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Cost-Effectiveness Analysis of Inpatient Versus Outpatient Treatment Centers for Substance Use Disorder in Ethiopia: A **Markov model from a Societal Perspective**

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Abbreviations and Acronyms

AUD	Alcohol Use disorder
CEACs	Cost Effectiveness Acceptability Curves
DALY	Disability Adjusted Life Year
DUD	Drug Use Disorder
E.F.Y	Ethiopian Fiscal Year
ETB	Ethiopian Birr
GBD	Global Burden of Diseases
GDP	Gross Domestic Product
HCA	Human Capital Approach
ICER	Incremental Cost Effectiveness Ratio
ITC	Inpatient Treatment Center
LMIC	Low and Middle Income Country
NCD	Non Communicable Diseases
OTC	Outpatient Treatment Center
PSA	Probabilistic Sensitivity Analysis
SUD	Substance Use Disorder
UNODC	United Nation Office on Drug and Crime
U.S.	United States
USD	United States Dollar
WHO-CHOICE	World Health Organization's Choosing Intervention that are Cost Effective
WHO	World Health Organization
WHO mhGAP	World Health Organization mental health Gap Action Program
WTP	Willingness-To-Pay
YLD	Years Lived with Disability
YLL	Years of Life Lost

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Abstract:

Background: Substance use disorders are a growing burden in Ethiopia, accounting for 34% of NCDs burden and higher indirect costs (86%). The treatment of SUD in Ethiopia, which is traditionally facility based, Inpatient (ITC) and outpatient (OTC) interventions are the two treatment modalities, yet their cost-effectiveness remains uncertain. This study aims to evaluate the cost-effectiveness of Inpatient (ITC) versus Outpatient (OTC) treatment for SUD in Ethiopia.

Methods: A retrospective cohort study design was used for conducting a full economic evaluation using a Markov model to assess the cost-effectiveness of SUDs treatment at inpatient (ITC) and outpatient (OTC) treatment centers in Addis Ababa, Ethiopia. A total of 282 SUD patients aged 18 and above was selected by simple random sampling. A bottom-up ingredient micro costing approach was employed to collect a relevant cost data. The primary cost and effectiveness data were collected from inpatient (ITC), outpatient (OTC) treatment centers and patient interviews to inform the Markov Model. Costs were evaluated from a societal perspective, and effectiveness was measured in terms of DALY averted, with both costs and effects discounted at 3%. The model, developed in Microsoft Excel, included six health states with start age of 18, and a one-year cycle length with a lifetime horizon. Data entry and analysis was also undertaken using Microsoft Excel. Caregiver costs were excluded due to data reliability concerns**.**

Results: The estimated life time costs of SUD treatment was USD 33,626 for ITC and USD 27,036 for OTC. The Average Cost Effectiveness Ratio (ACER) indicates that USD 102 per DALY averted is required for ITC, while only USD 82 per DALY averted is needed for OTC. In this regard, OTC is deemed the preferred option. The analysis further revealed that SUD treatment at ITC is not a cost-effective, with an ICER of USD 3710 per DALY averted, exceeding Ethiopia's cost-effectiveness threshold of one to three times the GDP per capita. In contrast, the study identified SUD treatment at OTC as a cost-effective alternative.

Conclusion: The SUD treatment in Ethiopia is associated with a significant financial burden. While outpatient care (OTC) is more cost-effective than inpatient (ITC), it remains largely inaccessible and unaffordable. Integrating SUD services into primary health care could enhance access and reduce costs, with specialized care reserved for severe and complex cases.

Key words: Cost-effectiveness**,** Inpatient Treatment, Outpatient Treatment, Substance Use Disorder, Ethiopia, Markov Model

Chapter I: Introduction

1.1 Background

Substance use disorders (SUDs) are serious global public health threat, with significant burden for affected individuals, their families, and society. According to the United Nations Office on Drugs and Crime (UNODC), approximately 296 million people aged 15 to 64 worldwide used illicit drugs at least once in 2021. Moreover, about 2.3 billion people were current alcohol drinkers, with 289 million affected by alcohol use disorders (AUDs) and 35 million affected by drug use disorders (DUDs). However, only 20% of people with SUDs receive treatment, leading to over 500,000 substance use related deaths [1].

There is dearth of national prevalence data in most of African countries, hindering effective response with evidence based prevention and treatment programs. According to UNODC World Drug Report 2022, the estimated cannabis, opioids, and heroin usage in African was 49.2, 9.2, and 3.6 million people respectively [2]. Sub Saharan Africa contends with triple burden of infectious, NCD (partly from SUDs) and injuries. This is due to socio-economic shifts, fostering middle class with disposable income for alcohol and recreational substances. Excessive alcohol use, key risk factor for NCDs, was widespread across the continent, especially in southern and sub-Saharan Africa [3,4]. Alcohol, tobacco, cannabis and khat are most consumed substance in Africa, while opioids, illicit and injected drugs are not uncommon in the region [5].

According to Ethiopian Demographic Health Survey (EDHS) 2012 report, tobacco use was reported by 4% of youths and 6.3% of individuals aged 25-29, while alcohol consumption was reported by 53% of men and 45% of women [6]. From EDHS 2016 report, over 62.5% of males had current history of substance use at the time of the survey. Alcohol, khat and tobacco are the most consumed substances with pooled life time and current prevalence of 31.5% and 23.9% respectively [7]. From meta analytic study done in Ethiopia in 2019, nearly one-third of young people in the country use different substances in their lifetime, with the odds of using substances among young males was threefold when compared to females [8]. In addition, there was evidences indicating the use of illicit drugs, such as hashish, cocaine, cannabis, sleeping pills, amphetamine, opioids, and shisha [9,10].

1.2 Statement of the problem

Substance use disorders are a growing public health threat in low and middle income countries (LMICs), where more than 80% of global population lives. Untreated SUDs impose significant costs on society, including lost productivity, higher healthcare expenditure, and costs related to criminal justice, social welfare, and other social consequences. For instance, it contributes to non-communicable diseases (NCDs) and is the second leading cause of disability among mental disorders, accounting for 25% of years lived with disability (YLD). Additionally, SUDs often linked with psychiatric co-morbidities. A studies in Ethiopia indicate high rate of depression, anxiety, and stress at 27.4%, 40.6%, and 18.8% among substance users respectively [11].

Data on the economic costs of SUDs in LMICs, including Ethiopia are limited. However, in 2016, global economic costs related to nicotine use disorder reached nearly USD 2 trillion, due to healthcare costs and lost productivity from premature death and morbidity [12]. In the U.S., SUDs incurred an estimated economic costs of USD 3.76 trillion in 2019, with the tangible (direct and indirect) at 13.4% and intangible costs at 86.6% [13]. In the absence of disease-specific cost data, estimating costs proportional to disease burden is a practical approach. The 2016 GBD study attributed 34% of NCDs burden in Ethiopia to SUDs [34]. SUDs contribute to higher premature death (6.22%) and increased health expenditures by government (10.2%) and households (7.82%). The WHO 2019 report estimated Ethiopia's annual SUDs cost at USD 374 million (0.61% of GDP), with indirect costs (86%), such as lost productivity (46.8%) and premature death (34.8%), far outweighing direct health care spending (14%) [14,15].

