Patients' Beliefs about Medicines, Adherence and Potential Drug-Drug Interactions in Cancer Treatment: A cross-sectional Study at Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia.

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Patients' Beliefs about Medicines, Adherence and Potential Drug-Drug Interactions in Cancer Treatment: ATripartite Study at Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia.

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A Thesis Submitted to the Department of Pharmacology and Toxicology, School of Pharmacy, Mekelle University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Pharmacology and Toxicology.

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Mekelle University, College of Health Sciences, School of Pharmacy Department of Pharmacology and Toxicology research proposal submission form.

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Declaration

I, Tsegay Lemma, hereby declare that the thesis titled ―*Patients' Beliefs about Medicines, Adherence and Potential Drug-Drug Interactions in Cancer Treatment: A Tripartite Study at Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia"* is my original work. It has been carried out under the supervision of Mr. Abera Hadgu, Dr. Desta Mulu and Mr. Meles Tekie, who have provided invaluable support and guidance throughout this research.

I confirm that this work has not been submitted for any other degree or qualification at any other institution. All sources used in the preparation of this thesis have been duly acknowledged, and I take full responsibility for the content of this document.

This research was conducted in compliance with ethical standards and was approved by the Institutional Review Board (IRB) of Mekelle University.

Signature: ----------

Tsegay Lemma (B.Pharm.)

Certificate

This is to certify that the thesis submitted by Tsegay Lemma in partial fulfillment of the requirements for the Degree of Master of Science in Pharmacology entitled ―Patients' Beliefs about Medicines, Adherence and Potential Drug-Drug Interactions in Cancer Treatment: A Tripartite Study at Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia‖. complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Signed by the following examining committee**:**

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List of Acronyms and Abbreviations

5-FU	5-Fluorouracil
ACSH	Ayder Comprehensive Specialized Hospital
ADR	Adverse Drug Reaction
AET	Adjuvant Endocrine Therapy
ANEO	Antineoplastic Oral
AOR	Adjusted Odds Ratio
AUC	Area Under the Curve
BMQ	Beliefs about Medication Questionnaire
DDI	Drug-Drug Interaction
ET	Endocrine Therapy
GH	General Harm (BMQ subscale)
GLOBOCAN	Global Cancer Observatory
GO	General Overuse (BMQ subscale)
IQR	Interquartile Range
IRB	Institutional Review Board
MMAS-8	8-item Morisky Medication Adherence Scale
MTX	Methotrexate
NSCLC	Non-Small Cell Lung Cancer
OR	Odds Ratio
P^{DDI}	Potential Drug-Drug Interaction
QoL	Quality of Life
SC	Specific Concern (BMQ subscale)
SN	Specific Necessity (BMQ subscale)
TDDI	Totally Drug-Drug Interaction
TMMAS	Total MMAS Score
WHO	World Health Organization

Abstract

Background: Patients' beliefs about medications, adherence to therapy, and of drug-drug interactions (DDIs) are critical in optimizing cancer treatment outcomes and ensuring safety. Understanding these factors can enhance adherence and reduce the risks associated with polypharmacy.

Objective: This study assessed beliefs about medicines, medication adherence, and the prevalence of DDIs among cancer chemotherapy patients at Ayder Comprehensive Specialized Hospital in Mekelle, Ethiopia. It also explored factors influencing these outcomes and the relationships between them.

Methods: A cross-sectional study was conducted from March 2024 to March 2025 involving 385 ambulatory cancer patients aged ≥18 years. Participants were randomly selected and evaluated using the Beliefs about Medicines Questionnaire (BMQ) and the 8-item Morisky Medication Adherence Scale (MMAS-8). Data analysis employed SPSS version 26 with descriptive statistics, logistic regression, and Pearson's correlation. Significance was set at $p \leq 0.05$.

Results: The study analyzed data from 385 patients (mean age 45.6 years; 74.3% female). Most were married (60.8%), had no formal education (44.2%), and low monthly income (71.4% earned ≤1500 ETB). Among them, 94.3% had been diagnosed within five years, 90.1% had no comorbidities, and 60% had non-breast cancers. BMQ findings showed that 92.7% believed in the necessity of their medications, but 67.3% had concerns about harm. MMAS-8 results revealed 71.7% adherence, with 94.8% reporting they rarely forget doses. 88.3% of cases of major DDI were those between 5-fluorouracil and leucovorin. Adherence was correlated positively with necessity and negatively with concerns and harm.

Conclusion: The study revealed a high level of perceived necessity and moderate adherence, higher than reported in comparable settings. However, concerns about medication and the high prevalence of DDIs highlight the need for improved patient counseling and medication safety practices.

Keywords: Medication adherence, beliefs, drug-drug interaction, cancer chemotherapy, Ayder Hospital.

Chapter 1: Introduction

1.1. Background

Cancer is a significant public health issue, accounting for one in every six deaths globally. In 2020, approximately 19.3 million new cancer cases and about 10 million cancer deaths were reported globally (Debela *et al.*, 2021). It has been estimated that by 2040, global cancer cases would increase to 26 million, with 15 million people requiring chemotherapy, mainly for lung (16.4%), breast (12.7%), and colorectal cancer (11.1%) (Sritharan Sivalingam, 2021). Cancer is an emerging health challenge in Africa that must be addressed effectively to manage rising incidence and mortality rates, Research suggests that by 2030, there will be a 70% increase in new cancer cases attributed to population growth and aging (Hamdi *et al.*, 2021).

In Ethiopia, cancer accounted for 39,480 deaths across both sexes in 2019, resulting in an age-standardized death rate of 87.5 per 100,000 (Awedew *et al.*, 2022). The five most commonly diagnosed cancers in Ethiopia included leukemia (8,310 cases), cervical cancer (6,570), breast cancer (5,900), colon and rectum cancer (3,200), and stomach cancer (2,580) (Awedew *et al.*, 2022). Patterns of cancer morbidity in the Tigray region. The trend in cancer morbidity rose by 2.6% during 2016-2017, The trend in cancer morbidity rose by 2.6% during 2016-2017 (Kiros Abrham, 2018).

The global cancer (GLOBOCAN) predicts that the number of cancer cases will reach 28.4 million in 2040 (Sung *et al.*, 2021). This increase is attributed to the growing prevalence of risk factors, including smoking, environmental pollution, obesity, unhealthy diet, physical inactivity, infections (hepatitis, helicobacter pylori and human papilloma virus) and use of oral contraceptives (M. Ismail). Cancer patients are frequently exposed to complex medical regimens, chemotherapeutic agents and concomitant medicines for treatment purpose placing them at high risk for drug-drug interactions (DDIs) (Alnaim *et al.*, 2022). The contributing risk factors for DDIs among oncology patients include, comorbidities such as CV disease, arterial hypertension, or diabetes mellitus may often influence the choice of treatment, (Nowakowska, 2020) poly pharmacy, long hospitalizations and advanced age (Alnaim *et al.*, 2022).

The toxic nature of cancer chemotherapy and potential DDIs leads to poor belief towards treatment and adherence medications.

Patients' beliefs about cancer chemotherapy medications are profoundly influenced by a range of factors, including psychological, cultural, and religious dimensions. The distressing side effects of chemotherapy, such as chemotherapy-induced alopecia, can significantly impact a patient's self-identity and social interactions, especially for women, where hair symbolizes femininity and attractiveness (Rosman 2004). Psychological factors such as depression fear of side effects, and stress can deter adherence to treatment, ultimately affecting survival rates and the risk of recurrence (Lin, Clark et al. 2017). Additionally, cultural perceptions play a crucial role; for example, East Asian patients may prioritize family obligations over personal discomfort, leading to different approaches to treatment and health-related quality of life (Tsai, 2016). Furthermore, religious beliefs can provide patients with hope and a sense of community, helping them cope with the emotional burdens of illness (Koenig 2012)). Belief about Medication questionnaires (BMQ) is a tool used to evaluate the beliefs of patients about their medication by addressing general and specific medication beliefs, This tool was validated and used in different languages such as German, Spanish, Danish, Norwegian, Swedish, French, Portuguese, and Maltese (Gatt, West et al. 2017).

Adherence to cancer treatment is critical for achieving optimal health outcomes Such as a cure or an improvement in quality of life. Despite the availability of cancer treatment options, patients are vulnerable to adverse drug reactions for a variety of reasons, including poor drug adherence and clinical conditions (Bekalu *et al.*, 2023). In patients with cancer, the social and cultural characteristics of the disease can differently impact on the barriers and facilitators of adherence to Antineoplastic oral (ANEO) (Talens *et al.*, 2021). Chemotherapy adherence is a joint effort and understanding between health workers and clients regarding the level of conformity in day-to-day treatment concerning the amount and frequency of treatment, including therapy duration and discontinuation of drug treatment when needed (S. Ademe *et al.*, 2024).

According to the World Health Organization (WHO), the implementation/medication possession ratio of more than 80% of the prescribed medicines and the persistence of the therapeutic regimen for the complete course, as recommended by the clinicians, are recognized as medication adherence (Reshma *et al.*, 2024). Adherence to cancer treatment is critical for achieving optimal health outcomes such as a cure or an improvement in quality of life (Bekalu *et al.*, 2023). Adherence to medication is a crucial part of patient

care and indispensable for reaching clinical goals. The WHO, in its 2003 report on medication adherence, states that ―increasing the effectiveness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatment (Lam Fresco, 2015).

Patients' levels of medication adherence can be assessed through various methods, which can be categorized as subjective or objective, and as direct or indirect. Subjective measures include self-report questionnaires such as the Morisky Medication Adherence Scale (MMAS), the Medication Adherence Questionnaire, the Medication Adherence Report Scale, and the Patient Activation Measure. These subjective measures, often utilized in cross-sectional studies, rely on patients' self-reports, making them less reliable and more susceptible to bias compared to objective methods ((Meadows and Davey 2022), (Lam and Fresco 2015)). Objective methods, on the other hand, encompass electronic monitoring devices, pill counts, and biochemical markers ((Lam and Fresco 2015), (De las Cuevas and Penate 2015)). Among these, the MMAS-8 has been shown to be a valid and reliable tool for measuring adherence across various patient populations, including those with heart failure, diabetes, asthma, hypertension, renal disease, and obesity (De las Cuevas and Penate 2015).

Measuring adherence is, therefore, important to both researchers and clinicians. Inaccurate estimation of medication adherence can lead to several problems which are potentially costly and dangerous in both settings.

Chemotherapy adherence is strongly related to patient related factors, therapy-related factors, condition-related factors, healthcare system factors, and socioeconomic factors (Bekalu *et al.*, 2023).Patient-related factors such as age, attitudes or beliefs about chemotherapy, mental health status, disease-related factors such as comorbidities and cancer stages, treatment-related factors such as unwanted side effects and toxicities, and other factors such as relationships with clinicians and medication costs are associated with poor adherence.

Drug-drug interactions (DDIs) are defined as the combination of two or more drugs that leads to a modification of the potency or efficacy of one drug due to the presence of another ((Magro, Moretti et al. 2012), (Riechelmann and Del Giglio 2009)). DDIs can be classified into pharmaceutical, pharmacokinetic, or pharmacodynamics interactions based on their mechanisms ((Blower, De Wit et al.

2005), (Magro, Moretti et al. 2012)).

These interactions can also be categorized by severity: mild, moderate, or severe. Major DDIs may be life-threatening or cause prolonged or permanent damage, while moderate DDIs may necessitate medical intervention or a change in therapy. In contrast, minor DDIs typically do not require adjustments in treatment. Regardless of severity, patients should be monitored for possible manifestations of these interactions (Varma, Pang et al. 2015).

Although the addition of medications is often clinically significant and aimed at improving patient health, polypharmacy can increase the risk of potential DDIs and drug-disease interactions (Hines and Murphy 2011)Factors such as old age and comorbidities also contribute to the risk of potential drug-drug interactions (Conde-Estévez, Henríquez et al. 2022).

Physician and pharmacist alert fatigue is a common reason for the occurrence of DDIs in patients receiving interacting drugs. While computerized DDI alert systems can reduce the incidence of DDIs, the high volume of alerts can lead to alert fatigue, resulting in a significant number of overrides. A study conducted in Japan found that physicians frequently ignored DDI alerts generated by computerized systems (Nasuhara, Sakushima et al. 2015). DDIs are assessed using various databases such as Lexicomp, Medscape, and physiologically-based pharmacokinetic modeling. However, tools like Micromedex are often underutilized in resource-limited settings, such as Ethiopia, due to subscription fees. In contrast, the free online database DDinter, utilized in this study, provides a valuable alternative (Xiong, Yang et al. 2022).

Finally, the relationship between patient's belief, medication adherence and potential drug-drug interactions (PDDIs) in cancer chemotherapy patients remains inadequately explored.

1.2. Statement of Problem

Adherence to cancer chemotherapy is critically influenced by patients' beliefs about their illness and treatment. Cancer, defined as the growth and propagation of uncontrolled abnormal cells, poses significant challenges to patients, especially regarding adherence to prescribed therapies (Ademe, Mohammed et al. 2024). Despite the effectiveness of chemotherapy in targeting rapidly growing cells, adherence rates remain low, with studies indicating only 42.3% adherence among cancer patients in Ethiopia (Bekalu *et al.*, 2023). This non-adherence is often linked to multidimensional issues, such as physical side effects, psychological distress, and cultural beliefs that may frame illness as a spiritual affliction (Mekonnen *et al.*, 2022).

Patients' beliefs about medications significantly impact their treatment decisions, adherence, and overall outcomes. Research shows that fear of side effects, particularly alopecia, leads some patients to refuse treatment altogether, with reports indicating up to 14% of patients make this choice due to anxiety surrounding hair loss (Malhotra *et al.*, 2024). Furthermore, beliefs regarding the nature of medications, their potential for harm or benefit, and concerns about their overuse by healthcare providers can create barriers to adherence (Grassi *et al.*, 2017). As such, understanding the prevalence of these beliefs and their impact on adherence is essential for developing effective interventions to improve adherence rates and enhance patient outcomes in cancer care.

Drug-drug interactions (DDIs) are a significant cause of morbidity and mortality in cancer patients, leading to adverse clinical events that may reduce or inactivate the therapeutic effects of medications, enhance toxicity, and compromise treatment outcomes and adherence (Rawal *et al.*, 2023; Riechelmann Del Giglio, 2009). Cancer patients often require multiple medications to manage both their malignancies and comorbid conditions, rendering them particularly vulnerable to interactions due to the potent and toxic nature of many anticancer drugs, which typically have a narrow therapeutic index (K. M. Venkatesh *et al.*, 2021). Studies in Brazil and Spain have shown that cancer patients are at increased risk for clinically relevant drug interactions stemming from polypharmacy, potentially leading to higher mortality rates, especially among the elderly (Rawal *et al.*, 2023). The complexity of cancer treatment protocols, particularly with the integration of targeted therapies and immunotherapies, further amplifies the risk of DDIs, which can undermine the efficacy of primary anticancer agents while exacerbating side effects,

Ultimately diminishing patients' quality of life. A study conducted in Adigrat, Northern Ethiopia, revealed a prevalence of potential drug-drug interactions (pDDIs) of 68.5% (Hailesilase *et al.*, 2024), while another study in Northwest Ethiopia found that 304 out of 422 patients (72.1%) were exposed to at least one pDDI (Mekonnen *et al.*, 2022). These findings underscore the urgent need for improved management strategies in cancer care, motivating further research on the prevalence of potentially harmful drug interactions in Mekelle, Tigray, Ethiopia. This study aims to develop more effective therapeutic guidelines that enhance patient safety and treatment outcomes, The researcher was eager to evaluate the prevalence of patients' beliefs and adherence to cancer chemotherapy, as well as the drug- drug interactions (DDIs) and the factors affecting these aspects.

1.3. Significance of the Study

Like other chronic illnesses Diabetes, tuberculosis and HIV/AIDs, which is already known, but even cancer patient goes through long treatment specially breast cancer patients also go a long-term oral hormonal therapy for five to ten years. However, the issue of adherence rate is under question yet neglected, even though it has been surrounded by many factors like socio-economic, treatment related, illness related, patient related and system related. Unlike other chronic disease, adherence level will be affected since anticancer drugs special the hormonal adjuvant hormonal therapy do have a marked side effects such as hair lose in women's (Alopecia) &neuropathic pain in anticancer drug taking patients, Therefore, causing non- adherence, as they are forced to withdraw the treatments, so, understanding adherence to is very important in routine clinical settings because it will not easy for close monitoring of the patient since they took the medication at home.

Moreover, the result of this study could be used as a base line data to other like researchers and voluntary institutions who are interested in studying this topic. Lastly, it would also assist policy makers to develop context specific and relevant policies to address factors most influential at low levels of adherence and assist in developing adherence counseling manual for breast cancer.

Even although the potential anticancer drug –drug interactions have many effects oncological patient ,such as orange toxicities, an additional burden of costs, long staying in hospitals, but as the researcher observed and tried to assess articles or researches done on this title, he found only one research being conducted in

Ethiopia the past 5 years back ,even though there many cancer center hospitals , As I have seen in many researched paper's outside Ethiopia ,there is a neglected issues of checking the prescribe drugs online software for adverse drug-drug interactions and it also being practiced in Ethiopia and in Tigray -Mekelle, so there could be high possibilities for drug -drug interaction & every time anew anticancer are being entered to the market so it is interesting to be conducted a researched for anticancer drug –drug interaction, and beside these ,the researcher thought, this could have an important input start for health researcher professional academician's and policy makers.

Chapter 2: Literature Reviews

2.1. Patients Belief and Adherence

A study conducted in China examined adherence to oral endocrine therapy in breast cancer treatment, utilizing the Morisky Medication Adherence Scale (MMAS). This study employed a cross-sectional survey design and included 1,875 breast cancer patients who were followed up via telephone interviews. Among the 888 patients who commenced adjuvant endocrine therapy, 769 (86.6%) adhered to their medication, while 119 (13.4%) did not (Xu *et al.*, 2020).

Two studies investigating medication adherence (MMAS-8) and beliefs (BMQ-18) among women with breast cancer were conducted using a cross-sectional design in Iraq. The study included 124 women with breast cancer recruited from the Middle Euphrates Cancer Center in Iraq. The results indicated that 25% of women were fully adherent according to the MMAS-8 (Sutton *et al.*, 2020).

