pertinent data or any of the results specified in the Inclusion criteria were omitted. Additionally, any articles that were not obtainable in their complete text form were also excluded.

2.2.3 Quality Assessment

To eliminate bias within the research, a rigorous choosing process for the articles was employed, adhering to recognized guidelines (Higgins et al., 2020) and predetermined inclusion parameters to guarantee trustworthy data. The Newcastle-Ottawa Scale (NOS), a tool for evaluating the quality of non-randomized studies, was applied to assess the caliber of the studies included (Wells et al., 2021). The title and summary of all sourced articles were scrutinized for pertinence and inherent validity. Distinct portions of research findings were independently verified for both inclusion and exclusion. The ultimate selection of studies relied on an agreement within the review team, and the key features and results of each study were catalogued. If any uncertainty or disagreement arose concerning a paper, it was resolved through team dialogue, leading to a collective agreement. A meta-analysis was not part of the original plan; instead, a narrative summary was crafted to delineate the principal discoveries and outcome measures of the included studies.

2.2.4 Screening and Data Extraction

The preliminary findings were gathered into a spreadsheet, and summaries were reviewed to identify studies that qualified. The abstracts of all articles chosen in the initial step were examined for their importance to the study. Any duplicate entries were discarded. Subsequently, the findings were subjected to peer review to rectify typographical errors, sentence structure, and line arrangements. All papers deemed possibly suitable were fully read to ascertain their relevance based on the inclusion criteria, and whether the study concentrated on pricing, affordability, availability, and access to anti-cancer medications in LMICs.

In the phase of full-text scrutiny, any research that did not satisfy the inclusion parameters was omitted. Information drawn from the studies had specifics such as the title, author, publication year, time frame for sample size, data collection, study specifics, methodology/assessment, key insights, outcome metrics, and the study's primary discoveries. The qualified full-text articles were finalized following consulting with the review team and input into the data extraction form. All the studies that were included were catalogued in the analysis, complemented by summaries of their principal features.

2.2.5 Analysis of the studies

A systematic review of the literature was conducted to guarantee that the narrative synthesis formulated was drawn from the most comprehensive compilation of relevant literature available. The articles underwent a thematic analysis and pertinent subcategories were established for scrutiny until no further themes were discerned, and saturation was considered to have been achieved. By employing the outcome categories forged through this analysis, the cost, availability, affordability, and accessibility of anti-cancer drugs in each included study category was described.

2.3 Results

A search across six electronic databases in early May 2020 produced a total of 9,516 articles, consisting of 9,494 abstracts, along with 22 additional abstracts from a supplementary search conducted at the end of May 2020. After removing 3,000 duplicates and excluding 6,429 abstracts due to unclear titles, abstracts, or research subjects (as depicted in Figure 1), 87 articles were pinpointed as potentially pertinent to the review goals, and their full-text versions were acquired. Out of these 87 potential articles, 44 were ruled out, and the remaining 43 full-text articles were thoroughly evaluated for suitability based on specified criteria and in accordance with the Cochrane guidelines (Higgins et al., 2020). Following the implementation of the inclusion and exclusion criteria, 13 studies were ultimately selected by the review team for qualitative analysis.

In total, 13 studies were incorporated into the review, a few of them with multiple outcomes. Specifically, five studies (Cuomo et al., 2017; Faruqui et al., 2019; Kolasani et al., 2016; Salmasi et al., 2017; Shrestha et al., 2020) focused on the pricing of anti-cancer medicines, four studies (Faruqui et al., 2019; Goldstein et al., 2017; Islam et al., 2015; Sarwar et al., 2018) explored the affordability of anti-cancer medicines, five studies examined (Cherny et al., 2017; Faruqui et al., 2019; Robertson et al., 2016; Sarwar et al., 2018; Shrestha et al., 2020) the availability of anti-cancer medicines, and four studies (Barr & Robertson, 2016; Cherny et al., 2017; Moye-Holz et al., 2018; Sruamsiri et al., 2015) investigated access to anti-cancer medicines.

Table 2 presents the correlations among the incorporated studies, an outline of the employed methodologies, primary discoveries, and outcome categories that emerged from this analysis related to pricing, availability, affordability, and access to cancer treatment drugs.

The evaluation of quality reveals that several of the criteria were inapplicable due to the types of studies incorporated in the review. Components like exposure verification, outcome selection, and outcome evaluation were prevalent in almost all the studies, while comparability was deemed non-applicable. The quantity of records incorporated and omitted at every phase was documented in a PRISMA flowchart, in accordance with the guidelines (Moher et al., 2009).

Figure 1: Research Selection Process Diagram - PRISMA 2009 Flow Chart (Moher et al., 2009)

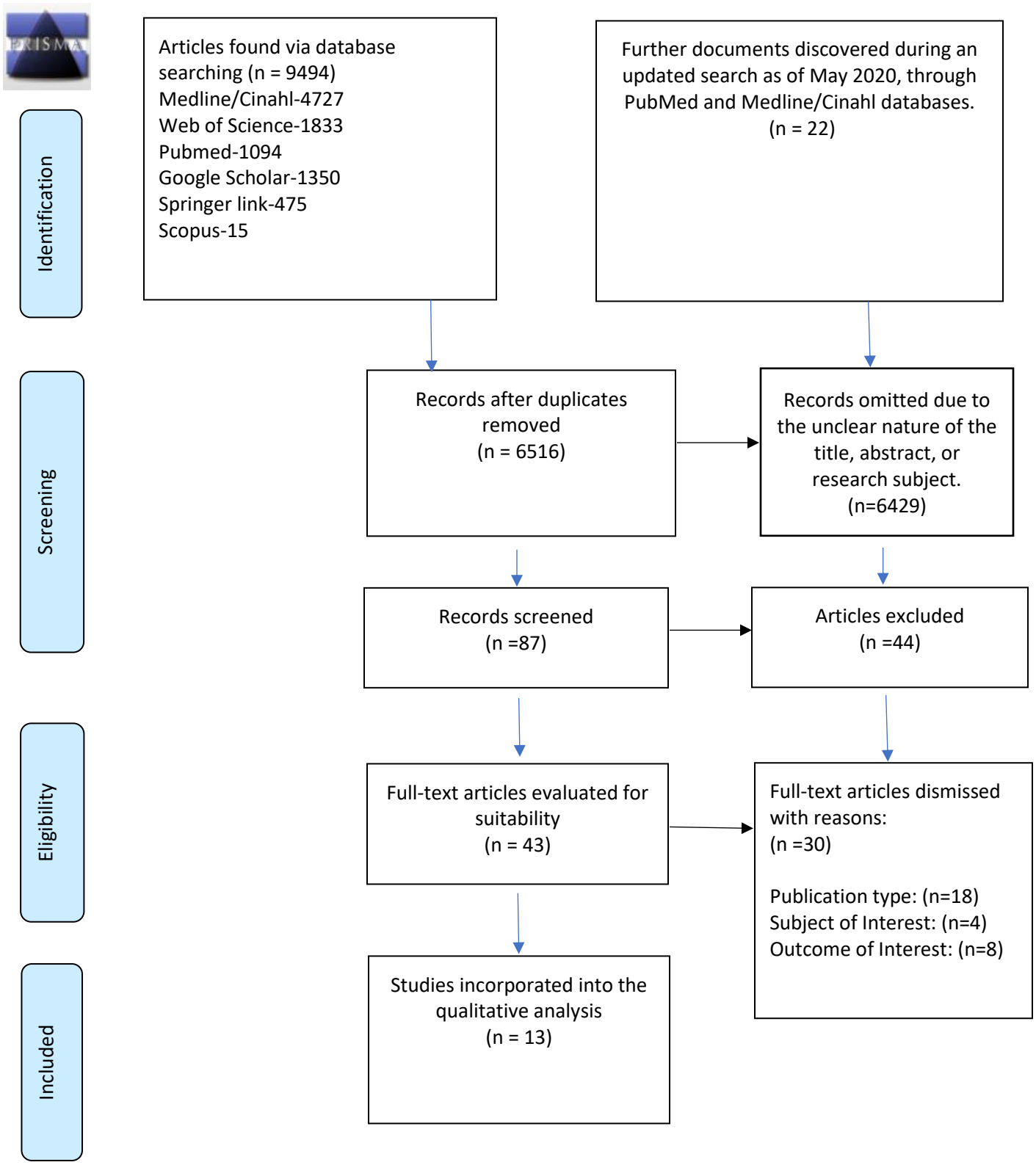


Table 2: Systematic literature review qualitative synthesis (Study details and findings)

Reference	Treatment\ Population\ Sample Size	Study Details	Method\Assessment details (assessment of accessibility, availability, costs)	Outcomes /Variables Measured	Main Findings of the Study
Goldstein et al., 2017	Eight patented cancer medicines: pemetrexed, bevacizumab, bortezomib, dasatanib, erlotinib, imatinib, trastuzumab, and rituximab.	Research Article Cross-sectional Survey.	The costs for a set of eight selected cancer medicines, all of which had established prices in all seven evaluated countries, were changed to US dollars utilizing forex rates and Purchasing Power Parity (PPP). To gauge global variations of wealth, data on Gross Domestic Product (GDP) per capita and average salaries were gathered. They assessed the affordability landscape of these cancer medicines by relating the prices of these medicines to the	Affordability	Cancer medications in India are markedly least affordable. Even with prices lower than those in the USA, cancer medicines are less affordable in MICs compared to HICs. Implementing differential pricing could be a feasible strategy to assure international accessibility and affordability of greatly effective cancer treatments.

			indicators of wealth, such as GDP per capita and average salaries.		
Cherny et al., 2017	Data obtained from 63 countries	Research Article. Cross-sectional survey	Internet-based questionnaire to assess (i) the global availability of a national formulary of authorized anti-cancer drugs, (ii) the out-of-pocket expenses for patients acquiring these medicines, (iii) the practical obtainability of the medicine for a patient bearing a legitimate prescription, (iv) data pertaining to potential factors negatively affecting the obtainability of cancer-fighting drugs, and (v) the influence of a country's economic progression status of these parameters.	Availability, Access/Accessibility.	There is a noteworthy gap in the availability of anti-cancer drugs in LMICs, with particularly limited access to newer, more costly targeted therapies compared to HICs. In LMICs, 32.0% of EML drugs are only accessible at full price and 5.2% are entirely unavailable. For low-income countries, these figures rise to 57.7% and 8.3% respectively. There exists a broad international variation in terms of formulary availability, out-of-pocket expenses, and the practical availability of most licensed

					cancer medications. Even for drugs listed on the WHO EML, the differences are largely due to high costs incurred out-of-pocket. Overall, LMICs and LICs report worse accessibility. The primary obstacles to accessibility include an unreliable or entirely lacking supplier, or budget constraints.
Kolasani et al., 2016	The analysis considered 23 medicines spanning six distinct categories, offered in 52 separate formulations.	Research article. Observational study The study was done in south India's tertiary care teaching hospital.	The pricing data for cancer drugs produced by various manufacturers, each with similar dosage and form, was extracted from the most recent 'Current Index of Medical Specialties' (CIMS) edition. An analysis was conducted on the disparity between the highest and lowest prices for the same medication across different brands. The	Pricing, Price Variations.	The average percentage differences in pricing across diverse brands of identical anti-cancer drugs, each with the same dosage and form, manufactured in India are considerably vast. The most significant price variability was observed with hormonal cancer drugs, reaching up to 714.24%, while the smallest variation was

			percentage variation in pricing was subsequently determined.		seen in targeted anti-cancer drugs, with a mere 5.56%.
Cuomo et al., 2017	Acquisition prices for 19 national and global purchasers, which covered a total of 29 countries, were gathered from Management Sciences for Health (MSH).	Research article. Longitudinal analysis.	Analyses were carried out on the median procurement prices (buyer price) for essential cancer medicines included in the WHO EML as per the MSH (procurement dataset). Price fluctuations were examined with respect to time/date of procurement, location, type of cancer medicine, price differences in relation to a country's disease burden, GDP, and other therapeutic medications. Comparisons were also made between generic versus branded drugs, and different dosage forms.	Pricing.	Substantial disparities were observed in costs paid across nations, regions, individual drugs, and categories of medications. In particular, nations within the African region seemed to pay a higher amount for a set of essential cancer drugs than their counterparts in the Latin American region.

Faruqui et al., 2018	Information regarding 33 essential anti-cancer medications was gathered from seven medical facilities (comprising three private, four public institutions and 32 dispensing pharmacies operating in the private sector).	Cross sectional study Research survey based on the WHO/ HAI Method.	Information on the presence and cost of 33 essential anti-cancer medications was gathered from a study that included seven medical facilities, of which four were public and three were private, as well as 32 pharmacies in the private sector.	Availability, Affordability, Price.	The majority of essential anti-cancer medicines were accessible, although they fell short of the WHO's goal of 80% accessibility. Despite medicine prices in New Delhi being relatively lower compared to International Reference Price (IRP), the financial burden of chemotherapy treatments appears to be substantial in the indigenous context. The average accessibility of essential anti-cancer medicines was calculated to be 43% in public hospital pharmacies, 38% in private retail pharmacies, and 71% in private hospital pharmacies.
Salmasi et al., 2017	This study utilized data on the retail prices of cancer	Cross-sectional survey. Research article.	Information related to pricing, along with the mean unit costs of 26 anti-cancer medication	Pricing	Significant discrepancies exist in the pricing of cancer medicines across the chosen countries and

	medications from ten nations, spanning regions such as the Western Pacific, South-East Asia, and the Eastern Mediterranean.		presentations (uniform in pharmaceutical form, potency, and packaging size) attuned for Purchasing Power Parity (PPP), were employed to juxtapose the prices of anti-cancer treatments in three geographical areas.		within their respective geographical areas. A direct correlation was observed between the economic status of the countries and the average unit price; lower-income countries having low average unit prices.
Shresta et al., 2020	The fluctuation in prices was evaluated for 31 anti-cancer drugs, classified into six main categories, within the two oncology hospitals in Nepal.	Research article Cross sectional study	The cost assessment for diverse brands of identical anti-cancer drugs found in the pharmacy departments of two oncology hospitals was carried out. Cost computations for various dosing forms were performed. The discrepancy between the highest and lowest prices for the same medication produced by different pharmaceutical	Pricing, Availability.	The most substantial price variations were observed in drugs from distinct categories. While the Nepalese government has set price controls for certain drugs, including anti-cancer treatments, this regulation is insufficient as many anti-cancer medicine prices remain unregulated. Therefore, additional approaches are necessary to manage the

			companies was identified, and the percentage difference in cost was calculated.		inconsistent pricing of anti-cancer drugs in Nepal. Additionally, 7 medicines that were included in the National essential medicines list for Nepal were not stocked in either of the hospital pharmacies.
Islam et al., 2015	Expenses encountered by 50 families with children undergoing treatment.	Research article. Cross sectional study	An analysis of expenses borne by 50 families with children under treatment was carried out at the Medical University Hospital in Dhaka. The treatment regimen for all patients was adjusted. Every family was instructed to keep and present all invoices for medications purchased from pharmacies, diagnostic tests, and hospital procedures (like lumbar punctures and bone marrow sampling), transportation, meals, and	Affordability	The fundamental expenditure for each family's treatment amounted to 3234 USD. A total of 33% of families had a monthly income less than 71 USD, while 51% earned between 71-285 USD and merely 16% surpassed the 285 USD threshold. This data implies that 84% of these families survived on a daily income of 2 to 9 USD. During the duration of this investigation, there was a 16% rate of treatment abandonment; of these cases, 62% were reportedly due to the

			lodging. Blood and blood product transfusions were charged at a standard hospital rate.		families' inability to shoulder the financial burden.
Sarwar et al., 2018	All participants (n = 4400) were aged 18 years or older.	A descriptive, cross-sectional survey	The study was conducted across 22 oncology institutions (18 state-run hospitals and 4 private hospitals) and 44 private drugstores in Punjab, Pakistan, with the aim of determining the accessibility of 40 anti-cancer drugs in both private and public sectors, as well as their affordability for patients from high-, middle-, and low-income classes. The selection of the medications was guided by three criteria: (a) an initial study where local demands and the burden of cancer were evaluated, (b) a review of	Availability, Affordability.	In terms of accessibility, both OBs and LPGs were found more frequently in pharmacies and private hospitals, as opposed to public hospitals. OBs, while more easily available at a rate of 52.5%, had a lower affordability index of 53.4%. On the other hand, LPGs were less available, showing a rate of 28.1%, but proved to be more affordable with a rate of 67.9%. The affordability of anti-cancer medications was greater among high income earning patients as compared to those with low incomes.

			existing literature, and (c) advice from various specialists.		
Robertson et al., 2016	NMLs for 135 countries (comprising of 26 LICs, 42 MICs, 44 upper MICs, and 23 HICs) were matched against the World Health Organization's EMLs from 2013 and 2015.	Longitudinal study	NMLs for 135 nations, each with a per capita GNI under $25,000 in 2015, were contrasted with the 2013 and 2015 Model Lists of Essential Medicines from the WHO. Relationships between government health spending, the number of cancer drugs included in the national lists and the GNI, and the number of physicians per 1000 population were scrutinized.	Availability	A frequently revised WHO Model List of essential medicines for cancer could offer direction to nations, especially those classified as LMICs, regarding the most beneficial drugs that should be given priority for acquisition and use. There are significant quantities of anti-cancer medications included in the national lists of these LMICs.
Barr & Robertson, 2016	Information was gathered on 18 essential and eight supplementary antineoplastic medications in the	Research Article Cross sectional study	The objective was to investigate the inclusion of antineoplastic drugs, listed in the SIOP and EML, in the NEMLs and NRMLs. Correlations between the quantity of listed drugs and	Access	Significant disparities were observed in the antineoplastic drugs deemed essential within NEMLs and NRMLs. The correlations with Gross National Income per capita and the

	NEMLs or National Reimbursable Medicine Lists (NRMLs) of 135 nations with a GNI per capita less than US $25,000.		various financial GNI per capita and annual government health expenditure per capita) and labor force characteristics (like the number of physicians per 1000 individuals) were also evaluated.		density of physicians were statistically noteworthy; however, the same wasn't true for the Annual Government Health Expenditure per capita.
Sruamsiri et al., 2015	The 2013 Thai National List of Essential Medicines (NLEM) includes two drugs (letrozole and imatinib), while three other medications for the same indications, namely trastuzumab, nilotinib, and	Research article. Longitudinal study	Chosen specialized cancer treatments were evaluated, with a focus on identifying policies and initiatives aimed to boost their access in Thailand. The usage of targeted cancer therapies was assessed using quarterly sales data from pharmaceutical companies and hospitals.	Access	The government, insurance providers, and drug manufacturers in Thailand have adopted a comprehensive approach to enable access to specialized cancer treatments for the population. As the access policies were put into action, there was an increase in the usage of these medicines and the number of patients treated.

	dasatinib, are not listed.				
Moye-Holz et al., 2018	Eight patented medications in Mexico: bevacizumab, dasatinib, imatinib, nilotinib, rituximab, sorafenib, sunitinib, and trastuzumab.	Drug utilization research method. Cross sectional study	Research techniques related to drug consumption were employed to evaluate the usage of eight patented cancer drugs. Data regarding the volumes of these drugs used across social health insurance institutions in five different regions and all public health facilities and was gathered via the national transparency platform. This data was then converted into the measure of Defined Daily Dose (DDD) per 1000 people per year.	Access	Obstacles to obtaining and utilizing innovative cancer treatments are associated with restricted support by public insurance programs, their presence in the EML, their accessibility at healthcare centers, and the presence of current clinical guidelines. Over the previous six years, consumption of eight cancer drugs has grown in Mexico, while usage of five has stagnated because of inadequate insurance coverage. Geographic disparities in the use of state-of-the-art cancer treatments underscore

					the unequal access to cancer care services.

2.3.1 Pricing of cancer medicines

Five studies (Cuomo et al., 2017; Faruqui et al., 2019; Salmasi et al., 2017; Shrestha et al., 2020; Kolasani et al., 2016) examining the cost of both adult and pediatric oncology drugs demonstrated considerable price discrepancies among various countries (Cuomo et al., 2017; Faruqui et al., 2019; Salmasi et al., 2017; Shrestha et al., 2020) and regions (Cuomo et al., 2017; Salmasi et al., 2017). Countries in Africa typically have to pay more on essential cancer medicine packages compared to Latin American countries (Cuomo et al., 2017). Price fluctuations were observed across individual and drug categories (Cuomo et al., 2017, Shrestha et al., 2020) and between different brands (Faruqui et al., 2019, Shrestha et al., 2020), for instance, the largest variation was seen in hormonal cancer medicines (714.24%) whereas targeted cancer medicines had the smallest variation (5.56%) (Kolasani et al., 2016). The procurement cost of infectious disease and cardiovascular medications is significantly less than the median cost of cancer drugs (Cuomo et al., 2017). As an example, the lowest median price was noted for allopurinol (n = 17; M = USD $ 6.40) and the maximum median price was observed for trastuzumab (n = 3; M = USD $1800.00) (Cuomo et al., 2017; Salmasi et al., 2017). The median expense for a cancer medication package was USD $12.63, with a range from USD $0.03 to USD $5250 (Cuomo et al., 2017).

A study depicted that the average unit cost for most medications exceeded USD $ 1000. When applying PPP-adjusted average unit costs, the three priciest drugs were cabazitaxel (USD $11,832·93), trastuzumab 440 mg (USD $4779·35), and panitumumab (USD $4146·99). Conversely, the three least expensive cancer medications were lapatinib ditosylate (USD $40·08), pazopanib disodium heptahydrate (USD $52·20), and imatinib (USD $56·92) (Salmasi et al., 2017).

An additional study calculated the treatment costs for a 30 kg child with standard risk leukemia and Hodgkin’s lymphoma to be USD $442 and USD $278, respectively (Faruqui et al., 2019). It was found that five anti-neoplastic OBs were priced 1.2–1.4 times higher than their most popular and LPG equivalents. The pricing disparity between public and private institutions was apparent (Faruqui et al., 2019, Shrestha et al., 2020). Consumers were observed to purchase medications in the private sector at rates 1.3 and 2.0 times higher than government prices and consumer prices, respectively (Faruqui et al., 2019). The Median Price Ratio (MPR), a measure comparing the local median unit price of a medicine to the median unit price outlined

in the MSH 2015 IRP Indicator Guide (MSH 2015), was applied. The MPR values for the most sold generic, LPG, and OB of pediatric anti-neoplastic medications were 0.74, 0.71, and 1.00 respectively, all of which are <4. This suggests that cancer drugs in India are more affordable compared to global standards (Faruqui et al., 2019), since an MPR of 1 signifies that the medication's price is equivalent to the IRP (WHO & HAI, 2020). Another cross-sectional study found a correlation between the price of cancer medicines and the income category of the country, for instance, cancer drug prices in LMICs averaged at USD $814.07, while in High Middle-Income Countries (HMICs), the average was USD $1150·63 (Salmasi et al., 2017).

2.3.2 Affordability of cancer medicines

Four studies (Faruqui et al., 2019, Goldstein et al., 2017; Islam et al., 2015; Sarwar et al., 2018) demonstrated that from the viewpoint of individual income (i.e., patients' income level and average wage) (Faruqui et al., 2019, Islam et al., 2015; Sarwar et al., 2018), anticancer medications are less accessible in LMICs compared to HICs, which was assessed based on the national economic factor of GDP per capita (i.e., a measure calculating a country's economic production per individual) (Goldstein et al., 2017). Utilizing global indicators of wealth, like the monthly GDP per Capita at the Purchasing Power Parity (PPP), provided by the International Monetary Fund (IMF), a study (Goldstein et al., 2017) found that in India, China, and South Africa, prices were unaffordable compared to all HICs, including even the United States where costs were noticeably elevated.

A recent study indicated that individuals with higher incomes had better access to anti-cancer medications than those with lower income levels, and LPGs (67.9%) were more financially accessible than the OBs (53.4%). Medications such as cytarabine, fluorouracil, mercaptopurine, methotrexate, mitomycin, and tamoxifen were found to be the most economical LPGs for low-income patients (Sarwar et al., 2018). Affordability investigations on pediatric anti-cancer drugs (Faruqui et al., 2019, Islam et al., 2015) revealed that the number of working days required for a daily wage laborer to finance cancer treatment varies based on the treatment plan and condition. For example, a day laborer earning a lowest wage of 318 Indian Rupees (INR) would need to labor for 88 days (for the most commonly sold price) and 100 days (for the maximum retail price) to afford medications for standard-risk B-cell precursor acute lymphoblastic leukemia in the private retail sector. For a child

diagnosed with early-stage Hodgkin's lymphoma, the cost of medication equates to 55 days' earnings (for the most commonly sold price) and 67 days' earnings (for the maximum retail price), respectively (Faruqui et al., 2019). Based on per capita income calculations, the expense of chemotherapy amounts to 23% and 14% of per capita income for acute lymphoblastic leukemia and early-stage Hodgkin's lymphoma, respectively (Faruqui et al., 2019). The study also revealed that over 84% of families were subsisting on between USD 2 and USD 9 daily (Faruqui et al., 2019). In Bangladesh, the rate of treatment abandonment for children with acute lymphoblastic leukemia was 16%, with many families (62% out of the 16%), citing reasons of unaffordable high cost of cancer treatments as the cause for the treatment abandonment (Islam et al., 2015).

2.3.3 Availability of cancer medicines

Five studies reported (Cherny et al., 2017; Faruqui et al., 2019, Robertson et al., 2016; Sarwar et al., 2018; Shrestha et al., 2020) on the availability of anticancer medicines. Some studies (Faruqui et al., 2019, Sarwar et al., 2018) reported higher availability of anticancer drugs in private hospitals (71%) compared to public hospitals (43%). Moreover, OBs (52.5%) were more frequently available, while LPGs (28.1%) were less common, and new anticancer medicines were seldom found in either sector (Faruqui et al., 2019, Sarwar et al., 2018). For instance, the availability was highest for fluorouracil (97%), etoposide (95.5%), methotrexate (95.5%), and tamoxifen (95.5%) among the OBs; while gemcitabine (81.1%), bleomycin (56.1%), and doxorubicin (56.1%) had the highest presence amongst LPGs in the study settings (Sarwar et al., 2018).

Another research study publicized that the mean availability of anti-neoplastic medications across hospital and retail pharmacies together was 70%. Certain strength-specific medicines not found in any pharmacy were accessible in different dosages and strengths, which were not on the EMLc (for instance, an alternative strength of 20 mg was available for daunorubicin). The average availability of anti-neoplastic drugs was reported to be 43% in public sector hospital pharmacies and 71% in their private sector counterparts (Faruqui et al., 2019).

One research revealed significant discrepancies between the listed availability and actual availability of several anticancer drugs. In LMICs, 32.0% of EML drugs are only accessible at their maximum price, and 5.2% are completely unavailable. The

scenario is even more dire for low-income countries (LICs), with respective figures of 57.7% and 8.3% (Cherny et al., 2017). The most striking absence of availability was observed in economically less-developed countries, notably in LMICs. Medicines stated in the WHO EML were sporadically available at a decreased price for patients, or only accessible at full price as an out-of-pocket expense, with many being entirely unavailable. This is attributed to the expensive nature of newer, targeted agents approved in the past decade, the absence of commercial or supplier interest, budget limitations, as well as inconsistent supply chains, as evidenced in Bangladesh, Ghana, India, Kenya, Myanmar, Pakistan, Afghanistan, and Burkina Faso (Cherny et al., 2017, Faruqui et al., 2019).

Other research indicated a substantial presence of anticancer medicines in the NEML of LMICs (Robertson et al., 2016; Shrestha et al., 2020). The median count of anticancer drugs from the Model Lists that were included in the NEMLs of 37 African nations in the study was relatively modest. For instance, out of the 25 anticancer medicines from the 2013 Model List and the 16 incorporated through the 2015 update of the Model List, 1-23 (median: 13) and 0-14 (median: 1) respectively, were listed in national registries, in contrast to the corresponding value for HICs which was ten (Robertson et al., 2016).

There was considerable variation in the number of medicines included in the NEML across different income brackets. A consistent pattern emerged, with more medicines being listed as the GNI per capita increased. The median count of medicines was at its lowest in the African region, which included 20 of the 26 LMICs participating in the study. The percentage of countries listing each of the 18 essential antineoplastic drugs also varied widely, for instance, thioguanine was listed by only 27% of countries, whereas methotrexate was listed by a substantial 95%. A negligible correlation was observed between the Annual Government Health Expenditure (AGHE) per capita, and the number of essential medicines listed. However, there were strong correlations between the inclusion of medicines and the number of physicians per 1,000 population as well as with GNI per capita (Robertson et al., 2016).

2.3.4 Access to cancer medicines

Research on accessibility has shown significant discrepancies within income categories regarding what is classified as essential in NEMLs and NRMLs (Barr & Robertson, 2016; Moye-Holz et al., 2018). One study examined the accessibility of 18 essential and eight ancillary antineoplastic medicines, as proposed by the International Society of Pediatric Oncology (SIOP) to be vital for supporting children with cancer, across 135 LMICs. The outcomes of this research underscored the gaps in the NEMLs and NRMLs, highlighting the need for improvements in the accessibility of effective antineoplastic medicines for pediatrics with cancer in LMICs (Barr & Robertson, 2016).

Another study revealed that in countries like India, Bangladesh, Ghana, Kenya, Myanmar, Pakistan, Afghanistan, and Burkina Faso, accessibility was notably poor, with patients bearing the burden of out-of-pocket expenses even for generic anti-cancer drugs included in the WHO EML (Cherny et al., 2017). The primary obstacles to accessibility were either the absence of a reliable supplier or fiscal limitations. The expense and feasibility of recent anti-cancer treatments largely contribute to the unequal access to these medications (Cherny et al., 2017).

Studies (Barr & Robertson, 2016; Moye-Holz et al., 2018) have undoubtedly shed light on disparities in obtaining cancer treatment. Obstacles to obtaining and using of novel cancer medicines are associated with inadequate support by public health insurance programs, exclusion from the EML, the lack of these drugs at healthcare centers, outdated medical protocols, and variations across different income brackets as indicated by NEMLs and NRMLs.

Another investigation (Sruamsiri et al., 2015) detailed the strategies and programs implemented by various participants within the healthcare system to promote availability of specialized cancer treatments, leading to a substantial number of patients receiving cancer medications.

Different pharmaceutical firms have collaborated, developed competencies, and launched access programs such as expanded Patient Assistance Program (PAP) or Patient Support Program (PSP), as well as pricing reductions. These typically offer some level of price reduction or contribution directly to the patients participating in the program. Numerous companies declared that they do not plan to apply for or enforce patents in certain low-to-middle income countries and have begun negotiations for future licensing deals for cancer drugs with the Medicines Patent

Pool (MPP). Companies like AstraZeneca, Novartis, and Roche have initiated access programs for 11 cancer medicines on the WHO Model Essential Medicines List (Oomen & Karuranga, 2017; Sruamsiri et al., 2015). Moreover, the government ensured varying coverage stipulations and social protection plans for payers, issued mandatory licenses, unique marketing agreements, while the payers discussed costs with producers and participated in collective purchasing (Sruamsiri et al., 2015). Another study discussed various policy and program strategies adopted by various stakeholders within Thailand's healthcare system to enable better availability of targeted cancer treatments. Although letrozole has been listed on the NLEM since 2004, its high price meant only a limited number of patients could be treated with it as hospitals couldn't bear the cost. The introduction of a Compulsory License in September 2007 and the E2 access program in March 2008 increased its accessibility, as reflected by its increased utilization over time. Pharmaceutical firms introduced unique marketing strategies to ease access to trastuzumab, including "Buy 3, Get 1 Free" offers, providing free medication to all patients under the Universal Coverage scheme aimed at the poor, and a 50% price cut for patients in the private sector social security scheme. This reduced treatment costs for patients paying out of pocket while waiting for decisions from the NLEM committee (Sruamsiri et al., 2015).

2.4 Discussion

This systematic review provides a comprehensive summary of the last five years' published research on the pricing, affordability, availability, and access to cancer medicines in LMICs. The expansive scope of this review offers critical insights and evaluation of the following topics: The extensive price discrepancies identified in the studies (Cuomo et al., 2017; Faruqui et al., 2019; Kolasani et al., 2016; Salmasi et al., 2017; Shrestha et al., 2020) may stem from various factors such as patent protections, monopoly markets for new entities, regulatory challenges, taxes and tariffs, geographic positioning, income level, and an absence of domestic price control measures. Geographic positioning might serve as a potential influencer of price fluctuation, considering that different health systems are paying diverse prices for the same medicine (Cuomo et al., 2017). Divergences in guidelines from various countries' medical regulatory authorities and their pricing policies contribute to the diverse medicine prices across different countries (Kolasani et al., 2016). The presence of generic medicines in the market could have impacted the prices set by the original manufacturer in some countries, whereas in others, the prices of originator drugs remained high (Faruqui et al., 2019). Governments ought to spearhead programs that encourage physicians to prescribe generic medications, enhance transparency in pricing, and enable patients to explore and compare costs for more affordable medication options (Faruqui et al., 2019).

In several developed nations, price control strategies like External Reference Pricing (ERP) or International Reference Pricing (IRP) have been extensively adopted by legislators to establish a standard to limit medicine expenditures (Rémuzat et al., 2015). A record of the 2015 anticancer drug prices by MSH according to the WHO's 21st edition of the EML (MSH, 2015), is the lone procurement instrument within the grasp of the pricing specialists in LMICs. Nevertheless, additional aid is required, such as a revised WHO EML section devoted to anti-cancer drugs, complemented by international pricing data and procurement guidelines (Salmasi et al., 2017). Enhanced clarity in price information across countries could facilitate negotiations between buyers and providers within nations. Knowledge on the incidence of more affordable medicines in neighboring countries could potentially stimulate policy decisions and administrative actions at national levels to bring down prices (MSH, 2015).

Affordability can be defined in terms of the number of days' wages the unskilled LPGW has to invest to purchase a course of medicine treatment (WHO & HAI, 2020). An alternative way to define affordability is by comparing medicine prices to international measures of wealth such as GDP per capita (Goldstein et al., 2017). In LMICs, where out-of-pocket healthcare expenses are prevalent, it is more common to use the individual patient's income as a measure (Faruqui et al., 2019; Islam et al., 2015; Sarwar et al., 2018). Assessments of affordability often factor in individual income, average wages, and GDP per capita, showing consistent results across these metrics (Gelbrand et al., 2016). The term unaffordability can also be used to indicate the portion of a population that is either already beneath the poverty line or would be pushed below it due to the cost of acquiring the medicine (Niëns et al., 2012).

The levels of affordability for anti-cancer medicines vary significantly across the globe. Those with high incomes generally have the capacity to afford these medicines, while those with lower incomes struggle. These treatments are less affordable in LMICs compared to HICs, with affordability being lowest in countries like India (Goldstein et al., 2017; Sarwar et al., 2018). These disparities are primarily attributed to lower wealth levels in MICs. As a result, a strategy of tiered pricing could be employed to guarantee worldwide affordability (Goldstein et al., 2017). However, making precise comparisons of affordability across countries is complex, due to variations in public reimbursements for medicines or whether the cost burden falls on individuals (Goldstein et al., 2017).

The feasibility of affording chemotherapy remains a significant concern, as the treatment often demands a prolonged duration, thereby resulting in substantial cumulative medication expenses (Faruqui et al., 2019, Islam et al., 2015). The projected expenses for chemotherapy drugs required to treat a 30 kg child diagnosed with standard risk leukemia or Hodgkin's lymphoma would demand 88 and 55 days of wages, respectively, for the lowest-paid government employee (Faruqui et al., 2019). For a patient with high-risk acute lymphoblastic leukemia, the costs could ascend to a staggering 244 days' wages if medications were acquired at the highest retail price (Faruqui et al., 2019). Expenses associated with pediatric cancer treatments hinge on the patient's age and size, determined medication dosage, the necessity for supportive care, costs associated with infection episodes, and expenses for food, accommodation, and travel. Families with a monthly income

between 70-285 USD are often unable to afford the steep treatment costs, resulting in a significant reduction in overall family income and premature discontinuation of treatment (Islam et al., 2015).

The cost of generic medicines listed on the WHO EML (Mayor, 2015; WHO, 2020) is frequently unaffordable in most LMICs (Eden et al., 2019). Existing EML policies neglect geographic and therapeutic class attributes that can directly influence procurement terms and subsequently impact the affordability of essential cancer medicines (Cuomo et al., 2017). Smaller and less affluent countries often possess limited bargaining power; hence, affordability typically exhibits a negative correlation with market size and GDP per capita (Van Harten et al., 2016). Heightened inflation, low income per individual, and the escalating cost of living are among the numerous barriers obstructing individuals' ability to afford anti-cancer medication (Faruqui et al., 2019, Islam et al., 2015).

The concern with lack of affordability underscores the imperative need to establish policies that assure fair affordability, optimize procurement and supply systems in both the public and private sectors to minimize costs to families in LMICs. Long-term sustainability requires financial strategies such as differentiated pricing, low-cost insurance plans, medication price reductions, patient-access programs, tax incentives, joint public-private initiatives, changes in patent regulations, and national health strategies (Faruqui et al., 2019, Islam et al., 2015). Among LMICs, countries including Egypt, El Salvador, Indonesia, Malawi, Palestine, Sudan, Uganda, Vietnam, and Zambia, stand out as outliers for providing essential anticancer drugs at reasonable cost. This suggests the presence of effective models in governance and public health management that could potentially be replicated (Cherny et al., 2017).

While it is crucial for healthcare systems to seek optimal value for money, a strategy primarily focused on cost reduction might compromise patients' access to effective treatments and potentially diminish incentives for innovation (London School of Economics, 2016). To guarantee the affordability of anti-cancer medications, the correlation between price and health outcomes should be bolstered through schemes that incentivize innovation while maintaining a financially sustainable healthcare system. Achieving these calls for joint efforts and cooperation involving governments, donors, the pharmaceutical industry, the International Society of Pediatric Oncology (SIOP), the WHO, the Union for International Cancer Control

(UICC), international agencies, and Non-Governmental Organizations (NGOs) (Islam et al., 2015; London School of Economics, 2016; Saltz, 2015).

Though not a direct gauge of accessibility, including pediatric anti-cancer medications in NEMLs and NRMLs represents a critical initiative in directing the procurement and acquisition of crucial anti-cancer treatments for the public sector (Barr & Robertson, 2016). A considerable amount of anti-cancer treatments made it into the NMLs of LMICs (Robertson et al., 2016). The inclusion of these new medications in national lists showed significant correlations with GNI per capita, yearly government health expenditure, and the number of physicians per 1000 population (Robertson et al., 2016). Nations with reduced economic progress, especially those classified as low and middle-income, including African countries, had a smaller range of anti-cancer drugs included in their NEML (Cherny et al., 2017, Robertson et al., 2016; Barr & Robertson, 2016).

Significant imbalances exist between the listed availability and the actual accessibility of vital anti-cancer medications. These imbalances could stem from the high costs associated with new and expensive cancer-fighting agents (Cherny et al., 2017; Kolasani et al., 2016; Robertson et al., 2016; Barr & Robertson, 2016). The hindrance to impact is minimal when curative measures only necessitate traditional anti-cancer drugs, rather than novel molecularly targeted therapies or costly agents. However, even some conventional and inexpensive cancer drugs, like tamoxifen and cisplatin, are not consistently accessible, often due to issues with governance, production, and distribution (Cherny et al., 2017, Faruqui et al., 2019). Progress in enhancing patient outcomes relies on the accessibility of costly anti-cancer medications, which are attainable in the world's richest countries and at considerable personal cost in the least economically developed nations (Cherny et al., 2017). Medicines that are in limited supply may be selectively sent to countries that provide more lucrative profit possibilities, resulting in a severe imbalance in access to both treatment and patient care (Cherny et al., 2017).

While it doesn't directly indicate availability, the process of listing is a vital preliminary action, informing procurement in the public sector and subsequently the obtainability of anti-cancer drugs (Barr & Robertson, 2016). There was significant inconsistency in the designation of essential antineoplastic agents in the WHO's model EML (Cherny et al., 2017). Several anti-cancer drugs suggested in the WHO's Model EML are listed (Robertson et al., 2016), whereas others are not found in the NEML and NRML

in a substantial portion of countries (Barr & Robertson, 2016). They are accessible solely at full price as a direct personal expenditure, and their availability is restricted due to inconsistent supply, as observed in countries like Bangladesh, Ghana, India, Kenya, Myanmar, Pakistan, Afghanistan, and Burkina Faso (Cherny et al., 2017). Steps should be taken to regularly update NEMLs as they are crucial instruments for prioritizing medications and guaranteeing their accessibility (Robertson et al., 2016, Barr & Robertson, 2016). Some studies highlighted high availability for OBs and typically limited availability for LPGs, with private sector healthcare settings showing a higher availability of cancer drugs compared to the public sector, and scarce availability of new cancer drugs in both sectors (Faruqui et al., 2019; Sarwar et al., 2018). Since hospitals are the primary sites for administering chemotherapy, all pediatric anti-cancer drugs included in the EMLc should ideally be stocked by hospital pharmacies. Yet, these public hospital pharmacies exhibited a low average availability, (<80%) (Faruqui et al., 2019; Shrestha et al., 2020) likely due to inefficient supply chain systems, imprecise medicine demand forecasts, or insufficiently funded public health sectors (Prinja et al., 2015). The sparse availability of essential drugs in public hospitals underscores the need to refine drug procurement, distribution, and supply systems. Limited demand for anti-cancer drugs and high storage costs (such as refrigeration) connected with storing these drugs may explain their scarce presence in the dispensaries and retail pharmacies (Faruqui et al., 2019).

Four studies (Barr & Robertson, 2016; Cherny et al., 2017; Moye-Holz et al., 2018; Sruamsiri et al., 2015) have revealed that hurdles to the utilization and accessibility of groundbreaking cancer drugs are tied to restricted coverage by public insurance programs (Moye-Holz et al., 2018), their exclusion from the EML (Barr & Robertson, 2016), the unavailability of the drug at healthcare facilities, and outdated clinical guidelines (Barr & Robertson, 2016; Moye-Holz et al., 2018; Sruamsiri et al., 2015). The development of new anticancer treatments is accelerating (Buckland, 2016). Nevertheless, the substantial costs attached to these advancements are often unaffordable for patients and healthcare systems, thus hindering access to new cancer treatments (Cherny et al., 2017). Making new and improved treatments more affordable and available demands ongoing revisions of therapeutic protocols, drug lists, the SIOP EML, NEMLs, and NRMLs. This task is managed by the anti-cancer drug review committee, and it forms a crucial part of the strategy to enhance

accessibility in LMICs (Faruqui et al., 2019; Barr & Robertson, 2016; Sruamsiri et al., 2015).

The usage and accessibility of certain anti-cancer medicines have seen improvements over time; however, these improvements remain uneven across different insurance plans and regions (Oomen & Karuranga, 2017). Monitoring the consumption of medications serves as an indirect gauge of medicine access, facilitating comparisons across diverse contexts (such as insurance systems, healthcare coverage, and geographical areas) (Oomen & Karuranga, 2017). Geographical location can be a hurdle to obtaining cytotoxic drugs, and these regional variations might be attributable to variations in disease prevalence, purchasing ability, healthcare system capacity, disease priorities, budget, and resource allocation for innovative cancer treatments (Cuomo et al., 2017, Oomen & Karuranga, 2017). The decentralization of healthcare is a necessity to make treatments more accessible to patients and to enhance equitable access to affordable cancer treatments, thereby improving health outcomes (Moye-Holz et al., 2018; Oomen & Karuranga, 2017).

Over 80% of a cancer patient cohort encountered obstacles in accessing innovative medications, which could potentially offer superior treatment results. The access impediments included geographical location, inequality among insurance plans, healthcare coverage (pertaining to the type of medicine and cancer medication), regional disparities, and institutions (with private institutions offering more per insured population than the Ministry of Health) (Moye-Holz et al., 2018). Such barriers might be attributed to variations in disease incidence, budget, and resources, buying power, discrepancies in healthcare system capabilities, and prioritization of diseases (Cuomo et al., 2017; Elseviers et al., 2016; Moye-Holz et al., 2018). The minimal average government health expenditure per capita in numerous countries, such as Myanmar, implies potential challenges with public sector procurement (Barr & Robertson, 2016). These elements ought to be considered when nations evaluate formulary choices, negotiate terms of medicine procurement, and when creating health and cancer policies (Cuomo et al., 2017). Comprehensive policy and program strategies that involve variety of stakeholders (government bodies, funders, and pharmaceutical firms) such as effective resource distribution (Moye-Holz et al., 2018), healthcare decentralization, patient aid initiatives, distinct marketing strategies, and enforcing obligatory licenses for

procurement can pave the way for equitable access and usage of cost-effective cancer treatments (Moye-Holz et al., 2018; Oomen & Karuranga, 2017; Sruamsiri et al., 2015). Through multisector partnerships and Medicines Access Programs (MAPs), pharmaceutical companies have the potential to enhance access to the continuum of cancer care in LMICs (Oomen & Karuranga, 2017). MAPs enable access to medications that are not publicly funded, and it is at the discretion of the pharmaceutical companies (Sruamsiri et al., 2015). While MAPs are extensively operational, there is an unequal access with some offering medications free of charge, some offering discounted rates, and some initiating cost-sharing arrangements between the patient and the pharmaceutical company (Oomen & Karuranga, 2017; Sruamsiri et al., 2015). These challenges point to a requirement for a standardized and enforced policy to resolve issues with MAPs.

Enhancing accessibility to innovative treatments, which have confirmed efficacy, safety, and cost-effectiveness, will lead to superior cancer care, improved health results, and a reduction in cancer-related fatalities (Wahlster et al., 2015).

Additional scrutiny and critique of the incorporated studies revealed that a comprehensive analysis of individual country's healthcare systems was lacking, which could have clarified the implications of price discrepancies in relation to accessibility to cancer drugs, governmental or public expenditure, and patient adherence (Islam et al., 2015; Salmasi et al., 2017). The inaccessible confidential discount prices were also an issue as the studies were grounded on officially announced ex-factory prices, leaving potential savings for payers unexamined (Islam et al., 2015; Salmasi et al., 2017). Retail prices were used, which consider additional costs such as taxes and distribution fees, but the absence of extensive data on these extras meant that the potential areas for price reduction remained unidentified (Salmasi et al., 2017).

The studies were marked by small sample sizes for pricing data, an absence of analysis on the variation in prices among formulations involving drug combinations and no analysis of independent variables. Additionally, there was an absence of analysis that compared the costs of various anti-cancer medications produced by diverse manufacturers. (Cuomo et al., 2017; Faruqui et al., 2019). The lack of scrutiny on price discrepancies across various medicine formulations, including combination therapies and other individual variables further hindered the

understanding of pricing structures and comparison across different manufacturers of anti-cancer drugs (Cuomo et al., 2017; Faruqui et al., 2019).

The investigations evaluating the affordability of anti-cancer medicines have certain shortcomings, mainly, the failure to consider additional economic elements that could impact the cost-effectiveness of these drugs (Faruqui et al., 2019, Islam et al., 2015; Sarwar et al., 2018). Assessing monthly expenditures (Goldstein et al., 2017; Sarwar et al., 2018) might be less relevant than considering the complete cost of treatment (Faruqui et al., 2019, Islam et al., 2015). The choice of countries studied, which was not randomized, restricts the capacity to generalize these findings globally (Faruqui et al., 2019; Goldstein et al., 2017; Islam et al., 2015, Sarwar et al., 2018).

There are certain constraints associated with the studies focusing on the availability of medicines. Specifically, these studies may not accurately reflect the fluctuating patterns of medicine availability since they were based on single-time data collection from healthcare facilities. A more comprehensive understanding of availability could be achieved via a long-term study rather than a snapshot-like cross-sectional study (Faruqui et al., 2019, Sarwar et al., 2018). For some countries, the EMLs or NRMLs were either not accessible, outdated, or more recent versions might not have been included in the sources utilized (Barr & Robertson, 2016). Additionally, these studies failed to probe into the real-world availability of the medicines detailed on national documentation or registers pertinent to cancer-specialized facilities in each studied country (Robertson et al., 2016).

Several constraints were observed in the studies regarding access to medicines. One such study (Barr & Robertson, 2016) suffered from unavailability or outdated versions of EMLs or NRMLs for some countries, potentially omitting more recent versions of these documents. This gap in essential document availability could impede access to efficient antineoplastic treatments in the concerned nations. Another study (Moye-Holz et al., 2018) was restricted to a limited selection of innovative cancer drugs, disregarding the broader treatment protocol. Future studies should concentrate on entire treatment regimens to enlighten stakeholders and policymakers about the existing conditions and highlight possible hurdles to access. In another study (Sruamsiri et al., 2015), the discrepancy in the approximated number of treated patients based on product volumes sold could be due to shifts in treatment routines over time, general market expansion, or intricacies in supply

chains and inventory management. Ongoing research is necessary to address the obstacles to obtaining these medicines at both individual and system levels.

2.5 Limitations of the literature review

The research was restricted to literature published in English, thereby excluding any publications in other languages. Relevant conference abstracts were also omitted from the systematic search. The limited number of articles (13) incorporated in the qualitative analysis curbed the capacity to draw broad and comprehensive deductions. The focus on publications from the previous five years was intended to underscore the most pertinent data reflecting current circumstances in various countries and to avoid obsolete, less applicable, and unreliable data, albeit this restriction did narrow the pertinent population. Lastly, the review selection only included articles from peer-reviewed journals, with gray literature being disregarded. This was done to maintain a high standard of academic precision through the peer-review process. Notwithstanding these limitations, the review yields significant revelations about the pricing, availability, access, and affordability of cancer medications in LMICs.

2.6 Conclusion

This systematic review brings together recent original research around the subjects of cancer drug pricing, availability, affordability, and accessibility in LMICs. The findings reveal significant disparities in the cost of cancer treatments across LMICs, posing financial challenges for low-income patients. Obstacles to accessing and utilizing cancer treatments are tied to their high cost, inadequate public insurance coverage, exclusion from EML, and limited or no availability at healthcare facilities. This review also underscores the knowledge gap concerning the pricing of cancer medications in Africa and other developing regions. It demonstrates that the undertaken investigations have distinct focal points, with some having multiple themes and outcomes. None of the studies, however, covered all four dimensions - pricing, affordability, availability, and access. Given these emerging themes and observed limitations, it is crucial to encourage further research that thoroughly addresses the issues of pricing, availability, affordability, and access to anti-cancer medications in LMICs, particularly in Africa.

CHAPTER 3: Methods

Chapter 3: Methods

3.1 Research Design

3.1.1 Introduction

This chapter begins with an exploration of the philosophical perspective and the theoretical framework that underpins the research. Here, I will explain the essence of research, the research design, strategies, and various research methods, along with their benefits and drawbacks. An important part of this discussion will be their potential to produce valid findings that align with the goals of the thesis, which in turn justifies the research methodology employed for the study. The structure of the study, selection strategy, methodology, and practices for data analysis, used to fulfill the aims and address the research questions specified in Chapter one, are elaborated upon.

The first goal of the study was to execute a systematic literature review of original research papers focusing on the availability, affordability, access, and pricing of cancer drugs in LMICs. The review revealed that cancer drug prices and availability in LMICs show broad variations across different medicine brands and countries. It also revealed that these medications are often unaffordable for patients with low income, which can result in treatment discontinuation.

The foundation of the thesis emerged from the systematic literature review, I published (Ocran Mattila et al. 2021), which is detailed in the second chapter of the thesis, as well as a desk review of existing publications on the subject. The nature of the research was exploratory, correlational, and explanatory, employing a structured approach to data collection and organization. The research was practical in nature, aimed at resolving specific problems, with the results intended to inform decision-making processes.

The field of natural sciences revolves around exploring the physical universe, while social sciences focus on studying human behaviors, perceptions, relationships, and societal structures (Mansfield, 1980; Regoli 2019). Scientific research is the process by which scientist study various phenomenon using systematic methods of collecting, analyzing, and interpreting data. It can also be defined as any organized endeavor aimed at contributing to universal knowledge (expressed as theories, principles, or declarations about associations) (Casarett et al., 2000). It is a search for knowledge to discover hidden truths and can result in novel additions to existing understanding. The data for this endeavor may come from various sources like

personal experiences, human interactions, literature, the natural world, and so forth (Gounder, 2012). Depending on the purpose of research, scientific research can be grouped into three categories: exploratory, descriptive, and explanatory.

A sub-specialty has been emerged within health services research, referred to as pharmacy practice research. This subfield employs an evidence-based methodology to study various aspects of pharmacy. It seeks to investigate the expenses associated with pharmacy services, the reasons and ways people utilize these services, the patient outcomes stemming from these services, and a comparative analysis of these costs and results with those of identical or similar services offered by other providers. The primary objective of this research domain is to inform evidence-based policy-making and practical decisions in scenarios where medications are prescribed or utilized, and where pharmacists are engaged in the process (Babar, 2015).

Research can be categorized from three angles, according to Gounder (2012): the application of the research study, the objectives motivating the research, and the mode of inquiry used. In terms of application, social research falls into two categories: basic research and applied research (Gounder, 2012; Regoli 2019).

Basic research, also referred to as pure, fundamental or academic research, is essentially the seedbed for virtually all scientific concepts and principles (Regoli 2019). Its focus lies in creating and expanding new ideas, principles, and theories (Mohajan, 2018). Pure research is dedicated to formulating and testing theories and hypotheses that pose intellectual challenges to the researcher, regardless of whether they hold any immediate or future practical relevance.

The knowledge acquired from pure research is to be added the existing pool of research methods (Gounder, 2012). It offers a thorough and systematic insight into a problem, facilitating the extraction of scientific and logical interpretations and conclusions. It plays a pivotal role in forging new territories of knowledge. The results of basic research form the bedrock for a multitude of applied research endeavors (Gounder, 2012).

Applied research is an investigation aiming to provide answers to specific problems, with the findings used to influence decisions. Applied research is used to tackle precise, practical issues, facilitate policy creation, administration, and enhance understanding of a phenomenon. It leverages established theories and principles to solve problems (Gounder, 2012). While it can be exploratory in nature, it typically

takes a descriptive approach. It is primarily built upon the foundations laid by basic research (Gounder, 2012). A significant portion of experimental research, case studies, and interdisciplinary research predominantly constitute applied research (Gounder, 2012).

The table 3 presented below outlines the distinctions between the basic and applied research.

Table 3: Comparison of basic and applied research (Neuman, 2014; Surbhi, 2018)

Basis for Comparison	**Basic Research**	**Applied Research**
Definition	It focuses on the expansion of current scientific knowledge.	It is used to propose solutions to issues.
Nature	Theoretical	Practical
Primary Audience	Intellectuals	Non-researchers
Utility	Universal.	Only to the issues of the research.
Research consistency	High level of consistency.	Variation and moderation in its consistency.
Assessors	The assessment is conducted by researchers.	Evaluation is conducted by administrators and specialists.
Purpose	To establish a rational and confirmable body of knowledge	To develop methodologies and strategies for addressing issues.
Impact	Academic writing and publications	Direct implementation in solving issues.
Goal	To provide additional knowledge to the current ones	To resolve practical issues.

Additional forms of research include action research (which involves data collection aimed at enhancing action quality within the social world), explanatory research (which seeks to elucidate events and phenomena, for instance, answering why things are the way they are), exploratory research (which is about acquiring more information on a specific subject), and comparative research (which is focused on recognizing similarities and contrasts between events, methodologies, techniques, etc.) (Gounder, 2012).

Depending on the research goals, research can be categorized as:

Descriptive: This type of research methodically attempts to illustrate a circumstance, issue, phenomenon, or service, or to outline attitudes towards a specific topic.

Correlational: Correlational research aims to identify or establish the presence of an association or interplay among two or more elements of a situation.

Explanatory: Explanatory research is used to elucidate the reasons and mechanisms behind an association involving two or more facets of a condition or phenomenon.

Exploratory: Exploratory research is utilized to study a domain where knowledge is sparse or to examine the potential for conducting a specific research investigation (feasibility analysis/preliminary study).

Most research endeavors are a blend of the first three types. Two approaches are used to find solutions to issues or respond to research questions:

Unstructured approach: This approach is often classified as qualitative research. It allows adaptability in all phases of the research process. It is more suitable for examining the characteristics of a problem, issue, or occurrence without providing a numerical measure (Gounder, 2012).

Structured approach: This approach is typically categorized as quantitative research. The entire research process, including objectives, design, sampling, and the questions asked to respondents, is pre-established. It is more advantageous for quantifying the degree of a problem, issue, or event, for example, determining the number individuals affected by a specific problem or the number of people holding a specific viewpoint (Gounder, 2012).

I used the structured approach for the research process of defining the objectives, the research design, and the research methodology.

3.1.2 Research philosophy

A research philosophy shows how the research should be carried out with ideas about reality and the type of knowledge (Collis, 2013). An awareness of the pre-understanding and how this could influence the research questions helped to minimize the effect of pre-conceptions and assumptions to enhance understanding (Dahlager & Fredlund, 2008).

As a researcher i needed to grasp and articulate views about the essence of reality, what can be learned about it, and the methods for acquiring such knowledge. These principles form research paradigms. A research paradigm is a collection of fundamental beliefs and agreements among scholars regarding the appropriate understanding and approach to problems, guiding research activities (Kuhn, 1964; Guba,1990). A paradigm is a foundational belief system and theoretical framework that encompasses assumptions concerning ontology, epistemology, methodology, and methods (Rehman & Alharthi, 2016)

It is worth noting that the philosophical underpinnings of research are often concealed, and researchers should strive to be more explicit about their philosophical stance (Creswel, 2014). The term "worldviews" is often used to describe what others refer to as paradigms, epistemologies, and ontologies (Mertens, 2010; Crotty, 1998). Research paradigms can be described as follows:

Ontology:

What is the nature of existence? (Guba,1990). The type of our beliefs about reality. The ontological question will cause a researcher to find out about the type of reality that exists: A single, certifiable reality and truth or socially made multitude of realities (Patton, 2002, p. 134; Richards, 2003, p. 33).

Epistemology:

How do you know something? (Guba,1990). Epistemology is the branch of philosophy that studies how individuals understand 'existence' or 'reality' and the theory about the creation of knowledge (Liamputtong& Ezzy, 2005). It is a philosophical field that investigates the essence of knowledge, the way knowledge is acquired, and how it is verified (Gall, et al., 2003, p. 13). Epistemological questions lead a researcher into discussions around possibilities of seeking generalizability, subjectivity, objectivity, causality, and validity (Patton, 2002, p. 134).

The epistemological viewpoint must logically stem from the researcher's ontological beliefs to ensure methodological robustness and alignment (Liamputtong & Ezzy, 2005; Lincoln & Guba ,1985). Various epistemologies define what should be recognized as knowledge, the validity of such knowledge, what separates knowledge from belief, the sorts of things that can be known, and indeed whether anything can be definitively known (Donyai, 2012). The driving force behind research methodology is epistemology, which ultimately shapes the kind of data the research produces (Baber, 2015).

The epistemology of the quantitative approach for the research was based on the belief that the research quantifiable data will be used to generate reliable, valid, and generalizable conclusions which gives an objective representation of the research results.

Methodological considerations:

This involves using a well framed theoretically grounded approach to generate data (Ellen, 1984, p. 9). How to go about finding it out? (Guba,1990). It denotes the in-depth study and detailed analysis of data generation strategies. It is the process, plan, strategy, design that guides the choice of research methods (Crotty, 1998, p. 3). It shows how a type of research should be conducted (Grix, 2004, p. 32). The researcher is guided in choosing what type of data is needed for the study and what instruments are suitable for data collection and for accomplishing the research study. Methodological questions direct the researcher to question how to carry out the research study. The research was done using an adapted WHO/HAI methodology (WHO&HAI, 2020) to determine factors on pricing, affordability, availability, and access to cancer medicines.

The method (s) employed for a research project is dependent on the project's design and the researcher’s theoretical mindset. These refer to specific procedures for gathering and interpreting data, such as utilizing questionnaires or conducting unstructured interviews.

There are three primary styles to educational research namely positivism, interpretivism and critical theory. When researchers use different frameworks, the results will not be understandable (Patton, 2002), p.134). Knowing a researcher’s ontological and epistemological beliefs will enable a good understanding of the value and relevance of the study.

The research study used the positivism approach.

Positivism: This indicates that reality exists independent of human perception. It isn't influenced by our sensory experiences and is ruled by absolute laws. The ontological stance of positivists aligns with realism. Positivists strive to understand the social realm in a similar fashion to how they interpret the natural world, aiming to establish the cause-and-effect relationships between phenomena with certainty, which can then be extrapolated to predict future outcomes (Rehman & Alharthi, 2016). Regardless of time or place, diverse researchers will converge on the same understanding of a particular phenomenon (Rehman & Alharthi, 2016). Positivism is based on deductive reasoning approach to test a hypothesis. Positivism is a method grounded in empirical evidence, wherein the researcher is expected to remain detached from the subjects, their context, and their surroundings. Positivists allude to the laws governing social phenomena, which by the application of scientific methods, can generate laws which can be presented in factual statements (Gall et al., 2003). The positivist researcher obtains knowledge via the unbiased gathering of information. Within the interpretative framework, the emphasis is on cultivating a comprehensive comprehension of a particular scenario, and thus the potential to generalize findings to create a theory is viewed as secondary (Lincoln & Guba, 1985).

As a result, positivists aim for a far greater level of generalizability in their results. Positivist research commonly yields numerical data. Employing a quantitative strategy to portray and scrutinize characteristics of social reality aligns with the positivist epistemology. This perspective assumes the constancy of social reality's traits over time and different environments. It posits that a specific attribute can be isolated, conceptualized as a variable, and can adopt varying values as an entity. These values can be depicted as numerical scales (Gall et al., 2003, pp. 19-20). Researchers adhering to positivist philosophy utilize quantitative data to respond to research inquiries and build theories using data procured via bona fide experiments or less stringent quasi-experiments, standardized assessments, and extensive or narrow surveys employing fixed-response questionnaires. Numerical data derived from these methodologies undergo either descriptive or inferential statistical evaluation. Per the positivist viewpoint, research is considered high quality if it embodies internal validity, external validity, reliability, and impartiality (Guba & Lincoln, 1994). When the researcher verifies that the dependent variable was

influenced solely by the independent variable, not any extraneous factors, it demonstrates the study's internal validity. The ability to extrapolate the findings indicates its external validity. If various researchers, working at different times, places, and contexts, carry out the study and achieve identical outcomes, the study possesses reliability. Researchers who objectively study a phenomenon without allowing their biases to interfere illustrate objectivity.

Post-positivism:

post-positivist research operates under the assumption that there is a potentially observable and measurable objective reality that exists independently ("out there") (Cresswel, 2014). This paradigm acknowledges that "reality is imperfect," and accommodates the prejudices that may emerge from social exchanges, or the manner in which research is carried out (Watjana, 2016). Positivists believe that research may sometimes be value-laden, with significant biases kept under control. When researchers themselves are part of the study and can influence the outcomes, it is considered to be laden with values. Therefore, the postpositivist paradigm is deemed to be an optimal approach to describe the predetermined aspects, suggesting the study to employ a survey or other quantitative methods (Winit-Watjana, 2016).

Constructivism: This perspective is often paired with interpretivism, resting on the belief that individuals possess their own personal interpretations of reality, which primarily exist in the mind of the observer. The observer determines what is real based on their individual perceptions (Cresswell, 2014; Jonassen, 1991).

Transformative: This philosophical perspective highlights the wants of individuals and groups in the society who may be sidelined or alienated. The aim of transformative research is to initiate a social or political change to be of benefit for the alienated groups (Cresswell, 2014).

Pragmatic: The pragmatic perspective is frequently associated with mixed-methods research due to its independence from any specific philosophical system or reality (Cresswell, 2014). It is primarily concerned with the research problem and employs whatever tools or methods necessary to gain insight into the problem at hand.

Reflexivity: “Reflexivity is a researcher’s self-conscious pondering of their own philosophical assumptions about the study. It means self-evaluation in research” (Berger, 2015, p. 220). This portion of the study demonstrates how the researcher's perspective influences the research process and acknowledges its presence. Unless

left undisclosed by the researcher, preconceptions should not be misconstrued as bias. If well managed, personal matters can become valuable foundations for meaningful and unique research" (Malterud, 2001, p. 484). Therefore, it is crucial to disclose the researcher's presumptions as they can significantly shape the execution of the research. Berger (2015) outlined three forms of reflexivity for a researcher: proficiency in the subject matter, enabling the researcher to share personal understandings regarding the study with participants; the transition of the researcher's position from outsider to insider; and unfamiliarity with the subject matter and the participants' experiences.

3.1.3 Discussion and rationale for the research paradigm

It is widely acknowledged and observed that no research methodology stands superior to all others (Benbasat et al., 1987). Given the multifaceted and intricate nature of reality, the chosen methodology should suit the problem being examined and the goals of the research (Benbasat, 1984).

Pragmatic paradigms do not conform to a singular philosophy or structure of reality (Creswell, 2014). The core principles of the pragmatism paradigm are defined as: pragmatism does not subscribe to any predefined philosophy or reality system; the investigator is at liberty to opt for any methods and techniques that are apt for responding to the research queries; Research invariably takes place within a social, historical, and political context (Creswell, 2014, p. 11). Consequently, the researcher has the flexibility to pick any suitable methodologies and techniques to tackle the specified research questions.

For the research, I used the positivist approach through a quantitative research methodology, after reviewing the advantages and disadvantages of each research method. I objectively gathered facts using numerical data and was able to generalize the findings according to the pragmatist approach. The research questions in the thesis were addressed using the quantitative research methodology (the positivist paradigm), as it was best suited to respond to the raised inquiries. The findings from the research were shaped by notions from the literature review and the systematic literature surveys undertaken (Chapter 1 & 2). The quantitative research methodology was used for a study in South Africa, a cross-sectional survey in Ghana and a case study in Ghana.

As the author of this thesis, I am a public health pharmacist and a supply chain specialist (amongst other roles) and thus, view my role in all three categories. Being a public health pharmacist, I was conversant with cancer medicines, but I wasn't aware of the pricing, availability, access, and affordability of the cancer drugs, as well as its mark ups along the supply chain. The limited research of the factors affecting cancer medicines access, especially in the LMICs, stimulated my interest to explore the subject of the research study.

The socio cultural and professional experiences gained whilst working in the pharmaceutical sector and with the ministry of health, the literature review of the subject matter, the systematic review of literature and discussions held with my supervisor and colleagues have all contributed to the development and maturation of my preunderstandings to influence the research design. Many friendships were formed with many pharmacists, lots of researchers, administrators, hospital staff and professors in South Africa, UK, and Ghana, which helped to guide the study design and support with the data collection. A team of two research assistants trained in quantitative research methodology supported in data collection. Team Interactions with the healthcare professionals within resources limited settings was followed up with an initial analysis of the gathered data on the field at the end of the day to discuss the process, and outcomes to address challenges.