Despite the widespread prevalence of SUDs and their profound impact on society, access to effective treatment remains limited, with only 7% of people worldwide and 1% in LMICs receiving care. Specifically, only 20% globally and 10% in LMICs receive treatment for AUDs, and only 12.5% in LMICs receive treatment for DUDs [16]. While treatment models for SUDs evolving, a significant gap exists between research and their practical implementation, more particularly in LMICs like Ethiopia, where culturally acceptable services and trained health workers are scarce [17,18]. In rural Ethiopia, a study revealed a wide treatment gap for AUDs (87%), with 70% reporting high internalized stigma. Barriers to seeking help included the desire to handle the problem by their own, believing that it will resolve by itself, and uncertainty about where to seek help [19].

Evidence on SUDs treatment mainly originates from high income countries, with costly care models. In LMICs, recent review of mental health service highlighted neglect towards AUDs. AUDs are overlooked in LMICs, where most problematic drinkers visit primary care and remain untreated. Limited services in LMICs mainly target severely dependent patients at tertiary care. A recommendation urged a policy shift towards cost-effective interventions, prioritizing brief interventions for non-dependent users who are the majority. Due to cost concern, effective psychosocial and pharmacological interventions take a backseat, favoring a potential stepped care approach [20]. However, the subsequent publication addressing a spectrum SUDs evidence based care for LMICs, later incorporated in the WHO mhGAP intervention guide [21,22]. Yet, over a third of these nations lack alcohol and drug policies. Most allocate less than 1% of their health budget to mental health, often neglecting SUDs due to prevalent stigma [23].

In conclusion, in many LMICs including Ethiopia, treatment services for SUDs are limited, lacking essential follow up and support for lasting sobriety. Most treatment and rehabilitation centers primarily focus on detoxification without providing comprehensive aftercare. This results in ineffective outcomes such as relapse, readmission, dropout, and even death [24].

1.3 Significance of the study

This study on cost and cost-effectiveness of SUD treatment at ITC and OTC provides crucial evidences to guide healthcare providers in selecting the most effective and financially sustainable treatment approach. By identifying the more cost effective modality, this research ensures that a greater number of SUDs patients receive quality care at lowest possible cost. The findings will contribute to evidence-based decision-making, helping policymakers design targeted policies and strategic interventions that optimize resource allocation. By offering clear policy recommendations, the study supports efforts to prioritize public resource efficiently, ensuring that public funding is directed toward the greatest health and economic benefits. Moreover, the study equips local administrators and healthcare planners with actionable recommendations to enhance prevention and treatment programs, ultimately improving access, affordability, and the overall quality of SUD care.

Chapter II: Literature Review

The aim of this chapter is to review the existing literature related to substance use disorder and its treatment cost, effectiveness, and cost-effectiveness of SUD treatment modalities. It seeks to broaden our theoretical understanding of the cost effectiveness of studied SUD treatment approaches, particularly in their role in facilitating rehabilitation and social reintegration of substance users into their community as productive and valued actors**.**

2.1 General overview of substance use disorders

Substance use disorders is a chronic and complex condition marked by the persistence and harmful patterns of using alcohol and psychoactive substances, even in the face of significant harm and adverse health outcomes. These disorders linked to substance-induced mental disorder. The severity of SUDs is categorized as mild, moderate, or severe based on the presence of two to three, four to five and six and more DSM-5 criteria symptoms respectively [25].

2.2 Global burden of substance use disorders

Substance use disorders are affecting all human beings living anywhere in the world, being notable inter-country variation in prevalence. From the 2021 WHO report, a 1.8% of diseases burden were attributed to SUDs, with 1.2% and 0.6% from AUDs and DUDs respectively [26]. Alcohol and drug contribute for 99.2 million DALYs (4.2% of all DALYs) and 31.8 million DALYs (1.3% of all DALYs), respectively. Among these, alcohol remained as the most prevalent substance, with age standardized prevalence of 1320.8 cases per 100,000 individuals, followed by opioids and cannabis with age standardized prevalence of 353.0 and 289.7 cases per 100,000 individuals respectively. Harmful use of alcohol resulted in an estimated 3 million deaths (5.3% of all deaths). In African region, age standardized burden of diseases and injuries was the highest of all WHO region, with 70.6% deaths and 3044 DALY per 100,000 people. This is partly due to its contribution to other burden of diseases like infectious and NCDIs [26]. According to the GBD 2019 report, tobacco-related deaths were the second-highest cause globally, constituting 15.4% of all deaths [27].

Beyond this estimated diseases burden, SUDs contribute additional health impact due to their linkage to myriad of medical conditions such as infectious and non-communicable diseases. By 2050, the burden of SUDs in sub-Saharan Africa was projected to surge by approximately 130%

[28]. Despite this alarming trend, SUDs prevention and treatment system remain severely under-resourced, with a treatment gap as high as 87% (23,19). The WHO had proposed strategies to address this challenge, including boost funding for SUDs prevention and treatment, by utilizing revenue from taxation on legal substances and betting to support SUDs care. Moreover, pooling all financial resources for SUDs services into a common fund has been recommended to optimize their efficient utilization [29]. To address the growing burden of SUDs and bridge the existing treatment gap, such strategies could be effectively adopted in LMICs, including Ethiopia.

2.3 Burden of substance use disorders in Ethiopia

Ethiopia stands among the pioneer to produce alcoholic beverages in the world, and the origin of coffee and khat [30]. Indeed, evidence suggests that substance misuse is on the rise in Ethiopia due to growing urbanization, economic boom, high unemployment rate and cultural transition. However, national data exists on three commonly misused substances such as alcohol, khat, and tobacco. From a 2015 STEPS survey report involving nearly 10000 adults, revealed a 12.4% of heavy episodic drinking, 15.8% for current chat chewing, 3.5% for tobacco smoking [31–33]**.** According to GBD 2016, 34% of NCDs burden attributable to those risk factors. [34]. From 2017 GBD report, SUDs contribute to 1% of total DALY in Ethiopia [35]. According to GBD 2019 report, AUDs is the six leading cause of death and disability in Ethiopia [36].

2.4 Substance use disorders treatment services in Ethiopia

Treatment services for SUDs in Ethiopia are still in its infancy. This is reflected in limited access to mental, neurological, and substance use (MNS) disorder services, lack of evidence based treatments, poor clinical skills among health care providers, and inadequate government prioritization. There is also lack of resources, awareness, and prevalent stigma and discrimination towards individuals with SUDs. Furthermore, SUD treatment is not allocated dedicated budget and regular input provision is lacking. Notably, SUD treatment cost is not covered under the current national health insurance scheme [19,37,38].