A retrospective cross-sectional study in the United States utilized Medical Expenditure Panel Survey (MEPS) data collected between 2011 and 2015. This study aimed to assess adherence to hormonal therapy among breast cancer patients receiving Tamoxifen and aromatase inhibitors. Among the 354 breast cancer patients receiving hormonal therapy, 194 (54.8%) adhered to their treatment, while 160 (45.2%) did not.

Another observational cross-sectional study at the University Hospital Centre Zagreb investigated patients' beliefs regarding adjuvant endocrine therapy (AET) as well as their association with non-adherence and socio-demographic and clinical factors. Out of 420 early breast cancer (BC) patients included in the study, 79.5% perceived AET as necessary and important for their health, as measured by the Beliefs About Medicines Questionnaire (BMQ), with the mean necessity score (20.4 ± 3.68) significantly higher than the mean concerns score (13 ± 4.81) ($p < 0.001$ (Tan *et al.*, 2021).

Another study was conducted in Africa, Egypt, A descriptive design was used to assess medication adherence on sample of 60 women diagnosed with breast cancer and treated with hormonal therapy, and less than two-thirds of the women studied had an unsatisfactory level of knowledge regarding breast cancer and hormonal therapy. Fewer than half exhibited a high level of adherence (Refaat Elmaadawy *et al.*, 2022). A study conducted in Ethiopia, specifically at Black Lion Hospital assessed the level of

adherence to adjuvant hormonal therapy and associated factors among women with breast cancer, based on a selected sample of 216 participants using Morisky Medication Adherence Scale (MMAS-8) and the result was out of 216, 209 women with breast cancer participated in the study with response rate of 97%. The adherence levels were reported as 41%, 33%, and 26% for low, medium, and high adherence, respectively (Wako *et al.*, 2021)). A similar study conducted at Tikur Anbessa Specialized and Teaching Hospital, Addis Ababa, Ethiopia, A Cross-sectional study was conducted among 164 breast cancer patients with chemotherapy, The present study the results showed that the majority 137, (83.5%) of patients were in good adherence to their chemotherapy (F. Hassen *et al.*, 2022)),,another study was conducted on A hospital-based prospective cross-sectional study design was employed, and a total of 460 cancer patients were enrolled using a systematic random sampling method at Felege Hiwot and Dessie comprehensive specialized hospitals from May 15, 2022, to July 15, 2022, in the Amhara region, The overall response rate in this study was 94.1% (433), with 42.3% of patients adhering to chemotherapy(Bekalu *et al.*, 2023). Another study was also conducted on Women with Breast Cancer Attending the Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia, A Cross-sectional Study was conducted, and the result was Out of 216 women with breast cancer 209 participated in the study with a response rate of 97%. The overall adherence in this study was 77.5 % (Adherence to Adjuvant Hormonal Therapy Study).

2.1.1. Factor Associated with Adherence

A retrospective cohorts study was conducted on Sweden To determine compliance to adjuvant ET and the impact on survival in a population-based series of patients with early breast cancer (BC) advised ET& the result was 1090 consecutive patients with hormone receptor positive (HR+) stage I-III BC diagnosed from 1 January 1997 to 31 December 2003, reason for termination and outcome, 72 patients were excluded leaving 1018 patients with a HR+ stage I to III BC for analyses. The most common ET was tamoxifen (n = 751, 73.8%). At the last follow up (31 Dec 2019) with a median follow-up of 18 years (interquartile range 16–22) 228 (22.4%) patients had a relapse. 71.1% of the included patients were compliant to endocrine therapy. Older patient's ≥74 years had lower compliance (Chamalidou *et al.*, 2023). Another study was done to examine adherence to adjuvant hormone therapy and related factors among women with breast cancer attending the Tikur Anbessa Specialized Hospital Oncology Center from 216 selected participants, 209 were involved in the study with a response rate of 97%. Of 209, 88 (42.1%) were in

the age group 45–65 years, 121 (57.9%) were from urban, 103 (49.3%) were high school and above, 154 (73.7%) of the participant were married ((Tilahun *et al.*, 2023), another study was done on A retrospective cross-sectional study was conducted at the Oncology Unit of the University of Gondar Comprehensive Specialized Hospital aimed to assess the drug-related problems among patients with breast cancer The mean age of the study participants was 44.53_12.53 years. More than half of the patients were in the age group of 36–55 years. The female to male ratio was found to be 10:1. About 69% of patients were married, and 65% of the study participants could not read and write. Occupationally, more than 35% of the study participants were unemployed, while about 9% of the patients were government employees (Degu Kebede, 2021).

Another study was also conducted on Patients diagnosed with breast cancer have psychological or emotional concerns about altered body image, self-esteem, Issues with fertility and sexuality. Diagnosis is also associated with shock, unknown outcomes of disease, death, creating a sense of sadness, anxiety and depression (Kudjawu Agyeman- Yeboah, 2021).Another study done on America, White women and women over 50 years of age were more likely to be adherent compared with women who were Black and 50 years old and younger (69.4% vs. 51.9%; $P < 0.001$ and 68.9% vs. 49.2%; $P < 0.001$, respectively (Sheppard *et al.*, 2021).

The study population was generally healthy with hypertension being the most common 9.5% of patients reporting a history of smoking. Baseline population characteristics (Sella Chodick, 2020). Out of 216 women with breast cancer 209 participated in the study with a response rate of 97%. The overall adherence in this study was 77.5%. Getting social support (Tilahun *et al.*, 2023).

Among the respondent, 190(90.9%) has no family history, 92(44%) with stage 3 at diagnosis, 143(68.4%) were post-menopause women, 186(89.0%) with unknown receptor status, A respondent who received chemotherapy, surgery and radiotherapy were 194(92.8%), 188(90.0%) and 51 (28.2%) respectively, 189 (90.4%) undergone mastectomy, 159 (76.1%) have no comorbidity ((A. M. Hassen *et al.*, 2019).

Another study was done to examine adherence to adjuvant hormone therapy and related factors among women with breast cancer attending the Tikur Anbessa Specialized Hospital Oncology Center

From 216 selected participants, 209 of 209, 190 (90.9%) had no family history, 187 (89.5%) were ductal Carcinoma, 151 (72.2%) with advanced stage, 143 (68.4%) were postmenopausal women, 186 (89.0%) with unknown receptor status, 205 (98.1%) were with one breast unilateral, respondents who received chemotherapy, surgery and radiotherapy were 194 (92.8%), 188 (90.0%) and 51 (28.2%), Respectively, 189 (90.4%) undergoing mastectomy, 159 (76.1%) have no comorbidity, Among 50 (23.9%) those who had comorbidity; 24 (48%) were diabetic, 12 (24%) were HIV/AIDS, 8 (16%) had a heart problem and 6 (12%) had a respiratory problem (Tilahun *et al.*, 2023).

The two highly prevalent adverse effects identified among patients were nausea and vomiting. The former occurred in 48 (44.9%) patients while the latter affected 39 (36.4%) of the patients. Fourteen (13.1%) patients experienced alopecia, while 20 (18.7%) patients complained of neuropathic pain due to adverse effects of medications. Nonetheless, anemia was found to be the least (2.8%) commonly occurring type of ADR being identified in our setting (Degu Kebede, 2021).

Research was done on Sweden; a lower discontinuation rate of 20–40% for ET tamoxifen was due to its side effects are reported from clinical trials, the reasons for termination of ET include hot flushes, musculoskeletal symptoms, vaginal dryness, osteoporosis, fear for an increased risk for endometrial cancer and cardiovascular events(Chamalidou *et al.*, 2023).A study done in China on literature review, physical appearance and menopausal symptoms (e.g., weight gain, hair loss, body image, hot flashes, and vaginal dryness), changed women sense of identity. Secondly, daily functioning (e.g., pain, fatigue, sleep difficulties, sexual functioning) led to poor memory, poor concentration at work, sweating interfering with sleep, and not having enough energy to participate in life and work. Thirdly, emotional well-being (e.g., mood fluctuations, depressed mood, anxiety), 2 women experiencing severe depression and suicidal thoughts, Survivors suffered from these symptoms and were unable to tell friends or families about it because they may not be able to understand the pain that survivors experience ((Long *et al.*, 2023).

According to a previous qualitative study done in southwest Ethiopia, misdiagnosis of BC, long distance to referral facilities, high cost of diagnostic services, long waiting time for diagnostic tests, and lack of screening and diagnostic tests in local facilities were identified as health-system-related barriers for late diagnosis of BC (Getachew *et al.*, 2020).

The mean walking time to the next health center (nurse available) was about 1.1 h (range 0.1–3) and travel to Aria hospital (physicians available) required 6.1 h (range 0.1–24) ((Reibold *et al.*, 2021). The financial constraints 4, (14.8%), security or distance from cancer referral center, 3, (11.1%) were also identified as factors for non-adherence (F. Hassen *et al.*, 2022) Most (65.0%) women did not report any non-adherent behaviors. For the remaining women, 22.2% reported one non-adherent behavior, 11.2% reported two non-adherent behaviors, and 1.6% reported three non-adherent behaviors. The most common non-adherent behavior was due to forgetting to take medications (26.4%) followed by missing their medications for reasons other than forgetting (17, 3%). It was uncommon for women to cite non-adherence due to feeling worse after taking their medication (5.4%) (Reibold *et al.*, 2021; Sheppard *et al.*, 2021).

2.2. Drug-Drug Interactions

Several studies have investigated the prevalence of potential drug-drug interactions (DDIs) among cancer patients across various regions, including Turkey, India, the United States, Pakistan, and several African countries. In Turkey, a study conducted in the Department of Medical Oncology in Istanbul assessed DDIs among 179 adult oncology patients using the Micromedex online drug interaction checker. This research evaluated a total of 1,671 drugs, including 303 chemotherapeutic agents, and identified 374 interactions, with 203 classified as significant. Interactions were reported in 118 patients (65.9%), averaging 3.2 interactions per patient. Notably, 46 major interactions involved anticancer agents, primarily cyclophosphamide (n=13) and cisplatin (n=12) (Umar *et al.*, 2023).

In India, a study conducted in Bangalore focused on the incidence, patterns, and severity of potential DDIs among 150 cancer inpatients, utilizing Micromedex software. This study identified 360 potential DDIs in 111 patients (74%), predominantly affecting females (67.33%) and breast cancer patients (30%). The findings indicated that severe interactions comprised 63.88%, while moderate and mild interactions accounted for 35.83% and 0.27%, respectively. The potential mechanisms of these DDIs included 38.33% pharmacodynamics, 48.33% pharmacokinetics, and 13.33% unspecified (HV *et al.*, 2023)..

In the United States, another study examined the association between polypharmacy, potential DDIs, and adverse treatment outcomes in older adults with advanced cancer. The mean age of the patients was 77 years, with 57% having lung or gastrointestinal cancers. On average, patients were taking five medications

(Ranging from 0 to 24), with 28% on eight or more. The study reported that 67% of patients received one or more potentially inappropriate medications (PIMs), and 25% had one or more major DDIs. Notably, the mean number of grades ≥2 toxicities was higher in patients with polypharmacy (9.8) compared to those without (7.7) (Mohamed *et al.*, 2023).

Research conducted in Pakistan found potential DDIs in 96% of patient prescriptions, with 31.3% of patients experiencing at least three interactions (Bibi *et al.*, 2021). In Uganda, a cross-sectional study among 300 cancer patients receiving chemotherapy at Mbarara Regional Referral Hospital revealed that 181 patients experienced 495 clinically significant DDIs, resulting in a prevalence of 60.3% (95% CI: 55.0-66.0%). The most commonly diagnosed category in this study was digestive organ neoplasms, representing 26.7% of cases (Luzze *et al.*, 2022). A study in Sudan, conducted at Khartoum Oncology Hospital, assessed DDIs between chemotherapeutic agents and chronically used medications. Among 117 patients, 20.5% experienced DDIs, which represented 8% of total DDIs identified. Most interactions (76%) were pharmacodynamics, with 92% classified as moderate severity. The most common interactions involved antihypertensive medications and paclitaxel (Osman *et al.*, 2020).

Lastly, an institutional-based study in Northwest Ethiopia found the prevalence of 72.1% (95% CI: 68% to 76%) potential DDI using three databases: Drugs.com, Medscape, and Lexicomp. The study found that patients aged 50 years and older and those with polypharmacy and comorbidities were also at a higher risk of DDI (Wondm *et al.*, 2023). The Prevalence of Drug-Drug Interaction and Associated Factors

A comprehensive analysis of drug-drug interactions (DDIs) among cancer patients reveals significant concerns, particularly among the elderly population. In a study involving 678 patients, 358 (52.8%) were male and 320 (47.2%) were female, with the majority falling within the age range of 41–60 years (29.5%), followed closely by those aged 21–40 years (26.4%) (Ismail, Khan et al., 2020). Geriatric cancer patients are particularly vulnerable to DDIs largely due to polypharmacy. One study found that DDIs were identified in an alarming 97.6% of elderly cancer patients, with 89% having at least one DDI involving antineoplastic medications. The maximum number of DDIs recorded for a single patient was 12 (S. K. Ramasubbu *et al.*, 2021).

Further research highlighted that nearly all older cancer patients were on long-term medications prior to initiating cancer therapy, with an average of five medications per patient. Commonly used drug classes included antithrombotic agents, medications affecting the renin-angiotensin system, and diuretics. Over half of the patients were classified as having polymedication (taking five or more drugs), with approximately 10% exposed to hyperpolymedication (ten or more drugs). Additionally, a significant portion of patients was on potentially inappropriate medications prior to cancer treatment, with about one-third exhibiting relevant potential drug-drug interactions (pDDIs) in their long-term medication regimens (Ortland *et al.*, 2022).

Another study focusing on older patients with multimorbidity and polypharmacy found a high prevalence of clinically significant DDIs, estimated at 54% upon hospital admission. Patients with specific medical conditions—such as depression, coronary artery disease, heart failure, atrial fibrillation, and chronic obstructive pulmonary disease (COPD), were more likely to experience at least one DDI (Zerah *et al.*, 2021). In Croatia, research revealed a significant association between age and concerns related to medication beliefs, indicating that younger patients (< 50 years) had greater concerns about their anti-cancer therapy (AET) compared to older patients (≥ 65 years) (Dugonjić Okroša, Silovski et al., 2023).

Research has highlighted specific drug combinations that are frequently implicated in drug-drug interactions (DDIs) among cancer patients, which can significantly affect treatment efficacy and safety. Notable examples include combinations such as Paracetamol/Ondansetron, Cyclophosphamide/Ondansetron, Doxorubicin/Cyclophosphamide, Metformin/Dexamethasone, and Dexamethasone/Aspirin, with mechanisms ranging from altered drug metabolism to reduced therapeutic effects (A. A. Koni *et al.*, 2022). A study conducted in China from June to December 2016 identified 6,578 patients who were simultaneously receiving at least one anti-cancer drug and one non-anti-cancer drug. Among these, 1,379 DDIs (69.68%) were attributed to the combination of cisplatin and furosemide, marking it as the most significant interaction identified (Weilan *et al.*, 2019).

In a cohort study in the United States involving 718 patients aged 70 and older with advanced cancer, the mean age was 77 years, and 57% of participants had lung or gastrointestinal cancers. This study revealed that patients averaged five medications, with 28% taking eight or more. Additionally, 67% received one

Or more potentially inappropriate medications (PIMs), and 25% had major potential drug interactions (PDIs). Notably, the mean number of grades ≥2 toxicities was higher in patients with polypharmacy (9.8) compared to those without (7.7) (Mohamed *et al.*, 2023). At Nanjing Medical University, research emphasized the importance of monitoring DDIs due to the narrow therapeutic windows of many antitumor agents, including taxanes, cyclophosphamide, and anthracyclines, which are associated with adverse reactions such as hepatotoxicity, nephrotoxicity, and bone marrow suppression (Li *et al.*, 2024). Another cross-sectional study in South India assessed potential DDIs among cancer patients receiving chemotherapy over six months, identifying a total of 895 DDIs, including 261 linked to chemotherapeutic drugs. Cyclophosphamide was involved in 14.18% of interactions with Ondansetron (K. Venkatesh *et al.*, 2021).

Further investigations into the interactions of 257 antineoplastic and supportive care drugs with direct oral anticoagulants (DOACs), warfarin, enoxaparin, and fondaparinux categorized these interactions by clinical significance, revealing a spectrum from negligible to potentially significant (Peixoto de Miranda *et al.*, 2020). A separate study involving 13,917 patients at two tertiary care hospitals in China identified 297 clinically significant hazardous DDIs; with proton pump inhibitors (PPIs), dexamethasone, and fluoroquinolones frequently involved. Notably, the concurrent use of certain molecular targeted agents with PPIs was highlighted as a prevalent contraindication. Multivariate analysis indicated that younger patients, those using multiple medications, and those treated with targeted therapies were at higher risk for DDIs (Wang *et al.*, 2022).

Among 100 study participants, 65% had drug-drug interactions (DDIs) in their prescriptions. The majority of patients had a history of comorbidities, and 53.85% were employed during the study period. Diabetes mellitus was identified as the most common comorbidity present alongside cancer in groups, those with DDIs and those without (Sankar, Parthasarathy et al., 2019). A strong understanding of drug-drug interactions (DDIs) is crucial for reducing the adverse clinical outcomes associated with DDI-related morbidity and healthcare costs. However, healthcare professionals—including physicians, pharmacists, and nurses—in the present study exhibited low scores in DDI knowledge (Endale *et al.*).

2.3. Research Gap

Our search highlights significant gaps in the understanding of beliefs regarding anticancer drugs, particularly as no studies have utilized the Belief Medication Questionnaire (BMQ-18) in this context. This work is particularly novel in Ayder, Mekelle, where such research has not previously been conducted. Additionally, the methodology for assessing adherence, using the Morisky Medication Adherence Scale (MMAS-8), was adapted from chronic diseases like hypertension and diabetes, reflecting a new contextual application. We also employed the DDInter.com database software to explore drug-drug interactions (DDI), marking a fresh approach in this local setting.