3.1.4 Research approach

The research was designed using the following approach to achieve the goals and objectives. As a first step, I identified the research problem to be studied. This guided the decisions about the methodology to be used.

The effectiveness of any research endeavor hinges on the researcher's ability to turn a clinical issue into a research query because the research question is what influences the research architecture, strategy, methodology (Sackett & Wennberg, 1997), and what guides the analysis decisions, and publication (Stone, 2002). Thus, it was necessary to define the research question(s) from the very first stage of the PHD Journey. The title was framed to reflect the research questions. It was imperative for the research question to be appropriate, meaningful, and purposeful (Stone, 2002). Thus, the FINER criteria, (Hulley, 2007), which is often used to define a solid research question for it to be feasible, interesting, novel, ethical, and relevant was used, and with the help of my supervisor, the question(s) were developed.

The following strategies were used to identify the research problems (Buelow, 2006; Chulay, 2006; Haynes et al., 2006; Hulley, 2007).

Being a public health pharmacist, I used my own experience(s) to guide the decisions. I discussed the issues with my colleague researchers. I read literature and publications to identify what the gaps in literature were, and it was notable that there had been no systematic review of literature done on the identified subject of interest. I had series of discussions with my academic supervisor and was open to new ideas and technological advances. I had exploratory discussions with friends and family, keeping my imagination alive, and I searched for information about global and national burden of cancer disease.

The type of research problem(s) guides the selection of appropriate research method(s) to be used in the study (Gounder, 2012). The research study was aimed at resolving the research question, and I ensured that the research process was done within a structure of certain principles (research methods), using the quantitative approach and the academic disciplines (Gounder, 2012). I used processes, methodologies, and techniques that have been scrutinized for their validity (correct procedures were utilized to seek answers to the research question) and reliability (quality measurement procedures used to find answers to the research questions) (Gounder, 2012). The research was designed to be unbiased and objective without introducing my own perceptions to arrive at conclusions in an unbiased manner (Gounder, 2012).

The second step involved clearly choosing the research questions precisely to guide the studies, so there will be no misalignment between the research questions, data to be gathered and the examination of the data. The research questions were as follow:

- What is the cost incurred by individuals for cancer drugs?
- Does the cost and accessibility of identical drugs differ in diverse sectors like the public and private sector?
- How does the cost and accessibility of original brand drugs compare with generic equivalents?
- Is there a price difference among product categories (or instance, original brands vs. generics) within the same category?
- How do domestic prices stack up against global reference prices?

- What is the cost discrepancy between original brand cancer drugs and their generic counterparts?
- For a typical patient, how many days of earnings are required to cover the treatment costs? How feasible is it for ordinary individuals to afford these medications?
- Are the chosen cancer drugs readily available in healthcare facilities and do they feature on the NEML?
- What are the factors influencing the affordability, availability, and access to cancer drugs, and what potential solutions could improve these aspects?
- What are the taxes and tariffs imposed on medications and what's the extent of different mark-ups contributing to the selling and public sector prices?

The third step was to review written literature to guide the studies. This guided the decisions on research design, sampling, developing the research tools, data gathering, and data interpretation.

The fourth step involved the development of a written literature review: I collected relevant literature and thoroughly reviewed it to present a body of literature. Executing a systematic review is a type of research typically classified as 'secondary' research (Babar, 2015). Evidence from pharmacy practice research ought to be systematically arranged through a review method, which entails thorough identification of all documents pertaining to a subject, categorizing them based on pre-established inclusion and exclusion parameters, evaluating their quality, and summarizing their findings. The objective of a systematic review is to discover and incorporate all germane documents, irrespective of their findings, although the reality may slightly differ. Once identified, these documents must be subject to critical assessment (Babar, 2015).

An article in the Annals of Pharmacotherapy emphasizes the significance of systematic reviews in the context of pharmacy practice (Charrois et al. 2009), providing helpful advice on searching, assessing, understanding, and disseminating the results.

The published systematic review of Literature is presented in chapter 2.

The fifth step was the development of the research plan.

The PhD thesis embodies an exploratory approach and the research methodology after conceptualization was further influenced by insights from the systematic

literature review (Chapter 2). The information from the systematic literature review and the goals for the research was used to develop the research design. To design the research, I thought carefully about how to frame the inquiry logic, what to choose, the kind of data to gather, and the type of analysis to execute (Centellas, 2016).

3.1.4.1 Description of research methods

This section describes the research methods and procedures employed in the thesis, and an explanation for each method's advantages and disadvantages and the chosen methods used in the research.

The main methods used for the thesis included a review of publicly available records and literature (Chapter 1), a systematic review of the literature (Chapter 2), an analysis of a dataset on pricing, a cross sectional survey utilizing a questionnaire and a case study using a questionnaire (Chapter 4, 5 & 6). For the research, both primary data and secondary data were collected. The primary information was gathered using a questionnaire in a cross-sectional survey, analysis of a data set on pricing and a case study using a questionnaire. The secondary data was gathered through an analysis of publicly available documents and literature. The research adapted a positivist paradigm and was conducted using the quantitative methodology after carefully considering both advantages and disadvantages of various methodologies, as well as what is best suited to answer the research question. I used acceptable scientific methodologies to investigate the research questions and solved them to create new knowledge that can be generally applied (Gounder, 2012).

Scientific research makes use of both qualitative and quantitative methods when investigating diverse phenomena. The qualitative approach aims to comprehend the intricate reality and the significance of actions within a particular context. Conversely, the quantitative method is focused on acquiring precise and dependable measurements that facilitate statistical analysis. Each method provides a range of techniques, capabilities, and constraints that researchers need to examine and understand (Almeida, 2017; Buelow, 2006).

The organization of procedures to ascertain facts is referred to as research methods. Despite the existence of diverse knowledge sources, social science research relies on structured approaches to discern social realities, which are known as research

methods (Posner, 1973). Research methods are the various procedures, organized structures, schemes, specific strategies, techniques, algorithms, etc. used in in analyzing and interpreting data in research (Bodgan & Biklen, 2007; Mansfield, 1980; Merriam, 2002). The entirety of methods employed in a research study is referred to as research methods (Gounder, 2012). Methods refer to the specific strategies employed in a study to select instances, measure, and observe social life, compile, and refine data, analyze data, and report on outcomes (Posner, 1973).

The three research methods, namely, qualitative, quantitative, and mixed methods align with distinct sets of epistemological and ontological (Creswell & Creswell, 2017; Morrison, 2000). The comparative analysis of these two research methods (i.e., qualitative, and quantitative research) is concentrated on procedures for data collection and does not discount the potential combination of two research methods in a single study. This blend of qualitative and quantitative research is what some researchers refer to as mixed method or triangulation.

The choice of a specific research method is guided by its ability to answer specific research questions (LoBiondo-Wood et al., 2013; Polit & Beck, 2008).

The research methods used correct procedures to find out solutions to the research questions. I had to know how to apply research techniques, knowing which methods or techniques were pertinent and which were not, and interpreting their implications and significance. I had to comprehend the presuppositions that underpin various methods, and the criteria that would help determine which techniques and procedures were best suited to address specific issues.

Choosing the method for the research was based on a comparative study of the most pertinent and commonly used methods, with the aim of understanding their primary advantages and limitations. The research methods were used to find solutions to the research problems.

3.1.4.1.1. Quantitative research in pharmacy

Quantitative research refers to an organized inquiry about an issue or observation through the collection of numeric data and application of mathematical, statistical, or computational techniques. It is rooted in the positivist paradigm, which supports approaches based on statistical analysis. This includes strategies like inferential statistics, hypothesis testing, mathematical modelling, controlled and semi-controlled experimental designs, randomization, controlled protocols, and surveys with a limited

scope of predefined responses (Slevitch, 2011). Quantitative focuses on quantifying aspects of a subject. It probes questions such as ‘how long’, ‘how many’ or ‘to what extent’. Quantitative methods convert data into a quantifiable form and draw results from a sample of the specified demographic. It measures the prevalence of various perspectives and opinions in a selected sample or aggregates outcomes (MacDonald & Headlam, 2009). Quantitative data is about quantities (amounts) of things, whilst qualitative data is about the characteristics of things. Quantitative data captured in numerical format while qualitative data is documented in more descriptive methods (Centellas, 2016). Larger sample sizes are important in quantitative research, so it can adequately represent the entire populace, for the purpose of generalizing the research findings. Quantitative research primarily answers ‘what’, ‘when’ and ‘who’ questions and the results are generalizable, whilst qualitative research answers ‘how’ and ‘why’ queries and the findings aren’t meant for generalization. Quantitative methods employ precise, statistical procedures that is dependent on the inherent properties of the numbers involved. In quantitative research methods, the design of a research structure, analyzing, and quantifying the linkage between the variables is made (Creswell & Clark, 2007; Polit & Beck, 2004). For quantitative research, there are rules and procedures to be used by researchers in analyzing data and generalizing the findings (Slevitch, 2011).
Qualitative research involves collecting and interpreting non-numerical data to be used for comprehending human behavior and the societal environment. It focuses on the systematic description and interpretation of phenomenon and to describe people’s actions and relationship with others (Blackstone, 2018; Centellas, 2016Neuman, 2014; Surbhi, 2018).

Features of the quantitative research

Data collection was with a planned research instrument (questionnaires). The outcomes of the Ghana pricing study represented the entire country, whilst that of the South African pricing study only represented the private sector. I clearly formulated the research questions which needed to be answered.

Advantages and disadvantages of quantitative research

The advantages include simplicity of analysis, whereby data analysis was relatively easy, as the data was presented in numerical and statistical formats.

Consistency, as the research instruments had a very high level of reliability and can be verified through statistical calculations. Generalization of results, as quantitative research findings was used for the intention of universal inference. Sample groups were meticulously chosen through methods like convenience sampling from the complete demographic and the results were used and generalized for the whole population (Babar, 2015; Queirós et al., 2017).

The disadvantage of quantitative research includes the fact that surveys have a rigid structure, which fails to capture the emotional states, behaviors, and emotional transitions of the respondents. Consequently, the dependability of survey data is hinged on the quality of responses and the organization of the survey itself (Babar, 2015; Queirós et al., 2017).

Quantitative research approaches

The aim of the quantitative research can be quantified and are inseparable from variables and hypotheses. Variables are ideas with variances that can adopt multiple values, whereas hypotheses are unverified suppositions or assertions about the relationship between variables (Babar, 2015). The research approaches most employed within the quantitative research scope, which were also utilized for the study, included surveys and case studies.

After assessing the characteristics, categories, benefits, and drawbacks of the two research methodologies under scrutiny, I observed that the appropriateness or distinctiveness of each methodology is contingent upon the objectives of the research. By evaluating the pros and cons of each approach, it allowed me to make a more precise, informed, and comprehensive decision, leading me to select the quantitative methodology (Almeida, 2017).

Survey research method

Survey research techniques are commonly utilized in the field of health services research. This method is both economical and practical in comparison to experimental research or case study research methods (Mertler, 2016). Surveys are predominantly of two types: cross-sectional and longitudinal. A cross-sectional survey offers an assessment of similar attributes and differences among multiple groups at a specific moment in time (Christensen, 2014c). On the other hand, a longitudinal survey studies a single population over varying periods. This

necessitates administering surveys at several intervals to describe alteration, constancy, or trends over a defined duration (Christensen, 2014c; Dulock,1993).
The cross-sectional survey research method was used for the pricing study in Ghana. This is because surveys are cost effective, reliable, versatile and the findings can be generalized. However, it can be inflexible, lack of depth and have validity issues (Neuman, (2014). Details of the comprehensive survey on cancer medicines is elaborated in chapter 5.

Case study

A case study is a research strategy typically employed when there's a need for a comprehensive investigation into a phenomenon to unearth the roots of fundamental principles. Essentially, it is a design devoid of an independent control group. This implies that a case needs to be examined over time, i.e., longitudinally (Centellas, 2016).
Although a universally agreed-upon definition for case research is lacking, it is acceptable to provide an in-depth characterization of a case study by outlining its features, strengths, and drawbacks (Slevitch, 2011).

Survey research features

Surveys entail gathering information from all the individuals within a specific geographical area (Neuman, 2014). The delineative aspect of the survey research method relies on the data collection process, which consists of obtaining data from a sample that's representative of all respondents, enabling the outcomes to be generalized to the entire population being studied (Neuman, 2014). Uniform questionnaires are utilized to systematically gather information regarding people's attitudes, behaviors, and habits (Austin & Sutton, 2018). In pharmacy practice, such instruments can serve to evaluate perspectives, knowledge, beliefs, and experiences related to medication usage, adherence, or other health-centric topics, all from the viewpoint of both patients and medical professionals (Green & Norris, 2015).
Quantitative research uses survey as a data collection instrument. The WHO has formulated a variety of instruments specifically for deployment in LMICs (WHO, 2007; WHO & HAI, 2020).
The use of a questionnaire and/or interview are the 2 tools used in surveys. Utilizing questionnaires for data collection is highly beneficial. Nevertheless, the validity of the

results hinges on the precision, clarity, and consistency of the questions framed (Hussain et al., 2019). While this method is cost-effective and efficient, it is not entirely immune to bias (Mathers et al., 2007). Examples of survey methods include automated phone polls using random number dialing, computer stations in public areas inviting public feedback, and online survey completions (Baber, 2015).
Data was collected from the field, and this required careful organization and an eye for detail. To have a successful fieldwork, I had to build relationships with a broader community of pharmacists, hospital administrators, researchers, entrepreneurs, scholars, and collaborators.
Ann interactive research strategy was used for the surveys. As there was some interaction with the pharmacy staff during the data collection (Centellas, 2016). The survey research instruments were developed rigorously in conformity to the protocols necessary for crafting sound, valid and reliable instruments. The validity and reliability of these tools must be confirmed through statistical calculation to decipher if the instruments can be reliably used for measuring what they designed to measure. I used a survey questionnaire that had some closed ended questions as well as open ended for the pharmacy staff to fill. Multiple factors, including cultural, economic, political, ethical, and legal contexts, influenced the chosen sampling strategies. The survey responses were efficiently translated into numerical data, enabling a comprehensive summation of data, effective visualization, analysis, interpretation, and presentation of research findings. Details of the research survey is stated in chapter 5.

3.1.4.2 Research method validation and reliability

The merit of a quantitative study is usually evaluated through the measurement of validity and reliability (Hardon et al, 2001), Heale & Twycross, 2015).
The term 'validity' in a research context pertains to the worth, actuality, and novelty of the study findings. A study’s validity signifies the magnitude to which the research results are correct and can be generalized. Reliability denotes the precision of the research instrument, and its consistency in generating the same results when used repeatedly in the same situations (Friedman 2004, Hardon et all, 2001, Heale &Twy cross, 2015).
The research study was based on the WHO/HAI methodology that has been tested, promoted, and widely used to conduct pricing studies globally (WHO &HAI, 2020).

Elements influencing internal and external validity ought to be managed, so that it doesn't affect the dependability of results and the ultimate interpretation of the research (Green, & Norris, 2015; Mertler, 2016). For measuring the external validity of the quantitative research method, I ensured that accurate data was collected in the right location. The specification of the sampling size was thoroughly detailed, and the selected sectors represented the sample site under study (Austin& Sutton, 2018; Smith, 2010a). The survey instruments using structured questionnaires were standardized. Before using the newly developed survey instruments for the research study, they were pilot tested (Dulock,1993). Research assistants who supported with data collection were trained in the use of the standardized research tools.

The seventh step was to analyze the data collected for the research. The quantitative data was analyzed statistically with numerical descriptions, comparison of groups and measures of relationships amongst variables. For example, in the Ghana pricing study, I used a statistical software to show the statistical significance using the Kruskal-Wallis test. The 'mean-median' amongst the three sectors for corresponding groups of medicines were examined and the 'mean-median' along with standard deviations in availability, prices, and affordability were outlined. A Kruskal-Wallis test was applied and a p-value less than 0.05 was used to denote a significant variation.

The eight-step involved the development of the conclusion and recommendations. The conclusion was from the interpretation of results and the recommendations for future research and practice, which was linked to the body of literature and systematic literature review.

The final step was the preparation of the final report outlining the steps described above.

Conclusion

The research findings are essential for pharmacy practitioners and the scientific community in LMICs, especially Ghana and South Africa. This is because it serves as a method of recording and sharing evidence to improve healthcare and the emerging responsibilities of pharmacy practice (Bond 2006; Elkassem et al. 2013; Peterson et al. 2009; Roberts & Kennington 2010a; Roberts & Kennington 2010b).

3.2.1 Ethical clearance

Ethical approval for all the research studies was given by the University of Huddersfield, UK (Ref: SAS-SREIC 19.11.19-2). The study in Ghana received ethical approval from Korle Bu Teaching Hospital technical committee (Ref: KBTH-STC 00003/2020), Ghana Health Service technical committee (Ref: GHS-ERC 007/01/20), and the Komfo Anokye Teaching Hospital Institutional Review Board Research & Development Unit (Ref: KATH IRB/CA/102/20), respectively. Ethics approval for the study in South Africa was obtained from the Humanities and Social Science Ethics Committee of the University of KwaZulu-Natal (HSS/0154/013).

3.2.2 Research overview

An overview of the thesis research is shown in Figure 2 below:

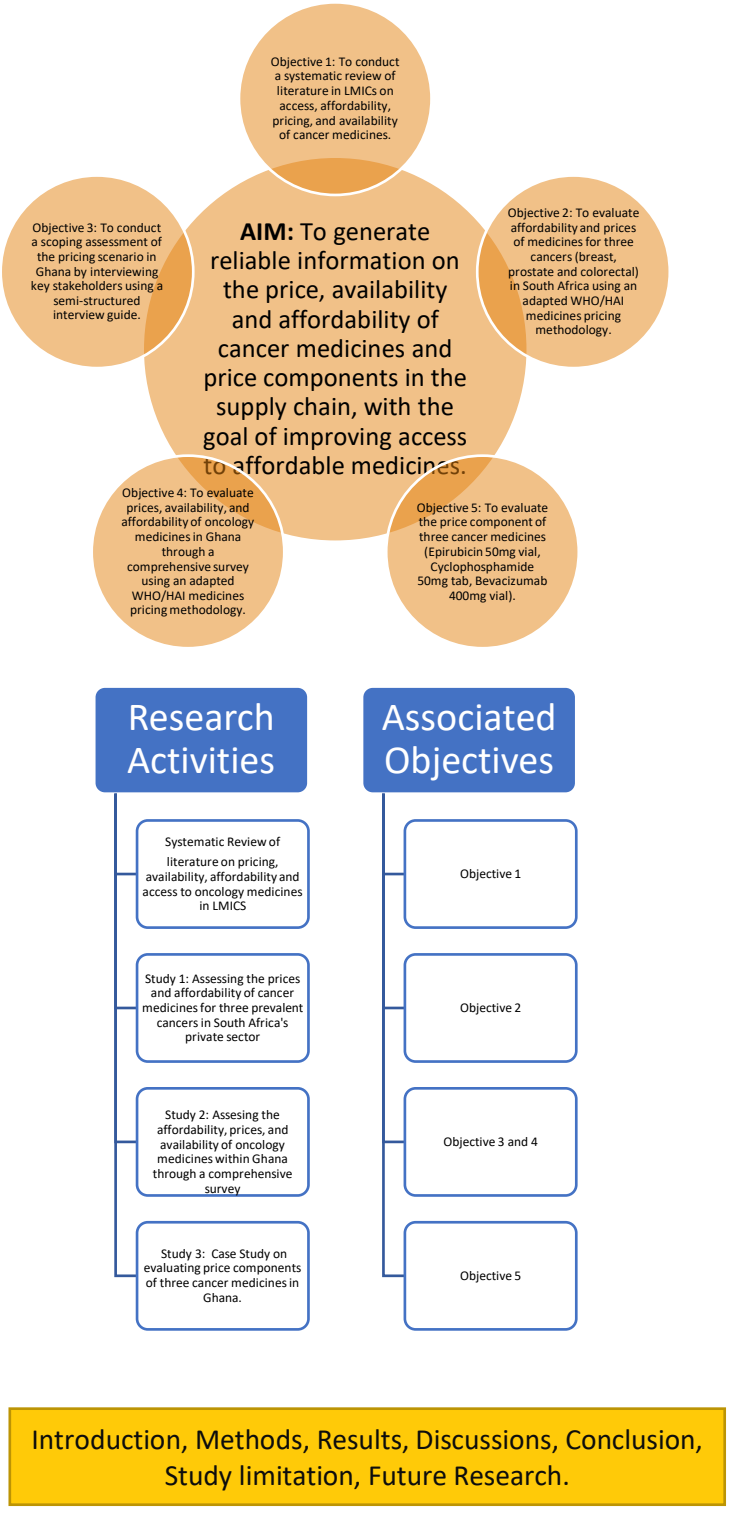


Figure 2: Aims, objectives and research activities of the research

CHAPTER 4: Assessing the prices and affordability of oncology medicines for three common cancers within the private sector of South Africa

Chapter 4: Assessing the prices and affordability of oncology medicines for three common cancers within the private sector of South Africa

4.1 Introduction

In 2020, South Africa recorded 108,168 new instances of cancer, a figure that is projected to rise to 177,773 by 2040 (Ferlay et al., 2020). Among the ten most widespread kinds of cancer within the country, breast, prostate, and colorectal cancers were prominent, with respective counts of 15,491, 13,152, and 7,354 cases in that year (Ferlay et al., 2020; Staff Writer, 2020). The expected significant increase in cancer occurrences in South Africa can be partially attributed to an aging population, but also to the presence of Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) (Meyer et al., 2021).

Early diagnosis and intervention can enhance the prognosis for adults afflicted with cancer (WHO, 2018). Success in this area depend on fair access to effective, affordable, and readily available cancer medications. In LMICs, the steep cost for treating cancer due to the price of medicines, severely restrict access. Many latest medications for cancer remain unattainable in LMICs, for vast numbers of people living in poverty. Yet conventional chemotherapy agents are just within the financial reach of a limited number of patients. To illustrate this, a WHO publication reveals that a normal regimen for treating early-stage human epidermal growth factor receptor 2 positive (HER2+) breast cancer, including drugs like docetaxel, doxorubicin, trastuzumab, and cyclophosphamide, will be equal to a decade's worth of average yearly earnings in South Africa and India (WHO, 2018b).

South Africa, ranked as an Upper Middle-Income Country (UMIC), with a population of 60,919,884 in 2022 (Worldometer, 2022) and a GNI per capita of USD $ 6440 as of 2021 (Macrotrends, 2022). The international Poverty Line (PL), defined by the WB, is fixed at USD $ 1.90 a day per person. This calculation is based on PPPs, along with a broad collection of data from household income and spending surveys conducted in 2011 (World bank, 2018). It represents the bare minimum required to meet essential requirements in certain poor countries in the world and serves as a definitive benchmark for identifying poverty. However, in an UMIC like South Africa, this standard is adjusted to reflect local conditions, with the PL set at USD $ 5.50 per person daily (Jolliffe & Prydz, 2016). If an individual's income before buying medication (pre-payment income) exceeds this PL, but the remaining income after

the purchase (post-payment income) falls beneath it, then the acquisition of that medicine can be said to have pushed that individual into poverty within the South African context (Niens et al., 2010).

Based on the World Health Statistics of 2020, only 1.4% of the South African population spends below 10% of their overall family's income or expenses at healthcare (WHO, 2020). Certain costs are attributable to public sector-dependent individuals, such as those who are unemployed or have low incomes but seek healthcare, including medications, in the private sector (Suleman & Gray, 2017). While the South African government provides healthcare to all citizens free of charge, individuals have the option to buy private insurance for treatment in private hospitals and clinics. Those who can afford it (typically the wealthier segment of the population) have the choice to cover their healthcare costs either through a medical aid scheme (insurance) or by paying directly, referred to as OOP expenditure. The OOP costs might include co-payments for medical procedures, modifications to nutrition, rehabilitative services, coupled with transportation for medical appointments. Such full scope of OOP expenses, to cancer patients within South Africa is not currently known.

Many patients find the cost of medicines and treatment out of reach, as they are often priced to align with first-world markets, and can be exorbitantly high, with no repercussions for such pricing (Meyer et al., 2021).

Following the end of apartheid, South Africa has put into action various significant measures related to medicine pricing, guided by the NDP,1996 (Gray et al., 2015). A central goal of the South African NDP was to enhance accessibility of secure and effective medications at most affordable prices. This is achieved through oversight and negotiation of medication costs, streamlining the pricing structure in both private and public healthcare segments, to encourage generic medicines utilization (NDoH, 1996; Gray et al., 2017).

After so many challenges and ongoing legal battles in the South African Courts, the South African Department of Health took decisive action to tackle medicines prices. A significant step to establish the SEP was made in 2004 (NDoH, 1996; Gray et al., 2017; Suleman & Gray, 2015; Suleman & Gray, 2017). This SEP policy acts as an instrument to enhance the clarity of drug pricing and to lower both the cost of medicine and inflation (Naidoo & Suleman, 2021).

A lack of information on pricing and affordability stands as a significant obstacle in crafting an efficient and visible policies on pricing for LMICs. Consequently, an emphasis of this research was analyzing SEPs of medications utilized in treating three distinct types of cancer (colorectal, breast, and prostate), evaluating both their cost effectiveness and the potential economic failure they may cause.

4.1.1 Objective of study

To evaluate affordability, and prices of medications for three prevalent types of cancer (breast, prostate, and colorectal) in South Africa using an adapted WHO/HAI medicines pricing methodology.

4.2 Methods

Study design

The approach used for this research drew upon the WHO/HAI measurement method for prices and affordability of medicines. This was applied to ten medications including LPG and OB products for cancer, (NDoH, 2019; WHO, 2020; WHO & HAI, 2020). These prices per vial for both originator and generic injectable cancer medicine formulations were determined centered on the private sector's high, median, and low and 2020 SEP. These were acquired through the Medicine Price Registry of South Africa on the 11th of March 2020 (NDoH, 2019).

The Medicines Price Registry of South Africa, overseen by the National Department of Health (NDoH), is an openly accessible public dataset encompassing an existing SEP for every medicine registered in South Africa. Earlier types are also obtainable at specific times. The databank shows the achievement of clear policies on pricing aimed at the private industry, in line with South African law. Producers are mandated to provide SEPs to NDoH, to be recorded in the database, which is displayed on the website as a spreadsheet in EXCEL (NDoH, 2019). This information is consistently updated to reflect price changes. The SEP comprises of three components: a logistics fee, the ex-manufacturer price, and VAT. The VAT levy of 14%, is uniformly determined using the logistics fee and ex-manufacturer price, and then included in the combined amount.

This research concentrated exclusively on the SEP of selected cancer medications for prevalent cancer situations within the private industry, specifically examining how prices impact affordability. The study intended to examine the changes in pricing

among various types of cancer medications in the private industry as well as to determine whether goals set by the NDP can be achieved in the context of oncology drugs (NDoH, 1996).

Through its comparison between OB and LPG, this study sought to highlight the potential cost-saving benefits utilizing LPG for cancer patient treatment. The ethical authorization for conducting this research was given by the Humanities and Social Science Ethics Committee of the University of KwaZulu-Natal (HSS/0154/013).

Data entry and analysis

A uniform electronic workbook has been employed for entering and evaluating information from the private sector regarding elements of medication pricing and the medicines affordability (WHO & HAI, 2020). The worksheet designed for entering data entry produces summation tables, displaying the median costs of the medications.

Price assessment

The SEP for all chosen cancer drugs was gathered and denominated in the South African currency, Rand. The prices were sourced from a sealed databank, thus subsequent alterations on the price were not feasible during the particular year, meaning all necessary adjustments to the SEP had already been finalized for that time frame. Every distinct price (even for a single price being discovered) for each medication was obtained from the manufacturer's input to the databank and incorporated into the evaluation (NDoH, 2019).

The MPR could not be computed in this study, because of the obsolete 2015, ERPs from MSH (MSH, 2020). As such, the International Price Ratio (IPR) comparison could not be performed. Instead, the median price was displayed for single medications. These findings of the research will be explored: Purchasing efficiency which is determined as the change relating to the Highest-Priced Medicine (HPM) and Lowest-Priced Medicine (LPM), and product premiums amongst the most expensive generics, originator brand medicines and the least expensive generic counterparts were ascertained (WHO & HAI, 2020). The median unit price of the SEP was evaluated rather than using average values. The difference in price or variations in cost were computed in percentages with the following formula:

Cost Differential (%) = (the Originator Price - the Generic Price)/ the Originator Price x 100 (WHO & HAI, 2020).

The ratio between OB Price and LPG Price or ratio between HPM and LPM was determined as:

Price Ratio = (The OB Price / The LPG Price) or (HPM Cost/ LPM Cost) (WHO & HAI, 2020).

The highest and lowest prices of each OB or LPG drug having equal potency was utilized to determine the percentage (%) difference in cost between minimum and maximum SEP.

Affordability assessment

In the context of this research, the affordability of medicine was measured by the number of days' salary an unskilled LPGW in the country would need to cover the cost of a standard treatment course (WHO & HAI, 2020). The study unveils the costs borne by patients and the affordability of the products following the WHO/HAI methodology (WHO & HAI, 2020). It scrutinized the expenses associated with cancer therapies, contrasting them with the LPGW's everyday earnings (WHO & HAI, 2020). As of 2020, the South Africa daily salary for an unqualified LPGW amounted to 166.08 ZAR, from an hourly wage of 20.76 ZAR and an 8-hour working day (South African Government, 2020). This is equivalent to 9.9271 USD, using the exchange rate of 1 USD = 16.73 ZAR as of 12th September 2020 (Google exchange rate, 2020).

Treatment protocols for late-stage prostate cancer, colo-rectal, and breast which are the utmost prevalent types among men and women in South Africa, were sourced from the United Kingdom's Electronic Medicines Compendium (EMC) and the National Comprehensive Cancer Network (NCCN) guidelines for treatment (Datapharm Ltd, 1999; NCCN, 2020; WHO, 2020).

The financial impact on a patient was illustrated by computing a month's cost of oncology treatment if it were to be paid for from cash on hand, recognizing that a patient with cancer typically undergoes more than one treatment cycle and often requires several different medication regimens.

How many days salary is needed for treatment affordability= price of cancer medicine (vial(s)) required every month/ everyday salary of LPGW (WHO/HAI, 2020).

It should be noted that these expenses just pertain to the medication part of the whole cost of treatment. Additional charges for consultations and diagnostic tests could substantially elevate the overall expense to the patient. A constraint in this study's approach is the omission of associated cost factors for example selling charges, hospital costs, administrative charges, physicians' charges, that contribute to the final price for cancer patients.

In this study, an added measure of unaffordability was employed using the method formulated by Niens et al. (Niëns et al, 2010; Niëns et al, 2012; Niëns & Brouwer, 2013). This approach to calculating the effect of impoverishment on purchasing medications drew inspiration from a technique employed by Van Doorslaer et al. Deprivation assessments from 11 countries in Asia were revised by considering the family unit's healthcare spending (Van Doorslaer et al., 2006). This method of analyzing impoverishment has also found application in various other sciences of evaluating health coverage and affordable housing (Bundorf & Pauly, 2006; Hancock, 1993; Kutty, 2005).

The effect of impoverishment caused by a medicine is assessed by the proportion of individuals who will end up under an earning threshold of USD $5.50 per day after buying the medicine. While various income benchmarks have been suggested or used, the selection of the USD $5.50 poverty lines was guided by their status as the most recently acknowledged indicators of poverty, as utilized by the World Bank (Chen & Ravallion, 2008; Van Doorslaer et al., 2006, The World Bank Group, 2010). In essence, this method evaluates the household income per person every day, both prior to and following the theoretical acquisition of a medication. The percentage of the people dropping beneath the poverty line (PL) was assessed both prior to prepayment incomes (Ipre) and following post payment incomes (Ipost) of the theoretical acquisition of medications and compared to a designated poverty line (Niëns et al, 2012). If Ipre is above the USD $5.50 threshold and Ipost is below this line, the act of purchasing the medicine is considered to push people into poverty. The portion of people characterized by Ipost would find the medicines not affordable. Through this approach, I determined "impoverishment rates," reflecting the fraction of the populace that would be pushed into poverty. The term unaffordability, in this context, denotes the segment of people that is already under or may drop beneath the USD $5.50 daily poverty line because of medicine procurement (Jolliffe & Prydz, 2016; Niëns et al, 2010; Niëns et al, 2012; Niëns & Brouwer, 2013; World Bank,

2018). Three types of information were needed: the cost of medicine, aggregated information on income (Y), and specifics regarding distribution of income (Niëns et al, 2012; The WB Group, 2022). (Ref: Table 1). I utilized the PL baseline of USD $ 5.50 or ZAR 92.02 daily (Google exchange rate, 2020; Jolliffe & Prydz, 2016; WB, 2018). Medicine costs were derived from the pricing method of the WHO/ HAI, that reports on private sector patient median prices on chosen cancer drugs, covering both the LPG and OB products (WHO & HAI, 2020). Information on income distribution and Household Final Consumption Expenditure (HHFCE) data were provided by the WBs World Development Indicators (WDIs) (The WB Group, 2020). The HHFCE was preferred over GDP per capita as it more accurately mirrors the resources of the household (O'Donnell et al., 2008). The WDIs revealed aspects of South Africa's income allocation through detailing of the total earned shares from seven income groups; five quintiles, where the wealthiest and the poor were divided into ten equal groups. Nevertheless, utilizing aggregate data necessitated certain assumptions regarding income distribution among demographic groups. The mean income per person in every group was ascertained by adding the portion of the overall income in the groupings having HHFCE information, as presented by the WDIs. Since only mean income data in the various quintiles and deciles were accessible, a linear assumption of the allocation of income in these applicable groupings where the USD $5.50 lines were situated was applied in the impoverishment calculation. Thus, those who would earn less than USD $5.50 daily after purchasing the medication, and not prior will be deemed poor because of the medicine purchase. The medication will be considered reasonable for a segment of the population that stays over the line of poverty after the purchase. Since HHFCE is quoted in current US dollars, I converted the USD $5.50 poverty lines and the WHO/HAI medicine prices into US dollar values.

4.3 Results

4.3.1 Prices of cancer medicines

The differences in the costs of ten different cancer drugs, varying in strengths and forms of dosage, were examined (Table 5). The cost/price difference for the vast majority (90%) of all the medicines assessed exceeded 50%. The greatest pronounced disparity was observed in Doxorubicin 50mg injection, with a difference of 97.33%, while Oxaliplatin 100mg injection demonstrated the smallest price variation, at 25.46%. Upon evaluating the cancer drugs individually, Doxorubicin 50mg injection stood out, with its most expensive variant being 37.44 times costlier than its least expensive counterpart. Otherwise, nearly every cancer drug (90%) scrutinized in this study exhibited substantial price variations between their least and most expensive versions, having a price difference ratio greater than 2.

Table 4: Assessment of the minimum price against the maximum price for identical medication (SEP) in South Africa.

No	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Type of Cancer*	Minimum SEP (ZAR)	Maximum SEP (ZAR)	Cost differential between Min and Max SEP (%)	Price Ratio	Number of generic Medicines	Number of Branded Medicines
1	Paclitaxel	300mg	vial	1	Breast	24.8286	183.2814	86.45	7.38	9	1
2	Doxorubicin	10mg	vial	1	Breast	16.2022	126.7600	87.22	7.82	5	2
3	Doxorubicin	50mg	vial	1	Breast	16.2022	606.5330	97.33	37.44	8	2
4	Docetaxel	20 mg	vial	1	Breast/ Prostrate	209.3080	789.7929	73.50	3.77	6	0
5	Docetaxel	80mg	vial	1	Breast/ Prostrate	279.0797	1490.2191	81.27	5.34	6	1
6	Fluorouracil	500mg	vial	1	Colo-rectal	4.3900	36.4800	87.97	8.31	2	1
7	Oxaliplatin	50mg	vial	1	Colo-rectal	41.6963	111.8818	62.73	2.68	3	0
8	Oxaliplatin	100mg	vial	1	Colo-rectal	83.3926	111.8818	25.46	1.34	3	0

9	Irinotecan	40mg	vial	1	Colo-rectal	211.9561	599.5800	64.65	2.83	1	1
10	Irinotecan	100 mg	vial	1	Colo-rectal	211.9529	708.0000	70.06	3.34	1	1

Table 5 illustrates the median variability in prices / the differences in costs between the OB and the LPG. Only the medications where both the original brand and a generic equivalent were identified, were considered in this study, to enable a fair comparison of costs across these two categories of products. Docetaxel 20mg, Oxaliplatin 50 mg, and Oxaliplatin 100mg were not included in the findings since there were no OB counterparts for comparison. The outcomes reveal that within the private sector, OBs are typically more expensive than their generic counterparts. The MPR fluctuated between 3.58 and 0.13, with 86% of the cancer drugs possessing an MPR greater than 1. The price difference between the OB and LPG for two-thirds of the evaluated medications was above 50%, signifying that when OB drugs are recommended and provided privately, patients are charged over 50% more than for the generic versions. The most pronounced difference in cost was observed in Doxorubicin 100 mg (72.09%), trailed by Irinotecan 100mg (70.06%), Irinotecan 40mg (64.65%), and Docetaxel 80mg (62.13%) in that order. As a result, patients are incurring significantly higher expenses for OB drugs when LPGs are an available option. For 28.6% of the examined OB and LPG cancer medications, the cost differences were minor, falling below 50%. The smallest were found in paclitaxel 300mg (22.39%) and Doxorubicin 50mg (32.35%). Interestingly, the generic version of fluorouracil was pricier than its original brand, leading to a negative price difference of -679.73%.

Table 5: Price variation across various brand names of oncology drugs obtainable in South Africa.

No	Medicine Name	Medicine Strength	Dosage Form (per unit)	Target Pack Size	Type of Cancer*	Median SEP Price per unit OB (ZAR)	Median SEP Price per unit LPG (ZAR)	Median Price Variation/ Cost Differential (%)	Median Price Ratios
1	Paclitaxel	300mg	vial	1	Breast	35.4918	27.5465	22.39	1.29
2	Doxorubicin	10mg	vial	1	Breast	72.9250	20.3500	72.09	3.58
3	Doxorubicin	50mg	vial	1	Breast	315.5469	213.4550	32.35	1.48
4	Docetaxel	80mg	vial	1	Breast/ Prostrate	1490.2191	564.2920	62.13	2.64
5	Fluorouracil	500mg	vial	1	Colo-rectal	4.3900	34.2300	-679.73	0.13
6	Irinotecan	40mg	vial	1	Colo-rectal	599.5800	211.9561	64.65	2.83
7	Irinotecan	100mg	vial	1	Colo-rectal	708.0000	211.9529	70.06	3.34

Treatment plans derived from the emc and NCCN treatment protocols. (Datapharm Ltd, 2021; NCCN, 2020).

4.3.2 Affordability of cancer medicines

An analysis of the affordability has been conducted exclusively for 17 variations of OB and LPG cancer drugs using data from the private sector (Ref: Tables 7 & 8 and Figure 5), (WHO & HAI, 2020). Except for paclitaxel 300mg (equivalent to 0.2 days wage) and Fluorouracil (Fluroblastin) 500mg (equal to 0.3 days wage), the expenses for all OB therapies exceeded the equivalent of a full day's earnings. Of the medications investigated, the OB for a 30-day treatment with Irinotecan (Campto) 40mg demanded 32.3 days wage, marking it as the least affordable. The generic versions of Irinotecan 40mg were priced at 11.5 days wage. For Docetaxel 80mg, the OB's value in days' wage is 9, whereas the LPG's cost is 3.4 days. For Irinotecan 100mg, the OB's value is 17.1 days compared to 5.1 days for the LPG. For Doxorubicin 50mg, the corresponding figures are 3.8 days for the OB and 2.6 for the LPG. A one-month regimen of Doxorubicin 10mg demands roughly 3.5 days' wage for the OB and a single day's wage for the LPG. For LPG drugs with no corresponding OB, the purchase of Docetaxel 20mg, Oxaliplatin 100mg, and Oxaliplatin 50mg required 13.6, 1.1-, and 0.5-days’ wage, respectively. Furthermore, Paclitaxel 300mg OB, paclitaxel 300mg LPG, Doxorubicin 10mg LPG, Fluorouracil (Fluroblastin) 500mg OB, Oxaliplatin 50mg LPG, and Oxaliplatin 100 LPG were identified as the most economical cancer treatments in South Africa's private healthcare. One should recognize that these figures refer solely to the pharmaceutical aspect of the complete therapy expenses. The inclusion of consultation charges and diagnostic examinations could lead to significantly higher overall expenditures for the patient.

Table 6: Treatment regimen for calculating affordability (Datapharm Ltd, 2021) of cancer medicines in South Africa

Medicine	**Strength**	**Dosage**	**Treatment Regimen per month**
Paclitaxel	300mg	220mg/m2 once	1 vial (first Line treatment)
Doxorubicin	10 mg	75mg/m2 once	8 vials
Doxorubicin	50 mg	75mg/m2 once	2 vials
Docetaxel	20mg	75mg/m2 once	4 vials
Docetaxel	80mg	75mg/m2 once	1 vial
Fluorouracil	500mg	15mg/kg every week	10 vials (based on an 80kg adult)
Oxaliplatin	50mg	85mg/m2 twice every month	2 vials
Oxaliplatin	100mg	85mg/m2 twice every month	1 vial
Irinotecan (Campto)	40mg	350mg/m2 once	9 vials
Irinotecan (Campto)	100mg	350mg/m2 once	4 vials

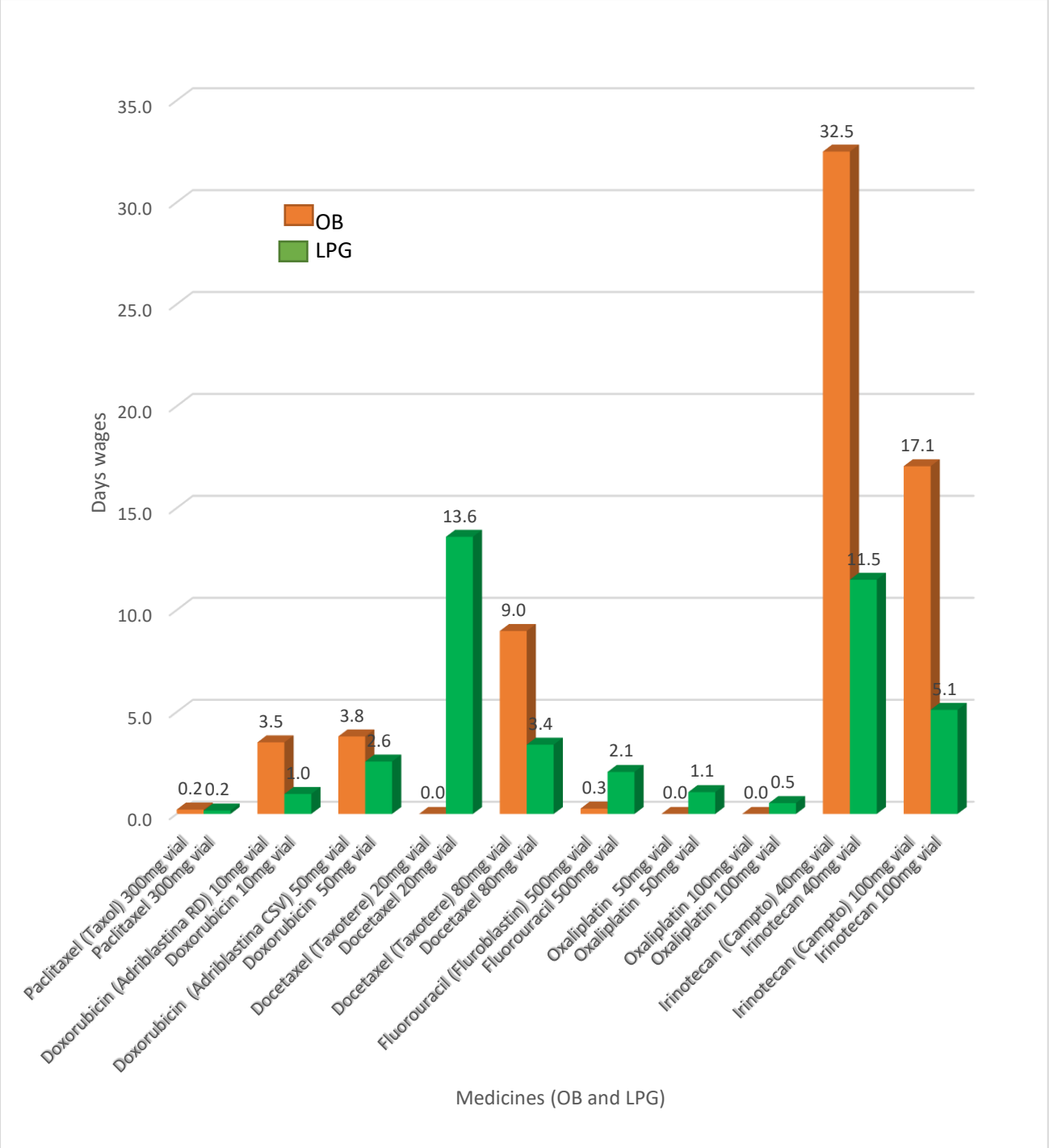


Figure 3: Affordability analysis of selected cancer drugs in South Africa.

Table 7: Affordability in terms of number of day's salary of a government employee in South Africa required to cover for treatment with cancer drug(s) (Datapharm Ltd, 2021).

No.	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	SEP Median Price (ZAR)	Treatment (Number of vials needed per month)	Treatment Cost per month (ZAR)	Daily Wage (ZAR)	Affordability
1	Paclitaxel (Taxol)	300mg	vial	1	OB	35.4918	1	35.4918	166.0800	0.2
2	Paclitaxel	300mg	vial	1	LPG	27.5465	1	27.5465	166.0800	0.2
3	Doxorubicin (Adriblastina RD)	10mg	vial	1	OB	72.9250	8	583.3996	166.0800	3.5
4	Doxorubicin	10mg	vial	1	LPG	20.3500	8	162.8000	166.0800	1.0
5	Doxorubicin (Adriblastina CSV)	50mg	vial	1	OB	315.5469	2	631.0938	166.0800	3.8
6	Doxorubicin	50mg	vial	1	LPG	213.4550	2	426.9100	166.0800	2.6
7	Docetaxel	20 mg	vial	1	LPG	564.2920	4	2257.1680	166.0800	13.6

8	Docetaxel (Taxotere)	80mg	vial	1	OB	1490.2191	1	1490.2191	166.0800	9.0
9	Docetaxel	80mg	vial	1	LPG	564.2920	1	564.2920	166.0800	3.4
10	Fluorouracil (Fluroblastin)	500mg	vial	1	OB	4.3900	10	43.9000	166.0800	0.3
11	Fluorouracil	500mg	vial	1	LPG	34.2300	10	342.3000	166.0800	2.1
12	Oxaliplatin	50mg	vial	1	LPG	89.0000	2	178.0000	166.0800	1.1
13	Oxaliplatin	100mg	vial	1	LPG	89.0000	1	89.0000	166.0800	0.5
14	Irinotecan (Campto)	40mg	vial	1	OB	599.5800	9	5396.2200	166.0800	32.5
15	Irinotecan	40mg	vial	1	LPG	211.9561	9	1907.6045	166.0800	11.5
16	Irinotecan (Campto)	100mg	vial	1	OB	708.0000	4	2832.0000	166.0800	17.1
17	Irinotecan	100mg	vial	1	LPG	211.9529	4	847.8115	166.0800	5.1

By employing the method formulated by Niens and colleagues (Niens et al., 2010; Niens et al., 2012, Niëns & Brouwer 2013), the percentage of individuals subsisting beneath the poverty threshold prior to (I_{pre}) the hypothetical procurement of a drug is identified at 57%. After (I_{post}) the hypothetical procurement, the percentage plummeting into poverty can reach up to 26%, rendering the costliest drug, Irinotecan (Campto) 40mg OB, inaccessible to 82.95% of the population. The percentage falling into poverty for the remaining medications varies between 0.3% and 17.8% (Ref: Table 9 & 10 below).

Table 8: The distribution of income and the average daily income per capita (IPC) in South Africa (The World Bank Group, 2021).

Cumulative % of population	**Income group**	**Income distribution (%)**	**Average daily IPC (USD $)**	**Average daily IPC (ZAR)**
D_1 0–10	Poorest 10%	0.9	0.89	14.91
D_2 10–20	Second poorest 10%	1.5	1.49	24.85
D_3 20–40	Second 20%	4.8	2.38	39.77
D_4 40–60	Third 20%	8.2	4.06	67.94
D_5 60–80	Fourth 20%	16.5	8.17	136.70
D_6 80–90	Second richest 10%	17.7	17.53	293.29
D_7 90–100	Richest 10%	50.5	50.02	836.78

The population of South Africa is approximately 58,558,270, and the total household final expenditure (Y) is 211,692,570 million US dollars.

Table 9: Medicine prices, cost of treatment per month and proportion impoverishment data in South Africa (The World Bank Group, 2012, WHO & HAI 2020).

No.	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	SEP Median Price (ZAR)	Treatment (Number of vials needed per month)	Treatment Cost per month (ZAR)	I (post) %	The proportion impoverished I (post) − I (pre) %
1	Paclitaxel (Taxol)	300mg	vial	1	OB	35.49	1	35.4918	57.35	0.35
2	Paclitaxel	300mg	vial	1	LPG	27.55	1	27.5465	57.27	0.27
3	Doxorubicin (Adriblastina RD)	10mg	vial	1	OB	72.93	8	583.3996	62.66	5.66
4	Doxorubicin	10mg	vial	1	LPG	20.35	8	162.8000	58.58	1.58
6	Doxorubicin	50mg	vial	1	LPG	213.46	2	426.9100	61.14	4.14
7	Docetaxel	20 mg	vial	1	LPG	564.29	4	2257.1680	72.93	15.93
8	Docetaxel (Taxotere)	80mg	vial	1	OB	1490.2	1	1490.2191	70.48	13.48
9	Docetaxel	80mg	vial	1	LPG	564.29	1	564.2920	62.47	5.47
10	Fluorouracil (Fluroblastin)	500mg	vial	1	OB	4.39	10	43.9000	57.43	0.43
11	Fluorouracil	500mg	vial	1	LPG	34.23	10	342.3000	60.32	3.32
12	Oxaliplatin	50mg	vial	1	LPG	89.00	2	178.0000	58.73	1.73
13	Oxaliplatin	100mg	vial	1	LPG	89.00	1	89.0000	57.86	0.86
14	Irinotecan (Campto)	40mg	vial	1	OB	599.58	9	5396.2200	82.95	25.95
15	Irinotecan	40mg	vial	1	LPG	211.96	9	1907.6045	71.81	14.81
16	Irinotecan (Campto)	100mg	vial	1	OB	708.00	4	2832.0000	74.76	17.76
17	Irinotecan	100mg	vial	1	LPG	211.95	4	847.8115	65.22	8.22

I (pre) = 57%

4.4 Limitations of research study

The medications examined in this research were sourced from the private sector database, raising potential questions about whether the findings accurately reflect the situation across South Africa. Nonetheless, the substantial price differences indicate that the conclusions drawn from this study are correct. With a focus solely on fundamental indicators, this investigation doesn't provide a comprehensive view of South Africa's pharmaceutical landscape. The median price ratio wasn't determined, making the gathered data not aligning with international reference prices. The affordability assessments might skew towards an underestimate, as the calculations were grounded on the salaries of the lowest-paid government employees, despite the fact that a considerable segment of the populace earns less than this wage level. Another constraint in this study's approach is the omission of additional cost components that contribute to the patient's final expense, such as fees for dispensing, facilities, administration, and medical practitioners. Affordability calculations were conducted using the standard dosing for individual drugs, a factor that might lead to variations if a patient is prescribed multiple medications. The study only focused on pricing and affordability of cancer medicines and not its quality. Should quality emerge as a potential issue, it could become the focus of subsequent research. Lastly, this study did not examine price composition, a factor that would entail a comparative review of the diverse elements contributing to the overall pricing framework.

4.5 Conclusion of the research study

Treating cancer is financially burdensome. The findings of this investigation indicate that the cost and affordability of medications in South Africa are worrisome issues. As the nation advances on implementing an NHI, it becomes essential to consider and devise strategies for patients who face steep expenses for treatment. While the South African Government has set regulations on medication pricing, additional measures and novel strategies are imperative to tackle the elevated costs associated with cancer drugs. Addressing this complex issue necessitates a multi-dimensional approach, including the reassessment and realignment of existing policies, regulations, and educational efforts. A valuable direction for upcoming research might be to explore the effects of price benchmarking for cancer drugs within South Africa's private healthcare sector.

CHAPTER 5: Comprehensive survey of cancer medicines prices, availability, and affordability and scoping assessment of cancer medicines pricing scenario in Ghana

Chapter 5: Comprehensive survey of cancer medicines prices, availability, and affordability and scoping assessment of cancer medicines pricing scenario in Ghana

5.1 Introduction

In the year 2020, Ghana recorded 24,009 new cancer diagnoses and suffered 15,089 fatalities, with predictions estimating that new cases may reach 44,475 by the year 2040 (Ferlay et al., 2020). The most common kinds of cancer among adults include breast cancer (18.7%), liver cancer (14.4%), cervical cancer (11.6%), prostate cancer (8.9%), non-Hodgkin's lymphoma (5%), ovarian cancer (4.2%), and colorectal cancer (3.3%). For children, the dominant forms are non-Hodgkin's lymphoma (20%), leukemia (16.1%), kidney cancer (11%), brain and nervous system (BNS) tumors (7.2%), liver cancer (2.2%), Hodgkin's lymphoma (1.9%), and nasopharyngeal cancer (1.7%) (Ferlay et al., 2020). The detrimental impact of cancer, regarding both its occurrence and death rates, can be lessened through timely detection and appropriate care (WHO, 2021). This mitigation is heavily reliant on fair access to cancer treatments that are both readily available and reasonably priced.

Concerns are rising regarding the insufficient availability of both novel and non-patented cancer drugs, with escalating costs identified as a key contributing element (WHO, 2018b). A significant number of cancer patients find the financial burden of therapy unmanageable, particularly in the absence of sufficient insurance protection, governmental refunds, or financial assistance (WHO, 2018b). Those lacking proper insurance often find themselves grappling with severe economic strain due to the exorbitant prices of cancer medications. This pressure can become so overwhelming that patients might reduce the prescribed dosages, only partially obtain the necessary prescriptions, or even abandon the treatment entirely (WHO, 2018b). Many cancer patients are unable to obtain treatment at an affordable cost due to the limited availability of necessary medications. Contributing factors include the exclusion of these cancer drugs from the Essential Medicines List (EML), inefficient distribution networks, inconsistent or entirely absent suppliers, and financial limitations (Boyle et al., 2016; Cherny et al., 2017; WHO, 2018b).

In Ghana, the provision of healthcare is overseen by the government, mainly under the guidance of the MOH and GHS. Approximately 29 establishments,

encompassing government specialist and referral hospitals such as Korle Teaching Hospital, Komfo Anokye Teaching Hospital, Cape Coast Teaching Hospital, Tamale Teaching Hospital, the 37 Military Specialist Hospital, along with private hospitals and pharmacies, are responsible for supplying cancer medications to patients (MOH, 2021).

Cancer medications are exclusively brought into the country by privately licensed drug suppliers and wholesalers, making their prices highly susceptible to changes in foreign exchange rates. Additionally, the impact of import tariffs and duties, along with the inclusion of profit markups, drives the cost to a level that renders these medicines exorbitantly expensive and inaccessible to the majority of patients. (Ghana minimum wage, 2021). The purchases of many cancer drugs are often characterized by small quantities, which contributes to the elevated pricing.

To improve inclusive coverage and fairness in healthcare services, Ghana established the National Health Insurance Scheme (NHIS) in 2003. This system encourages Ghanaians to contribute annually to a fund that, in times of sickness, can support them in obtaining reasonably priced healthcare. Contributors in Ghana are categorized based on their income levels, and premiums are set based on their financial capacity (NHIS, 2021). The NHIS currently funds only two (2) specific cancer drugs, leaving the majority (98%) of the costs for cancer medications to be covered through direct out-of-pocket payments, commonly referred to as "cash and carry" (Vanderpuye & Dadzie, 2016). Given that the minimum daily wage is around USD $2, this approach makes the cost of cancer treatment exceedingly high and challenging to bear, plunging many individuals into financial hardship (Cherny et al., 2017; Ghana minimum wage, 2021).

The primary factors determining whether patients can acquire medicines at a reasonable cost are price, availability, and affordability. When incorporated into the NMP, price transparency can fortify the government's bargaining position and increase its capability to secure more economically priced medicines (Babar, 2018). The NMP in Ghana, along with the NEML and Ghana Standard Treatment Guidelines (STG), embraces a pricing policy aimed at refining pricing structures and fostering medicine affordability. However, the actual effect of this policy on the affordability of medicines remains ambiguous (MOH, 2017a; MOH, 2017b; MOH, 2017c).

Numerous studies have explored the aspects of availability, price, and affordability of medicines (Cherny et al., 2017; Ocran et al., 2021), but none have specifically addressed the picture of pricing, availability, and affordability for adult cancer medications in Ghana. This research is the inaugural nationwide thorough survey focusing on these aspects for adult cancer treatments within the country. Additionally, the scarcity of data regarding the expenses associated with delivering childhood cancer medicines poses a significant hindrance to the creation and execution of national strategies for childhood cancer (Renner et al., 2018). As a result, this survey further investigated the pricing, availability, and affordability of pediatric cancer treatments. The goal of this research was to evaluate the price variations among different brands of cancer medications, as well as their availability and affordability, in private hospitals, public hospitals, and private pharmacies throughout Ghana.

5.1.1 Objectives of study

1. To conduct a scoping assessment of the pricing scenario in Ghana by interviewing key stakeholders.
2. To evaluate prices, availability, and affordability of oncology medicines in Ghana through a comprehensive survey employing an adapted WHO/HAI medicines pricing approach.

5.2 Methods

5.2.1 Methods on scoping assessment of the cancer medicines pricing

A rapid assessment of the country's cancer pricing modality within the pharmaceutical sector and cancer treatment facilities was conducted. This was crucial to attain a comprehensive grasp of the pharmaceutical services, the existence of a national medicines policy (including pricing policy), the essential medicines list, the role of diverse sectors in providing cancer drugs and to identify the main procurement and distribution channels for cancer medicines in Ghana. It was also to check if there have been any recent surveys on cancer pricing in Ghana. This was to explore, and plan for the survey objectives, scope, survey areas, medicines to be surveyed, and to have background information on the pharmaceutical sector. The

findings were used to ensure a successful survey and used to help interpret survey findings.

This was done using an abridged semi-structured questionnaire to collect data from several ministries departments and agencies, including the MOH's departments for policy, procurement and supply, Food and Drug Authority (FDA), Ghana Pharmacy Council and the Pharmaceutical Society of Ghana (Ref: Appendix 1). The collection of this information was done through telephone interviews to limit direct contact with the informants and thereby reducing exposure to COVID 19.

5.2.2 Methods on comprehensive survey of cancer medicines prices, availability, and affordability in Ghana

Study Design

The research was conducted in a cross-sectional manner, using the abridged version of the WHO/HAI methodology to comprehensively evaluate the availability, price, and affordability of cancer medicines in public and private healthcare facilities comprising of three sectors namely, public hospitals, private hospitals, and private pharmacies in Ghana (WHO & HAI, 2020).

The WHO/HAI approach was used in selecting the medicine outlets (survey facilities) in both private and public sectors, and to purposively sample one central hospital in the major urban center in the capital city of Ghana, identifying and randomly selecting facilities that were accessible within a day's journey from the chosen central hospital which became the survey anchor. A survey of the prices of country specific cancer medicines was carried out systematically in the medicine outlets within the survey areas. The medicine outlets refer to locations where cancer drugs are provided to patients (e.g., pharmacies, dispensaries, clinics etc.) (WHO & HAI, 2020). Pricing and availability data on the cancer medicines was collected by the trained research assistants who functioned as data gatherers during their visits to the private retail pharmacies, main public hospital pharmacies, mission/faith-based hospitals, private hospital pharmacies, private pharmacies in public hospitals. Data was collected on OB and LPG medicines found at each health facility, and their prices compared with IRPs for international comparisons (MSH, 2016; WHO & HAI, 2020). No patient was involved directly in this study however, only cost of treatment and medicines was assessed. For public hospitals, the medicine price and

availability data were collected from the outpatient healthcare services. Data was gathered on the country's demographics, including the national currency, the exchange rate to the US dollar, and the daily earnings of the lowest-paid unskilled government employee. Data was also collected on the structures, processes of country's pharmaceutical situation e.g., procurement process, regulatory, dispensing and prescribing, medicines supply chain, medicine financing, rational use of medicines (availability of NML), medicine pricing policies, price comparisons etc. Affordability was determined using the daily earnings of the least-paid unskilled government employee (WHO & HAI, 2020).

Owing to the COVID-19 outbreak, the study was carried out with measures to safeguard the health, rights, and well-being of both research participants and research staff. This research took place from August 2020 to November 2020. This survey was classified as a national survey due to the extensive data collection from all survey areas representing what pertains in Ghana.

Identifying the study areas

Based on the above methodology, four survey areas was purposively chosen based on the availability of oncological services, from the administrative Regions of Ghana representing the three eco-epidemiological zones of Ghana. These included the Greater Accra and Cape Coast in the coastal savannah, the Ashanti region in the middle forest zone and the Northern region in the northern savannah zone. Each survey region encompassed a populace ranging from approximately 143,000 to 1,960,000 and was within a day's journey from Ghana's principal capital city, Accra (MOH, 2022). A map of the survey regions and facilities is shown below in figure 4. The sampled four survey areas were sufficiently expansive to represent Ghana on a national scale and contained the necessary number of health institutions offering oncology services such as the public hospitals (teaching hospitals, tertiary care, military hospital, primary care hospital), mission hospitals, private pharmacies, private hospitals.

Figure 4: Map of Ghana showing survey regions and facilities.

Sampling strategy

The research was carried out to investigate the pricing, availability, affordability, and accessibility of cancer drugs in Ghana, employing a condensed version of the WHO/HAI sampling strategy (WHO/HAI,2020). Using a purposive sampling, all available cancer treatment health facilities, including four central health facilities (N=4) (Ref. Table 28 in Appendix 15), namely Korle-Bu Teaching Hospital (KBTH) in Accra, Cape Coast Teaching Hospital (CCTH) in Cape Coast, Komfo Anokye

Teaching Hospital (KATH) in Kumasi, and Tamale Teaching Hospital (TTH) in Tamale were selected from four (4) capital cities in 4 regions (survey areas) of Ghana, to serve as the survey anchor (MOH, 2022). The KBTH established in 1923, is currently the third largest hospital on the African continent, foremost teaching hospital and the primary national referral center in Ghana. It has a bed capacity of 2000 and sees 1500 patients daily at its outpatient departments (MOH, 2022, MOH, 2024). The Cape Coast Teaching Hospital (CCTH) stands as the largest healthcare facility in the central region of Ghana. With room for more than 400 patients, this hospital functions as the primary referral center for nearby healthcare establishments within the central region, as well as some areas of the western region (MOH, 2022; MOH, 2023). The Komfo Anokye Teaching Hospital (KATH) is the second educational hospital and the largest medical facility located in Kumasi, the regional capital of the Ashanti Region and has a 1200-bed capacity (MOH, 2022). It serves as the referral hub for pediatric oncology for nearly ten out of the sixteen regions in Ghana. The Tamale Teaching Hospital (TTL) is a regional hospital in Tamale in the Northern region of Ghana. It acts as the referral center for the three northern regions of Ghana, and It is the third teaching hospital in Ghana after the KBTH and KATH. Currently, the hospital has the ability to accommodate 484 patients and offers care to over a hundred thousand patients annually (MOH, 2022).

The major urban center (capital city of Ghana, Greater Accra Region) was chosen as the primary survey anchor, and additional survey locations within a day's journey from this primary survey anchor were identified and selected. Within each survey area, the primary public hospital was designated as the survey anchor, and healthcare facilities (pharmacies or hospital dispensaries) within a three-hour travel radius from this hospital were also selected. The facilities were selected using the snowball approach to identify and reach the next available facility. Each surveyed area encompassed a population ranging from about 1.9 million to 5.9 million (Ghana Statistical Service, 2021) (See Table 1). A comprehensive survey was intentionally conducted across 29 oncology health facilities, comprising seven public (teaching/tertiary/referral) hospitals, 20 private pharmacies, and two private hospitals. These facilities were spread over four geographical survey areas, namely Greater Accra, Ashanti, Central, and Northern Regions (MOH, 2022).

Public sector medicine outlets (Public Hospitals Pharmacies/Dispensaries):
In the Greater Accra Region, Ashanti Region, Central Region, and Northern Regions respectively public sector pharmacies or dispensaries *within three hours' travel* from the Korle Bu Teaching Hospital (KBTH), Komfo Anokye Teaching Hospital (KATH), Cape Coast Teaching Hospital and Tamale Teaching Hospitals respectively (main hospitals selected in Step 1) were selected (WHO &HAI, 2020). These facilities comprise the KBTH Child Health Pharmacy, KBTH Surgical Department Pharmacy, KBTH National Radiotherapy/Nuclear Medicine Oncology Pharmacy, KATH Oncology Directorate Pharmacy, Cape Coast Teaching Hospital's 24-Hour Pharmacy, Tamale Teaching Hospital Surgical Pharmacy, and the 37 Military Hospital.

Private sector medicine outlets (licensed Private Pharmacies/wholesalers):
In the Greater Accra Region, Ashanti Region, Central Region, and Northern Regions respectively Private Sector Pharmacies *within three hours' travel* from the Korle Bu Teaching Hospital, (KBTH), Komfo Anokye Teaching Hospital (KATH), Cape Coast Teaching Hospital and Tamale Teaching Hospitals respectively (main hospitals selected in Step 1) were selected (WHO &HAI, 2020). These comprised of: Greater Accra Region; Rock Chemist, Add Pharma Pharmacy, West Point Pharmacy, Parker Pharmacy, Vital Pharmacy and Top Up Pharmacy. Ashanti Region; Silva Pharma, Western Pharmacy, Partners Pharmacy, Lansah Chemist, Bandy Chemist, Garrison Pharmacy, KATH 24-HR Pharmacy. Two pharmacies (Peace and Love Hospital and Menri Pharmacy) selected for data collection did not consent to the study, Central Region; Ashgin Pharmacy and Honsal Pharmacy, Northern Region; Obarsi pharmacy, A&A Pharmacy, Mauplus Pharmacy, Mainstreet Pharmacy and Gina Pharmacy.

Private sector medicine outlets (Private Hospitals pharmacies/ Dispensaries):
In the Greater Accra Region, Ashanti Region, Central Region, and Northern Regions respectively Private Sector Hospital Pharmacies *within three hours' travel* from the Korle Bu Teaching Hospital, (KBTH), and Cape Coast Teaching Hospital respectively (main hospitals selected in Step 1) were selected comprising of: Sweden Ghana Medical Centre and Oak Tree Medical Services (WHO &HAI, 2020).