2.4.1 Treatment strategies for substance use disorders in Ethiopia

The cost of SUDs and associated complication imposes a significant challenges to the government health care systems and increase household expenditure for health, particularly in LMICs like Ethiopia [21]. The country doesn’t have clear alcohol and drug policy and strategy.

However, there is five year national mental health strategic plan that barely incorporate the treatment strategy of SUDs, with the target of increasing SUDs treatment access from 1% to 20% at the end of 2025 [39]. As per WHO recommendation, MNS disorder treatment strategy integrated into the primary health care services delivery platform, aiming to ensure an extensive equitable, accessible and cost effective services for all citizens in need of the services [40,41].

As other LMICs, Ethiopia adopts the **WHO mhGAP intervention guide** model through integrating the services into the existing primary health care system. At each time point, individuals with minimal need can be treated in minimal resource-intensive settings, like community resource and primary care; whereas as severity increases the more intensive treatment approaches, such as specialized outpatient and inpatient care, are tailored to match the increasing need. The treatment strategies recommended at the currently available few treatment centers are shown in **Table 1** [42].

Table 1**:** Evidence based recommendation for treatment of SUDs in LMICs

Alcohol use disorders	Detail description of an interventions
Screening & brief interventions	Routine screening in clinics using validated instruments such as AUDIT-3, AUDIT-C, ASSIST, and brief interventions for hazardous and harmful alcohol use.
Alcohol withdrawal management	Start with benzodiazepines. Consider adding antipsychotics as needed. Administer oral or IV/IM thiamine in cases of Wernicke's encephalopathy or severe malnutrition. Consider inpatient care when necessary.
Relapse prevention in alcohol dependency	Offer acamprosate, disulfiram, or naltrexone based on patient preference to prevent alcohol dependence relapse.
Psychosocial intervention for alcohol dependent patients	Routine provision of psychosocial support to patients with alcohol addiction, with provision of more structured therapies when possible. Non-specialist health care workers should provide family support.
Role of mutual help group like Alcoholic anonymous (AA)	Refer patients with alcohol addiction to self-help groups, monitor attendance. Encourage family members of patients with alcohol addiction to attend family groups.
Drug use disorders	
Brief psychosocial interventions	Offer a brief intervention lasting 5-30 minutes to individuals who consume cannabis or psychostimulant, providing personalized feedback and advice on reducing or stopping consumption, followed by potential follow-ups. If issues persist, consider referring them for specialist assessment.
Drug withdrawal management	1. Cannabis, cocaine, or amphetamines: are best undertaken in a supportive environment. While no specific medication is suggested for withdrawal, manage symptoms like agitation

	or sleep issues with appropriate medications. Monitor closely for potential depression or psychosis during withdrawal and seek specialist advice if needed. 2. Benzodiazepines: convert to long acting benzodiazepines, gradually taper dose over 8–12 weeks. Additional psychosocial support should be considered. If severe withdrawal symptoms, seek specialist advice.
Treatment of psychostimulant dependent patients	Avoid using Dexamphetamine for the treatment of stimulant use disorders.
Psychosocial support for management of psychostimulant use disorder and cannabis dependent and abuse	Brief motivational interviewing based psychological support; refer non responders for treatment in a specialist setting, when available.
Role of sterile injection equipment & outreach programs for injecting drug users	Provision of sterile needles in primary care where injecting drug use is common and safe retrieval of used ones. This can be facilitated by community pharmacies or through outreach program. Testing for HIV and hepatitis is also necessary and referral to treatment is needed.

2.4.2 SUDs treatment center in Ethiopia

Currently, SUDs treatment is mainly delivered using **WHO mhGAP intervention guide model**, which aims to address the significant gap between limited resources and the growing demand for the services by utilizing evidenced based, integrated packages of interventions aimed at achieving universal health coverage. These packages are effective and efficient in improving health services, relatively cost-effective in terms of training and supervision, and strategically direct scarce resources to interventions that deliver the highest value for money [22,41].

2.4.2.1 Inpatient treatment centers (ITC) for SUDs

Patients at this setup stay at treatment facility for specified period of time to receive intensive care and support. They undergo thorough medical and psychosocial evaluation to make appropriate treatment plan specific to each patients and receive education on SUDs and their treatment. This includes understanding the type, goal, and duration of inpatient treatment, patient's expectations from the treatment, outlining post discharge plan to prevent relapse and overdose, and discussing treatment costs. According to [43] the responsibilities of Inpatient Treatment Centers (ITC) include preparing space for services, hiring qualified staff, admitting patients with complicated conditions, and planning smooth transition to the next treatment stage and aftercare.

In Ethiopia, there are four inpatient SUD treatment centers (ITC), three in Addis Ababa (Amanuel MSH, St. Paul HMMC, Zewuditu Memorial Hospital, with 16, 5, and 4 beds respectively), and one in Tigray at Ayder Specialized Hospital with a capacity of five beds [39].

2.4.2.2 Outpatient Treatment Centers (OTC) for substance use disorders

This program, **also known as community based**, allows SUDs patients to receive treatment through follow up visits while maintaining their routine activities. Patients visit outpatient treatment center (OTC) either from the community or after inpatient care. After thorough evaluation, they receive information about their overall condition and the next treatment plan. Sometimes, the decision to continue at outpatient or switch to inpatient care aligns with the patient's preferences. According to [43] the responsibilities of outpatient treatment facilities include preparing space and employing staff for services, provide follow up care for inpatient or community referral, and offer psychological and psychosocial support, including psychotherapy as needed.

Ethiopia has five SUD outpatient treatment centers (OTC), four based in the capital city Addis Ababa (St. Amanuel MSH, St. Paul's HMMC, Zewuditu Memorial Hospital, and Gefersa Rehabilitation Center), and one in the Tigray region at Ayder Specialized Hospital [39].

2.6.2 Disability-Adjusted life years (DALYs)

The disability adjusted life year (DALY) is a public health measure that used to quantify burden of disease. DALY is calculated by adding years of life lost (YLL) due to premature death and year of life with disability (YLD). The concept behind is every person born with a determined life years with an optimal health. However, people lost their productive life years due to disability and /or dying before standardized life expectancy. These losses in life years exactly are what measured by DALY metric. Using the DALY as the main outcome measure allows analysts to quantify population-level gains as a proportion of the existing disease burden, which is also measured in DALYs.