2.4. Conceptual Framework

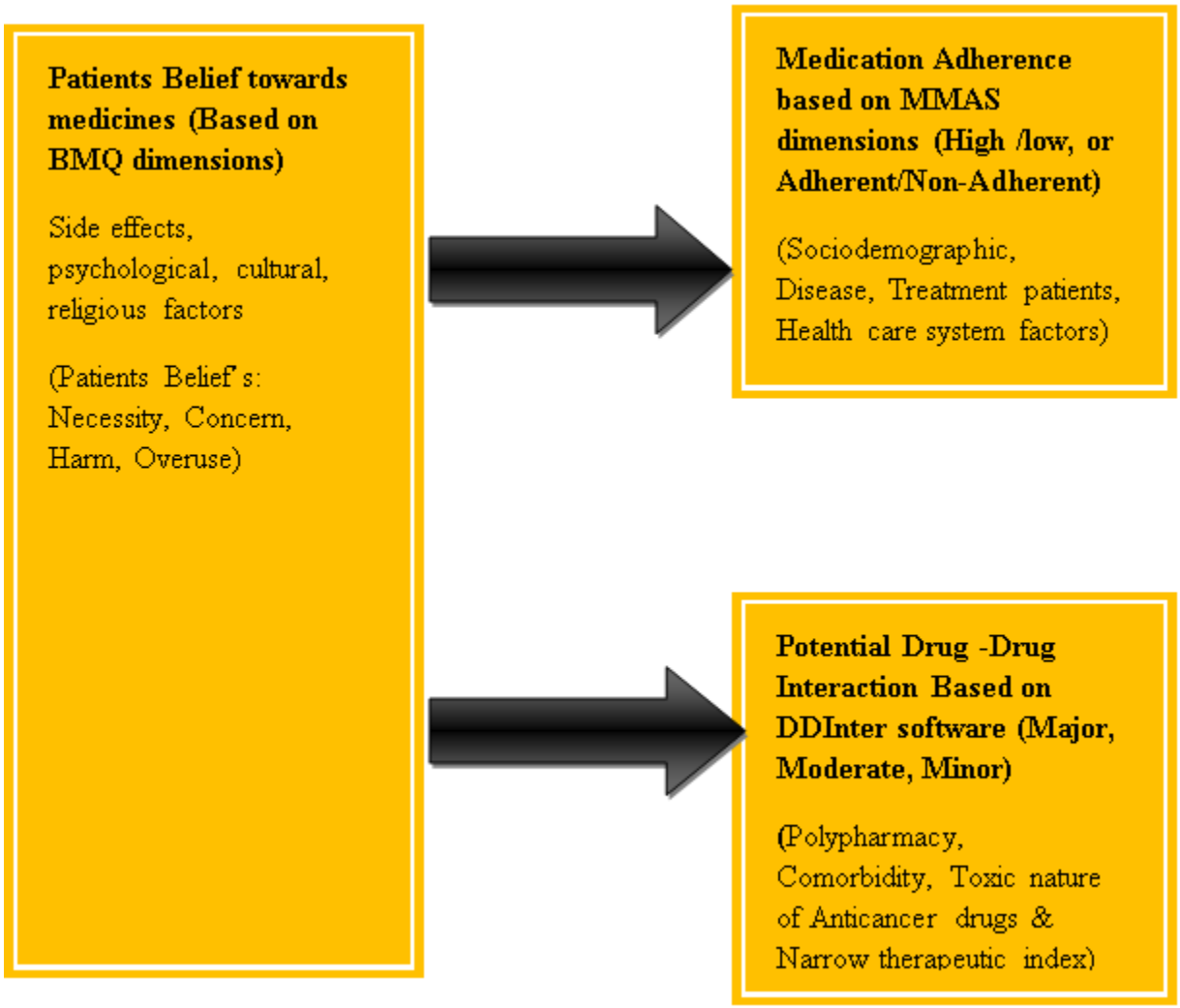

Figure 1. Schematic representation of the conceptual framework of the study.

Chapter 3: Study Objectives and Research Questions

3.1. Study Objectives

3.1.1. General Objective

To assess cancer patients' beliefs about medicines, medication adherence, potential drug-drug interactions, and the factors affecting these at Ayder Comprehensive Specialized Hospital Oncology Clinics

3.1.2. Specific Objectives

- To assess the prevailing beliefs regarding cancer medications among patients.
- To determine the adherence rates among cancer patients and identify factors influencing adherence.
- To determine the prevalence of potential drug-drug interactions in cancer treatment prescriptions and identify factors influencing these interactions.
- To integrate the relationships between patient beliefs, adherence, and drug-drug interactions.

3.2. Research Questions

- What beliefs and perceptions do cancer patients have regarding chemotherapy treatments?
- What factors influence patients' beliefs about cancer chemotherapy?
- What are the levels of medication adherence among cancer patients undergoing chemotherapy?
- What factors affect adherence to cancer chemotherapy treatments?
- What are most common drug-drug interactions associated with cancer chemotherapy regimens?
- What factors contribute to the risk of drug-drug interactions among cancer patients?

Chapter 4: Methodology

4.1. Study Area and Period

The study was conducted from March, 2024 to March 15, 2025 at ACSH oncology clinic in Mekelle. The hospital is located in the Tigray Regional state Mekelle city, Ethiopia. It is located around 780 kilometers north of the capital Addis Ababa. ACSH commenced rendering its referral and non-referral services in 2008 to the 8 million populations in its catchment areas of the Tigray, Afar and South-eastern parts of the Amhara Regional States. It provides a broad range of medical services to both in and out patients of all age groups. As such, the Hospital can be designated as the most advanced medical facility by all accounts in the Northern part of the country and that it stands as the second largest hospital in the nation with the total capacity of about 500 inpatient beds in four major departments and other specialty units, ACSH is also used as a teaching hospital for the College of Health Sciences, Mekelle University. (Gebretsadik *et al.*, 2017). The hospital provides follow up care for chronic diseases; tuberculosis, psychiatry, cardiovascular, HIV and oncology. Here in Ayder there are four oncology wards, namely OPD, and inpatient adult oncology wards, pediatric and gynecology-oncology wards. The present study was conducted in the outpatient oncology unit.

4.2. The Study Design

An institution-based cross-sectional study design was employed

4.3. Population

4.3.1. Source Population

All Cancer patients receiving chemotherapy and follow-up care at ACSH oncology outpatient's unit.

4.3.2. Study Population

For the Belief and Adherence study, we included all cancer patients who had follow-up appointment during the data collection phase & for the Drug-Drug Interactions (DDI) study, our analysis included cancer patients with accessible prescription data.

4.4. Eligibility Criteria

Inclusion Criteria: All ambulatory patients aged above 18 years diagnosed with any type of cancer and at least on follow up for 3 months.

Exclusion Criteria: Patients unable to communicate due to serious illness or any cognitive derangement, admitted patients.

4.5. Sample Size and Sampling Procedures

4.5.1. Sample Size Determination

For Belief, Adherence and DDI the sample size was the same (i.e. drugs prescribed for those participated in the belief and adherence survey will be checked for potential DDI). The sample size was determined by using single population proportion formula n=z2Pq/d2. Z-Score (for 95% confidence): 1.96., P=proportion, d= marginal error= 5% (0.05); q=p-1. Assuming 50% of non-adherence rate (p): 50%. The total sample size will be 384.16 (n = (1.96)2(0.50) (0.50)/ (0.05)2. n=384.16), so sample size should be 385.

4.5.2. Sampling Procedure

A simple random sampling method was employed to select study participant. From the records of the patients this method involves selecting individuals who are easily accessible or readily available to the researcher. The patients were approached for consent to participate in the study during their appointment until the desired final sample size was reached.

4.6. Study Variables

4.6.1. Dependent Variables

- Patient Belief
- Adherence,
- Drug-drug interaction,

4.6.2. Independent Variables

Socio-demographic factors (age sex, religion, educational status, household income) comorbidity, number of medications, stages of cancer, type of cancer, time since diagnosis.

4.7. Data Collection Tools and Techniques

For three of the studies, there were three different data collection tools, for patient's Belief; we used Belief about Medicine Questioners (BMQ), for adherence Morisky Medicine's Adherence Scales (MMAS8) tool & for checking Drug-Drug interactions, DDInter data base software.

4.7.1. The Beliefs about Medicines Questionnaire (BMQ)

The Beliefs about Medicines Questionnaire (BMQ) is a self-administered questionnaire, which assesses cognitive representations of medication. It includes two distinct versions: the BMQ-Specific, a 10-item questionnaire with Specific-Necessity and Specific-Concern subscales, and the BMQ-General, an 8-item questionnaire featuring General-Harm and General-Overuse subscales. The Specific-Necessity subscale assesses patients' beliefs about the importance of prescribed medications for their health, while the Specific-Concern subscale addresses worry about potential adverse effects. Conversely, the General-Harm subscale evaluates concerns about the potential dangers of medications, and the General-Overuse subscale highlights issues related to medication overuse by healthcare providers. Responses are measured on a 5-point Likert scale, with higher scores indicating stronger beliefs in the concepts represented by the subscales. Total scores for the necessity and concerns subscales range from 5 to 25, while the General-Harm and General-Overuse subscales score from 4 to 20, for specific Necessity & concern mean below 12.5 is low and above High and for General Overuse &Harm mean below 10 is low and above 1o is High, The BMQ can be used in both combined and separate formats, with individual item scores summed to reflect patient beliefs (Dugonjić Okroša *et al.*, 2023; Gebretsadik *et al.*, 2017).

About Necessity Concan Deffendall: - The Necessity-Concern Differential (NCD) score is determined by subtracting the patient's Concern score from their Necessity score. The higher their NCD scores, the stronger this relationship will be. The necessity and concern frameworks were then further analyzed using the subscale mid-point of 15 to differentiate between high- and low-scoring respondents. This generated four different attitudinal constructs according to the combination of high or low Concern and Necessity scores: low Concern and high Necessity (In-favor) construct; high Concern and low Necessity (Distrustful) construct; low Concern and low Necessity (Indifferent), Construct; and high Concern and high Necessity (Mixed-feelings) construct (Lee, 2022).

4.7.2. The Morisky Medicine's Adherence Scales (MMAS8)

This modified MMAS8 scale demonstrate strong psychometric properties with good specificity and sensitivity compared to the original scale four item scale. This version expanded on the original four items and included a total of eight items. The first seven items had dichotomous response categories (yes or no), while the eighth item utilized a five-point Likert response. The scale consists of 8 items, with items 1 to 7 being dichotomous, with yes scored 0 and no scored 1; question 5 is reverse scored. Item 8 was a 5-point Likert scale, with scores of 0.00, 0.25, 0.50, 0.75 and 1.00 for "always‖, ―Often", "sometimes", "hardly ever", and "never", respectively. The sum of the scores for each item is the total score. A score of under 6 is considered low adherence, 6 or 7 is moderate, and 8 is considered high (Ling, 2025). These data collection tools will be translated into local language Tigrigna then will be back translated to English to see for consistency. The Survey has three sections including

i. Socio-demographic Section Clinical characteristics
ii. The Beliefs about Medicines Questionnaire (BMQ)
iii. The Morisky Medication Adherence Scale (MMAS)

Data collection for the study will involve patient interviews and chart reviews using a semi-structured questionnaire. Patients will be interviewed after their physician consultations and pharmacy visits. Information such as disease stage, breast cancer type, surgery details, medication initiation timing, and hormone receptor status will be extracted from health records. Drug-drug interactions (DDIs) will be assessed using a structured questionnaire developed for Study-DDI, where each prescribed medication will be entered into the online database DDInter (http://ddinter.scbdd.com/inter-checker/). The results will categorize interactions as major, moderate, or low and will be recorded in the Study-I baseline characteristics section. Data collectors trained for Study-I will gather consented snapshots of patients' prescriptions. DDInter, which is freely accessible without registration, serves as a valuable tool for

predicting drug interactions worldwide. It has been frequently used in countries such as China and India and has been referenced in several publications, including (Xiong, 2022, Tian, 2025, Zhao, 2024, and Singh,).

4.8. Data Quality Control Issues

To ensure the quality of data, the data collection tool was pretested on 5% of the sample size in similar patient group to assess its consistency and reliability. The Data collectors were two Nurses, & trained for one day regarding for the purpose of the survey and proper data collection procedures. Regular supervision was conducted throughout the data collection process to ensure adherence to protocols. Open and transparent discussions were held with data collectors to address challenges encountered during data collection. A daily review and checkup of the collected data was performed to check for completeness and accuracy before data entry. Additionally, data cleaning was carried out by running simple frequency distributions to identify missing values and inconsistency in patient responses

4.9. Data Analyses

The collected data was entered into an Excel spreadsheet and exported to SPSS version 26 (SPSS Inc., US) for analysis. Descriptive statistics were used to show patient sociodemographic and clinical characteristics, cross tabulation was also used to analyses the attitudinal Necessity Concern NCD) quadrant figure, Altitudinal analysis of Necessity &concern, Distribution of NCD by Socio-demographic and clinical characteristics, , Bivariate and Multivariate logistic regression was used to analyses factors Affecting Adherence (MMAS), and DDI, Pearson's correlation was used to determine the association between BMQ, MMAS & DDI.

4.10. Ethical Consideration

Ethical approval was granted by the ethics review board of the College of Health Sciences at Mekelle University (MU-IRB 22228/2024). A support letter from the ACSH medical director was sought prior to the commencement of data collection. Participants were asked to provide informed consent after the purpose of the study was explained through a participant information sheet. Confidentiality was strictly maintained by excluding personal identifiers from the data collection tools, ensuring that any information potentially revealing a participant's identity was omitted. Access to the collected data was limited to individuals directly involved in the study, and respondents were informed of their right to refuse or withdraw from the study at any time without facing any consequences.

4.11. Operational Definition

BMQ-18: the score below half of the sum of specific necessity was a negative belief, whereas half of the sum of specific concern was seen as a positive belief. Similar to concern sum less than half (<10) for overuse and harm was considered a positive belief.

MMAS-8: the sum of the score categorized 0-6, ≥6-7, and ≥7-8 as low, moderate, and high or good adherence but also non-adherent (0-6) and adherent (>6-8).

Drug-Drug Interaction (DDI): is defined as the pharmacokinetic, pharmacodynamics, or pharmaceutical effect of one drug over the other that can affect the safety and efficacy, and even cause severe adverse effects.

Sever DDI: this is a severe type of interaction that requires medical treatment to prevent severe adverse effects unless it may lead is life-threatening.

Moderate DDI: this type of interaction may result in exacerbation of the medical condition of the patient and/or a change in therapy.

Low DDI: a type of interaction that may decrease the therapeutic effect of the other medication.

Total DDI: is the burden of a drug interaction that occurs in a single patient.

Polypharmacy: The concurrent use or prescribing of greater than or equal to five drugs within one day (Beezer, 2022).

Risk Rating:

X: Contraindicated (drugs which should never be used together Because of severe, life- threatening interactions).

D: Potential for serious interaction- consider therapy Modification.

C: Potential for serious interaction – typically requires close monitoring.

B: No action needed.

A: No known interaction.

Chapter 5: Results

5.1. Sociodemographic Characteristics of the Study Participants

A total of 385 participants were successfully interviewed, resulting in a 100% response rate. The analysis of the sociodemographic variables revealed several significant findings. The mean age of participants was 45.61 years with a standard deviation of 15.205 years, indicating a mature demographic. The median age was 45 years, with an interquartile range of 22.5 years. In terms of frequency distribution, the majority of participants were aged between 1-40 years (42.5%), followed closely by those aged 41-60 years (40%). Females constituted 74.3% of the total sample, while 25.7% were males. Regarding marital status, 60.8% of respondents were married. With respect to educational status, a notable 44.2% of participants had no formal education. Lastly, the income level indicated that a significant 71.4% of participants earned between 1-1500 **(**Table1)

Table 1.Seciodemographic characteristic of patients attending follow up at ACSH, Oncology Clinic.

Variables	Category	Frequency	Percent
Age	Mean ± SD	45.61 ± 15.205	
	Median (IRQ)	45(22.5)	
	1-40	165	42.5
	41-60	154	40
	61 –80	60	15.6
	81-100	6	1.6
Gender	Male	99	25.7
	Female	286	74.3
Residence	Urban	193	51.2
	Rural	188	48.8
Marital status	Married	234	60.8
	Single	60	15.6
	Divorced	41	10.6
	Windowed	50	13
Religion	Orthodox	359	93.2

	Muslim	11	2.9
	Catholic	13	3.4
	Others	2	5
Educational status	No formal education	170	44.2
	Primary	101	26.2
	Secondary	77	20
	Diploma and above	37	9.6
Income level	1-1500	275	71.4
	15001-5000	59	15.3
	5001-8000	32	8.3
	>8000	19	4.9

5.2. Disease and Clinical Related Characteristics of the Study Participants

In the study of cancer patients, the duration of cancer in years revealed that the majority, 94.30% (36.3% of 385 patients), had been diagnosed for 5 years. Additionally, the presence of comorbidity was noted in 38 patients (9.90%), while 347 patients (90.1%) reported no comorbid conditions. Among the types of comorbidities, hypertension was the most common, affecting 12 patients (3.10%). Regarding the diagnosis of cancer, 231 patients (60%) had general cancer other than breast cancer, while 154 patients (40%) were diagnosed with breast cancer. The highest significant finding was that 338 patients (87.80%) were taking fewer than 5 drugs (Table2).

Table 2. Clinical characteristics of cancer patients attending follow up at ACSH, Oncology Clinic,

Variable	Category	Frequency	Percent
Duration of cancer in years	5	36.3	94.30%
	5-10	21	5.50%
	>10	1	0.30%
Presence of comorbidity	NO	347	90.1
	Yes	38	9.90%
Type of comorbidity	DM	3	0.80%
	DM&HTN	4	1.00%
	TB	1	0.30%
	Asthmatics	1	0.30%
	HTN	12	3.10%
	Gastritis	13	3.40%
	Psychiatric cases	2	0.50%
	Infection	3	0.50%
	Coughing	1	0.30%
	NO other diseases	344	89.40%
Diagnosis of cancer	Cancer other than BC	231	60%
	Breast cancer	154	40%
Numbers of Drugs given for comorbidity	1	34	89.40%
	2	5	1.30%
	3	1	0.30%
	5	1	0.30%
Number of Anticancer drugs prescribed	1-3	251	65.2
	4-5	91	23.6
	6-7	43	11.2
	1-4	291	75.6
Total numbers of drugs given for	5-8	93	24.2
	9-12	1	.3
Patients who **take** less than 5 drugs		338	87.80%
Patients who **take m**ore than 5 drugs		47	12.20%

5.3. Beliefs about Medications among Cancer Patients.

5.3.1. Beliefs about Medicines: Overall Score of Responses to BMQ.

In assessing patient beliefs regarding cancer medication using the BMQ questionnaires, out of 385 respondents the results indicated that 92.7% of respondents agreed on the specific necessity of their medications. However, 67.3% expressed concerns about these medications side effects. (Table3).