These were the sole medicine outlets in Ghana supplying cancer drugs to patients during the survey duration and was a representative sample. This constituted a national survey, as they represented the cancer pricing, availability, and affordability situation in the country adequately.

Study population inclusion and exclusion criteria

Selection and identification of participants and stakeholders: Prior knowledge of the potential participants was obtained from the Pharmacy association network in country. Each participant was reached out to by phone to identify their willingness to partake in the research. No patients were selected nor interviewed for this study. Pharmacists, dispensary technicians, procurement officials and other oncology health care workers and stakeholders, working at the selected health facilities and pharmacies who provided their consent, were incorporated into the study. The participants assisted in completing the questionnaire for the data collections at the health facilities and the nearby selected pharmacies. In every health facility/pharmacy, about two health care professionals were interviewed.
The second group of participants were the officers at the Ministries, Departments and Agencies who provided information in the scoping assessment questionnaire concerning structures and processes of the cancer landscape in Ghana. This second questionnaire was conducted among participants in Accra only. None of the participants was vulnerable.

Selection of survey medicines

In line with the WHO/HAI guidelines, information was gathered on 65 distinct cancer drugs (varying in strength and administration type). The surveyed cancer drugs were based on the worldwide and regional prevalence of the disease, availability, utilization, and necessity [Babar et al., 2007; WHO, 2021a, WHO, 2021b). Other considerations included the importance and listing in the 2017 Ghana NEML, 2021 WHO EML, 2021 and WHO EMLc, the availability in standard formulations, the possibility of having an IRP and the recommended oncological treatment protocols in Ghana (MOH, 2017, WHO, 2021a, WHO, 2021b) (See Table 2).
For each medicine, a review of its prices, availability, and affordability (Annex-Table 2- questionnaire for data collection at the pharmacies) was made. Each surveyed medicine had a specific dosage form and strength. Information was gathered

focusing on identical administration types and strengths of the same medicine in all medicine outlets for results comparison. The different dosage types and/or potencies of a given drug had different prices in all medicine outlets and were treated as distinct surveyed medicines each having a different set of availability and pricing information.

Using a structured questionnaire for the cancer medicines, data was gathered on prices for the OB (original pharmaceutical product that was first approved for sale, typically patented, with a distinct brand name and consistent from facility to facility); and LPG medicines (alternatives to the originator that contains the same active component, marketed under a different brand or the generic title). The data was collected on the generic based on the cheapest generic variant found in each pharmacy. LPG products therefore varied from facility to facility.

In this research, the phrase "cancer medicines" denotes both cytotoxic and adjuvant drugs. The cytotoxic category encompasses alkylating agents, analogs of folic acid, pyrimidine, and purine antimetabolites, natural compounds, hormones, hormone blockers, and several agents targeting specific molecular markers (Brunton et al., 2011).

Instrument development and data collection

From Aug 2020 to Nov 2020, a cross-sectional study was carried out. A Medicine Price and Availability Data Collection form was developed and used for the data collection (Ref: Annex- Table 2). This form was modeled after the WHO/HAI framework and incorporated three subsections: demographic details (pertaining to the pharmacy, etc.), availability of the medicine, and the unit prices for OB and LPG cancer medicines (WHO & HAI, 2022). A data collection pilot testing was carried out to ensure that the data collectors gain hands on experience, identify, and correct common mistakes such as recording wrong dosage forms and strengths of cancer medicines, to ensure they are well informed about the survey procedure and could collect data correctly (Babar et al., 2007; WHO& HAI, 2020).

The data collection form was validated during the pilot testing for efficacy and accuracy. The data from the trial test wasn't incorporated into the final study findings. After the pilot test both the drugs and the data collection document for the survey were finalized for use. The patient prices denoting the prices paid by patients were collected and the availability noted for all cancer drugs in the facility at the time of the

survey (WHO &HAI, 2020). The data collectors made visits to chosen retail and hospital drugstores and, with assistance from the on-duty pharmacist, filled out the data collection form/questionnaire conceptualized by the researcher.

Data was collected for the survey from three sectors, public hospitals, private hospitals, and private pharmacies representing public and private sector oncology healthcare establishments.

In the Greater Accra Region, the Korle Bu Teaching hospital (the main tertiary public hospital) was surveyed. Data was collected from the hospital's radiotherapy and oncology department's outpatient services as well as other levels of care such as the hematology department, child health (pediatric oncology) and surgical oncology unit. In the Ashanti Region, the Komfo Anokye Teaching Hospital (the main tertiary public hospital) was surveyed. Data was collected from the hospital's radiotherapy and oncology outpatient department's services as well as other levels of care such as pediatric oncology unit. In the Central Region, the Cape Coast Teaching Hospital (the main Regional public hospital) was surveyed. Data was collected from the hospital's oncology department's outpatient services. In the Northern Region, the Tamale Teaching Hospital (the main Regional public hospital) was surveyed. Data was collected from the hospital's oncology department's outpatient services.

Prior to to site visits, letters of introduction were prepared and shared with all the staff in the medicine outlets. Permission letters were obtained from their senior management before the survey was conducted. Appointments were made for visits to collect data, steering clear of the busiest hours. Each medicine outlet was approached directly or by phone to request permission and agree on the date and time for data collection. The survey and its goals were introduced, and assurance made that specific medicine stores would remain anonymous in the findings.

During the surveys, two data collectors (research assistants) were recruited for each Region and administered the structured questionnaires. These were non-health workers who were trained to conduct the interviews to avoid any bias that may be introduced through using health staff to monitor activities that will be implemented by the same health staff. The data collectors efficiently recorded prices, ensuring minimal disturbance. Each data visit lasted for about 1.5 hours plus travel time. The data gatherers approached the medicine outlets and documented data about the medicine prices and availability using the hard copy forms (one form per outlet), which was later entered into an excel sheet. For every drug in the survey,

information was collected only for the dosage form and potency mentioned on the data collection form.

In every facility, the availability data of each medicine was collected as well as details on the acquisition cost and patient price (selling price, retail price) data on the unit prices of the OB and the identified LPG (WHO& HAI, 2020). If there were more than one generically equivalent products, unit price (cost per pill, tablet, ml, dose) was calculated to identify the lowest. The most cost-effective generic product varied across different medicine outlets. The unit price refers to the cost per capsule, tablet, ml, dose, gram and not per box or strip and was calculated by dividing the total cost of the package by the number of units in it (i.e., price of pack / pack size). (WHO & HAI, 2020).

The OB refers to the initial pharmaceutical product that received marketing approval. The International Nonproprietary Name (INN), or the generic name, pertains to a product distinct from the originator brand but contains the same active component (substance), whether sold under a different brand name or the generic name (WHO & HAI, 2020). The LPG designates the generic item with the most affordable unit price found at each medicine outlet. Therefore, LPG products can differ from facility to facility (WHO& HAI, 2020). Data was gathered in local currency, Ghana (Gh) Cedis and converted to USD at an exchange rate of (1 Gh Cedis = 0.1652 USD), as of October 6th, 2021 (Currency Conversion, 2021).

The procurement prices were collected at all public sector medicine outlets purchasing directly from distributors and/or wholesalers.

To ensure quality, the data collectors reviewed the thoroughness, legibility and consistency of the data collected and corrected missing and unreliable data at the end of each day. The data was then meticulously re-verified for fullness and precision, with any gaps or mistakes amended and subsequently inputted into Microsoft excel sheets for analysis.

Completed forms were duplicated and preserved in water-resistant plastic pouches on-site. All primary data collection sheets, inclusive of those from validation visits, were given to the area supervisor once field activities concluded.

Quality assurance of survey data

The integrity of the data generated from the survey on medicine prices and availability was closely dependent on the data gathering process. Thorough preparation and training were done to minimize errors during data collection.

The overall responsibility for ensuring quality of data collected was with the Principal Investigator (PI), though all data collectors played a part in ensuring the information's accuracy. An area supervisor (identified from the GHS Research Unit) assisted the PI with the responsibility of overseeing the fidelity and dependability of the field data. The area supervisor and data collectors were subjected to ongoing supervision. Procedures were established to scrutinize the data for thoroughness, coherence, feasibility, and clarity during field operations, which allowed for timely corrections or additions. Entries on the data collection were complete. The area supervisor met with the data collectors regularly to receive updates on the data gathering progression, reviewed completed data sheets daily post fieldwork, and addressed any issues before the subsequent day's data gathering activities.

There were validation visits by the area supervisor, who undertook reviews at 20% of the surveyed medicine outlets to compare results with the data that had been collected by the research assistants. During the process of quality assurance, measures to limit and prevent the spread of COVID 19 was adhered to.

Monitoring and supervision of data collection

The study PI was the overall coordinator whilst a trained field area supervisor took on the full responsibility of overseeing all the field teams continuously. The PI was actively involved in the initial data gathering to closely observe the initial fieldwork and help in standardizing the data collection process. The PI participated in the initial data collection to closely monitor the initial fieldwork and assist in harmonizing the data collection.

The field area supervisor provided critical support to team members, oversaw the random selection of the facilities, assigned, and kept track of unique identification numbers to all completed questionnaires. Visits were made to the selected health facilities for the initial stages of the survey to ensure that any challenges that came up were dealt with promptly.

The study PI had full responsibility for continuously overseeing all four regional teams. The Field area supervisor also had the task of verifying the accuracy of the

data collected. Data collection and management were done concurrently. The data collection period varied depending on the availability of the respondents and based on the workload at the pharmacy during the data collection period. However, data gathering was estimated for 3-4 weeks in each region. The data cleaning, analysis and report writing took an additional 3 months. During the process of monitoring and supervision, measures to limit and prevent the spread of COVID 19 was adhered to.

Quality control during survey

Quality control was ensured throughout the research. To ensure reliability, the English data collection tool was explained in the local language to provide one common understanding among all the research assistants/data collectors to ensure that the context was not lost to provide the needed response. Preliminary testing of the data collection instruments was done during the training of the research assistants/data collectors, in a setting that had similar characteristics to the facilities used for the study. Pretesting of data collection tools was done in conformity to public health measures to prevent the transmission or risk of contracting of COVID 19. The tools were edited and finalized following pre-testing. The tools were cross-checked by the trained area supervisor for errors and blanks and mistakes rectified on the field. Double entry of data was done. At analysis stage, due process was followed for effective outcomes.

Data management

All quantitative data collected were checked daily for blanks, errors and inconsistencies and corrected. Data was screened for completeness and accuracy. Data was inputted into a Microsoft Excel sheet, after which it underwent cleansing and validation. It was also entered into the computerized WHO/HAI Medicine Price and Availability Workbook – Part I and Part II, a specialized tool tailored for Microsoft Excel (WHO &HAI, 2020). To enhance accuracy, two different individuals entered the data separately and then compared their inputs (double entry). Rigorous enforcement of data collection procedures ensured ease with data entry and analysis. Currency exchange figures were double-checked.

Data assessment was carried out using the digital workbooks, which are preconfigured to amalgamate and recapitulate findings. Various relationships between numeric variables and statistics were graphically displayed and thoroughly

analyzed to ensure clarity and precision. Basic cross-tabulation and suitable statistical tests and computational and statistical methods of analysis was carried out to determine the relationships between variables, trends, and groups.

Project management-roles and responsibilities

The PI was responsible for providing guidance, planned the technical and logistics components of the study, recruited and trained survey team, supervised data accumulation and input, ensured data reliability, conducted data control and analysis, interpreted findings, and prepared the survey document. The PI ensured that public health measures to prevent the spread or contracting of COVID 19 was adhered to by the research team.

The area supervisor helped to gain access to the health facilities and supervised all aspects of data collection, data quality and consistency in the survey area(s). He supervised the team of two data collectors. These data gatherers undertook the task of visiting medicinal outlets and meticulously documenting details related to medicine prices and their availability.

Ethical approvals and considerations

The study received ethical clearance from the University of Huddersfield, UK (Ref: SAS-SREIC 19.11.19-2); the technical committee at Korle Bu Hospital (Ref: KBTH-STC 00003/2020), Ghana Health Service's technical committee (Ref: GHS-ERC 007/01/20), and the Komfo Anokye Teaching Hospital's Research & Development Unit Institutional Review Board (Ref: KATH IRB/CA/102/20). Throughout the study, strict adherence to all ethical standards and protocols was maintained, and every approval letter was presented to the leaders of the medicine outlets. Before data gathering, administrative permissions and informed consents were verbally acquired over the phone from the medicine outlet managers.

Considering the circumstances of the COVID-19 pandemic, safety measures in line with national guidelines, including social distancing, hand washing with soap and water, using hand sanitizers, and wearing face masks, were diligently followed.

Anonymity, privacy, and confidentiality

No personal information such as name, organization, facility, hospital, or pharmacy etc. was shared with others to ensure anonymity of the facility or pharmacy. The

information shared was handled with discretion and was solely used for research purposes. weren't asked to share their names, and no identifying details were documented other than a sequential number. No personal information was collected as part of this study. All information (age, sex, position, organization) collected in this study were treated with confidentiality and in compliance with relevant laws and regulations. In the publication or presentation of the study findings, participants' identities were not disclosed. To alleviate any unease participants might have about the topics under discussion, all discussions took place in secluded and welcoming spaces within the pharmacies and dispensaries. Information about participant were de-identified and was not identifiable in any written report. Individual participants involved in this study could inspect data collected, where appropriate and necessary.

Participation in the study and consent

The management of the GHS regional health directorates, teaching hospitals and health facilities were briefed on the study's goals, and permission was sought and obtained by the PI before questionnaires were administered in the medicine outlets. Signed official letters granting access to the medicine outlets by the health authorities were obtained and shared with the staff at the medicine outlets prior to gathering data. The consent forms were drafted in English and all other standard ethical issues were duly followed during the process. Informed consent was sought from all respondents before to administering the questionnaires (forms attached). Study participants were assured of confidentiality and informed that statements they provided will not be used against them. An informed consent form was read out in English and explained further in local vernacular language to them, highlighting the interview's pros and cons and affording them the right to refuse or halt the interview at any juncture. Participation was wholly optional. There were no risks in carrying out this research. However in lieu of the ongoing COVID-19 pandemic, the risk of contracting COVID during the conduction of this research was mitigated as well as any identified risks to ensure successful research outcomes.

Risk communication on national preventive directives on COVID 19

COVID 19 is a highly infectious viral disease that spreads from person to person through respiratory droplets released by an infected person when coughing or sneezing, which can then be transmitted by touching one's eyes, nose, or mouth.

The Government of Ghana took vigorous action in the prevention and control of the COVID-19 disease. Therefore, everyone must comply with instituted disease prevention and control measures like local restrictions on large gatherings and to observe personal and public hygiene to reduce the risk of catching or spreading COVID-19.

Data analysis

A review was conducted on the pricing structures (covering both acquisition and consumer prices) and the accessibility of products within medicinal outlets, examining each specific sector and making comparisons across all sectors included in the study.

For the purposes of statistical evaluation, cancer medicines present in all three sectors (public hospitals, private hospitals, and private pharmacies) were considered. Instead of using average values, the Median Unit Price (MUP) for each medication was determined. The MUP represents the central procurement price for each unit dose (Zhu et al., 2019; WHO & HAI, 2020). The average of median values across the three sectors for comparable sets of medicines was contrasted, and variances in price, accessibility, and cost-effectiveness, as well as the average of median values and standard deviations, were outlined. The Kruskal-Wallis test was employed, and a p-value less than 0.05 was utilized to signify a noteworthy disparity.

Availability assessment

The presence of cancer drugs was ascertained by physically examining the medicinal outlets to see if they stocked cancer medications (OB and LPG) on the day the data was gathered. A cancer medicine was noted as "available" only if it was in stock on the day the data was collated (WHO & HAI, 2020). For each sector surveyed, availability was measured both for distinct cancer medicines and for the sector at large. For the individual medicines, the extent of availability was figured as the percentage presence of specific drugs. Point availability was determined by taking the count of medicines in stock at the time of the survey, dividing it by the total count of medicines investigated, and then multiplying the result by one hundred (WHO & HAI, 2020).

The extent of availability of cancer drugs was also figured as the fraction of all the medicinal outlets examined where the drug was in stock on the day the data was

collated (WHO & HAI, 2020). The percentage availability for each drug at every survey location or sector was determined as:
[(Count of hospital/private pharmacies where medicine is physically available) divided by (Total number of hospital/private pharmacies)] X 100 (WHO & HAI, 2020).
An analysis on the accessibility of individual drugs (OB and LPG) was done including a comparison of cancer medicines availability in all sectors. It was also documented whether each drug was listed on the NEML, WHO EML and EMLc.

Price assessment

Price comparisons for each medicine's procurement were conducted across each sector, using international reference price benchmarks as a standard.
To facilitate global comparisons, the prices obtained from the medicine procurement during the survey were displayed as ratios compared to a consistent set of IRPs. The international benchmark utilized for this comparison was the 2015 MSH Supplier IRP, aiming to align local cancer medicine procurement prices with an international norm (MSH, 2015). These IRPs represent the median values of recent procurement or tender offers made mainly by non-profit suppliers to developing nations for products sourced from multiple suppliers (MSH, 2015). The IRPs are the medians of recent procurement or tender prices offered by predominantly not-for-profit suppliers to developing countries for multi-source products (MSH, 2015). The MPRs were analyzed across different medicines, and across product types (OB/LPG) for the same medicine. The MPR is a ratio expressing how the median local medicine procurement price compares with the IRP, indicating if it is higher or lower (WHO & HAI, 2020). Ideally, the procurement prices for the LPGs should align closely with the MSH's international prices offered by suppliers/buyers (meaning, ratios nearing 1.00). For instance, an MPR value of 1.00 or lower suggests a highly efficient procurement system. In contrast, an MPR exceeding 1.00 may suggest inefficiencies in the procurement process (WHO & HAI, 2020). The MPRs for the original branded products could be significantly higher. An MPR value of 2 would indicate that the local price of the medicine is double the IRP (WHO & HAI, 2020). The formula to calculate the MPR is:
MPR = Median local unit price (USD)/Median IRP (USD) (WHO &HAI, 2020).
For this study, the latest available MSH IRP data was published in 2015 and the study price data was collected in a different year, and both subject to diverse inflation

rates. As a result, an MPR using prices adjusted by a deflation factor of 84.73% was derived based on the Ghana Consumer Price Index (CPI) from July 2014 to July 2019 (Consumer Price Index, 2021; MSH, 2015). The CPI serves as an inflation gauge, reflecting the present cost of items relative to their prices during a comparable time in a prior year, illustrating inflation's impact on buying power (Business Dictionary, 2016). This method of adjusting prices, akin to other researchers was chosen to enhance the credibility of comparisons between local and international prices (MSH, 2015; Saeed et al., 2019; Song et al., 2018).
Conventionally, an MPR value equal to or below one signifies effective procurement in the public domain. Meanwhile, a value under three denotes efficiency in the private sector (Babar et al., 2007; WHO & HAI, 2020).
Comparisons of patient prices were conducted between OB and LPG across all sectors. For each specific medication of the same potency and form, the retail price from every manufacturer was ascertained. In scenarios where multiple prices were identified within a facility, the most economical price was selected. By amalgamating the patient retail price data from all facilities, we determined the minimum, maximum, and MUP prices for every drug, both OB and LPG, even if only a single price was identified.
The measure of procurement efficacy was determined by the discrepancy between the HPM and the LPM. Additionally, brand premiums between OB and their LPG counterparts were assessed (WHO & HAI, 2020).
The variance between the highest and lowest prices of individual medicines produced by multiple pharmaceutical companies across various brands was determined using this equation:
Price Variation/Cost Differential (%) = [(Price of the Originator/Brand with highest price – Price of the Generic/Brand with lowest price) divided by (Price of Originator/Brand with highest price)] x 100 (WHO & HAI, 2020).
For the purpose of comparison, the prices of cancer medications were represented in relation to other prices. The Price Ratio (PR) between OB and LPG or HPM and LPM was found using:
Price Ratio = Price of the OB divided by Price of the LPG or Price of the HPM divided by Price of the LPM (WHO & HAI, 2020).
When the deduced ratio is ≤1, it signifies that the pricing in the public sector is justifiable. Conversely, a value of ≥3 in the private sector indicates that people in

Ghana are paying more for the medication than the WHO's recommended price (WHO & HAI, 2020). An analysis of the median patient prices of OB and LPG across the three sectors to highlight sectors with significant price gaps.

Affordability assessment

The feasibility of addressing primary cancer-related health issues through standard treatment protocols was assessed using the median prices acquired from the study. Using the WHO/HAI approach, the affordability metric was derived by evaluating the expense of a one-month medicine supply for the entire cancer treatment duration. This was done by juxtaposing the daily dosage and treatment length against the daily earnings of the LPGW (WHO & HAI, 2020). For this research, treatment protocols were referenced from the EMC (Datapharm Ltd, 2021) in the United Kingdom (UK) and the guidelines provided by the NCCN (NCCN, 2020). A single month's supply of cancer drugs was chosen to illustrate the financial burden on patients who might need to cover the cost directly, even though cancer treatment typically involves several cycles and diverse drug combinations. When necessary, computations were based on an 80 kg adult. As of 2021, the daily wage for the LPGW in Ghana stood at 12.53 Gh Cedis (2.07 USD) (Minimum Wage, 2021).
*Number of days wage needed to cover treatment = expense of tablet(s)/vial(s) of cancer medication required monthly /daily wage of LPGW (*WHO & HAI, 2020).
An analysis of treatment affordability in the different sectors as well as by individual medicines type (OB and LPG) was made.
According to the WHO, a treatment is deemed affordable if its cost doesn't surpass a day's income based on the salary of unskilled LPGW (WHO & HAI, 2020). The affordability analysis expressed prices in terms of an individual's financial capacity rather than benchmarking them against global prices. It is crucial to recognize that these expenses only cover the drug-related portion of the entire treatment expenditure, excluding costs for consultations and diagnostic evaluations.
I reviewed relevant policies such as the STG 2017, Ghana’s NMP (2017), Ghana’s EML (2017), EML (2021), EMLc (2021), Ghana NHIS, and National Strategy for Cancer Control in Ghana 2012 to 2016 (2011), to substantiate the findings and to enhance the discussions (NHIS, 2021; MOH, 2017a; MOH, 2017b; MOH, 2017c; WHO, 2021a; WHO 2021b). References from these policy materials have been included to offer qualitative perspectives.

5.3 Results

5.3.1 Results on scoping assessment of the cancer medicines pricing in Ghana

This scoping assessment revealed that cancer treatment in Ghana is hampered by numerous challenges, such as high prices of cancer drugs, with small or no repayment of by healthcare financing schemes. Weak medicine price controls, ineffective procurement modalities and the absence of financial coverage for cancer treatment does have substantial effects on availability and access to cancer drugs in the country. The high costs associated with supply and procurement mean there are only a handful of distributors for these medicines. Cancer medicines are procured by the Ministry of Health (MOH), centrally for the public facilities. It is stored at the national and regional medical stores for distribution to GHS cancer treatment hospitals. Most private pharmacies do not normally stock cancer drugs, and there's a direct prescription from a medical professional. Some patients could not pay for the cancer drugs and poverty is a contributory factor for default in treatment, or poor adherence to the treatment regimen. The cancer patients do not have preference in buying branded or generic medicines. They only submit to the pharmacist the prescription from the doctor who mostly prescribes generic cancer medicines due to their cost-effectiveness. Drugs for treating breast and cervical cancers are listed on the NHIS and thus provided free to all patients.

5.3.2 Results on comprehensive survey of cancer medicines prices, availability, and affordability in Ghana

The survey evaluated three main sectors: public (which includes public hospitals), private (encompassing private pharmacies), and others (representing private hospitals) (Table 11).

Table 10: Number of facilities (outlets sampled), regional population in 2020, and location of the cities involved in Ghana (Ghana Statistical Service, 2020).

Region	Regional Population	City Surveyed	Number of Facilities in each City		
			Public Hospitals	Private Pharmacies	Private Hospitals
Ashanti	5,924,498	Kumasi	1	7	0
Greater Accra	5,055,883	Accra	4	6	1
Central	2,605,492	Cape Coast	1	2	1
Northern	1,948,413	Tamale	1	5	0
Total Facilities			7	20	2

A total of 65 distinct cancer drugs (including LPGs and OBs with varying strengths and forms) were examined across 29 pharmaceutical locations (Table 12).

Table 11: Cancer drugs available in Ghana's cancer centers, their conditions, and their inclusion on the NEML, WHO EML, WHO EMLc (Brunton et al., 2011 MOH 2017a; WHO 2021a; WHO 2021b)

No.	International Non-Proprietary Name (INN)	Innovator Brand/OB Name	Branded Generic Name (s)	Medicine Strength	Dosage Form		Listed in Ghana EML	Listed in WHO EML	Listed in WHO EMLc	Chemotherapy Indication
1	Abiraterone	Zytiga	-	250mg	Tab		x			Hormones for prostate cancer.
2	Anastrozole	Arimidex	-	1mg	Tab		x			Hormones and antagonist for breast cancer.
3	Bevacizumab	Avastin,	-	400mg	Vial					Colorectal
4	Bicalutamide	Casodex	-	50mg	Tab	x	x			Hormones and antagonist for prostate cancer.
5	Bicalutamide	Casodex	-	150mg	Tab					Hormones and antagonist for prostate cancer.
6	Bleomycin	Bleo-Kyowa	Bleowel, Bleocel	15 IU PFR	Vial		x		x	Natural product for testis, cervical ovarian,

								Hodgkin's disease, non-Hodgkin's lymphoma.
7	Bortezomib	Velcade	Neomib	3.5mg	Vial	x		Miscellaneous agent for Multiple myeloma and mantle cell lymphoma.
8	Capecitabine	Xeloda	-	500mg	Tab	x		Anti-metabolite for breast, colon, esophageal, stomach, pancreas, premalignant skin lesion (topical), head and neck.
9	Carboplatin	Paraplatin	Carbotin, Carbotinol, Kemocarb	150mg	Vial	x	x	Alkylating agent for testicular, ovarian, bladder, esophageal, lung,

								colon, breast, brain, neuroblastoma, head, and neck.
10	Carboplatin	Paraplatin	Carbotin, Carbotinol, Kemocarb	450mg	Vial	x	x	Alkylating agent for testicular, ovarian, bladder, esophageal, lung, colon, breast, brain, neuroblastoma, head, and neck.
11	Chlorambucil	Leukeran	Celkeran, Chloramax	2mg	Tab	x		Alkylating agent for chronic lymphocytic leukemia, macroglobulinemia, Hodgkin lymphoma, and non-Hodgkin lymphoma

12	Cisplatin	Platinol	Cistero-10, Abiplatin, Kemoplat	10mg/10ml	Vial		x	x	Alkylating agent for testicular, ovarian, bladder, esophageal, lung, head and neck, colon, breast, cervical, mesothelioma, brain tumors and neuroblastoma.
13	Cisplatin	Platinol	Cistero-50, Kemoplat, Celplat	50mg	Vial	x	x	x	Alkylating agent for testicular, ovarian, bladder, esophageal, lung, head and neck, colon, breast, cervical, mesothelioma, brain tumors and neuroblastoma.

14	Cyclophosphamide	Endoxan, Cytoxan	Cycloxan, Phoxelon	50mg	Tabs	x	x		x	Alkylating Agent for acute and chronic lymphocytic leukemia, Hodgkin's disease, multiple myeloma, ovarian, breast, small cell lung, neuroblastoma, and sarcoma.
15	Cyclophosphamide	Endoxan, Cytoxan	Phoxelon-500, Cyphos	500mg	Vial	x	x		x	Alkylating Agent for acute and chronic lymphocytic leukemia, Hodgkin's disease, multiple myeloma, ovarian, breast,

								small cell lung, neuroblastoma, and sarcoma.
16	Cyclophosphamide	Endoxan, Cytoxan	Cyphos	1g	Vial	x	x	Alkylating Agent for acute and chronic lymphocytic leukemia, Hodgkin's disease, multiple myeloma, ovarian, breast, small cell lung, neuroblastoma, and sarcoma.
17	Cytarabine	Cytosar-U	Cytalon-100	100mg	Vial	x	x	Anti-metabolite for acute myelogenous and acute lymphocytic leukemia and

								non-Hodgkin’s lymphoma.
18	Dacarbazine	DTIC-Dome	Celdaz, Dacarex	200mg	Vial			Alkylating agent for malignant melanoma, Hodgkin’s disease, and soft-tissue melanoma.
19	Dacarbazine	DTIC-Dome	Celdaz-500	500mg	Vial			Alkylating agent for malignant melanoma, Hodgkin’s disease, and soft-tissue melanoma.
20	Dactinomycin/ Actinomycin D	Cosmegen	Dacilon	0.5mg	Vial	x	x	Natural product for choriocarcinoma, Wilms’ tumor, rhabdomyosarcoma, testis, Kaposi’s

								sarcoma, Ewing's sarcoma, trophoblastic neoplasm, and ovarian.
21	Daunorubicin	**C**erubidine	Daunotec	20mg	Vial			Natural product for acute and chronic myelogenous leukemia, and acute lymphocytic leukemia, and Kaposi's sarcoma.
22	Docetaxel Trihydrate	Taxotere	Docetero-20	20mg	Vial	x		Natural products for ovarian, breast, lung, prostate, bladder, stomach, head, and neck cancer

23	Docetaxel Trihydrate	Taxotere	Daxotel, Docetero-80, Docetaxel Sandoz	80mg	Vial				Natural products for ovarian, breast, lung, prostate, bladder, stomach, head, and neck cancer
24	Docetaxel Trihydrate	Taxotere	-	120mg	Vial				Natural products for ovarian, breast, lung, prostate, bladder, stomach, head, and neck cancer
25	Doxorubicin HCL	Caelyx, Adriblastina RD, Adriblastina CSV	-	10mg	Vial	x	x	x	Natural product for soft-tissue, osteogenic, and other sarcoma, Breast, bladder, Kaposi's sarcoma, Hodgkin’s disease, non-

								Hodgkin’s lymphoma, acute lymphocytic leukemia, breast, genitourinary, thyroid, lung, stomach, neuroblastoma and other childhood and adult sarcomas.
26	Doxorubicin HCL	Caelyx, Adriblastina RD, Adriblastina CSV	Doxinyl -50, Doxorubicine HCl Sandoz	50mg	Vial	x	x	Natural product for soft-tissue, osteogenic, and other sarcoma, Breast, bladder, Kaposi's sarcoma, Hodgkin’s disease, non-Hodgkin’s

										lymphoma, acute lymphocytic leukemia, breast, genitourinary, thyroid, lung, stomach, neuroblastoma and other childhood and adult sarcomas.
27	Epirubicin	Pharmorubicin	Epiget-50, Epiruba	50mg	Vial					Breast
28	Etoposide	Vepesid, Etopophos	Posid, Etopa, Etovel, Oncosid-100	100mg/5ml	Vial	x	x		x	Natural product for testis, lung, breast cancer, Hodgkin’s disease, non-Hodgkin’s lymphomas; acute myelogenous

								leukemia, Kaposi's sarcoma, neuroblastoma, and ovarian.
29	Exemestane	Aromasin	-	25mg	Tab			Hormones and antagonist for breast cancer.
30	Filgrastim	Neupogen, Zarzio, Nivestim, Accofil	-	300mcg	Vial	x	x	Hormonal Immune modulator for prophylaxis in patients at high risk for developing or have developed febrile neutropenia associated with

								myelotoxic chemotherapy.
31	Fluorouracil	Fluroblastin,	Raciwel	50mg/ml	Vial	x	x	Anti-metabolite for breast, colon, esophageal, stomach, pancreas, cervical, premalignant skin lesion (topical), head and neck.
32	Fluorouracil	Fluroblastin,	Raciwel, Fluracil, 5-flucel	500mg	Vial			Anti-metabolite for breast, colon, esophageal, stomach, pancreas, cervical, premalignant skin lesion (topical), head and neck.

33	Gemcitabine	Gemzar,	Gemget-1000, Gemwel	1000mg	Vial		x		Antimetabolite for pancreatic, ovarian, lung, testicular, breast, and bladder.
34	Goserelin	Zoladex	-	3.6mg	Vial	x			Adjuvant for hormone therapy
35	Goserelin	Zoladex	-	10.8mg	Vial	x			Adjuvant for hormone therapy
36	Hydroxy Urea (hydroxy carbamide)	Hydrea, Siklos	-	250mg	Tabs		x	x	Miscellaneous agent for chronic myelogenous leukemia, polycythemia, cervical, and essential thrombocytosis.
37	Ifosfamide+ Mesna	Haloxan 2G with Uromitexan	-	1g	Vial		x	x	Alkylating Agent for non-Hodgkin’s lymphoma, multiple myeloma,

								neuroblastoma, breast, ovary, lung cancer, Wilms' tumor, cervix, testis, soft-tissue sarcoma, bladder, muscles, and bones.
38	Imatinib	Gleevec, Glivec	Veenat-100	100mg	Tab	x	x	Miscellaneous agent for chronic myelogenous leukemia, gastrointestinal stromal tumors, hyper eosinophilia syndrome.
39	Imatinib	Gleevec, Glivec	-	400mg	Tab	x	x	Miscellaneous agent for chronic myelogenous leukemia, gastrointestinal

									stromal tumors, hyper eosinophilia syndrome.
40	Irinotecan	Campto	Irinotel	100mg/5ml	Vial		x	x	Natural product for colon, and small cell lung.
41	L-Asparaginase	Spectrila	Bionase	10,000iu	Vial		x	x	Natural product for acute lymphoblastic leukemia.
42	Lenalidomide	Revlimid	Lenalid-10	10mg	Cap				Miscellaneous agent (immune modulator) for Myelodysplasia (5q− syndrome), multiple myeloma.
43	Leuprolide Acetate	Prostap, Lupron	-	3.75mg	Vial	x			Hormone and antagonist for prostate and breast.

44	Leuprolide Acetate	Prostap, Lupron	Luprova	11.25mg	Vial		Hormone and antagonist for prostate and breast.
45	Liposomal Doxorubicin	Myocet, Doxil, Caelyx	-	20mg	Vial		Natural product for soft-tissue, osteogenic, and other sarcoma, Hodgkin’s disease, non-Hodgkin’s lymphoma, acute leukemia, breast, genitourinary, thyroid, lung, and stomach cancer, neuroblastoma, Kaposi's sarcoma, and other childhood

									and adult sarcomas.
46	Liposomal Doxorubicin	Myocet, Doxil, Caelyx	-	50mg	Vial	x		x	Natural product for soft-tissue, osteogenic, and other sarcoma, Hodgkin’s disease, non-Hodgkin’s lymphoma, acute leukemia, breast, genitourinary, thyroid, lung, and stomach cancer, neuroblastoma, Kaposi's sarcoma, and other childhood and adult sarcomas.

47	Melphalan	Alkeran, Evomela	Alkacel-2	2mg	Tab	x		Alkylating agent for multiple myeloma, ovarian, melanoma, and AL amyloidosis.
48	Mercaptopurine	Puri-Nethol, Xaluprine		50mg	Tab	x	x	Anti-metabolite for acute lymphocytic and chronic myelogenous leukemia, small cell non-Hodgkin’s lymphoma, Crohn's disease, and ulcerative colitis.
49	Mercaptopurine	Puri-Nethol, Xaluprine	-	150mg	Tab			Anti-metabolite for acute lymphocytic and

									chronic myelogenous leukemia, small cell non-Hodgkin’s lymphoma, Crohn's disease, and ulcerative colitis.
50	Methotrexate	Methofill, Metoject PEN, Nordimet, Zlatal	Biotrexate	2.5mg	Tab	x	x	x	Antimetabolite for acute lymphocytic leukemia; choriocarcinoma; breast, head, neck and lung cancers; osteogenic sarcoma; bladder cancer.
51	Methotrexate	Methofill, Metoject	Methocel-50	50mg	Vial		x	x	Antimetabolite for acute lymphocytic

		PEN, Nordimet, Zlatal					leukemia; choriocarcinoma; breast, head, neck and lung cancers; osteogenic sarcoma; bladder cancer.
52	Mitomycin	Mitocin	10mg	Vial			Natural product for stomach, anal, breast, superficial bladder tumors and lung cancer.
53	Oxaliplatin	Eloxatin	100mg	Vial	x	x	Alkylating agent for testicular, ovarian, bladder, esophageal, lung, colorectal, breast cancer head and neck.

54	Paclitaxel	Taxol, Abraxane	Intaxel, Ataxil, Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz	100mg	Vial			Natural products for ovarian, breast, lung, prostate, bladder, esophageal, Kaposi sarcoma, cervical, and pancreatic, head and neck cancer.
55	Sorafenib	Nexavar	Soranib, Orib, Sorafenat	200mg	Tab			Miscellaneous agent for renal, primary kidney cancer, advanced primary liver cancer, FLT3-ITD positive AML and radioactive iodine resistant advanced thyroid carcinoma.

56	Tamoxifen	Kessar 10, Nolvadex, Soltamox, Tamoxen	Tamoxifen-Teva	10mg	Tab	x	Hormones and antagonist for breast cancer.
57	Tamoxifen	Nolvadex-D / Kessar 20, Nolvadex, Soltamox, Tamoxen	Cytotam	20mg	Tab	x	Hormones and antagonist for breast cancer.
58	Thalidomide	Talidex	Thalix-50	50mg	Cap	x	Miscellaneous agent (immune modulator) for multiple myeloma.
59	Thalidomide	Talidex	Thalix-100	100mg	Cap		Miscellaneous agent (immune modulator) for multiple myeloma.
60	Trastuzumab	Herceptin,	-	600mg	Vial	x	Breast and stomach
61	Triptorelin Acetate	Decapeptyl	-	3.75mg	Vial		Prostate

62	Vinblastine	Velban	Chemoblast	10mg	Vial		x	x	Natural products for Hodgkin’s disease, non-Hodgkin’s lymphoma, non-small cell lung, bladder, brain, melanoma, and testis.
63	Vincristine	Oncovin, Vincasar, Marqibo	Biocristine-AQ, Vincristine Medcrist, Vinlon-1, Vincristine Micristin, Cytocristin	1mg	Vial	x	x	x	Natural products for acute lymphocytic leukemia, acute myeloid leukemia, neuroblastoma, Wilms’ tumor, rhabdomyosarcoma; Hodgkin’s disease; non-Hodgkin’s

								lymphoma, and small cell lung.
64	Vinorelbine	Navelbine	Vinelbine	50mg	Vial	x	x	Natural products for breast and non-small cell lung.
65	Zoledronic Acid	Zometa	Zoldron, Zelodro-Denk	4mg/5ml	vial	x		Adjuvant for bone diseases.

5.3.2.1 Availability of cancer medicines in Ghana

The collective presence of cancer drugs (both OB and LPG) in the 29 facilities assessed was notably limited. The distinctions between drug categories and institutions weren't statistically meaningful, given that $p>0.05$. LPGs were more frequently available than OBs across all sectors. Figures 6 and 7 display the percentage availability of LPG and OB drugs, analyzed using the Kruskal Wallis test. The 'mean of medians' availability for LPGs was greatest in private hospitals at 13.08%, followed by public hospitals at 10.55%. Private pharmacies exhibited the lowest rate at 9.69% (See Table 13, Figure 6). Regarding OBs, the 'mean of medians' availability was higher in private hospitals at 5.38% compared to private pharmacies at 2.46%. The least availability was recorded in public hospitals at 2.42% (See Table 13, Figure 7).

Table 12: Percentage availability using 'mean of median'

Facility	OB Mean	LPG Mean
Private Hospital	5.38	13.08
Public Hospital	2.42	10.55
Private Pharmacy	2.46	9.69
All Facilities	3.42	11.11

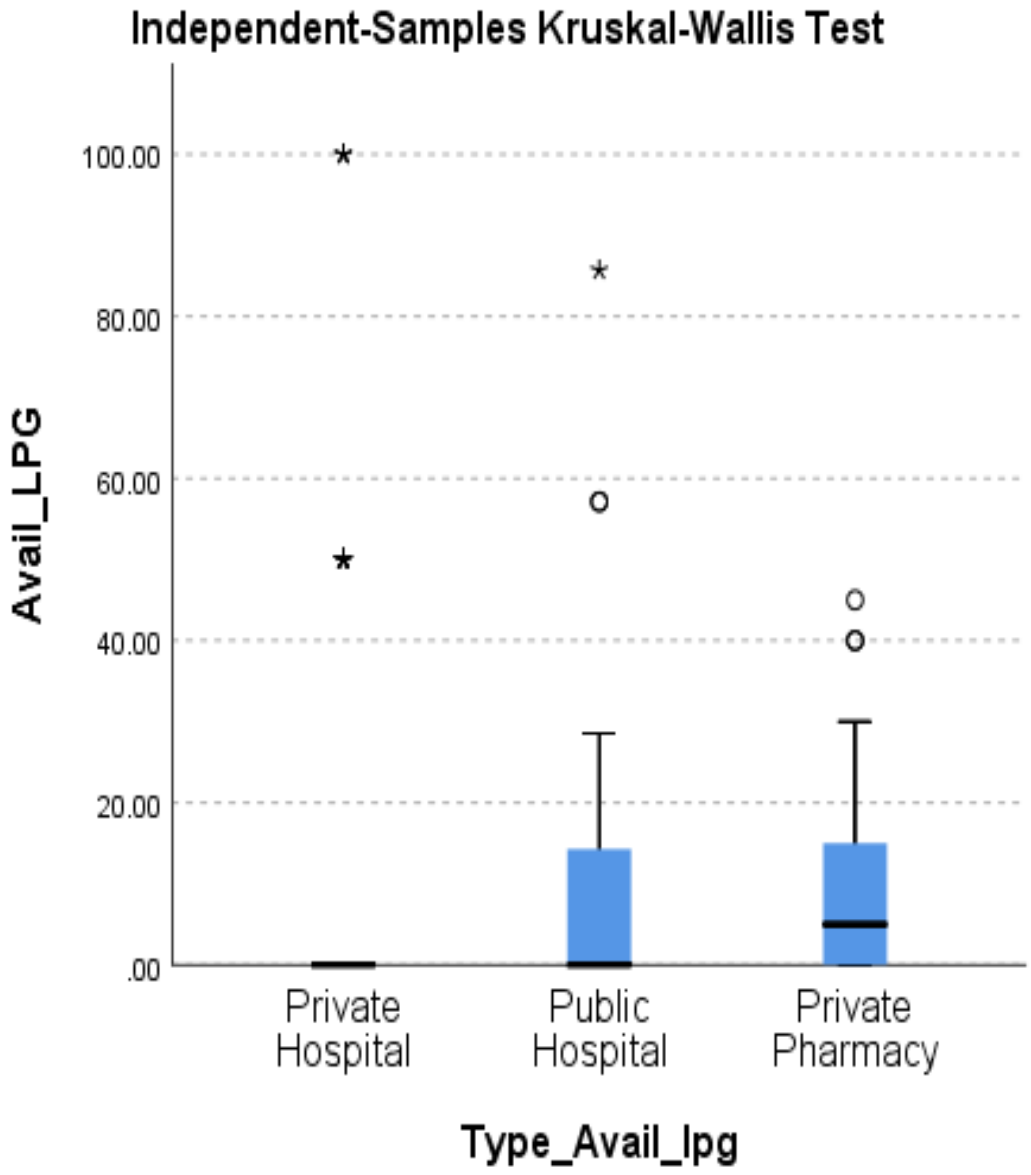


Figure 5: Percentage Availability of LPG assessed via Kruskal Wallis Test.

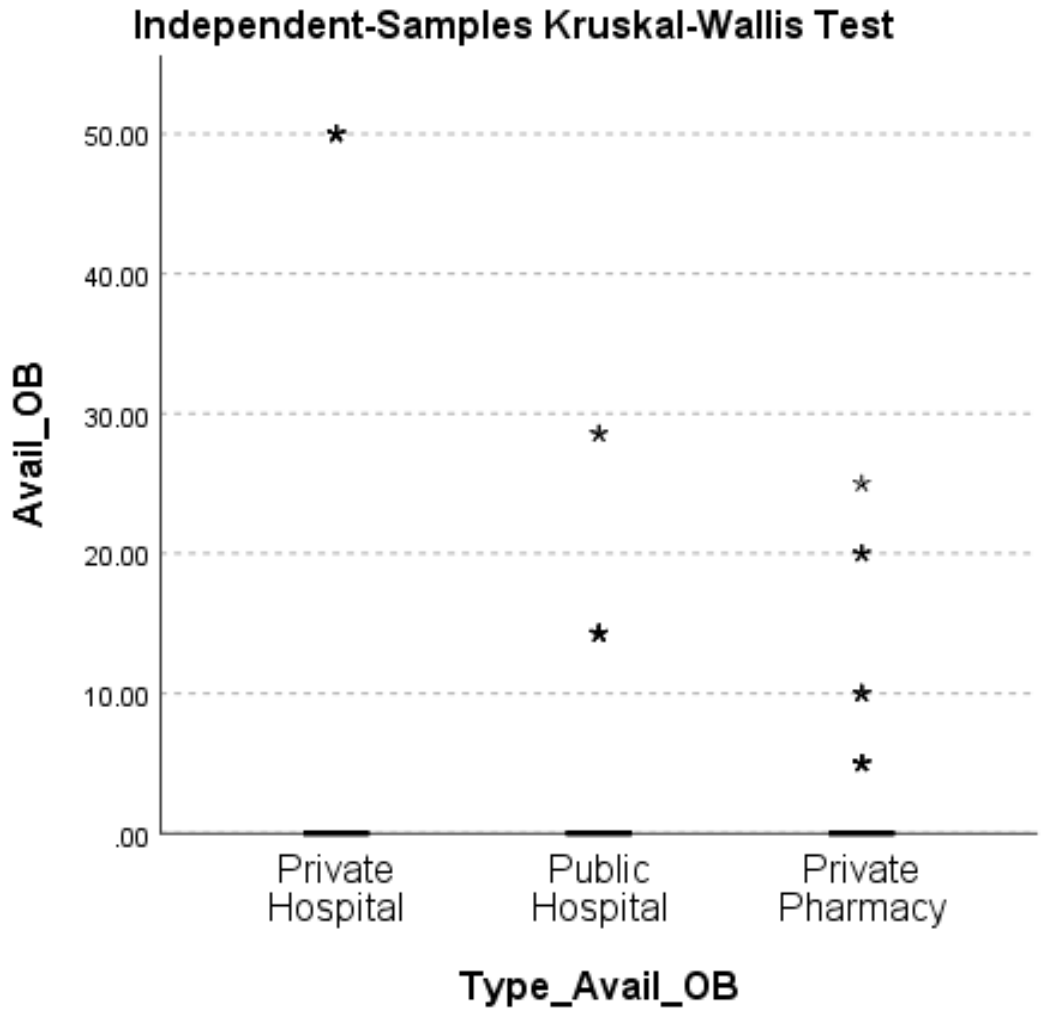


Figure 6: Percentage Availability OB using Kruskal Wallis Test.

In public hospitals, LPGs and OBs were available at rates of 46% and 14% respectively (Figure 8). Meanwhile, in private hospitals, LPGs had an availability rate of 22%, and OBs were at 11% (Figure 9). Within private pharmacies, 74% of LPGs were available, while OBs stood at 23% (Figure 10).

Of the cancer medicines present in the surveyed outlets, 16.92% were on the NEML. There were some medication strengths noted on the NEML that weren't available during the survey. However, a drug's absence from the NEML did not imply its unavailability; 83.08% of the cancer drugs found in outlets weren't listed on the NEML. The WHO EML and WHO EMLc included 66.15% of the surveyed cancer drugs.

Figures 8, 9, and 10 present the availability of Cancer Medicines (both OB and LPG) in Public Hospitals, Private Hospitals, and Private Pharmacies respectively.

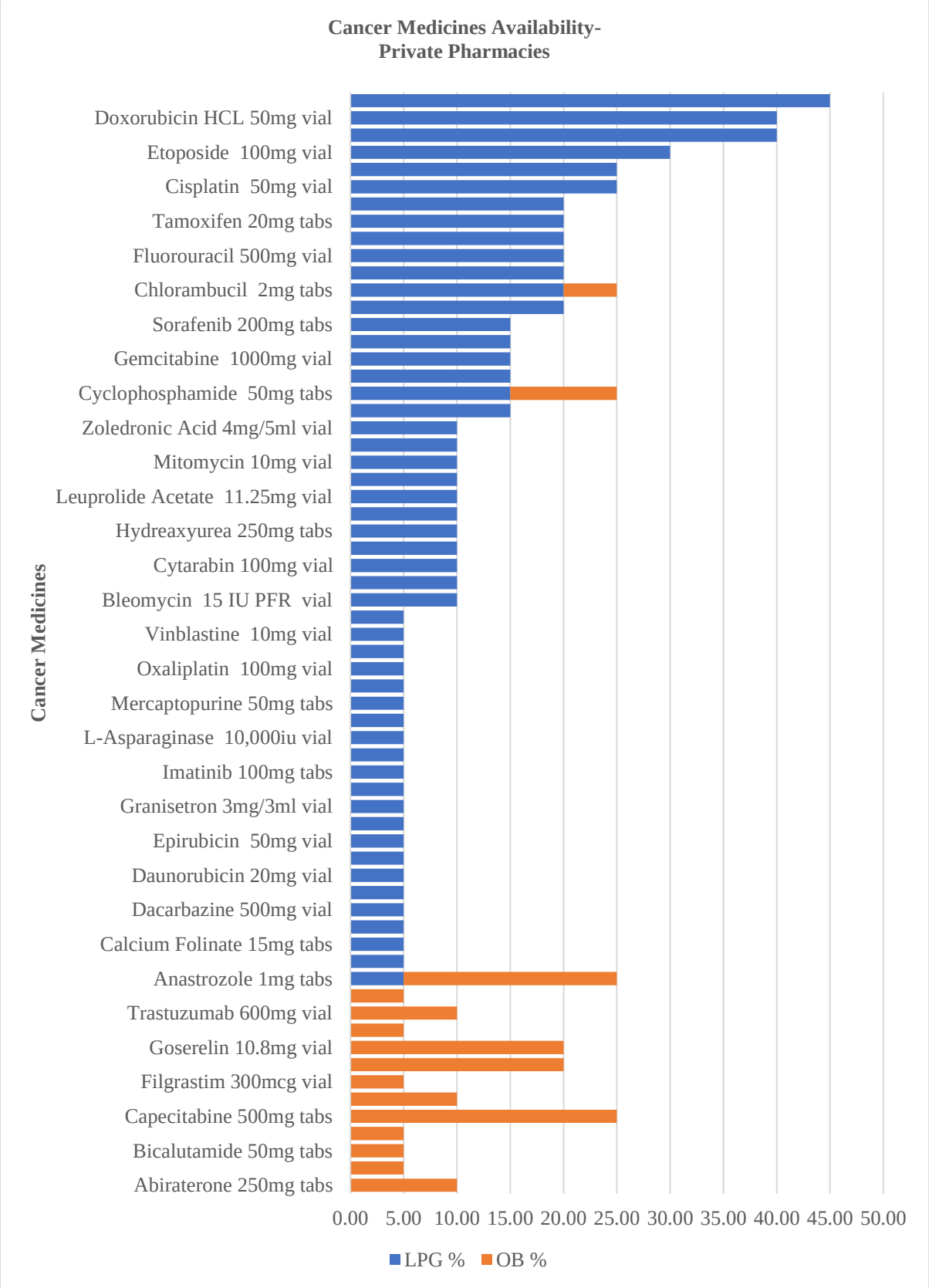


Figure 7: Presence of cancer drugs (OB and LPG) within Ghana's public hospitals.

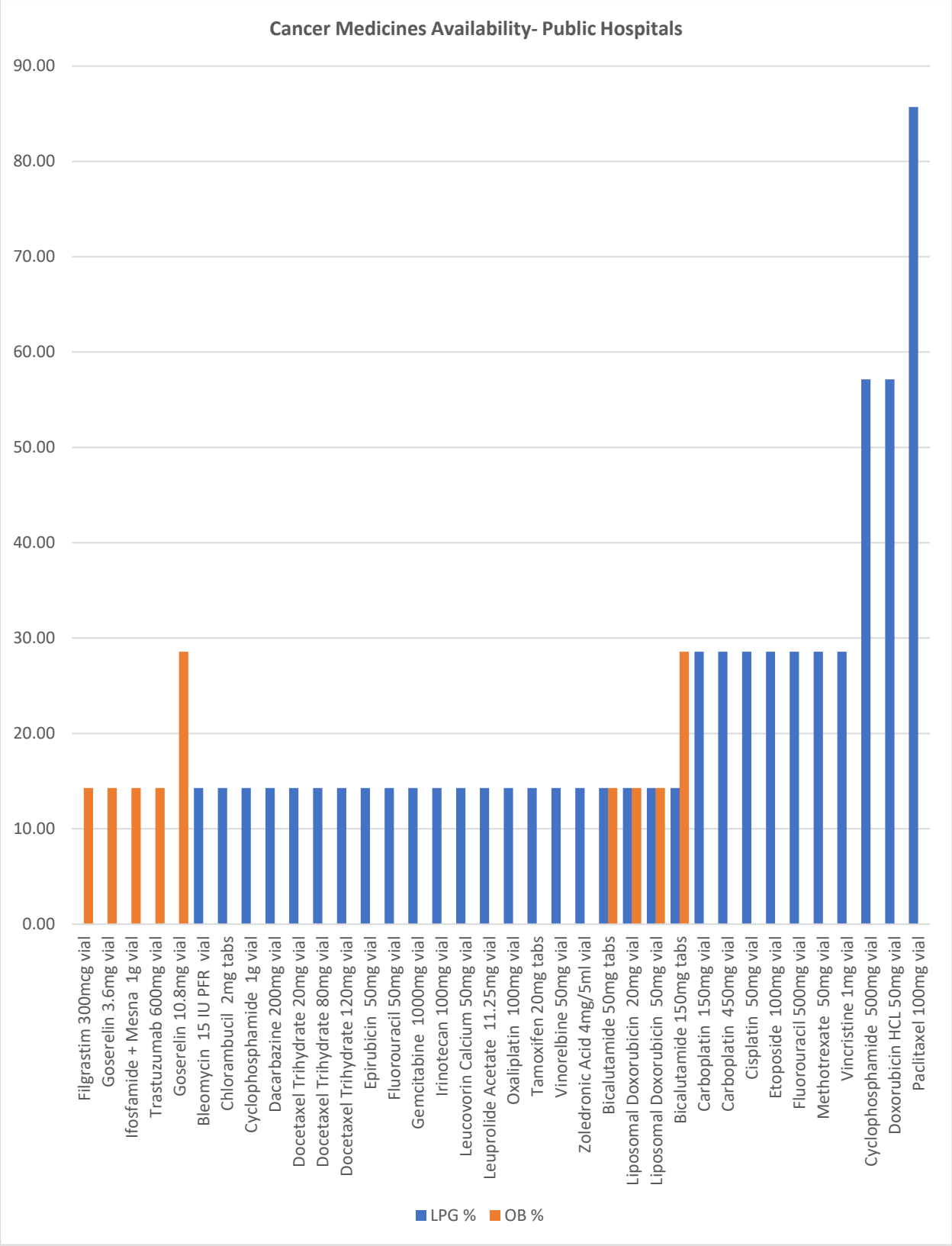


Figure 8: Accessibility of cancer drugs (OB and LPG) in Ghana's private hospitals.

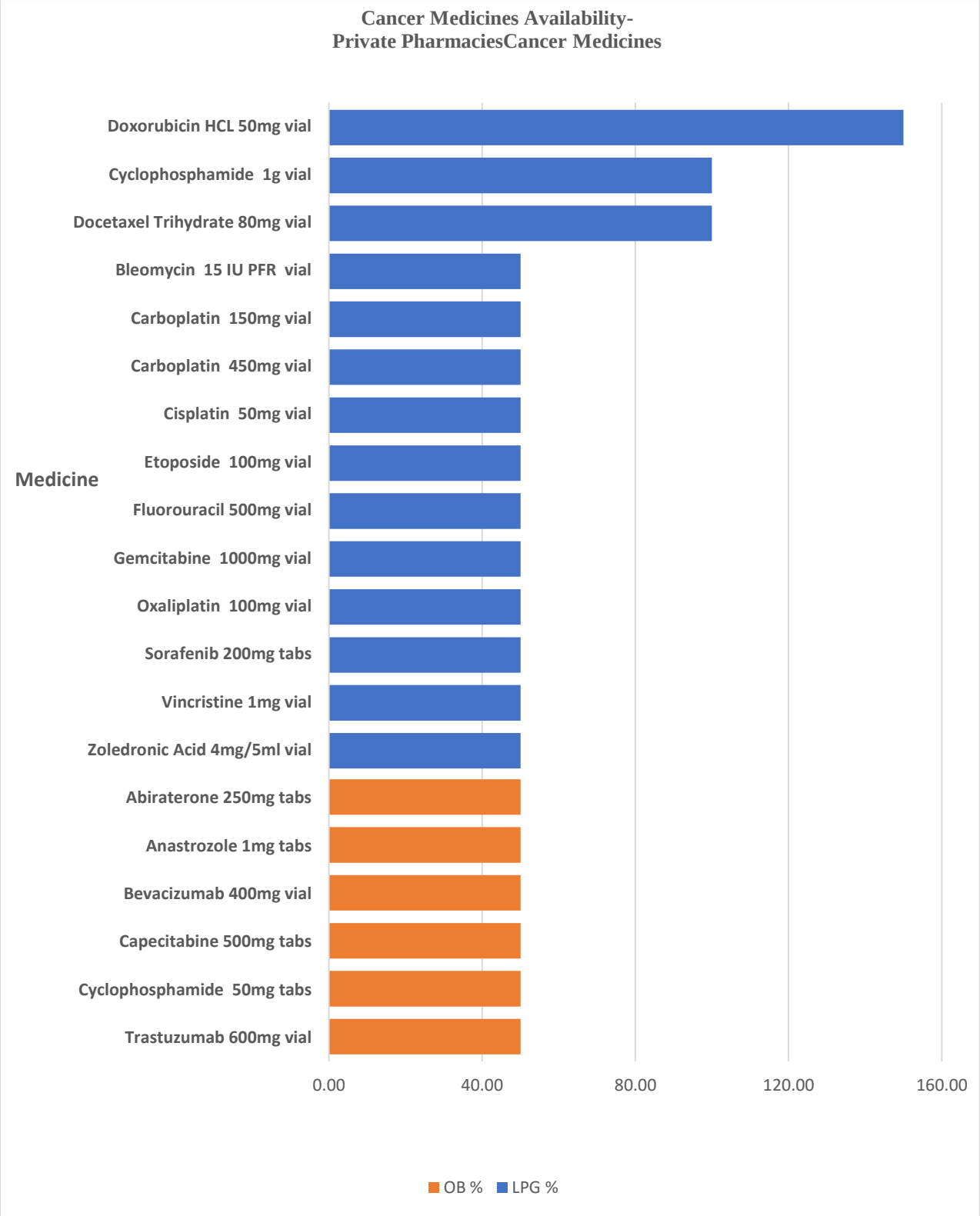


Figure 9: Presence of cancer treatments (OB and LPG) within private drugstores in Ghana.

5.3.2.2 Price Ratio Comparisons

The 65 surveyed cancer drugs, both OBs and LPGs, displayed notable price disparities between the highest and lowest prices (Table 14). These price differentials weren't statistically significant, evidenced by a p-value exceeding 0.05. Figures 11 and 12 present the median price fluctuations between OB and LPG, analyzed using the Kruskal Wallis Test.

The average of the median prices, denoted in USD, for LPGs peaked in private hospitals at 55.42. This was succeeded by public hospitals at 32.10, with private pharmacies registering the least at 31.99. Prices spanned from a mere 0.25 to an elevated 227.98. The maximum median price for LPGs was observed in private pharmacies (227.98), then in private hospitals (165.20), and the most modest in public hospitals (132.16) (Table 14, Figure 11).

For OBs, the average of the median prices, represented in USD, was highest in private hospitals, measuring 391.39. This was followed by public hospitals at 120.19 and the lowest was in private pharmacies at 104.67. Median prices for OBs oscillated between a low of 0.41 to as high as 1321.60. The highest median price for OBs was registered in private hospitals (1321.60), followed by public hospitals (646.59), with the most economical found in private pharmacies (581.21) (Table 14, Figure 12).

Table 13: Differences in median cost (USD) among HPM, LPM, OB, and LPG within Ghana

Facility Price	Mean of Median LPG	Minimum of Median LPG	Maximum of Median LPG	Mean of Median OB	Minimum of Median OB	Maximum of Median OB
Private Hospital	55.42	2.97	165.20	391.39	0.41	1321.60
Public Hospital	32.10	0.48	132.16	120.19	1.43	646.59
Private Pharmacy	31.99	0.25	227.98	104.67	0.50	581.21
All facilities	35.59	0.25	227.98	169.72	0.41	1321.60

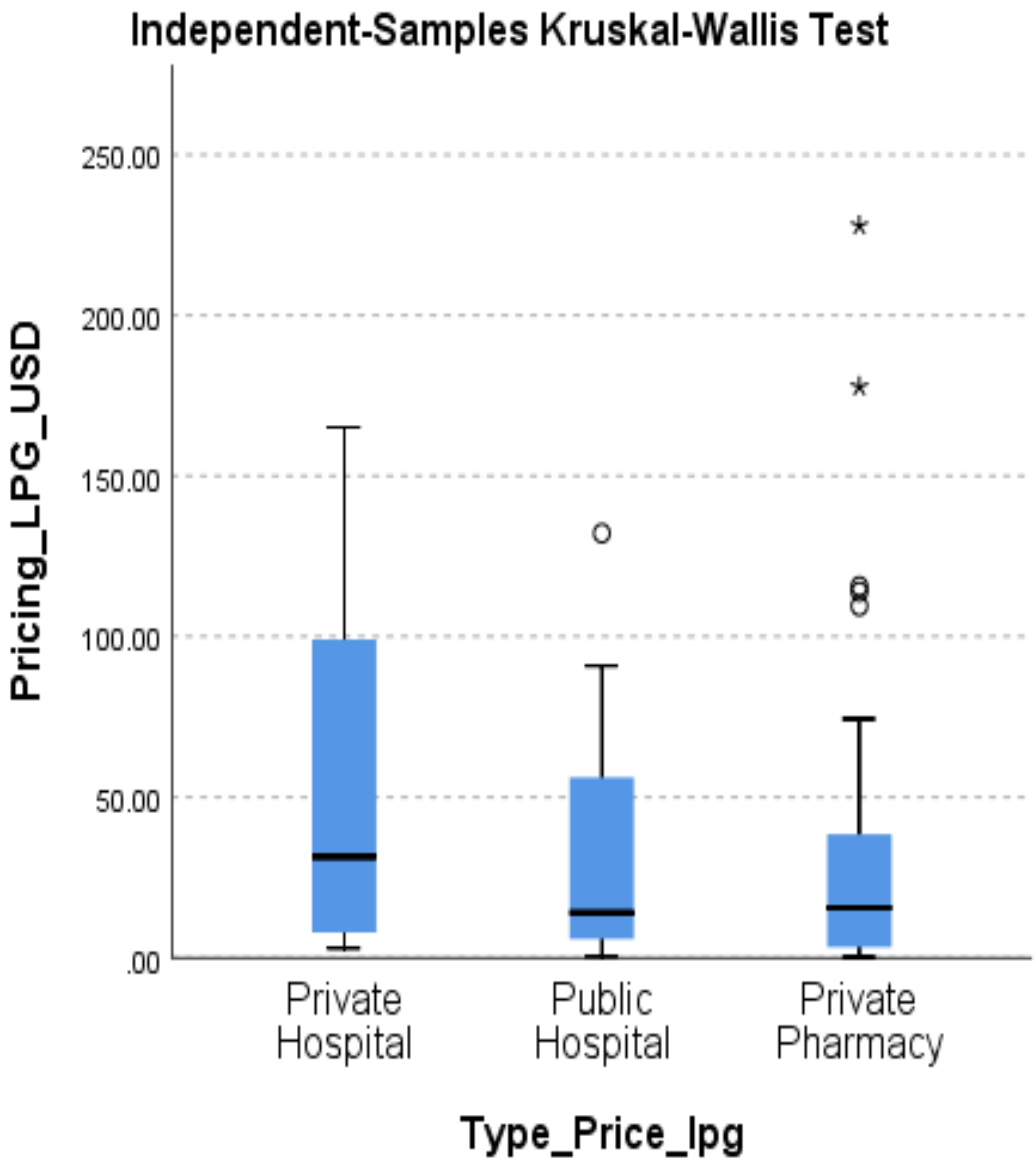


Figure 10: Median price variations between LPG as determined by the Kruskal Wallis test

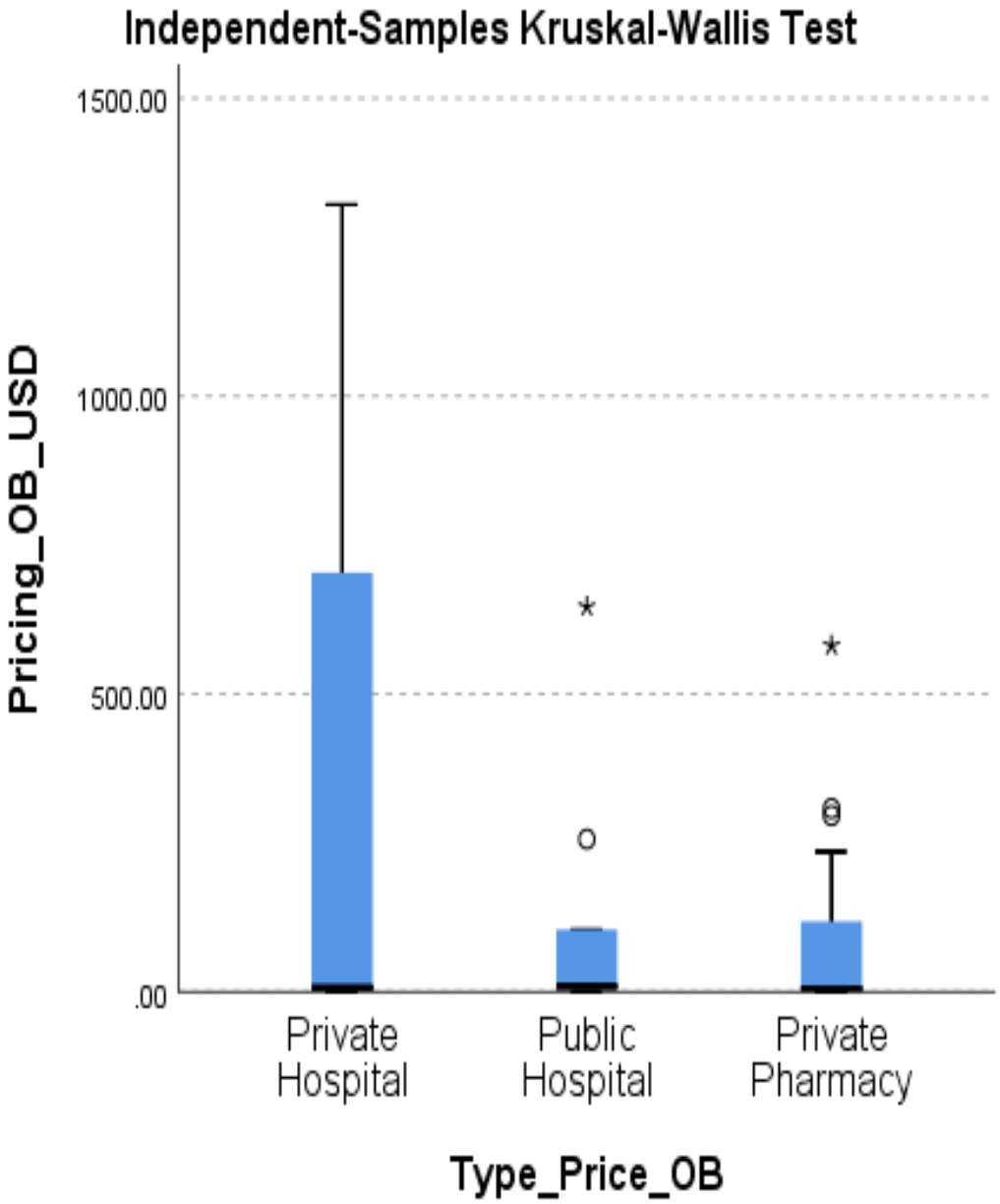


Figure 11: Median price variations between OBs as determined by the Kruskal Wallis test

In public hospitals, 8.33% of the cancer medications had a price gap surpassing 50%, with a price discrepancy ratio exceeding 2. Bicalutamide 150 mg tablets presented the most substantial price difference at 95.15%, while Vincristine 1mg vial had the least at 5.56% (Table 15). In contrast, private hospitals indicated that two thirds of their drugs had price gaps beyond 50%, and their discrepancy ratios were over 2. Doxorubicin HCL 50mg vial had a notable price gap of 88.75%, whereas Docetaxel Trihydrate 80mg vial had the smallest at 21.67% (Table 16). Concerning private pharmacies, 77.78% had a price ratio of less than 3, and one third of the cancer medications had price variations surpassing 50%. Thalidomide 50 mg capsules topped the list with a 97.92% price discrepancy, while Leuprolide acetate 11.25mg vial registered the least at 4.27% (Table 17).