2.5 Costs of substance use disorders (SUDs) treatment

Treating SUDs is costly and complex due to its chronic nature and a potential need for long term care, and often linked to co-existing medical and mental disorder. However, using evidence based approaches yields significant societal benefit because an indirect and intangible cost of substance use exceeds direct medical and non-medical costs. In the U.S., annual direct healthcare

expenditures on SUDs treatment was USD 118.5 billion, driven by inpatient and outpatient hospital spending (36%), treatment programs (34%). Indirect costs, primarily from lost productivity due to SUDs, reached USD 207 billion, with 89% stemming from health related conditions like premature deaths and 11% from crimes. Overall, tangible and intangible costs accounts 13.4% and 86.6% of total SUDs related economic costs, respectively. Treating SUDs yields a total societal benefit of US$ 534.6 billion compared to no treatment [44]. In other study in the U.S., the average annual medical costs per patient treated and total annual medical costs in the employer sponsored insurance population related to SUDs were USD15640 and USD 35.3 billion, respectively [45].

The cost analysis study was conducted from provider's perspective in four community and two general hospitals in Thailand in 2014. The study aims to estimate the treatment costs of outpatient care for mental and behavioral disorders due to psychoactive substance use. It showed that the total outpatient costs per patient treated ranged from USD 5263.94 to 59759.48. The unit cost per outpatient visit ranged from USD 5.30 to 22.55. The highest costs were incurred by labor costs (53%), followed by material (42%) and capital (6%) costs [46]. In another cost analysis study conducted in Thanyarak Institute, the unit cost per outpatient visit were USD 25.60 [47].

A study conducted to estimate the direct medical costs of treating SUDs patients in two tertiary hospitals in Nigeria in 2020. The study compares the cost of inpatient and outpatient and it was conducted from patient's perspective. The mean costs of treating SUDs were USD 384.82, USD 355.53, and USD 378.12 for AUD, DUD, and AUD and DUD combined respectively. The average inpatient cost was USD 359.56, which was higher than outpatient cost with USD 169.15. The highest costs in treating SUDs were from inpatient admission; include the cost of accommodation, feeding, and laundry, followed by cost of medicine. Though higher in treating AUDs, medical devices had the lowest cost [48].

To reduce the global impact of SUDs, providing evidence based intervention has been integrated into United Nations' Sustainable Development Goals (SDGs) for 2030. However, inadequate cost data, especially for SDG 3.5, hinders effective planning and resource allocation in many countries for preventing and treating SUDs. According to WHO global survey on progress with SDG health target 3.5, about 80% of countries provide specialized SUDs treatment services.

However, in about 10% of reporting countries, these services are available only for the treatment of acute conditions, and roughly 5% of countries, specialized services for SUDs are not available. Besides, investments in essential services have not matched the needs of the SUDs affected population [49].

2.6 Measurement of effectiveness

The effectiveness of treating SUDs in an outpatient and inpatient settings can be assessed through the rate of remission and abstinence, and social improvements. Though inpatient treatment is often considered as more successful than outpatient programs for the SUD treatment ,some studies suggest outpatient treatments can be equally or more effective, particularly in managing alcohol use disorder [50]. Despite high treatment costs, satisfactory outcome is achieved, especially with early access to treatment, patient commitment, social support, strong self-efficacy, and positive perception of life from the patients [51].

2.6.1 Treatment outcomes

The treatment outcomes in this study were categorized as follows: 1) Success (remission or abstinence), 2) Failure (relapse or dropout), and 3) Mortality. The effectiveness of the program was assessed using remission and abstinence rates from patient chart reviews and interviews, while ineffectiveness was indicated by dropout, relapse after remission or abstinence, and mortality during the treatment.

2.7 Cost-effectiveness of substance use disorders (SUDs) treatment

The cost-effectiveness of inpatient and outpatient treatment approaches for SUDs can be evaluated in terms of the total cost incurred relative to their ability to produce positive health outcomes. Besides, several techniques, like the Cost Effectiveness Acceptability Curves (CEACs), estimate the likelihood of cost effectiveness at varying willingness to pay (WTP) threshold, which is the maximum price in which a healthcare consumer might pay for health benefit. CEACs use statistical techniques to create confidence intervals around cost estimates, aiding in understanding intervention effectiveness [52]. Recommended by WHO-CHOICE project, this approach defines cost-effectiveness based on GDP per capita, categorizing interventions as highly cost-effective, cost-effective, or not cost-effective if it costs less than one, one to three, and more than three times the national annual GDP per capita per DALY averted, respectively [53]. However, it's crucial to note that this method alone doesn't determine funding

decisions or affordability but evaluates value for money in different settings when assessing the effectiveness of SUDs treatment across facilities.

Several studies found outpatient treatment to be more cost effective than inpatient care. In a US study, the costs per abstinent cases were USD 15600 for inpatient, USD 14900 for residential, USD 12400 for outpatient detox /methadone, and USD 6300 for outpatient drug free modality. The average cost across all modalities was USD 12400 per abstinent cases. Cost of successful treatment in the outpatient drug-free modality was lower than both inpatient and residential but not lower than the detox/methadone modality. Besides, for reduced substance use, the costs were USD 6100, USD 6700, USD 4600, and USD 2400 for inpatient, residential, outpatient detox /methadone, and outpatient drug free program respectively, averaging USD 4,900 per reduced substance use case. In this case, the cost of successful treatment in the outpatient drug-free modality was lower than all other modalities. The outpatient drug free modality proved to be the most cost-effective, with an ICER of USD 8000 per abstinent case and USD 4000 per case of reduced substance use. In contrast, the inpatient modality was the least cost-effective, with an ICER of USD 23600 per abstinent case and 11800 per case of reduced substance use [54].

In other study conducted in Kenya revealed that the average cost per patient treated of AUDs in community based and institution based detoxification and rehabilitation were USD 2114.9 and USD 3676.1 respectively. The former had save a per drinker average of USD 3785.8 (more cost effective) as compared to the later in stop drinking cases [55].

Chapter III: Conceptual Framework

The cost and cost-effectiveness of the two treatment approaches for SUDs, inpatient (ITC) and outpatient (OTC) treatment center, are determined by their costs and effectiveness, which in turn depends on various factors. This conceptual framework depicts that the setting should be cost-effective and evaluates factors affecting costs and effectiveness of this study.