Table 3. Frequency of General and Specific Beliefs about Medicines

Variable	Frequency (percent (%)				
	Strongly agree	**Agree**	**Uncertain**	**Disagree**	**Strongly Disagree**
Specific necessity					
My life would be impossible without my medicines	166(43.1%)	191(49.6%)	21(5.5%)	1(.3%)	6(1.6%)
Without of my medicines, I would be very sick	176(45.7%)	205(53.2%)	3(.8%)	1(.3%)	0
My health at presents depends on my medicines	118(30.6%)	245(63.6%)	14(3.6%)	8(2.1%)	0
My medicines protect me from becoming worse	149(38.7%)	231(60%)	3(.8%)	2(.5%)	0
My health in the future will depends on my medicines	98(25.5%)	251(65.2%)	21(5.5%)	15(3.95)	0
Specific concern					
I sometimes worry about long term effects of my medicines	63(16.4%)	259(67.3%)	20(5.2%)	42(10.9%)	1(.3%)
Having to take medicines worries me	42(10.9%)	268(69.6%)	15(3.9%)	58(15.1%)	2(.5%)
I sometimes worry about becoming too dependent on my medicines	11(2.9%)	24(6.2%)	9(2.3%)	315(81.8)	26(6.8%)

My medicines disrupt my life	11(2.9%)	24(6.2%)	9(2.3%)	315(81.8)	26(6.8%)
My medicines are mysteries to me	13(3.4%)	85(22.1%)	37(9.6%)	228(59.2%)	22(5.7%)
Overuse					
If doctors had more time with patients, they would prescribe fewer medicines	8(2.1%)	105(27.3%)	31(8.1%)	225(58.4%)	16(4.2%)
Doctors use too many medicines	63(16.4%)	308(80%)	1(.3%)	11(2.9%)	2(.5%)
Doctors' places too much trust on medicines	2(.5%)	12(3.1%)	22(5.7%)	284(73.85)	65(16.9%)
Natural medicines are safer than medicines	2(.5%)	12(3.1%)	22(5.7%)	284(73.85)	65(16.9%)
Harm					
Medicines do more harm than good	1(.3)	13(3.4%)	15(3.9%)	314(81.6%)	42(10.9%)
People who take medicines should stop their treatments for a while now and again	5(1.3%)	1(.3%)	0	201(52.2%)	178(46.2%)
Most medicines are additives	0	30(7.8%)	125(32.5%)	205(53.2%)	25(6.5%)
All medicines are poisons	11(2.9%)	88(22.9%)	110(28.6%)	162(42.1%)	14(3.6%)

5.3.2. Scores of Belief Subscales and Necessity-Concern Differential (NCD)

Out of a total of 385 respondents, the highest mean result was found in the Specific Necessity (SN) subscale, with a mean score of 21.49 and a standard deviation of 2.313. The Necessity Concern Differential (NCD) score was reported as 9.58. (Table 4)

Table 4.specfic and general beliefs about medication of cancer patients & NCD in ACSH, Mekelle

Subscale	Mean ± SD	Median (IRQ)	Frequency%		Max – Min (Ranges)
			Low	High	
Specific Necessity (SN)	21.49+2.313	20-23(3)	1(.3%)	384(99.7%)	11-25(
Specific Concern (SC)	11.97+2.159	11-13(2)	86(22.3%)	297(77.7)	4-20(
General –Overuse (GO)	10.67+1.65	10-12(2)	58(15.1%)	327(84.9%)	6-18(12
General Harm (GH)	8.795+1.66	8-10(2)	274(71.2%)	111(28.8%)	4-14(10)
Necessity-Concern Differential (NCD)	9.58+0.154				

5.3.3. Attitudinal analysis of BMQ Necessity& Concern for Cancer Patients

86 respondents (22.3%) are categorized as "accepting," indicating high necessity and low concern about their treatment. Conversely, 298 respondents (77.4%) have "ambivalent" feelings showing high necessity and high concern. Only 1 respondent (0.3%) was "skeptic" reflecting low necessity and high concern, with no respondents in the "Indifferent" category (Fig 2).

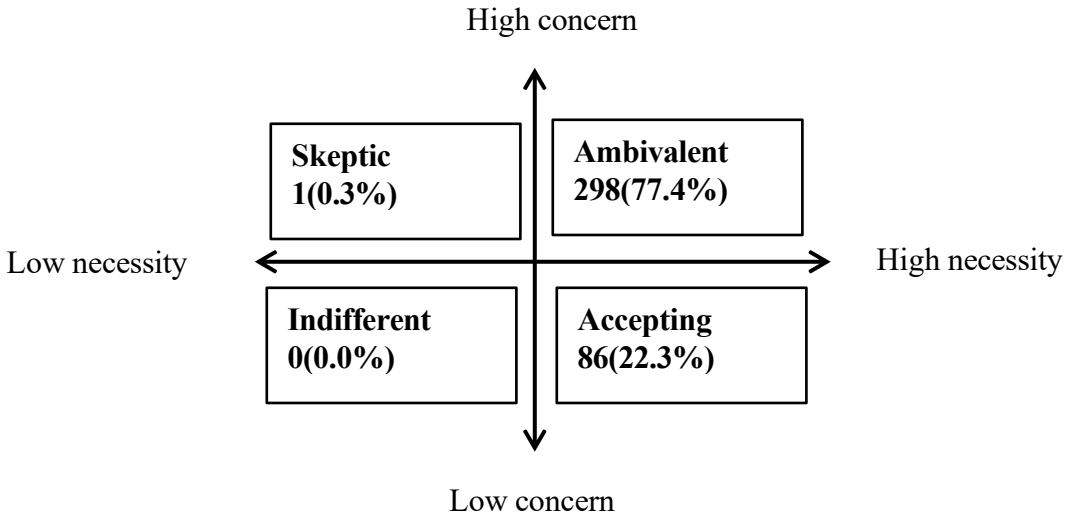

Figure 2. Four attitudinal constructs according to the combination of Concern and Necessity scores

5.3.4. Distribution of NCD by Sociodemographic and Clinical Characteristics

In a study involving 385 participants, the opinions regarding cancer care were categorized into three groups. Among the respondents, 86 patients (22.3%) expressed favorable (accepting) opinions, while 298 patients (77.4%) reported mixed-feelings (were ambivalent). Only 1 patient (0.3%) indicated a distrustful (skeptical) stance (Table5).

Table 5.Crosstabulation of NCD for Scio-demographic and clinical Characteristics ……

Characteristics		Accepting	Skeptical	Ambivalent
		N=86	N=1	N=298
Age	18-100	87	0	297
Gender	Male	16	1	82
	Female	71	0	215
Residence	Urban	39	1	157
	Rural	48	0	140
Marital status	Married	52	0	182
	Single	10	1	49
	Divorced	8	0	33
	Windowed	17	0	33
Educational level	Unable to read	42	0	128
	Primary school	21	0	80
	Secondary school	17	1	59
Religious	Diploma and above	7	0	30
	Orthodox	81	0	278
	Muslim	3	0	8
	Catholic	2	1	10
	Others	1	0	1
Monthly incomes	1-1500	67	1	207
	1501-5000	11	0	48
	5001-8000	6	0	26
	>8000	0	0	16

Duration of cancer in years	5yrs	79	1	283
	5-10	7	0	141
	>10	1	0	0
Presence of comorbidity	No	78	1	268
	Yes	9	0	29
Diagnose of cancer	G. cancer	38	1	192
	B. cancer	49	0	105
Drugs for	Cancer patients	87	1	297
Drugs for	Cancer comorbidity	87	1	297
Drugs for	Comorbidity	87	1	297

5.4. Medication Adherence among Cancer Patients on Chemotherapy.

5.4.1. Medication Adherence: Overall Score of Responses to MMAS-8 Questionnaire

The results of the MMAS-8 questionnaire revealed notable adherence patterns among participants, with a mean score of 6.605 and a standard deviation of ±1.437. A significant 94.8% of respondents reported that they do not forget to take their oral medications or receive injections on schedule. Additionally, 80.8% indicated that they had not missed taking their oral medications or receiving injections in the past two weeks. Furthermore, 77.4% of participants stated that they do not forget to bring their oral medications or injection supplies when traveling or leaving home. These findings underscore a high level of adherence to medication protocols among the surveyed individuals (see Table 6).

Table 6. Morisky medication adherence scale questioners (MMAS-8)

MMAS8 Questioners	Response	Frequency	Percentage
1. Do you sometimes forget to take your oral medications or receive your injections on schedule?	Yes	20	5.2
	NO	365	94.8
2. In the last two weeks, were there any days when you missed taking your oral medications or receiving your injections?	Yes	74	19.2.
	NO	311	80.8
3. Have you ever adjusted the timing of your oral medications or Injections without consulting your healthcare professional?	Yes	52	13.5
	NO	333	86.5
4. When you travel or leave home, do you sometimes forget to bring Your oral medications or injection supplies?	Yes	87	22.6
	NO	298	77.4
5. Do you take your oral medications and receive your injections at the right times as instructed?	NO	125	32.5
	YES	260	67.5
6. It is sometimes difficult for me to remember to take my oral medications or prepare for my injections.	Yes	92	23.90
	No	293	76.1
7. I follow the instructions provided by my healthcare professional for my oral medications and injections carefully	Yes	65	16.9
	No	320	83.10
8. How often do you have difficulty remembering to take your oral medications or prepare for your injections?	All the times	16	4.2
	Sometimes	12	3.1
	Never/Rarely	357	92.7
	Usually,	0	0

5.4.2. Adherence Levels of Cancer Patients on Chemotherapy in ACSH, Mekelle,

The distribution of MMAS-8 scores revealed that 28.3% of participants had low adherence (scores less than 6), 30.9% had moderate adherence (scores between 6 and 7), and 40.8% achieved high adherence (scores between 7 and 8). (Table 7)

Table 7.Adherent and non-adherent categories of cancer patients in ACSH, Mekelle,

Categories	MMAS-8 Score	Frequency	Percentage
Low	<6	109	28.3
Moderate	≥6 -7	119	30.9
High	≥7-8	157	40.8

Note: The MMAS-8 score is calculated by summing the responses from the eight questions of the MMAS-8 questionnaire, reflecting participants' medication adherence in three levels.

The adherence categories based on MMAS-8 scores indicated that 28.3% of participants were classified as non-adherent (scores less than 6), while a significant 71.7% were categorized as adherent (scores of 6 or higher) (Table 8).

Table 8 Adherent and Non-Adherent categories of cancer chemotherapy patients in ACSH, Mekelle,

Categories	MMAS _8 Score	Frequency	Percentage
Non-Adherent	<6	109	28.3%
Adherent	≥6	276	71.7%

Note: The MMAS-8 score is calculated by summing the responses from the eight questions of the MMAS-8 questionnaire, reflecting participants' medication adherence in two levels

5.4.3. Factors Affecting Adherence among Patients Attending Oncology OPD at ACSH

In a study examining factors affecting medication adherence levels among cancer patients, both bivariate and multivariate regression analyses identified several key variables In a study examining, both bivariate and multivariate regression analyses factors affecting medication adherence levels among cancer patients, was an Age 41-60: AOR = 0.715, p-value = 0.080, Age 61-80: AOR = 0.609, p-value = 0.080, Monthly Income Level > 8000: AOR = 9.169, p-value = 0.041, Duration of Cancer > 10 years: AOR = 1.429, p-value = 0.018 (Table 9).

Table 9. Factors affecting adherence among patients attending ACSH, oncology clinic

Variables	Category	Adherence Level		Odd Ratio						
				Crude Odd Ratio		Adjusted Odd Ratio			95%C. I	
Variables	category	Low	High	COR	Sig	Beta Value	AOR	Sig	Lower	Upper
Age	18-40	129	36							
	41-60	121	33			-.495	.609	.080	.350	1.061
	61-80	48	12			-.336	.715	.407	.323	1.580
	81-100	4	2			-2.711	.066	.028		.746
Monthly Income Level	1-1500	275	75.4							
	15001-5000	59	15.3			.337	.714	.312	.371	1.373
	5001-800	32	83			.393	1.481	.425	.564	3.894
	>8000	19	4.9			2.216	9.169	.041	1.093	76.894
Duration of Cancer in Years	5	284	79							
	5-10		3			-1.233	.291	.018	.105	.807
	>10	0	1			.357	1.429	.181	.847	2.411

5.5. Drug-Drug Interactions Using DDInter Online Database

5.5.1. The Prevalence & Severity of Drug-Drug Interactions

The analysis revealed that the most significant drug-drug interaction involved the combination of **F5-Fluorouracil and Leucovorin**, with **340 patients (88.3%)** affected. This interaction is critical as coadministration with Leucovorin may potentiate the pharmacologic effects of 5-fluorouracil (5-FU), leading to potentially increased toxicity in patients undergoing cancer treatment (10).

Table 10. DDIs of Major Severity

Pairs of drugs	Frequency & Percentage	Possible actions of drugs
Flu**orouracil** + Leucovorin	340(88.3%)	Coadministration with folate therapy may potentiate the pharmacologic effects of 5-fluorouracil (5-FU)
Morphine + Tramadol	1(.3%)	Concomitant use of tramadol with other central nervous system (CNS) depressants including other opioids may result in profound sedation, respiratory depression, coma, and death.
Ondansetron + Tramadol	63(16.7%)	Concomitant use of 5-HT3 receptor antagonists with tramadol may potentiate the risk of serotonin syndrome and/or reduce the analgesic efficacy of tramadol.
Tramadol + Promethazine	1(.3%)	The risk of seizures may be increased during coadministration of tramadol with any substance that can reduce the seizure threshold, such as selective serotonin reuptake inhibitors (SSRI antidepressants or anorectics), monoamine oxidase inhibitors, neuroleptic agents, central nervous system stimulants, opioids, tricyclic antidepressants, other tricyclic compounds (e.g., cyclobenzaprine, phenothiazine's), carbapenems , cholinergic agents, fluoroquinolones, interferon's , chloroquine, mefloquine, lindane, and theophylline.
Metformin + Cimetidine	2(.6%)	Cimetidine may significantly reduce the renal tubular secretion of metformin.

Table 11. DDIs of Moderate Severity

Pairs of drugs	Frequency& Percentage	Possible actions of drugs
Antineoplastic + Antineoplastic	163(42%)	The concomitant or sequential administration of multiple antineoplastic agents may result in additive toxicities, particularly in the bone marrow, gastrointestinal tract and heart.
Doxorubicin+(Tamoxifen+Tramadol+Ondansetron+Prmotheazine)	8(2.3%)	concurrent use of two or more drugs that can cause QT interval prolongation may result in additive effects and increased risk of ventricular arrhythmias including torsade de pointes and sudden death
Ondansetron+(Oxaloplatine+Tamoxifen+Promethazine)	40(11%)	concurrent use of two or more drugs that can cause QT interval prolongation may result in additive effects and increased risk of ventricular arrhythmias including torsade de pointes and sudden death
Tamoxifen + promethazine	1(.3%)	concurrent use of two or more drugs that can cause QT interval prolongation may result in additive effects and increased risk of ventricular arrhythmias including torsade de pointes and sudden death
Allopurinol + Methotrexate	1(.3%)	Coadministration of methotrexate with other agents known to induce hepatotoxicity may potentiate the risk of liver injury.
Bleomycin + Cisplatin	1(.3%)	The concurrent or sequential use of two or more potentially nephrotoxic or neurotoxic drugs may increase the risk of toxicity.
Capecitabine + Pantoprazole	4(1.1%)	Coadministration of proton pump inhibitors (PPIs) has been reported to reduce the antitumor efficacy of capecitabine.
Carboplatin + Omeprazole	3(.8%)	Chronic use of proton pump inhibitors (PPIs) may induce hypomagnesaemia, and the risk may be increased during concomitant use of diuretics or other agents that can cause magnesium loss.

Pairs of drugs	Frequency& Percentage	Possible actions of drugs
Carbopltin + Filgrastim	2(.5%)	Concerns exist regarding their concomitant administration because hematopoietic growth factors stimulate myeloid cell proliferation while antineoplastic agents primarily target rapidly dividing cells.
Cimetidine + docetaxel	6(1.7%)	Coadministration with inhibitors of CYP450 3A4 or dual CYP450 3A4 and P-glycoprotein (P-gp) inhibitors may increase the plasma concentrations of docetaxel, which is a substrate of both CYP450 3A4 and P-gp.
Cimetidine + Irinotecan	6(1.7%)	Coadministration with inhibitors of CYP450 3A4 and/or UGT1A1 may increase the plasma concentrations of irinotecan and its active metabolite, SN-38.
Cimetidine + Paclitaxel	29(8%)	Coadministration with inhibitors of CYP450 2C8 and/or 3A4 may increase the plasma concentrations of paclitaxel.
Cimetidine + Tramadol	39(10.9%)	Cimetidine may increase the effects of narcotic analgesics. Cases of respiratory depression, potentially fatal, have been reported in patients receiving cimetidine with morphine.
Cimetidine + Paclitaxel	1(.3%)	Coadministration with inhibitors of CYP450 2C8 and/or 3A4 may increase the plasma concentrations of paclitaxel.
Cisplatin + Dexamethasone	20(5.4%)	The concomitant use of corticosteroids and agents that deplete potassium.
Cisplatin + Omeprazole	22(3.79%)	Chronic use of proton pump inhibitors (PPIs) may induce hypomagnesaemia.
Cyclophospham ide + Metronidazole	21(5.7%)	An isolated case of encephalopathy with hallucinations and seizures has been reported in a child.