Figures 13 &14 illustrate the median price variability/cost differences between 6 OBs and 6 LPG across public hospitals, private hospitals, and private pharmacies. The analysis was limited to medicines where both the brand-name drug and its generic counterpart were available, ensuring a direct comparison of prices between the two categories of products.

The smallest price discrepancy between OB and LPG was observed for chlorambucil 2mg tablet, which stood at 21.05%, while Epirubicin 50mg vial had the most significant variation at 44.23%. This indicates that certain brand-name drugs were priced higher than their generic equivalents. Notably, Cyclophosphamide 50mg tablets recorded the steepest negative price disparity at -566.67%. Additionally, Liposomal Doxorubicin 50mg vial, Liposomal Doxorubicin 20mg vial, and Epirubicin 50mg vial showed negative price fluctuations of -325.00%, -166.67%, and -9.09%, respectively. This is because, for these medications, the generic versions had a higher price tag compared to their brand-name counterparts.

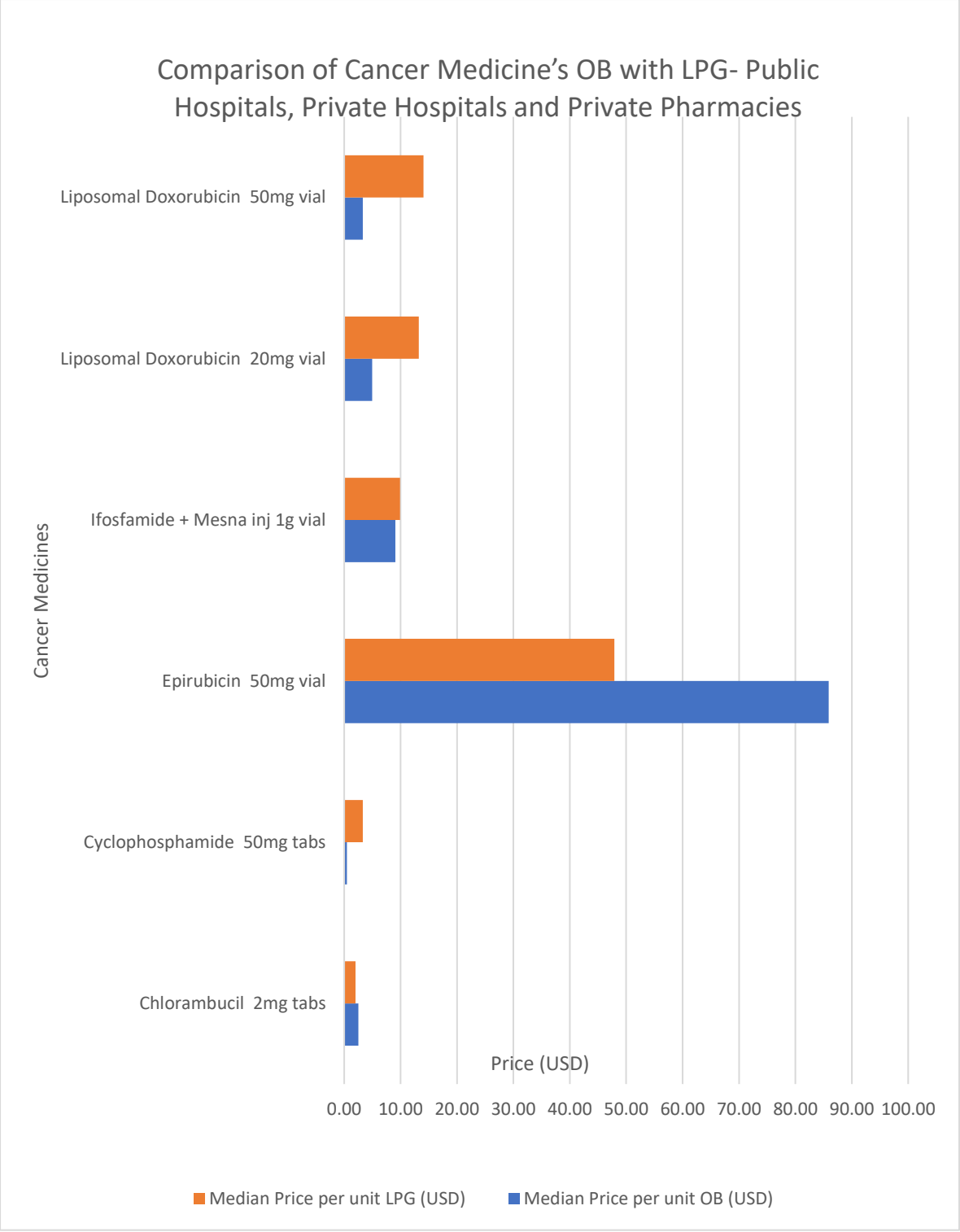


Figure 12: Comparison of cancer medicine's OB with LPG across public hospitals, private hospitals, and private pharmacies in Ghana

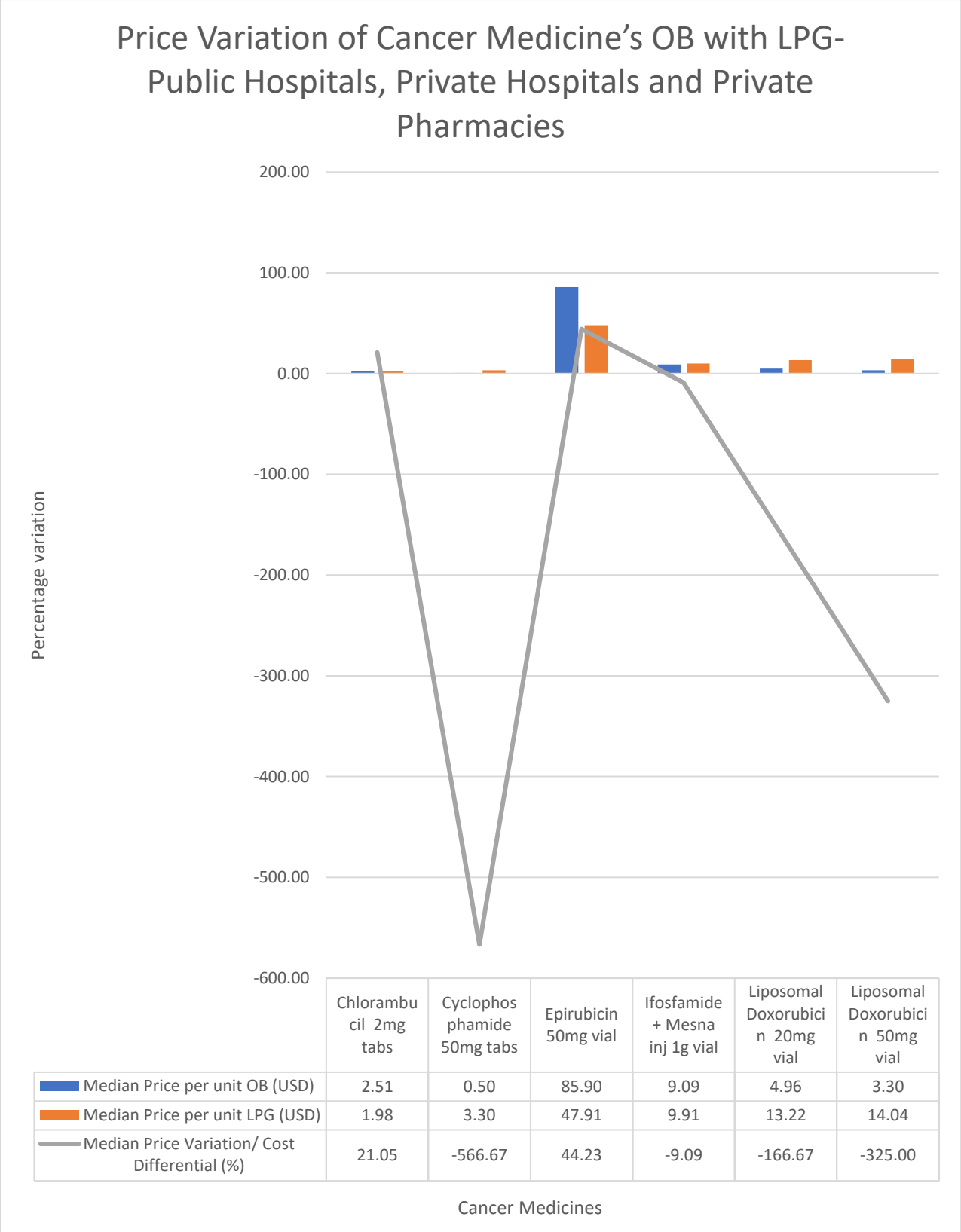


Figure 13. Price variation of cancer medicine's OB with LPG across public hospitals, private hospitals, and private pharmacies in Ghana

Table 14: Price variations of cancer medicine(s) in public hospitals in Ghana

No.	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	Minimum (USD)	Maximum (USD)	Cost Differential between Min and Max (%)	Price Ratio
1	Bicalutamide (Casodex)	150mg	tabs	1	OB	4.81	99.12	95.15	20.60
2	Carboplatin (Carbotin, Carbotinol, Kemocarb)	150mg	vial	1	LPG	21.48	32.05	32.99	1.49
3	Carboplatin (Carbotin, Carbotinol, Kemocarb)	450mg	vial	1	LPG	58.15	79.63	26.97	1.37
4	Cisplatin (Cistero-50, Kemoplat, Celplat)	50mg	vial	1	LPG	8.26	15.53	46.81	1.88
5	Cyclophosphamide	500mg	vial	1	LPG	2.64	3.30	20.00	1.25

	(Phoxelon-500, Cyphos)								
6	Doxorubicin HCL (Doxinyl - 50, Doxorubicine HCl Sandoz)	50mg	vial	1	LPG	14.04	16.52	15.00	1.18
7	Etoposide (Posid, Etopa, Etovel, Oncosid-100)	100mg	vial	1	LPG	5.62	6.94	19.05	1.24
8	Fluorouracil (Raciwel, Fluracil, 5-flucel)	500mg	vial	1	LPG	1.98	2.31	14.29	1.17
9	Goserelin (Zoladex)	10.8mg	vial	1	OB	223.02	289.35	22.92	1.30
10	Methotrexate (Methocel-50)	50mg	vial	1	LPG	5.45	5.95	8.33	1.09
11	Paclitaxel (Intaxel, Ataxil,	100mg	vial	1	LPG	32.21	37.17	13.33	1.15

	Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz)									
12	Vincristine (Biocristine-AQ, Vincristine Medcrist, Vinlon-1, Vincristine Micristin, Cytocristin)	1mg	vial	1	LPG	2.81	2.97	5.56	1.06	

Table 15: Price variations of cancer medicine(s) in private hospitals in Ghana

No.	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	Minimum (USD)	Maximum (USD)	Cost Differential between Min and Max (%)	Price Ratio
1	Cyclophosphamide (Cyphos)	1g	vial	1	LPG	4.13	11.56	64.29	2.80
2	Docetaxel Trihydrate (Daxotel, Docetero-80, Docetaxel Sandoz)	80mg	vial	1	LPG	116.47	148.68	21.67	1.28
3	Doxorubicin HCL (Doxinyl -50, Doxorubicine HCl Sandoz)	50mg	vial	1	LPG	3.72	33.04	88.75	8.89

Table 16: Price variations of cancer medicine(s) in private pharmacies in Ghana

No.	Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	Minimum (USD)	Maximum (USD)	Cost Differential between Min and Max (%)	Price Ratio
1	Abiraterone (Zytiga)	250mg	tabs	1	OB	4.79	6.20	22.67	1.29
2	Anastrozole (Arimidex)	1mg	tabs	1	OB	1.07	1.72	37.46	1.60
3	Bleomycin (Bleowel, Bleocel)	15 IU PFR	vial	1	LPG	23.95	28.91	17.14	1.21
4	Capecitabine (Xeloda)	500mg	tabs	1	OB	2.15	2.81	23.53	1.31
5	Carboplatin (Carbotin, Carbotinol, Kemocarb)	150mg	vial	1	LPG	16.52	82.68	80.02	5.01
6	Carboplatin (Carbotin, Carbotinol, Kemocarb)	450mg	vial	1	LPG	24.12	79.63	69.71	3.30
7	Chlorambucil (Celkeran, Chloramax)	2mg	tabs	1	LPG	1.98	7.10	72.09	3.58
8	Cisplatin (Cistero-10, Abiplatin, Kemoplat)	10mg	vial	1	LPG	14.87	19.33	23.08	1.30
9	Cisplatin (Cistero-50, Kemoplat, Celplat)	50mg	vial	1	LPG	13.22	18.17	27.27	1.38

10	Cyclophosphamide (Cyphos)	1g	vial	1	LPG	3.63	18.50	80.36	5.09
11	Cyclophosphamide (Cycloxan, Phoxelon)	50mg	tabs	1	LPG	0.26	3.47	92.38	13.13
12	Cyclophosphamide (Phoxelon-500, Cyphos)	500mg	vial	1	LPG	2.97	4.96	40.00	1.67
13	Cytarabin (Cytalon-100)	100mg	vial	1	LPG	9.91	17.35	42.86	1.75
14	Docetaxel Trihydrate (Docetero-20)	20mg	vial	1	LPG	42.29	46.26	8.57	1.09
15	Docetaxel Trihydrate (Daxotel, Docetero-80, Docetaxel Sandoz)	80mg	vial	1	LPG	92.51	111.51	17.04	1.21
16	Doxorubicin HCL (Doxinyl -50, Doxorubicine HCl Sandoz)	50mg	vial	1	LPG	13.22	18.17	27.27	1.38
17	Etoposide (Posid, Etopa, Etovel, Oncosid-100)	100mg	vial	1	LPG	6.44	9.09	29.09	1.41
18	Exemestane (Aromasin)	25mg	tabs	1	OB	1.38	9.17	84.97	6.65

19	Fluorouracil (Raciwel, Fluracil, 5-flucel)	500mg	vial	1	LPG	1.90	3.30	42.50	1.74
20	Gemcitabine (Gemget-1000, Gemwel)	1000mg	vial	1	LPG	94.99	132.16	28.13	1.39
21	Goserelin (Zoladex)	3.6mg	vial	1	OB	109.28	194.11	43.70	1.78
22	Goserelin (Zoladex)	10.8mg	vial	1	OB	264.32	341.65	22.63	1.29
23	Hydroxyurea (Hydrea, Siklos)	250mg	tabs	1	OB	0.41	0.83	50.00	2.00
24	Leuprolide Acetate (Luprova)	11.25mg	vial	1	LPG	173.96	181.72	4.27	1.04
25	Melphalan (Alkacel-2)	2mg	tabs	1	LPG	2.51	3.30	24.00	1.32
26	Methotrexate (Biotrexate)	2.5mg	tabs	1	LPG	0.12	0.38	69.57	3.29
27	Methotrexate (Biotrexate Methocel-50)	50mg	vial	1	LPG	6.61	8.26	20.00	1.25
28	Mitomycin	10mg	vial	1	LPG	32.21	43.12	25.29	1.34
29	Paclitaxel (Intaxel, Ataxil, Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz)	100mg	vial	1	LPG	23.95	39.65	39.58	1.66

30	Sorafenib (Soranib, Orib, Sorafenat)	200mg	tabs	1	LPG	1.82	4.30	57.69	2.36
31	Tamoxifen (Cytotam)	20mg	tabs	1	LPG	0.33	0.79	58.33	2.40
32	Thalidomide (Thalix-50)	50mg	caps	1	LPG	1.16	55.51	97.92	48.00
33	Thalidomide (Thalix-100)	100mg	cap	1	LPG	1.82	2.48	26.67	1.36
34	Trastuzumab	600mg	vial	1	OB	563.75	598.68	5.84	1.06
35	Vincristine (Biocristine-AQ, Vincristine Medcrist, Vinlon-1, Vincristine Micristin, Cytocristin)	1mg	vial	1	LPG	2.97	6.61	55.00	2.22
36	Zoledronic Acid (Zoldron, Zelodro-Denk)	4mg/5ml	vial	1	LPG	39.32	54.52	27.88	1.39

The MPR evaluation took into account all drugs (both OBs and LPGs) with IRPs. In Public Hospitals, the inflation adjusted MPRs for OBs ranged from a minimum of 0.01 to a maximum of 7.71. For LPGs, the range was between 0.08 and 10.15. Within Private Hospitals, the inflation adjusted MPRs for OBs varied between 0.21 and 0.61, while for LPGs, the range was 0.14 to 2.41. In Private Pharmacies, the OBs' inflation adjusted MPRs ranged from 0.12 to 1.03, whereas for LPGs, they ranged from 0.03 to 1.66 (Tables 18,19 & 20). Only 10.34% of drugs in Public Hospitals, 11.76% in Private Hospitals, and 8.70% in Private Pharmacies had an MPR exceeding 1.

Table 17: MPR of cancer medicines in public hospitals in Ghana

	Medicine Name	Medicine Strength	Dosage Form	Medicine Type	2020 Median Price (USD)	2015 MSH Price (USD)	Deflated local prices from 2020 (USD)	Median Price Ratio (MPR)
1	Bicalutamide (Casodex)	50mg	tabs	OB	1.43	0.23	0.22	0.93
2	Bicalutamide	50mg	tabs	LPG	0.48	0.23	0.07	0.31
3	Bicalutamide (Casodex)	150mg	tabs	OB	51.97	1.03	7.94	7.71
4	Bicalutamide	150mg	tabs	LPG	0.53	1.03	0.08	0.08
5	Bleomycin (Bleowel, Bleocel)	15 IU PFR	vial	LPG	18.17	12.32	2.77	0.23
6	Carboplatin	150mg	vial	LPG	26.76	16.01	4.09	0.26
7	Carboplatin (Carbotin, Carbotinol, Kemocarb)	450mg	vial	LPG	68.89	40.32	10.52	0.26
8	Carboplatin (Carbotin, Carbotinol, Kemocarb)	2mg	tabs	LPG	1.73	0.75	0.26	0.36
9	Cisplatin (Cistero-10, Abiplatin, Kemoplat)	10mg	vial	LPG	11.73	5.03	1.79	0.36

10	Cisplatin (Cistero-50, Kemoplat, Celplat)	50mg	vial	LPG	11.89	7.25	1.82	0.25
11	Cyclophosphamide (Cyphos)	1g	vial	LPG	5.95	8.27	0.91	0.11
12	Cyclophosphamide (Phoxelon-500, Cyphos)	500mg	vial	LPG	2.97	5.24	0.45	0.09
13	Dacarbazine (Celdaz, Dacarex)	200mg	vial	LPG	14.04	6.81	2.14	0.31
14	Docetaxel Trihydrate (Docetero-20)	20mg	vial	LPG	33.04	40.50	5.05	0.12
15	Docetaxel Trihydrate (Daxotel, Docetero-80, Docetaxel Sandoz)	80mg	vial	LPG	84.25	47.97	12.87	0.27
16	Doxorubicin HCL (Doxinyl -50, Doxorubicine HCl Sandoz)	50mg	vial	LPG	16.19	5.41	2.47	0.46
17	Epirubicin (Epiget-50, Epiruba)	50mg	vial	LPG	46.26	21.68	7.06	0.33

18	Etoposide (Posid, Etopa, Etovel, Oncosid-100)	100mg	vial	LPG	6.28	2.02	0.96	0.48
19	Filgrastim (Neupogen, Zarzio, Nivestim, Accofil)	300mcg	vial	OB	3.63	75.57	0.55	0.01
20	Fluorouracil (Raciwel)	50mg	vial	LPG	1.16	1.22	0.18	0.14
21	Fluorouracil (Raciwel, Fluracil, 5-flucel)	500mg	vial	LPG	2.15	0.26	0.33	1.25
22	Gemcitabine (Gemget-1000, Gemwel)	1000mg	vial	LPG	90.86	25.27	13.87	0.55
23	Ifosfamide + Mesna (Haloxan 2G with Uromitexan)	1g	vial	OB	9.09	26.71	1.39	0.05
24	Oxaliplatin	100mg	vial	LPG	66.08	74.77	10.09	0.13
25	Paclitaxel (Intaxel, Ataxil, Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz)	100mg	vial	LPG	33.54	11.08	5.12	0.46
26	Tamoxifen (Tamoxifen-Teva)	20mg	tabs	LPG	8.26	0.12	1.26	10.15

27	Vincristine (Biocristine-AQ, Vincristine Medcrist, Vinlon-1, Vincristine Micristin, Cytocristin)	1mg	vial	LPG	2.89	2.54	0.44	0.17
28	Vinorelbine	50mg	vial	LPG	74.34	29.01	11.35	0.39
29	Zoledronic Acid	4mg/5ml	vial	LPG	38.00	23.45	5.80	0.25

Table 18: MPR of cancer medicines in private hospitals in Ghana

	Medicine Name Generic	Medicine Strength	Dosage Form	Medicine Type	2020 Median Price (USD)	2015 MSH Price (USD)	Deflated local prices from 2020 (USD)	Median Price Ratio (MPR)
1	Anastrozole (Arimidex)	1mg	tabs	OB	0.71	0.53	0.11	0.21
2	Bleomycin (Bleowel, Bleocel)	15 IU PFR	vial	LPG	46.26	12.32	7.06	0.57
3	Capecitabine (Xeloda)	500mg	tabs	OB	2.62	1.67	0.40	0.24
4	Carboplatin (Carbotin, Carbotinol, Kemocarb)	450mg	vial	LPG	99.12	40.32	15.14	0.38
5	Cisplatin (Cistero-50, Kemoplat, Celplat)	50mg	vial	LPG	15.69	7.25	2.40	0.33
6	Cyclophosphamide (Cyphos)	1g	vial	LPG	7.85	8.27	1.20	0.14
7	Cyclophosphamide (Endoxan, Cytoxan)	50mg	tabs	OB	0.41	0.30	0.06	0.21
8	Docetaxel Trihydrate (Daxotel, Docetero-80, Docetaxel Sandoz)	80mg	vial	LPG	132.57	47.97	20.24	0.42

9	Doxorubicin HCL (Doxinyl -50, Doxorubicine HCl Sandoz)	50mg	vial	LPG	14.12	5.41	2.16	0.40
10	Epirubicin (Pharmorubicin)	50mg	vial	OB	85.90	21.68	13.12	0.61
11	Etoposide (Posid, Etopa, Etovel, Oncosid-100)	100mg	vial	LPG	16.52	2.02	2.52	1.25
12	Fluorouracil (Raciwel)	500mg	vial	LPG	4.13	0.26	0.63	2.41
13	Gemcitabine (Gemget-1000, Gemwel)	1000mg	vial	LPG	165.20	25.27	25.23	1.00
14	Oxaliplatin	100mg	vial	LPG	132.16	74.77	20.18	0.27
15	Paclitaxel (Intaxel, Ataxil, Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz)	100mg	vial	LPG	49.56	11.08	7.57	0.68
16	Vincristine (Biocristine-AQ, Vincristine Medcrist, Vinlon-1,	1mg	vial	LPG	2.97	2.54	0.45	0.18

	Vincristine Micristin, Cytocristin)							
17	Zoledronic Acid (Zoldron, Zelodro-Denk)	4mg/5ml	vial	LPG	82.60	23.45	12.61	0.54

Table 19: MPR of cancer medicines in private pharmacies in Ghana

No.	Medicine Name	Medicine Strength	Dosage Form	Medicine Type	2020 Median Price (USD)	2015 MSH Price (USD)	Deflated local prices from 2020 (USD)	Median Price Ratio (MPR)
1	Anastrozole (Arimidex)	1mg	tabs	OB	1.14	0.53	0.17	0.33
2	Anastrozole	1mg	tabs	LPG	0.50	0.53	0.08	0.14
3	Bicalutamide (Casodex)	50mg	tabs	OB	1.58	0.23	0.24	1.03
4	Bicalutamide (Casodex)	150mg	tabs	OB	3.47	1.03	0.53	0.51
5	Bleomycin (Bleowel, Bleocel)	15 IU PFR	vial	LPG	26.43	12.32	4.04	0.33
6	Capecitabine (Xeloda)	500mg	tabs	OB	2.64	1.67	0.40	0.24
7	Carboplatin (Carbotin, Carbotinol, Kemocarb)	150mg	vial	LPG	27.84	16.01	4.25	0.27
8	Carboplatin (Carbotin, Carbotinol, Kemocarb)	450mg	vial	LPG	74.34	40.32	11.35	0.28
9	Chlorambucil (Leukeran)	2mg	tabs	OB	2.51	0.75	0.38	0.51
10	Chlorambucil (Celkeran, Chloramax)	2mg	tabs	LPG	2.15	0.75	0.33	0.44

11	Cisplatin (Cistero-10, Abiplatin, Kemoplat)	10mg	vial	LPG	17.10	5.03	2.61	0.52
12	Cisplatin (Cistero-50, Kemoplat, Celplat)	50mg	vial	LPG	15.53	7.25	2.37	0.33
13	Cyclophosphamide (Cyphos)	1g	vial	LPG	9.58	8.27	1.46	0.18
14	Cyclophosphamide (Endoxan, Cytoxan)	50mg	tabs	OB	0.50	0.30	0.08	0.25
15	Cyclophosphamide (Cycloxan, Phoxelon)	50mg	tabs	LPG	3.30	0.30	0.50	1.66
16	Cyclophosphamide (Phoxelon-500, Cyphos)	500mg	vial	LPG	3.55	5.24	0.54	0.10
17	Cytarabin (Cytalon-100)	100mg	vial	LPG	13.63	3.48	2.08	0.60
18	Dacarbazine (Celdaz, Dacarex)	200mg	vial	LPG	17.18	6.81	2.62	0.39
19	Dactinomycin/ Actinomysin D (Dacilon)	0.5mg	vial	LPG	17.35	8.70	2.65	0.30

20	Daunorubicin (Daunotec)	20mg	vial	LPG	39.24	19.32	5.99	0.31
21	Docetaxel Trihydrate (Docetero-20)	20mg	vial	LPG	44.27	40.50	6.76	0.17
22	Docetaxel Trihydrate (Daxotel, Docetero-80, Docetaxel Sandoz)	80mg	vial	LPG	109.53	47.97	16.72	0.35
23	Doxorubicin HCL	10mg	vial	LPG	4.63	2.12	0.71	0.33
24	Doxorubicin HCL (Doxinyl -50, Doxorubicine HCl Sandoz)	50mg	vial	LPG	16.35	5.41	2.50	0.46
25	Epirubicin (Epiget-50, Epiruba)	50mg	vial	LPG	49.56	21.68	7.57	0.35
26	Etoposide (Posid, Etopa, Etovel, Oncosid-100)	100mg	vial	LPG	7.19	2.02	1.10	0.54
27	Exemestane (Aromasin)	25mg	tabs	OB	5.27	2.09	0.81	0.39

28	Filgrastim (Neupogen, Zarzio, Nivestim, Accofil)	300mcg	vial	OB	57.82	75.57	8.83	0.12
29	Fluorouracil (Raciwel)	500mg	vial	LPG	2.31	0.26	0.35	1.35
30	Gemcitabine (Gemget-1000, Gemwel)	1000mg	vial	LPG	113.99	25.27	17.41	0.69
31	Ifosfamide + Mesna	1g	vial	LPG	9.91	26.71	1.51	0.06
32	Imatinib (Veenat-100)	100mg	tabs	LPG	2.64	0.69	0.40	0.58
33	Imatinib	400mg	tabs	LPG	19.82	25.21	3.03	0.12
34	L-Asparaginase (Bionase)	10,000iu	vial	LPG	57.82	52.88	8.83	0.17
35	Melphalan (Alkacel-2)	2mg	tabs	LPG	3.30	0.9889	0.50	0.51
36	Mercaptopurine	50mg	tabs	LPG	0.38	2.24	0.06	0.03
37	Methotrexate (Biotrexate)	2.5mg	tabs	LPG	0.25	0.06	0.04	0.60
38	Oxaliplatin	100mg	vial	LPG	69.38	74.77	10.59	0.14
39	Paclitaxel (Intaxel, Ataxil, Paclitec-100, Pacliwel, Paclitec-100, Paclitaxel Sandoz)	100mg	vial	LPG	33.87	11.08	5.17	0.47

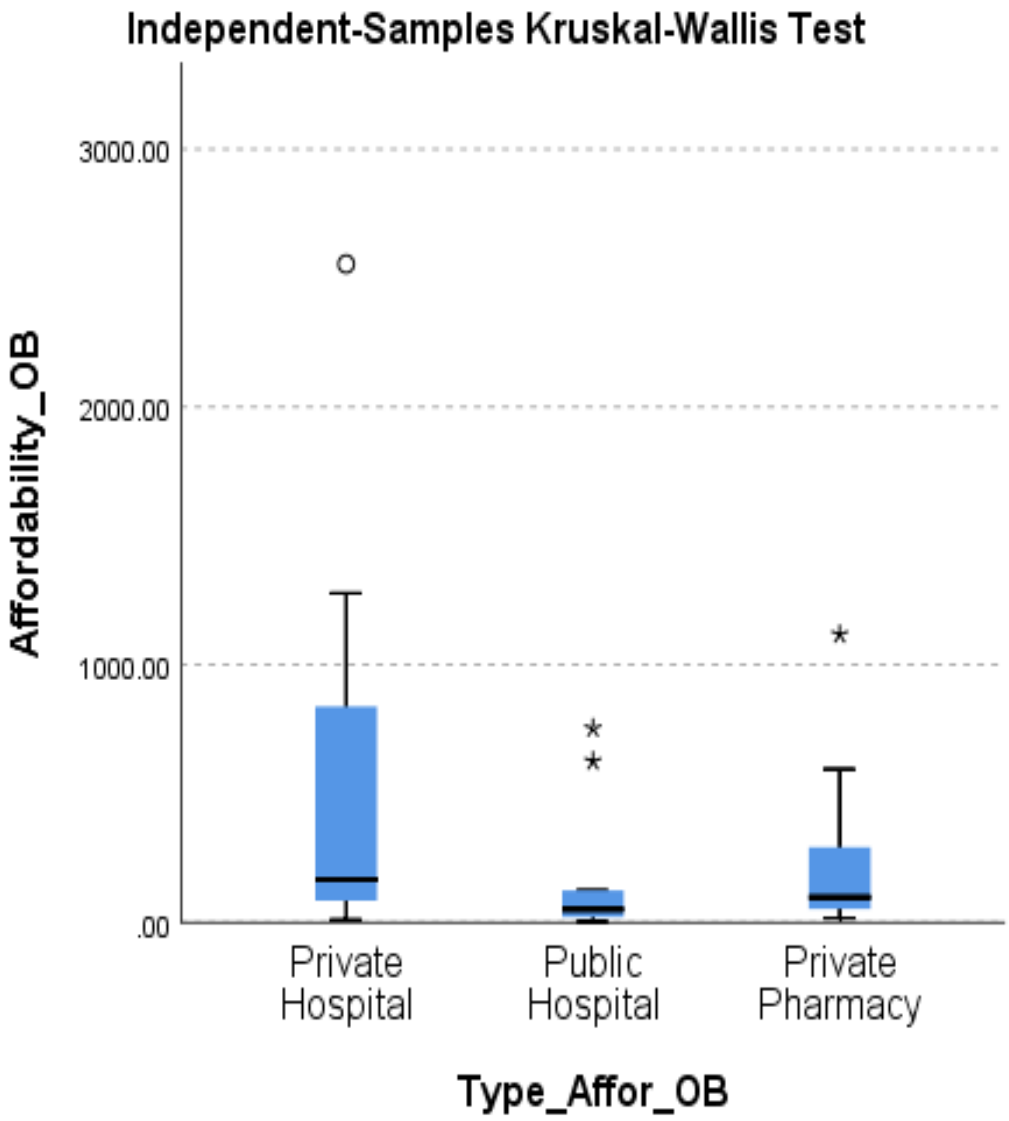
40	Tamoxifen (Tamoxifen-Teva)	10mg	tabs	LPG	0.64	0.08	0.10	1.23
41	Tamoxifen (Cytotam)	20mg	tabs	LPG	0.56	0.12	0.09	0.69
42	Thalidomide (Thalix-100)	100mg	cap	LPG	2.18	1.31	0.33	0.25
43	Vinblastine (Chemoblast)	10mg	vial	LPG	12.39	4.98	1.89	0.38
44	Vincristine (Biocristine-AQ, Vincristine Medcrist, Vinlon-1, Vincristine Micristin, Cytocristin)	1mg	vial	LPG	5.78	2.54	0.88	0.35
45	Vinorelbine (Vinelbine)	50mg	vial	LPG	115.64	29.01	17.66	0.61
46	Zoledronic Acid (Zoldron, Zelodro-Denk)	4mg/5ml	vial	LPG	46.92	23.45	7.16	0.31

5.3.2.3 Affordability of cancer medicines

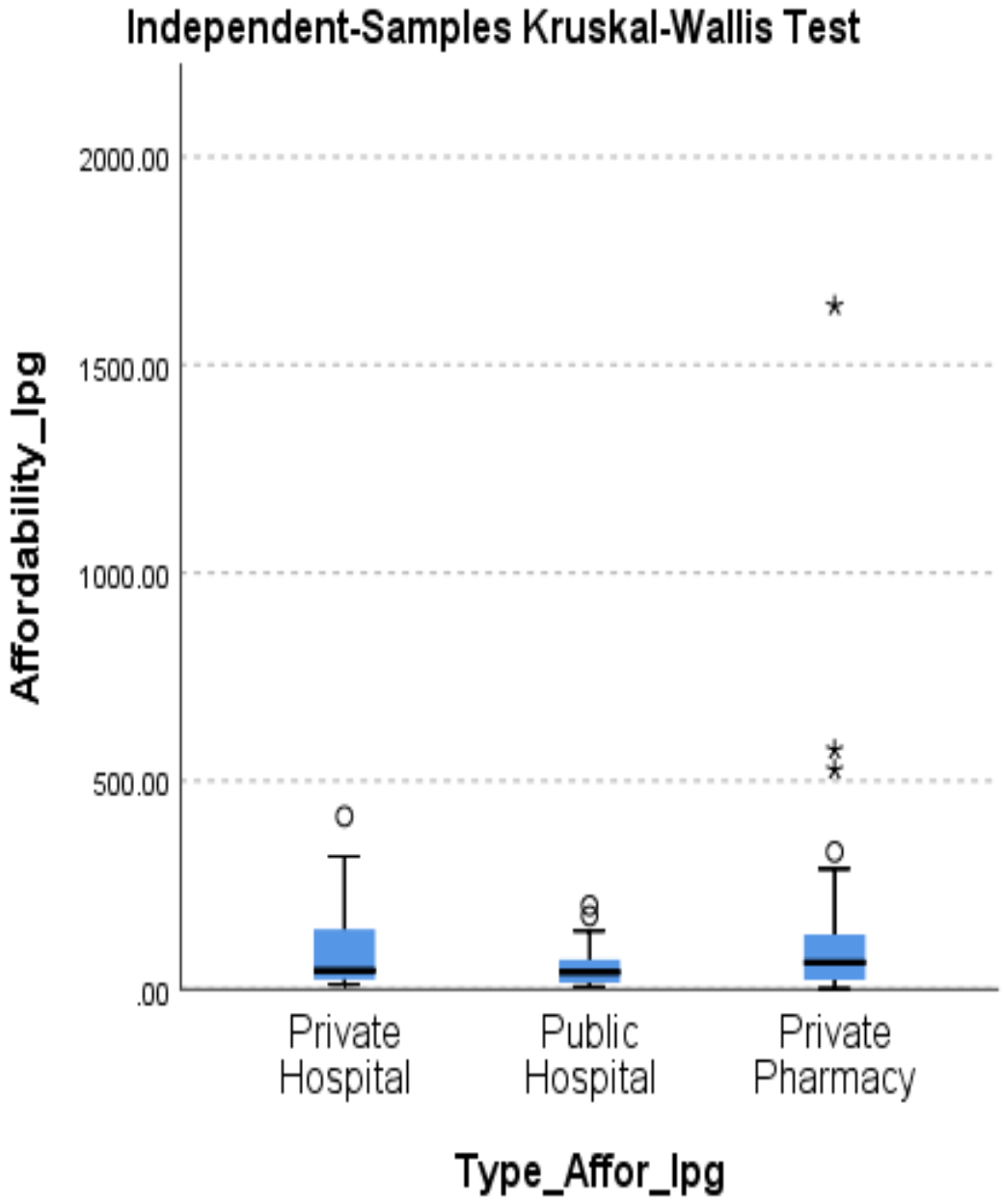
The cost-effectiveness of all cancer medications (both OB and LPG) was evaluated in relation to the daily income of an untrained LPGW. It was determined that these medicines generally exceeded a day's wages. Although disparities in affordability across the sectors were observed, these differences were not deemed statistically important, with p-values exceeding 0.05. The affordability distinctions between OB and LPG as analyzed by the Kruskal Wallis Test are displayed in Figures 15 and 16. Upon examining the sectors, it was found that cancer drugs in public hospitals were more cost-effective (OB at 188.00 and LPG at 54.81). This was followed by private hospitals (OB at 222.06 and LPG at 105.64), with private pharmacies being the priciest option (OB at 653.57 and LPG at 134.83) (Table 20 and Figures 15 & 16).

Table 20: Affordability of OB and LPG in Ghana

Affordability	**Mean LPG**	**Mean OB**
Private Hospital	105.64	653.57
Public Hospital	54.81	188.00
Private Pharmacy	134.83	222.06
All Facilities	103.42	304.30



Figures 14: Affordability of OB using Kruskal Wallis test.



Figures 15: Affordability of LPG using Kruskal Wallis test.

Across all sectors, treatments spanning one month with the priciest drugs necessitated several days of wages. Specifically, the Bevacizumab 400mg vial (OB) demanded 2554 days' earnings, while the Thalidomide 50mg capsule (LPG) required a substantial 1642 days of wages, making them the least affordable cancer treatments.

In every sector, the cost of a treatment using OBs surpassed a single day's earnings. Within public hospitals, the costliest medicine was Bicalutamide (Casadex) 150mg tablet, which demanded 753 days' wages. This was followed closely by Trastuzumab (Herceptin) 600mg vial at 625 days of wages. Meanwhile, Goserelin (Zoladex) 10.8mg vial necessitated 124 days' wages. On the more affordable end of the spectrum, Liposomal Doxorubicin (Caelyx) 50mg vial required just 2 days of wages (Table 22 & Figure 17).

Within private hospitals, Bevacizumab (Avastin) 400mg vial stood out as the costliest, necessitating 2554 days of earnings. This was succeeded by Trastuzumab (Herceptin) 600mg vial at 753 days' wages and Abiraterone (Zytiga) 250mg tablets demanding 399 days. On the more budget-friendly end, Anastrozole (Arimidex) 1mg tablet called for just 10 days of wages (Table 23 & Figure 18).

In private pharmacies, Filgrastim (Neupogen) 300mcg vial topped the list as the priciest, demanding 1117 days of labor for payment. This was trailed by Bevacizumab (Avastin) 400mg vial at 594 days and Trastuzumab (Herceptin) 600mg vial, which called for 562 days. On the more economical side, Granisetron (Kytril) 3 mg vial took only 7 days of wages (Table 24 & Figure 19).

Across every sector, the cost of all treatments using LPGs exceeded a day's earnings. In public hospitals, Chlorambucil 2mg tablet demanded the highest at 201 days' worth of wages. This was followed by Gemcitabine 1000mg vial at 176 days and Leucovorin Calcium 50mg vial at 144 days. On the other hand, Methotrexate 50mg vial was the most budget-friendly, costing just 6 days of labor (Table 22 & Figure 17).

Within private hospitals, Sorafenib 200mg tablet stood as the priciest, demanding a hefty 415 days of wages. Next in line was Gemcitabine 1000mg vial at 319 days and then Bleomycin 15 IU PFR vial at 179 days. On the more economical end, Vincristine 1mg vial was the least expensive, setting one back by only 11 days' earnings (Table 23 & Figure 18).

In private drugstores, Thalidomide 50mg capsule topped the list as the costliest, demanding a substantial 1642 days of labor. This was followed by Imatinib 400mg tablet at 575 days and then Cytarabine 100mg vial at 527 days. On the more affordable side, Methotrexate 2.5mg tablet was the least burdensome, needing only 1.4 days of wages (Table 24 & Figure 19).

When examining OBs that had a comparable LPG, the expense for a one-month regimen of Bicalutamide 150mg tablets (OB) equated to a staggering 753 days of earnings, while its LPG counterpart only required 8 days' wages.

In some cases, the OB medications proved to be more cost-effective than their generic equivalents, the LPGs. For example, with Cyclophosphamide 50mg tablets, an individual would need to labor for 289 days to afford the LPG version, while the same medicine in its OB form would require just 43 days of work for purchase.

Table 21: Affordability of cancer medicines in public hospitals in Ghana

Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	Median Price (USD)	Dosage (based on an 80kg adult)	Treatment per Month (Number of Vials/Tabs)	Treatment Cost per Month (USD)	Daily Wage (USD)	Affordability
Bicalutamide	50mg	tabs	1	OB	1.43	1 tab/day	30	42.77	2.07	21
Bicalutamide	50mg	tabs	1	LPG	0.48	1 tab/day	30	14.27	2.07	7
Bicalutamide	150mg	tabs	1	OB	51.97	1 tab/day	30	1558.98	2.07	753
Bicalutamide	150mg	tabs	1	LPG	0.53	1 tab daily	30	15.81	2.07	8
Bleomycin	15 IU PFR	vial	1	LPG	18.17	15000 IU/2x weekly	8	145.38	2.07	70
Carboplatin	150mg	vial	1	LPG	26.76	400mg/m2/month	3	80.29	2.07	39
Carboplatin	450mg	vial	1	LPG	68.89	400mg/m2/month	1	68.89	2.07	33
Chlorambucil	2mg	tabs	1	LPG	1.73	0.2 mg/kg/day	240	416.30	2.07	201
Cisplatin	10mg	vial	1	LPG	11.73	120 mg/ m2/month	12	140.75	2.07	68
Cisplatin	50mg	vial	1	LPG	11.89	120 mg/	3	35.68	2.07	17

						m2/month				
Cyclophosphamide	1g	vial	1	LPG	5.95	300 mg/m2 /day	9	53.52	2.07	26
Cyclophosphamide	500mg	vial	1	LPG	2.97	300 mg/ m2/day	18	53.52	2.07	26
Dacarbazine	200mg	vial	1	LPG	14.04	250 mg/ m2/day for 10 days (monthly)	13	182.55	2.07	88
Docetaxel Trihydrate	20mg	vial	1	LPG	33.04	75mg/m2/month	4	132.16	2.07	64
Docetaxel Trihydrate	80mg	vial	1	LPG	84.25	75mg/m2/month	1	84.25	2.07	41
Docetaxel Trihydrate	120mg	vial	1	LPG	90.86	75mg/m2/month	1	90.86	2.07	44
Doxorubicin HCL	50mg	vial	1	LPG	16.19	75mg/m2/month	2	32.38	2.07	16
Epirubicin	50mg	vial	1	LPG	46.26	90 mg/m² x2/month	4	185.02	2.07	89
Etoposide	100mg	vial	1	LPG	6.28	100 mg/m2	5	31.39	2.07	15

						/day x 5 days (monthly)				
Filgrastim	300mcg	vial	1	OB	3.63	5 µg/kg /day	40	145.38	2.07	70
Fluorouracil	50mg	vial	1	LPG	1.16	15mg/kg/week	100	115.64	2.07	56
Fluorouracil	500mg	vial	1	LPG	2.15	15mg/kg/week	10	21.48	2.07	10
Gemcitabine	1000mg	vial	1	LPG	90.86	1000 mg/m2 /week	4	363.44	2.07	176
Goserelin	3.6mg	vial	1	OB	104.56	3.6mg inj/ month	1	104.56	2.07	51
Goserelin	10.8mg	vial	1	OB	256.19	10.8mg inj/ every 3 months	1	256.19	2.07	124
Ifosfamide + Mesna inj	1g	vial	1	OB	9.09	10 g/m²/ month	10	90.86	2.07	44
Irinotecan	100mg	vial	1	LPG	72.69	350mg/m2/month	4	290.75	2.07	140
Leuprolide Acetate	11.25mg	vial	1	LPG	132.16	11.25 mg/ month	1	132.16	2.07	64

Liposomal Doxorubicin	20mg	vial	1	OB	4.96	50 mg/m2 /month	1	4.96	2.07	2
Liposomal Doxorubicin	20mg	vial	1	LPG	13.22	50 mg/m2 /month	1	13.22	2.07	6
Liposomal Doxorubicin	50mg	vial	1	OB	3.30	50 mg/m2 /month	1	3.30	2.07	2
Liposomal Doxorubicin	50mg	vial	1	LPG	14.04	50 mg/m2 /month	1	14.04	2.07	7
Methotrexate	50mg	vial	1	LPG	5.70	25 mg / week	2	11.40	2.07	6
Oxaliplatin	100mg	vial	1	LPG	66.08	85mg/m2/2x monthly	2	132.16	2.07	64
Paclitaxel	100mg	vial	1	LPG	33.54	260mg/m2/every 3 weeks (monthly)	6	201.21	2.07	97
Tamoxifen	20mg	tabs	1	LPG	8.26	20mg/day	30	247.80	2.07	120
Trastuzumab	600mg	vial	1	OB	646.59	600 mg/ every 3 weeks (monthly)	2	1293.19	2.07	625
Vincristine	1mg	vial	1	LPG	2.89	2 mg/ week	8	23.13	2.07	11

Vinorelbine	50mg	vial	1	LPG	74.34	25mg/m²/week	2	148.68	2.07	72
Zoledronic Acid	4mg/5ml	vial	1	LPG	38.00	4 mg/ month	1	38.00	2.07	18

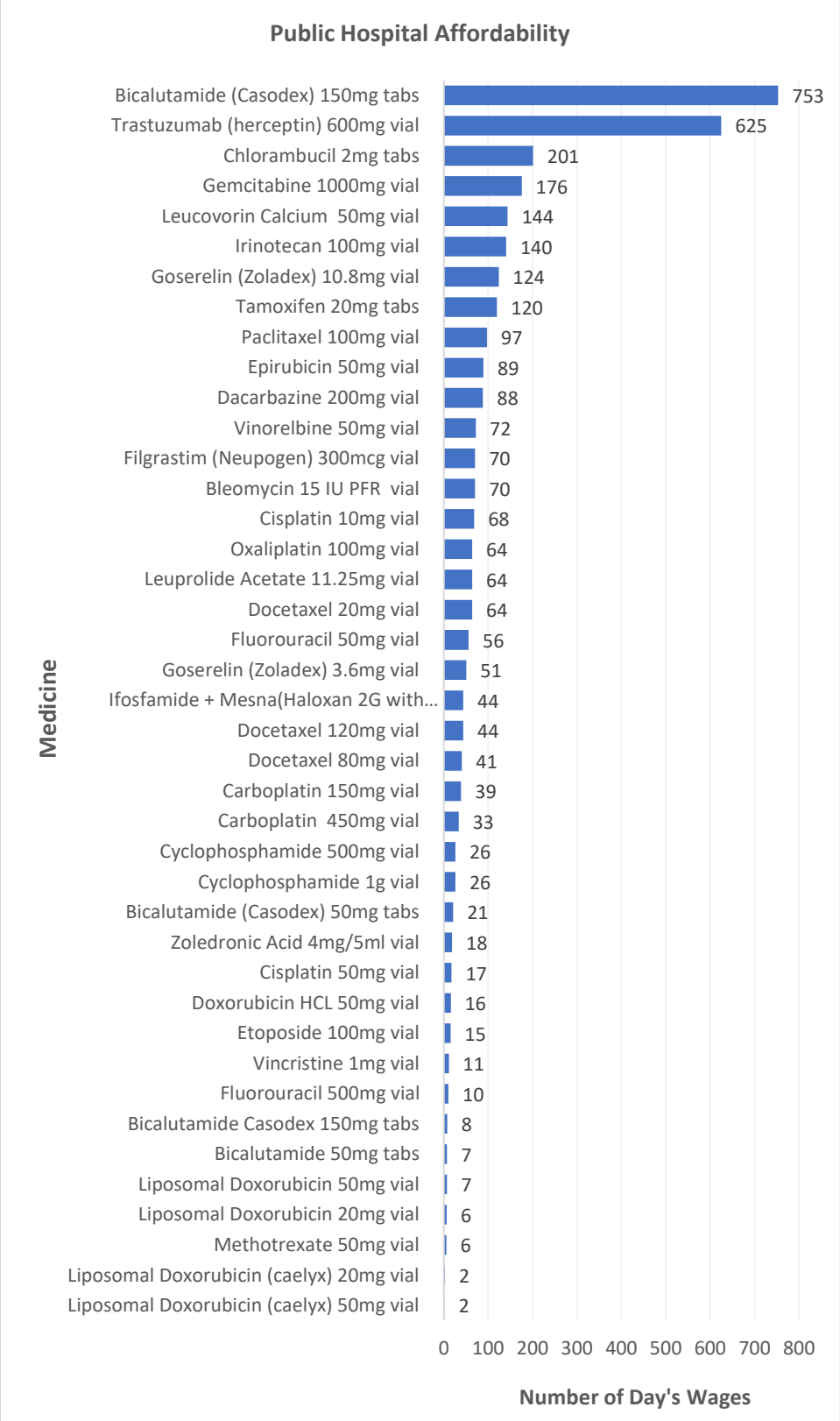


Figure 16: Affordability of cancer medicines in public hospitals based on day's wages in Ghana

Table 22: Affordability of cancer medicines in private hospitals in Ghana

Medicine Name	Medicine Strength	Dosage Form	Target Pack size	Medicine Type	Median Price (USD)	Dosage (based on an 80kg adult)	Treatment per Month (Number of Vials/Tabs)	Treatment Cost per Month (USD)	Daily Wage (USD)	Affordability
Abiraterone	250mg	tabs	1	OB	6.88	1000mg /Day	120.00	826.00	2.07	399
Anastrozole	1mg	tabs	1	OB	0.71	1 tab/day	30.00	21.24	2.07	10
Bevacizumab	400mg	vial	1	OB	1321.60	1600 mg/month	4.00	5286.40	2.07	2554
Bleomycin	15 IU PFR	vial	1	LPG	46.26	15000 IU/ 2x weekly	8.00	370.05	2.07	179
Capecitabine	500mg	tabs	1	OB	2.62	2500mg/ m2/day (21 days cycle)	105.00	274.64	2.07	133
Carboplatin	450mg	vial	1	LPG	99.12	400mg/m2/month	1.00	99.12	2.07	48
Cisplatin	50mg	vial	1	LPG	15.69	120 mg/m2 /Month	3.00	47.08	2.07	23
Cyclophosphamide	1g	vial	1	LPG	7.85	300 mg/m2 /Day	9.00	70.62	2.07	34

Cyclophosphamide	50mg	tabs	1	OB	0.41	300mg/day	180.00	74.34	2.07	36
Docetaxel Trihydrate	80mg	vial	1	LPG	132.57	75mg/m2/month	1.00	132.57	2.07	64
Doxorubicin HCL	50mg	vial	1	LPG	14.12	75mg/m2/month	2.00	28.25	2.07	14
Epirubicin	50mg	vial	1	OB	85.90	90 mg/m² x2/month	4.00	343.62	2.07	166
Etoposide	100mg	vial	1	LPG	16.52	100 mg/m2 /Day x 5 days (monthly)	5.00	82.60	2.07	40
Fluorouracil	500mg	vial	1	LPG	4.13	15mg/kg /Week	10.00	41.30	2.07	20
Gemcitabine	1000mg	vial	1	LPG	165.20	1000 mg/ m2/week	4.00	660.80	2.07	319
Oxaliplatin	100mg	vial	1	LPG	132.16	85mg/m2 /2x monthly	2.00	264.32	2.07	128
Paclitaxel	100mg	vial	1	LPG	49.56	260mg/m2/3 weeks (monthly)	6.00	297.36	2.07	144

Sorafenib	200mg	tabs	1	LPG	7.16	400mg/2x day	120.00	859.04	2.07	415
Trastuzumab	600mg	vial	1	OB	1321.60	600 mg/3 weeks (monthly)	2.00	2643.20	2.07	1277
Vincristine	1mg	vial	1	LPG	2.97	2 mg/week	8.00	23.79	2.07	11
Zoledronic Acid	4mg/5ml	vial	1	LPG	82.60	4 mg/ month	1.00	82.60	2.07	40

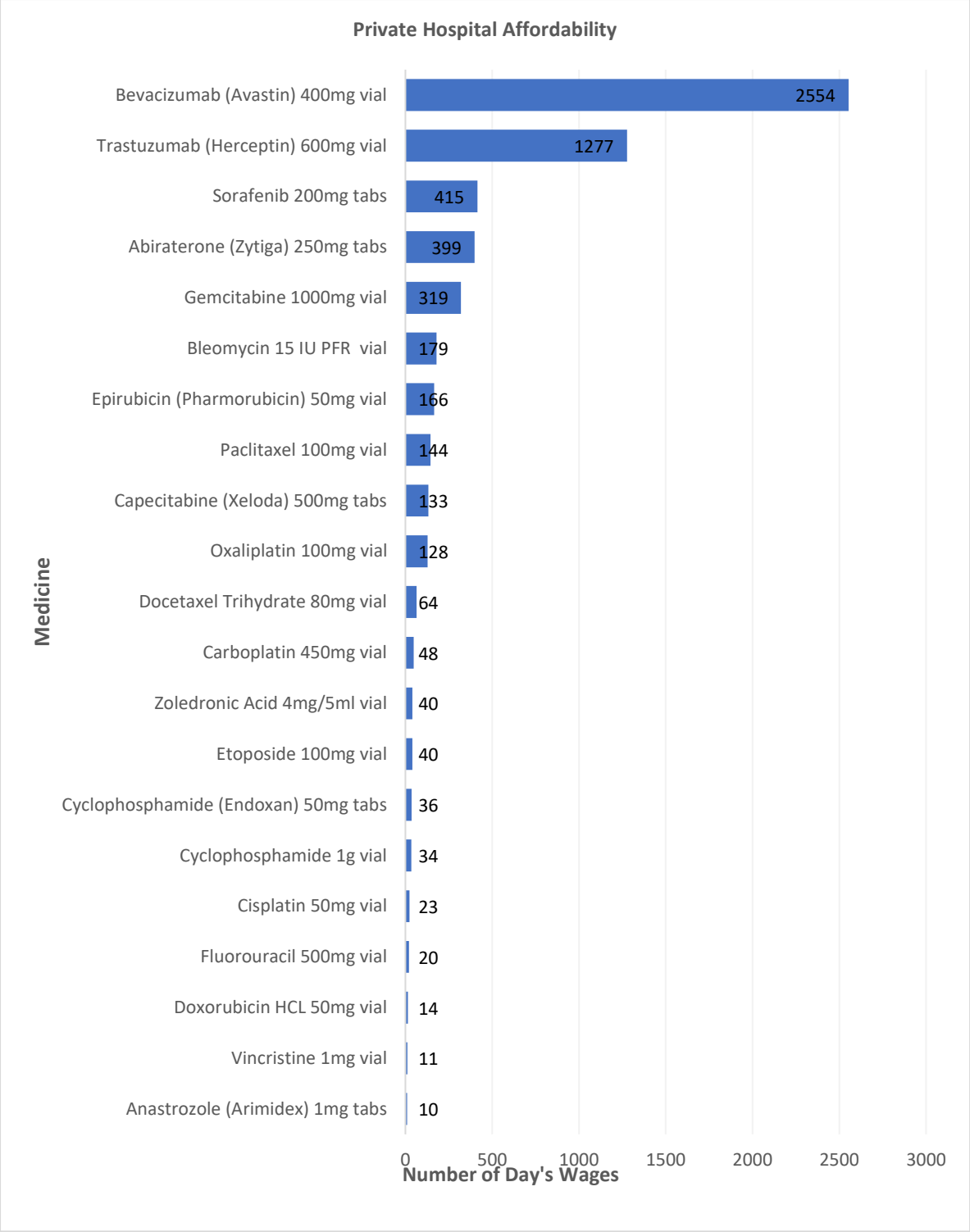


Figure 17: Affordability of cancer medicines in private hospitals based on day's wages in Ghana

Table 23: Affordability of cancer medicines in private pharmacies in Ghana

Medicine Name	Medicine Strength	Dosage Form	Target Pack Size	Medicine Type	Median Price (USD)	Dosage (based on an 80kg adult)	Treatment per month (Number of Vials/Tabs)	Treatment Cost per month (USD)	Daily Wage (USD)	Affordability
Abiraterone	250mg	tabs	1	OB	5.49	1000mg /Day	120	659.15	2.07	318
Anastrozole	1mg	tabs	1	OB	1.14	1 tab/day	30	34.05	2.07	16
Anastrozole	1mg	tabs	1	LPG	0.50	2 tab/day	31	15.36	2.07	7
Bevacizumab	400mg	vial	1	OB	307.44	1600 mg/ month	4	1229.75	2.07	594
Bicalutamide	50mg	tabs	1	OB	1.58	1 tab/day	30	47.44	2.07	23
Bicalutamide	150mg	tabs	1	OB	3.47	2 tab/day	31	107.55	2.07	52
Bleomycin	15 IU PFR	vial	1	LPG	26.43	15000 IU/ 2x week	8	211.46	2.07	102
Bortezomib	3.5mg	vial	1	LPG	227.98	1.3mg/m2 twice a week for a 3-week cycle	3	683.93	2.07	330

Capecitabine	500mg	tabs	1	OB	2.64	2500mg/m2 daily for a 21-day cycle	105	277.54	2.07	134
Carboplatin	150mg	vial	1	LPG	27.84	400mg/m2/ month	3	83.51	2.07	40
Carboplatin	450mg	vial	1	LPG	74.34	400mg/m2/ month	1	74.34	2.07	36
Chlorambucil	2mg	tabs	1	OB	2.51	0.2 mg/ kg/day	240	602.65	2.07	291
Chlorambucil	2mg	tabs	1	LPG	2.15	0.2 mg/ kg/day	241	517.57	2.07	250
Cisplatin	10mg	vial	1	LPG	17.10	120 mg/ m2/month	12	205.18	2.07	99
Cisplatin	50mg	vial	1	LPG	15.53	120 mg/ m2/month	3	46.59	2.07	23
Cyclophosphamide	1g	vial	1	LPG	9.58	300 mg/ m2/day	9	86.23	2.07	42
Cyclophosphamide	50mg	tabs	1	OB	0.50	300mg/day	180	89.21	2.07	43

Cyclophospha mide	50mg	tabs	1	LPG	3.30	300mg/ day	181	598.02	2.07	289
Cyclophospha mide	500mg	vial	1	LPG	3.55	300 mg/ m2/day	18	63.93	2.07	31
Cytarabin	100mg	vial	1	LPG	13.63	2 mg/kg/ day for 10 days, then increase to 4mg/kg/day	80	1090.32	2.07	527
Dacarbazine	200mg	vial	1	LPG	17.18	250 mg/m2/day for 10 days (monthly)	13	223.35	2.07	108
Dacarbazine	500mg	vial	1	LPG	17.35	250mg/m2/ day for 10 days (monthly)	5	86.73	2.07	42
Dactinomycin/ Actinomysin D	0.5mg	vial	1	LPG	17.35	0.6mg/m2/d ay for 10 days (monthly)	12	208.15	2.07	101

Daunorubicin	20mg	vial	1	LPG	39.24	60 mg/m2 on alternate days x 3 (monthly)	9	353.12	2.07	171
Docetaxel Trihydrate	20mg	vial	1	LPG	44.27	75mg/m2/ month	4	177.09	2.07	86
Docetaxel Trihydrate	80mg	vial	1	LPG	109.53	75mg/m2 /month	1	109.53	2.07	53
Doxorubicin HCL	10mg	vial	1	LPG	4.63	75mg/m2/ month	8	37.00	2.07	18
Doxorubicin HCL	50mg	vial	1	LPG	16.35	75mg/m2/ month	2	32.71	2.07	16
Epirubicin	50mg	vial	1	LPG	49.56	90 mg/m² x2 (monthly)	4	198.24	2.07	96
Etoposide	100mg	vial	1	LPG	7.19	100 mg/m2/ day x 5 days (monthly)	5	35.93	2.07	17
Exemestane	25mg	tabs	1	OB	5.27	1 tab/day	30	158.20	2.07	76

Filgrastim	300mcg	vial	1	OB	57.82	5 µg/kg/day	40	2312.80	2.07	1117
Fluorouracil	500mg	vial	1	LPG	2.31	15mg/kg/ week	10	23.13	2.07	11
Gemcitabine	1000mg	vial	1	LPG	113.99	1000 mg/m2 /Week	4	455.95	2.07	220
Goserelin	3.6mg	vial	1	OB	117.90	3.6mg inj/month	1	117.90	2.07	57
Goserelin	10.8mg	vial	1	OB	295.72	10.8mg inj/every 3 monthly	1	295.72	2.07	143
Hydreaxyurea	250mg	tabs	1	OB	0.62	30 mg/ kg/day	288	178.42	2.07	86
Ifosfamide + Mesna inj	1g	vial	1	LPG	9.91	10 g/m² /Month	10	99.12	2.07	48
Imatinib	100mg	tabs	1	LPG	2.64	400 mg/day	120	317.18	2.07	153
Imatinib	400mg	tabs	1	LPG	19.82	800 mg/day	60	1189.44	2.07	575
L-Asparaginase	10,000iu	vial	1	LPG	57.82	5000 U/m2 /every 3 days	5	289.10	2.07	140

Lenalidomide	10mg	capsules	1	LPG	6.61	25 mg/day/for 3 weeks cycle	53	350.22	2.07	169
Leuprolide	3.75mg	vial	1	OB	235.24	3.75 mg/month	1	235.24	2.07	114
Leuprolide Acetate	11.25mg	vial	1	LPG	177.84	11.25 mg/month	1	177.84	2.07	86
Melphalan	2mg	tabs	1	LPG	3.30	0.2 mg/kg /5 days (monthly)	40	132.16	2.07	64
Mercaptopurine	50mg	tabs	1	LPG	0.38	2.5 mg/kg /day	120	45.60	2.07	22
Mercaptopurine	150mg	tabs	1	OB	5.02	2.5 mg/kg /day	40	200.88	2.07	97
Methotrexate	2.5mg	tabs	1	LPG	0.25	7.5 mg / week	12	2.97	2.07	1
Methotrexate	50mg	vial	1	LPG	7.52	25 mg / week	2	15.03	2.07	7
Mitomycin	10mg	vial	1	LPG	37.67	10mg/m2 /month	1	37.67	2.07	18

Oxaliplatin	100mg	vial	1	LPG	69.38	85mg/m2/ 2x month	2	138.77	2.07	67
Paclitaxel	100mg	vial	1	LPG	33.87	260mg/m2 every 3 weeks (monthly)	6	203.20	2.07	98
Sorafenib	200mg	tabs	1	LPG	2.48	400mg/2x day	120	297.36	2.07	144
Tamoxifen	10mg	tabs	1	LPG	0.64	20mg/day	60	38.66	2.07	19
Tamoxifen	20mg	tabs	1	LPG	0.56	20mg/day	30	16.85	2.07	8
Thalidomide	50mg	caps	1	LPG	28.33	200mg/day	120	3399.82	2.07	1642
Thalidomide	100mg	cap	1	LPG	2.18	200mg/day	60	130.69	2.07	63
Trastuzumab	600mg	vial	1	OB	581.21	600 mg/ every 3 weeks (monthly)	2	1162.43	2.07	562
Triptorelin Acetate	3.75mg	vial	1	OB	107.38	3.75mg/ month	1	107.38	2.07	52
Vinblastine	10mg	vial	1	LPG	12.39	6 mg/m2/ week	3	37.17	2.07	18

Vincristine	1mg	vial	1	LPG	5.78	2 mg/week	8	46.26	2.07	22
Vinorelbine	50mg	vial	1	LPG	115.64	25mg/m²/ week	2	231.28	2.07	112
Zoledronic Acid	4mg/5ml	vial	1	LPG	46.92	4 mg/month	1	46.92	2.07	23

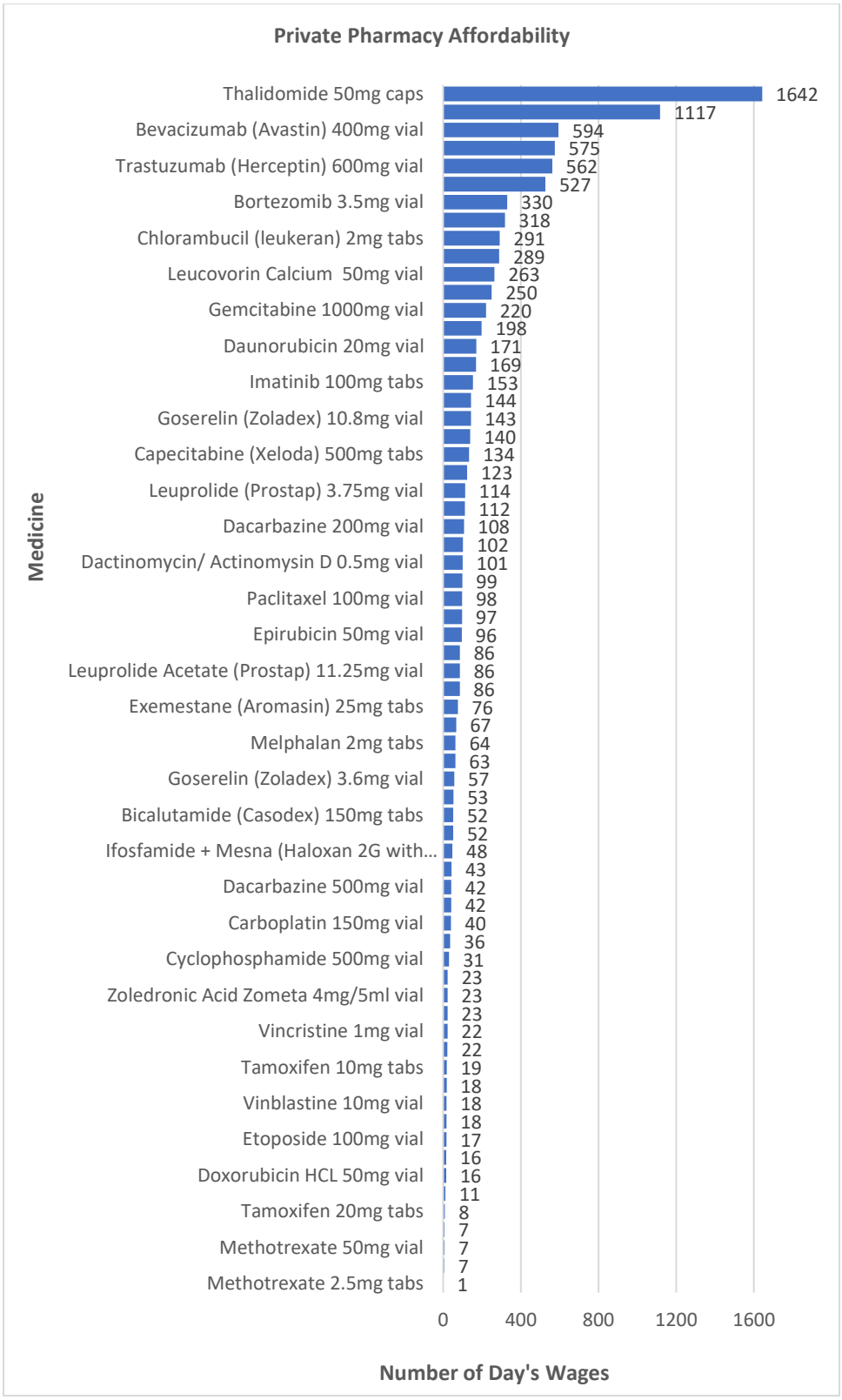


Figure 18: Affordability of cancer medicines in private pharmacies based on day's wages in Ghana.

