College of Health Sciences

School of Pharmacy

Department of Pharmacology and Clinical Pharmacy

Investigation of Non-Communicable Diseases Prevalence, Patterns and Outcomes among Hospitalized Patients: A Prospective Observational Study in Three Tertiary Hospitals

By: Alemu Belayneh (B. Pharm)

July 2024

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A Thesis Submitted to the Department of Pharmacology and Clinical Pharmacy, School of Pharmacy, College of Health Science, Addis Ababa University in Partial Fulfilment of the Requirements for the Degree of Master of Sciences in Pharmacy Practice.

Advisors: **Legese Chelkeba (PhD, Associate professor of Clinical pharmacy), Firehiwot Amare (Assistant Professor of clinical pharmacy)**

Co-advisors: **Senbeta Guteta (MD, professor of Cardiology), Dr. Henok Fisseha (MD, Internist, Gastroenterologist & Hepatologist)**

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School of Graduate Studies

This is to certify that the thesis prepared by Alemu Belayneh, entitled: **"Investigation of Non-Communicable Diseases Prevalence, Patterns and Outcomes Among Hospitalized Patients: A Prospective Observational Study in Three Tertiary Hospitals"** and submitted in partial fulfillment of the requirements for the Degree of Master of Pharmacy in Pharmacy Practice complies with the regulations of the University and meets the accepted standards concerning originality and quality.

Signed by the examining committee:

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ABSTRACT

Background: Non-communicable diseases (NCDs) pose a significant global health challenge, constituting over 71% of overall mortality and morbidity. Cardiovascular diseases, cancer, diabetes mellitus, and chronic respiratory disease are the major classes of NCDs and the leading cause of death globally. Recently, the burden of these NCDs have become more pronounced in low- and middle-income countries, including Ethiopia.

Objective: To determine the prevalence, patterns, patient outcome, and pattern of medication use of major NCD among hospitalized population.

Methods: A prospective follow-up study was conducted across three tertiary hospitals from October 2022 to January 2023 among hospitalized population. Socio- demographic and clinical data were collected through medical records review and interviews. Descriptive statistics, multinomial logistic regression, survival analysis and negative binomial regression were conducted to summarize, and determine the independent predictor of clinical outcomes, P-value < 0.05 was considered statistically significant.

Results: The overall prevalence of NCDs among hospitalized patients was 1302 (58.2%). However, after the exclusion of patients who did not fulfill the inclusion criteria for follow-up, the proportion of NCD among hospitalized patients in our sample became 523 (23.4%), of which 80 (15.3%) faced in-hospital mortality and 90 (17.2%) were discharged with unsatisfactory clinical outcomes. Cardiovascular diseases and cancer were the dominant NCDs among these patients, with a rate of 53% and 30% hospitalization and 13% and 22.7% in-hospital mortality, respectively. Participants diagnosed with cancer showed significantly higher odds of mortality and prolonged hospital stays. Medication non-adherence (AOR: 4.679, 95% CI: 2.48–8.80), the presence of other co-morbid conditions (AOR: 3.81, 95% CI: 2.024–7.19), and the presence of complications (AOR: 10.24, 95% CI: 5.35–19.63) were significant predictor of in-hospital mortality.

Conclusion: Our study reveals a substantial prevalence of NCDs among hospitalized patients, primarily with CVDs and cancer. Alarmingly, a significant mortality rate and prolonged hospitalization were observed among patients diagnosed with cancer.

Key word: Non-communicable disease, clinical outcome, prevalence, treatment, pattern.

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

NCDs	Non-Communicable Diseases
WHO	World Health Organization
CVDs	Cardiovascular Diseases
DM	Diabetes Mellites
MS	Metabolic Syndrome
T2DM	Type 2 Diabetes Mellitus
HTN	Hypertension
SPSS	Statically Package for Social Science
TASH	Tikur Anbessa Specialized Hospital
SPHMMC	St. Paul Hospital Millennium Medical College
Y12HMH	Yekatit 12 Hospital Medical College
HMIS	Hospital Management Information System
EMR	Electronic Medical Record
HPV	Human Papilloma Virus
CKD	Chronic Kidney Disease
DALY	Disability Adjusted Life Year
IQR	Interquartile Range
COPD	Chronic Obstructive Pulmonary Disease
IRR	Incidence rate ratio
PEN	package of essential non-communicable
VTE	Venous Thromboembolism
DVT	Deep Vein Thrombosis
IRR	Incidence rate ratio

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Background

Non-communicable diseases (NCDs), also known as chronic diseases, have a long duration and slow progression of morbidity (1). Previously, NCDs were a major problem in developed countries. It was associated with economic development and was called the disease of the rich. Since 1990, NCDs have become a global problem with an increased trend in low- and middle-income countries (LMICs) (2,3). Currently, one of the world's priority concerns is to reduce the burden of NCDs. According to the World Health Organization (WHO) Global Action Plan for the Prevention and Control of NCDs, member countries should plan to reduce the death rate from four major NCD (Cardiovascular diseases (CVDs), cancer, diabetes mellitus (DM) and chronic respiratory disease) by 25% until 2025 (4). These four groups of NCDs are the most prevalent and the top four killers of all NCDs (3,5). Accounting for more than 80% of all premature NCDs mortality (6). This has prompted the WHO to prioritize NCDs related premature mortality reduction action plans (1, 5, 6).

Rapid urbanization, globalization, and economic and social change are the major driving factors for the burden of NCDs (8,9). Global changes like technological advancements, migration, and urbanization affect human living and working conditions, leading to societal behavior changes and the emergence of modifiable risk factors like obesity, high cholesterol, and blood pressure, which ultimately result in the burden of NCDs.

Although, NCDs have received the highest attention worldwide, it is not given adequate attention to prevent and treat it, as per the negative effects on health in LMICs including Ethiopia (10). Even though NCDs are highly prevalent in both high-and low-income countries, it disproportionally affects LMICs with higher premature mortality and morbidity. Based on the WHO report, among 71% of NCDs-related deaths, 37% are premature deaths. Of these, 85% of premature deaths occur in LMICs, and it is expected to increase to 41.8 million deaths by 2030 and It is becoming an additional burden for developing countries with more prevalent communicable diseases and poor health infrastructure (3).

One of the 2030 sustainable development goals is the reduction of NCDs-related prematurity deaths, but the trend shows that only 25 high-income countries, which are western Pacific and

European countries, are on a positive track toward the 2030 sustainable development goal (11,12). To reduce NCDs-related premature mortality, an effective health system, tobacco and alcohol control, primary and secondary prevention of CVDs and DM for high-risk individuals, and effective cancer screening are important parameters (13).

Non-communicable disease causes three-quarters of mortality and a significant number of hospitalizations globally. The gradually increasing hospital admissions could devastate the hospital service and affect patients requiring urgent care. Hospital admission and mortality are the overall predictors of the burden of NCDs on death, quality of life, the economy, and the health system (9,14). All these burdens need preventive early identification and treatment measures. However, only 1-2% of global financing investment for health was released for NCDs (4). Therefore, national priorities for prevention and treatment could benefit from such study findings on the actual prevalence of NCDs and their effects on health, as well as attention from international health financing investment.

The increasing prevalence of NCDs in sub-Saharan countries, in combination with poor health infrastructure and a higher prevalence of communicable disease, have become a serious health burden. According to the WHO country profile of NCDs, the prevalence of NCDs-related mortality in Ethiopia is 39%, with 16% of CVDs, 7% of cancer, 2% of DM, and 12% of other NCDs-related mortality (7). A hospital-based study conducted in Addis Ababa stated that the prevalence of medical admission with NCDs were: CVDs (39.9%), cancer (20.4%), DM (19.8%), and respiratory disease (5.4%) (15). There is a gap in the comprehensive prevalence, patterns, outcomes, and associated factors of these diseases, particularly within hospitalized population, despite the large amount of research on the prevalence of NCDs in Ethiopia's outpatient population and the community, as well as some studies focused on specific NCDs among hospitalized patients (16–19). The failure to provide clear and up-to-date evidence among hospitalized population is masking the actual burden of NCDs for key decision makers and compounding the burden of NCDs (15). Evidence showed that Ethiopia would be among the first nations in Africa to experience the devastating effects of NCDs by 2040 (20).

Non-communicable disease requires long-term care with proven-quality medications. Due to the multimorbidity nature of NCDs, multiple drug use is common among patients with NCDs (21,22). Therefore, access to quality and guideline recommended medication is another

important component for NCDs prevention and treatment and is one of the determinant factors for successful clinical outcome of hospitalized patients. In general, to ensure preventive, curative, and rehabilitative health services, it is quite important to have regular availability of medications with proven quality, safety, and efficacy (23,24). Therefore, the aim of this study is to assess the prevalence, patterns, patient outcomes and patterns of medication use among hospitalized population in three tertiary hospitals in Addis Ababa, Ethiopia.

1.2. Statement of the problem

Non-communicable diseases are the leading cause of morbidity and mortality in the world, accounting for more than 71% of worldwide mortality, which is by far greater than all other causes of mortality collectively (11,25). The burden of NCDs affects LMICs disproportionally. In the past two decades, the burden of mortality has shown a potential shift to LMICs due to poorer control of NCDs. Around 85% of NCDs-related premature mortalities are from LMICs (7,25). More than 80% of all African countries are classified as low- and middle-income countries, so Africa is experiencing the huge burden of NCDs-associated prematurity death. Particularly in sub-Saharan countries, there is a complex health burden due to the double burden of disease, with highly prevalent communicable and non-communicable diseases (26–28).

In recent years, the international focus has been on the dynamic nature of infectious disease prevention, control, and treatment, particularly COVID-19. However, some studies predict that the impact of this neglect on NCDs will manifest with an increased prevalence and burden of NCDs in the coming years and decades (29). Since the burden of NCDs are a highly neglected issue with policymakers and funders, the impact of NCDs are not limited to the health system but also has a greater impact on the economic and social development of the countries (10,30,31). NCDs have multidirectional economic impacts. Patients and health systems are obligated to spend a huge amount of effort and resources on long-term management of NCDs, secondary prevention, hospital admission and complications management (32,33).

While NCD-related mortality has decreased in several developed countries since the implementation of the Sustainable Development Goals, However, NCDs-related mortality and morbidity in LMICs are alarmingly rising (34). Despite these huge burdens of NCDs, only

limited concern has been given to preventing and managing NCDs in LMICs. Although NCDs accounts for a large proportion of hospitalized patients and mortality, the health system is prioritizing communicable diseases because of their acute nature (15,35). According to Ethiopian NCDs commission report in 2018, only 54% of our health facilities were ready for general NCDs service (19). Since those developing countries have a double burden of communicable diseases and NCDs with limited health infrastructure, they are still highly concerned with communicable disease management(26).

Additionally, most international health finance is investing for communicable disease prevention and control (4). Evidence showed that 47% of the global population has little to no access to diagnostic services for NCDs (36). This affects early identification, prevention, and treatment of NCDs, and most of the patients come up with severe complications. The same reality is true in Ethiopia: Our hospitals are required to make a huge effort to manage the complications associated with NCDs. Most medications used to treat and prevent NCDs and its complications are also unavailable and unaffordable. This is one of the major challenges to achieving the sustainable development goal of 2030 in LMICs. On the other hand, in Africa, there is limited genetic research (37).

Now a days, there are different deriving factors for NCDs crisis, such as globalization, urbanization, and faster socio-economic changes. Urban residency is highly associated with physical inactivity, increased exposure to passive and active smoking, and relatively increased consumption of refined foods such as soft drinks and alcohol as well. Those exposures lead to obesity and atherosclerosis abnormalities, which are the immediate risk factors for NCDs (38). Currently, 25% of adults and 75% of adolescents do not meet WHO recommendations for the global physical activity level (39).

In Ethiopia, one out of eight adults aged 15–69 years exhibits an unhealthy lifestyle that promotes NCDs. These include consuming little or no fruit or vegetables, smoking, drinking too much alcohol, not getting enough physical activity, and being obese(40). The results of one meta-analysis showed that the pooled prevalence of metabolic risk factors in Ethiopia ranged from 12% to 24%, with the highest prevalence of obesity and HTN (23.9% and 21.1%, respectively) (41). In general, the risk of NCDs are determined by social, physical, and economic environments. This is why NCDs prevention needs the cooperative work of different sectors such as education, trade, agriculture, urban planning, and others.

In low and middle-income countries, NCDs related morbidity and mortality are alarmingly increasing. One study conducted in Uganda showed that, 53% of all deaths were due to NCDs (42). Similarly, based on a mixed-methods review, in Ethiopia, NCDs caused 42% of death with 27 % premature mortality. According to this report, Ethiopia will be among the first countries in Africa to experience the huge burden of NCDs by 2040 (20). According to the Ethiopian NCDs Commission report 46% of Ethiopian total disease burden is accounted with NCD and injuries, which expected to rise rapidly in the coming decades (19).

Even with all of these concerning risk factors and data in Ethiopia, there is still a lack of evidence regarding NCDs prevalence, pattern, and patient outcomes, as well as the medication use pattern of hospitalized population. The current evidences, like reviews and reports about NCDs in Sub-Saharan African countries, have been done with limited information (28). The impact of NCDs among hospitalized population are not well documented in Ethiopia as well (31,43). Therefore, the burden, patient outcome, and treatment pattern of NCDs in Ethiopia are underreported. Therefore, this study was aimed at determining the actual burden of major NCDs (CVDs, cancer, DM, and chronic respiratory disease) among hospitalized patients in three tertiary care hospitals in Addis Ababa, Ethiopia, and providing epidemiological and clinical evidence for health care providers to improve health care services.

The majority of reports on the prevalence of NCDs were based on health service utilization reports, household surveys, census data, cancer registry, and retrospective reviews of health facility records; however, all those data sources had their own limitations regarding data incompleteness, especially in resource limited areas like the eastern African region, including Ethiopia, due to poor data management and recording practices. Whereas our study was conducted among hospitalized population using a follow-up, prospective method, allowing us to reveal NCDs actual prevalence, pattern, patient outcomes and trend of medication use among hospitalized population.

1.3 Significance of the study

Evidences has revealed that NCDs morbidity and mortality are on an increasing track in Ethiopia; however, there is limited data about NCDs prevalence, patient outcome, and treatment pattern among hospitalized patients (17). So, the findings from this study could show

the actual burden of NCDs among hospitalized patients, and it would encourage health professionals, facility managers, and policymakers to emphasize the need for prioritizing NCDs prevention and treatment in order to reduce alarming morbidity and mortality rates. Giving focus and priority to NCDs prevention and management could reduce disease complications, hospitalizations, and health-related costs.

According to our search, hospital-based data on NCDs among hospitalized patients is scarce in Ethiopia and in sub-Saharan African countries as well. Therefore, this study explored the prevalence, patient outcome, and trend of medication use for NCDs among the hospitalized population. This could help in health system planning to improve health care responses such as early screening and prevention and to improve the availability of essential and standard medication used for the prevention, diagnosis, and treatment of NCDs. This study could also serve as a data source for future evaluations of the impact of NCDs. Additionally, it facilitates knowledge sharing in the eastern Africa region and globally about the burden of NCDs.

2. LITERATURE REVIEW

A literature search was conducted through electronic databases such as PubMed, Google scholar and Cochrane Central using the following key terms: non-communicable disease, chronic disease, cardiovascular disease, diabetes mellitus, chronic respiratory disease, asthma, COPD, burden, hospital admission, prevalence, incidence, mortality, medication, drug and clinical outcome. All studies with clear report about NCDs prevalence, mortality, morbidity, patient outcomes, medication use and risk factors have been reviewed for the development of this literature review.

2.1. Prevalence of NCDs

Non-communicable disease is the leading cause of mortality and disability in the world. It has been the cause of more than 200 million premature deaths in the past two decades for men and women aged between 30 and 70 years (1). According to a WHO report, 71% of overall mortalities in the world are due to NCDs, of which 77% of deaths are from LMICs. According to one systematic review report, this figure will increase to 75.26% by 2030. The major NCDs responsible for this mortality rate were CVDs, Cancer, DM and chronic respiratory disease. These four major groups of NCDs account for more than 80% of all NCDs deaths worldwide. In Ethiopia, these group diseases account for around 70% of all NCDs related deaths (7).

Based on the WHO report, more than 15 million premature deaths occur annually because of NCDs. of these premature deaths more than 85% were from LMICs. A systematic review of studies conducted between 1990 and 2019 among 10-24-year-old adolescents in European Union (EU) member states found that NCDs were responsible for 86.4% of years lived with disability (LYDs) and 38.8% of deaths in adolescents. In this age group, neoplasms were the major cause of mortality and morbidity. According to this review, mortality is higher in male while disability is higher among female adolescents (44). In America, NCDs represent 75% of all deaths each year, which account for 3.9 million deaths annually (8). Based on the 2014 WHO global status report on NCDs, an estimated economic loss due to NCDs during 2011-2025 in low and middle income countries is US$ 7 trillion (45).