Pairs of drugs	Frequency& Percentage	Possible actions of drugs
Cyclophospham + Tamoxifen	2(.6%)	Coadministration of tamoxifen with cyclophosphamide may increase the risk of thromboembolic complications.
Dexamethasone + Vincristine	1(.3%)	Coadministration with potent inducers of CYP450 3A4 and/or P-glycoprotein may significantly decrease the plasma concentrations of vinca alkaloids, which are substrates of both the hepatic microsomal isoenzyme and intracellular efflux transporter.
Doxorubicin + Vincristine	1(.3%)	Concurrent administration of vincristine and doxorubicin may lead to an earlier onset and/or an increased severity of side effects.
Filgrastim + Paclitaxel	9(2.6%)	Concerns exist regarding their concomitant administration because hematopoietic growth factors stimulate myeloid cell proliferation while antineoplastic agents primarily target rapidly dividing cells.
Ibuprofen + Oxaliplatin	14(3.8%)	Coadministration with drugs that are nephrotoxic may delay and/or decrease the clearance of oxaliplatin, which is primarily eliminated unchanged by the kidney.
Methotrexate + Leucovorin	2(.6%)	Coadministration of methotrexate with vitamin preparations containing folic acid, folinic acid (leucovorin) or their derivatives may diminish the therapeutic effects of methotrexate.
Morphine + Ondansetron	2(.6%)	Opioids may potentiate the effects of serotonergic agents and increase the risk of serotonin syndrome.
Omeprazole + Capecitabine	2(.5%)	Coadministration of proton pump inhibitors (PPIs) has been reported to reduce the antitumor efficacy of capecitabine.
Ondansetron + Tramadol	2(.5%)	Concomitant use of 5-HT3 receptor antagonists with tramadol may potentiate the risk of serotonin syndrome and/or reduce the analgesic efficacy of tramadol.

Pairs of drugs	Frequency& Percentage	Possible actions of drugs
Vincristine + Methotrexate	35(9.4%)	Co-administration of methotrexate with other agents known to induce hepatotoxicity may potentiate the risk of liver injury.
Carboplatin + Vincristine	3(.9%)	The risk of peripheral neuropathy may be increased during concurrent use of two or more agents that are associated with this adverse effect.
Cimetidine + Morphine	1(.3%)	Cimetidine may increase the effects of narcotic analgesics. Cases of respiratory depression, potentially fatal, have been reported in patients receiving cimetidine with morphine.
Cisplatin + Dexamethasone	1(.3%)	The concomitant use of corticosteroids and agents that deplete potassium (e.g., potassium-wasting diuretics, may result in increased risk of hypokalemia).
Cyclophospham + Tamoxifen	4(.6%)	Co-administration of tamoxifen with cyclophosphamide may increase the risk of thromboembolic complications.
Dexamethasone + Paclitaxel	1(.3%)	Co-administration with drugs that are inducers of CYP450 2C8 and/or 3A4 may decrease the plasma concentrations of paclitaxel, which is metabolized by these isoenzymes.
Etoposide + Ifsofamide	1(.3%)	Ifosfamide-induced renal dysfunction and a consequent decrease in the renal clearance of etoposide.
Ifosfamide + Morphine	1(.3%)	Centrally-acting agents such as antiemetic's, sedatives, narcotics, or antihistamines may add to the neurotoxic effects of ifosfamide.
Metformin+ Dexamethasone	4(1.1%)	The efficacy of insulin and other antidiabetic agents may be diminished by certain drugs, including by corticosteroids.
Methotrexate + Prednisolone	41(10.8%)	Corticosteroids may increase the risk of methotrexate toxicity.

Pairs of drugs	Frequency& Percentage	Possible actions of drugs
Dexamethasone + Doxorubicin	1(.3%)	Co-administration with inducers of CYP450 3A4 may decrease the plasma concentrations of doxorubicin, which is primarily metabolized by the isoenzyme.
Dexamethasone + Irinotecan	2(.6%)	Co-administration with inducers of the CYP450 3A4 isoenzyme may decrease the plasma concentrations of irinotecan and its pharmacologically active metabolite, SN-38.
HCT + Dexamethasone	1(.3%)	The concomitant use of corticosteroids and agents that deplete potassium (e.g., potassium-wasting diuretics, may result in increased risk of hypokalemia).
Methotrexate + Vincristine	2(.5%)	Co-administration of methotrexate with other agents known to induce hepatotoxicity may potentiate the risk of liver injury.

Table 12. DDIs of Minor Severity

Pairs of drugs	Frequency& Percentage	Possible action
Acetaminophen + Cimetidine	2(.5%)	Cimetidine may decrease the potential hepatotoxic effects of acetaminophen.
Cimetidine + filgrastim	10(2.6%)	drug interactions were found between the drugs in your list
Cimetidine + fluorouracil inj	5(1.3%)	Chronic administration of cimetidine may increase 5-fluorouracil serum concentrations and antineoplastic effectiveness
Cisplatin + Gemcitabine inj	6(1.6%)	Concurrent use of gemcitabine and cisplatin to have a synergistic effect.

Pairs of drugs	Frequency& Percentage	Possible action
Cyclophosphamide + Doxorubicin	16(4.2%)	Doxorubicin may enhance the risk of hemorrhagic cystitis associated with cyclophosphamide.
Cyclophosphamide + Ondansetron	46(12%)	ondansetron may significantly decrease the area under the plasma concentration-time curve (AUC) for cyclophosphamide
Dexamethasone + Docetaxel	4(1%)	Although docetaxel is a substrate of CYP450 3A4, no significant interaction has been reported with dexamethasone or prednisone, both of which are inducers of the isoenzyme.
Doxorubicin + Vinblastine	8(2.1%0	doxorubicin to have inhibitory effects on the biotransformation of vinblastine
Doxorubicin + Vincristine	8(2.1%)	Concurrent administration of vincristine and doxorubicin may lead to an earlier onset and/or an increased severity of side effects. The mechanism is the inhibition of the metabolism by CYP 3A subfamily
Etoposide + Vincristine	4(1%0	Concurrent administration of vincristine and etoposide may lead to an earlier onset and/or an increased severity of side effects. The mechanism is inhibition of the metabolism by CYP 3A subfamily
Methotrexate + Mercaptopurine 6mp	1(.3%)	Co-administration with methotrexate (MTX) may increase the plasma concentrations of mercaptopurine (6-MP).
Vincristine + Doxorubicin	2(.5%)	Concurrent administration of vincristine and doxorubicin may lead to an earlier onset and/or an increased severity of side effects
Vincristine + Etoposide	2(2.5%)	Concurrent administration of vincristine and etoposide may lead to an earlier onset and/or an increased severity of side effects.

5.5.2. Severity of Drug Interactions

In the assessment of cancer chemotherapy drug interaction severity levels, the results for major severity revealed notable findings. Specifically, 49 patients (12.7%) acknowledged potential interactions, while a significant majority of 336 patients (87.3%) reported no concerns regarding these interactions (Table13).

Table 13.The severity category of drug drug interaction (DDInter) levels

Categories	Assessed	Frequency	Percentage
Low	Yes	106	27.5%
	No	278	72.2%
Moderate	Yes	220	57.1%
	No	165	42.9%
Major	Yes	49	12.7%
	No	336	87.3%

5.5.3. Factors Associated with Potential DDIs Using Bivariate &Multivariate Analysis

The investigation into the multivariate and bivariate factors that influence drug-drug interactions in cancer chemotherapy has revealed a number of variables that are significantly impacted by the adjusted odds ratio (AOR). Among these factors are specific age groups, namely those ranging from 41 to 60 years and those from 61 to 80 years, as well as the diagnosis of breast cancer.

Additionally, the analysis considered the total number of drugs administered to patients, particularly focusing on those receiving between 4 to 5 drugs and those receiving between 6 to 7 drugs. Furthermore, it was noted that the medications prescribed for patients who are simultaneously dealing with both cancer and comorbid conditions, specifically those receiving between 5 to 8 drugs, also play a crucial role in this context. Of all the variables examined, the factor that showed the strongest association was the total number of drugs prescribed, which exhibited an AOR of 6.690 alongside a p-value of 0.000, as detailed in Table 13.

Table 14.Factors affecting DDI by Multivariate and bivariate logistic analysis

Variables	Category	Drug-Drug Interaction level		Odd Ratio					
				Crude Odd Ratio (COR95%C. I)		Adjusted Odd Ratio		95%&C. I	
		Low	High	COR	Sig	Beta(B)	AOR	Sig	Lower	Upper
Age	18-40	54	111							
	41-60	65	89	4.111(.730,23.149)	.109	-.421	.656	.142	.374	1.151
	61-80	23	37	2.738(.487,15.404)	.253	-.762	.467	.072	.204	1.070
	81-100	4	2	3.217(.545,18.991)	.197	-2.104	.122	.046	.015	.967
Diagnosis of Cancer	General Cancer	50	181							
	Breast Cancer	96	58	.167(.106,.262)	.000	-1.828.	.161	.000	.095	.967
Drugs given for Cancer Patients	1-3	134	117							
	4-5	9	82	10.435(5.021,21.667)	.000	1.901	6.690	.000	2.748	16.290
	6-7	3	40	15.271(4.603,50.659)	.000	1.880	6.554	.038	1.110	38.700
Drugs given for both Cancer comorbidity Patients	1-4	139	152							
	5-8	7	86	.000(.000)	1.000	2.407	11.01	.000	4.966	24.81
	9-12	0	1	.000(.000)	1.000	21.166	.775	.307	.475	1.264

5.6. Correlations between Medication Beliefs, Adherence & DDI

TDDI showed positive correlation with necessity (0.113, p = 0.027) and adherence (0.163, p = 0.001); and a negative correlation with concern (-0.114, p = 0.025) and harm (-0.164, p = 0.001). Moreover, concern had a positive correlation with necessity (0.137, p = 0.007) and overuse (0.250, p = 0.000). (Table 15).

Table 15.Correlations Between BMQ, MMAS&DDI

Variables		TDDI	BMQ Necessity	BMQ Concern	BMQ Overuse	BMQ Harm	TMMAS
TDDI	Pearson coefficients	1	.113*	-.114*			-.164**
	Sig		.027	.025			.001
	N		385	385			385
BMQ necessity	P.coefficient		1		.137*		
	Sig				.007		
	N				385		
BMQ Concern	P.coefficient			1	.250*	.202*	
	Sig				.000	.000	
	N				385	385	
BMQ Overuse	P.coefficient		-.137**	.250**	1	.219*	
	Sig		.007	.000		.000	
	N		385	385		385	
BMQ Harm	P.coefficient			.202**	.219*	1	
	Sig			.000	.000		
	N			385	385		
TMMAS	Pearson coefficient	.163**					
	Sig	.001					
	N	385					1

Chapter 6. Discussion

This study sought to investigate patient beliefs, medication adherence, and drug-drug interactions (DDIs) in cancer therapy at Ayder Comprehensive Specialized Hospital, Mekelle, Ethiopia. By employing the Beliefs about Medicines Questionnaire (BMQ) (R. Horne *et al.*; McHorney, 1997), the Morisky Medication Adherence Scale-8 (MMAS-8) (G. G. Gebregeorgise, 2019; McHorney, 1997) and the DDInter database, we aimed to understand the interplay of these factors influencing treatment outcomes.

6.1. Sociodemographic and Clinical Characteristics

The predominance of female participants (74.3%) in our study aligns with the higher incidence of breast cancer among women globally (Bekalu *et al.*, 2023). The mean age of participants, which was 45 years, suggests that lifestyle and environmental factors may contribute to cancer development in this population. The relatively long duration since diagnosis (94.3% diagnosed for at least 5 years) indicates a stable patient cohort, allowing for a more reliable assessment of long-term adherence and beliefs. The low prevalence of comorbidities (9.9%) may explain the limited use of multiple medications, with 87.8% of participants taking fewer than five drugs, Yet, at a > 10% prevalence, the level of polypharmacy calls for strategies to improve adherence and reduce risk of adverse drug events (I. Basak et al., 2021; R. Basak *et al.*).

6.2. Assessment of Patient Beliefs Regarding Cancer Chemotherapy

Our study revealed that 92.7% of the 385 respondents acknowledged the necessity of their cancer medications, underscoring a strong belief in their importance. This finding contrasts with results from other countries, where necessity scores vary. For instance, in Croatia, 79.5% recognized medication necessity (Dugonjić Okroša *et al.*, 2023), and in Australia, the mean necessity score was 17.5 (SD = 5.1), indicating similar beliefs but with lower concern scores (Rafhi, 2015). These discrepancies may stem from cultural differences in health perceptions and the healthcare system's approach to patient education. In Iraq, 76.2% viewed iron chelators as necessary, with 62.4% concerned about illness without medication (Mousavi), while in Palestine, 79.6% acknowledged the necessity but 58.2% were worried about regular intake (Jamous *et al.*). The elevated necessity score in our study indicates that patients have a deeper understanding of their treatment's impact, (Talens *et al.*, 2021).

6.2.1. Necessity-Concern Differential (NCD)

Out of a total of 385 respondents, the highest mean score was observed in the Specific Necessity (SN) subscale, with a mean of 21.49 and a standard deviation of 2.313. The Necessity Concern Differential (NCD) score was reported as 11.83, indicating a positive perspective where the perceived necessity for medication exceeds concerns about it. This NCD score is significantly higher than those recorded in Croatia, which were 7.4 (Dugonjić Okroša *et al.*, 2023) and 4.917 (Dimitrijević *et al.*, 2023), as well as in Iraq at 4.19 and Ethiopia at 5.8 (D. Gebregeorgise *et al.*). The higher NCD score in our study suggests that individuals may have a stronger belief in the importance of their medications compared to those in other countries.

Differences in NCD scores arise from factors such as improved patient education and support, which enhance perceptions of medication necessity. Cultural influences also encourage adherence to medical advice. Although NCD scores were lower in countries like Croatia and Iraq, patients still recognize the importance of their treatments, aligning with research indicating that those who acknowledge medication necessity are more likely to adhere to regimens (R Horne; McHorney, 1997).

6.2.2. The Altitudinal Analysis for Necessity and Concern

In our study, the Necessity-Concern framework revealed that 22.3% of respondents were classified as "Accepting ," indicating a strong belief in the necessity of chemotherapy with minimal concerns about side effects. In contrast, studies from Malaysia and Croatia showed different attitudes, with significant proportions of patients classified as "Indifferent" or "Distrustful." These discrepancies may be attributed to cultural attitudes and varying levels of trust in healthcare providers. Research suggests that effective communication and family support are key factors in fostering positive perceptions of treatment necessity (Alshammari; Talens *et al.*, 2021).

6.2.3. Distribution of Necessity and Concern by Sociodemographic & Clinical Characteristics

The analysis of socio-demographic and clinical characteristics through the Necessity-Concern framework reveals distinct patterns among patients. The "Accepting " group (N=86) is predominantly female (82.56%) and rural, with a strong belief in medication necessity, unlike the "Distrustful" group, which consists of a single male.

In contrast, Croatian findings show lower percentages of "Accepting " patients and higher rates of "Indifferent" and "Distrustful" individuals, reflecting cultural differences in healthcare perceptions. Most patients in our study reported severe pain, highlighting the need for effective communication and support to enhance treatment attitudes and adherence (Alshammari; Talens *et al.*, 2021).

6.3. Medication Adherence Levels

Our study found a high adherence rate of 71.7% using the MMAS-8, with a mean score of 6.605 (SD = ±1.437). This is higher than adherence rates reported in other Ethiopian studies (42.3% and 42.6%) (Baleta *et al.*; M.) as well as in Egypt (40.3%) and Brazil (44%) (Assad-Suzuki *et al.*). The higher adherence in our study may be attributed to the nature of the sample population, which included women receiving oral medications for breast cancer and injections administered by healthcare professionals for other conditions. Direct supervision of medication administration has been shown to improve adherence (Assad-Suzuki *et al.*). However, it is important to acknowledge that self-reported adherence measures like the MMAS-8 may be subject to recall bias and social desirability bias (S. Ismail et al., 2020). While our results are consistent with global trends, they highlight the importance of tailored interventions to improve medication adherence across diverse populations.

6.3.1. Bivariate and Multivariate Logistic Regression Analyses of Factors Influencing Adherence to Chemotherapy

Examining factors affecting medication adherence levels among cancer patients, we utilized both bivariate and multivariate regression analyses and identified several key variables. Our analysis revealed that age, income, and duration of cancer were significantly associated with medication adherence. Patients aged 41-60 (AOR: 0.715, p = 0.080), and 61-80 (AOR: 0.609, p = 0.080) exhibited lower adherence levels. Conversely, a monthly income greater than 8000 and the duration of cancer greater than 10 years showed a positive association at AOR = 1.429, (p-value = 0.018) and AOR = 9.169, p-value = 0.041). respectively. These findings align with previous research highlighting the role of socioeconomic factors and disease chronicity in influencing adherence (Bekalu *et al.*, 2023)..

Comparing our findings with those from (Bekalu *et al.*, 2023) and (Ademe *et al.*), we observe both similarities and differences. Bekalu et al. identified marital status, occupation, and transportation availability as significant factors, while Ademe et al. emphasized the importance of sex, family history, and comorbidity history. These variations underscore the complex interplay of social, economic, and personal factors that affect adherence.

6.4. Prevalence and Severity of Potentially Significant Interactions of Anticancer Drugs.

Our study revealed a high prevalence of major drug-drug interactions (DDIs), with 88.3% of patients taking 5-Fluorouracil and Leucovorin potentially experiencing enhanced effects. This finding aligns with similar studies in Adigrat (68.5%), Northwestern Ethiopia (72.1%), and Palestine (88.1%), although only 12.7% of our interactions were classified as major compared to 19.3% in Adigrat. The higher prevalence in our study may be attributed to several factors, including the narrow therapeutic windows of oncological drugs, which are known to increase the risk of adverse effects (Basak, 2021). Additionally, the significant prevalence of polypharmacy among cancer patients, many of whom have multiple comorbidities, further exacerbates the likelihood of DDIs. Recent literature indicates that DDIs occur in 55% of patients taking oral anticancer agents, corroborating earlier findings of 46-63% (Prely *et al.*, 2022). Furthermore, the variation in prescribing practices and healthcare provider awareness regarding DDIs may contribute to differences in prevalence across studies (Xiong *et al.*, 2022). These factors underscore the critical need for improved patient education and the effective use of drug interaction databases to enhance medication safety in clinical practice.