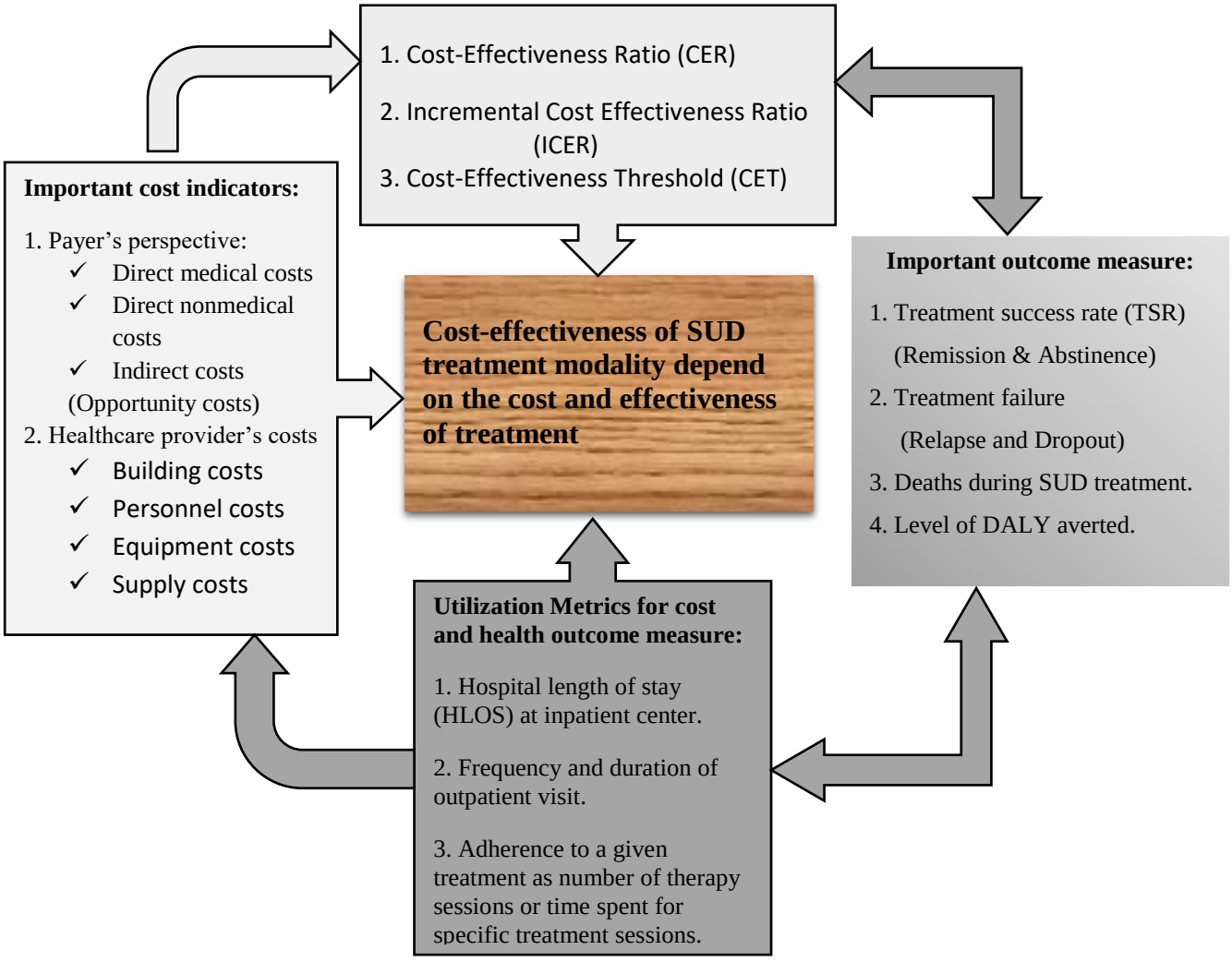

Figure 1: Conceptual framework for cost and cost-effectiveness study: 2024

Chapter IV: Objectives

4.1 General objective

- To compare the cost and cost-effectiveness of inpatient (ITC) and outpatient (OTC) treatment centers for substance use disorder in Addis Ababa in 2015 E.F.Y.

4.2 Specific objectives

- To estimate the total costs of SUDs treatment at inpatient (ITC) and outpatient (OTC) treatment centers, from societal perspective.
- To measure the impact of SUDs treatment on patients' health outcomes, in terms of disability adjusted life years (DALYs).
- To calculate the incremental cost effectiveness ratios (ICERs) of inpatient (ITC) versus outpatient (OTC) treatment centers for SUDs.

Chapter V: Methods

5.1 Study Area

Ethiopia is the second most populous country in Africa after Nigeria, with a population of more than 120 million. The country is administratively divided into twelve regions and two federal chartered cities. This study was conducted in Addis Ababa, which is the capital city of Ethiopia, and has an area of 527 square kilometers, with predicted population of over 5.2 million in 2022 [56]. Addis Ababa has 11 sub cities and 119 woreda, with 95 health centers and more than 40 hospitals including private hospitals in 2022**.** Addis Ababa has three hospitals (Amanuel MSH, St. Paul HMMC, and Zewuditu Memorial Hospital) as both inpatient (ITC) and outpatient (OTC) treatment centers. In addition, Gefersa rehabilitation center as OTC for SUDs services.

5.2 Study Design

A retrospective cohort study design was used for conducting a full economic evaluation using Markov model. The bottom-up ingredient-based micro-costing approach was used to estimate the average cost per patient from societal perspective. Costs were categorized as payer's (direct medical, non-medical costs, and indirect costs) and provider (capital and variable costs) perspective. Primary data were collected from hospital records, patient charts review, and interviews. A Markov model is well-suited to evaluate the long-term costs and outcomes of interventions, especially when a disease or condition like SUDs involves recurring events or chronic progression. It simulates how a cohort of individuals moves through health states over cycles, capturing transitions, costs, and outcomes at each stage. It characterized by the following.

1. Comparators groups

The study compares cost and cost-effectiveness of inpatient (ITC) and outpatient (OTC) treatment center for SUDs in Addis Ababa in 2015 E.F.Y. ICD-11 severity specifiers were used for diagnosis and treatment planning of SUDs, promoting a shared understanding among healthcare professionals.

2. Cycle length

In this study, the cycle length was annual, with costs and transition probabilities determined based on one year cycle. To account for events occurring midway through the cycle, a half cycle correction (HCC) was applied. This approach assumed that patients transitioned between health states halfway through the cycle, rather than solely at the start or end [57].

3. Time horizon

The study was conducted with a lifetime horizon. According to world life expectancy data, the Ethiopian life expectancy year was 68 years [58]. Since this study started with age above 18 year, we run the model in 50 cycles to find the difference in life expectancy.

4. States, transition and diseases progression

Initially, individuals are in "healthy state", with certain probability of progressing into SUDs. The transition rate to SUDs depends on factors like type, pharmacological properties, availability, legality and social acceptability of the substances [59]. Studies report cumulative transition rate of 16-67.5% for nicotine, 14-22.7% for alcohol, 17-20.9% for cocaine, 23% for heroin, and 8.9% for cannabis use disorders. Overall, the risk of transitioning to SUDs was higher when substance use begins at a younger age [59–61].