5.4 Limitations of comprehensive survey research

This research, utilizing fundamental markers, doesn't provide a comprehensive overview of Ghana's pharmaceutical industry. Making international price comparisons comes with several presumptions that can impact their conclusions; they serve merely as initial indicators for more in-depth research. Some cancer drugs lack IRPs, complicating the process of determining the MPRs. The MPRs were derived using the sole accessible but outdated 2015 MSH IRPs. To account for inflation, the CPI was used. Given this complication, experts from HAI recommend bypassing MPR calculations in favor of solely using MUPs, so this research presents both metrics. The method used to assess affordability might cause an overestimation as it was based on the wages of LPGW. A substantial segment of the populace, notably those employed in the informal sector, earns less than the LPGW. Not factoring in additional costs associated with the overall price for cancer patients—like dispensing, facility, and administration fees, doctor charges, and treatment regimens that necessitate multiple drugs—indicates the actual expenditure for patients could be higher. This study did not utilize other affordability estimation techniques like catastrophic and impoverishment methods. The study also did not break down retail prices, which often include extra charges like taxes and distribution fees, to identify possible areas for price reduction. One key limitation regarding availability is that it was gauged at a singular point in time, specifically on the data collection day. To get a clearer understanding of drug availability, a longer-term study would be more informative than this snapshot approach.

5.5 Conclusion

Prices of cancer medications in Ghana are steep, exhibiting significant variances. The availability of these drugs is alarmingly low, and a majority of patients find them financially out of reach. It is essential for these life-saving treatments to be both accessible and affordable to decrease cancer-related deaths and suffering. Ghana's government should holistically address health determinants, implementing comprehensive strategies and a range of interventions and regulations. This could include adjusting the prevailing exorbitant prices of cancer treatments, offering tax breaks, promoting health insurance, and advocating for the use of generic drugs. These steps would ensure that quality cancer treatments are equitably available,

promptly accessible, and financially attainable for everyone, aligning with the vision of the Ghana National Health Policy 2020.

CHAPTER 6: Case study on price components of cancer medicines in Ghana

Chapter 6: Case study on price components of cancer medicines in Ghana

6.1 Introduction

The price component survey is a fundamental component of the medicine prices survey. A medicine's price consists of many price components such as the MSP (WHO & HAI, 2020). Extra costs are added to the MSP, during movement of medicines in the supply chain, from the producer to the patient. These price elements are from several sources, including cost of freight, taxes, tariffs collected by the government and supplier's mark-ups to offset expenses, and purchasing processes (WHO & HAI, 2020).

These charges are repeatedly high, and can go above 100%, but normally ranges from 30% and 45% of the selling price of the medicine (WHO & HAI, 2020). Price components have both aggregate and direct impact on the medicine price. Every price component builds on the foundational MSP price upon which all ensuing charges are collected. Even a little price component when applied in the initial stages of the supply chain could contribute considerably when its effects are exacerbated with the application of other price components. Governments cannot have good medicine pricing policies and assess its impact due to inaccurate data about the medicine prices (WHO & HAI, 2020).

National pharmaceutical policies, such as mark-ups control, tax creation and exemptions on tariffs, and implementing government approved selling prices, with the aim of increasing access to essential medicines can be produced from price component data (WHO & HAI, 2020). The price components study will define the price component costs in the national health system, classify the parts with the most substantial input to the ultimate price, and help in the development of pharmaceutical policies for the reduction in selling prices of medicines (WHO & HAI, 2020). The cancer medicines price component case study will further broaden the knowledge on the factors affecting the ability to access cancer medicines.

6.2 Objective of case study

1. To identify the price component costs of three cancer medicines (Epirubicin 50mg vial, Cyclophosphamide 50mg tab, Bevacizumab 400mg vial).

6.3 Methods on price components case study

Study Design

The price components survey is a case study sequel of the Ghana cancer medicine prices, availability, and affordability survey. Data was collected on different points in the distribution chain using the WHO/HAI methodology (WHO & HAI, 2020). The data collection methodology included an examination of pharmaceutical policies at the central level (including policies on taxes charged on medicines within the supply chain and to the final purchaser, policies that regulate mark-ups in the supply chain, imported cancer medicines entry points into the country, the port fees and the customs clearing costs), and research into the actual price components within the distribution chain for cancer medicines (WHO & HAI, 2020).

Information on cost components was gathered from the five phases of the supply chain. In Ghana, every cancer medicine is imported from abroad. The stage 1 price refers to the manufacturer selling price, international freight's Cost Insurance Freight (CIF), and insurance (Babar et al., 2007; WHO & HAI, 2020). The stage 2 cost was the settled price, which covers all the various price components encountered during the procurement of the medicine and shipping to the purchasing office. This refers to the customs (import tariff, importer's mark-up, and customs clearing), transport (local shipping charges to the importer or wholesaler), and port charges/fees (Babar et al., 2007; WHO & HAI, 2020).

The stage 3 cost refers to the wholesaling selling price of distributors' and/or importers' charges. This was derived from the settled price, the extra costs of the wholesaler's, stockroom overheads such as the storage, processing, general costs (including security, salaries, and rent), profit margins and the local transport to the retailer or healthcare facility (Babar et al., 2007; WHO & HAI, 2020).

The stage 4 costs referred to is the retailer's markups and includes the retail/pharmacy price for the private health facilities or dispensary price for the public health facilities. The wholesale selling price forms the basis for the retail pharmacy selling price, comprising of the retailer's or dispensary's extra costs such as profit margins, storage, processing, and general expenses (Babar et al., 2007; WHO & HAI, 2020).

The dispensed price refers to the stage 5 costs, composed of the VAT, and the Goods and Services Tax (GST). This is meant to show the point of delivery costs to the patient, the health system, and the insurance schemes (Babar et al., 2007; WHO

& HAI, 2020). The stage 5 costs also include the stage 4 price, the dispensing charges, and sales taxes (VAT or GST), if applicable. In Ghana all pharmaceuticals are exempted from VAT, thus there was no dispensing fee, VAT, or sales tax applied. In Ghana, there is no VAT and GST, or dispensing fees, therefore information could not be gathered for stage 5 costs and so the price obtained in stage 4 has been the dispensed price (Babar et al., 2007; Govt News, 2022; WHO & HAI, 2020). The Ghana FDA charges a fee of 1.8% of the CIF value when the cancer medicines are registered in Ghana. These fees are billed annually upon the issuance of a market authorization and does not depend on the volume of medicines that are sold and thus, is not part of the price component expenses (FDA, 2023). The survey was conducted in Accra (capital city) in the Greater Accra region of Ghana. The data was collected in the private and public sectors already identified in the Ghana cancer medicine and availability survey.

Sampling strategy

The 3 cancer medicines were selected from the Ghana pricing survey based on their availability, widespread use, and reflected commonly found cancer medicines with high prices and different price structures (Babar et al., 2007; WHO & HAI, 2020). It was conducted after the Ghana pricing survey and had the advantage of having the 3 cancer medicines and cancer medicine outlets being chosen based on the findings from the Ghana medicine pricing and accessibility survey. Where possible, data was gathered for both the OB and LPG. The LPG, identified as the most frequently found low-cost generic during the survey in Ghana, was readily available at the distribution location. The two research assistants from the previous Ghana study, known for their excellent investigative abilities and interpersonal prowess, were employed. Their non-confrontational yet curious approach ensured thorough notetaking during interviews. They were equipped with a solid grasp of the various pricing elements applied throughout the distribution chain and were trained to pinpoint these elements while collecting data for the price component study. Visits were made to retailers, wholesalers, dispensing facilities, and importers in the private and public sectors already identified in the Ghana study to investigate the price components.

Data collection and survey tool

To offer a detailed insight into medicine pricing, the costs associated with various components of the medicine across different sectors were documented in a distinct form, which was both designed and validated specifically for collecting this component data.

Data collection begun at the terminal point of the supply chain, specifically at public dispensaries and private sector retail pharmacies. The three selected cancer medications were then traced in reverse through the supply chain, starting from the end point and going back to the initial stage, which begins with the importers, to document the various pricing elements (WHO & HAI, 2020).

Information was collected on three (3) cancer medicines (both OB and LPG), namely, Liposomal Doxorubicin 20mg vial, Chlorambucil 2mg tablet, Epirubicin 50mg vial, Bicalutamide 150mg tablet, Cyclophosphamide 50mg tablet and Liposomal doxorubicin 50 mg vial, in the five phases of the supply chain to show the additional costs that factor into the final pricing of these cancer drugs.

In both hospital dispensaries and private drugstores, data on the buying cost, the sale price, and the respective wholesaler or provider for every drug was identified. Mark-ups, taxes, and dispensing fees (WHO & HAI, 2020).

Information was collected on as many price components in the supply chain stages as possible such as wholesale mark-ups, and any taxes collected etc. For each stage, the identified cancer drugs were retraced through the supply sequence to their beginning stage, documenting the pricing components (WHO & HAI, 2020).

The data collection process commenced with noting the consumer or retail price. All details pertaining to pricing elements were recorded in Ghana cedis and converted to the USD equivalent using 1 USD =7.95481 Gh Cedis on 28th June 2022 (Currency Conversion, 2022).

Data analysis

Information on the pricing elements of these three cancer drugs was put into an excel spreadsheet. This was then examined in light of the five typical stages each medicine undergoes, transitioning from its production to the patient. The distribution of the pricing elements towards the final cost of every cancer drug was analyzed as follows (Babar et al., 2007; WHO & HAI, 2020):

Stage 1: Cost set by the manufacturer + charges for insurance and shipping.

Stage 2: Price upon arrival.
Stage 3: Wholesale price in the private domain.
Stage 4: Retail price (private sector) or dispensary price (public sector).
Stage 5: The price at which it is provided to patients.
Results of the collected data on price components was used to calculate the accumulated percentage markup within the supply process. This percentage showcases how much a particular price exceeds the initial manufacturer's selling price. Additionally, the study gauged the proportional contribution each supply chain stage made to the final pricing of the drug and also identified which pricing components had the most substantial impact on the final cost. A comparative analysis of pricing components throughout the inspected sectors was also conducted (WHO & HAI, 2020).
The markups were calculated as; (final price –stage 3 price or stage 1 price)/ (stage 3 price or stage 1 price) x 100 (WHO & HAI, 2020).
The contribution to final price % was calculated as; (Stage 3 price or stage 1 price/final price) x 100 (WHO & HAI, 2020).
Major cost contributors were juxtaposed against present policies to spotlight and discuss those elements not currently covered by Ghana's strategies. Detailed breakdowns of component costs across each stage are provided in Tables 25 & 26.

6.4 Results on price components case study

For the price component analysis, the marks-ups that influenced the final costs of the selected 3 cancer medicines in different sectors was calculated (Ref Table 25). For the private pharmacy wholesaler, the final patient price was compared with the stage 1 price to gauge the overall mark up on the cancer medicine (Ref: Table 26). The manufacturers selling price, insurance and freight data were provided together without a disaggregation of each part from the wholesaling company. The port authority charges were not known. The FDB charges 240 USD for imported cancer medicines and 60 USD for new cancer medicines registered as orphan drugs, until the generic versions are available. All importers are charged an inspection fee of 1.8% of the CIF value as the freight on board (FOB) for all cancer medicines entering through the port (FDA 2023). There were no import duties, sales taxes, VAT or GST on pharmaceutical products in Ghana (Boateng et al., 2020, MOH, 2017c, 3News, 2022).

In the three sectors examined, patients did not incur any dispensing fees for the cancer drugs they procured.

Procurement for public sector hospital

The markups at stage 3 of the LPG cancer medicines of epirubicin 50mg vial, cyclophosphamide 50mg tab and bevacizumab 400mg vial was found to be 83%, 80% and 88% of the total cost respectively. This showed the percentage share of the mark-ups at the third phase of the supply chain in determining the ultimate price for the patient. The overall combined mark-ups (stage 3) related to the LPG cancer medications of epirubicin 50mg vial, cyclophosphamide 50mg tab and bevacizumab 400mg vial were 20%, 24%, 14% respectively (Table 25).

Procurement for private sector hospital

Generic Epirubicin 50mg vial in stage 3 was found to be 73% of the total cost while it was 66%, for OB Epirubicin 50mg vial. The total markups for Epirubicin 50mg vial were 37% and 52%, respectively, for its OB and LPG.

The markup of LPG Cyclophosphamide 50mg tab was 40% with stage 3 and being 71% of the final price. For OB Bevacizumab (Avastin) 400mg vial, the markup was 43%, with the base price being 70% of the final expense (Table 25).

Procurement for private retail pharmacy

Both LPGs of Epirubicin 50mg vial and Cyclophosphamide 50mg tab in stage 3, had mark ups of 30% respectively and both LPGs of Epirubicin 50mg vial and Cyclophosphamide 50mg tab (in stage 3) was 77% of the final cost respectively (Table 25).

Private pharmaceutical wholesaler

Both LPGs of Epirubicin 50mg vial and Cyclophosphamide 50mg tab in stage 1, had mark ups of 47% respectively and both LPGs of Epirubicin 50mg vial and Cyclophosphamide 50mg tab (in stage 1) was 68% of the final cost respectively (Table 25).

Table 24: Price component analysis for epirubicin 50mg vial, cyclophosphamide 50mg tab and bevacizumab (avastin) 400mg vial in Ghana

Sectors	Variable	Epirubicin 50mg vial		Cyclophosphamide 50mg tab		Bevacizumab (Avastin) 400mg vial	
		Originator Brand Price (USD)	Lowest Priced Generic Price (USD)	Originator Brand Price (USD)	Lowest Priced Generic Price (USD)	Originator Brand Price (USD)	Lowest Priced Generic Price (USD)
Korle Bu Teaching Hospital Public Hospital	Stage 1						
	Stage 2						
	Stage 3		25.14		25.83		439.99
	Stage 4		30.17		32.12		502.84
	Stage 5						
	% Mark up		20%		24%		14%
	Contribution to final price %		83%		80%		88%
Rock Chemist Private Pharmacy	Stage 1						
	Stage 2						
	Stage 3		25.48		20.68		

	Stage 4		33.13	26.89	
	Stage 5				
	% Mark up		30%	30%	
	Contribution to final price %		77%	77%	
	Stage 1				
	Stage 2				
Ghana Sweden Medical Center Private Hospital	Stage 3	44.00	31.43	31.43	439.99
	Stage 4	60.34	47.77	44.00	628.55
	Stage 5				
	% Mark up	37%	52%	40%	43%
	Contribution to final price %	73%	66%	71%	70%
	Stage 1		17.35	14.08	
Rock Chemist Private Pharmaceutical Wholesaler	Stage 2		19.60	15.91	
	Stage 3		25.48	20.68	
	% Mark up		47%	47%	
	Contribution to final price %		68%	68%	

Rock Chemist Private Pharmaceutical Wholesaler and as a retailing Pharmacy	Stage 1	17.35	14.08
	Stage 2	19.60	15.91
Private Pharmacy	Stage 3	25.48	20.68
	Stage 4	33.13	26.89
	Stage 5		
	Cumulative % markup (stage 1)	91%	91%
	Contribution to final price %	52%	52%

Private pharmaceutical wholesaler and private pharmacy

In the combined private pharmaceutical wholesaler and private pharmacy, stage 1 markups for both generics of Cyclophosphamide 50mg tab and Epirubicin 50mg vial were 52% respectively (Table 26).

For generic Cyclophosphamide 50mg tab, as indicated in table 25, the manufacturing price, freight, and insurance cost was 14.08 USD, after the addition of a 13% local transport and other port charges, it became 15.91 USD. This provides a breakdown of the MSP distinct from the acquisition and landing the cancer medicine. It increased by another 30% to 20.68 USD as wholesaling costs and profits, showing an insight into the cost of the medicine upon arrival at the importer's warehouse before it ventured into the local distribution network. This increased again by 30% with retailing costs and profits to 26.89 USD and showed the overheads and profit percentages for the suppliers in the chain. The percentage contribution of stage 1 to the final price was 91%.

As indicated in table 26, for generic of Epirubicin 50mg vial and Cyclophosphamide 50mg tab, the manufacturing price, freight, and insurance cost was 17.35 USD, after the addition of a 13% local transport and other port charges, it became 19.60 USD. It increased by another 30% to 25.48 USD and increased again by 30% with retailing costs and profits to 33.13 USD. The contribution of the initial stage to the concluding price was again 91%.

Table 25: Combined private sector wholesale and pharmacy component costs for generic epirubicin 50mg vial and generic cyclophosphamide 50mg tab in Ghana

		Generic Epirubicin 50mg vial			Generic Cyclophosphamide 50mg tab		
Stages	**Type of charges found**	**Total Cost (USD)**	**Value of Change/add on Cost (USD)**	**Mark up %**	**Total Cost (USD)**	**Value of Change/add on Cost (USD)**	**Mark up %**
Stage 1	Production cost plus shipping and coverage	17.35			14.08		
Stage 2	Landed price	19.60	2.25	13%	15.91	1.83	13%
Stage 3	Distributor's list price (private sector)	25.48	5.88	30%	20.68	4.77	30%
Stage 4	Retail price (private sector)	33.13	7.65	30%	26.89	6.2	30%
Stage 5	Dispensed price + VAT	33.13	0	0%	26.89	0	0
Total mark up and final prices (%)		33.13	15.78	91%	26.89	12.80	91%

6.4 Limitation of the price component case study

Very few medicines were assessed for the price component case study and data was collected from very few facilities, thus this cannot be used in generalization, however it does give a snapshot of the price components with varying mark ups, which can be used for policy interventions.

6.5 Conclusion

While the research data is somewhat constrained, it highlights significant retail and wholesale price inflations and inconsistencies in cancer medicine costs across both private and public healthcare institutions. There's a prevalent trend of elevated mark-ups throughout the distribution process, escalating the costs and making these medications less accessible for those in dire need. The affordability of cancer treatments is a significant issue in Ghana. Despite the push for generic medicines, there's a clear absence of a robust system for the pharmacoeconomic assessment of these drugs.

Consequently, it is important to introduce a pharmaceutical pricing policy tailored to Ghana's current economic and healthcare framework and to establish firm institutions to evaluate Pharmacoeconomics. The government should consider devising pricing benchmarks for drugs in both private and public sectors and ensure adherence to capped mark-ups across the board. The creation of a medicine price index would be beneficial, particularly for cancer drugs. The state's initiative to promote generic prescription and distribution should be effectively carried out. To gauge the effectiveness of various strategies, policy modifications, and focused measures, consistent reviews of the price structure of cancer drugs are imperative (MOH, 2006).

CHAPTER 7: Discussion

Chapter 7: Discussion of findings in context of local and global literature

7.1 Discussion on assessing the prices and affordability of oncology medicines for three common cancers within the private sector of South Africa

Factors affecting cancer medicines accessibility in South Africa

In South Africa, government tax revenues account for roughly 40% of healthcare financing, with private medical schemes contributing about 45%. Direct, OOP payments make up an estimated 14% (Ataguba & Akazili, 2010). Including direct payments, it is estimated that between 28-38% of South Africans utilize private healthcare, suggesting a rising preference for private health services (Econex, 2013). The chances of survival for individuals diagnosed with cancer hinge on factors like treatment availability, cost, and ease of access. Many nations face hurdles in accessing high-priced cancer drugs due to barriers such as limited insurance coverage, absence of transparent pricing data for policy formulation, and the resulting exorbitant expenses borne by patients (Suleman & Gray, 2017). The South Africa NDP seeks to ensure the availability and accessibility of vital medications, whilst striving to reduce medication costs across both private and public sectors for all its residents (NDoH, 1996; Suleman & Gray, 2017).

Pricing policies in South Africa in view of global literature

Current pricing policies have contributed to significant fluctuations in cancer medicine costs (WHO, 2018b). A range of factors contribute to these price disparities, including patent rights, exclusive markets for novel products, regulatory constraints, taxes and tariffs, geographical factors, economic standing, and the absence of internal pricing control mechanisms. In LMICs, the focus should be on bolstering the healthcare system. This would enhance various aspects of the medication distribution chain, ensuring both access to and affordability of medicines (Babar, 2021). Discrepancies in medicinal regulatory guidelines and pricing strategies across countries result in diverse medicine prices globally (Kolasani et al., 2016). In South Africa, the NDP was introduced in 1996 to augment access to medicines in both public and private health realms (DOH, 1996). South Africa implements an open pricing model, as outlined in Section 22G of the Medicines and Related Substances Act 101 from 1965 (DOH, 1965).

The NDoH has instituted regulatory measures to manage medicine pricing, including the initiation of the SEP (Gray et al., 2017; Gray & Suleman, 2015; NDoH, 1996; Suleman & Gray, 2017). Within the private realm, it is the pharmaceutical sector that sets the SEP. The pricing structure involves pharmaceutical companies proposing the SEP, which is inclusive of the factory exit price, a recommended logistics fee, and VAT. Excluding the pharmacy's dispensing charges, this cost is regarded as the constant price at which the medicine is sold (DOH, 2020). The NDoH subsequently approves and publicizes the SEP, ensuring that drug prices in the private sector are standardized, thus making them more obtainable and economical for private healthcare patients (DOH, 2020; Meyer et al., 2021). The SEP, as defined by regulations, is "the cost at which a drug manufacturer or importer can sell a medicine or scheduled substance to a distributor or wholesaler. This price includes both the cost set by the manufacturer and a component for logistics fees. Following this, the distributor or wholesaler sells the drug to a pharmacist, who then incorporates a dispensing fee before the medicine reaches the end patient." There's also an established provision that allows for a regulated maximum price for the SEP, which is set yearly by the health minister based on recommendations from the pricing committee (Republic of South Africa, 1997). The maximum allowable increase fluctuates annually. Manufacturers have the flexibility to either adopt the full increase, a partial one, maintain their current prices, or even implement a decrease. When it comes to the pricing structure within South Africa's private sector, the SEP method coupled with the yearly rate adjustments has lent a degree of transparency to drug pricing, exclusive of the dispensing fee. Since its implementation, the SEP has led to an estimated 22% decrease in drug prices, translating to an annual savings of about ZAR 319 million in drug expenditures since 2004 (Discovery Health, 2012). The SEP mechanism, paired with its yearly adjustments, has armed the government with a potent strategy for medicine pricing (Gray & Suleman, 2015; Niëns et al., 2012; Suleman & Gray, 2017). The influence of the SEP on drug affordability remains ambiguous. The SEP doesn't tackle issues like medicine price inflation, transparent costing by manufacturers, standardization, bonuses, and markdowns in an unregulated drug marketplace (WHO, 2018b). The SEP's design is to ensure a standardized pricing policy, making certain that patients pay an identical cost regardless of their location within South Africa or their income level.

Consequently, the advantages of price negotiations should be uniformly accessible to every patient (WHO, 2018b).

Limited focus is given to the genuine production costs reported by the drug manufacturers. The NDoH handles the SEP mainly as a clerical task, neglecting tools of international benchmarking and studies on the real production expenses. Many pioneering companies contend that their manufacturing costs incorporate R&D expenses, using this to rationalize their elevated pricing (WHO, 2018b). The ex-manufacturer price/cost component of the SEP, according to IMS Health Incorporated, is linked with manufacturers, especially originators, trying to recoup expenses related to initial R&D, regulatory approval, advertising, production, and other elements (including profit margins). These expenses can fluctuate based on the kind medicine, the manufacturer, and the country (IMS Health, 2014). In contrast, generic manufacturers typically have much lower development and production costs, a finding also highlighted in the research (IMS Health, 2014). While a review of the private healthcare sector was initiated under Section 4A of the Competition Act 89 of 1998, this review did not encompass medicine price points (Competition Commission, 2016). The National Planning Commission's report also alluded to the necessity of such a review. For shaping and executing effective medicine pricing policies in line with South Africa's constitutional mandates, it is crucial to ensure transparency and fairness in the pricing process (WHO, 2018b).

Section 22G of South Africa's Medicines Act is designed to promote clear pricing and reasonable charges for medicines (DOH, 1965). Yet, the set SEP doesn't adequately address the prohibitive costs of oncology drugs, often forcing numerous cancer patients to abandon their treatments. Although there have been strides towards enhancing clarity in the distribution chain, the figures in South African medicine price registries might not accurately represent the prices settled upon between drug manufacturers and distributors or wholesalers (Bangalee & Suleman, 2016). South Africa has put into action many of the WHO's guidelines regarding the regulation of mark-ups within the drug supply and distribution chain (WHO, 2013). These endeavors could be further intensified by achieving full transparency in the pricing elements of the SEP. While South Africa enforces a general policy covering all medicines, there should be contemplation about tailoring such regulations specifically to certain groups of medicines, like oncology drugs. This is particularly crucial as not all drugs have the same health significance or classification. Therefore,

ensuring consistent accessibility, affordability, and stricter pricing and margin rules for these crucial drugs is of the essence.

Pricing strategies must be adjusted in response to the volatility in the South African currency, as this can affect the availability of crucial cancer treatments. The current mechanism of the regulated maximum SEP, which includes annual modifications, might require re-evaluation and fine-tuning. Any annual increases should also factor in unusual situations that could stem from significant currency shifts within a specific year (Gray & Suleman 2015; Suleman & Gray, 2017).

A frequent update of the national medicines policy is essential, especially as it addresses the challenges of separating the roles of purchasers and providers and overhauling the health financing system. Future pharmaceutical practices should be guided by such a policy, ensuring that it builds upon the progress already made (Suleman & Gray, 2017).

Various strategies are in place to encourage the adoption of generic medicines and/or reduce drug costs. Many nations take steps to streamline market entry, endorse dispenser substitution, adopt international pricing benchmarks, stimulate market competition, and promote the preference for generics among healthcare providers and patients (WHO, 2015). One primary factor driving the use of generics is the guarantee of their quality, which South Africa efficiently ensures through its medical oversight body, the South African Health Product Regulatory Authorities (SAHPRA). The presence and usage of generics in the market result in cost savings for any healthcare system, but the extent of these savings hinges on several country-specific factors, such as the number of available generics, prescription habits, market dynamics, the pricing of generics, and the price gap between branded and generic drugs (Maisonneuve & Martins, 2013; Seeley & Kanavos, 2008).

The government should persist in its endeavors to foster the prescription and use of generics, endorse the substitution of generics, ensure transparent pricing, implement effective regulatory measures, equip patients to seek cost-effective alternatives, enhance price transparency within health schemes, adopt both internal and external price reference benchmarks, incorporate health technology assessment approaches, and leverage pharmacoeconomic evaluations to negotiate the SEP costs of cancer drugs (Babar et al, 2007; Gray & Suleman 2015; Niëns et al., 2012; Suleman & Gray, 2017).

Assessing prices of cancer medicines in South Africa in view of global literature

The findings from the research indicate that the prices of oncology medications in South Africa remain elevated. In the private sector, there's a significant price discrepancy between the most expensive and their most affordable counterparts, as well as between OB and LPG. The price disparity between the highest-priced medicines and their most affordable counterparts reached up to 37.44 times in certain cases. The private sector displayed a trend where originator brands were notably more expensive than their generic counterparts, with some exhibiting a price variance of approximately 72.05%. Comparable observations were made in studies from other LMICs (such as India and Nepal, as well as regions in Africa, Latin America, Southeast Asia, Western Pacific, and the East Mediterranean) concerning the pricing of oncology treatments (Cuomo et al., 2017; Faruqui et al., 2019; Kolasani et al., 2016; Salmasi et al., 2017; Vogler et al., 2016). These studies unveiled substantial price divergences, both between nations within the same region and within individual countries between different brands of identical medications in terms of dosage and form, and between originator and generic versions (Cuomo et al., 2017; Faruqui et al., 2019; Gelband et al., 2016; Kolasani et al., 2016; Salmasi et al., 2017; Vogler et al., 2016). High costs for patients may arise due to the absence of generic competition, generic drug suppliers setting prices just marginally below the original branded version, excessive profit margins for manufacturers, substantial government-imposed taxes and duties on drugs, and an inefficient distribution system.

South Africa boasts an expansive and sophisticated private pharmaceutical production sector and market, representing about 25% in volume but capturing 65% in terms of value (Faruqui et al., 2019; Suleman & Gray, 2017). An examination of chemotherapy drug prices within the private sector revealed that the cost disparity between the OB and the LPG for drugs in the analysis varied, with the OB priced between 1.29 to 3.58 times higher than the LPG. Interestingly, the LPG for Fluorouracil 500 mg was pricier than its OB counterpart, showing a cost difference of -679.73%. This might be attributed to factors like generic competition. For the drug paclitaxel, the market offered ten LPGs in contrast to a single OB. These findings suggest potential cost savings when opting for LPGs. It is crucial for LPGs to be accessible, thereby enhancing the affordability of oncology drugs. Roughly a third of

the medications demonstrated an almost 1:1 price ratio between OBs and LPGs, hinting that the SEP policy could potentially stifle competition for certain drugs by setting maximum price limits. On the other hand, manufacturers might be using the OB's price as a benchmark for their pricing strategies.

In the context of South Africa, the proliferation of generic drugs has been a focal point, largely due to the legal stipulation mandating dispensers to offer generic alternatives (Gray & Suleman, 2015). Generics are believed to constitute approximately 65% of all prescriptions in the private sector, accounting for 40% of the total expenditure (Bateman, 2015). Following the SEP's 2004 inception, there was an observed 11.1-fold surge in the price gap between the original molecule and its cheapest generic in South Africa, aligning with trends observed in other LMICs (Cameron & Laing, 2010). The availability of generics does influence the pricing strategy of original brands in some nations. In certain scenarios, the presence of generics led to a price reduction for original brands due to competition, while in other nations, original brand prices remained elevated (Faruqui et al, 2019).

Globally, the cost of brand-name drugs is typically 2.5 times higher than their most affordable generic counterparts (Cameron et al., 2009). In LMICs, this price discrepancy can expand to over tenfold (Cameron & Laing, 2010).

Research has indicated that branded medications can be priced between 30% to 200% higher than generics (Veena, 2017). An analysis focusing on LMICs deduced that by switching from brand-name drugs to the most affordable generics, individual countries could achieve savings ranging from 9% to 89% in the private sector (Cameron et al., 2012). A comprehensive survey in Nigeria covering 129 drug outlets examined the pricing of 34 prescribed drugs. It was found that consumers were sometimes charged up to 64 times the global reference price (Auta et al., 2013).

The own research underlines that significant price variations for the same medication, depending on the manufacturer, can influence how much patients spend on treatment. This becomes particularly problematic when patients are uninformed about price differences and more economical alternatives, or if their insurance plan has approved a different, potentially more expensive medication. Consequently, patients might be burdened with hefty out-of-pocket expenses even with insurance coverage. It would be beneficial if insurance providers were transparent about their co-payment structures, publishing them online. This would enable patients to grasp

the expenses they are responsible for and identify if cost-effective substitutes exist that might not require any co-payment.

Pharmaceutical pricing of medicines in South Africa

South Africa has been actively pushing for the wider adoption of generic medications, alongside considering tools like external reference pricing, an expanded role for health technology evaluations, global price comparisons, and the incorporation of pharmacoeconomic studies in deciding drug selections and their pricing. Within the public domain, indicative reference pricing has bolstered the government's ability to procure medicines at competitive rates through its tender process. The initial "single exit price" rolled out in 2004 stood as a middle-ground solution, veering from the government's initial goal to mandate a 50% price slash. While the primary method for determining the yearly adjustment of the single exit price was based on a set formula (which might consider factors like consumer inflation and the exchange rate of the local currency against significant foreign currencies), it was intended as a negotiation platform between the state and manufacturers. Nonetheless, the legal framework permitted the health minister to factor in additional considerations.

Affordability of cancer medicines in South Africa in view of global literature

In addressing prevalent cancer types in South Africa using standard treatments, the affordability of generics appears problematic for drugs like Irinotecan 40 mg, Irinotecan 100 mg, Doxorubicin 50 mg, Docetaxel 20 mg, and Fluorouracil 500 mg. For the most affordable generics available in the private market, the LPGW equivalent is between 0.2 to 13.6 days of income. However, if OBs are prescribed or provided, the cost can soar, requiring between 0.2 to 32.5 days of income. The most economical generic can offer savings of up to 67% compared to its branded counterpart. Certain treatments are evidently out of reach for many; for instance, treating Colorectal cancer with either the brand-name or generic version of Irinotecan (Campto) 40 mg could cost an individual 32.5 or 11.5 days of earnings respectively. This means that for some cancer medications, even an entire month's salary might not cover the treatment cost. The Mediscor Medicines Review, which analyzed drug usage in the private sector, indicated that although more brand-name products are

accessible, the private sector leans towards generics when they're available (Mediscor PBM, 2019).

Impoverishment method of affordability in South Africa

The findings from the research indicate that a significant portion of South Africa's population could face financial hardships due to the costs of acquiring medications. Specifically, in South Africa, the financial feasibility of these treatments is alarmingly low. The data suggests that a staggering 57% of the population may not be able to cover the costs of their cancer treatments given that they are already grappling with financial constraints, living beneath the poverty threshold even before factoring in potential medical expenses. The OB drug Irinotecan (Campto) 40 mg, for instance, is notably expensive, proving unattainable for nearly 83% of South Africans.

Our discoveries align with the research conducted by Niens et al., which explored the financial strain of purchasing medicines. Their findings suggested notable disparities in impoverishing effects when comparing OB to LPG. They concluded that a significant segment of society could be financially destabilized due to medication expenses. In the private sector, LPGs were, for the most part, considerably more budget-friendly compared to their OB counterparts. Therefore, promoting the use of verified, high-quality generics can potentially diminish the financial burden associated with medicine costs. By doing so, there's a promising chance to enhance the overall well-being of these communities, ensuring that individuals adhere to prescribed medication dosages and durations. Niens et al. also estimated that for a whopping 775 million individuals across 16 LMICs, essential treatments—including those for cancer—are financially out of reach. This is particularly concerning for those contending with chronic ailments like cancer that necessitate continual medication. Another study underscored the gravity of this situation in Asia, where nearly 78 million individuals might plummet beneath the USD $1-a-day poverty benchmark after shouldering healthcare expenses (Van Doorslaer et al., 2006).

Affordability with private health care financing in South Africa in view of global literature

Another research found that in Pakistan, the monthly expenses for biological cancer drugs surpassed 20% of a family's monthly income after accounting for food costs (Saqib et al., 2018). Only a little over half (58.1%) of the non-biological cancer drugs

were within affordable limits (Saqib et al., 2018). A 2020 report by the national planning commission on drug pricing highlighted that OOP costs represented 19% of private healthcare spending. However, specific numbers concerning cancer drugs remain elusive (Niëns et al., 2012). In the private sector, funding for cancer treatments predominantly comes from insurance premiums, contributed by both individuals and companies, and OOP expenses (Suleman & Gray, 2017). The acquisition of these medications in private healthcare hinges on the patient's insurance plan.

Private healthcare in South Africa operates under the Medical Schemes Act 131 of 1998 (South African Government, 1998). This legislation establishes the foundation for medical schemes overseen by the Council for Medical Schemes, an independent regulatory entity formed by the government (Council for Medical Schemes, 2010). The PMBs ensure equitable access to basic healthcare services for all members, independent of their insurance plan. Cancer can potentially be classified as a PMB condition (Council for Medical Schemes, 2020). The EML sets the benchmark for the conditions and medicines covered under PMBs. Every scheme determines its specific oncology benefits for each plan, denoting the treatments covered and any associated extra charges. If medicines aren't listed on the EML, patients might have to pay OOP, on top of their scheme contributions and any additional expenses not covered by the scheme. Such treatments often don't get sanctioned if they don't provide significant life extension benefits, leaving patients grappling with both the disease and the accompanying financial strain (Desai & Gyawali, 2020).

In 2017, medical schemes were the dominant source of private healthcare funding in South Africa, but only 17.1% of the population had such coverage (WHO, 2020). Thus, if these treatments aren't insured, their prohibitive costs might exclude a significant number of cancer patients from access to care, especially if they're forced to bear the financial brunt independently.

The research aligns with another study which demonstrated that in Pakistan's private sector, the affordability of LPGs cancer medications (67.9%) was higher than that of OBs at 53.4% (Sarwar et al., 2018). Research conducted in India and Bangladesh concerning pediatric cancer drug affordability revealed that the majority of families found such treatments unaffordable, leading many to discontinue therapy (Faruqui et al., 2019; Islam et al., 2015).

Factors affecting affordability, and affordability considerations in south Africa in view of global literature

Research that surveyed prices across Australia, China, India, Israel, South Africa, the UK, and the US connected the cost of cancer drugs to their affordability by using global wealth indicators. This revealed significant disparities in affordability across these nations (Goldstein et al., 2017). Despite medicines in South Africa being less expensive than in most developed nations, including the US with its notably high prices, their relative affordability was lower due to the decreased wealth in middle-income countries. Determining the wealth disparity between countries can be complex since metrics like GDP per capita don't consider personal incomes that fluctuate with factors like unemployment, retirement, and employment trends (Goldstein et al., 2017). Adopting differential pricing might be a potential solution to guarantee the worldwide affordability of effective cancer treatments.

Several factors, including rapid inflation, low average income, and the escalating cost of living, impede individuals from accessing cancer treatments. Various strategies can be employed by governments to make cancer treatments more affordable in LMICs. These range from ensuring the availability of certified generic drugs in the private sector, waiving import taxes and VAT on cancer drugs, initiating regulated markup systems in the supply chain, introducing differential pricing, lower-cost insurance plans, medicine discounts, patient access plans, tax incentives, combined public-private strategies, altering patents, to adopting exemplary governance and public health administration models for sustained feasibility (Cameron et al., 2009; Cherny et al., 2017; Faruqui et al., 2019; Islam et al., 2015). The correlation between price and health outcomes can be optimized through structures that incentivize innovation while upholding an economically sustainable health system (Islam et al., 2015, London School of Economics, 2016; Saltz, 2015). The existing affordability challenges can adversely affect the world's most at-risk populations and demand comprehensive interventions. The research highlights that exorbitant medication prices can plunge a significant portion of patients into economic hardship. This necessitates coordinated efforts from governments, NGOs, and other stakeholders to prioritize cancer medicine accessibility as a measure towards alleviating poverty. Immediate policy interventions could encompass restricting supply chain profits, tax breaks, and price regulation for consumers. Strategies like promoting the adoption of reliable, economical generics through

expedited approval processes can also be vital (Cameron et al., 2009). Instituting health insurance systems that cover outpatient medications is pivotal to prevent impoverishment due to health emergencies. Pioneering solutions, such as using private channels to deliver subsidized drugs to cancer patients, are worth exploring. For patented medications, pharma companies should be persuaded to adopt tiered pricing, much like HIV/AIDS treatments (Waning et al., 2009). South Africa could mandate compulsory licensing, compelling patent owners to permit its utilization by the government or third parties (WHO, 2006), similar to Thailand's approach (Ford et al., 2007; Seim, 2007). In resource-constrained settings, priority should be given to those most in need, like cancer patients earning below USD $5.50 daily. We cannot afford the health consequences resulting from inaccessible cancer treatments.

In South Africa, as globally, the cost is a significant hurdle to accessing top-quality medical treatments (Antoñanzas et al., 2017). One strategy policymakers can adopt to achieve financial relief is pharmaceutical market regulation (Carone et al., 2012). Encouraging the use of generic drugs is a cost-efficient strategy to manage and reduce prices (Carone et al., 2012). Additional strategies encompass introducing transparent drug pricing systems – a primary goal of South Africa's NDoH – regulating dispenser reimbursement, managing wholesale and intermediary profits, and setting and publicizing drug manufacturing prices. Advanced approaches encompass assessments of health technologies to confirm the cost-effectiveness of new drugs and promoting the rational use of medicines to maintain public budgets (Aitken et al, 2016).

7.2 Discussion on assessing affordability, prices, and availability of oncology medicines within Ghana through a comprehensive survey.

Availability of cancer medicines in Ghana in view of global literature

The research revealed a concerning lack of cancer drug availability in Ghana. Alarmingly, none of the cancer medicines examined in the study reached the WHO's recommended 80% availability threshold across all sectors (WHA, 2013). This finding is consistent with a report by the Ghana NDP, which highlighted the inadequate supply of cancer drugs at major facilities like the Korle-Bu Teaching Hospital (KBTH) and the Komfo-Anokye Teaching Hospital (KATH), which are also the primary centers for pediatric cancer care in Ghana (Garcia-Gonzalez et al., 2015).

Persistent drug shortages can be traced back to various disruptions in the pharmaceutical supply chain, including issues with quantifying demand (Boateng et al., 2020). The data from the research corresponds with another Ghanaian study, indicating a stark contrast in cancer drug availability between hospital pharmacies (as highlighted by Sarwar et al., 2018) and private pharmacies, with the latter having a 75% availability rate (Mensah et al., 2021). The general accessibility of cancer drugs lags the WHO's established 80% target for essential cancer drugs (Cherny et al., 2017; Servan-Mori et al., 2015).

The research results echo findings from various studies in LMICs, illustrating the gap between the listed availability and actual supply of crucial cancer drugs (Babar et al., 2007; Barr & Robertson, 2016; Cherny et al., 2016; Cherny et al., 2017; Faruqui et al., 2018; Islam et al., 2015; Robertson et al., 2016; Sarwar et al., 2018).

There has been a persistent challenge in ensuring the availability of essential drugs in sub-Saharan Africa, more so than in other global regions (Cameron et al., 2009). On average, the availability of essential drugs in this region stands at about 40% in the public sector and 60% in the private sector. This falls significantly short of the WHO's 80% target for drug availability across all sectors (WHO, 2009).

Cancer medicines availability in the public and private sectors in Ghana

Various factors can contribute to the diminished availability of medicines in both public and private sectors. For instance, in the public realm, governments might not allocate adequate budgets, and fail to meet national requirements. They could

potentially misallocate funds, opting for pricier original products even when affordable, quality-assured generics are accessible, or diverting finances towards hospital administration rather than primary oncology medications. In the private sector, one frequent reason for the scant availability of certain drugs can be regulatory pricing structures, which might deter manufacturers or suppliers from producing, registering, or distributing a particular product. Another possibility is the limited market demand leading retailers to opt-out of stocking a certain product (WHO & HAI 2020).

Considering chemotherapy services are offered at hospitals, one would expect a consistent supply of cancer drugs there. However, the inadequate presence of these drugs in hospital pharmacies suggests a lack of governmental funding, especially for pediatric cancer drugs.

Research conducted in LMICs like Tanzania and Pakistan mirrors these findings, revealing a lesser availability of cancer drugs in government-operated hospital pharmacies compared to their private counterparts (Sarwar et al., 2018; Yohana et al., 2011). A limited budget allocation by the government for cancer drugs, despite the growing number of cancer cases in both children and adults, has been cited as a primary cause. For instance, the Pakistan study pointed out that due to financial constraints, the country struggles to maintain an optimal public healthcare standard (Irfan et al., 2011), leading to frequent medicine shortages in governmental hospitals (Sarwar et al., 2018). Other challenges leading to insufficient cancer drug supplies in hospital pharmacies can be attributed to tendering delays, extended lead times, unpaid dues to suppliers, suboptimal supplier performance, and suppliers' inability to match demands. Similar challenges have been reported in other LMICs like Kenya and South Africa (Modisakeng et al., 2020; Muhia et al., 2017).

The research indicated that LPGs were more prevalent than OBs across all sectors and had a stronger presence in hospitals than pharmacies. On the other hand, OBs showed greater availability in private entities compared to public ones. The scant supply of cancer drugs in public hospitals often compels patients to resort to the private sector, purchasing costlier medicines, and enduring financial strains from increased out-of-pocket expenses. Elevated personal expenditures for treatments pose a significant barrier to accessing health services. This underscores the importance of governmental interventions to refine the procurement, distribution, and

supply chain processes for cancer drugs in public facilities (Cherny et al., 2017; Ewen et al., 2017; Faruqui et al., 2018).

Supply chain issues affecting cancer medicines availability in Ghana

Establishing a Logistics Management Information System (LMIS) is crucial for enhancing the management of drug supplies in Ghana.

In Ghana, there's a shortage of cancer drug suppliers because of the high costs involved in procurement and distribution. Most pharmacies only stock these drugs when specifically prescribed, leading to inconsistent availability even for those who have the means to purchase them. Instances of cancer drug shortages have resulted in patient dissatisfaction and diminished trust in the healthcare infrastructure. Factors contributing to the scarcity of cancer drugs, such as budgetary limitations, inaccurate demand forecasts, delayed drug orders, challenges in national distribution, supplier disinterest, and imprecise need assessments, need to be tackled (Beran et al., 2018; Cherny et al., 2017).

The absence of a unified national strategy for procuring cancer drugs, together with the nonexistence of local cancer drug production, not only restricts drug accessibility but also drives up costs (Boateng et al., 2020). A major issue cited for drug shortfalls and inefficient pricing is the lack of centralized cancer drug procurement at both institutional and national levels, leading to missed opportunities for bulk buying advantages (Boateng et al., 2020).

Key obstacles to public procurement include viewing oncology medicines as a high-risk venture; private suppliers' reluctance to collaborate with the government due to past payment issues; and suppliers not responding to public tenders for cancer drugs (Boateng et al., 2020). Institutions often hesitate to procure cancer drugs due to fears of low demand, which might result in drugs reaching their expiry. This challenge is intensified by competition from private pharmacies that offer certain medications at bulk prices (Boateng et al., 2020). The current fragmented procurement methods, coupled with small-scale tenders, lead to longer processing times for drug orders (Boateng et al., 2020). Drug producers typically have to consolidate multiple orders until a minimum threshold is reached, extending the time needed for production and shipping to roughly 3 months. Additionally, prolonged approval times from the Ghana FDA pose challenges for those supplying cancer medications.

Strategies to enhance cancer medicines availability in Ghana

Several strategies, both top-down and community-based, are being utilized to address inconsistent drug availability, covering aspects such as market approvals, procurement, distribution, and management of supplies (Boateng et al., 2020). Efforts by the Ghana FDA and the West African Health Organization (WAHO) to refine regulatory processes are seen as potential game changers for improving drug availability. The WAHO's project for harmonizing medicinal regulations across the West Africa region seeks to unify product registration prerequisites and methodologies among the Economic Community of West African States (WAHO, 2019). The aspiration is to lure pharmaceutical firms, distributors, and producers to cater to the niche Ghanaian market and spur domestic production of cancer medications, thereby speeding up drug registration and reducing regional market entry time. The FDA has also instituted an expedited drug registration procedure (Boateng et al., 2020). Beyond the specialized drug category, the FDA has introduced standards that trim the application review period for specific drugs from 6 months down to 90 days (FDA, 2019a). This accelerated process, applicable to cancer treatments and pediatric formulations, is intended to notably slash market entry times.

Promoting local production would potentially make domestically manufactured cancer treatments more affordable and accessible. However, challenges like the absence of domestic production capabilities, the capital-intensive nature of the endeavor, and limited aggregate demand for oncology drugs have been pinpointed as significant roadblocks to the rise of local cancer drug manufacturers (Boateng et al., 2020). To bolster local manufacturing, recommended tactics encompass tax waivers for imported base materials, importation limits on specific drugs already produced locally, and government-backed financial support for domestic manufacturers, possibly through concessional loans (MOH, 2017c).

Using reference pricing for generics—setting generic prices at, say, 80% of the original brand price—can inadvertently incentivize suppliers to import a minimal amount of pricey original products to establish a high benchmark, only to sell generics at 80% of this elevated price. For a more effective and recommended approach, generic drug prices should be set using a fixed margin over acquisition costs, not by referencing original brand prices. Transparency in the market, where prices of validated generic drugs are publicly disclosed, coupled with encouraging or

mandating generic substitution, allows consumers to opt for the most cost-effective generic drug (WHO & HAI, 2020).

Governments have a variety of policy instruments at their disposal to enhance drug availability. These include prioritizing drug budgets in government bodies, focusing especially on essential drugs, and regularly updating this list. It is imperative for governments to opt for affordable generic versions over pricier original brands, allowing more patients to be treated with the same funds. If the private sector takes precedence and availability is compromised, there might be a rationale for offering essential chronic disease drugs in the private sector at the rates seen in public sector procurement, as has been done in the Eastern Caribbean and Jamaica for a select list of drugs for the elderly (WHO & HAI, 2020).

Research indicates that the inclusion of novel cancer treatments, like targeted therapies, in NEML is uncommon (Cherny et al., 2017). Among the 37 African nations adhering to the WHO EML, the average number of chemotherapy drugs included in national drug lists is fifteen. This translates to many cancer patients lacking legal and affordable access to basic cancer treatments (Barr & Robertson, 2016). The WHO's adult and pediatric EMLs serve as references for nations to shape their own NEMLs and the public sector's reimbursable lists, which in turn aid in the procurement, accessibility, and use of cancer drugs for both adults and children (WHO, 2021a; WHO, 2021b). Although listing doesn't directly indicate availability, it is a pivotal step to guide purchases and ensure drug accessibility (Barr & Robertson, 2016). Ghana's EMLc encompasses all cancer drugs endorsed by the WHO's Expert Committee. The responsibility is on the government to keep the Ghana EML and EMLc, as well as health insurance lists, current. Given that both adults and children use similar cytotoxic drugs, it appears redundant to have separate adult and pediatric NEMLs (Barr & Robertson, 2016; Robertson et al., 2016).

Affordability of cancer medicines in Ghana in view of global literature

Cancer treatment in Ghana faces multiple challenges, including the expensive nature of medicines and limited insurance coverage. In Ghana, only treatments for cervical and breast cancers are covered by the NHIS (NHIS, 2021). This coverage is pegged to the average generic price, compelling providers to predominantly distribute generic medicines. Consequently, patients mostly bear the cost of cancer treatments

directly, leading to financial strains and potential interruptions or termination of treatment due to the high expenses (Khatiwoda et al., 2019). Often, hospitals order medicines in small quantities, resulting in elevated prices. Although Ghana has introduced a NMP to make drugs more affordable (MOH 2017c), its enforcement appears to be lax, with the government only controlling prices for cancer treatments under the NHIS. The import costs of all cancer treatments are significantly influenced by currency exchange fluctuations and are set by drug wholesalers based on various factors like production, promotional costs, taxes, duties, and targeted profit margins, which can be substantial (MOH 2017c).

Research identified numerous factors influencing the affordability of medicines. High costs of cancer drugs were attributed to both existing and lacking regulations, encompassing elevated import duties, costs associated with drug registration, insufficient price regulations, and limited financing avenues (Boateng et al., 2020). Steep import costs, especially for cytotoxic agents and supporting treatments, were frequently linked to the current tax policies, further exacerbated by unfavorable foreign exchange rates (Boateng et al., 2020). Import duties and tariffs typically make up 30%-40% of the final cost of imported drugs (MOH, 2017c). Addressing this challenge, the parliament gave the green light for a VAT waiver on imported medicines in November 2017, adjusting benchmark NHIS prices with the hope of a 30% retail price decrease. However, this expected price drop wasn't observed in retail settings (Boateng et al., 2020). For a drug to qualify for public subsidy, the retail prices set by NHIS-approved pharmacies must align with NHIS standards. Due to this policy shift, NHIS prices suddenly did not match retail charges, leading to several drugs losing NHIS support and burdening patients with direct costs. This unforeseen price stasis, despite the VAT waiver, inadvertently affected medicine affordability. Addressing these unintended policy consequences, the VAT waiver might positively impact drug affordability. The absence of strict price regulation in the drug market was also highlighted as a principal cost factor (Boateng et al., 2020).

In Ghana, treatments for pediatric cancers aren't included in national welfare programs. Therefore, young cancer patients aren't covered by the NHIS (Graphic Online, 2019). As a result, their treatments, encompassing crucial cancer drugs, are paid directly by patients. Such circumstances, as highlighted in various studies, often drive the families of these children towards alternative treatments like herbalists or

non-specialized healthcare providers, causing delays in proper diagnosis and treatment (Mensah et al., 2021).

Research spanning Rwanda, Kenya, and Uganda revealed that cancer treatment plans, which follow WHO EML guidelines and incorporate new cancer drugs, are not economically feasible for LMIC nations in Sub-Saharan Africa. Nearly all such treatments are unaffordable for individuals without insurance (Darya et al., 2022). Well-conceived pharmaceutical pricing strategies can enhance drug affordability if they are meticulously implemented, frequently assessed, and adapted to the evolving landscape (Babar, 2021; WHO, 2020). The disparity in medicine prices can often be attributed to differing pricing policies (Islam et al., 2015).

Pricing of cancer medicines in Ghana in view of global literature

The research revealed that the cost of cancer medications in Ghana is considerably high. This observation is consistent with another report that positioned Ghana among African countries with notably high medicine prices, with retail mark-ups accounting for approximately 50% to 200% of the drug's retail price (MOH, 2017c). There's a significant price disparity across sectors, notably between HPM and LPM as well as between OB and LPG. In comparison to the public sector (public hospitals), private entities (private pharmacies and private hospitals) exhibited the steepest prices for both LPG and OB. Interestingly, private pharmacies recorded the lowest median prices for OB, which might be attributed to some of these pharmacies serving as both suppliers and wholesalers of oncology medications to both public and private outlets. Conversely, public hospitals showed the lowest median prices for LPG, possibly a reflection of governmental policies promoting generic prescriptions and insurance reimbursements. Strikingly, not a single medicine exhibited a price ratio less than one, hinting at inefficiencies in the procurement of oncology drugs in Ghana (WHO & HAI, 2020). The disparity in pricing between OB and LPG indicates that some branded medicines, when prescribed, impose higher costs on patients than their generic counterparts. However, certain generics surpass the price of branded versions, suggesting efficient OB procurement and pricing possibly influenced by generic competition, price regulations, market dynamics, or other factors (Faruqui et al., 2018).

Several elements might underpin the price variability experienced by patients across public and private sectors. These could encompass sector-specific procurement and

distribution efficiencies, the adoption of medicine sales as a revenue-generation strategy, or the unregulated nature and wide-ranging mark-ups of drug prices (WHO & HAI, 2020). This resonates with findings that the availability of generics could influence the prices of their branded counterparts or that branded prices remain elevated (Cherny et al., 2016). Potential contributors to these heightened patient costs could be the protective patents of branded medicines, absence of generic competition, generic suppliers pricing their popular products just marginally lower than branded versions, steep manufacturer profit margins, exorbitant governmental taxes and duties, inefficient supply chains, and excessive wholesale or retail mark-ups (Mattila et al., 2021).

The findings mirror those observed in studies from various LMICs (like Nepal, India, Malaysia, Africa, Latin America, South-East Asia, Western Pacific, East Mediterranean) on cancer drug pricing (Babar et al., 2007; Cuomo et al., 2017; Faruqui et al., 2018; Kolasani et al., 2016; Ocran Mattila et al., 2021; Mattila et al., 2021; Saeed et al., 2019; Salmasi et al., 2017; Shrestha et al., 2020). These analyses unveiled significant price fluctuations within countries, evident both across individual drug categories and brands. Notably, the price differential between public and private entities was clear (Babar et al., 2007; Cuomo et al., 2017; Faruqui et al., 2018; Kolasani et al., 2016; Salmasi et al., 2017; Shrestha et al., 2020).

The research indicates that a vast majority (over 85%) of OB/LPG medicines across public hospitals, private pharmacies, and private hospitals were reasonably priced relative to the IRP, potentially pointing to efficient procurement or perhaps issues with quality control (MSH, 2015). Drawing concrete conclusions from such data is challenging due to the inherent complexities of international price comparisons, which can be influenced by market dynamics, pricing strategies, economies of scale, and tax considerations (Saeed et al., 2019). Further probing is warranted to demystify these price differences.

Ghana's cancer medication supply is predominantly anchored in the private sector, with a limited number of retailers, minimal competition, and prices set largely unregulated. There is a broad acknowledgment that the absence of economic incentives for suppliers, resulting from small market sizes and disjointed procurement channels, has bolstered, and sustained exorbitant prices for oncology drugs (Boateng et al., 2020). Some have contended that distributing oncology drugs is not financially feasible due to insufficient demand (Boateng et al., 2020). In

response to these challenges, governmental interventions have sought to bolster incentives for cancer drug provision and centralize price regulation. Ghana's FDA categorizes cancer drugs as orphan drugs, allowing for expedited approvals and reduced registration fees (FDA 2019b). Other strategies aimed at price regulation involve the establishment of the National Medicine Price Committee (NMPC), responsible for overseeing pharmaceutical pricing in Ghana. The NMPC is tasked with establishing a drug price index, publishing ceiling sales and reimbursement prices for essential and high-cost medicines, and insulating stakeholders from erratic price swings (Ghana News Agency, 2019).

Ghana's governing body needs to bolster their cancer drug pricing strategies to ensure that they are fair, within reach, and promptly accessible. It is paramount that cancer patients get timely access to essential medications without any compromise on the quality and safety. Ensuring that the medications remain affordable throughout the treatment duration is vital. There should be a well-structured system in place with proper prescription, distribution, pricing, and procurement methods, all while upholding standards of clarity, effectiveness, and responsibility (WHO, 2018b). Initiatives must be put forth to make cancer medications more affordable for patients. It is crucial to champion the use of high-quality generics and encourage medical professionals to prescribe these alternatives. Efforts should be directed towards refining pricing structures, enhancing price clarity, endorsing shared costs, advocating for reimbursements based on value from insurance entities, and accelerating the approval process for novel cancer treatments (Babar et al., 2007; Boyle et al., 2016; Cherny et al., 2016; Gray & Suleman, 2015; Kolasani et al., 2016; Moye-Holz et al., 2020; Suleman & Gray, 2017; WHO, 2018b; WHO, 2020b). Tax breaks or waivers should be considered for local drug manufacturing entities or those offering affordable cancer medications, ensuring the resulting cost reductions benefit the end-users directly (WHO, 2018b). Delving into diverse drug pricing strategies and regulations, like tender processes, bargaining, uniform exit pricing/SEP, graduated pricing, value-oriented pricing, cost-based pricing, ERP or IRP, and oversight on profit margins throughout the distribution network, can provide sustainable solutions to curb escalating medication expenses (Cuomo et al., 2017; Mattila et al., 2021; Moye-Holz et al., 2020; Salmasi et al., 2017).

Affordability of cancer medicines in Ghana in view of global literature

The research indicates that the cost of cancer drugs in Ghana poses a significant financial burden. All standard treatment regimens exceed the cost of a day's earnings. Cancer drugs are less expensive in public hospitals compared to private establishments like private hospitals and pharmacies. For a month's dose of Bevacizumab 400mg vial (OB) and Thalidomide 50mg capsules (LPG), priced at 5286.40 USD and 3399.82 USD respectively, the LPGW would have to spend 2554 days' wages and 1642 days' wages. This means that the average monthly earnings are grossly insufficient for certain cancer medications, potentially leading to public health issues. It is also crucial to note that these figures only represent the cost of the medication. Additional expenses, like doctor's consultations and diagnostic procedures, could make the overall patient expense much steeper.

The results align with previous research which highlights issues related to the cost accessibility of LPGs and OBs in both public and private medical facilities, with some cases even leading to treatment discontinuation (Babar et al., 2007; Faruqui et al., 2018; Goldstein et al., 2017; Islam et al., 2015; Sarwar et al., 2018). The health obstacles faced by African nations, including Ghana, are extensive and varied. Several elements impact the availability of cancer drugs in these regions (Barr & Robertson, 2016; Cherny et al., 2017; Iyengar et al., 2019; MOH, 2020; Nie¨ns & Brouwer, 2013).

The cost of the examined drugs, while below global benchmark prices, remains out of reach for the average government minimum wage earner in Ghana. Pediatric cancer patients necessitate a consistent and reasonably priced source of cancer drugs. Lack of access to such cost-effective medicines can result in avoidable death and health complications. There are several policy measures and practical solutions the government can consider in making cancer treatments more accessible and affordable. Strategies like enhancing pricing transparency, establishing health insurance specifically for pediatric cancers, financial support for vital childhood cancer treatments, emphasizing cancer medications in the national EMLc, and direct government importation of these drugs should be considered (Mensah et al., 2021). A significant number of patients in Ghana struggle to access cancer treatments due to widespread poverty, escalating inflation, and a rising cost of living. Often, these individuals seek help late, resort to herbal treatments, or turn to traditional spiritual practices for healing (Mensah et al., 2021). Even though Ghana is categorized as a

middle-income nation, the living standards and poverty rates, especially in rural areas, are concerning, with around 2.99 million citizens living in dire poverty (Ghana Statistical Service, 2023). The substantial financial burden of cancer treatments significantly depletes a family's monetary reserves (Wakefield et al., 2014). To cope, primary caregivers often resort to selling assets, taking out loans, or seeking monetary aid from various channels to fund ongoing treatments (Bona et al., 2014). Even with the relative cost-effectiveness of managing childhood cancer in Ghana, families find it challenging to cover treatment costs consistently (Renner et al., 2018; Santacroce et al., 2018). Ghana's NHIS doesn't cover the expense of pediatric cancer treatments, placing the entire financial obligation on families. As a result, monetary pressures lead to interrupted or abandoned treatments, a pattern observed in many lower-middle-income countries regarding childhood cancer care (Bekui et al., 2022). Some studies in Ghana revealed that the absence of most cancer drugs in the NHIS led to treatment refusals and delays. Even though the breast and cervical cancers medicines are included in the NHIS, patients were frustrated that it still did not cover substantial amounts of treatments causing a huge financial burden on them. This coupled with medicines stockouts meant that some treatments cannot be started on time, and the medicines had to be purchased elsewhere at additional costs (Agbokey et al., 2019; Ayandipo et al., 2020; Nartey et al., 2018; Sanuade et al., 2021; Tuck et al., 2022). In emerging nations such as Ghana, where medical insurance is still evolving, elevated direct out-of-pocket expenses often lead to reduced treatment adherence or discontinuation. This has severe consequences and can profoundly impact the financial stability of families and households (Niens et al., 2012). The Government of Ghana (GoG) should introduce strategies to adjust the prevailing steep prices, allocate funds for both adult and pediatric cancer medicines in the national budget, and refine procurement and supply systems across both public and private sectors to ensure fair pricing and accessibility in Ghana (Mattila et al., 2021; Sarwar et al., 2018).

Access to cancer medicines in Ghana in view of global literature

LMICs face challenges accessing necessary resources due to constrained budgets, inadequate infrastructure, and limited healthcare resources. A study highlighted the effectiveness of the Coordinating Commission for the Negotiation of Prices of Medicines in guiding negotiations with drug manufacturers, which has successfully prevented price hikes in the public sector and fostered national collaboration, leading to reduced costs (Zhu et al., 2019). While some price inconsistencies in public institutions have been noted, this model can benefit emerging nations by providing a centralized authority that negotiates directly with drug manufacturers, giving more bargaining power to governments (Zhu et al., 2019). Promoting local manufacturing of cancer medications is viewed as a method to enhance both accessibility and affordability, especially relevant for LMICs. Producing "me-too" drugs locally can facilitate better price negotiations and spur competitive pricing. This in turn may lead to a decrease in the cost of similar drugs developed internationally (Zhu et al., 2019). Several approaches can be employed to enhance the accessibility of cancer drugs including reinforcing pricing regulations throughout healthcare sectors, encompassing setting upper limits on the costs of cancer drugs and refining a healthcare system's capability to oversee and modify drug prices; adopting differential pricing strategies that consider a healthcare system's buying capacity; augmenting clarity in the pricing of cancer medications (Cuomo et al., 2017; WHO, 2018b); consolidating resources from the Ministry of Health (MOH) and vital stakeholders, including NGOs (Bioventures for Global Health, 2019; CHAI & ACS, 2021), the WHO, multilateral financing bodies, and educational institutions (WHO GICC, 2018) for collective cancer drug price negotiations and joint procurement (Bharadwaj et al., 2021; Sruamsiri et al., 2015) utilizing both voluntary and mandatory licensing and leveraging flexibilities related to patent rights provided by the World Trade Organization (Baxi et al., 2019; Sruamsiri et al., 2015), advancing health service studies and program execution to boost operational efficiencies associated with cancer drug acquisition (Martei et al., 2018), judicious usage involving collaborations with charitable foundations, (Garcia-Gonzalez et al., 2015) and educational entities and eliminating incentives for prescribing cancer drugs that offer limited therapeutic advantages (Sruamsiri et al., 2015; WHO, 2018b; WHO, 2011).