Africa has a double burden of communicable disease and NCDs now, but it is estimated that deaths due to NCDs will exceed deaths from infectious disease by 2030. Since Africa has a double burden of disease and poor health infrastructure, African countries are not following

the global target of the NCDs reduction action plan (34,37). The prevalence of communicable disease burden affects not only the resources needed for NCDs prevention and control, but it also contributes to NCDs expansion. According to some literatures, infectious diseases like rheumatic heart disease due to streptococcal infection, gastric cancer due to H. pylori and cervical cancer due to human papilloma virus (HPV) are the major contributing factor for NCDs (46)(47). NCDs are one of the major problems with the growing trend among sub-Saharan African countries. According to results from the Global Burden of Disease Study conducted in 2017, in sub-Saharan Africa, DALYs due to NCDs increased by 67·0% between 1990 and 2017 (27).

2.2**. Patterns of Common NCDs**

Non-communicable diseases are considered a concerning agenda of United Nation General Assembly and WHO, notably, CVDs, cancer, DM and chronic respiratory disease are considered the top killers of all NCDs, accounting for 80% of NCDs premature mortality, with a total death of 17.9 million with CVDs, 9.3 million with cancer and 4.1 and 2 million with chronic respiratory disease and DM, respectively (9). These major NCDs are considered the major challenge for 2030 Sustainable development. According to the review conducted on NCDs prevention policy in six African countries, the greatest NCDs burden in Africa also from these four major NCDs (CVDs, cancer, DM and chronic respiratory disease) (48). Moreover, it is projected that within the next few decades, Africa will account for almost 70% of the world's cancer mortality(49).

A study conducted in Addis Ababa reported the highest medical admission rate among population with NCDs: CVDs (39.9%), cancer (20.4%), DM (19.8%), and chronic respiratory disease (5.7%) (15). Another study also exhibited that the majority of patients attending outpatient clinics roughly 40% of the total had CVDs, with DM and cancer making up 20% each and chronic respiratory disease account for 6%.

2. 3. Risk factors for NCDs

Risk factors for NCDs could be classified as modifiable and non-modifiable risk factors. Non-modifiable risk factors include; genetic factors, gender, age and other socio-demographic factors. Since those risk factors are unable to be modified with neither individual lifestyle modification nor national health policy, it is important to focus on modifiable risk factors in

order to find a way to prevent NCDs. According to WHO report and many other pieces of evidence, the most common modifiable risk factors of NCDs include an unhealthy diet, physical inactivity, tobacco use and alcohol miss use. Evidence showed that better control of modifiable risk factors could eliminate 80% of all CVDs, stroke and type 2 DM, as well as 40% of cancer disease (25). Vulnerable population groups who have unhealthy dietary practices, tobacco users, and having limited access to health services die sooner than socially high-class population.

Physical inactivity is a significant risk factor for chronic diseases like cardiovascular disease, diabetes, and cancer, with 7.2% of all deaths and 7.6% of CV deaths due to it (30). The WHO recommends moderate-to-vigorous physical activity (> 300 min/week) to reduce sedentary behavior associated with NCDs mortality. Physical inactivity is estimated to be associated with 1.6 million annual NCD deaths, possibly due to urbanization and technological advancements. The WHO aims to reduce physical inactivity by 15% by 2030(18,36).

Tobacco use is a major risk factor for NCDs, with over 8 million deaths annually worldwide. The WHO's Global Action Plan aims to reduce tobacco use by 30% by 2025, but the projected decrease is only 12.4%, with the highest prevalence in Southeast Asia and the lowest in Africa. This unmet goal of reducing tobacco use will remain a major risk factor for NCDs, necessitating countries to develop strategies and commitments to reduce tobacco consumption. Alcohol consumption is one for the four major risk factors of NCDs. Different evidence showed that inappropriate alcohol consumption was linked to cancer, CVDs and liver disease (37). According to Parry CD et.al., alcohol consumption accounts for 3.8% of annual deaths and 4.6% of disability adjusted life years (DALYs) lost globally (38). Another review showed that alcohol caused 1.8 million death and 52 million disability adjusted life years lost globally (39). One case control study in Ethiopia among 728 participants on the risk factors associated with NCDs reported that alcohol and coffee were associated with NCDs (40).

2. 4. Clinical outcome

Premature mortality is the worst outcome of NCDs. According to the Lancet report on the pathways to achieving the Sustainable Development Goal, ischemic heart disease is responsible for the highest risk of premature death in more than half of all countries for women, and more than three-quarters for men. Stroke, other cardiovascular diseases, and some cancers

have similar risks, even a higher risk of premature death than ischemic heart disease in some countries (13). In recent decades, evidence has shown a disproportionate increase of NCDs related hospital admission worldwide. A study conducted in Myanmar reported that hospital admissions due to the four major NCDs (CVDs, cancer, DM and COPD) increased by 2.2 fold from 2012-2017 (50). Research conducted in developed eastern coastal China Nepal and Nigeria also indicated a rising trend in NCDs in-inpatients over the years (51,52).

Non-communicable diseases have a prolonged course of morbidity and require a long-term, systematic approach to manage. By nature, NCDs need continuous prevention, treatment, evaluation and follow-up. Mal-distribution and shortage of medications, health care institutions and health professionals could be the major challenges to achieving better clinical outcome especially in low- and middle-incomes countries (53).

World Health Organization recommends the implementation of a package of essential non-communicable (PEN) interventions: early identification of NCDs risk factors, early diagnosis of NCDs, use of affordable medication for the prevention and treatment of NCDs, health education, and promotion of healthy behavioral habits in low- and middle-income countries in the primary health care setting (1). However, the lack of essential medicines and manpower becomes the key challenge in various settings (54). Currently, countries adopting to task-shifting strategy from physician to non-physician health care worker to involve themselves in NCDs screening, prevention, and treatment. This strategy has shown effective outcomes in child health and communicable diseases like HIV. One systemic review of 22 articles, of which 7 were randomized control trials, showed that task shifting from physician to non-physician health care workers for NCDs screening and primary care have improved health outcomes including reduction of blood pressure, medication non-adherence and depression scores. According to this review, medication non-availability, prescription restriction, non-availability of standard and protocol and the need for skill development training for non-physician health care professionals are the main challenges yet for effective primary health care in NCDs with non-physician health care workers (55).

2.5. Medication used among hospitalized patient with NCDs

The management of hospitalized patients requires not only the standard treatment of NCDs but also medications to treat medical complications associated with hospitalization and the

disease itself. In addition, acute care treatment for NCDs is mostly different from maintenance treatment, and it is the major determinant factor for patient outcome. WHO has set a target of 80% availability of essential medicines to treat major NCDs by 2025. One of the Sustainable Development Goals agreed with governments was to achieve at least 50% of eligible people with NCDs to receive drug therapy and counseling to prevent heart attacks and strokes" and "achieve 80% availability of affordable basic technologies and essential medicines to treat major NCDs." In order to ensure preventive, curative, and rehabilitative health services, it is quite important to have regular availability of medications with proven quality, safety, and efficacy. Despite this importance, access to medication for NCDs management is low, and this could also affect the treatment practice of health institutions and the clinical outcome of the patient as well.

International reports showed that only two-thirds of the world population has access to the required medication, and this problem is worse, up to 50% in the poorest countries in Africa and Asia (24). According to a WHO report in 2011, of 15 commonly served medicines for chronic disease in 40 developing countries, only 36% and 53.5% of their availability were reported in the public and private sectors, respectively(56). Another facility-based survey conducted on 14 global core lists and another 36 commonly used medications for the treatment of HTN, DM, and respiratory tract infections showed that only 15.2% and 18.9% of the lowest-priced generic medications have met WHO's targets in the public and private sectors, respectively, in low-income countries (57).

3. OBJECTIVE

3.1. General objective

To investigate NCDs prevalence, patterns, patient outcomes and pattern of medication use among hospitalized population across three tertiary hospitals in Ethiopia.

3.2. Specific objective

- To determine the prevalence of NCDs among hospitalized patients.
- To determine the pattern of major NCDs.
- To evaluate clinical outcomes of hospitalized patient with major NCDs.
- To determine the predictors of poor clinical outcome.
- To describe medication use pattern for major NCDs among hospitalized patient.

4. METHODOLOGY

4. 1. Study setting

The study was conducted at Tikur Anbessa Specialized Hospital (TASH), St. Paul Hospital Millennium Medical College (SPHMMC), and Yekatit 12 Hospital Medical College (Y12HMH). TASH is a referral public tertiary care hospital established in 1972 in Addis Ababa, Ethiopia. It is the largest referral hospital in the country. It is the major receiving center for tertiary care services for a diverse population in terms of socio-economic and demographic background. It is also an institution where specialized clinical services like cancer diagnosis and treatment are provided. It has over 700 beds and serves approximately 370,000 to 400,000 patients per year. It serves as the research and training center of Addis Ababa University for both undergraduate and postgraduate health students. Internal medicine wards and oncology wards are the major sites of NCDs-related admission for adult patients.

St. Paul Hospital Millennium Medical College was founded in 1968, and Millennium Medical College was established in 2007 and officially recognized by the Council of Ministers in 2010. The college implemented Ethiopia's integrated hybrid problem-based curriculum for undergraduate medical education. Currently, the college is increasing its postgraduate programs. Diversifying its program offerings. The college employs about 2800 clinical, academic, administrative, and support professionals who provide medical specialty services to patients referred from across the country, as well as instruct medicine and nursing students and conduct research.

The third hospital was Y12HMH, which was established in 1923. It is also a tertiary-level referral and teaching hospital in Addis Ababa that provides both inpatient and outpatient treatment for a large number of people from Addis Ababa city and different parts of the nation. Recently, it started providing services for cancer patients from different parts of the country.

4. 2. Study design and period

This study adopted a prospective follow-up design, focusing on patients admitted to the internal medicine, oncology, gynecology, and obstetrics wards during the period from October 2022 to January 2023. Patients were followed from admission to the clinical outcome (deceased, improved, or discharged with poor clinical outcomes such as, deteriorate, self-discharge against medical advice and discharged in same medical condition).

4.3. Population

4. 3. 1. Source population

All patients who were admitted in TASH, SPHMMC and Y12HMC during the study period were the source population of this study.

4. 3. 2. Study population

The study population encompassed all patients admitted to medical, oncology, gynecology and obstetrics wards at TASH, SPHMMC and Y12HMC who met the inclusion criteria of the study during the study period.

4. 4. Inclusion and exclusion Criteria

4. 4. 1. Inclusion Criteria

- Patients aged ≥ 14 years with confirmed NCD diagnoses.
- Willingness to participate in the study and answer interview questionnaires

4. 4. 2. Exclusion criteria

- Patients admitted for chemotherapy administration
- Patients admitted with communicable disease
- Patients admitted due to other non-communicable conditions (CKD, chronic liver disease, epilepsy and psychiatry, injury)
- patients who were very sick and unable to respond throughout the hospital stay.
- Pregnant women
- Patients discharged within 48 hours of admission
- Patients who had incomplete medical records

4. 5. Study variables

4. 5. 1. Dependent variables

- Clinical outcome
- Length of hospital stay

4. 5. 2. Independent variables

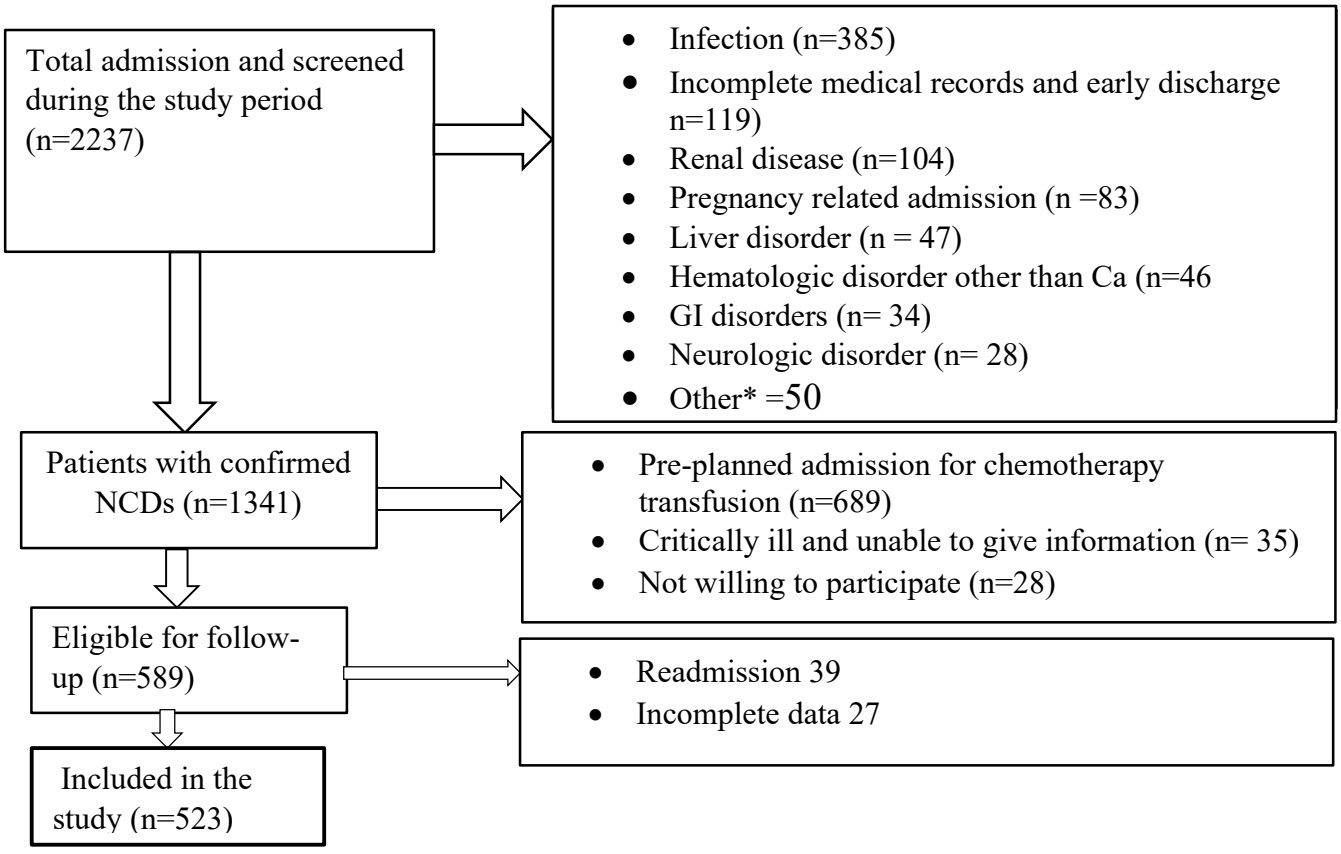
Age, gender, socioeconomic factors (monthly income, education and employment), lifestyle factors (physical activity, vegetable and fruit intake), behavioral factors (drinking and smoking habits), marital status, residency (urban/rural), family history of NCDs, self-reported

adherence to medications, medical complications, and concomitantly occurring medical conditions)

4. 6. Sample Size Determination and Sampling procedure

All patients registered for hospital admission during the study period were screened for follow-up and all patients who fulfilled the inclusion criteria were included in the study. The study period was determined by reviewing other similar studies with consideration of selected hospitals (TASH, SPHMMC and Y12HMC) hospital admission rates by reviewing a six-month hospital registry.

Out of the 2,237 hospitalized patients during the study period, consecutive sampling was employed. And (N = 589) study participants were eligible for follow-up. However, (n= 523) study participants were included in the analysis after the exclusion of readmission (39) and incomplete data (27).



*Trauma and injury, psychiatric disorder, hemiparesis, paraparesis, GBS,

Figure 1: Selection of Participants to determine prevalence, pattern, outcome and trend of medication uses, among hospitalized population in three tertiary hospitals in Addis Ababa, 2023

4. 7. Data collection procedure

Data was collected by trained data collectors (3 pharmacists and 3 nurses) using a pretested questionnaire. Relevant clinical information was obtained from patient medical charts and the Electronic Medical Record (EMR) through observations. Data on the socio-economic and behavioral characteristics of the patient were collected by interview.

Data were collected using a comprehensive tool developed according to the study's objectives and the local context. Risk factors were evaluated using established tools, including the WHO STEP wise approach to NCDs risk factor surveillance (58) and from studies and guidelines on NCDs pattern, burden, treatment approach and outcomes (59,60).