6.4.1. Logistic Regression Analyses of Factors Affecting Chemotherapy Drug Interactions

Our study identified the number of prescribed medications as the strongest predictor of potential drug-drug interactions (pDDIs) in cancer patients, with an adjusted odds ratio (AOR) of 6.690 ($p < 0.001$) (Mohammad *et al.*, 2020). This finding is consistent with research from India, which reported an odds ratio of 2.50 ($p < 0.01$) (J. Ramasubbu), and highlights significant factors such as age and comorbidities in Palestine (A. A. Koni *et al.*, 2022). In Uganda, being female and using six or more medications were major predictors (AOR = 18.82; $p < 0.001$) (Kigozi et al., 2021).

Variations in healthcare practices and demographics may account for differences in findings, particularly as polypharmacy is known to significantly increase the risk of drug interactions. A study by (Krska et al., 2016) emphasizes that the complexities of managing multiple medications in cancer patients elevate the potential for adverse effects and interactions, reinforcing the critical need for careful medication management in this population.

6.5. Correlation among Medication Beliefs, Adherence and Drug Interactions

The integrated analysis of patient beliefs, medication adherence, and potential drug-drug interactions (pDDIs) offers a comprehensive understanding of factors influencing cancer treatment outcomes at Ayder Comprehensive Specialized Hospital. Our findings reveal intricate relationships between these elements, highlighting the importance of considering the patient's perspective in medication management. A key observation is the positive correlation between Total Drug Interaction (TDDI) and BMQ Necessity, suggesting that patients who perceive their medications as essential may be more likely to experience DDIs (I. Basak et al., 2021; A. A. Koni *et al.*, 2022). This could be attributed to their increased adherence to complex medication regimens, potentially involving multiple drugs to manage both cancer and related symptoms. Conversely, concerns about medication harm and overuse were associated with fewer reported interactions, indicating that heightened awareness may lead to more cautious medication use. This underscores the significance of patient education in promoting safe medication practices.

The psychological dimension of cancer treatment is further illuminated by the strong positive correlation between BMQ Concern and BMQ Overuse. This reflects the internal struggle patients face, balancing the perceived need for medication with anxieties about potential adverse effects and long-term consequences (R. Horne *et al.*, 1999; Mohammad *et al.*, 2020). Such psychological distress can significantly impact adherence and overall treatment outcomes. Several studies have shown that negative beliefs about medications are associated with low self-reported adherence. Addressing these concerns through open communication and shared decision-making is crucial for building trust and improving adherence. Furthermore, our findings align with research indicating that patients who perceive their side effects to be well managed are more adherent than those who do not, underscoring the importance of toxicity management for better medication adherence.

The interplay between adherence and DDIs is particularly relevant in the context of cancer chemotherapy, where narrow therapeutic windows and polypharmacy are common (Basak; A. A. Koni *et al.*, 2022). Our study, along with others, highlights the high prevalence of potential DDIs in cancer patients (Bekalu *et al.*, 2023; A. Koni et al., 2022). These interactions can lead to increased toxicity, reduced efficacy, and compromised treatment outcomes (R. Basak *et al.*). Strategies to minimize polypharmacy, simplify medication regimens, and actively screen for DDIs are essential for improving medication safety (Basak; A. A. Koni *et al.*, 2022). Pharmacists can play a vital role in medication reconciliation and DDI screening, particularly in patients receiving complex chemotherapy regimens. The use of drug interaction databases, such as DDInter, is crucial for identifying potential DDIs and guiding clinical decision-making.

In conclusion, our integrated analysis underscores the complex interplay between patient beliefs, medication adherence, and drug-drug interactions in cancer therapy. By understanding these relationships, healthcare providers can develop tailored interventions to address individual patient needs, improve adherence, minimize DDI risk, and ultimately enhance treatment outcomes (Mohammad *et al.*, 2020; Mousavi). Future research should focus on longitudinal studies to examine the causal relationships between these factors and to evaluate the effectiveness of interventions designed to improve medication management in cancer patients.

Chapter 7. Conclusion

Regarding Beliefs about Medicines

This study reveals that 92.7% of respondents recognize a high necessity for their prescribed cancer chemotherapy drugs, as indicated by a Necessity Concern Differential (NCD) score of 11.83. This score reflects a strong positive perception of the importance of their medications. Furthermore, the application of the Necessity-Concern framework categorizes 22.3% of participants as "accepting," underscoring the robust belief in the necessity of their treatments.

Regarding Adherence

Our research identified a high medication adherence rate of 71.7% among participants, which surpasses adherence rates documented in studies from Ethiopia, Egypt, and Brazil. This elevated level of adherence can be attributed to the supportive healthcare environment and the direct supervision provided during medication administration. In contrast, the moderate adherence rates of 51.8% observed in other countries emphasize the importance of contextual factors, including healthcare accessibility. These insights suggest that tailored interventions may further enhance adherence in similar contexts.

Regarding Drug Interactions

The study highlights a significant prevalence of major drug-drug interactions (DDIs) among cancer patients, which calls for utilization of drug interaction databases to improve patient safety. The critical role of polypharmacy in these interactions reinforces the necessity for vigilant medication management practices.

Regarding Integrated Results of Beliefs, Adherence and Drug Interactions

Our analysis reveals significant correlations between medication beliefs, adherence, and DDIs in cancer chemotherapy patients. Specifically, perceptions of medication necessity and concerns about potential harm directly influence both adherence levels and the likelihood of drug interactions. Addressing these beliefs is crucial for enhancing patient safety and improving overall treatment outcomes.

Chapter 8. Limitations and Recommendations

Limitations

The research conducted at Ayder Comprehensive Specialized Hospital reveals several limitations regarding medication adherence among admitted patients. Firstly, the Medication Adherence Scale may not be fully applicable to this specific population, potentially leading to biases in the findings. Furthermore, the data collection process did not encompass inpatient wards, thus limiting the study's scope. The reliance on self-reported questionnaires may introduce bias, as participants might not accurately report their medication adherence behaviors. Additionally, the use of a single drug-drug interaction (DDI) checker may restrict the comprehensiveness of the analysis, particularly when compared to studies employing multiple checkers. Finally, the interaction of medications with food was not assessed, which could provide critical insights into adherence and safety.

Recommendations

Given the strong necessity perceptions for prescribed cancer chemotherapy drugs and the unanimous classification of participants as "Accepting ," it is recommended that healthcare providers continue to promote education and support programs. Patients should be encouraged to actively engage with healthcare providers, utilize available support resources, and remain informed about their treatment plans. This proactive involvement can help maintain and optimize their positive adherence, ultimately leading to better health outcomes. Utilizing free online drug interaction checkers is essential for enhancing medication reconciliation and pharmacist-led reviews in cancer chemotherapy patients. Education and training updates for oncologists, pharmacists, and nursing staff regarding common drug interactions will empower healthcare providers to better identify and mitigate risks, ultimately improving patient safety and treatment efficacy.

In general, it is crucial to address patients' beliefs and concerns about medications through targeted education and support initiatives. Such strategies can significantly enhance adherence and safety, fostering a more effective treatment environment.

References

Ademe, Mohammed, & M, F. (2021). Adherence to diabetic medications and associated factors among patients with type 2 diabetes mellitus in Jimma University Specialized Hospital, Southwest Ethiopia. *BMC Endocrine Disorders, 21*(1), 1-10. Retrieved from https://doi.org/10.1186/s12902-021-00669-5

Ademe, S., Mohammed, T., Edmealem, A., Tegegne, B., Bewket, B., Andualem, A., & Bires, A. (2024). Adherence to Chemotherapy and Associated Factors among Patients with Cancer in the Amhara Region, Northeast Ethiopia, 2022.

Alnaim, L. S., Almalki, H. M., Almutairi, A. M., & Salamah, H. J. (2022). The prevalence of drug-drug interactions in cancer therapy and the clinical outcomes. *Life Sci, 310*, 121071. doi:10.1016/j.lfs.2022.121071

Alshammari, T. M. (2019). Factors affecting medication adherence among patients with chronic diseases in Saudi Arabia. *Saudi Pharmaceutical Journal, 27*(7), 944-950. Retrieved from https://doi.org/10.1016/j.jsps.2019.02.001

Assad-Suzuki, R., Lima, P., & Santos, M. (2025). Adherence to oral chemotherapy in breast cancer: A multinational comparison. *Journal of Oncology Pharmacy Practice, 31*(1), 78-89.

Awedew, A. F., Asefa, Z., & Belay, W. B. (2022). National Burden and Trend of Cancer in Ethiopia, 2010-2019: a systemic analysis for Global burden of disease study. *Sci Rep, 12*(1), 12736. doi:10.1038/s41598-022-17128-9

Baleta, M., Melaku, T., & Gebregeorgise, D. (2025). Medication adherence among Ethiopian cancer patients: A multicenter study. *Ethiopian Journal of Health Sciences, 35*(3), 210-220.

Basak, G. W. (2021). Drug-drug interactions in oncology: clinical implications and management. *The Oncologist, 26*(1), e1-e13. Retrieved from https://doi.org/10.1634/theoncologist.2020-0711

Basak, I., & et al. (2021). *Medication adherence in cancer patients: a systematic review*: SAGE Publications.

Basak, R., McCune, J. S., & Ratain, M. J. (2021). Drug-drug interactions in oncology: Risk factors and clinical implications. *Cancer Chemotherapy and Pharmacology, 88*(4), 589-601.

Bekalu, Y. E., Wudu, M. A., & Gashu, A. W. (2023). Adherence to Chemotherapy and Associated Factors Among Patients With Cancer in Amhara Region, Northeastern Ethiopia, 2022. A Cross-Sectional Study. *Cancer Control, 30*, 10732748231185010.

Bibi, R., Azhar, S., Iqbal, A., Jabeen, H., Kalsoom, U.-e., Iqbal, M. M., & Nazeer, M. (2021). Prevalence of potential drug-drug interactions in breast cancer patients and determination of their risk factors. *Journal of Oncology Pharmacy Practice, 27*(7), 1616-1622.

Chamalidou, C., Nasic, S., & Linderholm, B. (2023). Compliance to adjuvant endocrine therapy and survival in breast cancer patients. *Cancer Treat Res Commun, 35*, 100704. doi:10.1016/j.ctarc.2023.100704

Debela, D. T., Muzazu, S. G., Heraro, K. D., Ndalama, M. T., Mesele, B. W., Haile, D. C., … Manyazewal, T. (2021). New approaches and procedures for cancer treatment: Current perspectives. *SAGE Open Med, 9*, 20503121211034366. doi:10.1177/20503121211034366

Degu, A., & Kebede, K. (2021). Drug-related problems and its associated factors among breast cancer patients at the University of Gondar Comprehensive Specialized Hospital, Ethiopia: A hospital-based retrospective cross-sectional study. *Journal of Oncology Pharmacy Practice, 27*(1), 88-98.

Dimitrijević, I., Dugonjić Okroša, S., & Horne, R. (2023). Necessity-concern differential in cancer patients: A Croatian perspective. *European Journal of Cancer Care, 32*(4), e13845.

Dugonjić Okroša, A., Silovski, T., Dedić Plavetić, N., Silovski, H., Kovačić, A., & Mucalo, I. (2023). Beliefs about medicines' association with endocrine therapy adherence in early breast cancer survivors in Croatia. *Acta Pharmaceutica, 73*(4), 671-689.

Endale, B., Getnet, D., & Gebrie, D. (2019). Healthcare professionals' awareness towards drug-drug interaction in Ayder comprehensive specialized hospital Mekelle, Ethiopia. *International Journal of Hospital Pharmacy*.

Gebregeorgise, D., Melaku, T., & Baleta, M. (2024). Medication beliefs and adherence patterns in Ethiopian patients. *PLOS ONE, 19*(2), e0298765.

Gebregeorgise, G. G. (2019). Medication adherence and associated factors among ambulatory patients with hypertension in Jimma University Specialized Hospital, Southwest Ethiopia. *PLOS ONE, 14*(12), e0226123. Retrieved from https://doi.org/10.1371/journal.pone.0226123

Gebretsadik, Z., Gebrehans, M., Getnet, D., Gebrie, D., Alema, T., & Belay, Y. B. (2017). Assessment of Drug-Drug Interaction in Ayder Comprehensive Specialized Hospital, Mekelle, Northern Ethiopia: A Retrospective Study. *Biomed Res Int, 2017*, 9792363. doi:10.1155/2017/9792363

Getachew, S., Tesfaw, A., Kaba, M., Wienke, A., Taylor, L., Kantelhardt, E. J., & Addissie, A. (2020). Perceived barriers to early diagnosis of breast Cancer in south and southwestern Ethiopia: a qualitative study. *BMC Womens Health, 20*(1), 38. doi:10.1186/s12905-020-00909-7

Grassi, L., Meggiolaro, E., Berardi, M. A., Sirgo, A., Colistro, M. C., Andritsch, E., … Nanni, M. G. (2017). Beliefs about medicines, doctor-patient relationship, and coping among European patients with cancer. *Psychooncology, 26*(2), 282-285. doi:10.1002/pon.4125

Hailesilase, G. G., Kidane, A. M., & Gebrezgabiher, H. A. (2024). Potential drug-drug interactions and associated factors among hospitalized pediatric patients in Adigrat general hospital, Tigrai, north Ethiopia: a retrospective cross-sectional study. *BMC Pediatr, 24*(1), 652. doi:10.1186/s12887-024-05128-9

Hamdi, Y., Abdeljaoued-Tej, I., Zatchi, A. A., Abdelhak, S., Boubaker, S., Brown, J. S., & Benkahla, A. (2021). Cancer in Africa: The Untold Story. *Front Oncol, 11*, 650117. doi:10.3389/fonc.2021.650117

Hassen, A. M., Taye, G., Gizaw, M., & Hussien, F. M. (2019). Quality of life and associated factors among patients with breast cancer under chemotherapy at Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia. *PLOS ONE, 14*(9), e0222629.

Hassen, F., Enquselassie, F., Ali, A., Addissie, A., Taye, G., Assefa, M., & Tsegaye, A. (2022). Adherence to Chemotherapy among Women with Breast Cancer Treated at Tikur Anbessa Specialized and Teaching Hospital, Addis Ababa, Ethiopia. *Asian Pacific Journal of Cancer Prevention: APJCP, 23*(9), 3035.

Horne, R. (2013). Understanding patients' adherence-related beliefs about medicines prescribed for long-term conditions: a meta-analytic review of the Necessity-Concerns Framework. *PLOS ONE, 8*(12), e80633. Retrieved from https://doi.org/10.1371/journal.pone.0080633

Horne, R., Weinman, J., & Hankins, M. (1999). *Beliefs about medicines questionnaire (BMQ): validation and application*: Taylor & Francis.

Horne, R., Weinman, J., & Hankins, M. (2013). The Beliefs about Medicines Questionnaire (BMQ): A new method for assessing cognitive representations of medication. *Psychology & Health, 28*(1), 1-24.

HV, A., Maka, V. V., & Patil, P. (2023). Incidence, Patterns, and Severity of Potential Drug Interactions Among Cancer Patients on Chemotherapy in a Tertiary Care Hospital. *Journal of Pharmacology and Pharmacotherapeutics*, 0976500X231162712.

Ismail, M. (2020). Prevalence and predictors of potential drug-drug interactions among patients receiving chemotherapy in a tertiary care hospital. *Journal of Pharmacy Practice and Research, 50*(1), 46-52. Retrieved from https://doi.org/10.1002/jppr.1571

Ismail, S., & et al. (2020). *Medication adherence: a comparison of self-report measures with electronically monitored data*: Wiley.

Jamous, K., Koni, A., & Basak, R. (2014). Necessity and concern beliefs in Palestinian cancer patients. *Eastern Mediterranean Health Journal, 20*(6), 389-397.

Kigozi, G., & et al. (2021). *Factors associated with medication adherence among patients with chronic illnesses in Uganda*: BioMed Central.

Kiros, F., & Abrham, A. (2018). Five Years (2011-2017) Cancer Morbidity in Tigray, Ethiopia: A Secondary Data Scanning and Analysis. *J Oncol Med & Prac, 3*(120), 2.

Koni, A., & et al. (2022). *Understanding the role of medication beliefs in adherence to treatment*: Dove Press.

Koni, A. A., Nazzal, M. A., Suwan, B. A., Sobuh, S. S., Abuhazeem, N. T., Salman, A. N., … Zyoud, S. e. H. (2022). A comprehensive evaluation of potentially significant drug-drug, drug-herb, and drug-food interactions among cancer patients receiving anticancer drugs. *BMC Cancer, 22*(1), 547.

Krska, J., & et al. (2016). *The role of community pharmacists in managing polypharmacy and improving medication adherence*: Wiley.

Kudjawu, S., & Agyeman- Yeboah, J. (2021). Experiences of women with breast cancer undergoing chemotherapy: A study at Ho Teaching Hospital, Ghana. *Nursing Open, 8*(6), 3161-3169.

Lam, W. Y., & Fresco, P. (2015). Medication Adherence Measures: An Overview. *Biomed Res Int, 2015*, 217047. doi:10.1155/2015/217047

Lee, J. (2022). *Necessity-Concern Differential and Medication Adherence*: Sage Publications.

Li, T., Zhou, S., Wang, L., Zhao, T., Wang, J., & Shao, F. (2024). Docetaxel, cyclophosphamide, and epirubicin: application of PBPK modeling to gain new insights for drug-drug interactions. *J Pharmacokinet Pharmacodyn, 51*(4), 367-384. doi:10.1007/s10928-024-09912-z

Ling, T. (2025). *Morisky Medication Adherence Scale (MMAS-8) Validation*: Wiley.

Long, Y., Xie, S., Liu, Q., Xu, F., Li, Q., Wang, N., & Zhang, Y. (2023). The experiences of adjuvant endocrine therapy for women breast cancer survivors: A literature review. *Medicine (Baltimore), 102*(51), e36704. doi:10.1097/MD.0000000000036704

Luzze, B., Atwiine, B., Lugobe, H. M., & Yadesa, T. M. (2022). Frequency, severity, and factors associated with clinically significant drug-drug interactions among patients with cancer attending Mbarara Regional Referral Hospital Cancer Unit, Uganda. *BMC Cancer, 22*(1), 1-11.