7.3 Discussion on price components of cancer medicines in Ghana

Mark ups on cancer medicines in Ghana in view of global literature

The add-on costs or mark-ups associated with various pricing elements directly and collectively influenced the overall prices of cancer medicines across all sectors in Ghana. A mark-up refers to an additional fee added to the purchase price to cover expenses and profit margins for distributors or sellers. This mark-up can be a consistent sum or a proportional fee. In certain nations, authorities dictate the maximum allowable mark-up at the wholesale or retail level. Some regions adopt a mixed approach at the retail stage, integrating a minimal consistent mark-up with a defined dispensing fee. In instances where a government stipulates mark-up ceilings but fails to ensure adherence, it might lead to distributors or sellers imposing mark-ups exceeding the legally permitted limits. Conversely, in highly competitive markets, distributors or sellers might opt for mark-ups below the maximum limits to attract a broader customer base (as mentioned by WHO & HAI, 2020).

The results show irregularities and a lack of standardization in the price mark-ups for cancer drugs across all sectors. Consequently, this leads to elevated and inconsistent prices for patients, varying between different sectors as well as among branded and generic medications. The mark ups/add-on costs were high for OB as compared to their generics in the private hospital. Profit margins and mark-ups are notably greater in the private hospitals and pharmacies than in the public hospitals. Within the public hospital system, some mark-ups were elevated, warranting a closer examination of the public procurement process.

In Ghana, there's no strict pricing oversight; the government doesn't set limits on the profit margins, allowing manufacturers, wholesalers, and pharmacies to determine their own prices.

Given the limited publicly available data on the cost components for cancer drugs, the markups for these medications in Ghana were juxtaposed with essential drug markups in other nations using WHO/HAI survey results. The findings were parallel for public hospitals and private retail pharmacies in these countries. However, Ghana's private wholesale pharmacies and private hospitals recorded significantly steeper markups compared to the data presented in these surveys.

For instance, research conducted in Malaysia found that retail pharmacy markups were considerable: ranging between 25%-38% for OBs and 100%-140% for generics

(Babar et al., 2007). The WHO/HAI surveys offer more insights. In Kenya's private retail sector, the wholesale markup for imported drugs fluctuated between 15%-30%, while the maximum retail markup ranged from 20%-33% (Babar et al., 2007). In Peru, the markup for imported generics was 36% for distributors and 33% for retailers (Babar et al., 2007). In Armenia's private sector, distributor markups for imported drugs varied between 18%-25%, and retailers charged between 15%-25% (Babar et al., 2007). Brazil's private retail sector had both the wholesaler's and retailer's markup around 27% (Babar et al., 2007). The private retail sector in the Philippines exhibited a 30% markup for OBs by both the distributor and retailer (HAI, 2006a). Lastly, in the state of Maharashtra in India, a 20% profit margin was reported for generic atenolol (HAI, 2006b).

The private hospitals in Ghana had markups of 40%–52% for generics, whilst the public hospital had mark-up of 14%-24% for generics. Also, as one moved along the supply chain from the public hospitals to the private hospitals, the potential for bulk purchasing advantages decreased due to decreasing volumes. This phenomenon is clearly observed the private hospitals where mark-ups are more substantial than at the public hospitals. The private hospitals in Ghana had markups of 37%-43% for OBs. The private pharmaceutical wholesaler had 47%-mark ups for generics. In private pharmacies, mark-ups of 30% were observed for generics.

The add-on costs for both OBs and generic counterparts were notably steeper in private hospitals and private pharmaceutical wholesalers than public hospitals and private pharmacies. Excessive markups throughout the supply chain escalate prices, undermining the affordability of cancer drugs. Therefore, by curtailing these add-ons, the cost of medicines can be significantly reduced. In In the private hospitals the profit margins for generic Epirubicin 50mg vial was more than that of the OB Epirubicin 50mg vial.

The amplified markups on generics observed in the components analysis highlighted that the OB prices remained stable even with generic competition, thus suggesting that the prices of OB medicines might serve as a benchmark for generic pricing, thus price-controlled generics may be the option of choice. Generics could be more affordable than the OBs, if there were constraints on these surcharges coupled with incentives promoting the adoption of generics.

Pharmaceutical policies in Ghana in view of global literature

In the 1980s, Ghana, along with many other sub-Saharan African nations, implemented economic restructuring policies. This included the introduction of certain cost recovery measures in the social sectors. Specifically in healthcare, the Hospital Fees Legislation was enacted in 1985, followed by the launch of the cash-and-carry (C&C) system for drug provision to outpatients within the Ministry of Health (MOH) framework in 1992 (Asenso-Okyere et al., 1998). The C&C system's genesis was not just rooted in structural adjustments but was also influenced by the "Bamako Initiative," by UNICEF and rolled out in numerous developing countries, particularly in Africa. This initiative was grounded in the idea that drug fees would support and enhance primary health care service delivery. The shortage of pharmaceutical supplies in Ghana's public sector prompted the spontaneous emergence of drug fee models within several MOH facilities. Consequently, the concept of enhancing drug supply across the board using user fees gained traction (Huff-Rousselle et al., 2002). However, while there were claims of better service efficiency and quality, user fees posed a financial hindrance to accessing health services. This led to disparities in accessing both health services and medicines (MOH, 2006).

Decision-makers in Ghana have the option to employ a variety of pricing policy strategies (WHO, 2020b) or select a policy that aligns well with their set goals. Ensuring affordable access to reliable and effective pharmaceuticals is crucial for attaining universal healthcare. As mentioned in the WHA 72.8 resolution passed in 2019, the Seventy-second World Health Assembly expressed deep concerns about the exorbitant prices of certain healthcare products. There were also worries about uneven access to these products both within and between member nations. The prohibitive prices posed financial challenges, hindering the journey towards achieving universal health coverage (WHO, 2020b).

Robust pharmaceutical pricing policies at the national level can enhance the accessibility and affordability of cancer medicines when they are crafted, deployed, and adapted in response to evolving situations. These policies should be squarely aimed at ensuring that consumers and healthcare systems can affordably and equitably access high-quality pharmaceutical products. These strategies should prioritize getting value for money by optimizing health outcomes across the population, all the while ensuring a consistent supply of top-notch products (WHO, 2020b). It is a recognized fact that the high costs of pharmaceutical items have

hampered numerous health systems' ability to deliver access to all. When there's a lack of insurance, obtaining pharmaceuticals can plunge patients and their families into severe financial stress. Those who lack the necessary funds might be completely excluded from receiving beneficial pharmaceutical care. On the flip side, excessively low prices might reduce profit margins, falling short of what businesses anticipate maintaining their operations. Such a situation could lead to a lack of availability or disruptions in the supply of specific drugs, affecting health services and ultimately resulting in adverse health outcomes for patients (WHO, 2020b).

Regulating medicine prices through price controls ensures that costs remain manageable and affordable. Governments have an array of pricing strategies at their disposal. Some of these strategies specifically target certain types of drugs and market sectors, like innovative medicines that have recently been developed, medicines whose patents have expired, or medicines that are reimbursed or subsidized. Additionally, these pricing measures can be applied at various points in the supply chain, such as the manufacturer, distributor, pharmacy, or even at the end-user level. A considerable amount of data, especially from high-income nations with longstanding pricing policies, highlights the effectiveness of price regulations in curbing prices and overall spending. Research indicates that prices in unregulated settings (like in the private sector) are often much higher than those set through tenders or other pricing mechanisms (Cameron et al. 2009; Babar 2015; Babar et al. 2018). Therefore, to ensure that essential medicines remain accessible at affordable rates, the implementation of pricing strategies is crucial. The WHO also supports the use of a mix of pharmaceutical pricing policies (WHO, 2020b).

Pharmaceutical pricing strategies are a pivotal element of the broader pharmaceutical policy landscape due to their significance in upholding the financial health of the healthcare system. They act as levers that policymakers use to influence the cost, variety, and combination of products available in a nation. Such strategies encompass various approaches, from price controls and negotiations to rebates, encouraging the use of generic alternatives, reference pricing, international cost comparisons, volume-oriented pricing, procurement strategies, and evaluations based on Pharmacoeconomics (Babar, 2015).

Governments can influence medication prices by adjusting taxes and overseeing the various price add-ons throughout the drug distribution process. This includes prices set by manufacturers, wholesalers, retailers, and the final price at which the drug is

dispensed. Such interventions can notably impact the final amount paid by the consumers (Babar, 2015).

Policies targeting specific areas within the drug value chain, especially concerning cancer medications, and with distinct objectives are essential. It is crucial to establish price controls and maintain price transparency throughout the drug distribution process. Governments can directly set the prices of cancer drugs or indirectly influence them via established pricing, negotiations, public purchases, and more (Austrian National Public Health Institute, 2022). Its opposite is free pricing.

Considering tiered pricing methods, pharmaceutical firms sometimes offer medications at reduced costs in lower-income regions, like some African nations, leveraging differentiated pricing tactics. For instance, Roche undertook initiatives to implement tiered pricing models in LMICs, which included drugs for cancer treatment. They tested a tiered pricing system for Herceptin® based on a patient's financial capability (Hoen, 2014). To implement this, Roche emphasized the need for international collaboration to prevent external referencing and parallel imports from nations that aren't on the same economic tier. A tactic to mitigate the repercussions of external referencing or parallel imports is the introduction of "alternate brands." An example is Roche supplying the same drug as Herceptin but under a different label, Herclon, in a collaboration with Emcure in India (Hoen, 2014). This ensures the price of Herceptin remains unaffected by any price variations between nations. The underlying motivation behind such regulations is to ensure drug prices are kept at manageable levels. Evidence from LMICs indicates that lacking price regulation can result in exorbitant prices (Schneider & Vogler, 2016), underscoring the need for stringent price controls to ensure medications are both affordable and accessible to the populace.

Effective strategies related to drug pricing, combined with comprehensive system-enhancing measures, have the potential to bolster health systems, ensuring both consistent supply and increased access to reasonably priced pharmaceutical items (WHO, 2020b).

The WHO has provided guidelines for nations to handle drug pricing (WHO, 2020b). These includes supervising mark-ups throughout the distribution chain for cancer treatments, evaluating tax reductions or exemptions for essential treatments including cancer drugs and their primary components, ensuring these initiatives translate to reduced prices for consumers and buyers. Additionally, leveraging price

discussions, referencing both external and internal pricing for transparency, and employing collective purchasing of cancer treatments considering both monetary and non-monetary advantages (like quality, availability, streamlined administration, negotiation leverage, better forecasting, and shared technical knowledge) are suggested. The organization also recommends regulatory strategies, quality checks, intellectual property regulations, comprehensive patent data, and coordinated financing across participating regions. Furthermore, they emphasize promoting the adoption of generic drugs through legal provisions supporting generic replacements, incentives for prescribers to use INN, dispensing fees favoring affordable generic treatments, and educational initiatives for both the public and professionals regarding the quality, safety, efficiency, and pricing of generic drugs (WHO, 2020b).

Considering the steep costs associated with biological medicines, biosimilars present an opportunity to stimulate competition and consequently reduce prices. Numerous research works have underscored the cost-saving potential that biosimilars offer (Vogler, 2022; Brodszky et al., 2016). Yet, to truly harness the benefits of cost-effective biosimilars, there's a need to amplify their utilization by prioritizing their prescription and use over the pricier original biologicals. Naturally, this could also push original biologicals to adjust their prices downwards. The promotion of biosimilars over their counterparts can be achieved through various demand-driven strategies (Rémuzat et al., 2017). The success of biosimilars, much like generic drugs, hinges on their endorsement by medical practitioners, pharmacists, and the general public. Ensuring high-quality products and fostering a comprehensive understanding of these drugs are pivotal, with the latter necessitating effective communication and capacity-building measures.

Additionally, some pricing strategies incorporate managed-entry agreements (MEAs). These agreements represent a pact between a drug manufacturer and a service provider, such as a hospital, allowing access to a specific medicine under certain conditions (Klemp et al., 2011; Vogler et al., 2016). MEAs are often the recourse when traditional pricing mechanisms fail to deliver affordable prices, especially when prices set through standard external price referencing are deemed exorbitant.

Pricing models of other countries could be explored and replicated based on the Ghanaian context.

The use of pricing strategies in Ghana

Historically, public sector pricing has been anchored on a cost-recovery model, where prices are set based on the associated costs. At every tier of the healthcare system, health institutions typically add a margin to the base price they pay for an item. These added charges aim to account for the expenses involved in procuring the products, factoring in aspects like potential losses, inflation, taxes, and direct product-related costs, such as insurance and incidental labor costs for management. MOH traditionally set fixed percentage mark-ups for each stage. Yet, the actual execution has frequently strayed from these official MOH-defined margins. Furthermore, while there have been alterations to the official policies over the years, these modifications weren't always meticulously recorded or disseminated (Huff-Rousselle et al., 2002).

Owing to lesser quantities and challenges such as lack of competitive intelligence, bargaining leverage, and limited time for price comparison, public healthcare entities often face elevated buying prices when sourcing from the private sector (Huff-Rousselle et al., 2002).

An example of a pricing strategy to ensure access was demonstrated in a health initiative in Ghana's Upper West Region, supported by DANIDA. Instead of adhering to the conventional C&C system, this program recalibrated prices with a broader vision in mind. Apart from incorporating standard considerations like replacements, wastage, and inflation, the pricing mechanism factored in the anticipated needs for future cycles in line with the program's expansion. The strategy was not just about replenishing the existing stock but about pricing in a way that facilitated the acquisition of additional stock in subsequent purchase cycles, mirroring the growing product demand. As a result, instead of imposing a uniform mark-up on all products, some of the costs of pricier and crucial medications were spread over larger quantities of less expensive items (Huff-Rousselle et al., 2002).

At Korle Pharmacy, a varied approach to pricing was observed. Products were priced with mark-ups ranging from 7.5% to 20%. While some items had a 25% markup, others were priced without any markup. The pharmacy adopted a tiered pricing system. Items that were affordable and had high sales volumes were often assigned a higher markup. In contrast, high-priced cancer treatments, such as Zoladez injection for prostate cancer and certain treatments for childhood leukemia, were exempt from mark-ups (Huff-Rousselle et al., 2002).

Such strategic pricing approaches offered indirect support to vital public health items. They could serve as models for making cancer medications more accessible in other settings (Huff-Rousselle et al., 2002).

Access to cancer medicines in Ghana

The government of Ghana established the NDP to ensure its citizens had fair, consistent, and long-term access to vital medicines. This is central to their plan to enhance the health of the population. Part of Ghana's NDP's mission was to set a national pricing system to make medicine prices more consistent, helping more people get what they need.

Trade liberalization in Ghana means consumers have more options. Some prefer local pharmacies or wandering drug sellers because it is quick, easy, available, and they don’t have to pay any consultation fees (Asenso-Okyere & Dzator, 1997). On the other hand, some choose mission-operated or private clinics because they believe this offer superior or more convenient services than the MOH alternatives. There's a misconception in the public sector about how much price matters to consumers in developing countries. Surprisingly to some, price isn’t always the top factor when choosing health products. People’s health needs change, and so do their purchases. It is hard for them to judge the quality of the health services they get and to see if they're getting good value. Buying health products isn't a regular thing for most, so they don't often compare prices, especially when dealing with illness. Other costs, like travel and wait times, matter too, especially if they mean lost wages. People's decisions are influenced by several things: ease of access, like going to a local pharmacy, or the perceived quality of a place, whether it is private, mission-run, or MOH. Price is just one piece of the puzzle. When public services become more expensive, people might turn to private or mission-operated services because they see them as better or more handy. Sometimes, in the absence of other information, they might think that a higher price means better quality. Patients need to be guided in terms of where to access quality low-cost medicines.

Pricing of cancer medicines in Ghana

The government of Ghana is promoting the expansion of the pharmaceutical sector. However, there's a challenge concerning how much the market should dictate the cost of cancer drugs, as there is no price control on cancer medicines. The local production of pharmaceuticals is only growing slightly and is affected by the government's open market approach. The power and influence of some local suppliers, having a local monopoly on the cancer medicines is cause for concern, as they determine the cancer medicine prices in Ghana. Hence, it is essential for the government to intervene in the pricing of pharmaceuticals. Relying solely on the market to determine the cost and availability of cancer medicines might not meet public health goals (Quick et al., 1997).

The increasing financial strain of cancer drug expenses on low-income families is undeniable. It is also unjust to label expensive drugs as the result of improper prescription practices when even generic drugs prescribed by private sector doctors are pricey.

Deciding the price of medicine is intricate, with each national market being notably divided. Different protocols are used in various sectors and for different drugs. The concept of "open markets" isn't applicable to patented medicines, as they grant a unique market advantage to the maker. It is common for manufacturers to have varying prices for the same medicine in different areas within a nation. Medicine prices for cancer drugs vary across countries and are largely unaffordable and unsustainable for Ghana. Policies should be tailored to fit Ghana's unique circumstances and context, ensuring they are in line with the desired policy goals. Given the challenges surrounding cancer drugs and the unique nature of the pharmaceutical market (which doesn't function like typical consumer markets) coupled with the essential role of these medicines in treating cancer, it is crucial to guarantee affordability. Elevated prices remain a significant hurdle to access, as pointed out by Babar in 2020.

Pharmaceutical pricing system in Ghana

Ghana, classified as a developing middle-income nation, largely operates on free-market principles similar to Ethiopia, without adopting the specific pricing techniques discussed previously. The Ghanaian authorities do not exercise direct control over the prices of cancer medications. Furthermore, the execution of their pharmaceutical

pricing strategy remains ambiguous. There are various mechanisms to enforce price controls, and some of them cause less disruption in the drug market than others. One of the most efficient methods involves using price benchmarks from countries with similar economic profiles during purchasing, ensuring that a country doesn't pay exorbitantly high prices. Reference pricing determines or caps the cost of a specific drug by comparing it to the price in different nations (WHO, 2018b; WHO, 2020b). The Ghana National Medicine Policy aims to provide access to reasonably priced medications. However, this study indicates that these goals are yet to be realized (MoH 2017c). There's a clear need in Ghana for both the enactment of a medication pricing policy and a system to monitor prices. Pricing can be regulated by setting caps on the profits of retailers and distributors, further reinforced by marking the highest acceptable prices on packages. From the buying perspective, a range of strategies, including bulk buying, negotiations rooted in cost-effectiveness data, parallel trading, or varied pricing can be applied to exert downward pressure on manufacturers' pricing. Initiatives should be in place to encourage the adoption of generic drugs, and the introduction of compulsory generic substitution could also be beneficial.

7.4 Comparison of pricing studies conducted in Ghana and South Africa

This chapter presents a comparison of the methodology and results of the cancer medicines pricing studies conducted in a higher MIC (South Africa) and a lower MIC (Ghana). See Table 27 below.

Table 26: Similarities and differences in the methodology and results of the cancer medicines pricing studies in Ghana and South Africa

Study	Similarities	Differences
Methodology	- Both studies were done using an adapted WHO/HAI methodology. - Both investigations assessed the cost and accessibility of cancer drugs in the private sector, considering both the original brand and the most affordable generic versions. - Both cost assessments evaluated the disparity between the HPM and the LPM. They also determined brand surcharges by comparing the priciest generic or original brand products with	- The Ghana pricing study measured medicine prices for 65 cancer medicines, whilst the South African pricing study measured medicine prices for 10 cancer medicines. - The Ghana pricing study assessed the presence of 65 cancer drugs in pharmacies, whilst the South African pricing study did not assess availability of cancer drugs in the pharmacies. - The South African price analysis also assessed the affordability of 10 cancer drugs by incorporating another unaffordability metric using Niens et al. approach, which is rooted in Van Doorslaer et al. method for gauging the financial hardship of acquiring medicines (Niens et al., 2010; Niens et al., 2012; Niëns & Brouwer, 2013). - The South African pricing study used cancer medicines prices data sourced from the South African Medicine Price Registry as of 11th March 2020, managed by the NDoH. This public database lists the current SEP prices for all registered drugs in South Africa (National Department of Health,

	their most affordable generic counterparts. Price ratios and price variations were also assessed (WHO & HAI, 2020). - Treatment regimens for both studies were taken from the EMC (Datapharm Ltd, 2021), United Kingdom (UK) and the NCCN treatment guidelines (NCCN, 2020). - For both studies, the affordability of medicines was analyzed by determining how many days' wages an unskilled LPGW in a given country would need to cover a standard treatment course, using the	2019). Whilst the Ghana Pricing Study, used cancer medicines prices from data collected during actual visits to the medicine outlets. - The South African pricing study collected SEPs for all selected cancer medicines in South African Rand and converted to USD (1 USD = 16.73 ZAR, 12 September 2020) (Google exchange rate, 2020), Whilst the Ghana pricing study collected medicine prices in local currency, Ghana (Gh) Cedis and converted to USD using foreign exchange rate of (1 Gh Cedis = 0.1652 USD =), as of 06 October 2021 (Currency Conversion, 2021). - The South African pricing study did not calculate the MPR because of the outdated 2015 reference from the MSH for ERP (citing MSH, 2015). As a result, there wasn't a juxtaposition with the International Price Ratio (IPR). In contrast, the Ghana pricing study calculated the MPR. They adjusted prices using a deflation factor of 84.73%, based on the Ghana Consumer Price Indices (CPI) from July 2014 to July 2019 to make the comparison between local and international prices more reliable (Consumer

	WHO/HAI affordability criteria (WHO & HAI, 2020). - In both studies, the financial burden of a month's oncology treatment was illustrated, indicating the potential cost to a patient if they had to cover it independently. It is important to note that a typical cancer patient usually undergoes multiple treatment cycles with various drug combinations. - Ethical approvals were granted for both studies.	Price Index, 2021; MSH, 2015; Saeed et al., 2019; Song et al., 2018; Zhu et al., 2019). - The Ghana pricing study involved three sectors namely, public hospitals, private hospitals, and private pharmacies, whilst the South African pricing study only involve one sector, namely the private sector. - In 2020, the daily earnings of an unskilled LPGW in South Africa stood at 166.08 ZAR, calculated from an hourly rate of 20.76 ZAR for an 8-hour workday (South African Government, 2020). This amount translates to approximately 9.9271 USD, considering the exchange rate on 12 September 2020 was 1 USD to 16.73 ZAR (Google exchange rate, 2020). On the other hand, the daily wage for an LPGW in Ghana in 2021 was set at 12.53 Gh Cedis, which equates to 2.07 USD (Ghana News, 2021). - The Ghana pricing study has a sequel case study on cost components to show the additional costs that factor into the final pricing of cancer drugs, whilst the South Africa pricing study did not include a cost component study.

Results	- Both study results showed that in South Africa and Ghana (both LMICs), the high costs of vital cancer drugs impede their accessibility. - The cost of cancer drugs is substantial, and there's a notable disparity in the prices of various cancer drug brands, especially in the private sectors of both South Africa and Ghana. - Notable price disparities existed between the most affordable and the most expensive drugs, and in the private sector, OBs typically had higher price tags	- In the South African pricing investigation, except for paclitaxel 300mg (which cost 0.2 days' earnings) and Fluorouracil (Fluroblastin) 500mg (at 0.3 days' earnings), all other OB treatments exceeded the cost of a day's wage. Notably, a one-month regimen of the OB Irinotecan (Campto) 40mg was the least affordable, demanding 32.3 days' wages. Its generic counterpart required a lesser 11.5 days' earnings. Excluding Paclitaxel 300mg (0.2 days' wage) and Oxaliplatin 100mg (0.5 days' earnings), all LPGs exceeded the cost of a day's wage. Interestingly, the generic form of fluorouracil was pricier than its branded counterpart, leading to a negative price difference of -679.73%. - The Ghana pricing survey showed that the cost of all treatments under OBs was more than a day's wage. In public hospitals, Bicalutamide (Casadex) 150mg tab had the steepest price, demanding 753 days' wages. In private hospitals, Bevacizumab (Avastin) 400mg vial was the priciest, needing 2554 days' wages. Meanwhile, in private

	than their generic equivalents.	pharmacies, Filgrastim (Neupogen) 300mcg vial took the top spot, costing 1117 days' wages. - The Ghana pricing survey showed that across all sectors, the cost of treatments using Lowest-Priced Generics (LPGs) always exceeded a day's wage. In the public hospital setting, the steepest price was for Chlorambucil 2mg tab, demanding 201 days' wages. In private hospitals, Sorafenib 200mg tab took the lead, costing 415 days' wages. Among private pharmacies, Thalidomide 50mg cap topped the list, necessitating 1642 days' wages. - Using the Niens et al method (Niëns et al., 2010; Niëns et al., 2012; Niëns & Brouwer, 2013), the south African pricing study showed that 57% of the population were already living below the poverty threshold prior to the hypothetical purchase of a medicine (I_{pre}). The percentage that would hypothetically slip into poverty post-purchase (I_{post}) could be as high as 26%. Irinotecan (Campto) 40mg OB is the most expensive medicine and it is unaffordable to 82.95%. - In the Ghana pricing study, the overall presence of cancer

		medications (both OB and LPG) in the 29 facilities studied was markedly low and far less than the WHO recommended 80% availability. - In the Ghana pricing study, OB cancer drugs were predominantly found in private pharmacies and private hospitals, more so than in public hospitals. In contrast, LPG cancer drugs were more commonly available in public hospitals compared to private hospitals and pharmacies. - In the Ghana pricing study, it was noted that only 16.92% of cancer medicines located in various medicine outlets were included in the NEML. A sizable 83.08% were not on the NEML. However, about 66.15% of the cancer medicines were present on both the WHO EML and the WHO EMLc.. - Private hospitals indicated that two-thirds of their medications exhibited price differences exceeding 50%, with ratios surpassing 2. The price differential for Doxorubicin HCL 50mg vial stood at a significant 88.75%. - For the Ghana pricing cost component study, the total cumulative mark ups (stage 3) for

		the LPG cancer medicine of cyclophosphamide 50mg tab was 24% in the public hospitals. - For the Ghana pricing cost component study, the total cumulative mark ups (stage 3) for the LPG cancer medicine of epirubicin 50mg vial was 20% in the public hospital, 52% for the private hospital and 30% for the private pharmacy respectively. This showed that the mark ups for the LPGs were higher in the private sectors than the public sector. - For the Ghana pricing cost component study, the total cumulative mark ups (stage 3) for the OB cancer medicine of epirubicin 50mg vial was 37%, whilst its LPG was 20% in the private hospital. This showed that the OBs had more marks ups and were thus more expensive than their corresponding LPGs.

7.5 Discussion of South Africa and Ghana pricing studies

The chances of survival for cancer patients hinge on elements like the availability, cost-effectiveness, and ease of access to treatment. In many nations, procuring high-priced cancer drugs is becoming increasingly challenging. Both study results showed that in South Africa and Ghana (both LMICs), there's a significant gap in accessing essential cancer medications due to their limited availability and prohibitive costs. Cancer medicine prices are high, and treatments are often unaffordable especially in the private sector, for example, cancer medicine Docetaxel Trihydrate 80mg vial (LPG) is available in the private sectors of Ghana and South Africa and when bought in the private hospital and pharmacy sectors, it can set back the lowest-earning, untrained government employee by about 64 and 53 days of wages respectively in Ghana, and can cost 3.4 days wages in South Africa. In Ghana, the availability of LPGs in the private sector was notably low. Furthermore, there are significant mark-ups in the medicine distribution process, and a myriad of taxes and charges are levied on these drugs.

Disparities in the guidelines set by medicine regulatory bodies across nations and their respective pricing strategies result in varying drug costs across borders (WHO, 2019). Elevated prices for patients can arise from the absence of generic competition, generic medicine suppliers setting prices of sought-after products just marginally less than the original brand, excessive profit margins set by manufacturers, significant government-imposed taxes and duties on medicines, and an ineffective distribution system. However, the expenses tied to the development and production of generics are usually lower, explaining why the costs for LPGs tend to be less than those for OBs (IMS Institute for Healthcare Informatics, 2014). Factors like patent protections, monopoly markets for novel compounds, regulatory challenges, geographic placement, economic standing, and the absence of internal pricing controls can also influence the price (IMS Institute for Healthcare Informatics, 2014).

In South Africa, there is an internal price regulation mechanism using the SEP.

In the private sector, drug pricing is established by the pharmaceutical sector as the SEP (DOH, 2020). The NDoH then provides official approval and announces this pricing, aiming to regulate prices within the private sector and ensure affordability and accessibility for those under private healthcare (DOH, 2020; Meyer et al., 2021). Nonetheless, the SEP doesn't tackle the inflation of drug prices, the clear outlining of

costs by producers, consistency in pricing, incentives, and discounts in a market where medicines aren't strictly regulated. The impact of the SEP on affordability though is unclear (WHO, 2018b).

Drug prices in Ghana rank among the steepest in Africa, with about 50% to 200% of a medicine's retail value coming from retail mark-ups (MOH, 2017c). The provision of cancer treatments in Ghana largely relies on the private sector. The limited outlets offering oncology medications face little competition, allowing them to set prices without any governmental checks or interventions. This situation is compounded by a widely acknowledged absence of financial incentives for businesses to provide cancer drugs. The small total market size combined with disjointed purchasing pathways amplify and perpetuate the inflated prices for cancer treatments (Boateng et al., 2020).

The scarcity of cancer treatments in Ghana's public hospitals often pushes patients towards the private sector to procure high-cost oncology drugs. This shift causes financial strain due to elevated direct payments. These significant direct payment expenses act as a major barrier to accessing healthcare services. It underscores the pressing need for the government to refine and enhance the processes of obtaining, distributing, and supplying cancer medications within the public framework (Cherny et al., 2017; Ewen et al., 2017; Faruqui et al., 2018).

Governments should persist in endorsing the use of generic drugs through measures such as encouraging generic prescription and substitution, enhancing pricing transparency, effective oversight, equipping patients to ask for cost-effective alternatives, enhancing visibility of pricing within health plans, adopting internal and external price comparison standards, implementing health technology evaluation methods, and utilizing pharmacoeconomic reviews to discuss cancer medicine prices (Babar et al., 2007; Gray & Suleman, 2015; Niëns et al., 2012; Suleman & Gray, 2017). Challenges like rampant inflation, limited per capita income, and a rising cost of living are just a few factors that impede individuals from procuring cancer treatments. To enhance the affordability of cancer drugs in LMICs, governments possess a plethora of strategies. This includes ensuring the availability of high-quality generic drugs in the private sector, eliminating import taxes on cancer drugs, waiving them from the value-added tax, introducing controlled markup systems for drug distribution, adopting differential pricing, providing affordable insurance plans, offering medicine discounts, patient accessibility programs, tax incentives, fostering

public-private collaborations, modifying patents, and drawing from successful governance and public health models for sustained efficacy (Cameron et al., 2009; Cherny et al., 2017; Faruqui et al., 2018; Islam et al., 2015).

CHAPTER 8: Conclusion, policy recommendation and future research

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8.1 Conclusion of research studies

The study of South Africa's private sector showed significant discrepancies in the prices of various cancer medicine brands. This implies that there's a pressing need to enhance both affordability and pricing of medicines in South Africa to guarantee equal access to cancer treatments, particularly for the economically challenged. While the South African government has set prices for certain medicines, there's much more to be addressed. Comprehensive strategies must be implemented to tackle the variation in the prices of cancer drugs. Implementing diverse interventions, reevaluating, and reshaping policies, regulations, and educational measures are crucial for better access to these vital medications.

The research in Ghana revealed that the cost of cancer medications is notably high, with significant price discrepancies observed across the three sectors. The differences span between the highest and lowest-priced equivalents, as well as between OB and LPG. The most affordable median prices for OBs were found in private pharmacies, likely because some of these establishments also serve as suppliers or wholesalers of cancer drugs to both government and commercial pharmacies. On the other hand, government hospitals recorded the lowest median prices for LPGs, potentially due to governmental directives promoting generic prescriptions and policies tied to medical insurance payouts.

Interestingly, the pricing disparities highlighted that patients often incur higher expenses when prescribed original brands as opposed to generics. Still, some generic medications were priced higher than their branded counterparts. This anomaly in generic pricing might be attributed to factors like competitive generic markets, price manipulation, market dynamics, or other underlying elements. The price difference also suggests that many individuals encounter steep out-of-pocket expenses to obtain cancer treatments.

The high price ratios suggests that Ghana's medicine procurement and distribution processes lack efficiency and transparency. Such elevated price ratios might arise from an absence of competitive generic markets, the lack of price controls, limited procurement volumes, and inflated wholesale or retail profit margins on medicines. This shows the need for significant improvement by health policy makers responsible for medicines procurement and supply.

The cost of cancer treatments in Ghana presents a significant burden, as all standard therapy regimens exceed the daily wage. This pricing challenge has potential implications for public health accessibility and affordability. Unaffordability of cancer medicines will push patients to lower quality alternatives, or they will be unable to buy medicines to cover their full treatment cycle. Cancer medications were more reasonably priced in public hospitals than in private entities such as private pharmacies and private medical facilities.

The accessibility of cancer medications is alarmingly limited, and the majority of patients struggle to afford these treatments. It is concerning that none of the analyzed cancer medicines reached the WHO's recommended 80% accessibility benchmark across all sectors. Only around 16.92% of the cancer drugs available in medical stores were on the NEML, while a staggering 83.08% were not.

When evaluating the pricing structures, significant mark-ups were observed throughout the distribution process. This inflates the prices, making essential cancer treatments less financially accessible to those in need. In private hospitals, the branded drugs, or OBs, faced higher add-on costs compared to their generic counterparts. Profit margins were noticeably steeper in private hospitals and pharmacies in comparison to public hospitals. In fact, some public hospitals also exhibited elevated mark-ups, pointing to a potential need to reevaluate their procurement systems.

Even though Ghana has a policy in place for medicine pricing, the actual cost determination of cancer treatments is majorly influenced by pharmaceutical wholesalers. They consider factors like the initial purchase cost, import expenses, marketing overheads, and desired profit margins.

For the well-being of its citizens, Ghana needs a comprehensive approach to health that encompasses robust policies, diverse interventions, and strict regulations. This approach should aim to revise the current high pricing structures, offer tax benefits, bolster health insurance, and encourage the adoption of generic medications. Only by ensuring affordable care, regardless of one's financial situation at the point of service, can the country move towards a healthier future.

It is anticipated that this research and its suggested measures will further the ongoing evaluation of Ghana's pharmaceutical landscape, aiming to bolster medicine accessibility and cost-effectiveness for everyone. The research will offer information, enrich existing scientific documentation, elevate understanding, and emphasize

fairness in aspects like availability, affordability, pricing, and accessibility to oncology drugs within LMICs especially Ghana and South Africa, to guide policy makers in formulating policies and pricing decisions that will ensure equitable access to cancer medicines globally including Africa.

8.2 Policy recommendation and future research

8.2.1 General Recommendations

Broadly speaking, there's a noticeable gap in data concerning the pricing of cancer medications in Africa. I aspire that the analysis will spark discussions amongst policymakers, academia, civic groups, the pharmaceutical sector, and healthcare professionals about pioneering methods to enhance the accessibility, availability, pricing, and affordability of vital cancer treatments for both adults and pediatrics.

Pharmaceutical companies can enhance access throughout the entire cancer care journey in both South Africa and Ghana through multi-sector partnerships and MAPs.

To facilitate access, an overarching regulatory policy, consistent governance, adequate information and protection of patients, outcome and safety monitoring, transparency and equity of access including cost-share arrangements must be addressed through guiding principles and policy.

Comprehensive strategies and initiatives involving various key players (including governments, payers, and pharmaceutical firms) like effective distribution of resources, decentralizing healthcare services, support schemes for patients, targeted marketing agreements, and enforcing mandatory licensing for acquisitions will enhance the availability of cancer treatments. This will lead to improved cancer care quality, better health results, and a reduction in cancer-related fatalities.

The development and implementation of a comprehensive strategy to strengthen systems, structures and processes in forecasting, quantification, procurement, warehousing, inventory management, logistics information management system and good pharmacy practice in the pharmaceutical sectors of Ghana and South Africa respectively, will lead to increased access of cancer medicines.

The WHO advises every nation to develop and enforce a comprehensive pharmaceutical strategy, addressing challenges in the pharmaceutical sector cohesively. South Africa and Ghana governments should explore, and adapt what is suitable to country context, any of the pricing policy guidelines recommended by WHO, to enhance transparency and equity. These strategies include:

External benchmarking, where prices are compared with the costs of identical medicines in similar countries; Internal benchmarking, ensuring prices align with the value of medicines with similar therapeutic effects within the nation; Regulation of mark-ups by South African and Ghanaian governments to define the margins that pharmaceutical distributors can add to medicine prices throughout the distribution

process; Price transparency to guarantee all pertinent stakeholders are informed about medicine prices and their determination methods; Tendering and negotiation processes to make sure prices reflect the most competitive offers from suppliers; Promotion of quality-assured generics and biosimilars to support the use of alternatives to branded medicines, which maintain similar qualities and effects; Collective procurement to consolidate resources, enhancing purchasing leverage and efficiency; Tax incentives such as reductions or exemptions to alleviate or remove levies on pharmaceutical goods.

Factors such as geographical constraints, disparities in insurance coverage, variance in healthcare provisions (including specific drugs and cancer treatments), diverse disease burdens, budgetary constraints, resource distribution, buying power, and differing healthcare system capacities and disease prioritizations should be accounted for by South Africa and Ghana. These considerations are vital when setting medicinal formularies, negotiating terms for the procurement of cancer drugs, and framing health and oncology policies.

The WHO should consistently refresh its EML for cancer, offering guidance to nations like South Africa and Ghana about which pivotal cancer drugs should be given procurement and usage precedence. To enhance accessibility in these countries, the introduction of cost-effective novel cancer treatments mandates regular modifications to treatment guidelines, formularies, SIOP EML, NEMLs, and NMRLs, overseen by a specialized cancer drug review board. At the very least, each nation should guarantee the availability of all cancer treatments listed on the WHO's Essential Medicines List.

To enhance affordability of cancer medicines, the link between drug pricing and health outcomes should be improved by governments, donors, pharmaceutical industry, Inter-national Society of Pediatric Oncology (SIOP), WHO, the Union for International Cancer Control (UICC), the pharmaceutical sector, international agencies, and NGOs. This collective effort should aim to acknowledge and reward innovation while maintaining the viability of an affordable healthcare system.

South Africa and Ghana should be encouraged to use generic and biosimilar cancer treatments, aiming to foster competition and ultimately reduce cancer medicine prices. Both governments should advocate to ensure that the application of patent law and rights for market exclusivity are not overcompensating at the expense of hindering accessibility. Substantial efforts should be made by both governments and

stakeholders to address cancer holistically through prevention, diagnostics, and therapeutic interventions to ensure improvements in the overall survival and life expectancy rates globally.

South Africa and Ghana governments should initiate economic evaluations of pharmaceutical health services to gain an understanding of which health care services provide value for money and will be cost-effective considering limited health care resources. Governments can guide policy and access decisions of cancer medicines through Health Technology Assessment (HTA), which applies to the assessment, appraisal, and decision-making around access via public subsidy to high-cost cancer medicines.

South Africa and Ghana governments should implement a pharmaceutical policy that entails the creation, distribution, and application of cancer medicines in their healthcare systems This strategy could greatly enhance the availability and accessibility of cancer medications, contributing to better societal well-being and reducing poverty levels.

To improve resource allocation to cancer medicines, different exceptional measures to maximize reimbursement of oncology medicines such as revising cost effectiveness threshold, policies for off-label medication usage and introducing new agreements for market access allowing access to cancer treatments can be explored for its applicability in the African context to improve resource allocation of cancer medicines in Africa.

A sustainable supply of cancer medicines, and the most cost-effective treatment options should be implemented by cancer health care providers, noting the limited resources in Africa.

To ensure equitable and open pricing for cancer medications, it is essential to establish mechanisms that produce consistent and high-quality data, guiding the selection of the most appropriate pricing strategy for these treatments. Both governments should enforce clearer visibility into cancer drug pricing and strengthen pricing policies at the national level. They should correct the imbalance negotiating powers between payers and manufacturers/suppliers.

To control medicine prices, governments should implement rules on profit margins throughout the supply and distribution pathways. By introducing tax cuts or waivers, and guaranteeing that these financial benefits reach the end-users, they can further ensure affordability.

Both governments should strengthen and enforce the legal framework, encompassing regulations for the pharmaceutical sector, competition oversight, and measures against corruption. This will establish a balanced environment, promoting a vigorous competitive market for generic drugs. Moreover, such legal foundations, strengthened for both pricing and procurement strategies, are pivotal for nurturing competition, which offers a more evident benefit in determining prices than direct price controls.

Pivoting towards universal health care, where the majority of cancer treatments are supported by public health insurance or social security schemes, empowers LMICs to amplify their bargaining strength, positioning them as the principal buyer and hence influencing reduced drug prices. Achieving this market supremacy paves the way for governments to proactively determine medicine prices, transitioning beyond their conventional regulatory roles.

Furthermore, the joint creation of robust healthcare information infrastructures is vital, ensuring effective execution, surveillance, and assessment of drug pricing and procurement strategies in LMICs.

8.2.2 Recommendations specific to South Africa

The South African government should enhance the availability of medications, by granting compulsory licenses to pharmaceutical firms that impose exorbitant prices for treatments that extend or save lives.

The Government should institute regulatory measures and reforms to expand access by amending the Intellectual Property Framework for South Africa (Patents Act).

Parliamentary discussions should be held on the lack of access to cancer medicines at reasonable prices, the restricted market competition, and the reasons behind allowing market exclusivity, which leads to escalated prices, especially given the serious health implications associated with cancer.

The government, in cooperation with all stakeholders, should instigate vital changes in the cost structure of crucial drugs for cancer treatment and management in South Africa. Policy interventions such as cost-reducing strategies, alternative pricing methods, encouragement for innovation, fostering local production, and adoption of generics or biosimilars should be implemented in south Africa.

With the limitations to the SEP, alternative policy measures, such as global price comparisons and mandatory pharmaco-economic assessments of specific drugs,

should be carried out. The South African Affordable Medicines Directorate (AMD) and the Directorate for Pharmacoeconomic Evaluation need to enhance their capacity to scrutinize and modify prices, and, if necessary, divest based on regular monitoring and assessment of data on usage, clinical benefits, costs, quality, and availability. Efforts to undertake more comprehensive pharmaco-economic studies are essential to gain deeper insights into market dynamics, especially concerning the ex-manufacturer's pricing and logistics charges: examining their patterns across different medication categories and in the wake of shifts in medicine patent statuses. These insights should inform policymaking and crucially, monitor market adaptations considering the implemented policies.

8.2.3 Recommendations specific to Ghana

Ghana's Ministry of Health, in collaboration with relevant stakeholders, should advocate for a broader inclusion of cancer therapies in the NHIS, emphasizing the addition of pediatric cancer treatments to relieve families of the associated financial strains.

The government must roll out effective pharmaceutical strategies and pricing systems that are adapted to local needs, transparent, consistent, and foreseeable. Ghana should adopt an all-encompassing generic medicine policy nestled within a more expansive national medicine strategy. This should integrate approaches that encourage a pro-generic mindset among prescribers, distributors, and patients. The government should rigorously enforce its stance on generic prescription and distribution. Efforts should be made to heighten public recognition and trust in generic alternatives, and to promote their prescription. The government should also roll out incentives to bolster adherence to the generic guideline, as prescribers require encouragement to recommend medicines by their generic designations.

The government ought to decrease import duties, taxes, and other associated fees on crucial cancer medicines since such charges significantly inflate the medication's final cost.

Clear pricing directives for cancer treatments in both the private and public sectors should be established by the government, ensuring that all sectors adhere to stipulated maximum mark-ups. It would be beneficial for the government to devise a medicinal pricing index specifically tailored for essential cancer treatments.

Decision-makers should consider creating an independent, national bulk-buying system for cancer drugs that serves the entirety of the health sector, thereby ensuring more competitive acquisition costs. For those cancer medications that are procured at prices significantly above the international reference prices, alternative procurement sources should be identified.

The government should champion and promote the local production of essential cancer medications. Lending rates for suppliers and producers, especially when importing necessary raw materials and machinery, should be lowered. Moreover, import charges on these essential raw materials and critical manufacturing apparatus should be waived.

To ensure the availability of high-quality generic medications in the market, the FDB needs to enhance their drug registration processes and maintain vigilant post-market monitoring. Doing so will bolster the public's trust and acceptance of these generics.

The insights from this study ought to serve as a foundation for a comprehensive evaluation of policy alternatives aimed at ensuring that all Ghanaians have access to cancer treatments. It is imperative to routinely conduct surveys on the pricing of cancer medications to gauge the effectiveness of interventions, policy shifts, and targeted strategies. A more detailed study is required to understand why there's a scarcity of cancer medicines, including generics, within the public health domain.

While more cost-effective generic options are available in Ghana, there seems to be a notable preference for original brands in the private retail pharmacy sector, as evidenced by their prominent presence. A detailed investigation into the private sector is necessary to understand prescribing behaviors and the apparent inclination towards brand-name drugs.

Pharmacoeconomic analysis of the cancer medicines should be undertaken as occurs in several countries. Mark-ups must be reasonable and government policies which impact prices should be enforced. E.g., the government should determine and oversee mark-ups for Stage 3 and Stage 4, ensuring set profit margins for both distributors and sellers.

8.3 Future research studies

Given the identified themes and acknowledged constraints, there's a pressing need for more comprehensive studies focusing on the pricing, availability, affordability, and accessibility of cancer drugs in LMICs, with a particular emphasis on Africa. A survey examining knowledge, attitudes, beliefs, and practices concerning the full acceptance of generics across all sectors is warranted.

Other factors that affect cost of the cancer medicines used in the treatment of other cancers in the private sector of South Africa should be investigated.

The implications of medicine price benchmarking for oncology drugs within this private sector should be investigated.

A longitudinal study might offer a clearer picture of the availability trends of cancer medicines. Additionally, a detailed scrutiny of the healthcare infrastructures of both Ghana and South Africa is essential. This would provide insight into the disparities in pricing and what these differences signify in terms of drug accessibility, government and public expenditure, and adherence to medication regimens by patients.

CHAPTER 9: References and Appendices

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9.1 References

Agbokey, F., Kudzawu, E., Dzodzomenyo, M., Ae-Ngibise, K. A., Owusu-Agyei, S., & Asante, K. P. (2019). Knowledge and health seeking behaviour of breast cancer patients in Ghana. *International Journal of Breast Cancer*, *2019*.

Aikins, A. D. G. (2005). Healer shopping in Africa: new evidence from rural-urban qualitative study of Ghanaian diabetes experiences. *Bmj*, *331*(7519), 737.

Aitken, M. (2016). Understanding the pharmaceutical value chain. *Pharmaceuticals Policy and Law*, *18*(1-4), 55-66. http://www.medra.org/servlet/aliasResolver?alias=iospress&doi=10.3233/PPL-160432

Ali, E. E., Gilani, A. H., & Gedif, T. (2014). Pharmaceutical pricing in Ethiopia. In *Pharmaceutical prices in the 21st century* (pp. 79-91). Cham: Springer International Publishing. https://www.springer.com/gp/book/9783319121680

American Cancer Society. (2019) *The Cancer Atlas*. http://canceratlas.cancer.org/the-burden/cancer-in-sub-saharan-africa/

American Cancer Society. (2021). *CHAI and ACS announce agreement to expand Cancer Access Partnership*. https://pressroom.cancer.org/2021-03-08-Clinton-Health-Access-Initiative-and-American-Cancer-Society-announce-agreement-to-expand-Cancer-Access-Partnership

Antoñanzas, F., Terkola, R., Overton, P. M., Shalet, N., & Postma, M. (2017). Defining and measuring the affordability of new medicines: a systematic review. *Pharmacoeconomics*, *35*, 777-791. https://doi.org/10.1007/s40273-017-0514-4

Asenso-Okyere, W. K., & Dzator, J. A. (1997). Household cost of seeking malaria care. A retrospective study of two districts in Ghana. *Social science & medicine*, *45*(5), 659-667.

Asenso-Okyere, W. K., Anum, A., Osei-Akoto, I., & Adukonu, A. (1998). Cost recovery in Ghana, are there any changes in health care seeking behaviour. *Health policy and planning*, *13*(2), 181-188.

Ashley, C. ThoughtCo. (2020). *An Overview of Qualitative Research Methods*. https://www.thoughtco.com/qualitative-research-methods-3026555

Ataguba, J. (2010). Health care financing in South Africa: moving towards universal coverage. *Continuing Medical Education*, *28*(2).

Auta, A., Bala, E. T., & Shalkur, D. (2013). Generic medicine substitution: a cross-sectional survey of the perception of pharmacists in north-central, Nigeria. *Medical Principles and Practice*, *23*(1), 53-58. https://doi.org/10.1159/000355473

Ayandipo, O., Wone, I., Kenu, E., Fasehun, L. K., Ayandipo, O., Gaye, F., ... & Thiam, S. (2020). Cancer ecosystem assessment in West Africa: Health systems gaps to prevent and control cancers in three countries: Ghana, Nigeria, and Senegal. *The Pan African Medical Journal*, *35*.

Babar, Z. U. D. (2015). *Pharmaceutical prices in the 21st century*. Springer International Publishing AG. https://doi.org/10.1007/978-3-319-12169-7

Babar, Z. U. D. (2017). Pharmaceutical policy in countries with developing healthcare systems.

Babar, Z. U. D. (2018). *Equitable Access to High-Cost Pharmaceuticals*. Elsevier. https://www.elsevier.com/books/equitable-access-to-high-cost-pharmaceuticals/babar/978-0-12-811945-7
Babar, Z. U. D. (2020). *Global Pharmaceutical Policy*. Palgrave Macmillan. https://doi.org/10.1007/978-981-15-2724-1
Babar, Z. U. D. (2021). Ten recommendations to improve pharmacy practice in low and middle-income countries (LMICs). *Journal of Pharmaceutical Policy and Practice*, *14*(1), 1-5. https://doi.org/10.1186/s40545-020-00288-2
Babar, Z. U. D., Ibrahim, M. I. M., Singh, H., Bukahri, N. I., & Creese, A. (2007). Evaluating drug prices, availability, affordability, and price components: implications for access to drugs in Malaysia. *PLoS medicine*, *4*(3), e82. https://doi.org/10.1371/journal.pmed.0040082
Bangalee, V., & Suleman, F. (2015). Evaluating the effect of a proposed logistics fee cap on pharmaceuticals in South Africa-a pre and post analysis. *BMC health services research*, *15*, 1-12.
Bangalee, V., & Suleman, F. (2016). Has the increase in the availability of generic drugs lowered the price of cardiovascular drugs in South Africa. *health sa gesondheid*, *21*(1), 60-66.
Bangalee, V., & Suleman, F. (2016). Towards a transparent pricing system in South Africa in pharmaceutical logistics fees. *South African health review*, *2016*(1), 221-231.
Barr, R., & Robertson, J. (2016). Access to cytotoxic medicines by children with cancer: a focus on low- and middle-income countries. *Pediatric Blood & Cancer*, *63*(2), 287-291. https://doi.org/10.1002/pbc.25722
Barron, A., & Wilsdon, T. (2016). Challenging perceptions about oncology product pricing in breast and colorectal cancer. *Pharmaceutical Medicine*, *30*(6), 321-326. http://doi.org/10.1007/s40290-016-0167-1
Bateman, C. (2015). Attacking 'prejudice' against generics could save SA billions. *SAMJ South African Medical Journal*, *105*(12), 1004-1006. https://doi.org/10.7196/SAMJ.2015.v105i12.10317
Bates, M. J., & Mijoya, A. (2015). A review of patients with advanced cervical cancer presenting to palliative care services at Queen Elizabeth Central Hospital in Blantyre, Malawi. *Malawi Medical Journal*, *27*(3), 93-95.
Baxi, S. M., Beall, R., Yang, J., & Mackey, T. K. (2019). A multidisciplinary review of the policy, intellectual property rights, and international trade environment for access and affordability to essential cancer medications. *Globalization and Health*, *15*(1), 1-14. https://doi.org/10.1186/s12992-019-0497-3
Bazargani, Y. T., de Boer, A., Schellens, J. H. M., Leufkens, H. G. M., & Mantel-Teeuwisse, A. K. (2014). Selection of oncology medicines in low-and middle-income countries. *Annals of oncology*, *25*(1), 270-276.
Bekui, B. A., Ohene, L. A., Badzi, C., Ampomah, M. O., & Aziato, L. (2023). Physical and socioeconomic burden of caregiving on family caregivers of children with cancer at a tertiary Hospital in Ghana. *Nursing Open*, *10*(2), 915-925. https://doi.org/10.1002/nop2.1359
Benbasat, I. (1984). An analysis of research methodologies. *The information systems research challenge*, *47*(79), 88-13. https://doi.org/10.2307/248684
Beran, D., Ewen, M., Lipska, K., Hirsch, I. B., & Yudkin, J. S. (2018). Availability and affordability of essential medicines: implications for global diabetes

treatment. *Current diabetes reports*, *18*, 1-10. https://doi.org/10.1007/s11892-018-1019-z

Berger, R. (2015). Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. *Qualitative research*, *15*(2), 219-234. https://doi.org/10.1177/1468794112468475

Bhakta, N., Force, L. M., Allemani, C., Atun, R., Bray, F., Coleman, M. P., ... & Fitzmaurice, C. (2019). Childhood cancer burden: a review of global estimates. *The lancet oncology*, *20*(1), e42-e53. https://doi.org/10.1016/S1470-2045(18)30761-7

Bharadwaj, M., Vallurupalli, M., & Huang, F. W. (2021). Global precision oncology: a call to action on expanding access to targeted cancer therapies. *The Oncologist*, *26*(5), 353-355. https://doi.org/10.1002/onco.13708

BIO Ventures and AORTIC. (2017). *Africa's Emerging Cancer Crisis: A Call to Action*. ICEC. https://www.iceccancer.org/africas-emerging-cancer-crisis-call-action/

Bioventures for Global Health. (2019). *Africa Access Initiative Annual Report*. https://bvgh.org/wp-content/uploads/2020/02/ BVGH-AAI-Annual-Report-2019.pdf

Blackstone, A. (2018). *Principles of sociological inquiry: Qualitative and quantitative methods*. Saylor Academy Open Textbooks. https://openlibraryrepo.ecampusontario.ca/jspui/handle/123456789/296

Boateng, R., Renner, L., Petricca, K., Gupta, S., & Denburg, A. (2020). Health system determinants of access to essential medicines for children with cancer in Ghana. *BMJ Global Health*, *5*(9), e002906. https://doi.org/10.1136/bmjgh-2020-002906

Bogdan, R. C., & Biklen, S. K. (2007). Research for education: An introduction to theories and methods.

Bona, K., Dussel, V., Orellana, L., Kang, T., Geyer, R., Feudtner, C., & Wolfe, J. (2014). Economic impact of advanced pediatric cancer on families. *Journal of pain and symptom management*, *47*(3), 594-603. https://doi.org/10.1016/J.JPAIN SYMMAN.2013.04.003

Bond, C. (2006). The need for pharmacy practice research. *International Journal of Pharmacy Practice*, *14*(1), 1-2. https://doi.org/10.1211/ijpp.14.1.0001

Bonser, A., Kanavos, P., & Taylor, D. (2016). Tender Loving Care? Purchasing medicines for continuing therapeutic improvement and better health outcomes. London School of Economics and Political Science, London, UK. http://eprints.lse.ac.uk/67824/

Boyle, P., Ngoma, T., Sullivan, R., Ndlovu, N., Autier, P., Stefan, C., ... & Brawley, O. W. (2016). The State of Oncology in Africa, 2015. *International Prevention Research Institute, Lyon*, 1-560.

Brawley, O. W. Medical Oncology in Africa. In: Boyle, P., Ngoma, T., Sullivan, R., Ndlovu, N., Autier, P., Stefan, C., ... & Brawley, O. W. (2016). The State of Oncology in Africa, 2015. *International Prevention Research Institute, Lyon*, 1-560.

Brodszky, V., Rencz, F., Péntek, M., Baji, P., Lakatos, P. L., & Gulácsi, L. (2016). A budget impact model for biosimilar infliximab in Crohn's disease in Bulgaria, the Czech Republic, Hungary, Poland, Romania, and Slovakia. *Expert review of pharmacoeconomics & outcomes research*, *16*(1), 119-125.

Buckland, D. (2016). New drug treatments for cancer: what the future holds. *Prescriber*, *27*(1), 17-21. https://doi.org/10.1002/psb.1425
Buelow, J. M. (2006). Identifying a researchable problem. *Clinical Nurse Specialist*, *20*(4), 175-176.
Bundorf, M. K., & Pauly, M. V. (2006). Is health insurance affordable for the uninsured. *Journal of Health Economics*, *25*(4), 650-673.
Business Dictionary.com. http://www.businessdictionary.com/definition/consumer-price-index-CPI.html
Business tech. (2020). *Massive rise in cancer related treatment in South Africa – these are the most common types among men and women*. https://businesstech.co.za/news/lifestyle/371244/massive-risein-cancer-related-treatment-in-south-africa-these-are-the-most-commontypes-among-men-and-women
Cameron, A., & Laing, R. (2010). Cost savings of switching private sector consumption from originator brand medicines to generic equivalents. *World health report*, *35*, 210-5.
Cameron, A., Ewen, M., Ross-Degnan, D., Ball, D., & Laing, R. (2009). Medicine prices, availability, and affordability in 36 developing and middle-income countries: a secondary analysis. *The lancet*, *373*(9659), 240-249. https://doi.org/10.1016/S0140-6736(08)61762-6
Cameron, A., Mantel-Teeuwisse, A. K., Leufkens, H. G., & Laing, R. O. (2012). Switching from originator brand medicines to generic equivalents in selected developing countries: how much could be saved. *Value in health*, *15*(5), 664-673. http://dx.doi.org/10.1016/j.jval.2012.04.004
Cancer Alliance. (2021). *Access To Cancer Medicines in South Africa* (Cancer Alliance Report CA03/2021).
Carapinha & Company. (2016). *Single Exit Price legislation: A source of harm to competition*. http://www.carapinha.com/single-exit-price-legislation-asource-of-harm-to-competition/
Carone, G., Schwierz, C., & Xavier, A. (2012). Cost-containment policies in public pharmaceutical spending in the EU. *Available at SSRN 2161803*. https://doi.org/10.2765/27111
Casarett, D., Karlawish, J. H., & Sugarman, J. (2000). Determining when quality improvement initiatives should be considered research: proposed criteria and potential implications. *Jama*, *283*(17), 2275-2280.
Cavaye, A. L. (1996). Case study research: a multi-faceted research approach for IS. *Information systems journal*, *6*(3), 227-242.
Centellas, M. (2016). Research Methods Handbook. https://www.researchgate.net/publication/303797397
Chabner, B., & Goodman, K. B. (2011). Gilman's the pharmacological basis of therapeutics 12th ed.
Charrois, T. L., Durec, T., & Tsuyuki, R. T. (2009). Systematic reviews of pharmacy practice research: methodologic issues in searching, evaluating, interpreting, and disseminating results. *Annals of Pharmacotherapy*, *43*(1), 118-122.
Chen, S., & Ravallion, M. (2010). The developing world is poorer than we thought, but no less successful in the fight against poverty. *The Quarterly Journal of Economics*, *125*(4), 1577-1625.

Cherny, N. I., Sullivan, R., Dafni, U., Kerst, J. M., Sobrero, A., Zielinski, C., ... & Piccart, M. J. (2015). A standardized, generic, validated approach to stratify the magnitude of clinical benefit that can be anticipated from anti-cancer therapies: the European Society for Medical Oncology Magnitude of Clinical Benefit Scale (ESMO-MCBS). *Annals of Oncology*, *26*(8), 1547-1573. doi: https://doi.org/10.1093/annonc/mdx521

Cherny, N. I., Sullivan, R., Torode, J., Saar, M., & Eniu, A. (2017). ESMO International Consortium Study on the availability, out-of-pocket costs and accessibility of antineoplastic medicines in countries outside of Europe. *Annals of Oncology*, *28*(11), 2633-2647. https://doi.org/10.1093/annonc/mdx521

Cherny, N., Sullivan, R., Torode, J., Saar, M., & Eniu, A. (2016). ESMO European Consortium Study on the availability, out-of-pocket costs and accessibility of antineoplastic medicines in Europe. *Annals of Oncology*, *27*(8), 1423-1443. https://doi.org/10.1093/annonc/mdw213

Christensen, L. B., Johnson, R. B., & Turner, L. A. (2014). Research methods, design, and analysis (12. baskı). *England: Pearson Education Limited*.

Chulay, M. (2006). Good research ideas for clinicians. *AACN Advanced Critical Care*, *17*(3), 253-265.

Clegg-Lamptey, J. N. A., Dakubo, J. C. B., & Attobra, Y. N. (2009). Psychosocial aspects of breast cancer treatment in Accra, Ghana. *East African Medical Journal*, *86*(7) (Clegg-Lamptey, 2009b).

Clegg-Lamptey, J., Dakubo, J., & Attobra, Y. (2009). Why Do Breast Cancer Report Late or Abscond During treatment in Ghana? A pilot study. *Ghana medical journal*, *43*(3) 127-131 (Clegg-Lamptey, 2009a).

Clouse, R. E. (2005). Proposing research questions. *Gastrointestinal endoscopy*, *61*(2), 279-280.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*. Routledge.

Collis, J. (2013). *Business research: A practical guide for undergraduate and postgraduate students*. Palgrave Macmillan.

Competition Commission South Africa. (2016). *Healthcare Market Inquiry – Market Inquiry into the Private Sector*. http://www.compcom.co.za/healthcare-inquiry/

Council for Medical Schemes. (2015). *Annual Report. Pretoria. 2014/15*.

Council for Medical Schemes. (2017). https://www.medicalschemes.co.za

Council for Medical Schemes. (2020). *Prescribed Minimum Benefits*. https://www.medicalschemes.co.za/resources/pmb/pmbconditions/

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approach*. Sage publications.

Crotty, M. J. (1998). The foundations of social research: Meaning and perspective in the research process. *The foundations of social research*, 1-256.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC medical research methodology*, *11*(1), 1-9.