SUDs are a chronic disorder, marked by longstanding alteration in brain function, with recovery depends on substance type, duration, treatment type, and individual factors [62]. Most individuals cycle through recovery, remission, relapse, and re-treatment before achieving lasting sobriety or facing permanent disability or death [63]. Studies indicate that about 33% of individuals oscillate between recovery, relapse, and re-treatment every quarter, 82% experience at least one transition, and 62% undergo multiple transitions within three years. Majority of individuals relapse within the first year after treatment, often within 30-90 days [64]. The rate of remission and relapse for SUDs vary by substances. Studies in the U.S. report the life time cumulative remission rate of 83.7% for nicotine**,** 90.6% for alcohol**,** 97.2% for cannabis**,** and 99.2% for cocaine use [59]. Among those in remission, 20% of cocaine [65] and over 50% of alcohol use disorder [66] relapse within 3 years. About half of nicotine use disorder relapse within the first year, with relapse risk decreasing overtime but never fully disappearing [67].

When timely and properly treated, mortality from SUDs were typically insignificant[68]. However, mortalities related to SUDs was 1.6 to 4.7 times higher than in age-matched groups without the disorder [69]. Studies show mortality rate of 5% at six months and 8% at one year following discharge from methadone maintenance therapy (MMT) [70,71].

The model assumes start age of 18 year and was designed in three health states: 1.Healthy [**H**], 2. Untreated SUD [**S**] and 3.Death [**D**]-"absorbing" state. Individuals start in the "healthy" state

and may transition to "Untreated SUDs". Once the disorder develops, some may receive treatment while others remain untreated. Due to the fragile nature of SUDs treatment, recovery [**R**], relapse [**L**], and treatment [**T**], are considered as "intermediate" state. Based on Markov's assumption, an individual can only be in one of these mutually exclusive health states at any given time interval (**Figure 2**).

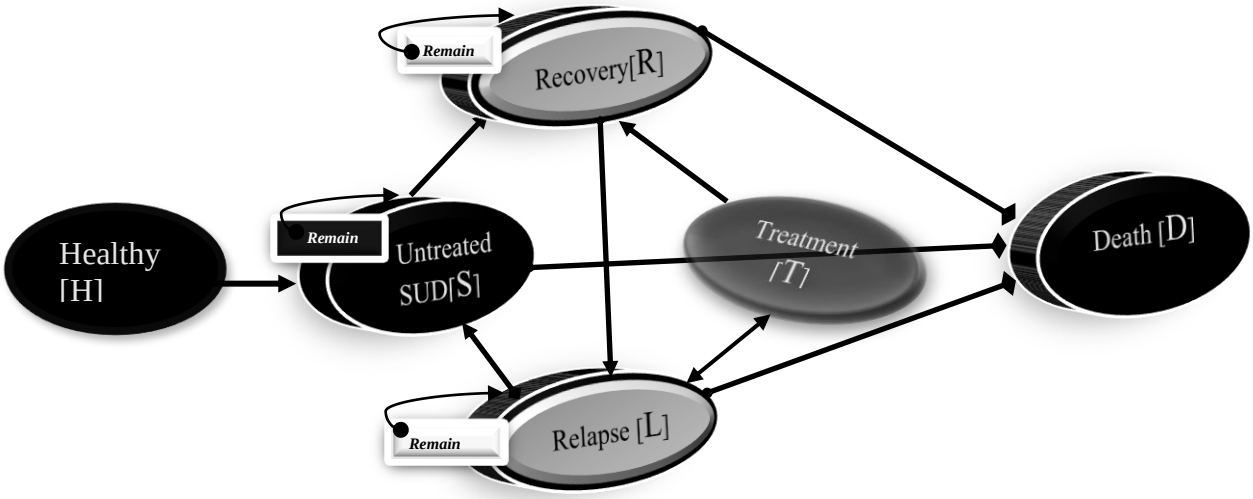

Figure 2: Markov modeling tree state transition diagram

The transition probabilities define the likelihood of transitioning between states within each cycle. The data of transition rates were from literatures, and the following formula was applied to change the transition rate into the transition probabilities.

$$TP = 1 - e^{-\lambda}$$

Where, TP: Transition probability per cycle,
e: The base of natural logarithm and
λ: Transition rate at time t.

Table 2**:** Transition probability values for Markov modeling

From/To	Healthy	SUD	SUD-Tx.	Death-SUD	Death-other	References
Healthy	0.7922	**0.2010**	#	#	**0.0068**	[59,61]
SUD	#	0.9138	**0.0676**	**0.0127**	**0.0059**	[16] [72]
SUD-Tx.	**0.0128**	**0.0014**	0.9799	**~0**	**0.0059**	[64–66] [67]
Death	0	0	0	1		

5. State rewards

Each health state associated with annual state rewards from spending a year in a certain health states. These include the annual societal cost of SUDs treatment and value of effectiveness per DALY averted. Besides, dis-utility from each transition of the disorder is accounted as transition reward per event.

6. Discounting

Both the costs and effects were discounted non-differentially at discount rate of 3% [73].

7. Perspective

The model considered a societal (payer's and providers) perspective to compare the cost and cost-effectiveness of inpatient (ITC) and outpatient (OTC) treatment centers for SUD. For payer's perspective, interviews were conducted to gather information on direct non-medical and indirect (productivity loss) costs, along with data on patient outcomes beyond clinical measures. For provider's perspective, hospital records provided valuable information on direct medical costs and insights into resource utilization such as length of hospital stay/number of visits, procedures conducted, and services utilized during treatment. Patient charts review offered details on clinical outcomes and direct program costs. Financial costs were used to estimate the economic costs as directly estimating economic costs proved challenging. Caregivers were excluded from the study due to potential unreliability of their data.

Table 3: Model input parameter values for the cost-effectiveness analyses

Input probability data	**Base value**	**Range**	Distribution	**Data source**
"Healthy" to "SUDs"	0.2010	0.1608-0.2408	Beta	[59,61]
"SUDs" to "SUDs treatment"	0.0676	0.0541-0.0811	Beta	[16]
"SUDs treatment" to "Recovery"	0.0128	0.0103-0.0152	Beta	[64]
"Recovery" to "Relapse"	0.0014	0.0012-0.0017	Beta	[65] [66] [67]
Mortality from SUDs	0.0127	0.0102-0.0152	Beta	[72]
Disability weight for SUDs	0.3145	0.2516-0.3758	Beta	[74]
SUDs treatment success rate (TSR) at ITC	0.65	0.52-0.78	Beta	Own data
SUDs treatment success rate(TSR)at OTC	0.74	0.59-0.89	Beta	Own data
SUDs treatment costs at ITC (USD)	33626	26901-40351	Gamma	Own data
SUDs treatment costs at OTC (USD)	27036	21629-32444	Gamma	Own data
Discounting for costs and effects	0.03	0.01-0.06	Beta	[73]

8. Measurement of effectiveness

Treatment effectiveness was evaluated in terms of DALY averted. DALY is the sum of years of life lost (YLL) due to premature deaths and years of life with disability (YLD). It stem from two sources. Global burden of diseases study that documented the disability weight for mental,

neurologic, and substance use (MNS) disorder and WHO life tables [58,75]. The disability weight for patients who are healthy or complete their treatment and entering lasting sobriety assumed to be zero as there is no disability in this scenario. To measure the cost-effectiveness of inpatient and outpatient treatment centers for SUD, Incremental Cost Effectiveness Ratio (ICERs) was calculated. The uncertainty in ICER result was assessed and characterized using Willingness-To-Pay (WTP) and Cost Effectiveness Acceptability Curves (CEACs) [52].