M., M. T. (2020). Medication adherence and associated factors among patients with chronic diseases in Gondar University Hospital, Northwest Ethiopia. *BMC Pharmacology and Toxicology, 21*(1), 1-9. Retrieved from https://doi.org/10.1186/s40545-020-00262-6

Malhotra, C., Loo, W. S., Chaudhry, I., Group, C. S., & Group, C. S. (2024). Do advanced cancer patients and their caregivers agree on preferred place of patient's death?-a prospective cohort study of patient-caregiver dyads. *Ann Palliat Med, 13*(2), 531-541. doi:10.21037/apm-23-496

McHorney, C. A. (1997). *The MOS 36-item short-form health survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health*: Lippincott Williams & Wilkins.

Mekonnen, A. G., Gebeyehu, B. T., & Woldearegay, M. (2022). Experience of patients with breast cancer with traditional treatment and healers' understanding of causes and manifestations of breast cancer in North Shewa zone, Ethiopia: a phenomenological study. *BMJ open, 12*(12), e063726. doi:10.1136/bmjopen-2022-063726

Mohamed, M. R., Mohile, S. G., Juba, K. M., Awad, H., Wells, M., Loh, K. P., … Ramsdale, E. E. (2023). Association of polypharmacy and potential drug-drug interactions with adverse treatment outcomes in older adults with advanced cancer. *Cancer, 129*(7), 1096-1104. doi:10.1002/cncr.34642

Mohammad, I., Sehrash, K., Fahadullah, K., Sidra, N., Hira, S., Shazia, Y., & Irum, R. (2020). Prevalence and significance of potential drug-drug interactions among cancer patients receiving chemotherapy. *BMC Cancer, 20*, 1-9.

Mousavi. (2014). Adherence to iron chelation therapy in Iranian patients with thalassemia major: a cross-sectional study. *International Journal of Hematology, 99*(3), 340-346. Retrieved from https://doi.org/10.1007/s12185-014-1506-2

Ortland, I., Mendel Ott, M., Kowar, M., Sippel, C., Ko, Y.-D., Jacobs, A. H., & Jaehde, U. (2022). Medication risks in older patients (70+) with cancer and their association with therapy-related toxicity. *BMC geriatrics, 22*(1), 1-10.

Osman, M. A., Abdalla, M. A., Mohamed, A. A., & Yousef, B. A. (2020). Assessment of drug–drug interactions between chemotherapeutic and chronically used medications at Khartoum Oncology Hospital. *Sci Med, 4*, 79-84.

Peixoto de Miranda, E. J. F., Takahashi, T., Iwamoto, F., Yamashiro, S., Samano, E., Macedo, A. V. S., & Ramacciotti, E. (2020). Drug-Drug Interactions of 257 Antineoplastic and Supportive Care Agents With 7 Anticoagulants: A Comprehensive Review of Interactions and Mechanisms. *Clin Appl Thromb Hemost, 26*, 1076029620936325. doi:10.1177/1076029620936325

Prely, H., Herledan, C., Caffin, A. G., Baudouin, A., Larbre, V., Maire, M., … Rioufol, C. (2022). Real-life drug-drug and herb-drug interactions in outpatients taking oral anticancer drugs: comparison with databases. *Journal of Cancer Research and Clinical Oncology, 148*(3), 707-718. doi:10.1007/s00432-021-03645-z

Rafhi, N. (2015). The association between illness perceptions, treatment beliefs and adherence to adjuvant endocrine therapy in women with breast cancer. *Breast Cancer Research and Treatment, 150*(3), 647-655. Retrieved from https://doi.org/10.1007/s10549-015-3563-7

Ramasubbu, J. (2020). A study on potential drug-drug interactions in oncology outpatients receiving chemotherapy. *Indian Journal of Medical and Paediatric Oncology, 41*(2), 213. Retrieved from https://doi.org/10.4103/ijmpo.ijmpo_147_19

Ramasubbu, S. K., Mahato, S. K., Agnihotri, A., Pasricha, R. K., Nath, U. K., & Das, B. D. (2021). Prevalence, severity, and nature of risk factors associated with drug-drug interactions in geriatric patients receiving cancer chemotherapy: A prospective study in a tertiary care teaching hospital. *Cancer Treat Res Commun, 26*, 100277. doi:10.1016/j.ctarc.2020.100277

Rawal, K. B., Mateti, U. V., Shetty, V., Unnikrishnan, M., & Shastry, C. (2023). Detection of potential drug-drug interactions among ovarian cancer patients in a tertiary care teaching hospital in south India-A retrospective approach. *Clinical Epidemiology and Global Health*, 101333.

Refaat Elmaadawy, A., Salah Hassan, M., Mohamed Mohamed, Y., & Eldin Moussa Sherif, D. (2022). Factors affecting Adherence to Adjuvant Hormonal Therapy among Women with Breast Cancer. *Egyptian Journal of Health Care, 13*(4), 1033-1049.

Reibold, C. F., Tariku, W., Eber-Schulz, P., Getachew, S., Addisie, A., Unverzagt, S., … Kantelhardt, E. J. (2021). Adherence to Newly Implemented Tamoxifen Therapy for Breast Cancer Patients in Rural Western Ethiopia. *Breast Care (Basel), 16*(5), 484-490. doi:10.1159/000512840

Reshma, V., Chacko, A. M., Abdulla, N., Annamalai, M., Kandi, V., & CHACKO, A. M. (2024). Medication Adherence in Cancer Patients: A Comprehensive Review. *Cureus, 16*(1).

Riechelmann, R. P., & Del Giglio, A. (2009). Drug interactions in oncology: how common are they? *Ann Oncol, 20*(12), 1907-1912. doi:10.1093/annonc/mdp369

Sella, T., & Chodick, G. (2020). Adherence and Persistence to Adjuvant Hormonal Therapy in Early-Stage Breast Cancer Patients: A Population-Based Retrospective Cohort Study in Israel. *Breast Care (Basel), 15*(1), 45-53. doi:10.1159/000500318

Sheppard, V. B., Sutton, A. L., Hurtado-de-Mendoza, A., He, J., Dahman, B., Edmonds, M. C., … Tadesse, M. G. (2021). Race and Patient-reported Symptoms in Adherence to Adjuvant

Endocrine Therapy: A Report from the Women's Hormonal Initiation and Persistence Study. *Cancer Epidemiol Biomarkers Prev, 30*(4), 699-709. doi:10.1158/1055-9965.EPI-20-0604

Sritharan, S., & Sivalingam, N. (2021). A comprehensive review on time-tested anticancer drug doxorubicin. *Life Sci, 278*, 119527. doi:10.1016/j.lfs.2021.119527

Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin, 71*(3), 209-249. doi:10.3322/caac.21660

Sutton, A. L., Salgado, T. M., He, J., Hurtado-de-Mendoza, A., & Sheppard, V. B. (2020). Sociodemographic, clinical, psychosocial, and healthcare-related factors associated with beliefs about adjuvant endocrine therapy among breast cancer survivors. *Supportive Care in Cancer, 28*, 4147-4154.

Talens, A., Guilabert, M., Lumbreras, B., Aznar, M. T., & Lopez-Pintor, E. (2021). Medication Experience and Adherence to Oral Chemotherapy: A Qualitative Study of Patients' and Health Professionals' Perspectives. *Int J Environ Res Public Health, 18*(8), 4266. doi:10.3390/ijerph18084266

Tan, E. H., Wong, A. L. A., Tan, C. C., Wong, P., Tan, S. H., Ang, L. E. Y., … Tai, B. C. (2021). Facilitators and barriers to medication adherence with adjuvant endocrine therapy in women with breast cancer: a structural equation modelling approach. *Breast Cancer Res Treat, 188*(3), 779-788. doi:10.1007/s10549-021-06204-9

Tilahun, S. W., Kitaw, L. D., & Yusuf, N. T. (2023). Predictors of information needs among women with breast cancer receiving adjuvant therapy at Tikur Anbessa specialized hospital, Addis Ababa Ethiopia: a cross-sectional study. *BMC Women's Health, 23*(1), 659.

Umar, R. M., Can, Z. Y., GÜVEN, E., Koçberber, E. K., & OLMEZ, O. F. (2023). The Prevalence of Drug-Drug Interactions and Reported Therapy Related Side Effects in Oncology Out-Patients. *Clinical and Experimental Health Sciences, 13*(1), 212-217.

Venkatesh, K., Acharya, S., & Holla, R. (2021). Assessment of potential drug-drug interaction among the patients receiving cancer chemotherapy: a cross-sectional study. *Journal of Pharmacology and Pharmacotherapeutics, 12*(2), 79-85.

Venkatesh, K. M., Acharya, S., & Holla, R. (2021). Assessment of Potential Drug - Drug Interaction among the Patients Receiving Cancer Chemotherapy: A Cross-sectional Study. *Journal of Pharmacology and Pharmacotherapeutics, 12*(2), 79-85. doi:10.4103/jpp.jpp_16_21

Wako, Z., Mengistu, D., Dinegde, N. G., Asefa, T., & Wassie, M. (2021). Adherence to adjuvant hormonal therapy and associated factors among women with breast cancer attending the Tikur

Anbessa Specialized Hospital, Addis Ababa Ethiopia, 2019: a cross-sectional study. *Breast Cancer: Targets and Therapy*, 383-392.

Wang, H., Shi, H., Wang, Y., Wang, N., Li, Y., Yang, Q., … Xie, J. (2022). Potentially Hazardous Drug-Drug Interactions Associated With Oral Antineoplastic Agents Prescribed in Chinese Tertiary Care Teaching Hospital Settings: A Multicenter Cross-Sectional Study. *Front Pharmacol, 13*, 808848. doi:10.3389/fphar.2022.808848

Weilan, W., Bingkun, X., Ziqi, L., Dongxiao, W., & Man, Z. (2019). The prevalence of the potential drug-drug interactions involving anticancer drugs in China: a retrospective study. *Iranian Journal of Public Health, 48*(3), 435.

Wondm, S. A., Tamene, F. B., Gubae, K., Dagnew, S. B., Worku, A. A., & Belachew, E. A. (2023). Potential drug–drug interaction and its determinants among patients with cancer receiving chemotherapy in oncology centres of Northwest Ethiopia: an institutional-based cross-sectional study. *BMJ open, 13*(12).

Xiong, G., Yang, Z., Yi, J., Wang, N., Wang, L., Zhu, H., … Cao, D. (2022). DDInter: an online drug-drug interaction database towards improving clinical decision-making and patient safety. *Nucleic Acids Res, 50*(D1), D1200-D1207. doi:10.1093/nar/gkab880

Xu, H., Jin, F., Zhang, X. J., Wang, D. Q., Yu, S. F., & Wang, A. P. (2020). Adherence status to Adjuvant Endocrine Therapy in Chinese Women with Early Breast Cancer and its influencing factors: A cross-sectional survey. *Cancer Med, 9*(11), 3703-3713. doi:10.1002/cam4.3017

Zerah, L., Henrard, S., Wilting, I., O'Mahony, D., Rodondi, N., Dalleur, O., … Spinewine, A. (2021). Prevalence of drug-drug interactions in older people before and after hospital admission: analysis from the OPERAM trial. *BMC geriatrics, 21*(1), 1-11.

Appendices

Appendix I: Information about the Studies

English Version

My name is_____, a data collector for Mr. Tsegay Lemma, a master's student at Mekelle University's College of Health Sciences. He is conducting a study on cancer treatment management, focusing on patient medication adherence, beliefs about medications, potential drug-drug interactions, and associated factors at Ayder Comprehensive Specialized Hospital.

The study aims to: Assess patient adherence and beliefs regarding cancer treatments, identify potential drug-drug interactions and factors influencing adherence, examine the impact of comorbidities on cancer patients.

Your participation involves answering specific questions and allowing us to photograph your prescription. Participation is voluntary, and you may withdraw at any time. Your decision will not affect the care you receive. All data will remain confidential, stored securely with password protection and restricted access. Hard copies will be kept in locked files, accessible only to the research team.

For questions, contact:

Tsegay Lemma (PI): 975273115/ tsegaylemma4@gmail.com

Mr. Abera Hadgu (Adviser): 0913549059/ ahadgu@gmail.com

Consent:

I understand the above conditions and:

1. Agree _____2. Disagree _____to participate.

Interviewer: _____Sign_____Date: _____

Supervisor: _____Sign_____Date: _____

Thank you for your time.

TGR¾

ብዛዕባ ንመድሓኒት ዘሎ ኣመለኻኽታ ዝጥምት ሓበሬታ ፅሑፋዊ መሕትት

ሽመይ ..... ይበሃል። ኣብ ኮሌጅ ሳይንስ ጥዕና መቐለ ዩኒቨርስቲ ናይ ማስተርስ ተምሃራይ ኣይተ ፀጋይ ለማ ዳታ ኣካቢ እየ። እዚ መጽናዕቲ እዚ ኣብ ዓይደር ኮምፕረህንስቭ ስፔሻላይዝድ ሆስፒታል ሕሙማት ካንሰር ብዛዕባ ኣገባብ ኣወሳስዳን ኣምነት መድሓኒቶምን፡ መድሓኒታቶም ነንባዕሎም ዘለዎም ምትእስሳር ምስ ተዛመድቲ ረቓሒታቶምን ወሰንቲ ሕማማትን ተሓባበርቲ ረቓሒታትን መጽናዕቲ ይካይድ ኣሎ። ነዞም ተሳትፎ ዝጠልቡ ነገራት ፍሉይ ሕቶ ንሓትተኩም/ክን እሞ መልስኹም/ክን ድማ ክንምዝግብ ኢና። ምትሕብባርኩም/ክን ምስሊ ናይቲ ዝተኣዘዝኩም መድሃኒት ክንሕዝ ምፍቃድና እውን የጠቓልል። ናይ ዘይምስታፍ መሰልኩም/ክን ዝተሓለወ እዩ። ኣብዚ መጽናዕቲ ዘይምስታፍኹም ነቲ ኣብ ኩሉ ግዜ እትረኽብወ ኣገልግሎት ኣይቅይሮን እዩ። እንተዘይተረዲኡኹም ሕቶ ምሕታት መሰልኩም እዩ። ኣብ መስርሕ ሕቶን መልስን ኣብ ዝኾነ እዋን ናይ ምውጻእ መሰል ዝተሓለወ እዩ። ይኹን እምበር ካብኡ ዝረኽቦ ፍልጠት ኣብ ምሕደራ ካንሰርመፍትሒ ንምርካብ ክውዕል እዩ። ኣብ ምሉእ ግዜ ውልቃዊ ሓበሬታኩም/ክን ብጥብቂ ከም ዝሕሎ ከነረጋግጸልኩም ንፈቱ።

ዝኾነ ሕቶታት ምስ ዝህልወኩም ወይ ብዛዕባ እቲ መጽናዕቲ ተወሳኺ ሓበሬታ ክትረኽቡ ምስ እትደልዩ፤ በጃኹም ነዞም ዝስዕቡ ሓላፍነት ዘለዎም ኣካላት ርክብ ግበሩ፤ ክትረኽብዎም ዘለኩም ሰባት፤

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ፍቓድ፡- ኩሎም ኣብ ላዕሊ ዝተገለፁ ቅድሞ ኩነታት ብኣከባቢ መረዳእታ ተነቢቡለይ ኣሎ። ስለዚ ኣነ፤

1. ኣብ ተሳትፎ ተሰማሚዐ.....2. ኣብ ተሳትፎ ኣይተምስምማዕኩን_____

ስም ሓታቲ፡ _____ፈርማ _____ዕለት_____

ስም ተቐጻጻሪ፡_____ፈርማ_____ዕለት_____

ስለቲ ግዜኹም የቐንየልና።

Appendix II: Socio-demographic Characteristics

English Version

1. Age----------

2. Gender A. Male B. Female

3. Residence A. Urbana B. Rural

4. Marital status A. Married Single Divorced D. Widowed

5. Educational level A. No Formal Education B. primary school B. Secondary Education D. ≥ Diploma

6. Religious A. orthodox B. Muslim Catholic D. others

7. Monthly household income categories: A. High B. Moderate C. low

8. Duration of Cancer under treatment in years A. <5 B.5-10 C.>10

9. Presence of comorbidities A. no B. Yes, if yes: 1. DM 2. HTN 3. CKD 4. Others specify----------

10. Currently prescribed Medications_____

TGR¾

መምርሒ 3፡ መበገሲ ባህርያት ተሳተፍቲ መጽናዕቲ

1. ዕድመ (ዓመታት)----------

2. ጾታ ሀ. ተባዕታይ ለ. ኣንስተይቲ

3. መንበሪ ሀ. ከተማ ለ. ገጠር

4. ኩነታት ሓዳር ሀ. ተመርዕዩ ለ.ንጽል ሐ.ተፋቲሑ መ. መበለት

5. ደረጃ ትምህርቲ ሀ. ወግዓዊ ትምህርቲ የለን ለ. መባእታ ቤት ትምህርቲ ሐ. ካልኣይ ደረጃ ትምህርቲ መ. ዲፕሎማን ልዕሊኡን

6. ሃይማኖታዊ ሀ. ኦርቶዶክሳዊ ለ. ኣስላማይ ሐ. ካቶሊክ መ.ካልኦት

7. ወርሓዊ ምድባት እቶት ስድራቤት ሀ. ልዑል ለ. ማእከላይ ሐ. ትሑት

8. ንውሓት ግዜ ሕዱር ሕማም ኣብ ትሕቲ ሕክምና ብዓመታት ሀ. <5 ለ.5-10 ሐ.>10

9. ህላወ ምትሕውዋስ ሕማማት A. ኣይፋልን B. እወ እንተኾይኑ እወ፤ ምግላጽ----------

10. ሐZ ZwSDwM መድሓኒትታት_____

Appendix III: Beliefs about Medicines Questionnaire: (BMQ-18)

English Version

Here, we would like to ask you about your personal views about medicines prescribed
For you. Below here are the questioner types.