Cuomo, R. E., Seidman, R. L., & Mackey, T. K. (2017). Country and regional variations in purchase prices for essential cancer medications. *BMC cancer*, *17*, 1-10. https://doi.org/10.1186/s12885-017-3553-5

Dahlager, L., & Fredslund, H. (2008). Hermeneutic analysis-understanding and pre-understanding. *Research methods in public health*, 159-184.
Dare, A. J., Bayle, A., Hatoqai, A., Mungo, C., Velilla, D. G., Soto-Perez-de-Celis, E., ... & Mushininga, V. D. (2023). Ensuring Global Access to Cancer Medicines: A Generational Call to Action. *Cancer discovery*, *13*(2), 269-274. https://doi.org/10.1158/2159-8290.CD-22-1372
Datapharm Ltd. (2021). *The electronic medicines compendium (emc)*. https://www.medicines.org.uk/emc
De la Maisonneuve, C., & Martins, J. O. (2013). Public spending on health and long-term care: a new set of projections. http://www.oecd.org/eco/growth/Health FINAL.pdf
De-Graft Aikins, A., Boynton, P., & Atanga, L. L. (2010). Developing effective chronic disease interventions in Africa: insights from Ghana and Cameroon. *Globalization and health*, *6*(1), 1-15.
Dent, J., Manner, C. K., Milner, D., Mutebi, M., Ng'ang'a, A., Olopade, O. I., ... & Stefan, D. C. (2017). Africa's emerging cancer crisis: A call to action. *Clin Cancer Genet Glob Heal*, 1-8.
Department of Health, Pricing and Supply Branch. (2003). *Pharmaceutical price regulation scheme*. http://www.dh.gov.uk/assetRoot/04/06/73/32/04067332.PDF
Department of Health. (1996). National drug policy for South Africa. *Pretoria.* http://www.doh.gov.za/docs/policy/drugsjan1996.pdf
Desai, A., & Gyawali, B. (2020). Financial toxicity of cancer treatment: moving the discussion from acknowledgement of the problem to identifying solutions. *E Clinical Medicine*, *20*. https://doi.org/10.1016/j.eclinm.2020.100269.
Discovery Health Medical Scheme. (2012). *Integrated annual report*. https://www.discovery.co.za/medical-aid/annual-reports-and-financials
Donkor, A., Lathlean, J., Wiafe, S., Vanderpuye, V., Fenlon, D., Yarney, J., ... & Kyei, K. A. (2015). Factors contributing to late presentation of breast cancer in Africa: a systematic literature review. *Archives of Medicine*, *8*(2.2), 1-10.
Donyai, P. (2012). *Social and cognitive pharmacy: theory and case studies*. Pharmaceutical Press.
Dror, D. M., Preker, A. S., & Jakab, M. (2002). The Role of Communities in Combating Social Exclusion. *Social reinsurance: A new approach to sustainable community health financing*, 37.
Dulock, H. L. (1993). Research design: Descriptive research. *Journal of Pediatric Oncology Nursing*, *10*(4), 154-157.
Dyer, O. (2017). Pfizer and Cipla plan to make cancer drugs affordable in Africa.
Econex. (2013). The South African private healthcare sector: role and contribution to the economy. *Research Note*, *32*. http://econex.co.za/wpcontent/uploads/2016/09/Econex_private_health_sector_study_12122013-1.pdf
Eden, T., Burns, E., Freccero, P., Renner, L., Paintsil, V., Dolendo, M., ... & Molyneux, E. (2019). Are essential medicines available, reliable and affordable in low-middle income countries. *Journal of Cancer Policy*, *19*, 100180. https://doi.org/10.1016/S1470-2045 [15] 70240-8
Elkassem, W., Pallivalapila, A., Al Hail, M., McHattie, L., Diack, L., & Stewart, D. (2013). Advancing the pharmacy practice research agenda: views and

experiences of pharmacists in Qatar. *International journal of clinical pharmacy*, *35*, 692-696. https://doi.org/10.1007/s11096-013-9802-z
Ellen, R. F. (Ed.). (1984). *Ethnographic research: A guide to general conduct* (No. 1). Academic Press.
Elsevier, M. (2016). *Medicine utilization research: methods and applications.* Wiley.
Eskinder Eshetu Ali, Anwarul-Hassan Gilani, and Teferi Gedif – these are the authors- check if this is specifically for Ethiopia.
Ewen, M., Zweekhorst, M., Regeer, B., & Laing, R. (2017). Baseline assessment of WHO's target for both availability and affordability of essential medicines to treat non-communicable diseases. *PloS one*, *12*(2), e0171284. https://doi.org/10.1371/journal.pone.0171284
Exchange-Rates.org. *Convert Ghanaian Cedis (GHS) to US Dollars (USD)*. https://www.exchange-rates.org/
Faruqui, N., Martiniuk, A., Sharma, A., Sharma, C., Rathore, B., Arora, R. S., & Joshi, R. (2019). Evaluating access to essential medicines for treating childhood cancers: a medicines availability, price and affordability study in New Delhi, India. *BMJ global health*, *4*(2), e001379. https://doi.org/10.1136/bmjgh-2018-001379
Federal Ministry of Health. (2016*). Ethiopia Disease Prevention and Control Directorate, National Cancer Control Plan 2016-2020 (FMOH, 2016).*
Ferlay, J., Ervik, M., Lam, F., Colombet, M., Mery, L., Piñeros, M., ... & Bray, F. (2018). Global cancer observatory. *Cancer today*, *2019*.
Ferlay, J., Ervik, M., Lam, F., Colombet, M., Mery, L., Piñeros, M., ... & Bray, F. (2020). Global Cancer Observatory: Cancer Today. Lyon: International Agency for Research on Cancer. IARC; 2018.
Ford, N., Wilson, D., Chaves, G. C., Lotrowska, M., & Kijtiwatchakul, K. (2007). Sustaining access to antiretroviral therapy in the less-developed world: lessons from Brazil and Thailand. *Aids*, *21*, S21-S29.
Friedman, G. D. (2004). *Primer of epidemiology*. New York: McGraw-Hill.
Fundytus, A., Sengar, M., Lombe, D., Hopman, W., Jalink, M., Gyawali, B., ... & Booth, C. M. (2021). Access to cancer medicines deemed essential by oncologists in 82 countries: an international, cross-sectional survey. *The Lancet Oncology*, *22*(10), 1367-1377.
Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction* (7th ed.). Pearson.
Garcia-Gonzalez, P., Boultbee, P., & Epstein, D. (2015). Novel humanitarian aid program: the Glivec International Patient Assistance Program—lessons learned from providing access to breakthrough targeted oncology treatment in low-and middle-income countries. *Journal of Global Oncology*, *1*(1), 37-45. https://doi.org/10.1200/ JGO.2015.000570.
Gelband, H., Sankaranarayanan, R., Gauvreau, C. L., Horton, S., Anderson, B. O., Bray, F., ... & Jha, P. (2016). Costs, affordability, and feasibility of an essential package of cancer control interventions in low-income and middle-income countries: key messages from Disease Control Priorities. *The Lancet*, *387*(10033), 2133-2144. https://doi.org/10.1016/S0140-6736(15)00755-2
Ghana Business News. (2021). *National Daily Minimum Wage for 2021 is GH¢12.53*. https://www.ghanabusinessnews.com/2021/06/05/national-daily-minimum-wage-for-2021-is-gh%C2%A212-53/

Ghana Food & Drug Authority. (2019). *Guidelines for the registration of medicinal products classified for fast-track processing.*
Ghana Food and Drug Authority. (2019). *Guidelines for registration of an orphan drug 2019*.
Ghana Health Service, Ministry of Health. (2006). *Medicine Prices in Ghana: A comparative study of Public, Private and Mission sector medicine prices*.
Ghana Ministry of Health. (2007). *National health policy: creating wealth through health*.
Ghana Ministry of Health. (2017). *Ghana national medicines policy 2017*.
Ghana National Drugs Programme. (2017). *Assessment of availability and price, prescribing, dispensing and use of medicines in palliative care in two teaching hospitals, two regional hospitals and for district hospitals*.
Ghana Statistical Service. *Ghana poverty profile*. https://www.stats ghana.gov.gh
Ghana Statistical Services. *Consumer Price Index*. https://statsghana.gov.gh/
Ghana Statistical Services. *Regional population Ashanti*. https://www.statsghana.gov.gh/regionalpopulation.php?population=MTI5MzE3OTU5OC40NDg1&&Ashanti®id=1
Goldstein, D. A., Clark, J., Tu, Y., Zhang, J., Fang, F., Goldstein, R., ... & Rosenbaum, E. (2017). A global comparison of the cost of patented cancer drugs in relation to global differences in wealth. *Oncotarget*, *8*(42), 71548. https://doi.org/10.18632/oncotarget.17742
Graphic Online. Put childhood cancers on NHIS. 2019.
Gray, A. L. (2009). Medicine pricing interventions--the South African experience. *Southern Med Review*, *2*(2).
Gray, A., & Suleman, F. (2014). Pharmaceutical pricing in south africa. In *Pharmaceutical prices in the 21st century* (pp. 251-265). Cham: Springer International Publishing.
Gray, A., & Suleman, F. (2015). Pharmaceutical pricing in South Africa. In Z. Babar (Ed.), *Pharmaceutical Prices in the 21st Century*. Springer International Publishing.
Gray, A., Suleman, F., & Pharasi, B. (2017). South Africa's National Drug Policy: 20 years and still going? *South African Health Review*, *2017*(1), 49-58. https://journals.co.za/doi/10.10520/EJC-c80c69129
Green, J. A., & Norris, P. (2015). Quantitative methods in pharmacy practice research. *Pharmacy practice research methods*, 31-47.
Grix, J. (2004) *The foundations of research*. Palgrave Macmillan.
Guba, E. G. (1990). The paradigm dialog. In *Alternative paradigms conference, mar, 1989, indiana u, school of education, san francisco, ca, us*. Sage Publications, Inc.
Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. *Handbook of qualitative research*, *2*(163-194), 105.
Health Action International. (2006). Medicine prices survey profile and reports. http://www.haiweb.org/medicineprices/survey_results.php. (HAI, 2006a).
Health Action International. (2006). Survey results for India, Maharashtra (4 regions). http://www.haiweb.org/medicineprices/survey_results.php?sr¼200501IG (HAI 2006b).
Håkansson, A. (2013). Portal of research methods and methodologies for research projects and degree projects. In The 2013 World Congress in Computer Science, Computer Engineering, and Applied Computing

WORLDCOMP 2013; Las Vegas, Nevada, USA, 22-25 July (pp. 67-73). CSREA Press USA.
Hancock, K. E. (1993). 'Can pay? Won't pay?'or Economic Principles of'Affordability'. Urban studies, 30(1), 127-145.
Hardon, A., Boomongkon, P., Streefland, P., Tan, M. L., Hongvivatana, T., van der Geest, S., ... & Gerrits, T. (2001). Applied health research manual: Anthropology of health and health care.
Harris, B., Goudge, J., Ataguba, J. E., McIntyre, D., Nxumalo, N., Jikwana, S., & Chersich, M. (2011). Inequities in access to health care in South Africa. *Journal of public health policy*, *32*, S102-S123. https://doi.org/10.1057/jphp.2011.35
Hassali, M. A., Shafie, A. A., Babar, Z. U. D., & Khan, T. M. (2012). A study comparing the retail drug prices between Northern Malaysia and Australia. *Journal of Pharmaceutical Health Services Research*, *3*(2), 103-107.
Hawking, F. (1978). The selection of essential drugs. Report of a WHO Expert Committee, 1977. WHO Technical Report Series, No. 615. Geneva, WHO, 36 pp. (ISBN 92 4 120615 2). https://apps.who.int/iris/handle/10665/41272
Haynes, R. B. (2012). *Clinical epidemiology: how to do clinical practice research*. Lippincott williams & wilkins.
Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-based nursing*, *18*(3), 66-67.
Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2019). *Cochrane handbook for systematic reviews of interventions*. John Wiley & Sons.
Hogerzeil, H. V., & Mirza, Z. (2011). The world medicines situation 2011: access to essential medicines as part of the right to health. *Geneva: World Health Organization*, *680*, 689. https://www.ohchr.org/en/development/access-medicines-fundamental-element-right-health.
Howard, D. H., Chernew, M. E., Abdelgawad, T., Smith, G. L., Sollano, J., & Grabowski, D. C. (2016). New anticancer drugs associated with large increases in costs and life expectancy. *Health Affairs*, *35*(9), 1581-1587.
Huff-Rousselle, M., & Azeez, J. N. K. (2002). Ghana. Pharmaceutical pricing in the public sector. Theory and practice–myth and reality.
Hulley Stephen, B., Cummings Steven, R., Browner Warren, S., Grady Deborah, G., & Newman Thomas, B. (2007). Designing clinical research. *William and Wilkins Baltimore, MD*, *21202*.
Ilbawi, A. M., Einterz, E. M., & Nkusu, D. (2013). Obstacles to surgical services in a rural Cameroonian district hospital. *World journal of surgery*, *37*, 1208-1215.
IMS Institute for Healthcare Informatics. (2014). *Understanding the pharmaceutical value chain*. http://www.imshealth.com/imshealth/Global/Content/Corporate/IMS%20Health%20Institute/Insights/Understanding_Pharmaceutical_Value_Chain.pdf
International Agency for Research on Cancer. (2018). Global Cancer Observatory. https://gco.iarc.fr/ (WHO, 2018c)
International Agency for Research on Cancer. (2020). *Fact sheet: GLOBOCAN 2020*. https://gco.iarc.fr/.

International Agency for Research on Cancer. South Africa. *Globocan 2020*. https://cansa.org.za/files/2021/02/IARCGlobocan- SA-2020-Fact-Sheet.pdf (WHO, 2020).
IQVIA. (2019). *Global Oncology Trends 2019*. https://www.iqvia.com/insights/the-iqvia-institute/reports/global-oncologytrends-2019/.
Irfan, S. M., Ijaz, A., & Shahbaz, S. (2011). An assessment of service quality of private hospitals in Pakistan: a patient perspective. *Indian Journal of Commerce and Management Studies*, *2*(2), 20-34.
Islam, A., Akhter, A., & Eden, T. (2015). Cost of treatment for children with acute lymphoblastic leukemia in Bangladesh. *Journal of Cancer Policy*, *6*, 37-43. https://doi.org/10.1016/j.jcpo.2015.10.002.
Iyengar, S., van den Ham, R., & Suleman, F. (2019). Medicine prices in Africa. In *Medicine Price Surveys, Analyses and Comparisons* (pp. 85-111). Academic Press. https://doi.org/10.1016/B978-0-12-813166-4.00007-3
Izak, B., David, G., & Melissa, M. (1987). The case research strategy in studies of information systems. *Mis Quarterly*, *11*(3), 369-386.
Jenei, K., Aziz, Z., Booth, C., Cappello, B., Ceppi, F., de Vries, E. G., ... & Moja, L. (2022). Cancer medicines on the WHO Model List of Essential Medicines: processes, challenges, and a way forward. *The Lancet Global Health*. https://doi.org/10.1016/S2214-109X(22)00376-X.
Jemal, A,. Torre, L,. Soerjomataram, I,. Bray, F. (2019). The Cancer Atlas. Third Ed. Atlanta, GA: American Cancer Society. www.cancer.org/canceratlas.
Jolliffe, D., & Prydz, E. B. (2016). Estimating international poverty lines from comparable national thresholds. *The Journal of Economic Inequality*, *14*, 185-198.
Jonassen, D. H. (1991). Objetivismo versus constructivismo: Necesitamos un nuevo paradigma filosófico. *Educational Technology Research and Development*, *39*, 5-14. https://doi.org/10.1007/BF02296434.
Jonathan, D. Q., Hans, H. V., Velásquez, G., & Rägo, L. (2002). Twenty-five years of essential medicines. *Bull World Health Organ*, *80*(11), 913.
Kemp, K., & Schondelmeyer, S. (2000). Role of price transparency in the pharmaceutical market. In *proceedings of Pharmaceutical Pricing Practices, Utilization, and Costs Conference: Pricing practices in the pharmaceutical market. Washington, USA*. http://aspe.hhs.gov/health/reports/drug-papers/Kemp1.htm#TOC
Kerlinger, F. N., & Rint, N. (1986). *Foundations of Behavior Research*. Winston Inc.
Khatiwoda, S. R., Dhungana, R. R., Sapkota, V. P., & Singh, S. (2019). Estimating the direct cost of cancer in Nepal: A cross-sectional study in a tertiary cancer hospital. *Frontiers in public health*, *7*, 160. https://doi.org/10.3389/fpubh.2019.00160.
Kizub, D. A., Naik, S., Abogan, A. A., Pain, D., Sammut, S., Shulman, L. N., & Martei, Y. M. (2022). Access to and affordability of world health organization essential medicines for cancer in Sub-Saharan Africa: examples from Kenya, Rwanda, and Uganda. *The Oncologist*, *27*(11), 958-970.
Klemp, M., Frønsdal, K. B., & Facey, K. (2011). What principles should govern the use of managed entry agreements? *International journal of technology assessment in health care*, *27*(1), 77-83.

Kolasani, B. P., Malathi, D. C., & Ponnaluri, R. R. (2016). Variation of cost among anti-cancer drugs available in Indian market. *Journal of clinical and diagnostic research: JCDR*, *10*(11), FC17. https://doi.org/10.7860/JCDR/2016/22384.8918

Kuhn, T. S. (1964). The Structure of Scientific Revolutions. *The British Journal for the Philosophy of Science, 15*(58), 158-161. https://doi.org/10.1093/bjps/XV.58.158.

Kutty, N. K. (2005). A new measure of housing affordability: Estimates and analytical results. *Housing policy debate*, *16*(1), 113-142.

Lam, C. G., Howard, S. C., Bouffet, E., & Pritchard-Jones, K. (2019). Science and health for all children with cancer. *Science*, *363*(6432), 1182-1186. https://doi.org/10.1126/science.aaw4892.

Liamputtong, P., & Ezzy, D. (2005). *Qualitative research methods. Second*. Melbourne: Oxford university press.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. Newberry Park/sage.

LoBiondo-Wood, G., Haber, J., & Berry, C. (2013). *Study guide for nursing research-e-book: methods and critical appraisal for evidence-based practice*. Elsevier Health Sciences.

London School of Economics. (2016). *Tender loving care? Purchasing medicines for continuing therapeutic improvement and better health outcomes*. http://eprints.lse.ac.uk/67824/.

Lopes, D., De Souza, J.A., Barrios, C. (2013). Access to cancer medications in low- and middle-income countries. Nat Rev Clin Oncol. 2013 Jun;10(6):314-22. doi: 10.1038/nrclinonc.2013.55. PMID: 23568416.

MacDonald, S., & Headlam, N. (2008). *Research Methods Handbook: Introductory guide to research methods for social research*. Centre for Local Economic Strategies.

Macrotrends. *South Africa GNI Per Capita 1962–2023*. https://www.macrotrends.net/countries/ZAF/south-africa/gni-per-capita

Magrini, N., Robertson, J., Forte, G., Cappello, B., Moja, L. P., de Joncheere, K., & Kieny, M. P. (2015). Tough decisions on essential medicines in 2015. *Bulletin of the World Health Organization*, *93*, 283-284. https://doi.org/10.2471/BLT.15.154385

Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, *358*(9280), 483-488. https://doi.org/10.1016/S0140-6736(01)05627-6

Management Sciences for Health. (2015). *International Medical Products Price Indicator Guide. Cambridge, Massachussetts*. https://mshpriceguide.org/en/home/

Mansfield, E. (1980). Basic research and productivity increase in manufacturing. *The American Economic Review*, *70*(5), 863-873. http://www.jstor.org/stable/1805767

Martei, Y. M., Chiyapo, S., Grover, S., Hanna, C., Dryden-Peterson, S., Pusoentsi, M., ... & Tapela, N. (2018). Methodology to forecast volume and cost of cancer drugs in low-and middle-income countries. *Journal of Global Oncology*, *4*, 1-8. https://doi.org/10.1200/JGO.17.00114

Martei, Y. M., Chiyapo, S., Grover, S., Ramogola-Masire, D., Dryden-Peterson, S., Shulman, L. N., & Tapela, N. (2018). Availability of WHO essential medicines for cancer treatment in Botswana. *Journal of global oncology*, *4*, 1-8. https://doi.org/10.1200/JGO.17.00114

Mathers, N. J., Fox, N. J., & Hunn, A. (1998). *Surveys and questionnaires* (Vol. 1998). NHS Executive, Trent.
Mattila, P. O., Babar, Z. U. D., & Suleman, F. (2021). Assessing the prices and affordability of oncology medicines for three common cancers within the private sector of South Africa. *BMC Health Services Research*, *21*(1), 1-10. https://doi.org/10.1186/s12913-021-06627-6
Mayor, S. (2015). WHO includes 16 new cancer drugs on list of essential medicines. *The Lancet Oncology*, *16*(7), 757. https://doi.org/10.1016/S1470-2045 [15] 70240-8
Medicines Control Council. (2014). *Licenses issued in terms of section 22C of the Medicines and Related Substances Act, 1965. Pretoria*.
Medicines Patent Pool. https://medicinespatentpool.org/what-we-do/ medspal/
Mediscor Medicines Review 2014. *Centurion: Mediscor PBM (Pty) Ltd*. https://drive.google.com/file/d/1cee3EwPUwvcPw1eooggAnnXIte945zGk/
Mensah, K. B., & Mensah, A. B. B. (2020). Cancer control in Ghana: A narrative review in global context. *Heliyon*, *6*(8), e04564. https://doi.org/10.1016/j.heliyon.2020.e04564
Mensah, K. B., Mensah, A. B. B., Bangalee, V., Padayachee, N., & Oosthuizen, F. (2021). Evaluating essential medicines for treating childhood cancers: availability, price, and affordability study in Ghana. *BMC cancer*, *21*(1), 1-9. https://doi.org/10.1186/s12885-021-08435-x
Merriam, S. B., & Grenier, R. S. (2002). Qualitative Research in Practice: Examples for Discussion and Analysis Jossey-Bass. *San Francisco, CA, USA*.
Mertens, D. M. (2010). Transformative mixed methods research. *Qualitative inquiry*, *16*(6), 469-474. https://doi.org/10.1177/1077800410364612
Mertler, C. A. (2016). *Action research: Improving schools and empowering educators*. Sage Publications.
Meyer, S., Nqabeni,G., Tsotetsi,N., (2021). Access to cancer medicines in South Africa. Cancer Alliance Report CA03/2021.
Microsoft. *Microsoft exchange rate 12 September 2020*. https://www.bing.com/search?q=convert+usd+to+zar
Mikkelsen, L., Phillips, D. E., AbouZahr, C., Setel, P. W., De Savigny, D., Lozano, R., & Lopez, A. D. (2015). A global assessment of civil registration and vital statistics systems: monitoring data quality and progress. *The Lancet*, *386*(10001), 1395-1406.
Minister of Health. (2014). *Regulations relating to a transparent pricing system for medicines and scheduled substances: (Benchmark methodology)* (Government Notice No. R.324). Government Gazette No. 37625.
Minister of Health. (2016) *Annual adjustment of the single exit price of medicines and scheduled substances (SEPA) for the year 2016* (Government Notice No. R.24). Government Gazette No. 39594. 2016
Ministry of Health of Malawi (2015*). Malawi Standard Treatment Guidelines, incorporating Malawi Essential Medicines List* (5th Edition)
Ministry of Health, Ghana National Drugs Programme. (2017). *Essential Medicines List, 7th Edition, 2017* (MOH, 2017a).
Ministry of Health, Ghana National Drugs Programme. (2017). *Ghana National Medicines Policy 3rd Edition* (MOH, 2017c).

Ministry of Health, Ghana National Drugs Programme. (2017). *Standard Treatment Guidelines, 7th Edition, 2017* (MOH, 2017b).
Ministry of Health. Cape Coast Teaching Hospital. http://www.ccthghana.org/about-us/ (MOH, 2023)
Ministry of Health. *Ministry of Health Facilities, Ghana*. https://en.wikipedia.org/wiki/List_of_hospitals_in_Ghana (MOH,2022)
Ministry of Health. Ministry of Health facilities. Ghana. https://www.moh.gov.gh/korle-bu-teaching-hospital/ (MOH, 2024).
Ministry of Heath, Republic of Ghana. (2020). National health policy: ensuring healthy lives for all.
Modisakeng, C., Matlala, M., Godman, B., & Meyer, J. C. (2020). Medicine shortages and challenges with the procurement process among public sector hospitals in South Africa; findings and implications. *BMC health services research*, *20*(1), 1-10.
Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. *Journal of economic development, environment, and people*, *7*(1), 23-48.
Moher D, Liberati A, Tetzlaff J, Altman DG. Liberati, M., Tetzlaff, J., & Altman, D. G. (2009). group tP. Preferred Reporting items for systematic reviews and meta-analyses: THE PRISMA statement. *Plos Medicine*, *6*(7), 1-6. https://doi.org/10.1371/journal.pmed.1000097
Moye-Holz, D., Ewen, M., Dreser, A., Bautista-Arredondo, S., Soria-Saucedo, R., van Dijk, J. P., ... & Hogerzeil, H. V. (2020). Availability, prices, and affordability of selected essential cancer medicines in a middle-income country–the case of Mexico. *BMC health services research*, *20*(1), 1-11. https://doi.org/10.1186/s12913-020-05167-9
Moye-Holz, D., Soria Saucedo, R., van Dijk, J. P., Reijneveld, S. A., & Hogerzeil, H. V. (2018). Access to innovative cancer medicines in a middle-income country-the case of Mexico. *Journal of Pharmaceutical Policy and Practice*, *11*(1), 1-8. https://doi.org/10.1186/s40545-018-0153-y
Muhia, J., Waithera, L., & Songole, R. (2017). Factors affecting the procurement of pharmaceutical drugs: a case study of Narok County referral hospital, Kenya.
My Joy Online. (2019). *Health Ministry inaugurates National Medicine Price Committee*. https://myjoyonline.com/lifestyle/2019/July-4th/health-ministry-inauguratesnational-medicine-price-committee.php
Mywage.org/Ghana. *Minimum Wages in Ghana*. https://mywage.org/ghana/salary/minimum-wages/archive/minimum-wages-in-ghana-with-effect-from-01-01-2019-to-31-12-2019
Naidoo, K., & Suleman, F. (2021). Evaluating the impact of single exit pricing (SEP) on medicine product withdrawal from the private healthcare market in South Africa. *South African Medical Journal*, *111*(5), 444-447. https://doi.org/10.7196/SAMJ.2021.v111i5.15297
Nartey, Y., Hill, P. C., Amo-Antwi, K., Nyarko, K. M., Yarney, J., & Cox, B. (2018). Characteristics of women diagnosed with invasive cervical cancer in Ghana. *Asian Pacific Journal of Cancer Prevention: APJCP*, *19*(2), 357.
National Comprehensive Cancer Network. *Clinical guidelines in practical oncology: NCCN guidelines 2020*. https://www.nccn.org/professionals/physician_gls/recently_updated.aspx

National Department of Health (NDoH). (1996). National Drug Policy for South Africa. Pretoria. http://www.doh.gov.za/docs/policy/drugsjan1996.pdf.
National Department of Health. *Standard treatment guidelines and essential medicines lists for primary health care level (2018). Pediatric Hospital (2017) and Adult Hospital (2015) levels*.
National Health Insurance Authority. (2021). *Ghana National Health Insurance Scheme*. http://www.nhis.gov.gh/
National Institute of Health Research. (2020). *International Prospective Register of Systematic Reviews (PROSPERO)*. https://www.crd.york.ac.uk/prospero/
National Pharmaceutical Pricing Authority. *2012 Policy*. http://www.nppaindia.nic.in/index1.html
Neuman, W. L. (2014). Pearson new international edition social research methods: qualitative and quantitative approaches. *England. Pearson Education Limited*.
News Ghana. (2021). *Ghana's National Daily Minimum Wage for 2021 is GH¢12.53*. https://newsghana.com.gh/ghanas-national-daily-minimum-wage-for-2021-is-gh%C2%A212-53/#:~:text=The%20National%20Daily%20Minimum%20Wage%20(NDMW)%20for%202021%20is%20GHC12.
NHIS. *Ghana National Health Insurance Scheme*. http://www.nhis.gov.gh/
Niëns, L. M., & Brouwer, W. B. F. (2013). Measuring the affordability of medicines: importance and challenges. *Health Policy*, *112*(1-2), 45-52. https://doi.org/10.1016/j.healthpol.2013.05.018.
Niëns, L. M., Cameron, A., Van de Poel, E., Ewen, M., Brouwer, W. B., & Laing, R. (2010). Quantifying the impoverishing effects of purchasing medicines: a cross-country comparison of the affordability of medicines in the developing world. *PLoS medicine*, *7*(8), e1000333. doi: 10.1371/journal.pmed.1000333.
Niëns, L. M., Van de Poel, E., Cameron, A., Ewen, M., Laing, R., & Brouwer, W. B. F. (2012). Practical measurement of affordability: an application to medicines. *Bulletin of the World Health Organization*, *90*, 219-227. https://doi.org/10.2471/BLT.10.084087.
Noor, K. B. M. (2008). Case study: A strategic research methodology. *American journal of applied sciences*, *5*(11), 1602-1604.
Ocran Mattila, P., Ahmad, R., Hasan, S. S., & Babar, Z. U. D. (2021). Availability, affordability, access, and pricing of anti-cancer medicines in low-and middle-income countries: a systematic review of literature. *Frontiers in Public Health*, 462. https://doi.org/10.3389/fpubh.2021.628744.
O'Donnell, O., Wagstaff, A., Van Doorslaer, E., & Lindelow, M. (2008). *Analyzing health equity using household survey data: a guide to techniques and their implementation*. World Bank Publications.
Okifo, F. O., Tuoyire, D. A., Appiah, A. B., Debrah, S. Y., Morna, M. T., & Duda, R. B. (2021). Breast cancer treatment and outcomes at Cape Coast Teaching Hospital, Ghana. *Ghana Medical Journal*, *55*(3), 190-197. http://dx.doi.org/10.4314/gmj.v55i3.3.
Oomen, K. P., Karuranga, S., & Iyer, J. K. (2017). Improving access to cancer care. A first analysis of pharmaceutical company actions in low- and middle-income countries.

Osinde, G., Niyonzima, N., Mulema, V., Kyambadde, D., Mulumba, Y., Obayo, S., ... & Orem, J. (2021). Increasing access to quality anticancer medicines in low-and middle-income countries: the experience of Uganda. *Future Oncology*, *17*(21), 2735-2745. https://doi.org/10.2217/fon-2021-0117

Oteba, M., Wagner, A. K., Seru, M., Embrey, M., & Trap, B. (2018). Pharmaceutical system strengthening in Uganda: implementing a holistic, evidence-informed, long-term strategy. *Journal of pharmaceutical policy and practice*, *11*, 1-7.

Parkin, D. M., Bray, F., Ferlay, J., & Jemal, A. (2014). Cancer in Africa 2012Cancer in Africa. *Cancer Epidemiology, Biomarkers & Prevention*, *23*(6), 953-966.

Patton, M. Q. (2002). Qualitative research and evaluation methods. Thousand Oaks. *Cal.: Sage Publications*, *4*.

Peterson, G. M., Jackson, S. L., Fitzmaurice, K. D., & Gee, P. R. (2009). Attitudes of Australian pharmacists towards practice-based research. *Journal of clinical pharmacy and therapeutics*, *34*(4), 397-405. https://doi.org/10.1111/j.1365-2710.

Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins.

Posner, M. I. (1973). Cognition: An introduction.

Pretorius, D. (2011). The impact of the implementation of single exit pricing for pharmaceuticals in South Africa. *Master of Business Administration, University of the Witwatersrand, Johannesburg*.

Prinja, S., Bahuguna, P., Tripathy, J. P., & Kumar, R. (2015). Availability of medicines in public sector health facilities of two North Indian States. *BMC Pharmacology and Toxicology*, *16*, 1-11. https://doi.org/10.1186/s40360-015-0043-8.

Queirós, A., Faria, D., & Almeida, F. (2017). Strengths and limitations of qualitative and quantitative research methods. *European journal of education studies*. https://doi.org/10.5281/zenodo.887089.

Quick, J. D., Hogerzeil, H. V., Rankin, J. R., Dukes, M. N. G., Laing, R., Garnett, A., & O'Connor, R. W. (1997). *Managing drug supply: the selection, procurement, distribution, and use of pharmaceuticals*. West Hartford, Connecticut: Kumarian Press.

Regoli, N L. Vittana.org. (2019). *An Overview of Qualitative Research Methods*. Personal Finance Blog. https://vittana.org/23-advantages-and-disadvantages-of-qualitative-research.

Rehman, A. A., & Alharthi, K. (2016). An introduction to research paradigms. *International Journal of Educational Investigations*, *3*(8), 51-59. https://www.researchgate.net/publication/325022648

Rémuzat, C., Urbinati, D., Mzoughi, O., El Hammi, E., Belgaied, W., & Toumi, M. (2015). Overview of external reference pricing systems in Europe. *Journal of market access & health policy*, *3*(1), 27675. https://doi.org/10.3402/jmahp.v3.27675.

Renner, L., Shah, S., Bhakta, N., Denburg, A., Horton, S., & Gupta, S. (2018). Evidence from Ghana indicates that childhood cancer treatment in sub-Saharan Africa is very cost effective: a report from the childhood cancer 2030 network. *Journal of global oncology*, *4*, 1-9.

Republic of South Africa. (1997). *Medicines and Related Substances Control Amendment* (Act 90 of 1997). Government Gazette Vol. 390, No. 18505.

Republic of South Africa. *Medicines and Related Substances Act 101 of 1965*. http://www.mccza.com/documents/Integrated%20Act%20101.zip
Richards, K. (2003). *Qualitative inquiry in TESOL*. Springer.
Roberts, R., & Kennington, E. (2010). Pharmacy practice research has an impact on each and every pharmacist. *Pharmaceutical journal*, *284*(7593), 267-268.
Roberts, R., & Kennington, E. (2010). What are the benefits for pharmacists of engaging in practice research. *Pharmaceutical journal*, *284*(7594), 291-292.
Robertson, J., Barr, R., Shulman, L. N., Forte, G. B., & Magrini, N. (2016). Essential medicines for cancer: WHO recommendations and national priorities. *Bulletin of the World Health Organization*, *94*(10), 735. https://doi.org/10.2471/BLT.15.163998.
Roche. (2019). *Roche Innovative Pricing Solutions*. https://www.roche.com/sustainability/access-to-healthcare/innovative-pricing-solutions.htm.
Rodriguez-Galindo, C., Friedrich, P., Alcasabas, P., Antillon, F., Banavali, S., Castillo, L., ... & Gross, T. (2015). Toward the cure of all children with cancer through collaborative efforts: pediatric oncology as a global challenge. *Journal of Clinical Oncology*, *33*(27), 3065.
Ross, S. M., & Morrison, G. R. (2004). Experimental research methods. In *Handbook of research on educational communications and technology* (pp. 1021-1043). AECT.
Rubagumya, F., Costas-Chavarri, A., Manirakiza, A., Murenzi, G., Uwinkindi, F., Ntizimira, C., ... & Booth, C. M. (2020). State of cancer control in Rwanda: past, present, and future opportunities. *JCO Global Oncology*, *6*, 1171-1177.
Russo, G., & McPake, B. (2010). Medicine prices in urban Mozambique: a public health and economic study of pharmaceutical markets and price determinants in low-income settings. *Health Policy and Planning*, *25*(1), 70-84.
Sackett, D. L., & Wennberg, J. E. (1997). Choosing the best research design for each question: It is time to stop squabbling over the “best” methods. *Bmj*, *315*(7123), 1636.
Saeed, A., Saeed, H., Saleem, Z., Fang, Y., & Babar, Z. U. D. (2019). Evaluation of prices, availability, and affordability of essential medicines in Lahore Division, Pakistan: A cross-sectional survey using WHO/HAI methodology. *PloS one*, *14*(4), e0216122. https://doi.org/10.1371/journal.pone.0216122
Salmasi, S., Lee, K. S., Ming, L. C., Neoh, C. F., Elrggal, M. E., Babar, Z. U. D., ... & Hadi, M. A. (2017). Pricing appraisal of anti-cancer drugs in the Southeast Asian, Western Pacific and East Mediterranean region. *BMC cancer*, *17*(1), 1-11. https://doi.org/10.1186/s12885-017-3888-y
Saltz, L. B. (2016). Perspectives on cost and value in cancer care. *JAMA oncology*, *2*(1), 19-21. https://doi.org/10.1001/jamaoncol.2015.0287
Sam, G. (2012). Research Methodology and Research Method. *Victoria University of Willington, New Zeeland*. https://www.researchgate.net/publication/333015026
Santacroce, S. J., Tan, K. R., & Killela, M. K. (2018). A systematic scoping review of the recent literature (~ 2011–2017) about the costs of illness to parents

of children diagnosed with cancer. *European Journal of Oncology Nursing*, *35*, 22-32. https://doi.org/10.1016/j.ejon.2018.04.004.
Sanuade, O. A., Ayettey, H., Hewlett, S., Dedey, F., Wu, L., Akingbola, T., ... & de-Graft Aikins, A. (2021). Understanding the causes of breast cancer treatment delays at a teaching hospital in Ghana. *Journal of health psychology*, *26*(3), 357-366.
Saqib, A., Iftikhar, S., & Sarwar, M. R. (2018). Availability and affordability of biologic versus non-biologic anticancer medicines: a cross-sectional study in Punjab, Pakistan. *BMJ open*, *8*(6), e019015.
Sarwar, M. R., Iftikhar, S., & Saqib, A. (2018). Availability of anticancer medicines in public and private sectors, and their affordability by low, middle, and high-income class patients in Pakistan. *BMC cancer*, *18*(1), 1-11. https://doi.org/10.1186/s12885-017-3980-3.
Scale, N. O. (2014). Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses.
Schneider, P. (2016). Pharmaceutical pricing and reimbursement reform in Kyrgyzstan. https://www.ciaonet.org/attachments/27387/uploads
Seim, L. (2007). Thailand: government issues compulsory licences for HIV/AIDS drugs. *HIV/AIDS policy & law review*, *12*(1), 28-29.
Servan-Mori, E., Heredia-Pi, I., Montañez-Hernandez, J., Avila-Burgos, L., & Wirtz, V. J. (2015). Access to medicines by Seguro Popular beneficiaries: pending tasks towards universal health coverage. *PLoS One*, *10*(9), e0136823. https://doi.org/1 0.1371/journal.pone.0136823.
Shazad, M., El-Dahiyat, F., Javid, F., Zare, N., Ozbek, B., Stephenson, J., & Babar, Z. U. D. (2022). Analysis of cancer drug prices: a narrative review of literature. *Journal of Pharmaceutical Health Services Research*, *13*(3), 208-214. https://doi.org/10.1093/jphsr/rmac027.
Shrestha, S., Poudel, R. S., Kc, B., Poudel, B. K., Sapkota, B., Sharma, S., & Khadka, A. (2020). Price variation among different brands of anticancer medicines available in hospital pharmacies of Nepal. *Journal of pharmaceutical policy and practice*, *13*(1), 1-11. https://doi.org/10.1186/s40545-020-0203-0.
Shulman, L. N., Wagner, C. M., Barr, R., Lopes, G., Longo, G., Robertson, J., ... & Magrini, N. (2016). Proposing essential medicines to treat cancer: methodologies, processes, and outcomes. *Journal of Clinical Oncology*, *34*(1), 69. https://doi.org/10.1200/ JCO.2015.61.8736.
Simon, M. K., & Goes, J. (2013). Ex post facto research. http://www.dissertationrecipes.com/wp-content/uploads/2011/04/Ex-Post-Facto-research.pdf .
Sirkia, T., & Rajaniemi, S. (2003). Country report, Finland pharmaceutical pricing and reimbursement policies. European Commission. http://ec.europa.eu/enterprise/phabiocom/docs/tse/finland.pdf
Slevitch, L. (2011). Qualitative and quantitative methodologies compared: Ontological and epistemological perspectives. *Journal of quality assurance in hospitality & tourism*, *12*(1), 73-81.
Smith, F. (2010). *Conducting your pharmacy practice research project: a step-by-step approach*. Pharmaceutical press.
Song, Y., Bian, Y., & Zhen, T. (2018). Making medicines more accessible in China: an empirical study investigating the early progress of essential

medicine system. *PLoS One*, *13*(8), e0201582. https://doi.org/10.1371/journal.pone.0201582
South Africa Department of Health. (1996). *Medicines and Related Substances Act 101 of 1965: National Drug Policy*. https://www.gov.za/documents/national-drugs-policy
South African Department of Health. (2019). National Department of health. *South African Medicine Price Registry Database of Medicine Prices*. Pretoria. http://www.mpr.gov.za/PublishedDocuments.aspx#DocCatId=21 (NDoH, 2019).
South African Government. (1965). Medicines and Related Substances Act No. 101 of 1965. South Africa.
South African Government. (1998). *Medical Schemes Act 131 of 1998*. https://www.gov.za/documents/medical-schemes-act
South African Government. Department of Employment and Labour. (2020). *Employment and Labour on new National Minimum Wage rate*. https://www.gov.za/speeches/new-nmw-base-rate-come-effect-march-E2%80%93-department-employment-and-labour-24-feb-2020-0000
South African National Department of Health. (1996). *National Medicine Policy of South Africa*.
Sruamsiri, R., Ross-Degnan, D., Lu, C. Y., Chaiyakunapruk, N., & Wagner, A. K. (2015). Policies and programs to facilitate access to targeted cancer therapies in Thailand. *PLoS One*, *10*(3), e0119945. https://doi.org/10.1371/journal.pone.0119945
Stander, M. P., Bergh, M., & Miller-Jansön, H. (2014). A first step towards transparency in pricing of medicines and scheduled substances-publication of guidelines for pharmaco-economic submissions. *SAMJ: South African Medical Journal*, *104*(1), 10-11.
Stone, P. (2002). Deciding upon and refining a research question. *Palliative medicine*, *16*(3), 265-267.
Suleman, F., & Gray, A. (2017). Pharmaceutical Policy in South Africa. In Z. Babar (Ed.), *Pharmaceutical Policy in Countries with Developing Healthcare Systems*. 285-302.Springer International Publishing.
Surbhi, S. Key Differences. (2018). *Difference Between Basic and Applied Research*. https://keydifferences.com/difference-between-basic-and-applied-research.html
t Hoen, E. (2015). Access to cancer treatment: a study of medicine pricing issues with recommendations for improving access to cancer medication. https://policy-practice. oxfam.org/resources/access-to-cancer-treatment-a-study-of-medicine-pricing-issues-with-recommendati-344070/
The Clinton Health Access Initiative. (2019). *Ethiopia expands breast cancer care nationally*. https://clintonhealthaccess.org/ethiopia-expands-breast-cancer-care-nationally-helping-women-access-the-treatment-they-need/
The World Bank Group. http://go.worldbank.org/C9GR27WRJ0.
The World Bank Group. *World development indicators*. http://wdi.worldbank.org/table
Tordrup, D., Van Den Ham, H. A., Glanville, J., & Mantel-Teeuwisse, A. K. (2020). Systematic reviews of ten pharmaceutical pricing policies–a research protocol. *Journal of Pharmaceutical Policy and Practice*, *13*(1), 1-7. https://doi.org/10.1186/s40545-020-00228-0

Towse, A., Cole, A., & Zamora, B. (2018). The debate on indication-based pricing in the US and five major European countries. *OHE Consulting Report. London: Office of Health Economics*.

Truong, J., Chan, K. K., Mai, H., Chambers, A., Sabharwal, M., Trudeau, M. E., & Cheung, M. C. (2019). The impact of pricing strategy on the costs of oral anti-cancer drugs. *Cancer Medicine*, *8*(8), 3770-3781. http://doi.org/10.1002/cam4.2269

Tuck, C. Z., Akparibo, R., Gray, L. A., Aryeetey, R. N. O., & Cooper, R. (2022). What influences cancer treatment service access in Ghana? A critical interpretive synthesis. *BMJ open*, *12*(10), e065153. https://doi.org/10.1136/ bmjopen-2022-65153.

3News. (2022). *Cost of medicines in Ghana expected to go down after removal of VAT on pharmaceutical products – Govt*. https://3news.com/cost-of-medicines-in-ghana-expected-to-go-down-after-removal-of-vat-on-pharmaceutical-products-govt/

United States Department of Commerce: International Trade Administration. (2004). *Pharmaceutical price controls in OECD countries. Implications for U.S. consumers, pricing, research and development, and innovation*.

Van Doorslaer, E., O'Donnell, O., Rannan-Eliya, R. P., Somanathan, A., Adhikari, S. R., Garg, C. C., ... & Zhao, Y. (2006). Effect of payments for health care on poverty estimates in 11 countries in Asia: an analysis of household survey data. *The lancet*, *368*(9544), 1357-1364.

van Harten, W. H., Wind, A., De Paoli, P., Saghatchian, M., & Oberst, S. (2016). Actual costs of cancer drugs in 15 European countries. *The Lancet Oncology*, *17*(1), 18-20. https://doi.org/10.1016/S1470-2045(15)00486-6

Vanderpuye, V., & Dadzie, M. A. (2016). Ghana. In P. Boyle, T. Ngoma, R. Sullivan, N. Ndlovu, P. Autier, S. Stefan ... O. B. Brawley (Eds.), *The State of Oncology in Africa 2015*. *International Prevention Research Institute, Lyon*, 1-560.iPRI Scientific Publication 4.

Veena, R. (2017). Generic prescriptions and dispensing in India—problems and solutions—a study. *World Journal of Pharmaceutical Research, 6*(9), 414-29. http://wjpr.net/dashboard/abstract_id/7646

Vitry, A. I., Thai, L., & Roughead, E. E. (2014). Pharmaceutical pricing policies in Australia. In *Pharmaceutical prices in the 21st century* (pp. 1-23). Cham: Springer International Publishing.

Vogler, S. (2022). Prices of new medicines: International analysis and policy options. *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*, *175*, 96-102. https://doi.org/10.1016/j.zefq.2022.09.009.

Vogler, S., & Vitry, A. (2016). Cancer drugs in 16 European countries, Australia, and New Zealand: a cross-country price comparison study. *The Lancet Oncology*, *17*(1), 39-47. https://doi.org/10.1016/S1470-2045(15)00449-0

Vogler, S., Zimmermann, N., Ferrario, A., Wirtz, V. J., de Joncheere, K., Pedersen, H. B., ... & Scientific Programme Committee of the 2015 PPRI Conference. (2016). Pharmaceutical policies in a crisis? Challenges and solutions identified at the PPRI Conference. *Journal of Pharmaceutical Policy and Practice*, *9*, 1-5.

Wagstaff, A., & Doorslaer, E. V. (2003). Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. *Health economics*, *12*(11), 921-933.

Wagstaff, A., & van Doorslaer, E. K. (2001). *Paying for health care: quantifying fairness, catastrophe, and impoverishment, with applications to Vietnam, 1993-98* (Vol. 2715). World Bank Publications.
Wahlster, P., Scahill, S., & Lu, C. Y. (2015). Barriers to access and use of high-cost medicines: a review. *Health Policy and Technology*, *4*(3), 191-214. https://doi.org/10.1016/j.hlpt.2015.04.009
Wakefield, C. E., McLoone, J. K., Evans, N. T., Ellis, S. J., & Cohn, R. J. (2014). It is more than dollars and cents: The impact of childhood cancer on parents' occupational and financial health. *Journal of Psychosocial Oncology*, *32*(5), 602-621. https://doi.org/10.1080/07347 332.2014.936653
Waning, B., Kaplan, W., King, A. C., Lawrence, D. A., Leufkens, H. G., & Fox, M. P. (2009). Global strategies to reduce the price of antiretroviral medicines: evidence from transactional databases. *Bulletin of the World Health Organization*, *87*(7), 520-528.
Wells, G. A., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M. (2021). *The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses (2021)*. http://www.ohri.ca/programs/clinical_epidemiology/oxford.http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.
West Africa Health Organization. (2017). *Harmonization of medicines registration in the ECOWAS region*. https://www.wahooas.org/web-ooas/en/actualites/cote-divoire/harmonization-medicines-registration-ecowas-region
World Health Assembly. WHA72, R. (2019). 8. Improving the transparency of markets for medicines, vaccines, and other health products. *Seventy-second World Health Assembly, Geneva*, 20-28.
WHO Collaborating Centre for Pharmaceutical Pricing and Reimbursement Policies. (2022). *Glossary of pharmaceutical terms*. https://ppri.goeg.at/about_translations.
Wikipedia. *List of hospitals in Ghana*. https://en.wikipedia.org/wiki/List_of_hospitals_in_Ghana
Wild, C., Weiderpass, E., & Stewart, B. W. (Eds.). (2020). *World cancer report: cancer research for cancer prevention*. International Agency for Research on Cancer. http://publications.iarc.fr/586.
Williams, C. (2007). Research methods. *Journal of Business & Economics Research (JBER)*, *5*(3).
Williams, K. (2007). Pharmaceutical price regulation. *South African Journal on Human Rights*, *23*(1), 1-33. http://reference.sabinet.co.za/webx/access/electronic_journals/ju_sajhr/ju_sajhr_v23_n1_a1.pdf.
Winit-Watjana, W. (2016). Research philosophy in pharmacy practice: necessity and relevance. *International Journal of Pharmacy Practice*, *24*(6), 428-436. https://doi.org/10.1111/IJPP.12281.
Wirtz, V. J., Hogerzeil, H. V., Gray, A. L., Bigdeli, M., de Joncheere, C. P., Ewen, M. A., ... & Reich, M. R. (2017). Essential medicines for universal health coverage. *The Lancet*, *389*(10067), 403-476. https://doi.org/10.1016/S0140-6736(16)31599-9
Wirtz, V. J., Kaplan, W. A., Kwan, G. F., & Laing, R. O. (2016). Access to medications for cardiovascular diseases in low-and middle-income

countries. *Circulation*, *133*(21), 2076-2085. https://doi.org/10.1161/CIRCULATIONAHA.115.008722
Woldeamanuel, Y. W., Girma, B., & Teklu, A. M. (2013). Cancer in Ethiopia. *The Lancet Oncology*, *14*(4), 289-290.
World Bank. (2018). Poverty and shared prosperity 2018: Piecing together the poverty puzzle.
World Bank. (2021). *World Bank Country and lending groups, Country classification*. http://data.worldbank.org/about/country-and-lending-groups.
World Health Organization. (2015). *Assessing National Capacity for the Prevention and Control of Non-communicable Diseases: Global Survey*. http://apps.who.int/iris/bitstream/10665/246223/1/9789241565363-eng.pdf?ua¼1.
World Health Organization (2014). *World cancer report 2014.* C. P. Wild, & B. W. Stewart (Eds.). Geneva, Switzerland: World Health Organization. http://publications.iarc.fr/Non-Series-Publications/World-Cancer-Reports/World-Cancer-Report-2014/.
World Health Organization (2018). *Global Initiative for Cancer Registry Development (GICR).* http://gicr.iarc.fr/ (WHO,2018d).
World Health Organization AFRO Region. (2019). Health topics, cancer. https://www.afro.who.int/health-topics/cancer.
World Health Organization. (1977). *The selection of essential drugs: report of the WHO Expert Committee*. World Health Organization. https://apps.who.int/iris/handle/10665/41272.
World Health Organization. (2000). *Global Comparative Pharmaceutical Expenditures with Related Reference Information*.
World Health Organization. (2004). *WHO Medicines Strategy 2004–2007 – Countries at the Core*.
World Health Organization. (2006). *Public health innovation and intellectual property rights. report of the commission on intellectual property rights, innovation, and public health*.
World Health Organization. (2007). *WHO operational package for assessing, monitoring, and evaluating country pharmaceutical situations: guide for coordinators and data collectors* (No. WHO/TCM/2007.2). World Health Organization. http://www.who.int/iris/handle/10665/69927.
World Health Organization. (2008). *Measuring medicine prices, availability, affordability, and price components* (No. WHO/PSM/PAR/2008.3). World Health Organization. https://haiweb.org/what-we-do/price-availability-affordability/collecting-evidence-on-medicine-prices-availability/
World Health Organization. (2008). *Medium-term strategic plan 2008-2013 and proposed programme budget 2008-2009* (No. PB/2008-2009). World Health Organization. https://apps.who.int/iris/handle/10665/2180.
World Health Organization. (2008). *Pharmaceutical Policy: cost containment and its impact*. http://www.euro.who.int/__data/assets/pdf_file/0003/80445/Eurohealth14_2.pdf.
World Health Organization. (2012). Key Prevention and Control Interventions for Reducing Cancer Burden in the WHO African Region: A Handbook for Leaders and Managers. *Brazzaville, Republic of Congo: Regional Office for Africa*.

World Health Organization. (2013). Follow-up to the Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases. *Sixty-sixth World Health Assembly, Agenda item*, *13*.
World Health Organization. (2013). *WHO guideline on country pharmaceutical pricing policies*. http://www.ncbi.nlm.nih.gov/books/NBK258631/.
World Health Organization. (2015). *WHO Guideline on Country Pharmaceutical Pricing Policies*. http://apps.who.int/iris/bitstream/10665/153920/1/9789241549035_eng.pdf
World Health Organization. (2017). World Health Assembly Resolution 70.12. Cancer prevention and control in the context of an integrated approach. https://apps.who.int/iris/ handle/10665/275676.
World Health Organization. (2018). *Access to Medicines, Vaccines and Pharmaceuticals, Pricing of Cancer Medicines, and its impacts* [Technical Report] https://apps.who.int/iris/handle/10665/277190 (WHO, 2018b).
World Health Organization. (2018). *Cancer: Facts Sheet*. https://www.who.int/news-room/fact-sheets/detail/cancer (WHO,2018a)
World Health Organization. (2019). *World Health Organization model list of essential medicines: 21st list 2019* (No. WHO/MVP/EMP/IAU/2019.06). World Health Organization. https://apps.who.int/iris/handle/10665/325771
World Health Organization. (2020). Assessing national capacity for the prevention and control of noncommunicable diseases: report of the 2019 global survey. https://apps.who.int/iris/handle/10665/331452 (WHO,2020a).
World Health Organization. (2020). *Measuring medicine prices, availability, affordability, and price components. 2nd edition*. https://haiweb.org/what-we-do/price-availability-affordability/collecting-evidence-on-medicine-prices-availability/.
World Health Organization. (2020). *WHO guideline on country pharmaceutical pricing policies, second edition*. https://apps.who.int/iris/handle/10665/335692 (WHO,2020b).
World Health Organization. (2020). *World Health Statistics 2020: Monitoring health for the SDGs*. https://www.who.int/gho/publications/world_health_statistics/2020/en/
World Health Organization. (2021). Cure All framework: WHO global initiative for childhood cancer: increasing access, advancing quality, saving lives. https://apps.who.int/iris/handle/10665/347370 (WHO, 2021c)
World Health Organization. (2021). *Facts Sheet*. http://www.who.int/mediacentre/factsheets/fs297/en/
World Health Organization. (2021). *World Health Organization model list of essential medicines: 22nd list (2021)* (No. WHO/MHP/HPS/EML/2021.02). World Health Organization (WHO, 2021a).
World Health Organization. (2021). *World Health Organization model list of essential medicines for children: 8th list (2021)* (No. WHO/MHP/HPS/EML/2021.03). World Health Organization (WHO,2021b).
World Health Organization. (2022). *Facts Sheet on cancer*. https://www.who.int/news-room/fact-sheets/detail/cancer
World Health Organization. (2018). *Global initiative for childhood cancer*. https://www.who.int/cancer/childhood-cancer/ (WHO, 2018e)
World Health Organization. (2019). *Price information exchange for selected medicines in the Western Pacific Region*.

https://www.who.int/medicines/areas/access/med_price_info_sources/en/, (WHO, 2019).
World Health Organization. (2019). *WHO Model List of Essential Medicines and 7th WHO Model list of Essential Medicines for children*. https://www.who.int/medicines/publications/essentialmedicines/en/
World Health Organization. *World Health Statistics 2020: Monitoring health for the SDGs*. https://www.who.int/gho/publications/world_health_statistics/2020/en/
Worldometer. *South African Population*. https://www.worldometers.info/world-population/south-africa-population/
Yohana, E., Kamuhabwa, A., & Mujinja, P. (2011). Availability and affordability of anticancer medicines at the Ocean Road Cancer Institute in Dar es Salaam, Tanzania. *East African journal of public health*, *8*(1), 51-56.
Yu, X., Li, C., Shi, Y., & Yu, M. (2010). Pharmaceutical supply chain in China: current issues and implications for health system reform. *Health policy*, *97*(1), 8-15.
Zhu, Y., Wang, Y., Sun, X., & Li, X. (2019). Availability, price, and affordability of anticancer medicines: evidence from two cross-sectional surveys in the Jiangsu Province, China. *International Journal of Environmental Research and Public Health*, *16*(19), 3728. https://doi.org/10.3390/ijerph16193728.

9.2 Appendices

9.2.1 Appendix 1: Abridged questionnaire on scoping assessment of cancer medicines pricing and pharmaceutical situation in Ghana

Abridged questionnaire on cancer medicines pricing and pharmaceutical situation in Ghana

Introduction
The *Abridged questionnaire on cancer medicines pricing and pharmaceutical situation in Ghana* is a basic assessment tool that provides a rapid means of obtaining information on the existing infrastructure and key processes of the cancer medicines pricing ad pharmaceutical sector.

The coordinator and respondents
To complete the Questionnaire, it is likely that you will need to gather data from several departments/ divisions within the Ministry of Health, such as those responsible for policy, procurement and supply, financing, etc., as well as other ministries and agencies, including the Medicines Regulatory Authority, the association/ministry responsible for training, etc. Which ministries, departments and agencies will need to be consulted will depend on the division of responsibilities in Ghana.

Instructions
Provide your full name, position, and contact details at the top of the Questionnaire so that we may contact you for any clarifications.
Identify appropriate persons to complete each section of the questionnaire. Suggestions on which ministries, departments, agencies, etc. may be able to contribute to each section are provided at the beginning of the section.
At the end of the questionnaire, include a list of all respondents contributing to the Questionnaire together with their contact details and the sections to which they contributed.
When providing statistical information, please use national/local sources (e. g. local health statistical yearbook, drug accounts, information from the Medicines Regulatory Authority, etc) if available. Utilize the most recent statistics.
Make sure that the responses are as accurate as possible using available resources and calling upon knowledgeable respondents. In some cases, where exact figures are unavailable, it may be necessary to give your best estimate.
Answer all the questions. Use ‘DK’ or "Don't Know" if you simply cannot provide/obtain the appropriate response/information.

Please forward the entire completed questionnaire to phyllis.ocran@hud.ac.uk.
Where available, please include the following documents.

1. National medicines policy
2. National Essential medicines list
3. National Standard treatment guidelines
4. Reports of national indicators of the pharmaceutical situation, rational use and/or access to medicines.

Abridged questionnaire: on cancer medicines pricing and pharmaceutical situation in Ghana

Country:	**Date (dd/mm/yyyy):**
Name of coordinator/principal respondent:	**E-mail address:**
Position:	**Postal address:**

Questions	Responses	Explanations
NATIONAL MEDICINES (DRUGS) POLICY (NMP) ***Please consult the health ministry, medicines regulatory authority and/or medicine service in answering the questions in this section.***		
1.1 Is there a National Medicines Policy (NMP) document? *If no, skip to 2.*	**Yes ☐ No ☐ Don't Know**	A national medicines (drug) policy document is a written expression of the government's medium to long term goals and priorities for the pharmaceutical sector and the main strategies for attaining them.
a) If yes, is it an official or draft document?	**☐ Official ☐ Draft ☐ Don't Know**	Mark "official" if the NMP document has been endorsed or officially adopted by the government otherwise mark "draft".
b) What year was it last updated?	**Year** _____	Indicate the year of last update whether the document is still in draft form or has been officially adopted.
1.2 Is there an NMP implementation plan that sets activities, responsibilities, budget and timeline?	**☐ Yes ☐ No ☐ Don't Know**	
a) If yes, when was it last updated?	**Year** _____	
REGULATORY SYSTEM ***Please consult the medicines regulatory authority in answering the questions in this section. Specific information regarding medicines tested for quality control purposes and monitoring of adverse drug reactions may need to be obtained from the quality control laboratory or the responsible agency/department.***		
Regulatory authority		

Questions	Responses	Explanations
2.1 Is there an existing formal medicines regulatory authority?	☐ **Yes** ☐ **No** ☐ **Don't Know**	This question is asking if there is a formal regulatory body with existing staff and a specific budget for conducting relevant medicines (drug) regulatory functions. Mark "no" if medicines regulatory functions, such as registration and licensing, are performed on an ad-hoc basis by an office, group or department that performs other pharmaceutical service functions, such as supply management and procurement.
Importers or exporters of medicines:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
3. Quality control		
3.1 Are there regulatory procedures to ensure quality control of imported anti-cancer medicines?	☐ **Yes** ☐ **No** ☐ **Don't Know**	This question is asking if there are standard operating procedures for ensuring the quality of imported anti-cancer medicine, such as reviewing dossiers, product evaluation and testing of imported medicine products. This may include donated medicines.
4. Dispensing and prescribing		
4.1 Is prescribing by generic name compulsory in the:		A generic name (international non-proprietary name - INN) is a non-proprietary or approved name rather than a proprietary or brand name under which a generic medicine is marketed. If prescribing by generic name is obligatory, then prescribers are required to prescribe by generic name.
Public sector:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
Private sector:	☐ **Yes** ☐ **No** ☐ **Don't Know**	

Questions	Responses		Explanations
4.2 Is generic substitution permitted at:			Generic substitution is the practice of substituting a product, whether marketed under a trade name or generic name, by an equivalent product, usually a cheaper one, containing the same active ingredient at the dispensing level. Mark “yes” if either generic substitution is required or if the dispenser is allowed to make a generic substitution in at least some instances.
Public pharmacies:	☐ **Yes** ☐ **No** ☐ **Don’t Know**		
Private pharmacies:	☐ **Yes** ☐ **No** ☐ **Don’t Know**		
4.3 Are there incentives to dispense generic medicines at:			Incentives may include dispensing fees or mark-ups which provide financial incentive for dispensers to dispense lower-priced generic medicines.
Public pharmacies:	☐ **Yes** ☐ **No** ☐ **Don’t Know**		
Private pharmacies:	☐ **Yes** ☐ **No** ☐ **Don’t Know**		
5 MEDICINES SUPPLY SYSTEM ***Please consult the agency/department responsible for the procurement and supply of medicines in answering the questions in this section.***			
5.1 Is public sector procurement of anti-cancer medicines pooled at the national level (i.e., there is centralised procurement for the regions/provinces)?	☐ **Yes** ☐ **No** ☐ **Don’t Know**		Mark “yes” if public sector procurement is centralised and medicines are procured for the entire public sector by a national procurement body even if in some instances, such as cases of stock outages, public sector facilities procure medicines through other means.
5.2 Who is responsible for anti-cancer medicines procurement and distribution:	***Procurement***	***Distribution***	
Ministry of Health:	☐ **Yes** ☐ **No** ☐ **DK**	☐ **Yes** ☐ **No** ☐ **DK**	
Individual health institutions:	☐ **Yes** ☐ **No** ☐ **DK**	☐ **Yes** ☐ **No** ☐ **DK**	

Questions	Responses		Explanations
Other Sector (Non-governmental organization (NGO), Private hospitals, Mission hospitals, private pharmacy in govt or private hospital):	☐**Yes** ☐**No** ☐ **DK**	☐**Yes** ☐**No** ☐ **DK**	Mark “yes” for other sector if government funds or foreign contributions are allocated to NGOs or other sector to procure or distribute medicines. Non-governmental organizations (NGOs) are non-governmental, non-profit organizations, networks and voluntary associations including charities, community groups, faith-based organizations, professional associations, academia and trade unions.
Private institutions (private pharmacy, wholesalers etc):	☐**Yes** ☐**No** ☐ **DK**	☐**Yes** ☐**No** ☐ **DK**	Mark “yes” for private institution if a private entity procures or distribute medicines.
5.3 Is public sector procurement limited to medicines on the Essential Medicines List (EML)?	☐**Yes** ☐**No** ☐**Don’t Know**		An Essential Medicines List (EML) is a government-approved selective list of medicines or national reimbursement list. Essential medicines are those that satisfy the priority health care needs of the population. They are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness. Essential medicines are intended to be always available within the context of functioning health systems in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and the community can afford.
6. MEDICINES FINANCING ***Please consult the budget/ finance division of the health ministry and/or the pharmaceutical supply group in answering the questions in this section. The hospital/health facility service and/or the national social and insurance services may also need to be consulted.***			

Questions	Responses	Explanations
6.1 What is the total public or government expenditure for anti-cancer medicines in US$ for the most recent year for which data are available?	**US$** _____ **Year** _____	This question is asking for the total amount the government has spent on anti-cancer medicines, including government allotment, health ministry expenditure, donor contributions channelled through the government, etc.
6.2 Is there a national policy to provide at least some anti-cancer medicines free of charge (i.e., patients do not pay out-of-pocket for medicines) at public primary care facilities?	☐ **Yes** ☐ **No** ☐ **Don't Know**	If anti-cancer medicines are provided for free but patients must pay service fees, mark "yes" here. If some facilities provide anti-cancer medicines for free but there is not a consistent national policy that applies to all primary public health facilities, mark "no" here. If there is a national policy to provide anti-cancer medicines for free at primary public health facilities, but facilities are not required to abide by the policy and not all facilities provide anti-cancer medicines for free, mark "no" here.
b) Which of the following types of patients receive anti-cancer medicines for free: Patients who cannot afford them:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
Children under 5 years of age:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
Older children:	☐ **Yes** ☐ **No** ☐ **Don't Know**	Mark "yes" for "older children" if children over 5 years of age receive anti-cancer medicines for free, regardless of the age limit, for example mark "yes" if children under 12 receive anti-cancer medicines for free.
Pregnant women:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
Elderly persons:	☐ **Yes** ☐ **No** ☐ **Don't Know**	
6.3 Which fees are commonly charged in public care facilities for cancer treatment:		

Questions	Responses	Explanations
Registration/consultation fees:	☐ **Yes** ☐ **No** ☐ **Don't Know**	Registration and consultation fees are fees patients must pay for seeing a health professional for a health check-up and/or diagnosis regardless of whether or not medicines are prescribed.
Dispensing fees:	☐ **Yes** ☐ **No** ☐ **Don't Know**	A dispensing fee is a fixed fee that pharmacies are allowed to charge per prescribed item or per prescription instead of or in addition to a percentage mark-up. The dispensing fee is paid to the dispenser and is in addition to the cost of the medicine. Both the dispensing fee and the cost of the medicine may be paid in part or whole by the patient, insurer, or government.

Questions	Responses		Explanations
Flat fees for anti-cancer medicines:	☐**Yes** ☐**No** ☐**Don't Know**		Mark "yes" for "flat fees" if either a flat fee for medicines or a flat fee per medicine item is commonly charged. A flat fee for medicines is a fee which remains the same irrespective of the number of medicines or the quantity of each medicine dispensed. Thus, for example, a patient receiving 3 medicines would pay the same as one receiving 1 medicine. Also a patient receiving 20 tablets of one medicine would pay the same as a patient receiving 100 tablets each of 2 medicines. A fee per drug item is a fee where the patient pays one set fee per each medicine irrespective of the number of units (tablets) of that medicine dispensed. Thus, for example, a patient receiving one medicine would pay $1 and a patient receiving 2 medicines would pay $2 and a patient receiving 3 medicines would pay $3 and so on. However, a patient receiving 10 tablets of one medicine would pay the same as a patient receiving 100 tablets of one medicine.
Flat rate co-payments for anti-cancer medicines:	☐**Yes** ☐**No** ☐**Don't Know**		A flat rate co-payment is a fixed amount that a patient must pay either per medicine or per prescription to cover part of the cost of medicines, the other part being paid by an insurer or government.
	Public sector	***Private sector***	

Questions	Responses			Explanations
6.4 Do prescribers dispense anti-cancer medicines?	☐ **Always** ☐ **Frequently** ☐ **Occasionally** ☐ **Never** ☐ **DK**	☐ **Always** ☐ **Frequently** ☐ **Occasionally** ☐ **Never** ☐ **DK**		In answering this question, mark the degree of frequency doctors or other authorised prescribers dispense medicines in the public and private sectors irrespective of laws permitting or disallowing authorised prescribers to dispense medicines.
6.5 What proportion of the population has health insurance?	☐ **All** ☐ **Some** ☐ **None** ☐ **DK**	☐ **All** ☐ **Some** ☐ **None** ☐ **DK**		Health insurance is any prepayment scheme for health care costs additional to but excluding subsidies funded through the health ministry budget. The purpose of questions 4.6 and 4.7 are to identify how much protection the population has against exposure to the cost of medicines at the time people are sick. This includes: Prepaid financing and Public funding through the (prepaid) health ministry budget.
6.6 Are anti-cancer medicines covered by health insurance?	☐ **All** ☐ **Some** ☐ **None** ☐ **DK**	☐ **All** ☐ **Some** ☐ **None** ☐ **DK**		
6.7 Is there a policy covering anti-cancer medicine prices that applies to the public sector, the private sector, or other sector e.g non-governmental organisations, Mission hosp, private hosp etc?	***Public sector*** ☐ **Yes** ☐ **No** ☐ **DK**	***Private sector*** ☐ **Yes** ☐ **No** ☐ **DK**	***Other eg. NGO, private hosp etc*** ☐ **Yes** ☐ **No** ☐ **DK**	In some countries, NGOs, such as faith-based missions, provide non-profit or not-for-profit health services. The third column should be completed by ticking any policies applicable to this sector. Non-governmental organizations (NGO) are non-governmental non-profit organizations, networks and voluntary associations including charities, community groups, faith-based organizations, professional associations, academia and trade unions.

Questions	Responses			Explanations
a) If yes, which of the following policies covering anti-cancer medicine prices apply: Maximum wholesale mark-up:	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	A wholesale mark-up is a certain percentage added to a purchasing price to cover the cost and profit of the wholesaler.
Maximum retail mark-up:	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	A retail mark-up is a certain percentage added to a purchasing price to cover the cost and profit of the retailer.
Duty on imported raw pharmaceutical materials:	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	A duty/tax on imported raw pharmaceutical materials is a fee assessed by customs or other responsible national authority on imported starting materials, reagents, intermediates, process aids, and solvents intended for use in the production of intermediates or active pharmaceutical ingredients.
Duty on imported finished pharmaceutical products:	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK	A duty/tax on imported finished pharmaceutical products is a fee assessed by customs or other responsible national authority on medicinal products that require no further processing and are already in their final containers.
6.8 Is a national medicine prices monitoring system for retail/patient prices in place? Does this include anti-cancer medicines	☐ Yes ☐ No ☐ DK ☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK ☐ Yes ☐ No ☐ DK	☐ Yes ☐ No ☐ DK ☐ Yes ☐ No ☐ DK	A national medicine prices monitoring system for retail/patient prices is any means of regularly tracking and comparing over time retail/patient medicine prices in the public, private and/or NGO sectors.