All the necessary data, including the patients' demographic details (age, sex, marital status, education level, employment), were collected and documented through interviews. The behavioral characteristics of the patients (smoking, alcohol consumption, physical activity, and consumption of fruit, vegetables, and salt) were assessed using the WHO STEP-wise approach to the NCDs risk factor surveillance tool.

Clinical data (precipitating factors, family history, co-morbidity, diagnosis, hospital stay, and status during discharge) were collected by reviewing the physician's record on the medical chart and HMIS admission/discharge register. In addition to that, medication(s) used during hospitalization were reviewed from the EMR by using the patient's i-care number and medical chart. The outcome of the patient has been evaluated based on the HMIS record of discharge status labeled as (A=improved, B=same, C=deteriorate, D=left against medical advice, E=died, and F=referred) and the physicians' discharge report attached to the medical chart of the patient. Supplementary information and clarifications on some patients' medical information were obtained through discussion with the physicians and nurses.

4. 8. Data quality assurance

Training has been provided to the data collectors (three nurses and three pharmacists) to familiarize them with the data collection instrument, how to collect the necessary data from

patient medical records, and how to conduct patient interviews. Subsequent support has been given by the principal investigator as needed. A pre-test was done on 5% of the expected sample to assure clarity, avoidance of ambiguity, comprehensiveness, and content uniformity before the actual data collection started. Based on the results that have been obtained from the pre-test, some amendments were made to the data collection tool, and the assessment was based on the inputs found in the pre-test. There was continuous supervision by the principal investigator during the data collection period.

4. 9. Data analysis

Data completeness and consistency were assessed beginning with the first day of data collection. The data was entered and analyzed using SPSS version 25. Variables were summarized using descriptive statistics such as percentages and frequencies. Categorical variables were presented as counts and percentages. In this investigation, the clinical outcome was determined by the discharge status recorded on HMIS, which was classified as improved, the same, deteriorated, left against medical advice, died, or referred to another health facility. The outcomes were then categorized into three outcome variables: improved, non-improved, and died. Multinomial logistic regression analysis was used to determine the relationship between treatment outcome and independent factors. "Improved treatment outcome" was used as a baseline to compare with the other outcome variables (non-improved versus improved and died versus improved). All clinically relevant variables and variables with a p-value of less than 0.2 in the univariate analysis were included in the multinomial logistics regression to identify possible predictors of poor clinical outcomes.

Kaplan-Meier Survival analysis was done to estimate the survivorship of hospitalized patients with NCDs with the log-rank test to compare survival time between groups such as different classes of NCDs, smoking history, vegetable consumption, fruit consumption, medication non-adherence, the presence of medical complications, and other comorbid conditions. To identify independent predictors of the probability of survival, a bivariate and multivariate Cox-proportional adjusted model was carried out. Predictors with a P-value < 0.2 in bivariate analysis were exported to a multivariable Cox proportional hazard model. A P-value of less than 0.05 was used to declare the presence of a significant association between predictors and outcomes.

The length of hospital stay was tested for normality using the Shapiro-Wilk test, and since the result showed a non-normal distribution, negative binomial regression was conducted to determine factors affecting the length of hospital stay among hospitalized patients with NCD. The assumption of this analysis is that a significance level of $p \leq 0.05$ was used, and results were reported with 95% confidence intervals.

4. 10. Ethical clearance

Ethical approval was obtained from the School of Pharmacy, College of Health Sciences at Addis Ababa University Ethical Review Committee (ERB/SoP/485/14/2023) and from Addis Ababa Public Health Research and Emergency Management Directorate. Permissions were also sought from each department involved. All study participants provided informed consent and assent (for those under the age of 18), after being fully informed about the study's objectives and given the choice to decline or participate in the study. Patient identification numbers were used instead of names to ensure confidentiality.

4. 11. Operational definition

Major NCDs: Cardiovascular diseases, cancers, chronic respiratory diseases and diabetes mellitus

Cardiovascular diseases: Are a group of disorders of the heart and blood vessels. They include:

- Heart failure
- Coronary heart disease
- Cerebrovascular disease
- Peripheral arterial disease
- Rheumatic heart disease
- Congenital heart disease
- Deep vein thrombosis and pulmonary embolism
- Hypertension

Burden: The rate of hospital admission, length of hospital stays and mortality

Drug use pattern: Type of drug used during hospital stay for each NCD.

Clinical outcome: The discharge status of the patient declared on HMIS :(A=improved, B=same, C=deteriorate, D=left against medical advice, E=died and F=Referred) and stated by the physician on discharge sheet.

Improve: patients who were discharged with better condition with HMIS declaration of: (A=improved)

Poor outcome: Patients who were discharged with HMIS declaration of: (B=same, C=deteriorate and D=left against medical advice)

Death: Patients who died during hospital stay with HMIS record of (E=died).

Complication: Any conditions the patients developed during hospital stay such as bleeding, shock, Diabetic ketoacidosis or hyperosmolar hyperglycemic state, hyper uricemia, anemia secondary to hematologic malignancy, neutropenic fever, adverse reaction to medications, organ failure (e.g. acute renal injury, respiratory failure, delirium, etc...).

5. RESULTS

During the data collection period, 2237 patients were hospitalized in TASH, SPHMMC, and Y12HMC at the medical, oncology, gynecology and obstetrics wards. Overall admission during the study period were 1111 (46.7%) in TASH, (Y12HMC, 671 (28%), and SPHMMC, 455 (20.34%). The study participants included in the study was distributed as: TASH (256, 49%), SPHMMC 144 (27.4%), and Y12HMC, 123 (23.5%).

5. 1. Sociodemographic data

Majority of the study participants were female 288(55.1%), with middle-aged adults 267 (51.1%). being the most common age group. The mean ± SD age of the study participants was 47.17±18.112. Most patients were urban dwellers 402 (76.9%) and married 346 (66.2%). Education varied, with one third completing primary school 175(33.5%) or college/university 126(26%). Notably, 190 (36.3%) reported monthly incomes exceeding $100, Additionally, about 165 (31.5%) of patients had a family history of at least one NCD. In terms of dietary habits, 302 (57.7%) were eating fruits regularly at least once per week, and 437 (83.6%) were consuming vegetables on a regular basis at least once per week. The rest either do not have complete access to fruits and vegetables or just consume them when they are available. Only 66.9% were adherent to their medication. Most don't smoke (88.9%) or drink alcohol (70%). Few engage in regular physical activity (6.5%).

Table 1: Sociodemographic characteristics of patients with a diagnosis of NCDs admitted to tertiary hospitals in Addis Ababa (n=523), 2023.

Variables	Category	Frequency (n)	Percentage (%)
Hospital	TASH	256	49
	SPHMMH	144	27.5
	Y12HMC	123	23.5
Gender	Male	235	44.9
	Female	288	55.1
Age (years)	Youth and adolescent (14-19)	28	5.4
	Young adults (20-34)	112	21.4

	Middle-aged adults (35-64)	267	51.1
	Senior adults (≥65)	116	22.2
Residence status	Urban	402	76.9
	Rural	121	23.1
Marital status	Married	346	66.2
	Single	105	20.1
	Divorced	31	5.9
	Widow	41	7.8
Educational status	No formal education	97	18.5
	Primary school	175	33.5
	Secondary school	115	22
	College and University	136	26
Monthly income	Low ($20 to 40)	70	13.4
	Average ($41 to 100)	163	31.2
	High (>$100)	190	36.3
	0thers*	100	19.1
Family history of	Yes	165	31.5
NCD	No	358	68.5
Fruit intake per	Never (0)	115	22
week	1-3	276	52.77
	4-7	26	4.97
	When having access	106	20.27
Vegetables per	Never (0)	37	7.1
week	1-3	369	70.55
	4-7	68	13.00
	When having access	49	9.4
Active smokers	Yes	58	11.1
	No	465	88.9
Passive smokers	Yes	125	23.9
	No	398	76.1
Drink Alcohol	Yes	157	30

	No	366	70
Adherence to	Yes	350	66.9
drugs	No	173	33.1
Regular physical	Yes	34	6.5
activity	No	489	93.5

*included patients with no income (7), do not know (59), and refuse to tell (34), TASH: Tikur Anbessa Specialized Hospital, SPHMMC: St. Paul Hospital Millennium Medical College, Y12HMC: Yekatit 12 Hospital Medical College

5. 2. Patterns of NCD among hospitalized patients

Cardiovascular diseases were the leading cause of NCDs related admissions 277 (53.00%) followed by Cancer 155(29.60%) and followed by Chronic respiratory disease 36 (6.90%) and DM 32 (6.12%). Among the study participants 23(4.4%) were diagnosed with both DM and CVD. Consequently, the proportion of NCDs-related admissions within our sample was (523/2237) 23.4%. However, the overall prevalence of confirmed NCDs admission before screening by exclusion criteria was 1302/2237, 58.2%.

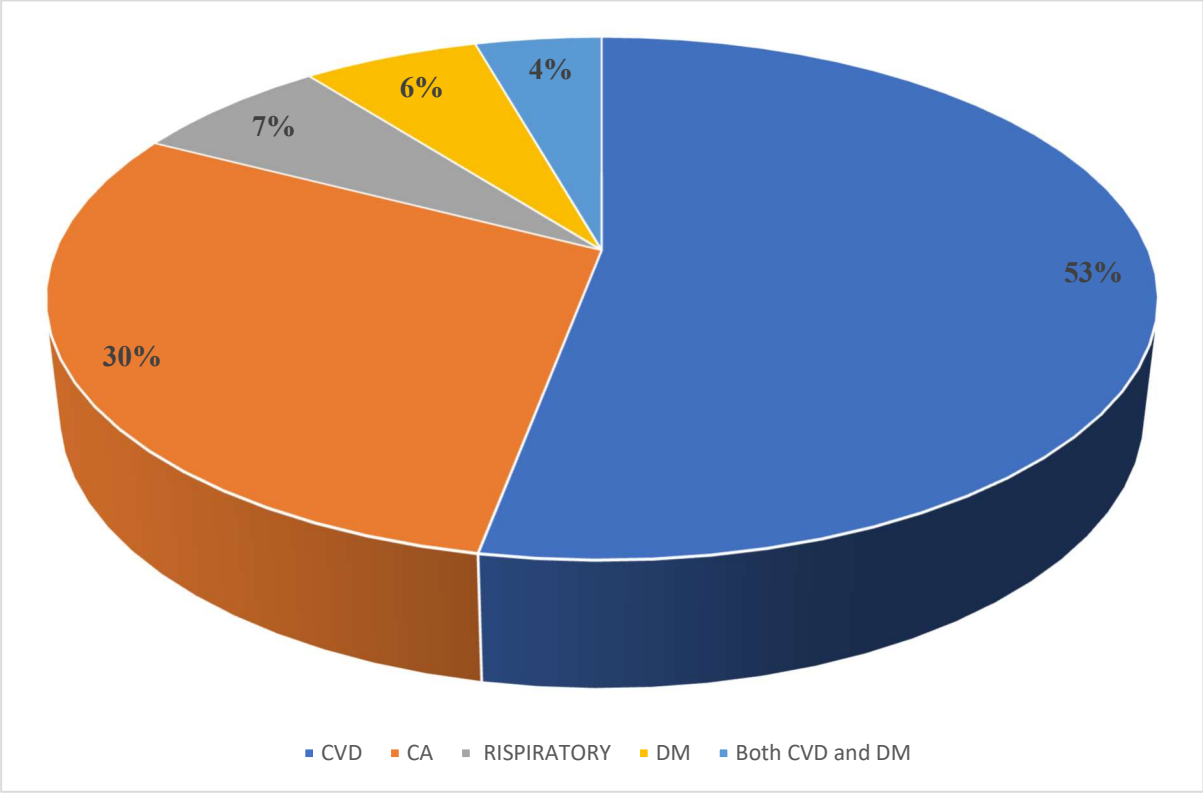
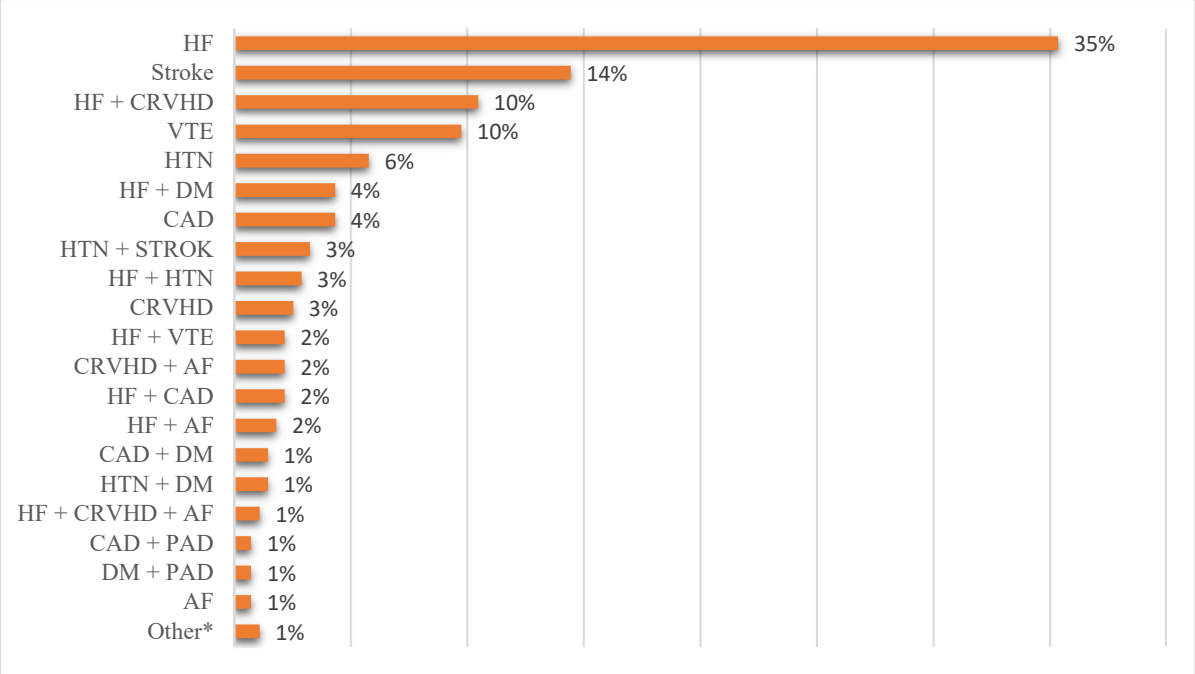


Figure 2: Patterns of Major NCDs among hospitalized patients admitted to tertiary hospitals in Addis Ababa (n=523), 2023.

5. 2. 1. Pattern of CVDs

In our study, heart failure emerged as the predominant CVD among hospitalized population, representing 98 (35.1 of cases, followed by stroke at 40 (14%). Notably, heart failure combined with chronic rheumatic valvular heart disease contributed to 10.1% of admissions.



HF: Heart failure, AF: VTE: Venous Thromboembolism, Atrial fibrillation, CAD: Coronary artery diseases, CRVHD: Rheumatic Heart Disease, HTN: Hypertension, VTE: Venous thromboembolism, *Peripheral Artery Disease (1) Dyslipidemias (1), DM+ Dyslipidemias (1)

Figure 3: Pattern of CVDs among hospitalized patients admitted to tertiary hospitals in Addis Ababa (n=277), 2023.

5.2.2. Pattern of Cancer among hospitalized patient

The primary cancer types resulting in hospital admissions, acute lymphoblastic leukemia (ALL) constituted the largest proportion at 27.7%, followed by acute myeloid leukemia (AML) at 20.6%, cervical cancer at 12.9% (**Figure 4**).

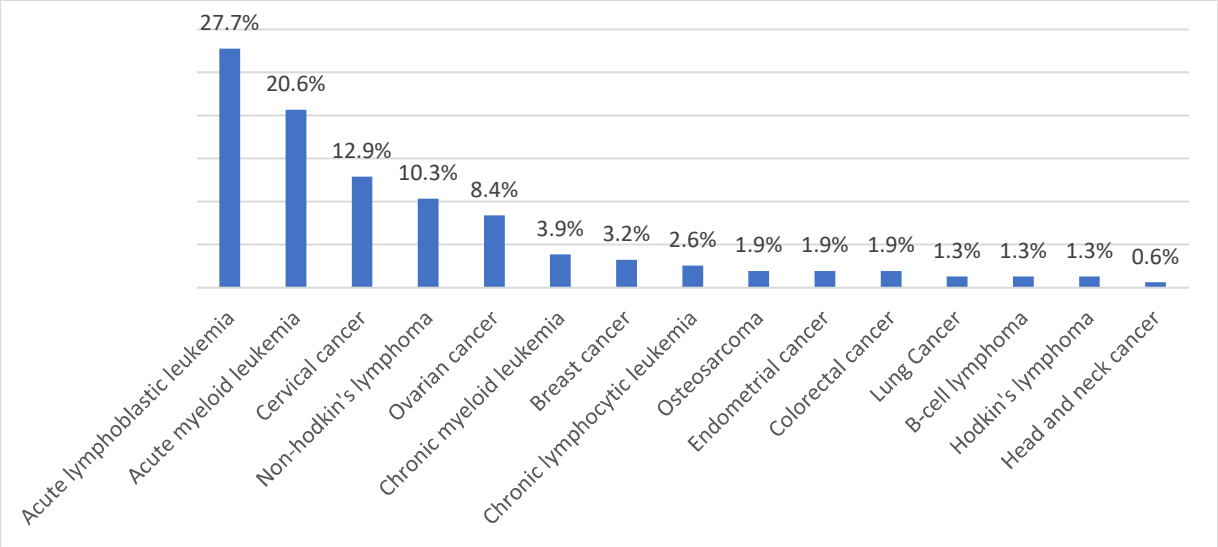


Figure 4: Pattern of cancer among hospitalized patient admitted to tertiary hospitals in Addis Ababa (n=155), 2023.