S. N	Beliefs about Medicines Questionnaire	Strongly Agree	Agree	Uncertain	Disagree	Disagree Strongly
1	My life would be impossible without my medicine					
2	Without my medicines, I would be very sick					
3	My health, at present, depends on my medicines					
4	My medicines protect me from becoming worse					
5	My health in the future will depend on my medicines					
6	I sometimes worry about the long-term effects of my medication					
7	Having to take medicines worries Me					
8	I sometimes worry about becoming too dependent on my medication					
9	My medicine disrupts my life					
10	My medicines are a mystery to me					
11	If doctors had more time with patients, they would prescribe fewer medicines					
12	Doctors use too many medicines					
13	Doctors place too much trust in Medicines					
14	Natural remedies are safer than					

	Medicines
15	People who take medicines should stop their treatment for a while now and again
16	Most medicines are addictive
17	All medicines are poisons
18	Medicines do more harm than good

TIgrigna

መምርሒ : ንመድሓኒት ዘሎ ኣመለኻኽታ ዝጥምት ፅሑፋዊ መሕትት

ኣብዚ፡ ብዛዕባ ዝተኣዘዙልኩም መድሃኒታት ዘለኩም ውልቃዊ ኣረኣእያ ክንሓተኩም ንፈቱ። ኣብ ታሕቲ ካልኦት ሰባት ብዛዕባ መድሃኒቶም ዝሃብዎ መግለጺታት ኣሎ። በጃኹም ነቲ ዝምልከቶ ደብዳበ ብምኽባብ ክሳብ ክንደይ ምስኦም ከም እትሰማምዑ ወይ ከም ዘይትሰማምዑ ኣመልክቱ።

ተ.ቁ	ንመድሓኒት ዘሎ ኣመለኻኽታ	ኣዝየ ይስማዕማዕ	እስማዕማዕ	ንምውሳን እፅገም'የ	ኣይስማዕማዕን	ብዕሊ እቃወም
1	ብዘይ መድሓኒት ክነብር ኣይክእልን።					
2	መድሓኒት እንተዘይተጠቒመ ብጣዕሚ ክሕመኒ ይኽእል ዩ።					
3	ኣብዚ ሐዚ እዋን ጥዒናይ ኣብ መድሓኒት ዝተመስረተ እዩ።					
4	መድሓኒት ሕማመይ ከይጋደድ ይከላኸለለይ እዩ።					
5	ናይ መፃኢ ጥዒናይ መድሃኒት ኣብ ምጥቃም ዝምስረት እዩ።					
6	ሓደ ሓደ ጊዘ መድሓኒት ምጥቃም ኣብ ነዊሕ እዋን ኣብ ጥዒናይ ክህልዎ ዝኽእል ሳዕቤን የተሓሳስበኒ።					

7	መድሓኒት ንክወስድ ክግበር ከለኹ የጨንቐኒ እዩ።
8	ሓደ ሓደ ግዜ ኣብ መድሃኒተይ ኣዝየ ጽግዕተኛ ከይከውን ይጭነቐ
9	መድሓኒት ተጠቃሚ (ት) ምኳን ህይወተይ ኣናጊዕዎ እዩ።
10	መድሃኒታተይ ንዓይ ምስጢር እዩ።
11	ሓካይም ምስ ሕሙማት ዝያዳ ግዜ እንተዝህልዎም ውሑድ መድሃኒት ምኣዘዙ
12	ሓካይም ምስ ሕሙማት ዝያዳ ግዜ እንተዝህልዎም ውሑድ መድሃኒት ምኣዘዙ
13	ሓካይም ኣብ መድሃኒታት ካብ መጠን ንላዕሊ ይኣምኑ
14	ተፈጥሮኣዊ መድሃኒታት ካብ መድሃኒታት ዝያዳ ውሑስ እዩ።
15	መድሃኒታት ካብ ጥቕሚ ንላዕሊ ጉድኣት የብጽሑ
16	መድሃኒት ዝወስዱ ሰባት ሕጂን ደጋጊምን ንዝተወሰነ ግዜ ሕክምናኦም ደው ከብሉ ይግባእ።
17	መብዛሕትኦም መድሃኒታት ወልፊ ዘለዎም እዮም።
18	ኩሎም መድሃኒታት መርዛማት እዮም

Appendix IV: Modified MMAS-8 for Oral and Injectable Medications

English Version

1. Do you sometimes forget to take your oral medications or receive your injections on schedule? Yes / No
2. In the last two weeks, were there any days when you missed taking your oral medications or receiving your injections? Yes / No
3. Have you ever adjusted the timing of your oral medications or injections without consulting your healthcare professional? Yes / No
4. When you travel or leave home, do you sometimes forget to bring your oral medications or injection supplies? Yes / No
5. Do you take your oral medications and receive your injections at the right times as instructed? Yes / No
6. It is sometimes difficult for me to remember to take my oral medications or prepare for my injections. Strongly agree / Agree / Disagree / strongly disagree
7. I follow the instructions provided by my healthcare professional for my oral medications and injections carefully. Strongly agree / Agree / Disagree / strongly disagree
8. How often do you have difficulty remembering to take your oral medications or prepare for your injections? A. Never/Rarely B. Once in a while C. Sometimes D. Usually E. All the times

TGR¾

መምርሒ 5: መሕትት ዝተመሓየሸ ናይ ሞሪስኪ ብዓል ሸሞንተ ናይ ሓኪም መምርሒ ምኽታል ዳህሳስ

1. ሓደ ሓደ ግዜ ናይ ኣፍ መድሃኒታትካ ምውሳድ ትርስዕ ዲኻ ወይ ድማ መርፍእካ ኣብ ዝተመደበሉ ግዜ ትወስዶ?

   ሀ .እወ ለ. ኣይፋልን

2. ኣብ ዝሓለፈ ክልተ ሰሙናት፡ ናይ ኣፍ መድሃኒታትካ ምውሳድ ወይ መርፍእ ምውጋእ ዝሰኣንካሉ መዓልታት ነይሩ ድዩ?

   ሀ. እወ ለ. ኣይፋልን

3. ንበዓል ሞያ ክንክን ጥዕናኻ ከይተማኸርካ ናይ ኣፍ መድሃኒታትካ ወይ መርፍእ ዝወሃበካ ግዜ ኣመዓራረኻዮ ትፈልጥ ዲኻ?

   ሀ.እወ ለ. ኣይፋልን

4. ክትገይሽ ወይ ካብ ገዛ ክትወጽእ ከለኻ፡ ሓደ ሓደ ግዜ ናይ ኣፍ መድሃኒትካ ወይ ናይ መርፍእ ናውቲ ሒዝካ ምምጻእ ትርስዕ ዲኻ?

   ሀ.እወ ለ. ኣይፋልን

5. ናይ ኣፍ መድሃኒታትኩም ትወስዱን መርፍእኹም ከምቲ መምርሒ ኣብ ትኽክለኛ ግዜ ትወስዱን ዶ?

    ሀ. እወ ለ. ኣይፋልን

6. ሓደ ሓደ ግዜ ናይ ኣፍ መድሃኒተይ ክወስድ ወይ ንመርፍእ ክዳሎ ምዝካር ይኽብደኒ።

    ሀ.ኣዝየ ይሰማማዕ

    ለ. ይሰማማዕ

    ሐ. ገለልተኛ

    መ.ኣይሰማማዕን

    ሠ.ኣዝየ ኣይሰማማዕን

7. ንኣፋዊ መድሃኒታተይን መርፍእታተይን ብበዓል ሞያ ክንክን ጥዕናይ ዝወሃበኒ መምርሒታት ብጥንቃቐ እኽተል

    ሀ. ኣዝየ ይሰማማዕ

    ለ. ይሰማማዕ

    ሐ. ገለልተኛ

    መ.ኣይሰማማዕን

    ሠ.ኣዝየ ኣይሰማማዕን

8. ክንደይ ግዜ ኢኻ ንኣፍ እትወስዶ መድሃኒታት ክትወስድ ወይ ንመርፍእካ ክትዳሎ ክትዝክር ትሽገር?

    ሀ. ፈጺሙ/ሳሕቲ

    ለ. ሓንሳብ ሓንሳብ

    ሐ . ሓደ ሓደ ግዜ

    መ. መብዛሕትኡ ግዜ

    ሠ. ኩሉ ግዜ

Appendix V: Potential Drug-Drug Interaction Instrument

English Version

Interaction Severity and mechanism of interaction of DDInter checker results

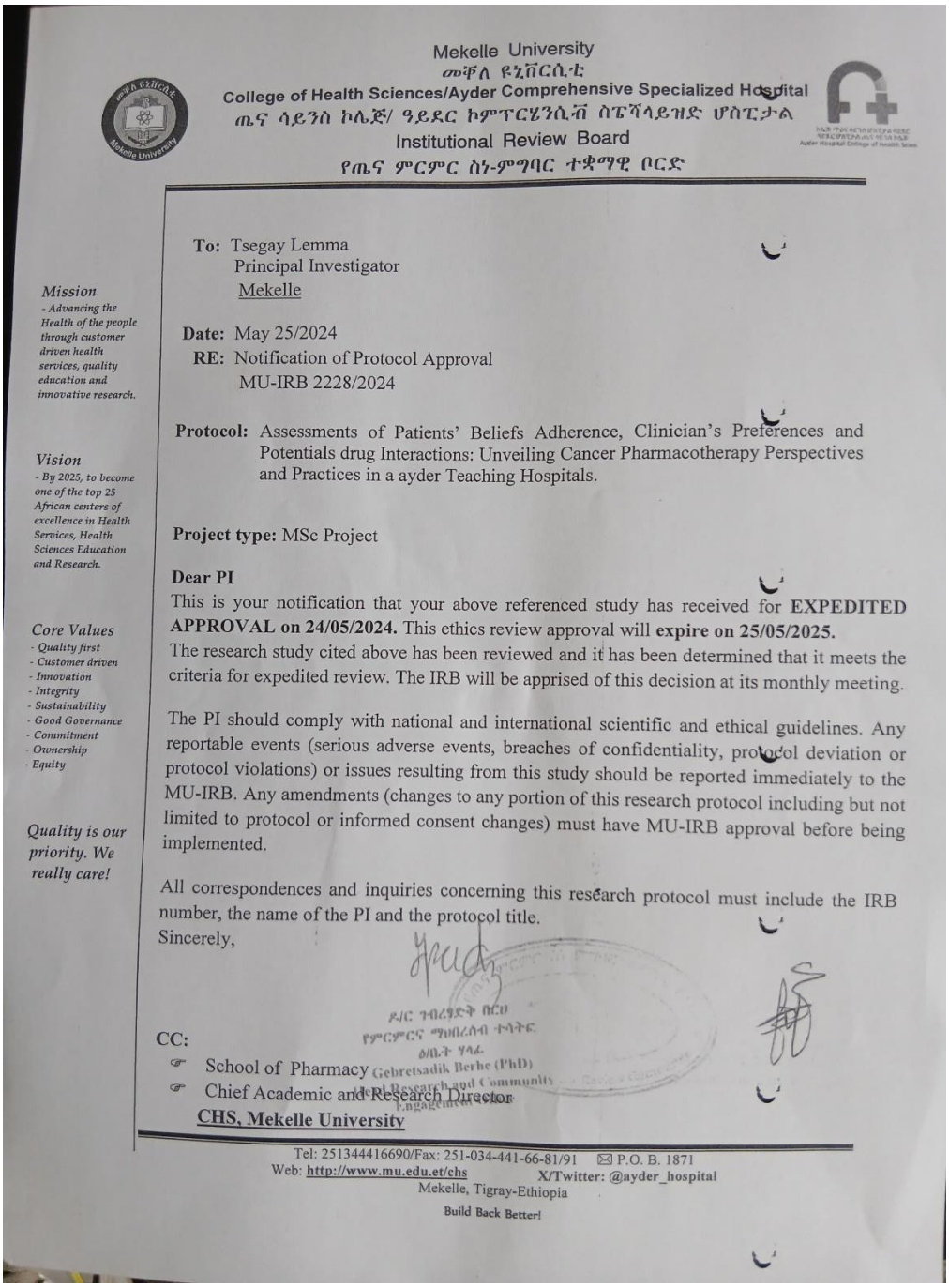
S. N	Diagnosis	Name of Medication	Dose	Frequency	Severity of Interaction			Risk Category
					Major	**Moderate**	**Minor**	
1								
2								
3								
4								

TGR¾

መምርሒ. ኣብዚ እዋን’ዚ ዝተኣዘዙ መድሓኒታት (መድሃኒትን መድሓኒትን ዘለዎም ምትእስሳር ንምፍታሽ)

ተ.ቁ.	**ውጽኢት መርመራ**	**ስም መድሓኒት**	**መ-N ናይቲ ዝተኣዘዘ መድሓኒት**	**ድግግም ምውሳድ መድሓኒት**	**ደረጃ ሓደጋ ምትእስሳር መድሃኒትን**			**መደብ ሓደጋ**
					ከቢድ	ማእከላይ	ቀሊል	
1								
2								
3								
4								
5								
6								
7								

Appendix VI: Notification of Protocol Approval



Mekelle University
መቐለ ዩኒቨርሲቲ
College of Health Sciences/Ayder Comprehensive Specialized Hospital
ጤና ሳይንስ ኮሌጅ/ ዓይደር ኮምፕርሄንሲቭ ስፔሻላይዝድ ሆስፒታል
Institutional Review Board
የጤና ምርምር ስነ-ምግባር ተቋማዊ ቦርድ

Mission
- Advancing the Health of the people through customer driven health services, quality education and innovative research.

Vision
- By 2025, to become one of the top 25 African centers of excellence in Health Services, Health Sciences Education and Research.

Core Values
- Quality first
- Customer driven
- Innovation
- Integrity
- Sustainability
- Good Governance
- Commitment
- Ownership
- Equity

Quality is our priority. We really care!

To: Tsegay Lemma
Principal Investigator
Mekelle

Date: May 25/2024
RE: Notification of Protocol Approval
MU-IRB 2228/2024

Protocol: Assessments of Patients' Beliefs Adherence, Clinician's Preferences and Potentials drug Interactions: Unveiling Cancer Pharmacotherapy Perspectives and Practices in a ayder Teaching Hospitals.

Project type: MSc Project

Dear PI
This is your notification that your above referenced study has received for **EXPEDITED APPROVAL on 24/05/2024.** This ethics review approval will **expire on 25/05/2025.**
The research study cited above has been reviewed and it has been determined that it meets the criteria for expedited review. The IRB will be apprised of this decision at its monthly meeting.

The PI should comply with national and international scientific and ethical guidelines. Any reportable events (serious adverse events, breaches of confidentiality, protocol deviation or protocol violations) or issues resulting from this study should be reported immediately to the MU-IRB. Any amendments (changes to any portion of this research protocol including but not limited to protocol or informed consent changes) must have MU-IRB approval before being implemented.

All correspondences and inquiries concerning this research protocol must include the IRB number, the name of the PI and the protocol title.
Sincerely,

ዶ/ር ገብረፃድቅ በርሀ
የምርምርና ማህበረሰብ ተሳትፎ
ዕቤት ፃላፈ
Gebretsadik Berhe (PhD)
Research and Community Engagement

CC:
- School of Pharmacy
- Chief Academic and Research Director
  CHS, Mekelle University

Tel: 251344416690/Fax: 251-034-441-66-81/91 ✉ P.O. B. 1871
Web: http://www.mu.edu.et/chs X/Twitter: @ayder_hospital
Mekelle, Tigray-Ethiopia
Build Back Better!

Ademe, S., et al. (2024). "Adherence to Chemotherapy and Associated Factors among Patients with Cancer in the Amhara Region, Northeast Ethiopia, 2022."

Blower, P., et al. (2005). "Drug–drug interactions in oncology: why are they important and can they be minimized?" Critical reviews in oncology/hematology **55**(2): 117-142.

Conde-Estévez, D., et al. (2022). "Treatment of non-metastatic castration-resistant prostate cancer: facing age-related comorbidities and drug–drug interactions." Expert Opinion on Drug Metabolism & Toxicology **18**(9): 601-613.

De las Cuevas, C. and W. Penate (2015). "Psychometric properties of the eight-item Morisky Medication Adherence Scale (MMAS-8) in a psychiatric outpatient setting." International Journal of Clinical and Health Psychology **15**(2): 121-129.

Gatt, I., et al. (2017). "Psychometric properties of the Belief about Medicines Questionnaire (BMQ) in the Maltese language." Pharmacy Practice (Granada) **15**(1).

Hines, L. E. and J. E. Murphy (2011). "Potentially harmful drug–drug interactions in the elderly: a review." The American journal of geriatric pharmacotherapy **9**(6): 364-377.

Koenig, H. G. (2012). "Religion, spirituality, and health: The research and clinical implications." International Scholarly Research Notices **2012**(1): 278730.

Lam, W. Y. and P. Fresco (2015). "Medication adherence measures: an overview." BioMed research international **2015**(1): 217047.

Lin, C., et al. (2017). "Breast cancer oral anti-cancer medication adherence: a systematic review of psychosocial motivators and barriers." Breast Cancer Research and Treatment **165**(2): 247-260.

Magro, L., et al. (2012). "Epidemiology and characteristics of adverse drug reactions caused by drug–drug interactions." Expert opinion on drug safety **11**(1): 83-94.

Meadows, T. and G. Davey (2022). "What factors influence adherence and non-adherence to multi-drug therapy for the treatment of leprosy within the World Health Organisation South East Asia region? A systematic review." Leprosy Review **93**(4): 311-331.

Nasuhara, Y., et al. (2015). "Physicians' responses to computerized drug interaction alerts with password overrides." BMC Medical Informatics and Decision Making **15**(1): 74.

Riechelmann, R. P. and A. Del Giglio (2009). "Drug interactions in oncology: how common are they?" Annals of oncology **20**(12): 1907-1912.

Rosman, S. (2004). "Cancer and stigma: experience of patients with chemotherapy-induced alopecia." Patient education and counseling **52**(3): 333-339.

Varma, M. V., et al. (2015). "Dealing with the complex drug–drug interactions: towards mechanistic models." Biopharmaceutics & drug disposition **36**(2): 71-92.

Xiong, G., et al. (2022). "DDInter: an online drug–drug interaction database towards improving clinical decision-making and patient safety." Nucleic acids research **50**(D1): D1200-D1207.