Questions	Responses			Explanations
6.9 Are there regulations mandating retail/patient medicine price information to be made publicly accessible?	☐ **Yes** ☐ **No** ☐ **DK**	☐ **Yes** ☐ **No** ☐ **DK**	☐ **Yes** ☐ **No** ☐ **DK**	For retail/patient medicine price information to be considered publicly accessible, one or more of the following or similar measures should be taken: prices should be available on the web or to anyone contacting the responsible authority, prices should be periodically published in national newspapers or official publications, prices should be posted in health facilities/pharmacies, etc.
7. RATIONAL USE OF MEDICINES ***Please consult the health ministry (hospital division), professional bodies and/or the education ministry in answering the questions in this section.***				
7.1 Is there a national Essential Medicines List (EML)?	☐ **Yes** ☐ **No** ☐ **Don't Know**			A national Essential Medicines List is a government-approved selective list of medicines or national reimbursement list from which most prescriptions should be made. Essential medicines are those that satisfy the priority health care needs of the population. They are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness.
a) When was the national EML last updated?	**Year:** _____			
b) Is the national EML being used in the following:				Mark "yes" if the EML is currently being used.
Public sector procurement:	☐ **Yes** ☐ **No** ☐ **Don't Know**			
Public insurance reimbursement:	☐ **Yes** ☐ **No** ☐ **Don't Know**			
Private insurance reimbursement:	☐ **Yes** ☐ **No** ☐ **Don't Know**			
c) Is there a committee responsible for the selection of products on the national EML?	☐ **Yes** ☐ **No** ☐ **Don't Know**			This refers to a formally recognised committee with members of different expertise and from different agencies/organizations.

Questions	Responses			Explanations
7.2 Are the following types of standard treatment guidelines (STG) produced by the health ministry for major conditions?	***National STG*** ☐ **Yes** ☐ **No** ☐ **DK**	***Hospital level STG*** ☐ **Yes** ☐ **No** ☐ **DK**	***Primary care STG*** ☐ **Yes** ☐ **No** ☐ **DK**	Mark “yes” if the health ministry or similar national authority produces a collection of treatment guidelines covering prevalent/common disease conditions in the country for use at the national, hospital or primary care levels. If treatment guidelines are produced separately for each disease/condition or organ system, mark “no”.
a) If yes, when were the STGs last updated?	**Year** _____	**Year** _____	**Year** _____	

Questions	Responses	Explanations
8 Retail		
8.1 What proportion of patients access anti-cancer medicines through: a) public/government sector b) formal private sector c) Other: specify: d) Other: specify:	**a)** _____% **b)** _____% **c)** _____% **d)** _____%	The formal private sector refers to licensed medicine retail outlets and licensed retail drug stores. Common other sectors include non-government organizations, mission health facilities, or dispensing doctors.
8. 2 Are there private pharmacies which sell anti-cancer medicines in public health facilities?	☐**Yes** ☐**No** ☐**Don't Know**	
9. Medicine pricing policies		
9.1 Does the government set the price of some/all originator brand products?	☐**Yes** ☐**No** ☐**Don't Know**	
a) If yes, please describe how this is done (e.g., direct price controls, international reference pricing):		Direct price controls refer to price-setting using a pricing formula, e.g. production costs + a % margin. International reference pricing refers to comparing prices to those in other countries.
9.2 Does the government set the price of some/all generic products?	☐**Yes** ☐**No** ☐**Don't Know**	
a) If yes, please describe how this is done (e.g., direct price controls, national reference pricing):		National reference pricing refers to setting prices by comparing the prices of similar medicines (by molecule or therapeutic class; originator brand or generics) on the national market.
9.3 Are prices set in the private sector for medicines on the national Essential Medicines List?	☐**Yes** ☐**No** ☐ **No national EML**	This question is asking whether price-setting is limited to medicines on the national EML.

9.4 Of the medicines included in the survey, are there any which are patent protected or only available as the originator brand product (i.e., single source products)?	☐ **Yes** ☐ **No** ☐ **Don't Know**	
a) If yes, please specify which medicines:		
9.5 Please provide the website address (URL) of any websites that publish the following information: a) pharmaceutical legislation b) Standard treatment guidelines c) Regulatory procedures d) Prescribing information e) Licensed manufacturers f) Medicines approved for marketing g) List of registered products h) Medicine prices (procurement or patient)	a) b) c) d) e) f) g) h)	

****

List of respondents

Name	Position	Address	E mail	Section(s) completed

9.2.2 Appendix 2: Medicine price and availability form

Use another form for each facility

Name of Country: _____

Date (period of study): _____

Section A: Demographics

This section contains general information about you and your organization – this is only to enable the researchers to contact you again to make any clarifications regarding the data you have collected. Your name will not appear in any reports. Information about your country is being collected in questions 5-7 to enable comparisons to be made with other countries in the study.

	Name of the Data Collector (your name):		
	Profession of the Data Collector and Current Position (your occupation and title):		
	Contact details (e-mail, fax, phone, address):		
	Name of your organization (involved in data collection):		
	Local currency of your country:		
	Exchange Rate with United States Dollars:	Exchange rate:	Date when this rate applied:
	Daily salary (in the local currency) of the less paid uneducated civil servant		

Section B: Facility for Medicines

Facility _____

Name of the city: _____

Type of medicine facility:

a) Government segment medicine facility (please specify):

First level facility ☐

Second level facility ☒

Third level facility ☐

b) Other segment medicine facility (please specify): _____

Private hospital/clinic ☐

Mission hospital/clinic ☐

NGO ☐
c) Private sector facility
Pharmacy ☐
Medicine Store ☐
Type of price:
a) Procurement price ☐
b) Patient Price: ☐

Manager's Information _____
Informant on prices Name and Position (if different from Manager): _____

Medicine Prices and Availability Questionnaire (WHO/HAI 2018)

Section C: Medicine Prices and Availability								
Cancer Medicine Generic name, Strength, Pack Size and Dosage	**Medicine Type**	**Originator/ Brand name (s)**	**Manufacturer name**	**Is the product available today? (Yes/No)**	**Buying price (unit price in local currency)**	**Selling price (unit price in local currency)**	**Alternative Pack Size found**	**Medicine on National EML (Yes or No)**
Medicine: L-Asparaginase **Medicine strength:** 10000iu **Pack size:** **Dosage form**: vial	**Originator**							
	Low- priced generic							
Medicine: Bleomycin **Medicine strength:** 15mg (15,000 IU) PFR **Pack size:** **Dosage form:** vial	**Originator**							
	Low priced generic							
Medicine: Carboplatin **Medicine strength:** 150mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low-priced generic							

Medicine: Carboplatin **Medicine strength:** 450mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low- priced generic							
Medicine: Cisplatin **Medicine strength:** 50mg/ml **Pack size:** **Dosage form:** Inj	**Originator**							
	Low- priced generic							
Medicine: Cyclophosphamide **Medicine strength:** 1g **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Cytarabin **Medicine strength:** 100mg **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Docetaxel	**Originator**							

Medicine strength: 80mg **Pack size: Dosage form:** Inj.	**Low- priced generic**							
Medicine: Doxorubicin **Medicine strength:** 50mg **Pack size: Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Epirubin **Medicine strength:** 50mg **Pack size: Dosage form:** inj.	**Originator**							
	Low- priced generic							
Medicine: Etoposide **Medicine strength:** 20mg/ml **Pack size: Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Gemcitabine **Medicine strength:** 1000mg **Pack size:**	**Originator**							
	Low- priced generic							

Dosage form: Inj.								
Medicine: Ifosfamide **Medicine strength:** 1g **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Leucovorin Calcium **Medicine strength:** 50mg PFR **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Mesna **Medicine strength:** 100mg/ml **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Oxaliplatin **Medicine strength:** 100mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low- priced generic							

Medicine: Paclitaxel **Medicine strength:** 100 mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low- priced generic							
Medicine: Vinblastine **Medicine strength:** 10 mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low- priced generic							
Medicine: Vincristine **Medicine strength:** 1mg/ml **Pack size:** **Dosage form:** Inj.	**Originator**							
	Low- priced generic							
Medicine: Zoledronic Acid **Medicine strength:** 4 mg **Pack size:** **Dosage form:** vial	**Originator**							
	Low- priced generic							
PLEASE RECORD ANY ADDITIONAL MEDICINE FOUND AT THE FACILITY								
Medicine:	**Originator**							

Medicine strength: Pack size: Dosage form: vial								
	Low- priced generic							
Medicine: Medicine strength: Pack size: Dosage form: vial	**Originator**							
	Low- priced generic							
Medicine: Medicine strength: Pack size: Dosage form: vial	**Originator**							
	Low- priced generic							
Medicine: Medicine strength: Pack size: Dosage form: vial	**Originator**							
	Low- priced generic							
Medicine: Medicine strength: Pack size: Dosage form: vial	**Originator**							
	Low- priced generic							

Before leaving the facility: Data collectors should check that the data collection form is legible, accurate and complete before leaving the facility and returning completed forms to researchers. They should report any problems as soon as possible. The data collector should also ***check to see whether at least half of the survey medicines were available***, to determine whether a visit to a back-up facility is required.

9.2.3 Appendix 3: Price component survey questionnaire

Price Component Questionnaire						
Public Hospital/ Private Hospital/ Private Pharmacy/ Wholesaler						
Name of Data Collector: Region: Name of Facility: Product name, dosage, strength: Pack Size: Product Type (Originator or Generic):						
	Type of charge	Charge status	Charge basis	Price to which charge is applied	Amount of charge	Comments
Stage 1 - manufacturer selling price	Manufacturers selling price	price				
	Insurance and freight					
	CIF					
Stage 2: Landed price (Customs, transport,						

and port charges)							
Stage 3: Wholesaler or medical store (distributors' and/or importers' charges)	Procure price	value					
Stage 4: Retailer or dispensary (retailer's markups)	Type of charge	Charge status	Charge basis	Price to which charge is applied	Amount of charge	Comments	
	Procure price	value					
Stage 5: Dispensed price (goods and services tax and value added tax (VAT)	Type of charge	Charge status	Charge basis	Price to which charge is applied	Amount of charge	Comments	
	Selling price	value					

9.2.4 Appendix 4: Ethical approval from University of Huddersfield to conduct research

University of HUDDERSFIELD
Inspiring tomorrow's professionals

School of Applied Sciences
University of Huddersfield
Queensgate
Huddersfield
HD1 3DH

19th November 2019

Professor Zaheer Babar
School of Applied Sciences
University of Huddersfield

Dear Zaheer,

Re: Ethical Approval of projects entitled: Availability, Affordability and Pricing of Anti-Cancer Medicines in selected Low and Middle-Income Countries in Africa; Ghana and Malawi

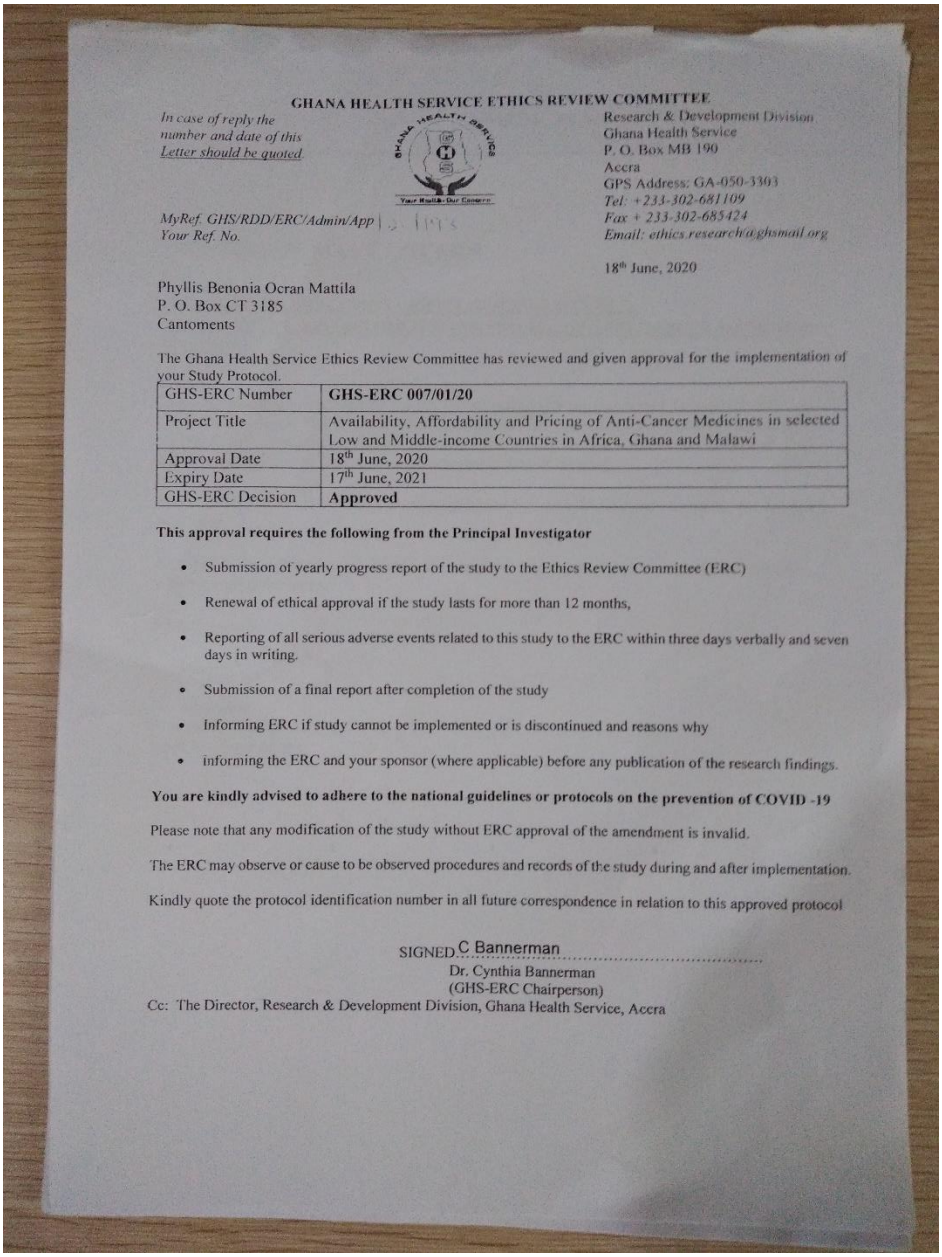
Thank you for submitting your ethics application forms for project listed above. I am happy to confirm that the project has been approved without any modifications. We note that project was due to start on the 1st September 2019 and is due to end on the 31st December 2020. If you require an extension to this work, please let me know.
Please quote this reference number SAS-SREIC 19.11.19-2 in any further correspondence to the committee.

Yours sincerely

R. M. Phillips.

Professor Roger M Phillips BSc, PhD, SFHEA
Chair – School of Applied Sciences Research Integrity and Ethics Committee

9.2.5 Appendix 5: Ghana Health Service (GHS) ethical approval to conduct research in GHS facilities



GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

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

MyRef. GHS/RDD/ERC/Admin/App
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
GPS Address: GA-050-3303
Tel: +233-302-681109
Fax + 233-302-685424
Email: ethics.research@ghsmail.org

18th June, 2020

Phyllis Benonia Ocran Mattila
P. O. Box CT 3185
Cantoments

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

GHS-ERC Number	**GHS-ERC 007/01/20**
Project Title	Availability, Affordability and Pricing of Anti-Cancer Medicines in selected Low and Middle-income Countries in Africa, Ghana and Malawi
Approval Date	18th June, 2020
Expiry Date	17th June, 2021
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

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

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

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

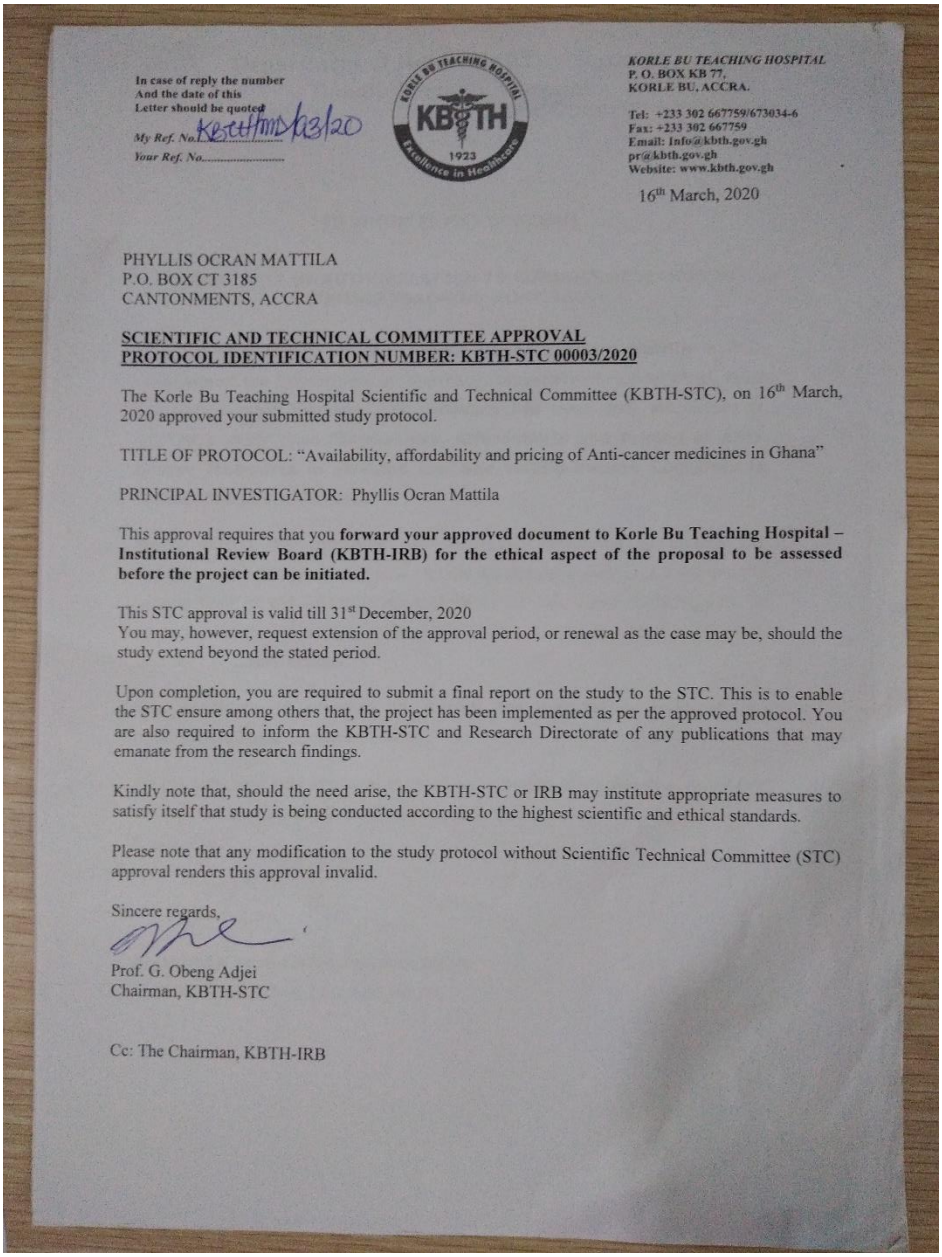
The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

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

SIGNED C Bannerman
Dr. Cynthia Bannerman
(GHS-ERC Chairperson)

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

9.2.6 Appendix 6: Korle Bu Teaching Hospital (KBTH) ethical approval letter to conduct research in KBTH



In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. KBTH/STC/03/20
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

16th March, 2020

PHYLLIS OCRAN MATTILA
P.O. BOX CT 3185
CANTONMENTS, ACCRA

SCIENTIFIC AND TECHNICAL COMMITTEE APPROVAL
PROTOCOL IDENTIFICATION NUMBER: KBTH-STC 00003/2020

The Korle Bu Teaching Hospital Scientific and Technical Committee (KBTH-STC), on 16th March, 2020 approved your submitted study protocol.

TITLE OF PROTOCOL: "Availability, affordability and pricing of Anti-cancer medicines in Ghana"

PRINCIPAL INVESTIGATOR: Phyllis Ocran Mattila

This approval requires that you **forward your approved document to Korle Bu Teaching Hospital – Institutional Review Board (KBTH-IRB) for the ethical aspect of the proposal to be assessed before the project can be initiated.**

This STC approval is valid till 31st December, 2020
You may, however, request extension of the approval period, or renewal as the case may be, should the study extend beyond the stated period.

Upon completion, you are required to submit a final report on the study to the STC. This is to enable the STC ensure among others that, the project has been implemented as per the approved protocol. You are also required to inform the KBTH-STC and Research Directorate of any publications that may emanate from the research findings.

Kindly note that, should the need arise, the KBTH-STC or IRB may institute appropriate measures to satisfy itself that study is being conducted according to the highest scientific and ethical standards.

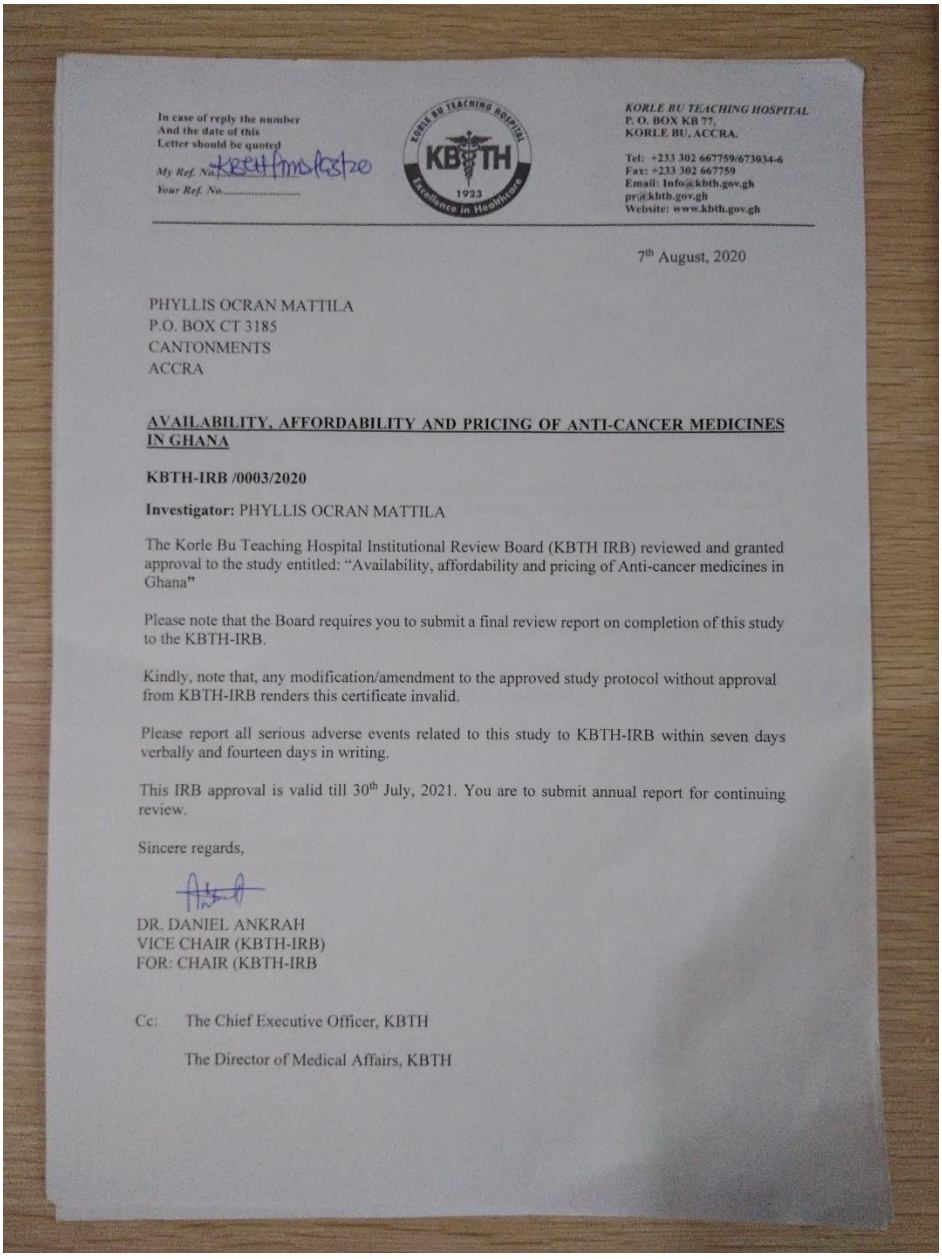
Please note that any modification to the study protocol without Scientific Technical Committee (STC) approval renders this approval invalid.

Sincere regards,

Prof. G. Obeng Adjei
Chairman, KBTH-STC

Cc: The Chairman, KBTH-IRB

9.2.7 Appendix 7: KBTH information on approval to conduct research in KBTH



In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. KBTH/ms/0370
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

7th August, 2020

PHYLLIS OCRAN MATTILA
P.O. BOX CT 3185
CANTONMENTS
ACCRA

AVAILABILITY, AFFORDABILITY AND PRICING OF ANTI-CANCER MEDICINES IN GHANA

KBTH-IRB /0003/2020

Investigator: PHYLLIS OCRAN MATTILA

The Korle Bu Teaching Hospital Institutional Review Board (KBTH IRB) reviewed and granted approval to the study entitled: "Availability, affordability and pricing of Anti-cancer medicines 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 30th July, 2021. You are to submit annual report for continuing review.

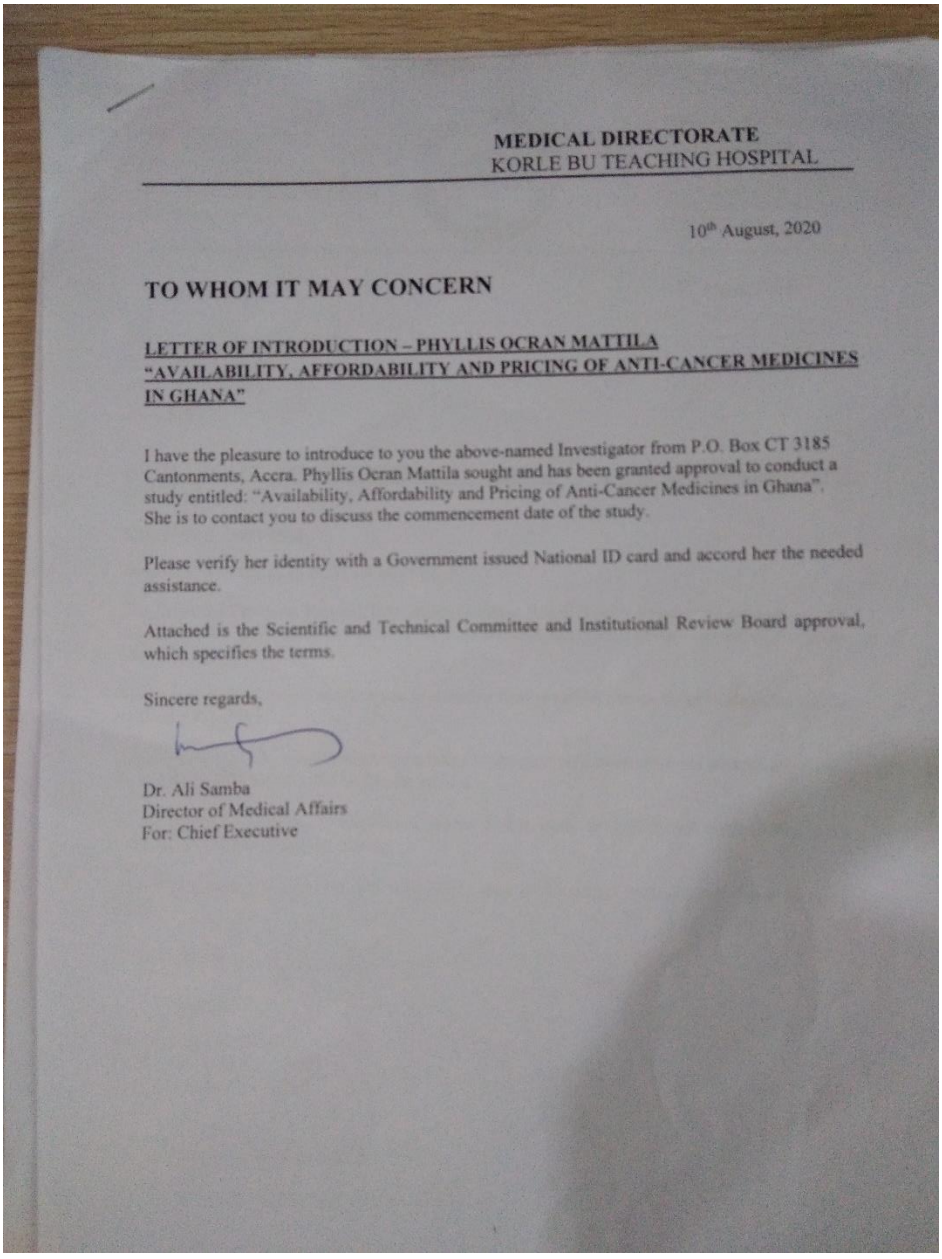
Sincere regards,

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

Cc: The Chief Executive Officer, KBTH

The Director of Medical Affairs, KBTH

9.2.8 Appendix 8: KBTH letter of introduction to conduct Research in KBTH



MEDICAL DIRECTORATE
KORLE BU TEACHING HOSPITAL

10th August, 2020

TO WHOM IT MAY CONCERN

LETTER OF INTRODUCTION – PHYLLIS OCRAN MATTILA
"AVAILABILITY, AFFORDABILITY AND PRICING OF ANTI-CANCER MEDICINES IN GHANA"

I have the pleasure to introduce to you the above-named Investigator from P.O. Box CT 3185 Cantonments, Accra. Phyllis Ocran Mattila sought and has been granted approval to conduct a study entitled: "Availability, Affordability and Pricing of Anti-Cancer Medicines in Ghana". She is to contact you to discuss the commencement date of the study.

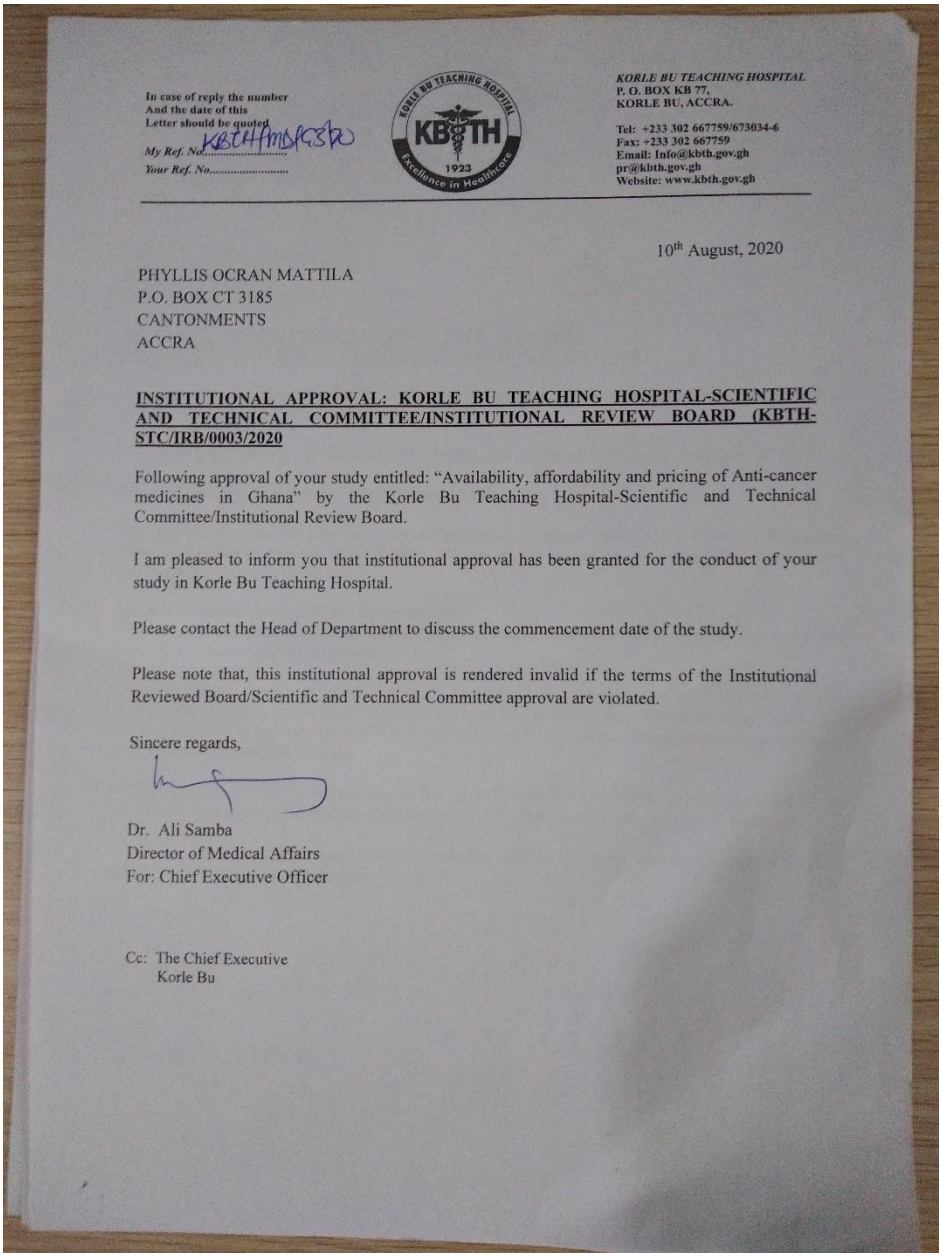
Please verify her identity with a Government issued National ID card and accord her the needed assistance.

Attached is the Scientific and Technical Committee and Institutional Review Board approval, which specifies the terms.

Sincere regards,

Dr. Ali Samba
Director of Medical Affairs
For: Chief Executive

9.2.9 Appendix 9: KBTH institutional approval notification to conduct research in KBTH



In case of reply the number
And the date of this
Letter should be quoted
My Ref. No. KBTH/MS/C3/20
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

10th August, 2020

PHYLLIS OCRAN MATTILA
P.O. BOX CT 3185
CANTONMENTS
ACCRA

INSTITUTIONAL APPROVAL: KORLE BU TEACHING HOSPITAL-SCIENTIFIC AND TECHNICAL COMMITTEE/INSTITUTIONAL REVIEW BOARD (KBTH-STC/IRB/0003/2020

Following approval of your study entitled: "Availability, affordability and pricing of Anti-cancer medicines 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.

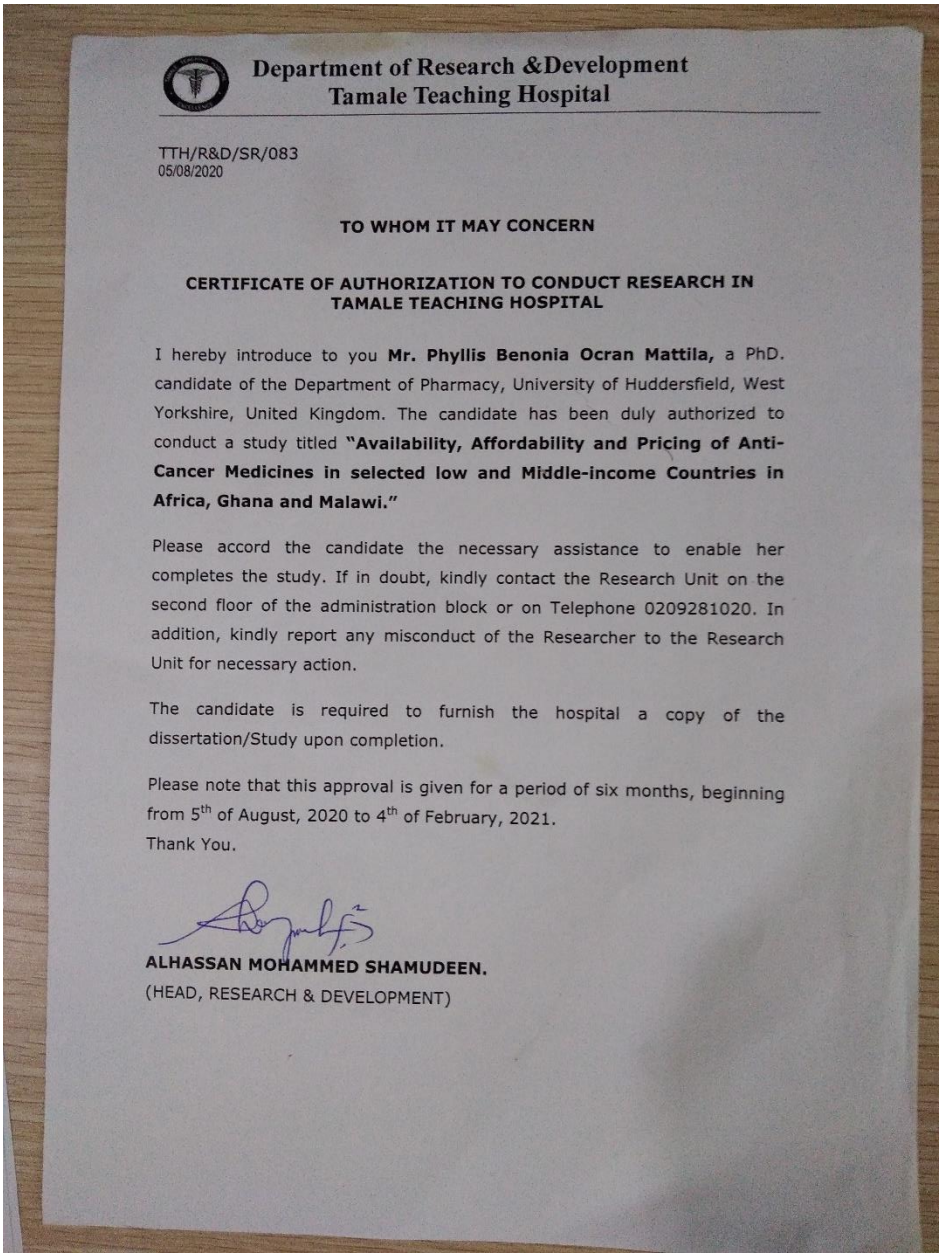
Please note that, this institutional approval is rendered invalid if the terms of the Institutional Reviewed Board/Scientific and Technical Committee approval are violated.

Sincere regards,

Dr. Ali Samba
Director of Medical Affairs
For: Chief Executive Officer

Cc: The Chief Executive
Korle Bu

9.2.10 Appendix 10: Tamale Teaching Hospital (TTH) ethical authorization to conduct research in TTH



Department of Research &Development
Tamale Teaching Hospital

TTH/R&D/SR/083
05/08/2020

TO WHOM IT MAY CONCERN

CERTIFICATE OF AUTHORIZATION TO CONDUCT RESEARCH IN TAMALE TEACHING HOSPITAL

I hereby introduce to you **Mr. Phyllis Benonia Ocran Mattila,** a PhD. candidate of the Department of Pharmacy, University of Huddersfield, West Yorkshire, United Kingdom. The candidate has been duly authorized to conduct a study titled **"Availability, Affordability and Pricing of Anti-Cancer Medicines in selected low and Middle-income Countries in Africa, Ghana and Malawi."**

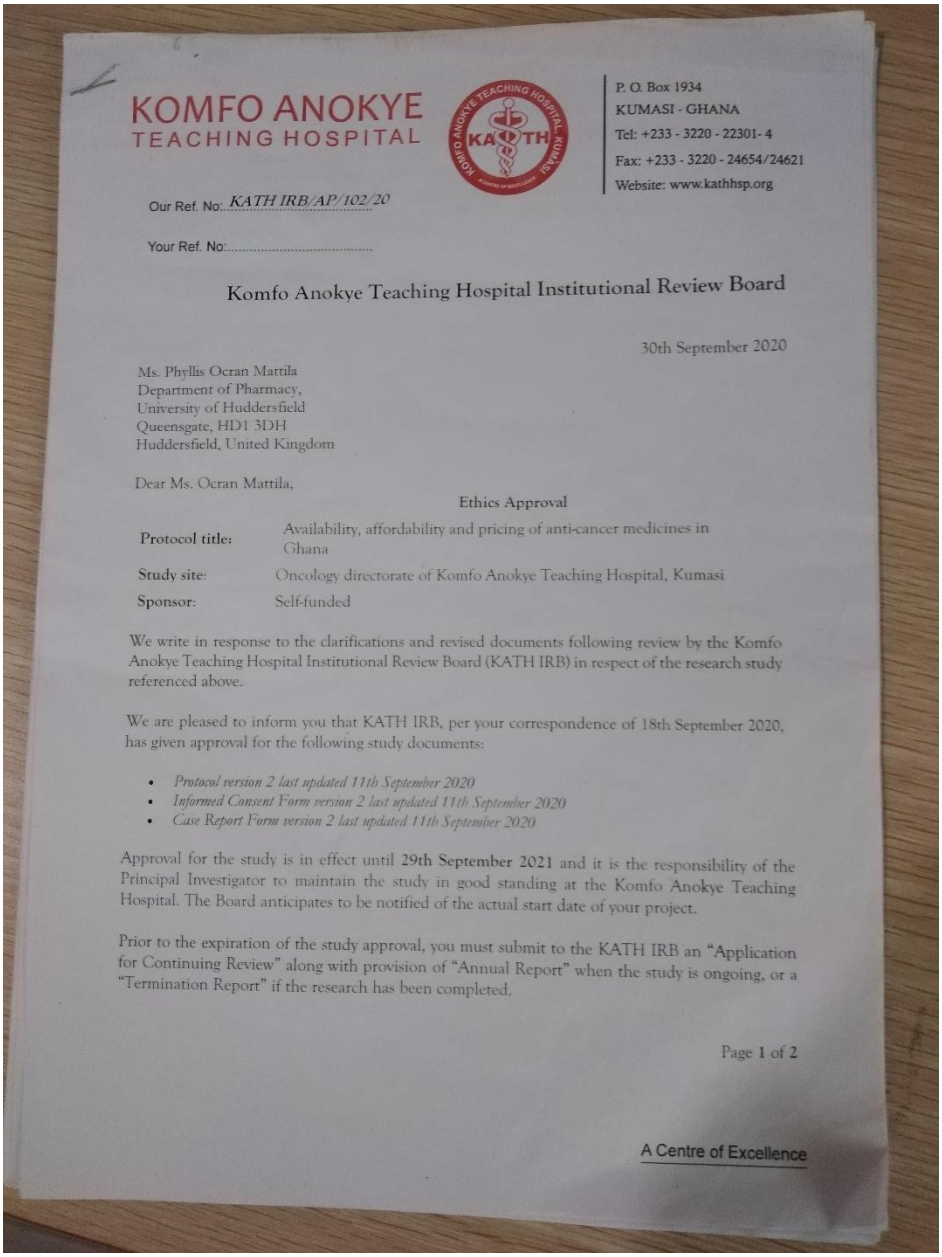
Please accord the candidate the necessary assistance to enable her completes the study. If in doubt, kindly contact the Research Unit on the second floor of the administration block or on Telephone 0209281020. In addition, kindly report any misconduct of the Researcher to the Research Unit for necessary action.

The candidate is required to furnish the hospital a copy of the dissertation/Study upon completion.

Please note that this approval is given for a period of six months, beginning from 5th of August, 2020 to 4th of February, 2021.
Thank You.

ALHASSAN MOHAMMED SHAMUDEEN.
(HEAD, RESEARCH & DEVELOPMENT)

9.2.11 Appendix 11: Komfo Anokye Teaching Hospital (KATH) ethical approval to conduct research in KATH



KOMFO ANOKYE
TEACHING HOSPITAL

P. O. Box 1934
KUMASI - GHANA
Tel: +233 - 3220 - 22301- 4
Fax: +233 - 3220 - 24654/24621
Website: www.kathhsp.org

Our Ref. No: *KATH IRB/AP/102/20*

Your Ref. No:.....

Komfo Anokye Teaching Hospital Institutional Review Board

30th September 2020

Ms. Phyllis Ocran Mattila
Department of Pharmacy,
University of Huddersfield
Queensgate, HD1 3DH
Huddersfield, United Kingdom

Dear Ms. Ocran Mattila,

Ethics Approval

Protocol title:	Availability, affordability and pricing of anti-cancer medicines in Ghana
Study site:	Oncology directorate of Komfo Anokye Teaching Hospital, Kumasi
Sponsor:	Self-funded

We write in response to the clarifications and revised documents following review by the Komfo Anokye Teaching Hospital Institutional Review Board (KATH IRB) in respect of the research study referenced above.

We are pleased to inform you that KATH IRB, per your correspondence of 18th September 2020, has given approval for the following study documents:

- *Protocol version 2 last updated 11th September 2020*
- *Informed Consent Form version 2 last updated 11th September 2020*
- *Case Report Form version 2 last updated 11th September 2020*

Approval for the study is in effect until **29th September 2021** and it is the responsibility of the Principal Investigator to maintain the study in good standing at the Komfo Anokye Teaching Hospital. The Board anticipates to be notified of the actual start date of your project.

Prior to the expiration of the study approval, you must submit to the KATH IRB an "Application for Continuing Review" along with provision of "Annual Report" when the study is ongoing, or a "Termination Report" if the research has been completed.

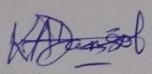
Page 1 of 2

A Centre of Excellence

You must hastily report to the KATH IRB should a modification to the research be proposed, and without delay if an unanticipated development occurs before the next required review. Regulations do not permit you to modify conduct of the study in its present form prior to ethics approval; except where urgent action is required to eliminate an apparent immediate hazard to a study subject or other person. It is of utmost importance data generated from this study must be used for the intended purposes only.

Thank you.

Sincerely,



Prof. Kwabena Antwi Danso, BSc, MB ChB, FWACS, FGCS, FACOG
Chairman, KATH IRB

9.2.12 Appendix 12: Sample letter of introduction of research team for research work

Letter of introduction
To whom it may concern

Medicine price and availability survey …… (place and dates)

By this letter I would like to introduce to you ……..... [name of Survey person (s)] as they begin to collect information from registered pharmacies and other medicine facilities/outlets on the price and availability of selected medicines in your area.
This work is in accordance with methods promoted by the World Health Organization and Health Action International and endorsed by ……. (Ministry of Health and/or ethical review boards). The results will be made publicly available, and the anonymity of individual pharmacies and individual respondents will be strictly maintained.
This work should contribute to better knowledge about retail price differences, both in the country and internationally. It should also help us to understand how these prices are determined and how we might better control them. As you are aware, the price of medicines is of great importance to all people.
The survey team's work consists of interviewing staff at a preselected sample of medicine outlets about the prices and availability of anti-cancer medicines. Each outlet visit will probably take about two hours and we will try to ensure that the timing of the visit is convenient for you and your staff. Interviewers have specifically been asked to avoid arriving at peak times when the outlet is busiest. A prior appointment will be made with each pharmacy/medicine facility to be visited at a date and time convenient to staff.

Should you need further information or have questions about this survey, please contact me directly (email: pocran.ocran@hud.ac.uk, Tel: +265-9982-97090). I would be grateful for every assistance you can provide to…….. survey person(s) in carrying out the work.

Signed
Designation
Place
Date

Attachments:
Full contact details of survey manager
Names of all data collectors in survey area
Planned schedule of dates and times of visits to medicine outlets
Copy of letter(s) of endorsement

9.2.13 Appendix 13: Statement to comply with ethical principles during the research

STATEMENT TO COMPLY WITH ETHICAL PRINCIPLES

I, PHYLLIS OCRAN MATTILA. The Principal Investigator (PI) of this study and my Co investigator write to state that we will comply with all ethical principles and guidelines throughout the conduct of the study.

I shall conduct the study in accordance with the approved protocol.

NAME OF PI: PHYLLIS OCRAN MATTILA……Signature…*ophyl*……

DATE (dd-mm-yyyy)…06/06/2020

NAME of CO INVESTIGATOR: PROF. RICHARD BIRITWUM……Signature…RB……

DATE (dd-mm-yyyy)…06/06/2020

9.2.14 Appendix 14: Participant information and consent form

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE
Application for Ethics Approval-
For Research with Human Participants ERC GUIDE

Study Title: Availability, Affordability and Pricing of Anti-Cancer Medicines in Ghana

Introduction:
My name is Phyllis Ocran Mattila. I am a PHD Student at the centre of Pharmaceutical Policy and Practice Research, University of Huddersfield, UK, I have planned a quantitative study on the above-mentioned research topic.
For this purpose, you have been identified as an important and influential stakeholder with interests and experience relevant to the aim of this study and I would like to humbly request for your participation in an interview. Below please find some information about the project.

Background and Purpose of research:
The overall aim of this research is to assess prices, availability, and affordability of selected medicines for the treatment of cancer with a view to ensuring equitable access to affordable anti-cancer medicines for Ghana.

Nature of research: The study is cross-sectional in design using the abridged World Health Organization and Health Action International (WHO/HAI) methodology to assess availability, price and affordability of anti-cancer medicines in the public and private healthcare sectors in Ghana. Country specific list of essential cancer medicines selected based on their importance in treating cancer diseases will be systematically surveyed for their prices and availability. **No patient will be involved directly in this study however**, only cost of treatment and availability of the oncology medicines will be assessed.

Project Procedures:
A semi-structured guide will be used for the interviews and a questionnaire will be used for the quantitative study. The interviews will be recorded, transcribed, and then analyzed.

Duration /what is involved: Data collection is expected to last for 14 days (two weeks) in each region. No patients will be selected for this study. Pharmacists, Dispensary Technicians working at the selected pharmacies who have consented to participate will be involved in the study. These group of participants will assist in completing the questionnaire for the data collections at the health facilities and the nearby selected pharmacies. The second group of participants will be the officers at the Ministries, Departments and Agencies to assist in completing the questionnaire on structures and processes of pharmaceutical situations in Ghana.

Potential Risks: The study has no expected potential risks.
Benefits: Participation in the study may not directly benefit the participant but will generate evidence-based data that will help improve availability, affordability and price of cancer treatment in Ghana.

Costs/Compensation: There will be no cost in participating in the study and **t**here will be no compensation in participating in the study.

Anonymity and Confidentiality: Study participants will be assured that the information collected will be kept confidential and will not be divulged to anyone. Participant names will not be mentioned in any study outputs. Also, in order to minimize participant's discomfort about the issues being discussed, all interviews will be conducted in a private place. During training, field staff will be made aware of the importance of protecting interviewee's privacy and confidentiality of information obtained from them. Interviewees will not be required to give their name and no identifiers will be recorded beyond a serial number. All audio files and electronic data will be stored in a password protected computer at the University of Huddersfield. Any information you provide may be quoted in publications or presentations, however, confidentiality will be maintained, and any references will be quoted anonymously.

Voluntary participation/withdrawal: Informed consent will be read out in the appropriate language (local or English) to all respondents outlining the risks and benefits of being interviewed and giving them the opportunity to decline to be interviewed or to discontinue the interview at any time. Participation will be completely voluntary. Those who give their consent will be asked to sign or put their thumbprint on the consent form to indicate their willingness to participate in the study.

Outcome and Feedback: All the information gathered will be put together in a report. The findings of the study will be shared with all stakeholders including the study participants.

Sharing of participants Information/Data: The data generated from participants is owned by the Research Team.

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.

Interview time:
This is planned to last about 20-30 minutes.

Funding:
The project is self-funded, and not funded by any organization.

Who to Contact for Further Clarification/Questions:
PI – Phyllis Ocran Mattila

Tel: 0205671262
Email: phyllis.ocran@hud.ac.uk

Please contact the below mentioned for ethical issues and rights to participation:
Nana Abena Apatu
Ghana Health Service Ethics Review Committee Administrator
Tel: 0503539896, Email: ethics.research@ghsmail.org

STATEMENT OF PERSON OBTAINING INFORMED CONCENT:
I have fully explained the purpose of the study to---------- and have given sufficient information, including risks and benefits, to enable the prospective participant to make an informed decision to or not to participate.
DATE: ----------
SIGNATURE OR THUMPRINT----------
NAME: ----------
STATEMENT OF PERSON GIVING CONSENT:
I have been informed of the nature and purpose of this study in a language I understand. ☐
I have had the opportunity to ask all and any questions I desire. ☐
The questions have been answered to my satisfactory. ☐
I understand that my participation is voluntary. ☐
I know enough about the purpose, methods, risks, and benefits of the research study to judge that I want to take part in it. ☐
I understand that I may freely stop being part of the study up until the point when I have completed the interview. ☐
I have received a copy of the study information letter and consent form to keep for myself. ☐
SUMMARY OF PARTICIPANTS' STATEMENT
I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and satisfactorily explained to me in a language I understand (English/ Local language). I fully understand the contents and any potential implications as well as my right to change my mind (ie withdraw from the research) even after I have signed this form.
I voluntarily agree to be part of this research.
Name or Initials of Participant…… ID Code ……..
Participants' Signature ……OR Thumb Print…… OR Mark (Please specify)…….
Date…….
Witness signature or Thumb Print----------
Witness Name: ----------Witness
Position: ----------
INVESTIGATOR STATEMENT AND SIGNATURE
I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.
Researcher's name…Phyllis Ocran Mattila…….
Signature …….
Date……

9.2.15 Appendix 15: Table 27- Selected facilities for data collection

No.	Region	Central Health Facility (N=4)	Adjoining Health Facilities and Pharmacies Sampled	Status
1	Greater Accra	Korle-Bu Teaching Hospital	37 Military Hospital	Public
			KBTH Child Health Pharmacy	Public
			KBTH Surgical Department Pharmacy	Public
			KBTH National Radiotherapy Oncology and Nuclear Medicine Centre Pharmacy	Public
			Sweden Ghana Medical Centre	Private
			Rock Chemist	Private
			Add Pharma	Private
			West Point Pharmacy	Private
			Parker Pharmacy	Private
			Top Up Pharmacy	Private
			Vital Pharmacy	Private
2	Ashanti	Komfo Anokye Teaching Hospital	KATH Oncology Directorate Pharmacy	Public
			KATH 24-HR Pharmacy	Public
			Silva Pharma	Private
			Western Pharmacy	Private
			Partners Pharmacy	Private
			Lansah Chemist	Private
			Bandy Chemist	Private
			Garrison Pharmacy	Private
3	Northern	Tamale Teaching Hospital	Tamale Teaching Hospital Surgical Pharmacy	Public
			Obarsi Pharmacy	Private
			A&A Pharmacy	Private
			Mauplus Pharmacy	Private
			Mainstreet Pharmacy	Private
			Gina Pharmacy	Private
4	Central	Cape Coast Teaching Hospital	Cape Coast Teaching Hospital 24 Hour Pharmacy	Public
			Oak Tree Medical Services	Private
			Ashgin Pharmacy	Private
			Honsal Pharmacy	Private
Total	4 Regions	4 Main Hospitals (Anchor)	29 Health Facilities	

9.2.16 Appendix 16: Glossary and Definitions (Brunton et al., 2011; Niens & Brouwer, 2013; Niens et al., 2012; Niens et al., 2010; WHO, 2018; WHO & HAI, 2020).

Active pharmaceutical ingredient (API): The chemical substance responsible for a product's effect. In this manual, it is called "substance".

Affordability: For the health system, it refers to the proportion of spending on cancer medicines compared to existing expenditure on medicines or other health products and services. For individual patient, it refers to the number of days' wages needed to pay for the cost of treatment or the cost of treatment in relation to peoples' income. It can be estimated using the daily wage of the lowest-paid unskilled government worker by determining the number of days' wages required to purchase selected courses of treatment for common acute and chronic conditions.

Availability: Presence of medicines in national formulary available to patients for free or for a fixed fee.

Average value: Mean, median and mode are the three ways of expressing the average value.

Brand name: Name given to a pharmaceutical product by the manufacturer: e.g., Valium is the originator brand name (also called trade name) for diazepam. The use of this name is reserved exclusively to its owner as opposed to the generic name e.g., diazepam.

Brand premium: A brand premium is the difference in price between the innovator brand and the lowest price generic equivalent.

Buyer prices: these are usually government international competitive bidding, or tender, prices. They are actual prices obtained by organizations, and usually do include insurance and transportation charges.

Branded generics: These are brand names used for generic products. These brand names are different from innovator brand names.

Cancer medicines: refer to cytotoxic and adjuvant medicines. The cytotoxic medicines include alkylating agents, antimetabolite analogs of folic acid, pyrimidine, and purine, natural products, hormones and hormone antagonists, and a variety of agents directed at specific molecular targets were assessed.

Cost, insurance, freight (CIF): Shipping term meaning the seller must pay the costs, insurance, and freight charges necessary to bring the goods to the port of destination.
Cost-based pricing: This involves setting the price of a medicine based on the costs of inputs and add to it a mark-up percentage or amount.
Cost-plus pricing: Ensures that prices are set by assessing the costs of producing the medicines and adding a profit margin.
Dispensing fee: Normally a fixed fee that pharmacies are allowed to charge per prescribed item instead of or in addition to a percentage mark-up. The fee more accurately reflects the work involved in dispensing a prescription. a percentage mark-up makes profit dependent on the sale of expensive medicines.
Dosage form: This is the administration form of the completed pharmaceutical product: e.g., tablet, capsule, suspension, injection. Also called dose form or dosing unit.
Essential medicines: Essential medicines are intended to be always available within the context of functioning health systems, in adequate quantities, in the appropriate dosage forms, with assured quality and adequate information, and at a price the individual and community can afford. The precise definition of the medicines that are regarded as essential remains a national responsibility.
External referencing: Ensures that prices are benchmarked against the same medicines in other comparable countries.
Free on board (FOB): Shipping term meaning the buyer must pay all costs and insurance against risks of damage once goods are loaded for shipping.
Generic equivalent: all products other than the originator brand that contain the same active ingredient (substance), whether marketed under a brand name (“branded generic”) or the generic name.
Generic medicine: A pharmaceutical product usually intended to be interchangeable with the originator brand product, manufactured without a license from the originator manufacturer and marketed after the expiry of patent or other exclusivity rights. Generic medicines are marketed either under an INN, for example diazepam or occasionally another approved name, rather than under a proprietary or brand name. However, they are also quite frequently marketed under brand names, often called “branded generics”.

Many different branded generic products of the same medicine can be on the market in a country along with the originator brand product.

Government regulation of mark-ups: Sets the limits of what pharmaceutical suppliers can add to the costs of medicine as they sell it along the supply chain and eventually to patients.

Innovator brand: Innovator brand is generally the product that was first authorized worldwide for marketing (normally as a patented product) based on the documentation of its efficacy, safety, and quality, according to requirements at the time of authorization. The innovator brand name may vary between countries.

Interchangeable pharmaceutical products: Products within a therapeutic class, but with different active ingredients are interchangeable if they have equivalent therapeutic effect.

Internal referencing: Ensures that prices are benchmarked against products with the same or similar medicinal value in the same country.

International Nonproprietary Name (INN): A common, generic name selected by designated experts for the unambiguous identification of a new pharmaceutical substance. The selection process is based on a procedure and guiding principles adopted by the World Health Assembly. INNs are recommended for worldwide use. The system was introduced by WHO in 1950 as a means of identifying each pharmaceutical substance or active pharmaceutical ingredient by a unique name that is universally accessible as public property (non-proprietary). It is often identical to the generic name: e.g., diazepam. A brand name (trade name) should not be derived from the INN name.

Lowest-priced generic equivalent: are defined as the generically equivalent products with the lowest unit price available at each medicine outlet (e.g., health center, private pharmacy) on the day of the survey.

Managed entry agreements" or "risk-share agreements": this involves discounts or rebates granted by manufacturers based on the volume of sales or payment according to health outcomes.

Marketing authorization or Registration: An official document issued by a competent medicine's regulatory authority for the purpose of marketing or free distribution of a product after evaluation for safety, efficacy, and quality.

Mark-up: A certain percentage added to a purchasing price to cover the cost and profit of the distributor, wholesaler, retailer, medical store etc.

Mark-up: A certain percentage added to a purchasing price to cover the cost and

Maximum "ceiling" price: This refers to pricing through tendering and negotiation, which involves setting prices based on the best offer received from tenderers [2].

Median: The median is the value that divides the distribution of data in half. If the observations are arranged in increasing order, the median is the middle observation. The median is a useful descriptive measure if there is an asymmetrical distribution of data or there are one or two extremely high or low values, which would make the mean unrepresentative of the majority of the data.

Medicine outlet: A term sometimes used to describe a shop that is not owned or run by a pharmacist and that has a limited licence. However, in this thesis "medicine outlet" is used more broadly to identify any place in which medicines are sold, including private retail pharmacies, outpatient pharmacies and dispensaries.

Medicine procurement prices: The prices from the private sector e.g., the NGO sector or mission sector is collected and analyzed separately.

Medicine: Any dosage form containing a substance approved for the prevention and treatment of disease. The term "medicine" is increasingly used to distinguish it from a drug as a substance that is misused.

MSH reference prices: MSH issues an annual International Drug Price Indicator Guide (http://erc.msh.org).

Originator brand premium: The difference in price between the originator brand and a generic equivalent (in this case the lowest-priced generic equivalent).

Originator pharmaceutical product/ brand: Original pharmaceutical product that was first authorized for marketing, normally as a patented product, based on the documentation of its efficacy, safety and quality, according to requirements at the time of authorization with a brand name and does not vary from vary from facility to facility.

Other private sector patient prices: This refers to the prices of medicines in health facilities run by NGOs, such as charitable organizations, health facilities run by religious organizations, such as church missions, private hospitals, dispensing doctors, private pharmacy in a public hospital and vertical programs.

Patent: A title granted by public authorities that confers a temporary monopoly for the exploitation of an invention upon the person who reveals it, furnishes a sufficiently clear and full description of it, and claims this monopoly.

Patient co-payments: Payments by patients of a fixed amount per prescribed medicine, even if reimbursed.

Pharmaceutical equivalence: Medicines with identical amounts of the same active ingredient in the same dosage form and route of administration, that meet the standards of strength, quality, purity, and identity.

Pharmaceutical product: Any medicine intended for human use, presented in its finished dosage form that is subject to control by pharmaceutical legislation (registered). A product may be sold under a brand name (e.g., Valium) or under the generic name (e.g., diazepam).

Pooled procurement: Ensures that financial and non-financial resources are pooled to create greater purchasing power and improve efficiency.

Price transparency: Ensures that all relevant stakeholders know the prices of medicines and the way in which they are set.

Pricing: Price is the net transaction prices of cancer medicines between the sellers (e.g., manufacturers, service providers) and the payers/buyers (governments, consumers).

Private sector patient prices: Prices paid by patients in the private sector which includes licensed retail pharmacies prices of medicines.

Procurement efficiency/brand premium: This examines whether procurement prices are comparable amongst other types/brands of the same medicine. Medicine price variations between product types of the same medicine's highest- and lowest-priced product, as well as between the OB and LPG, whereby analysis is limited to those medicines for which both product types were found (matched pair analysis). The difference is expressed as a ratio and a percentage.

Procurement price: The price paid by the government, wholesalers, retailers, and other purchasers to procure medicines. Different prices may be paid for the same product by a public sector purchaser, such as the Ministry of Health, the medicine outlet

that supplies the medicine to the patient, and the individual who purchases the medicine.

Public – Other' patient prices: The expected availability and prices of medicines at each level of care is considered for e.g. inpatient care or tertiary care services within a public hospital.

Public sector patient prices: Public sector patient prices can include prices of medicines paid by patients from government health facilities, where patients receive medicines, such as hospitals and clinics. This focuses on medicines available from the outpatient of the teaching or regional hospitals.

Public sector procurement prices: These are prices that the government pays to procure medicines. The procurement data is collected centrally from the Ministry of Health Procurement Unit (from tender or other documents). For this sector, data is only collected on medicine prices and not availability.

Rebate: Pharmacies may receive a bulk refund from a wholesaler, based on sales of a particular product or total purchases from that wholesaler over a particular period. It does not affect the price the patient pays, but the retailer's profits will be higher.

Reference pricing: This involves setting the price according to the prices in other comparable referenced countries/organizations.

Retail mark-up: A percentage added to the purchasing price to cover the retailer's costs and profit.

Retailer: A company that sells goods to consumers. In the pharmaceutical sector, the retailer is the pharmacy or any other medicine outlet. Many LMICs have at least two different types of shops in which medicines can be purchased, pharmacies with a registered pharmacist and drug stores, chemists or medicine outlets with paramedical staff or lay people.

Standard deviation: The standard deviation measures how spread out a set of data is around the average (mean) value. Normally, about two-thirds of the values in a set of data will fall within one standard deviation above or below the average, and only one in 20 will fall more than two standard deviations above or below the average. When you get a very low standard deviation about the mean it indicates that most of the values are close to the mean (little spread) thus the mean is a good indicator for the sample.

Conversely, when there is a large standard deviation there is a lot of spread and the value of the mean as an indicator is reduced, as a lot of observations are going to be a long way off the mean.

Supplier prices: prices offered by not-for-profit and for-profit suppliers to developing countries for multi-source generically equivalent products. Most supplier prices do not include insurance and transportation charges.

Tax exemptions or reductions: Ensures the removal or reduction of taxes on pharmaceutical products.

Tendering and negotiation: Ensure that prices are set according to the best offer from suppliers.

The availability: of individual medicines is reported as the percentage (%) of medicine outlets in which the medicine was found on the day of data collection.

The mean: is simply the sum of the values divided by the number of values.

The median: is the value that divides the distribution in half. If the observations are arranged in increasing order, the median is the middle observation. The median is a useful descriptive measure if there is an asymmetrical distribution of the data or if there are one or two extremely high or low values, which would make the mean unrepresentative of the majority of the data.

The use of quality-assured generic and biosimilar medicines: Encourages the use of other versions of brand-name products that have the same or similar characteristics as the original product.

Trade-Related Aspects of Intellectual Property Rights (TRIPS): An agreement annexed to the World Trade Organization convention aimed at strengthening and harmonizing aspects of the protection of intellectual property at the global level. It includes trademarks and patents as well as other forms of intellectual property.

Value-based pricing: Considers the medicine's worth compared to existing available treatments for the same conditions. This includes assessing factors such as the number of life years a patient can gain, the extent to which the patient's quality of life will improve, and whether treatment can save the system resources by avoiding hospitalization or longer-term care.

Value-based pricing: This involves setting the price of a medicine based on the differentiated value of the medicine for a group of patients compared to the value of comparable medicines.

Wholesale mark-up: A percentage added to the wholesaler's purchasing price to cover his expenses and profit.

Wholesaler: A company that buys goods from a manufacturer or importer and sells it to retailers. The wholesaler may be an agent for one company only or deal with products from several companies. Manufacturers may also be wholesalers for their own products.