5.2.3. Patterns of chronic respiratory disease and DM

Among respiratory disorders leading to hospital admissions, asthma prevailed, affecting 63.89% of cases, while COPD were present in 25% of respiratory related admissions and patients admitted with Asthma-COPD overlap syndrome were 4 (11.1%)

Table 2: Pattern of chronic respiratory diseases among patients admitted to tertiary hospitals in Addis Ababa (n=36), 2023.

Chronic respiratory disease pattern	Frequency	Percent
Asthma	23	63.89
COPD	9	25.00
Asthma plus COPD	4	11.11

COPD: Chronic obstructive pulmonary disease

Diabetes mellitus accounted for 55 (10.51%) of all admissions, which includes individuals with both DM and CVDs. Of which the major portion was type 2 DM 47(85.45%) followed by type 1 DM 8(14.55%). Furthermore, our analysis revealed the most common combination of CVDs and DM resulting in hospital admissions was heart failure with DM, representing 52.2% of cases. Hypertension with DM and coronary heart diseases with DM followed closely

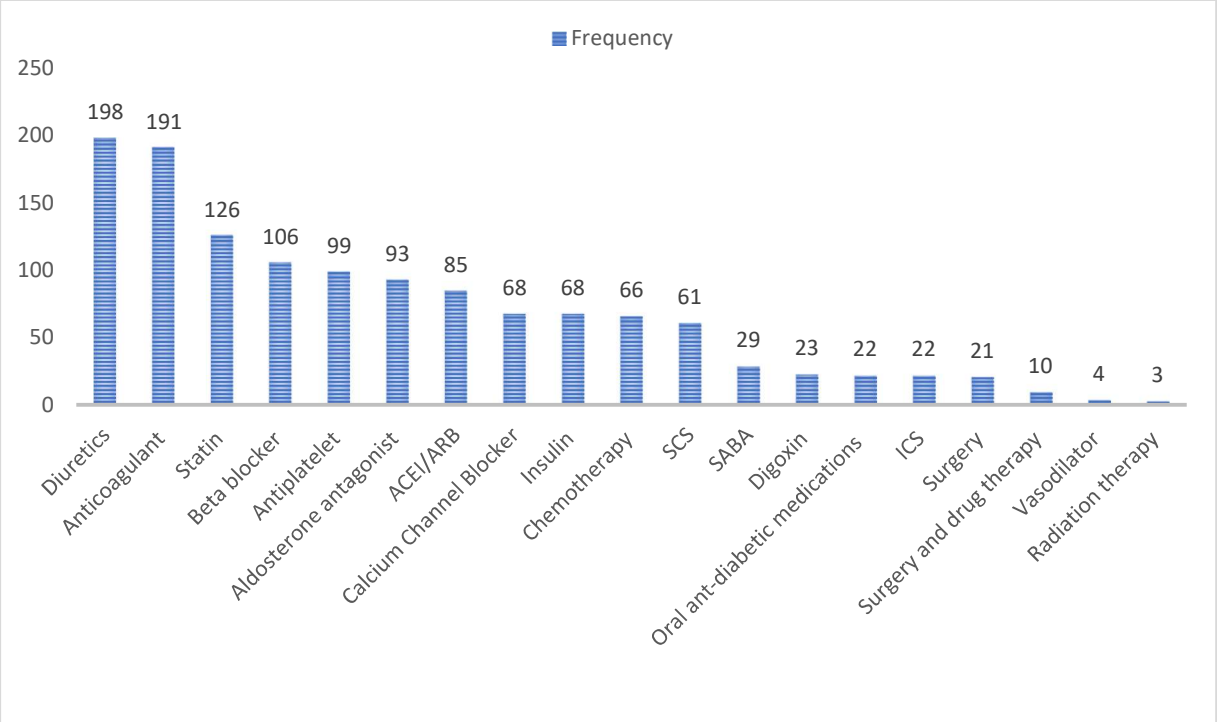
at 17.4% each, while peripheral artery disease contributed to 8.7% of admissions. The combination of dyslipidemia and DM was the least common, accounting for 4.4% of cases.
In this study 133 (25.4%) of the study participants had other co- existing comorbid conditions. These comorbid conditions are either developed after admission to the hospital or they are long lasting comorbidity but that had no contribution for the current admission. among these comorbid conditions, bacterial infection, CKD, tuberculosis HIV/AIDS, neurologic disorder and anemia were the most common one (**Table 3**).

Table 3: The distribution of other comorbid conditions among patients admitted to tertiary hospitals in Addis Ababa (n=523), 2023

Other comorbid condition	Classifications	Frequency	Percent
Having Other comorbid condition	Yes	133	25.4
	No	390	74.6
Type of Other comorbid condition	Bacterial Infections	41	7.84
	Chronic kidney disease	37	7.1
	Tuberculosis	19	3.63
	HIV/AIDIS	15	2.87
	Anemia	10	1.91
	Epilepsy	10	1.91
	Other	11	2.1

5. 3. Medication use patterns among hospitalized patients with NCDs

The prescription patterns for patients admitted to the hospital due to NCDs indicated that diuretics were the most commonly prescribed medications, constituting 198 (37.9%) of the prescriptions. Following diuretics, anticoagulants 191 (36.5%) and statin 126 (24.1%) were frequently prescribed. In contrast, vasodilator drugs and radiation therapy were the least frequently utilized approaches for the management of hospitalized patients who were admitted with the four major NCDs (**Figure: 5**)



SCS, systemic corticosteroid, SABA, short acting beta Agonist, ICS, Inhalational Corticosteroid

Figure 5:Treatment pattern among patients admitted to tertiary hospitals in Addis Ababa (n=523), 2023.

5. 3. 1 Treatment pattern based on the pattern of NCDs.

When the prescription pattern was aligned with the pattern of NCDs; diuretics were the most commonly prescribed medications among HF patients (HF, HF+CRVHD, and HF+DM), accounting for 88.8%, 85.7%, and 91.7%, respectively. In patients diagnosed with HTN with or without stroke, CCBs were the most commonly prescribed medications: HTN (75%) and HTN + stroke (77.8%), nevertheless, stroke patients without HTN were primarily prescribed antiplatelet (52.5%), followed by anticoagulant (50%). Anticoagulants were also repeatedly given to patients with VTE. Insulin and SABA were the most commonly prescribed drugs for diabetes and chronic respiratory disease, respectively **(Annex: I**)

A significant portion of cancer patients (40%) were receiving supportive treatment exclusively to manage cancer related complications and associated illnesses as well as to prevent side effects. Chemotherapy was administered to (42.6%) of the cancer patients who were hospitalized. Radiation therapy was the least popular management strategy in this study.

Table 4: Pattern of cancer treatment among patients admitted to tertiary hospitals in Addis Ababa (n=155), 2023.

Treatment pattern	Frequency	Percent (%)
Chemotherapy	66	42.6
Supportive treatment	62	40.0
Surgery	19	12.3
Chemotherapy+ Surgery	5	3.23
Radiation therapy	3	1.9

5. 3. 2. Other supportive treatment

While the initial reason for admission of the study participants was related to NCDs, various complications and challenges necessitated the implementation of diverse supportive therapies. Notably, a significant proportion of participants (276, 52.8%) were prescribed antimicrobial medications for a range of purposes. These included the management of hospital-acquired infections, addressing neutropenic fever associated with hematologic malignancies, treating diabetic foot ulcers, as well as for prophylactic measures. Additionally, other supportive treatments administered to NCDs patients encompassed anti-ulcer medications (113, 21.6%), anti-pain medications (95, 18.2%), and anti-emetic medications (71, 13.6%).

Table 5: Patterns of other supportive treatment among patients admitted to tertiary hospitals in Addis Ababa (n=523), 2023.

Supportive treatment	Frequency	Percent (%)
Anti-microbials	276	52.8
Antiemetic and other chemo-protective medication	123	23.5
Anti-ulcer	113	21.6
Antipain	95	18.2
Other	87	16.6

5. 4. Clinical outcome

The Patient outcomes after hospitalization for NCDs were examined, revealing a diverse of trajectories. Among 523 study participants, the majority, 353 (67.5%), recovered and were

discharged. The greater proportion of patients 405 (77.4%) were returning home (including patients discharged with unsatisfactory outcome). A subset of patients, around 10 (1.9%), required admission to the intensive care unit (ICU), indicating the severity of their conditions. Additionally, approximately 16 patients (3.1%) were transferred to other wards. Over the study period, 7.5% patients experienced readmission, while 203 (38.8%) developed complications during their hospital stay, **(Table: 6).**

Table 6: Outcomes of hospitalized population with a diagnosis of NCDs, admitted to tertiary hospitals in Addis Ababa (n=523), 2023

Clinical outcome		Frequency	Percentage (%)
Discharge status	Improved	353	67.5
	Died	80	15.3
	Same	63	12.0
	Deteriorate	15	2.9
	Self-discharge	12	2.3
Complication	Yes	203	38.8
	No	320	61.2

Among the 523 patients included in the study, 80 (15.3%) died during their hospitalization. On the other side, 90 (17.2%) were discharged alive with unsatisfactory outcomes, which included discharges in similar condition, against medical advice, or deterioration.

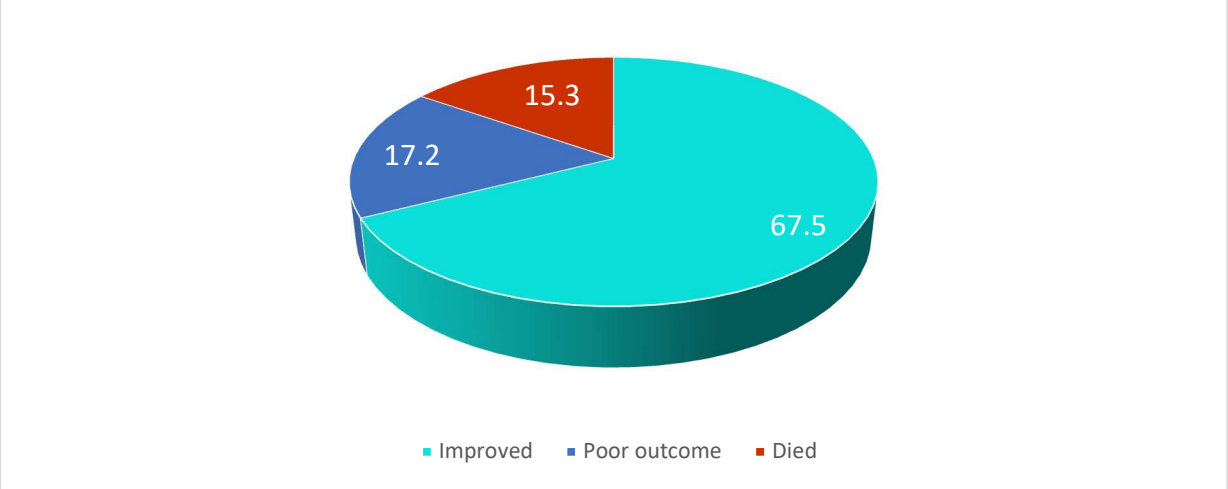


Figure 6: Outcomes of hospitalized population with a diagnosis of NCDs, admitted to tertiary hospitals in Addis Ababa (n=523), 2023.

Among 523 study participants, the overall mortality rate was 15.3%. However, this figure is varying between different type of NCDs. Notably, cancer had the highest fatality rate (22.7%), followed by CVDs (13%), and diabetes mellitus (DM) (12.5%).

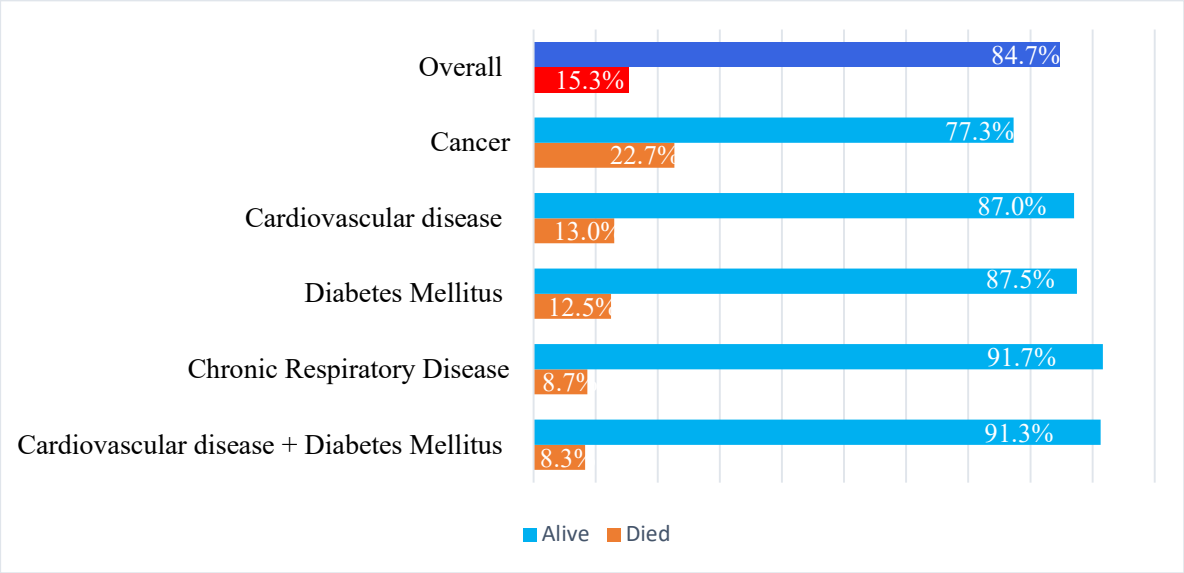


Figure 6: Distribution of mortality rate by the pattern of NCDs, among patients admitted to tertiary hospitals in Addis Ababa, 2023.

5.4.1. Predictor of poor clinical outcome and mortality

This study aimed to identify factors associated with mortality and poor clinical outcome among patients with NCDs through multinomial logistic regression analyses. potential predictors were considered, including demographic factors, lifestyle choices, the type of NCDs, comorbid conditions, and hospital-related factors. After conducting rigorous statistical analyses, three key variables emerged as independent predictors of poor clinical outcome: patients with cancer diagnosis, non-adherence to medications, and the presence of complications during the hospital stay. Patients with the diagnosis of cancer were 10.63 times more likely to be discharged with poor clinical outcome compared to patients diagnosed with chronic respiratory disease (AOR:10.63, 95%CI: 1.98-57.06, P=0.006). Patients who were non-adherent to their prescribed medications were 2.73 times more likely to have poor clinical outcome compared to adherent patients (AOR: 2.73, 95% CI: 1.55-4.80, p< 0.001). Patients

having complication were 3.25 times more likely to have poor clinical outcome compared to patients without complication (AOR: 3.25, 95% CI: 1.88-5.62, P< 0.001). However, in case of mortality five predictor variables appeared as statistically significant independent predictors of mortality: patients with cancer diagnosis, regular vegetable consumption, medication non-adherence, the presence of other comorbid condition, and complication. Patients with cancer diagnosis had 10.63 times higher risk of mortality (AOR:10.63,95%CI: 1.98-57.06, P=0.006). Patients who have regular vegetable consumption at least one times per week had 70% lower risk of mortality compared to those who had no regular vegetable conception history (AOR: 0.30, 95%CI:0.122-0.75, P=0.009). Medication non-adherent patients had 4.67 times higher mortality compared to adherent patients (AOR: 4.67 95%, CI: 2.48-8.80, P <0.001). patients who have other comorbid condition had 3.8 times higher mortality compared to patients who had no other comorbid conditions (AOR: 3.81, 95%, CI: 2.024-7.19 P<0.001) Patients with complications during their hospital stay were about 10.24 times more likely to die compared to patients without complications, (AOR: 10.24, 95%, CI: 5.35-19.63, p < 0.001) (**Table 7**)

Table 7: Predictive factors for clinical outcome among hospitalized patients in tertiary hospitals with NCD, in Addis Ababa, Multinomial regression (n=523), 2023.