DALY= YLD + YLL

Table 4: Inputs for disability adjusted life years (DALYs) for SUDs treatment

Input indicators	Base	Range	Reff.
Disability weight from SUDs	0.3145	[0.2516-0.3758]	[74]
Start Age	≥18years	-	[assumption]
Ethiopian life expectancy, years	68	-	[58]
Discounting rate for cost and effect	0.03	[0.01 – 0.06]	[73]

5.3 Target population

The sample source of this study was a cohort of patients enrolled into SUDs treatment center (Amanuel MSH, St. Paul HMMC, and Zewuditu Memorial Hospital) in 2015 E.F.Y., all of which provided specialized inpatient and outpatient treatment services for SUDs.

5.4 Study population

The study was conducted at Amanuel MSH, St. Paul HMMC, and Zewuditu Memorial Hospital, which provided both outpatient and inpatient treatment for SUDs. A sample of 282 SUDs patients aged 18 and above was selected through simple random sampling from both ITC and OTC. These hospitals were chosen as they were the only public facilities in Addis Ababa specializing in SUDs treatment.

5.4.1 Inclusion-Exclusion criteria

- In this study patients with the following criteria will be included:
  1. SUDs patients treated in the selected hospitals from July 2022 to July 2023 (2015 E.F.Y) with available outcome data records.
  2. SUDs patients aged 18 and above during the start of the treatment
  3. SUDs patients who are consented to participate in the study
- The following patients will be excluded from the study:
  1. SUDs patients who declined to participate in the study.
  2. SUDs patients who haven't indicated clear outcomes.

3. SUDs patients with inconsistent or incomplete recording.
4. SUDs patients aged less than 18 during the start of the treatment.

5.4.2 Sample size estimation

The sample size of the study was determined using the sample size determination formula for comparing two population means. The study in Nigeria showed that, the mean inpatient and outpatient costs for SUDs were USD 359.56 and USD 169.15, respectively [48]. From the same study, the standard deviation [SD] that gives the highest sample size was USD 150. The least mean difference sought to be detected is USD 50 (assumptions from expert opinion). Using 95% of confidence interval (a critical value of $z\alpha/_2$= 1.96) and power of 80% (β = 0.02), Zβ is approximately 0.84 and with desired level of significance, α=0.05 the sample size for each group becomes as follows.

$$n = 2 * (\sigma)^2 * \left({z\alpha}/{2} + Z\beta\right)^2 / (\mu 1 - \mu 2)^2 = 2 * (150)^2 * (2.80)^2 / (50)^2$$

n = 141 for each group

Where; n= Desired sample size per group

$Z\alpha/_2$= the critical value at 95% of confidence level (=1.96)

$Z\beta$= the critical value for the desired power level of 80% (=0.84)

σ= the standard deviation from previous study

$\mu 1 - \mu 2$= the least mean difference expected to be detected between the two means.

The sample size for each group was determined to be 141, resulting in a total of 282 study participants with a one to one (1:1) ratio between the inpatient and outpatient groups. This calculation was adjusted to include a 10% (282*10%=28) non-response rate to account for a potential missing data or recording inconsistencies in patient information. The final sample size was set at 310 and was collected using simple random sampling.

5.4.3 Sampling procedures

Facility level data were obtained from the HMIS report of three hospitals treating SUDs patients between July 2022 and July 2023(Amanuel MSH, 2024; St. Paul's HMMC, 2024; Zewuditu Memorial Hospital, 2024)[76]. These reports provide annual records of patient admissions, treatment types, and outcomes, serving as the basis for defining the study population. The required sample size from each cohort was calculated and a proportional representative sample was selected by simple random sampling, and the results were presented accordingly.