		COR (95% CI)	P-value	AOR (95%CI)	P-value
Poor outcome VS Improved					
Length of Hospital stay		1.02(1.00-1.03)	0.008	1.004(0.99-1.02)	0.537
Sex	Male	1.62(1.02-2.58)	0.042	0.972(0.549-1.72)	0.923
	Female	1.00		1.00	
Age	14-20	2.05(0.73-5-75	0.17	1.43(0.385-5.32)	0.592
	21-34	2.12(1.03-4.31)	0.041	0.85(0.324-2.23)	0.741
	35-64	1.16(0.61-2.21)	0.66	0.54(0.22-1.30)	0.166
	≥65	1.00		1.00	
Employment	Employed	2.00(0.92-4.32)	0.078	2.61(0.91-7.49)	0.074

	Unemployed	1.06 (0.466-2.41)	0.893	0.941(0.32-2.75)	0.912
	Retire	1.00		1:00	
Marital status	Married	0.86(0.355-2.08)	0.737		
	Single	1.26(0.48-3.32)	0.643		
	Divorced	0.97(0.28-3.30)	0.960		
	Widow	1.00			
Residence	Urban	0.55(0.33-0.92)	0.023	.709(0.38-1.32)	0.278
	Rural	1.00		1.00	
Passive Smokers	Yes	1.67(1.00-2.81)	0.052	1.45(0.75-2.81)	0.264
	No	1.00		1.00	
Active smokers	Yes	2.42(1.25-4.68)	0.009	1.50(0.63-3.57)	0.361
	No	1.00		1.00	
Drinking alcohol	Yes	1.23(0.75-2.02)	0.412		
	No	1.00			
Regular physical activity	Yes	1.33(0.55-3.24)	0.526		
	No	1.00			
Regular fruit consumption	Yes	0.69(0.39-1.20)	0.057	0.81(0.45-1.47)	0.495
	No	1.00		1.00	
Regular vegetable consumption	Yes	1.09(0.57-2.1)	0.790	1.18 (0.52-2.68)	0.689
	No	1.00		1.00	
Family history	Yes	1.04(0.63-1.69)	0.892		
	No	1.00			
Type of NCD	CVD	1.7 (0.49-5.87)	0.402	2.52(0.52-12.24)	0.253
	Cancer	6.9(1.99-23.88)	0.002	10.63(1.98-57.06)	**0.006**

	DM with or without CVD	.652(0.123-3.45)	0.615	1.39(0.22-8.66)	0.727
	Respiratory disease	1		1.00	
Non-adherence to medications	Yes	2.17(1.34-3.51)	0.002	2.73(1.55-4.80)	**<0.001**
	No	1.00		1.00	
Other comorbid illness	Yes	1.32(0.77-2.26)	0.317	1.17(0.62-2.22)	0.625
	No	1.00		1.00	
Complication	Yes	3.60(2.23-5.81)	0.000	3.25 (1.88-5.62)	**<0.001**
	No	1.00		1.00	
Died Versus Improved					
Length of hospital stay		1.01(01.00-1.03)	0.113	0.99(0.98-1.01)	0.418
Sex	Male	1.49(0.92-2.43)	0.11	0.99(0.52-1.89)	0.969
	Female	1.00		1.00	
Age	14-20	2.54(1.03-6.26)	0.043	3.35 (0.865-12.99)	0.080
	21-34	.83(.38-1-81)	0.64	0.43(0.135-1.36)	0.149
	35-64	.81(.44-1.49)	0.49	0.62(0.24-1.61)	0.325
	≥65	1.00		1.00	
Employment	Employed	.77(.38-1.55)	0.466	1.06 (0.35-3.17)	0.920
	Unemployed	.86(0.43-1.74)	0.681	0.87(0.29-2.599)	0.806
	Retire	1.00		1.00	
Marital status	Married	0.65(0.28-1.51)	0.312		
	Single	1.15(0.46-2.92)	0.764		
	Divorced	0.28(0.05-1.54)	0.133		
	Widow	1.00			
Residence	Urban	0.61(0.35-1.06)	0.081	0.88 (0.42-1.84)	0.740

	Rural	1.00		1.00	
Passive Smokers	Yes	1.88(1.10-3.21)	0.021	2.06(0.98-4.30)	0.055
	No	1.00		1.00	
Active smokers	Yes	2.17(1.07-4.39)	0.0321	1.17(0.45-3.08)	0.747
	No	1.00		1.00	
Drinking alcohol	Yes	1.12(0.66-1.89)	0.676		
	No	1.00			
Regular physical activity	Yes	1.28(0.50-3.29)	0.605		
	No	1.00			
Regular fruit consumption	Yes	0.9(0.55-1.47)	0.674	1.98(0.95-4.13)	0.067
	No	1.00		1.00	
Regular vegetable consumption	Yes	0.64(0.35-1.16)	0.138	.30(0.122-0.75)	**0.009**
	No	1.00		1.00	
Family history	Yes	0.69(0.40-1.2)	0.21		
	No	1.00			
Type of NCD	CVD	1.75 (0.51-6.03)	0.377	2.52(0.52-12.24)	0.253
	Cancer	4.93(1.41-17.27)	0.013	10.63(1.98-57.06)	**0.006**
	DM with or without CVD	1.30(0.30-5.62)	0.721	1.39(0.22-8.66)	0.727
	Respiratory disease	1		1.00	
Non-adherence to medications	Yes	3.14(1.94-5.17)	<.001	4.67(2.48-8.80)	**<0.001**
	No	1.00		1.00	
Another comorbidity	Yes	3.3(1.98-5.49)	<.001	3.81(2.024-7.19)	<**0.001**
	No	1.00		1.00	
Complication	Yes	9.92(5.57-17.65)	<.001	10.24(5.35-19.63)	**<0.001**

No	1.00	1.00	

5. 4. 2. Predictor of prolonged hospital stay.

The analysis unveiled a median hospitalization duration of 12 days for all patients, with a significant range of 3-150 days, indicating notable variation in the length of hospital stay among the study participants. Normality of the data was assessed by Shapiro-Wilk test. Since the data was not normally distributed, negative binomial regression analysis was conducted to determine the predictor variable for hospital stay. Age, gender, employment status, type of NCDs, the presence of other comorbid conditions, medical complication and medication non-adherence fulfilled the criteria for multivariable analysis (p-value <0.2 in bivariate analysis). Finally, gender, patient hospitalized with cancer and patients having other comorbid condition were statistically significant predictors of length of hospital stay. The length of hospital stay was increased by the factor of 1.25 among male study participants compared to female (IRR: 1.25, 95% CI:1.04-1.51, P=0.018). The length of hospital stays among cancer patients and patients having other comorbid condition were increased by a factor of 1.57 and 1.25 (IRR: 1.57, 95% CI: 1.05-2.34, P=0.027 and (IRR:1.25, 95% CI:1.01-1.55, P=0.037) respectively.

Table 8: Predictor of prolonged hospital stay, among hospitalized population in tertiary hospitals with NCDs in Addis Ababa (n = 523), 2023.

Variables	CIRR (95% CI))	P value	AIRR (95% CI)	P value
Age	0.62(0.507-0.75)	<.0001	0.99 (0.99-1)	0.53
Gender				
Male	1.39(1.16-1.66)	<.0001	1.25(1.04-1.51)	**0.018**
Female	1		1	
Employment status				
Employed	1.35(1.03-1.77)	0.029	0.97(0.72-1.32)	0.856
Non-employed	1.24(0.94-1.64)	0.123	0.92(0.67-1.27)	0.610
Retired	1	.	1	.
Type of NCD				
CVD	0.95 (0.67-1.37)	0.801	0.998(0.69-1.44)	0.992

CA	1.76 (1.21-2.57)	0.003	1.57(1.05-2.34)	**0.027**
DM with or without CVD	0.91(0.59-1.42)	0.686	0.92(0.59-1.44)	0.722
Respiratory disease	1		1	
The presence of Other comorbid illness				
Yes	1.49(1.22-1.83)	000	1.25(1.01-1.55)	**0.037**
No	1		1	
Complication				
Yes	1.14(0.95-1.37)	0.157	0.99(0.82-1.20)	0.923
No	1		1	
Medication non-adherence				
Yes	0.86(0.71-1.04)	0.123	0.94(0.78-1.148)	0.566
No	1		1	

CIRR: Crude Incidence rate ratio, AIRR: Adjusted Incidence rate ratio

5. 4. 3. Survival analysis

Kaplan-Meir survival analysis for medication non-adherence revealed that study participants who adhered to their medicine had a higher chance of survival than their counterparts. The median survival for adherent population was 15.71 weeks, and the overall median survival rate was 9.57 weeks.

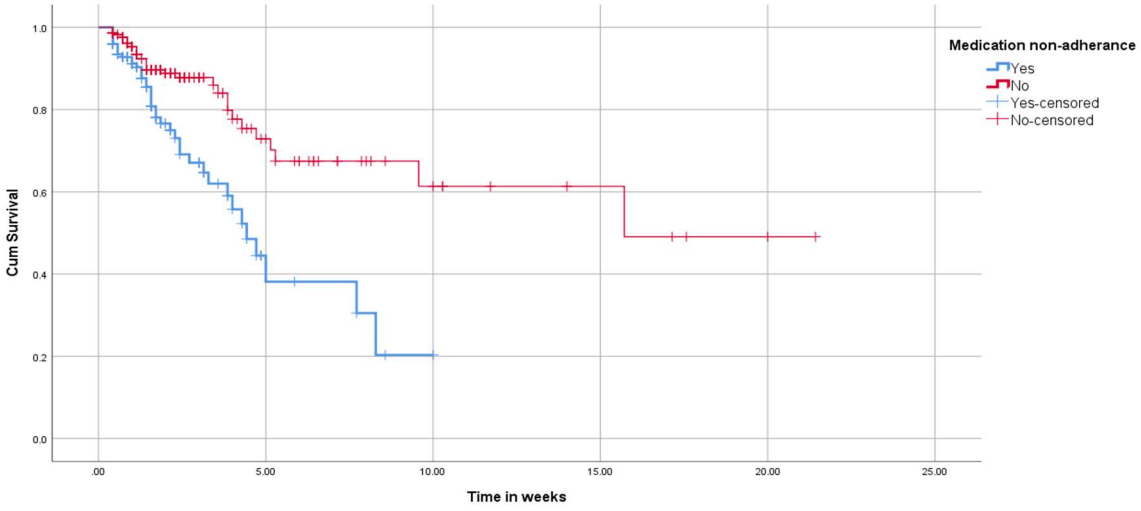


Figure 7: Kaplan-Meier survival curve for the comparison of medication adherent and non-adherent patients, admitted to tertiary hospitals in Addis Ababa, (n=523), 2023.

According to the Kaplan-Meier survival curves shown in figures 8 and 9 below, having other comorbid conditions and the presence of medical complications related to NCD was significantly associated with a lower survival chance compared to participants without complication and co-existing medical condition. The median survival time of patients with medical complication was 4.29 weeks, while the median survival time of patients with out complication was not reached (log rank,0.001). Similarly patients who have other comorbid condition showed shorter median survival time compared to patients with out other comorbid condition 5.14 weeks and not reached respectively (log rank=0.015).

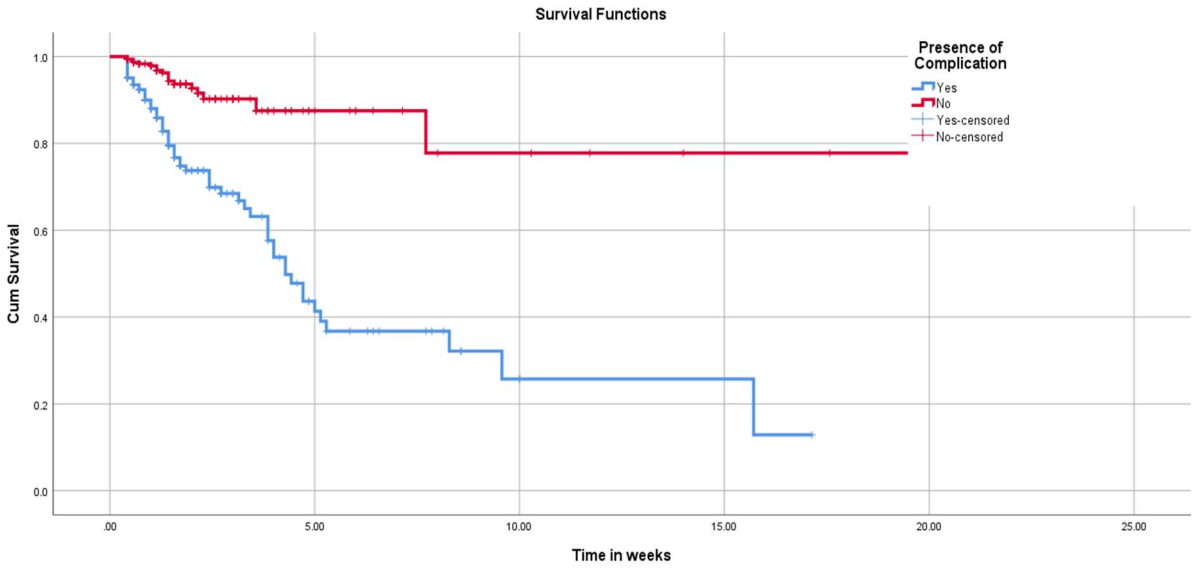
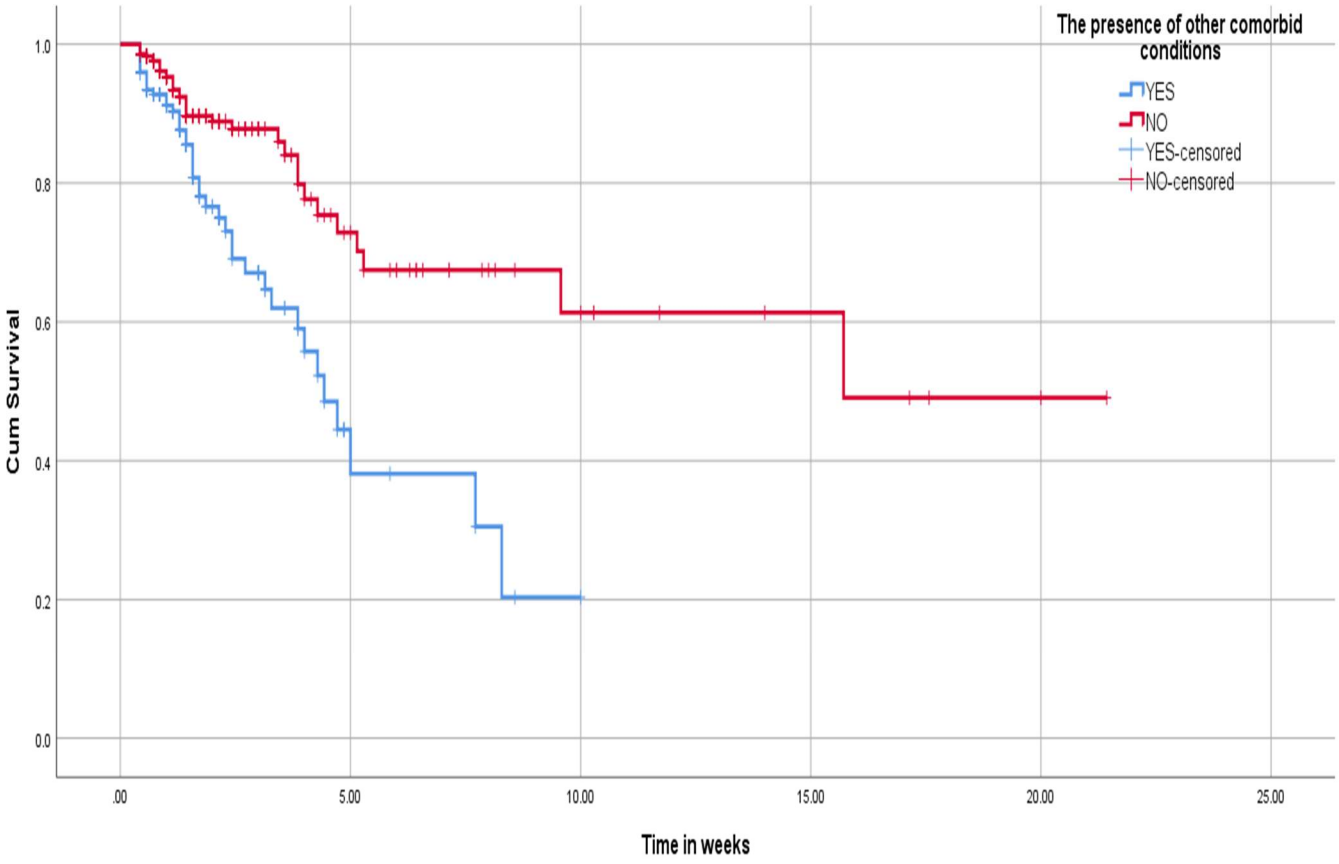


Figure 8: Kaplan-Meir survival analysis to compare the effect of complications on survival, among patients admitted to tertiary hospitals in Addis Ababa, (n=523), 2023.



Other comorbid conditions: TB, HIV, Hospital acquired Infections and renal disorder.

Figure 9: Kaplan-Meir survival analysis to compare the impact of other comorbid condition on survival, among patients admitted to tertiary hospitals in Addis Ababa, (n=523), 2023.

Among 523 study participants 80 died, and 443 were censored. Based on the finding showed in the **table 9** below, medication non-adherence, the presence of other comorbid illness and the presence of medical complication found to be significantly associated with time to death. Medication non-adherent patient had 2.258 times higher mortality hazard compared to adherent patient (AHR=2.258, 95% CI: 1.44-3.54, p=<0.001). patients with other comorbid illness and having medical complication had 1.657- and 3.95-times higher mortality hazard compared to their counterparts;(AHR=1.657; 95%CI: 1.045-2.63, p=0.032) and (AHR=3.951 95% CI: 2.315-6.74, p<0.001) respectively. However, the variation of NCDs did not exhibit

the significant association with time to mortality outcome. This showed that, there is no significant difference of time to Survival among different type of NCDs.

Table 9: Distribution of Cox-Regression for mortality predictors among hospitalized patients, admitted to tertiary hospitals in Addis Ababa, (n=523), 2023.

Covariates	Category	Alive	Died	(AHR 95%-CI)
Having regular vegetable consumption	Yes	437	62	0.746(.438-1.27)
	No	86	18	1.00
Passive smoker	Yes	125	26	1.136(0.70- 1.839)
	No	398	54	1.00
Medication Non-adherent	Yes	173	42	2.258(1.44-3.54) **
	No	350	38	1.00
Other comorbid condition	Yes	133	37	1.657(1.045-2.63) *
	No	390	43	1.00
Complication	Yes	203	62	3.951(2.315-6.74) **
	No	320	18	1.00

* p<0.05, **P<0.0001

6. DISCUSSION

The aim of this study was to investigate the prevalence and pattern of NCDs, clinical outcomes, predictors of poor clinical outcomes, and the pattern of medication usage among the hospitalized population at a multicenter tertiary hospital in Addis Ababa. In this follow-up study, the overall rate of major NCDs (CVDs, cancer, DM, and chronic respiratory disease) admissions was 1302 (58.2%). However, after the exclusion of patients who did not fulfill the inclusion criteria, the rate of admission became 523 (23.4%), of which 80 (15.3%) died and 90 (17.2%) were discharged with death and unsatisfactory outcomes such as deterioration, against medical advice, and on a similar medical condition.

The overall prevalence of NCDs found in this study are consistent with another studies from Ethiopia and other African countries(61–63). However, other studies conducted in Sudan reported a 71.8% prevalence of NCDs admission, which is higher than our finding. This difference could be due to the different types of NCDs included in the study: the study conducted in Sudan encompassed all NCDs conditions collectively, while our study focused on only four major NCDs (CVDs, cancer, DM, and chronic respiratory disease). Another study conducted in Eastern Sudan and Myanmar on the major NCDs found 36.4% and 25.4% of hospital admissions (50,62) which is lower than our finding. This disparity could be due to the capacity differences of hospitals to address a variety of specialized cases. Our study covered a broader spectrum of specialties, in addition to medical wards. This broader scope may account for variations in the rankings of conditions when compared to a study conducted solely in medical wards.

Eighty-three percent of hospitalizations for the four major NCDs were related to either cancer or CVDs. In this study, the leading cause of hospitalization was found to be CVDs (53%), with cancer coming in second (29.6%). This result is in line with the results of another studies conducted In Ethiopian (15) and the 2021 WHO report of NCDs burden, (25). This dispels the misconception that "NCD is the disease of the rich" and makes NCDs a serious worry in low-income nations. This is a worrying scenario for a nation like Ethiopia that is already dealing with a significant increase in the burden of NCDs with limited health infrastructure and an ongoing pandemic of infectious diseases such as malaria, TB, and HIV. Worldwide, CVDs are the primary cause of both disability and death, according to numerous national and international research(63–66). This persistent report on the top cause of CVDs impairment and

mortality has a worrying impact on overall health; thus, it requires a special focus for preventative measures, early detection, and management, starting from primary healthcare institutions.

In our study, we observed an in-hospital mortality rate of 15.3% among patients with NCD. Notably, cancer exhibited the highest mortality rate at 22.7%, followed by CVDs at 13%. The mortality rate of cancer found in this study is consistent with another review reporting 22.2% and 29.4% of acute care hospital cancer mortality in the United States and the Netherlands, respectively (67). Our results, however, are greater than those of a different American study that found a 2.7% ward death rate from cancer and a 9.2% deterioration rate (i.e., death or transfer to an intensive care unit).(68). The limited intensive care unit (ICU) capacity at our hospitals, which lowers ICU transfer rates and raises in-ward mortality, may be the cause of this discrepancy. Additionally, the highest death rate among hospitalized cancer patients in our institutions might be explained by the highest incidence of neutropenic fever, which is linked to the highest communicable disease prevalence in Ethiopia as part of the eastern African region.

According to this study, the main causes of death were cancer and CVDs, which accounted for 43.8% and 45% of the 15.3% overall in-hospital mortality of major NCDs (CVDs, cancer, DM, chronic respiratory disease) respectively. This result is in line with another study that shows 47.7% of NCDs patients mortalities are related to CVDs(69). Cardiovascular disease-related mortality observed in this study is also similar with a global heart review report, which found that CVDs deaths account for half of NCDs mortality (66). On a global scale, WHO reported in 2021 that 41 million lives were claimed by NCDs, encompassing CVDs responsible for 44% of NCDs-related deaths, cancer at 23%, chronic respiratory diseases at 10%, and DM at 4% (9). These collective results underline the urgency of focusing on NCDs management and prevention strategies to mitigate their impact and improve patient well-being. Multinomial regression analysis indicated that the probability of poor clinical outcome compared to an improved patient, the presence of complications (AOR: 3.25, 95% CI: 1.88–5.62, P< 0.001), and medication non-adherence (AOR: 2.73, 95% CI: 1.55–4.80, p< 0.001) were significantly associated with increased odds of poor clinical outcome as compared to patients without medical complications and adherent patients for medication. It is consistent

with previous studies that reported the association between medication non-adherence and the poor outcome of NCDs at different times (70–72). Furthermore, patients with the diagnosis of cancer were 10.63 times more likely to be discharged from hospitals with poor clinical outcomes compared to other NCDs (AOR: 10.63, 95%CI: 1.98–57.06, P = 0.006). This could be attributed to the nature of the treatment, which requires prolonged duration to observe the outcome of most cancer treatment modalities. Additionally, most patients with cancer are admitted with advanced-stage disease from all corners of the country because of the limited cancer specialty centers in the nearby health facilities.

Study participants who were diagnosed with cancer had longer hospital stays and higher probabilities of in-hospital mortality. The highest mortality rate among hospitalized patient with cancer in this study could be attribute to the late diagnosing practice at advanced stage due to limited specialty center for cancer diagnosis and treatment as well as the effect of communicable diseases as an added burden for hospitalized patients whose immunity has been compromised by malignancies such as hematologic cancer. Similarly, patients who were medication non-adherence and having medical complications had the highest risk of in hospital mortality compared to their counterparts. The impact of those factors on mortality and morbidity are well known and assured by other many studies conducted around the world (73–75). Furthermore the association of other comorbid condition with prolonged hospital stay and increased odds of in hospital mortality support the prior study finding in Malawi(76). Therefore, the findings of this study underscore the importance of medication adherence in reducing mortality among patients with NCDs. Additionally, the presence of concomitant comorbid conditions and the presence of medical complications during the hospital stay significantly increases the risk of death. So that, these findings emphasize the importance of medication management, and timely intervention for complications and comorbid condition in the care of hospitalized patients with NCDs.

On the other hand, the odds of death were lower in patients with regular vegetable consumption per week compared with patients with no vegetable consumption or having unpredictable consumption. Similarly, other studies supported the preventive impact of vegetables on NCDs-related mortality (75,77,78). This preventive effect could be attributed to the abundance of micronutrients and fiber, which may have protective benefits against major NCDs. While Age,

gender, residency, being active smoker, the habit of regular fruit consumption and known family history of NCDs had no statistically significant association with poor clinical outcome and death in this study.

In terms of treatment pattern, when we compared the general prescription pattern to the total admission, diuretics were the most commonly prescribed class of medications, followed by anticoagulants and statins. 198 (37.9%) of the study participants were given diuretics during their hospital stay. The need for diuretics in this amount may be associated with the highest proportion of CVDs-related hospitalizations, with HF making the greatest contribution in one or more ways. Diuretics, as recommended by most clinical practice guidelines, are one of the most frequently prescribed drugs for patients with HF, HTN, and similar illnesses to treat acute medical issues such as fluid overload and high blood pressure. On the other hand, the multipurpose indications (treatment and prevention) could be the reason for the highest frequency of anticoagulant and statin prescriptions. In this study, anticoagulants were prescribed for deep vein thrombosis (DVT) prophylaxis for patients who met the risk criteria, including cancer patients, as well as for treatment purposes for VTE cases. Similarly, most DM and CVDs patients were taking statins as a preventive measure for CVDs-related concerns; they were also prescribed to treat dyslipidemia cases.

To gain a more meaningful understanding, medication use patterns were stratified by the patterns of NCDs. According to this descriptive analysis, diuretics were the most commonly prescribed class of medications among HF patients, regardless of whether they had other concurrent NCDs. This result is similar to another study conducted at Y12HMC in Ethiopia, which reported that 96% of HF patients were prescribed diuretics during hospitalization (79). In cases of HTN with or without stroke co-existing cases, CCB was the most commonly utilized class of medications: HTN (75%) and HTN + stroke (77.8%), with their respective numbers. This is in contrast with another study conducted in Ethiopia where the highest antihypertensive treatment was diuretics(80). Nevertheless, stroke patients without HTN were generally prescribed antiplatelets (52.5%), followed by anticoagulants (50%). Patients with VTE were also frequently administered anticoagulants. Insulin and SABA were the most often given medications for diabetes and chronic respiratory diseases, respectively.

Among patients hospitalized with cancer, chemotherapy and supportive treatments were equally common (42.6%) and 40%, respectively. This finding disclosed the severity of cancer-

related medical complications and their burden among hospitalized patients that necessitate intense management efforts and resources. The complication was not only causing treatment burden but also had a statistically significant impact on mortality and length of hospital stay.

Although NCDs were the main reason for the research participants' hospitalization, several issues and consequences required the administration of a range of supportive drugs. Antimicrobial medications were administered to a considerable percentage of research participants (276, 52.8%) for various causes. These included treating diabetic foot ulcers, infections acquired in hospitals, treating neutropenic fever linked to hematologic malignancies, and adopting preventive measures. Additionally, anti-ulcer medications (113, 21.6%) were given to NCDs patients as supportive therapy to address pre-existing peptic ulcer issues and stress ulcer prophylaxis. Other supportive drugs that are frequently used for the management of patients admitted with NCDs include anti-pain (95, 18.2%) and anti-emetics (71, 13.6%). Furthermore, even though these supportive medications are helpful in lowering mortality from complications, they may increase the cost of hospitalization and worsen nonadherence to the main treatment of NCDs. According to a study done in Qatar, people who take more medications also tend to non-adherent for their treatment (81).

7. Limitation of the study

Although we have made every effort to improve the quality of this study, such as conducting it at multiple centers with a large sample size and using a prospective study method, the study only includes patients admitted to internal medicine, oncology, gynecology, and obstetrics wards, and we are unable to conclude the burden of NCDs in other hospital settings like emergency wards and so on.

Secondly, the rate of death and unsatisfactory clinical outcomes as well as prolonged hospital stay were estimated by the major class of NCDs, which did not indicate the confounding influence of each NCDs pattern under each major category.

Additionally, the inclusion of adolescents aged 14 years and older in the study might lead to differences in health profiles and outcomes.

Last, patients admitted for conditions other than CVDs, cancer, DM and chronic respiratory diseases were excluded from the study. This exclusion might overlook patients with rare or emerging NCDs or those with multiple co-morbid conditions.

8. Conclusion and Recommendation

8.1. Conclusion

This study reveals a significant prevalence and alarming mortality rate of NCDs among hospitalized patients, primarily with CVDs and cancer. Key predictors of mortality and length of hospital stay were identified by examining a large cohort across three tertiary hospitals. Medication non-adherence, the presence of concomitant comorbid conditions, and medical complications were a significant predictors of increased mortality risk. An alarmingly higher mortality rate was observed among hospitalized patients diagnosed with cancer. Similarly, prolonged hospital stays were noted among male patients, those with the diagnosis of cancer and having other comorbid conditions. Diuretics, anticoagulants, and statins were the most frequently prescribed classes of medications for hospitalized patients with major NCDs. Overall, this study contributes to advancing our understanding of NCDs epidemiology and clinical management, with implications for improving healthcare delivery and patient outcomes in hospital settings.

8.2. Recommendation

Prevention, early diagnosis strategies, and management practices should be established for NCD, particularly CVDs and cancer, at all levels of health care facilities, starting from the health center, to reduce the burden of hospitalization with NCDs and associated complications.

Complication management and infection prevention should be prioritized alongside NCDs management in order to reduce mortality and length of hospital stay among hospitalized patients.

Implementing strategies that could increase medication adherence inorder to improve patient outcomes.

Policymakers, funders, health facilities, and healthcare practitioners should all pay attention to NCDs prevention and management.

9. References

1. WHO. World Health Organization. Package of Essential Noncommunicable (PEN) Disease Intervention for Primary Health Care. WHO [Internet]. 2020. 1–37 p. Available from: https://iris.paho.org/handle/10665.2/52998

2. Habib SH, Saha S. Burden of non-communicable disease: Global overview. Diabetes Metab Syndr Clin Res Rev. 2010;4(1):41–7.

3. Boutayeb A, Boutayeb S. The burden of non communicable diseases in developing countries. Int J Equity Health. 2005;4(Table 1):1–8.

4. WHO. Noncommunicable Disease Surveillance , NCD global monitoring framework Section navigation Ensuring progress on noncommunicable diseases in countries. 2021;4–7. Available from: https://www.who.int/teams/ncds/surveillance/monitoring-capacity/gmf

5. Bigna JJ, Noubiap JJ. The rising burden of non-communicable diseases in sub-Saharan Africa. Lancet Glob Heal [Internet]. 2019;7(10):e1295–6. Available from: http://dx.doi.org/10.1016/S2214-109X(19)30370-5

6. WHO. Noncommunicable Diseases: Progress Monitor [Internet]. 2022. Available from: https://apps.who.int/iris/bitstream/handle/10665/353048/9789240047761-eng.pdf

7. Damasceno A. Noncommunicable Disease. Heart of Africa: Clinical Profile of an Evolving Burden of Heart Disease in Africa. 2016. 155–157 p.

8. Pan American Health Organization. Non-communicable diseases in the americas: All sectors of society can help solve the problem. 2011;1–8.

9. WHO. Non-communicable diseases. Public Heal An action Guid to Improv Heal [Internet]. 2021;(September):1–5. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

10. Beaglehole R, Yach D. Public health Globalisation and the prevention and control of non-communicable disease : the neglected chronic diseases of adults. 2003;362:903–8.

11. Martinez R, Lloyd-Sherlock P, Soliz P, Ebrahim S, Vega E, Ordunez P, et al. Trends in premature avertable mortality from non-communicable diseases for 195 countries and

territories, 1990–2017: a population-based study. Lancet Glob Heal [Internet]. 2020;8(4):e511–23. Available from: http://dx.doi.org/10.1016/S2214-109X(20)30035-8

12. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med. 2006;3(11):2011–30.

13. Online P, Ezzati PM. NCD Countdown 2030: pathways to achieving Sustainable Development Goal target 3.4. Lancet. 2020;396(10255):918–34.

14. Cowie MR, Lopatin YM, Saldarriaga C, Fonseca C, Sim D, Magaña JA, et al. The Optimize Heart Failure Care Program: Initial lessons from global implementation. Int J Cardiol [Internet]. 2017;236:340–4. Available from: http://dx.doi.org/10.1016/j.ijcard.2017.02.033

15. Bekele A, Teklie H, Tadesse M, Defar A. Pattern and Trend of Medical Admissions of Patients of Chronic Non-Communicable Diseases in Selected Hospitals in Addis Ababa , Ethiopia. 2015;(October 2016):34–48.

16. Misganaw A, Mariam DH, Ali A, Araya T. Epidemiology of Major Non-communicable Diseases in Ethiopia: A Systematic Review. 2014;32(1):1–13.

17. Shegaze M, Adal T, Mesfin D, Shibiru T. The burden of cancer in Ethiopia, 2000–2016: analysis of evidence from the Global Burden of Disease study and Global Health Estimate. Med Stud. 2020;36(2):83–9.

18. Tesfay FH, Zorbas C, Alston L, Backholer K, Bowe SJ, Bennett CM. Prevalence of chronic non-communicable diseases in Ethiopia : A systematic review and meta-analysis of evidence.

19. Ethiopa NCDI commission. ADDRESSING THE IMPACT OF NONCOMMUNICABLE DISEASES AND INJURIES IN ETHIOPIA : FINDINGS AND RECOMMENDATIONS FROM THE NONCOMMUNICABLE DISEASES AND INJURIES (NCDI) COMMISSION OF ETHIOPIA A Collaboration with the Global Lancet Commission on Reframing NCDIs. 2018;(November):0–122.

20. Shiferaw F, Letebo M, Misganaw A, Feleke Y, Gelibo T, Getachew T, et al. Non-communicable Diseases in Ethiopia: Disease burden, gaps in health care delivery and

strategic directions. Ethiop J Heal Dev. 2018;32(3).

21. Nicholson K, Liu W, Fitzpatrick D, Hardacre KA, Roberts S, Salerno J, et al. Prevalence of multimorbidity and polypharmacy among adults and older adults: a systematic review. Lancet Heal Longev [Internet]. 2024;5(4):e287–96. Available from: http://dx.doi.org/10.1016/S2666-7568(24)00007-2

22. Cavalcanti G, Doring M, Portella MR, Bortoluzzi EC, Mascarelo A, Dellani MP. Multimorbidity associated with polypharmacy and negative self-perception of health. Rev Bras Geriatr e Gerontol. 2017;20(5):634–42.

23. Hollingworth S, Kairuz T. Measuring Medicine Use: Applying ATC/DDD Methodology to Real-World Data. Pharmacy. 2021;9(1):60.

24. Sicotte D. world health organization. Measuring medicine prices,availability, affordability and price components 2nd Edition.". Soc Nat Resour. 2007;20(8):763–5.

25. WHO. Non-communicable diseases. World Health [Internet]. 2021;(Aprile):1–5. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

26. Collaborators M. Global Health Metrics Global , regional , and national age-sex-specific mortality and life expectancy , 1950 – 2017 : a systematic analysis for the Global Burden of Disease Study 2017. 2018;392.

27. Gouda HN, Charlson F, Sorsdahl K, Ahmadzada S, Ferrari AJ, Erskine H, et al. Burden of non-communicable diseases in sub-Saharan Africa, 1990–2017: results from the Global Burden of Disease Study 2017. Lancet Glob Heal [Internet]. 2019;7(10):e1375–87. Available from: http://dx.doi.org/10.1016/S2214-109X(19)30374-2

28. Maher D, Sekajugo J, Harries AD, Grosskurth H. Research needs for an improved primary care response to chronic non-communicable diseases in Africa. Trop Med Int Heal. 2010;15(2):176–81.

29. Gordon Patti K, Kohli P. COVID's Impact on Non-communicable Diseases: What We Do Not Know May Hurt Us. Curr Cardiol Rep [Internet]. 2022;24(7):829–37. Available from: https://doi.org/10.1007/s11886-022-01704-6

30. Allen L. Non-communicable disease funding. 2017;1–2. Available from: https://researchonline.lshtm.ac.uk/id/eprint/4664525/1/Allen_2017

31. Dalal S, Beunza JJ, Volmink J, Adebamowo C, Bajunirwe F, Njelekela M, et al. Non-communicable diseases in sub-Saharan Africa : what we know now. 2011;(April):885–901.

32. Chaker L, Falla A, Lee SJ Van Der, Muka T. The global impact of non-communicable diseases on macro-economic productivity : a systematic review. Eur J Epidemiol [Internet]. 2015;357–95. Available from: http://dx.doi.org/10.1007/s10654-015-0026-5

33. Murphy A, Palafox B, Walli-Attaei M, Powell-Jackson T, Rangarajan S, Alhabib KF, et al. The household economic burden of non-communicable diseases in 18 countries. BMJ Glob Heal. 2020;5(2):1–13.

34. Oni T, Mogo E, Ahmed A, Davies JI. Breaking down the silos of Universal Health Coverage: Towards systems for the primary prevention of non-communicable diseases in Africa. BMJ Glob Heal. 2019;4(4):10–3.

35. Noor SK, Elmadhoun WM, Bushara SO, Ahmed MH. The changing pattern of hospital admission to medical wards: Burden of non-communicable diseases at a hospital in a developing country. Sultan Qaboos Univ Med J. 2015;15(4):e517–22.

36. Lancet IT, Watkins D. Editorial Non-communicable diseases : what now ? Lancet [Internet]. 2021;399(10331):1201. Available from: http://dx.doi.org/10.1016/S0140-6736(22)00567-0

37. Chikowore T, Kamiza AB, Oduaran OH, Machipisa T, Fatumo S. Non-communicable diseases pandemic and precision medicine: Is Africa ready? EBioMedicine [Internet]. 2021;65:103260. Available from: https://doi.org/10.1016/j.ebiom.2021.103260

38. Bhagyalaxmi A, Atul T, Shikha J. Prevalence of risk factors of non-communicable diseases in a district of Gujarat, India. J Heal Popul Nutr. 2013;31(1):78–85.

39. Cooper RN. Living with global imbalances: A contrarian view. Vol. 28, Journal of Policy Modeling. 2006. 615–627 p.

40. Gelaw YA, Koye DN, Alene KA, Ahmed KY, Assefa Y, Erku DA, et al. Socio-demographic correlates of unhealthy lifestyle in Ethiopia: a secondary analysis of a national survey. BMC Public Health [Internet]. 2023;23(1):1–11. Available from: https://doi.org/10.1186/s12889-023-16436-7

41. Alamnia TT, Tesfaye W, Abrha S, Kelly M. Metabolic risk factors for non-communicable diseases in Ethiopia: A systematic review and meta-analysis. BMJ Open. 2021;11(11):1–16.

42. Id DN, Wosu AC, Ndyomugyenyi DB, Waibi M, Kajungu D. An assessment of non-communicable disease mortality among adults in Eastern Uganda , 2010 – 2016. 2021;2010–6. Available from: http://dx.doi.org/10.1371/journal.pone.0248966

43. Misganaw Dr. A, Mariam DH, Ali A, Araya T. Epidemiology of major non-communicable diseases in Ethiopia: A systematic review. J Heal Popul Nutr. 2014;32(1):1–13.

44. Armocida B, Monasta L, Sawyer S, Bustreo F, Segafredo G, Castelpietra G, et al. Burden of non-communicable diseases among adolescents aged 10–24 years in the EU, 1990–2019: a systematic analysis of the Global Burden of Diseases Study 2019. Lancet Child Adolesc Heal. 2022;6(6):367–83.

45. World Health Organization. Global Status Report On Noncommunicable Diseases 2014. 2014;

46. Coates MM, South N, Sydney W, Casey DC. in 2017 : a Modelling Study. 2021;8(12).

47. Coates MM, Kintu A, Gupta N, Wroe EB, Adler AJ, Kwan GF, et al. Burden of non-communicable diseases from infectious causes in 2017: a modelling study. Lancet Glob Heal [Internet]. 2020;8(12):e1489–98. Available from: http://dx.doi.org/10.1016/S2214-109X(20)30358-2

48. Juma PA, Wisdom J. Introduction: Non-communicable disease prevention policies in six African countries. BMC Public Health. 2018;18(Suppl 1):8–9.

49. Parkin DM, Bray F, Ferlay J, Jemal A. Cancer in Africa 2012. Cancer Epidemiol Biomarkers Prev. 2014;23(6):953–66.

50. Swe EE, Htet KKK, Thekkur P, Aung LL, Aye LL, Myint T. Increasing trends in admissions due to non-communicable diseases over 2012 to 2017: Findings from three large cities in Myanmar. Trop Med Health. 2020;48(1).

51. Yu D, Shi J, Zhang H, Wang Z, Lu Y, Zhang B, et al. Identifying patterns of non-communicable diseases in developed eastern coastal China: A longitudinal study of electronic health records from 12 public hospitals. BMJ Open. 2017;7(10):1–9.

52. Amundsen MS, Kirkeby TMG, Giri S, Koju R, Krishna SS, Ystgaard B, et al. Non-communicable diseases at a regional hospital in Nepal: Findings of a high burden of alcohol-related disease. Alcohol [Internet]. 2016;57:9–14. Available from: http://dx.doi.org/10.1016/j.alcohol.2016.10.008

53. World health organization. Better noncommunicable disease outcomes: challenges and opportunities for health systems. 2014;

54. Prasad J, Mishra S. Diabetes & Metabolic Syndrome : Clinical Research & Reviews How effective was implementation of the package of essential non- communicable disease (PEN) interventions : A review of evidence ? Diabetes Metab Syndr Clin Res Rev [Internet]. 2021;15(5):102266. Available from: https://doi.org/10.1016/j.dsx.2021.102266

55. Joshi R, Alim M, Kengne AP, Jan S, Maulik PK, Peiris D, et al. Task shifting for non-communicable disease management in low and middle income countries - A systematic review. PLoS One. 2014;9(8).

56. Cameron A, Roubos I, Ewen M, Mantel-Teeuwisse AK, Leufkens HGM, Laing RO. Differences in the availability of medicines for chronic and acute conditions in the public and private sectors of developing countries. Bull World Health Organ. 2011;89(6):412–21.

57. Ewen M, Zweekhorst M, Regeer B, Laing R. Baseline assessment of WHO ' s target for both availability and affordability of essential medicines to treat non-communicable diseases. 2017;1–13.

58. World Health Organisation. Noncommunicable Disease Risk Factor Survey Myanmar 2009 : www.who.int/ncds/steps. 2011;112. Available from:

http://www.who.int/chp/steps/2009_STEPS_Survey_Myanmar.pdf

59. WHO. WHO STEPS Instrument (investigation guide). 2013;1–14.

60. Of S, Carediabetes M. Professional Practice Committee: Standards of Medical Care in Diabetes—2022. Diabetes Care. 2022;45(January):S3.

61. Hailu A, Gidey K, Ebrahim MM, Berhane Y, Gebrehawaria T, Hailemariam T, et al. Patterns of Medical Admissions and Predictors of Mortality in Ayder Comprehensive Specialized Hospital, Northern Ethiopia: A Prospective Observational Study. Int J Gen Med. 2023;16(January):243–57.

62. Omar SM, Osman OS, Gasim GI, Adam I. Pattern and Trends in Adult Hospitalization/ Admission and Mortality Among Medical Ward Inpatients at Gadarif Hospital in Eastern Sudan: A Four-Year Retrospective Study. Int J Gen Med. 2022;15(June):5879–89.

63. Chizindu Akubudike A. Non Communicable Disease Admissions in Developing Country as Experienced from the Medical Ward of a Tertiary Centre in Nigeria. Cent African J Public Heal. 2018;4(2):34.

64. Ouyang F, Cheng X, Zhou W, He J, Xiao S. Increased Mortality Trends in Patients With Chronic Non-communicable Diseases and Comorbid Hypertension in the United States, 2000–2019. Front Public Heal. 2022;10(July):1–9.

65. Awedew AF, Berheto TM, Dheresa M, Tadesse S, Hailemariam A, Tollera G, et al. The Burden of Non-Communicable Diseases and Its Implications for Sustainable Development Goals Across Regions in Ethiopia. Ethiop J Heal Dev. 2023;37(Special Issue 2).

66. Frieden TR, Cobb LK, Leidig RC, Mehta S, Kass D. Reducing Premature Mortality from Cardiovascular and Other Non-Communicable Diseases by One Third: Achieving Sustainable Development Goal Indicator 3.4.1. Glob Heart. 2020;15(1):1–10.

67. Bekelman JE, Halpern SD, Blankart CR, Bynum JP, Cohen J, Fowler R, et al. Comparison of site of death, health care utilization, and hospital expenditures for patients dying With cancer in 7 developed countries. JAMA - J Am Med Assoc. 2016;315(3):272–83.

68. Lyons PG, Klaus J, McEvoy CA, Westervelt P, Gage BF, Kollef MH. Factors associated

with clinical deterioration among patients hospitalized on the wards at a tertiary cancer hospital. J Oncol Pract. 2019;15(8):E652–65.

69. Kontis V, Mathers CD, Rehm J, Stevens GA, Shield KD, Bonita R, et al. Contribution of six risk factors to achieving the 25×25 non-communicable disease mortality reduction target: A modelling study. Lancet. 2014;384(9941):427–37.

70. Ho PM, Magid DJ, Masoudi FA, McClure DL, Rumsfeld JS. Adherence to cardioprotective medications and mortality among patients with diabetes and ischemic heart disease. BMC Cardiovasc Disord. 2006;6:1–9.

71. Brummel A, Carlson AM. Comprehensive medication management and medication adherence for chronic conditions. J Manag Care Spec Pharm. 2016;22(1):56–62.

72. Mongkhon P, Ashcroft DM, Scholfield CN, Kongkaew C. Hospital admissions associated with medication non-adherence: A systematic review of prospective observational studies. BMJ Qual Saf. 2018;27(11):902–14.

73. Anghel LA, Farcas AM, Oprean RN. An overview of the common methods used to measure treatment adherence. Med Pharm Reports. 2019;92(2):117–22.

74. Kanyongo W, Ezugwu AE. Feature selection and importance of predictors of non-communicable diseases medication adherence from machine learning research perspectives. Informatics Med Unlocked [Internet]. 2023;38(March):101232. Available from: https://doi.org/10.1016/j.imu.2023.101232

75. Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2224–60.

76. Olds P, Kachimanga C, Talama G, Mailosi B, Ndarama E, Totten J, et al. Non-communicable disease burden among inpatients at a rural district hospital in Malawi. Glob Heal Res Policy [Internet]. 2023;8(1). Available from: https://doi.org/10.1186/s41256-023-00289-z

77. Yazew T, Daba A. Health Benefits of Fruit and Vegetables Consumption : Preventive

Implications for Non-communicable Diseases in Ethiopia Advanced Techniques in Biology & Medicine. Res Gate [Internet]. 2020;(October):6. Available from: t: https://www.researchgate.net/publication/344595848

78. Voortman T, Kiefte-de Jong JC, Ikram MA, Stricker BH, van Rooij FJA, Lahousse L, et al. Adherence to the 2015 Dutch dietary guidelines and risk of non-communicable diseases and mortality in the Rotterdam Study. Eur J Epidemiol. 2017;32(11):993–1005.

79. Solela G. Clinical Characteristics , Treatment Patterns and Outcomes of Hospitalized Patients with Acute Heart Failure at Yekatit 12 Hospital Medical College , Addis Ababa , Ethiopia : A Cross-Sectional Study. 2023;

80. Abegaz TM, Tefera YG, Abebe TB. Antihypertensive drug prescription patterns and their impact on outcome of blood pressure in Ethiopia: a hospital-based cross-sectional study. Integr Pharm Res Pract. 2017;Volume 6:29–35.

81. Zidan A, Awisu A, El-Hajj MS, Al-Abdulla SA, Figueroa DCR, Kheir N. Medication-Related Burden among Patients with Chronic Disease Conditions: Perspectives of Patients Attending Non-Communicable Disease Clinics in a Primary Healthcare Setting in Qatar. Pharmacy. 2018;6(3):85.

10. Annexes

Annex I: Treatment trend based on the pattern of NCDs.

	Treatment used	Frequency	Percentage (%)
HF (n=98)	Diuretics	87	88.78
	Aldosterone antagonist	46	46.94
	BB	41	41.84
	Anticoagulant	38	38.78
	ACEI/ARB	32	32.65
	Statin	28	28.57
	Antiplatelet	25	25.51
	CCB	9	9.18
	Digoxin	5	5.10
HF+CRVHD (n=28)	Diuretics	24	85.71
	Penicillin for 2^0 prophylaxis	18	64.29
	BB	12	42.86
	Aldosterone antagonist	11	39.29
	Digoxin	8	28.57
	Anticoagulant	8	28.57
	ACEI/ARB	4	14.29
	Antiplatelet	4	14.29
	Other*	3	10.71
HF+AF (n=5)	BB	5	100.00
	Diuretics	5	100.00
	Anticoagulant	4	80.00
	Aldosterone antagonist	3	60.00

	Other**	3	60.00
HF+CAD (n=6)	Statin	6	100.00
	Diuretics	5	83.33
	Antiplatelet	5	83.33
	ACEI/ARB	4	66.67
	Aldosterone antagonist	3	50.00
	Anticoagulant	3	50.00
	Other***	3	50.00
HF+VTE (n=6)	Anticoagulant	6	100.00
	Diuretics	3	50.00
	ACEI/ARB	2	33.33
	Statin	2	33.33
	Other****	2	33.33
HF+DM (n=12)	Diuretics	11	91.67
	Insulin	8	66.67
	BB	6	50.00
	Anticoagulant	6	50.00
	Statin	6	50.00
	CCB	5	41.67
	ACEI/ARB	4	33.33
	Other*****	8	66.67
HF+HTN (n=8)	BB	6	75.00
	ACEI/ARB	4	50.00
	CCB	4	50.00
	Diuretics	4	50.00
	Aldosterone antagonist	4	50.00
	Anticoagulant	4	50.00
	other******	4	50.00

HF+AF+CRVCH (n=3)	Diuretics	3	100.00
	Anticoagulant	2	66.67
	Penicillin for 20 prophylaxis	2	66.67
	Other*******	3	100.00
Stroke (n=40)	Antiplatelet	41	52.5
	Anti-coagulant	40	50.00
	Statin	26	65.00
	CCB	15	37.50
	ACEI/ARB	6	15.00
	Other********	6	15.00
VTE (n=27)	Anti-coagulant	25	92.59
Stroke +HTN (n=9)	CCB	7	77.78
	Statin	6	66.67
	Antiplatelet	4	44.44
	Anti-coagulant	3	33.33
	Other*********	5	55.56
HTN (n=16)	CCB	12	75.00
	Diuretics	6	37.50
	Anti-coagulant	4	25.00
	ACEI/ARB	3	18.75
	Other**********	3	6.25
HTN +DM (n=4)	Insulin	4	100.00
	Statin	3	75.00
	Antiplatelet	3	75.00
	CCB	2	50.00
	Diuretics	2	50.00
	ACEI/ARB	2	50.00
	Other***********	2	50.00
CAD (n=12)	Antiplatelet	11	91.67

	Diuretics	10	83.33
	Anti-coagulant	9	75.00
	BB	9	75.00
	Aldosterone antagonist	8	66.67
	Statin	7	58.33
	ACEI/ARB	6	50.00
	Other[#]	3	25.00
CAD +DM (n=4)	Insulin	4	100.00
	Antiplatelet	3	75.00
	Anti-coagulant	3	75.00
	Statin	3	75.00
	Diuretics	2	50.00
	BB	2	50.00
	ACEI/ARB	2	50.00
	Oral antidiabetics	1	25.00
CAD + PAD (n=2)	Anti-coagulant	2	100.00
	Other[##]	5	
CRVHD (n=7)	Penicillin for 2^0 prophylaxis	4	57.14
	Anti-coagulant	3	42.86
DM (n=32)	Insulin	29	90.62
	Statin	13	40.62
	Antiplatelet	8	25.00
	ACEI/ARB	7	21.88
	Oral antidiabetic drug	5	15.62
	Anti-coagulant	4	12.5
Asthma (n=23)	SABA	22	95.66
	ICS	16	69.57

	LABA	10	43.48
	SCS	10	43.48
COPD (n=9)	ICS	3	33.33
	LABA	2	22.22
	SCS	2	22.22
	SABA	1	11.11
Asthma + COPD	SABA	4	100.00
(n=4)	ICS	3	75.00
	LABA	2	50.00
	SCS	2	25.00

*Statins and CCB, **Digoxin, statin and antiplatelet, ***Digoxin and BB, **** Aldosterone antagonist and Antiplatelet, *****Oral ant diabetics, Antiplatelet, Aldosterone antagonist, ****** Antiplatelet and Statin, ******* Digoxin, Statin and BB, ********BB, Aldosterone antagonist, *********BB, ACEI/ARB, Aldosterone antagonist, Diuretics, ********** Statin and BB, ********** Anti-coagulant, Oral antidiabetics, # CCB and digoxin, ##Statin, BB, ACEI/ARB, Aldosterone antagonist and Digoxin, ### Statin, BB, ACEI/ARB, Digoxin and antiplatelet

Annex II: Data collection tool

Verbal consent

Hello, my name is_____ this study is conducting on non-communicable disease burden and the overall aim of the study is to assess the burden, clinical outcome and medication use pattern on non-communicable disease. The interview would take a maximum of 5-10 minutes of your time. Your participation is completely voluntary and you can withdraw from the interview or refuse to answer any question at any time. Participating or not participating in this study has no any impact on the service you will get from this hospital. All your response will remain strictly confidential. Your name will not appear on the paper by any means.

Are you volunteer to participate in the study? Yes ☐ No ☐

<table>
<tr><th colspan="4">Section 1: Sociodemographic characteristics of the patient</th></tr>
<tr><td></td><td>Ward_____
I care No._____</td><td></td><td>Bed No._____</td></tr>
<tr><td>1</td><td>Sex: ☐ Male ☐ Female</td><td>2</td><td>Age (year)_____</td></tr>
<tr><td>3</td><td>Occupation:
☐ Gov’t employee
☐ Non-Gov’t employee
☐ Self-employee
☐ Unemployed
☐ Retire
☐ Student
☐ House wife
Other specify_____</td><td>4</td><td>Marital status:
☐ Single
☐ Divorce
☐ Married
☐ widowed</td></tr>
<tr><td>5</td><td>Residency:
☐ Urban ☐ Rural</td><td>6</td><td>Average monthly house hold income _____</td></tr>
<tr><td>7</td><td colspan="3">Educational status:
☐ Unable to read and write
☐ Primary school</td></tr>
</table>

	☐ Secondary school ☐ Higher education (Diploma, Degree and above)		
Section 2: Behavioral Characteristics			
1	In the past, did you ever smoke any tobacco products? ☐ Yes ☐ no	2	Do you currently smoke any tobacco products? ☐ Yes ☐ no
3	On average, how many (packs) times a day/week do you use_____		
4	Is there any smoker in your home or work place? ☐ Yes ☐ no		
Alcohol Consumption			
5	Have you ever consumed any alcohol such as beer, wine, spirits or other local drink? ☐ Yes ☐ No If yes how frequently do you drink? _____		
Diet			
6	In a typical week, on how many days do you eat fruit? _____	10	In a typical week, on how many days do you eat vegetables? _____
Dietary salt			
7	How often do you add salt to your food right before you eat it or as you are eating it? ☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never		
8	How often is salt added in cooking or preparing foods in your household? ☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never		

9	How much salt do you think you consume? ☐ Far too much ☐ Too much ☐ Just the Right amount ☐ Too little ☐ Far too little ☐ Don't know

Physical Activity

Vigorous-intensity activities: are activities that require hard physical effort and cause large increases in breathing or heart rate.

Moderate-intensity activities: are activities that require moderate physical effort and cause small increases in breathing or heart rate.

10	Do you do vigorous-intensity activities?	☐ Yes ☐ No
11	Do you do moderate-intensity activities?	☐ Yes ☐ No
12	In a typical week, on how many days do you walk or bicycle? _____day For how much time_____ Hours: min	
13	Do you do any sports or fitness	☐ Yes ☐ No
14	**Medication Non-adherence**	
14.1	Have you ever forgotten to take your medications?	☐ Yes ☐ No
14.2	Have you ever been careless about taking your medicines?	☐ Yes ☐ No
14.3	Do you stop taking medications when you feel better?	☐ Yes ☐ No
14.4	Do you stop taking medications if you feel worse?	☐ Yes ☐ No

Section 3: Clinical characteristics

1	Date of admission_____	2	Discharge date_____	3	Length of hospital stay (day)_____

4	Diagnosis 1 2 3 Co-morbidity 1 2	5	Medication used (name, dose, dosage form rout, frequency, duration)

	3		
6	Time since diagnosis _____year/ month/day	7	Treatment type: ☐ surgery ☐ Radiation therapy ☐ Drug therapy
8	Purpose of treatment? ☐ supportive treatment ☐ Definitive treatment		
9	Family history of NCD: ☐ Yes ☐ No If yes type of NCD_____		
ction 4: Clinical outcome			
1	Status at discharge: ☐ Improved ☐ Died ☐ Same ☐ Deteriorated ☐ Referred ☐ Left against medical advice or discontinue care Other specify_____		
2	Discharge to: ☐ Home ☐ Death ☐ ICU ☐ Another ward		
3	Is there any complication? ☐ Yes ☐ No If yes specify _____		
4	Readmission? ☐ Yes ☐ No		
5	Relapse during hospital stay? ☐ Yes ☐ No		
6	Disease recurrence? ☐ Yes ☐ No		

አማርኛ ቃለመጠይቅ

ጤና ይስጥልኝ እኔ _____እባላለሁ ይህ ጥናት ተላላፊ ያልሆኑ በሽታዎች ላይ የሚሰራ ሲሆን፡ የጥናቱ አላማ በሽታዉ ስለሚፈጥረዉ ጫና፣ የህክምና ዉጤት እንድሁም የምድህኒት አጠቃቀም ሁኔታ ለማጥናት ነዉ፡፡ መጠይቁ ቢበዛ ከሰአተዎ ከ5-10 ደቂቃ የሚዎስድ ሲሆን በዚህ ጥናት ዉስጥ የርሰዎ ተሳታፊነት ሙሉ በሙሉ በርሰዎ ፈቃደኝነት ላይ የተመሰረተ ነዉ፡፡ በዚህ ጥናት መሳተፍም ሆነ አለመሳተፍ በሆሰፒታሉ ዉስጥ በሚየገኙት አገልግሎት ላይ ምንም አይነት ተፅእኖ የማይኖረዉ ሲሆን ቃለመተይቁን ማቋረጥ ወይም ጥያቄዎችን አለመመለስ ይችላሉ፡፡ በጥናቱ ዉስጥ የሚሰጡአቸዉ መልሶች ሙሉ በሙሉ በሚስጥር የሚጠበቁ ሲሆን የእርሰዎ ስም በማንኛዉም መልኩ በጥናቱ ዉስጥ አይገለፅም፡፡

በጥናቱ ለመሳተፍ ፈቃደኛ ነዎት? ☐ አዎ ☐ አይ

ክፍል 1: ስለታካሚው የሶሺዮዲሞግራፊ ባህሪያት			
	ዋርድ_____ ካርድ ቁጥር _____		አልጋ ቁጥር_____
1	ፆታ ☐ ወንድ ☐ ሴት	2	ዕድሜ(ዓመት)_____
3	ሥራ: ☐ የመንግስት ሰራተኛ ☐ የግል ድርጅት ተቀጣሪ ☐ የግል ስራ ☐ ሥራ አጥ (ሥራ መሥራት የሚችል) ☐ ጡረታ ወጠቻለሁ ☐ ተማሪ ☐ የቤት እመቤት ሌላ ይግለጹ_____	4	የጋብቻ ሁኔታ፡- ☐ ያገባ ☐ ያላገባ ☐ የትዳር አጋርን በሞት ያጡ ☐ በፍች የተለያዩ
5	የመኖሪያ ቦታ፡ ☐ አዲስ አበባ ☐ ክልል ከተማ ☐ ገጠር		
6	አማካይ ወርሃዊ የቤት ገቢ _____ ብር		
7	የትምህርት ደረጃ፡ ☐ ማንበብ እና መጻፍ አልችልም ☐ የመጀመሪያ ደረጃ ትምህርት ☐ ሁለተኛ ደረጃ ትምህርት ☐ ከፍተኛ ትምህርት (ዲፕሎማ፣ዲግሪ እና ከዚያ በላይ)		
ልማድን የሚመለከቱ ጥያቄዎች			
1	የትምባሆ ምርቶችን አጨሰዉ ያውቃሉ? ☐ አዎ ☐ አይ		
2	አሁን ያጨሳሉ ☐ አዎ ☐ አይ	3	በአማካይ፣ በቀን/ሳምንት ስንት ሲጋራ ይጠቀማሉ?_____
4	በቤትዎ ወይም በስራ ቦታዎ የሚያጨስ አለ? ☐ አዎ ☐ አይ		
የአልኮል መጠጥን የሚመለከቱ ጥያቄዎች			
5	አልኮል የመጠጣት ልምድ አለዎት? ☐ አዎ ☐ አይ አዎ ካሉ ቢንስ አንድ መለኪያ አልኮል በየስንት ጊዜ ይጠቀማሉ _____		
አመጋገብን የተመለከቱ ጥያቄዎች			

6	በሳምንት ውስጥ ስንት ቀናት ፍራፍሬ ይመገባሉ? _____ቀን	7	በሳምንት ውስጥ ስንት ቀናት አትክልት ይመገባሉ? _____ቀን
8	ምግብ ሲዘጋጅ፣ ከምግበ በፊት ወይም ሲበሉ ጨው ይጨምራሉ? ☐ ሁልጊዜ ☐ ብዙ ጊዜ ☐ አልፎ አልፎ ☐ በጭራሽ		
9	ምን ያህል ጨው የሚጠቀሙ ይመስለዎታል? ☐ በጣም ብዙ ☐ ትክክለኛው መጠን ☐ በጣም ትንሽ ☐ ብዙ ☐ ትንሽ ☐ አላውቅም		
አካላዊ እንቅስቃሴን የሚመለከቱ ጥያቄዎች			
10	ከባድ እንቅስቃሴ የሚጠይቁ ስራዎችን ይሰራሉ?	☐ አዎ	☐ አይ
11	መጠነኛ እንቅስቃሴ የሚጠይቁ ስራዎችን ይሰራሉ?	☐ አዎ	☐ አይ
12	በሳምንት ዉስጥ ለስንት ቀን በግር ወይም በብስክሌት ይሄዳሉ?_____፣ ለምን ያህል ሰአት/ደቂቃ? _____		
13	ያካል ብቃት እንቅስቃሴ፡ ወይም ስፖርት ይሰራሉ?	☐ አዎ	☐ አይ
ክሊኒካዊ ባህሪያት			
14	ተላላፊ ያልሆኑ በሽታዎች ያለበት ቤተሰብ አለዎት?	☐ አዎ	☐ አይ
15.1	መድሃኒትዎን መውሰድ ረስተው ያውቃሉ?	☐ አዎ	☐ አይ
15.2	መድሃኒትዎን ለመውሰድ ግድየለሽ ሆነዉ ያውቃሉ?	☐ አዎ	☐ አይ
15.3	ጥሩ ስሜት ሲሰማዎት መድሃኒቶችን መውሰድ ያቆማሉ?	☐ አዎ	☐ አይ
15.4	መጥፎ ስሜት ከተሰማዎት መድሃኒቶችን መውሰድ ያቆማሉ?	☐ አዎ	☐ አይ

Annex III: Ethical approval

በ ፋርማሲ ት/ቤት
የኢቲክስ ሪቪው ኮሚቴ

አዲስ አበባ ዩኒቨርሲቲ
Addis Ababa University

School of Pharmacy
Ethical Review Committee

ቀን Date: September 04, 2022

ቁጥር Ref. No.: ERB/SOP/485/14/2022

To: **Alemu Belaynch**
School of Pharmacy

Re: Ethical Clearance

It is to be recalled that you submitted a research proposal entitled "**Burden, pattern of drug, and clinical outcomes of patients admitted to hospitals due to non-communicable diseases".** The committee thoroughly reviewed the proposal based on its operational guideline and found that, it fulfills all the ethical requirements stipulated in the guideline. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Shemsu Umer (PhD)
Chairperson, ERC
School of Pharmacy
College of Health Sciences
Addis Ababa University

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አዲስ አበባ ከተማ አስተዳደር ጤና ቢሮ
City Government of Addis Ababa Health Bureau

REF.N.O. ፈ/ጤ/ጥ/3916/227
DATE 9/2/2015

TO:

- **Yekati 12 Hospital Medical College**

Subject: Request to access Facilities to conduct approved research

This letter is to support **Alemu Belayneh** to conduct research which is entitled as" **Burden, pattern of drug, and clinical outcomes of patients admitted to hospitals due to non-communicable diseases.**" The study proposal w as duly reviewed and approved by Addis Ababa Health Bureau procedures and submit an activity progress report to the Ethical Committee as required. Therefore we request the facility and staffs to provide support to the principal investigator.

With Regards

Ethical Clearance Committee

ዶ/ር ዮሐንስ ወ/ኪዳን
የህብረተሰብ ጤና ምርምር
ቡድን መሪ

Cc

- **ALEMU BELAYNEH**
- **ETHICAL CLEARANCE COMMITTEE**