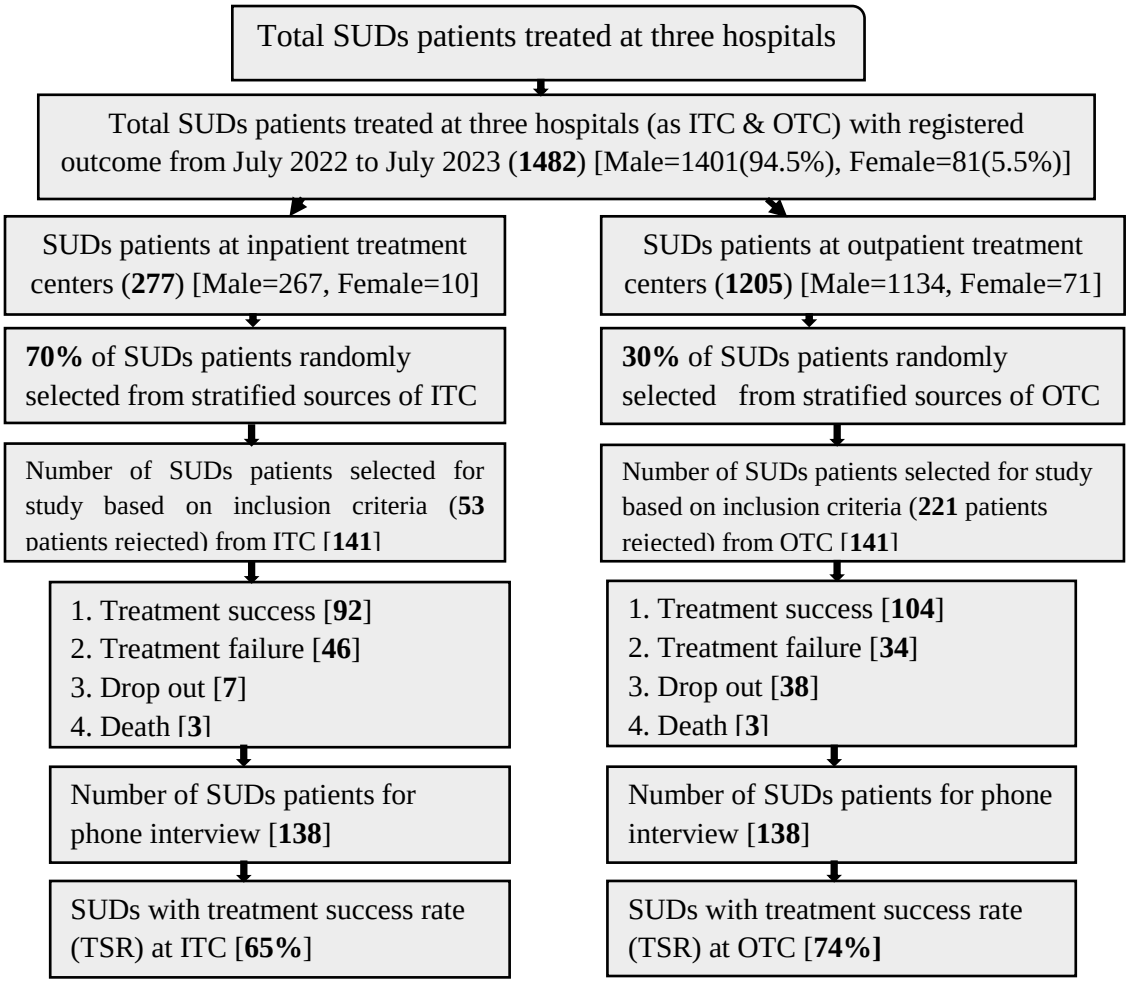

Figure 3: Sampling procedures of cost and cost-effectiveness study: 2024

5.5 Study variables

The study variables included dependent and independent variables. Dependent variable was health outcomes (measured in terms of DALYs). Independent variables included the socio-demographic and clinical profile of the study participants, duration, regimens, and type of

treatment modalities, and healthcare system dynamics for SUDs treatment. Costs were evaluated from societal perspective, using bottom-up ingredient costing method, with assumptions based on average literature values.

5.9 Data analysis plan

All costs were calculated in 2022/23 (2015 E.F.Y) prices and converted to United States Dollars (USD) using an exchange rate (1 USD=53.57 ETB) from the same period, end year of 2022. Data analysis was conducted using Microsoft Excel, with Visual Basic for Applications (VBA) macros used for sensitivity analysis. Socio-demographic and clinical data was analyzed using Stata version.14. The cost effectiveness of inpatient (ITC) and outpatient (OTC) treatment centers for SUD was assessed by computing incremental cost effectiveness ratios (ICERs). The cohort based Markov model employed in the cost effectiveness analysis was from previously published peer-reviewed international journal articles and follows WHO guidelines [53].

5.9.1 Sensitivity Analysis

To assess the robustness of the results both one-way (with tornado diagram) and probabilistic (PSA) sensitivity analysis were conducted. A sensitivity analysis employed in this study would help to determine how variations in key parameters, such as transition probabilities, disability weight, costs, and DALY impact cost-effectiveness analysis under a given set of assumptions.

5.9.2 Monte Carlo simulation

Monte Carlo simulation is the type of statistical analysis in which the probability of various outcomes is calculated iteratively, employing different scenario for each calculation. These calculations were performed via Microsoft Excel as a single operation and offered information on ICER values and the probability of cost effectiveness under different WTP threshold[77].

5.9.3 Average Cost Effectiveness Ratio (ACER)

The average cost-effectiveness ratio (ACER), cost per unit of outcome, is an important summary metric to evaluate cost-effectiveness of an intervention by comparing costs relative to its effectiveness. It provides a ratio for a single intervention to evaluate its cost-effectiveness. In this study, it used to assess the cost-effectiveness of inpatient or outpatient SUDs treatment in terms of total treatment cost (from societal perspective) to its total DALYs averted. These, a lower average cost-effectiveness ratio (ACER) are considered preferable [78].

5.9.4 Incremental Cost-Effectiveness Ratio (ICER)

Incremental cost-effectiveness ratio (ICERs), incremental cost per incremental effectiveness, is a metric used in cost-effectiveness analysis to compare the relative cost-effectiveness of two or more interventions. It used to evaluate an additional cost required for each additional health benefits gained by an intervention compared to an alternative. It is computed as dividing the difference in costs to the difference in health effects of the two interventions [78]. This study will use the WHO-CHOICE cost effectiveness thresholds (CET) approach, which is based on gross domestic product (GDP) per capita. According to this method, interventions that avert one DALY for less than one national average GDP per capita deemed to be very cost-effective. Interventions costing less than three times the average GDP per capita per DALY averted are still considered cost-effective, while those surpassing this threshold are deemed not cost-effective [53].

5.6 Cost data sources and collection procedures

The study's source population consisted of SUDs patients treated from July 2022 to July 2023 (2015 E.F.Y) at Amanuel MSH, St. Paul HMMC, and Zewuditu Memorial Hospital. Data were collected from hospital records, patient charts, and interviews with informed consent, involving healthcare staff such as nurses, pharmacists, laboratory personnel, psychologists, psychiatrists (including addiction specialists if available), and administration staff between February 19, to May 15, 2024.

Table 5: Data sources for costing analysis

Type of data	Sources
1. Building costs (OTC & ITC room, office)	Consulting local architects & quantity surveyors to estimate rental values of similar building in the area per square meter.
2. Drug costs for SUDs treatment	Interview pharmacy case team & central drug stores. Review of records & purchase prices at central drug stores.
3. Direct patient costs	Patient and caregiver phone interviews.
4. Indirect patient costs	Patient and caregiver phone interviews.
5. Personnel costs (salary & incentives)	Interview with hospital heads, review of payrolls; salary scale of personnel & administrative officers.
6.Supply costs (stationary, glove, syringe)	Interview with lab., department heads, & expert opinion. Review of hospital purchase order price & patient card.
7. Equipment costs	Interview with department heads & expert opinion. Review of hospital purchase order price
8. Furniture & capital costs	Review of hospital purchase order price

5.6.1 Cost valuation

Costs were categorized as recurrent and capital. Recurrent costs covered recurrent expenses lasting less than a year; while capital costs lasting over a year, were annuitized based on the useful life years, initial price, and consumer price index (CPI) to account for annual inflation [79]. Direct non-medical costs, including food, transportation, and accommodation, were monetized via patient interviews on round trips and visit frequency.

Indirect costs were estimated using human capital approach (HCA), as it's commonly used in cost effectiveness analysis [80]. Gross wages were used for patients with permanent jobs, while income loss for those without permanent jobs was based on the local daily wage rate for unskilled labor, assuming 26 working days per months (excluding four Sundays).

The cost valuation process involves two steps: first, measuring resources quantities, with their unit prices, then valuing them in Ethiopian Birr (ETB) and converting to United States Dollar (USD) using end 2022 exchange rate. The analysis was performed by using individual patient data, with the following table showing how cost items were valued in this study (**Table 6**).

Table 6: Valuation of costing analysis for SUDs treatment

Data type	**Data sources**
1. Building costs	From expert opinion, 500 ETB *per sqm. per month
2. Personnel costs	Each visit per minute*total minute per patient treated, then changed to ETB based on personnel salary.
3. Supply costs	Unit price * total supply consumed per patient.
4. Equipment costs	Annuitized based on the useful life year
5. Investigation and drug costs	[Unit price* No of Ix done/drug used]*per patient treated
6. Costs from lost productivity	Via Human Capital Approach (HCA)
7. Direct nonmedical costs	Average round cost***** No of visit per patient treated

The supply costs were estimated by multiplying the average unit cost per patient by the total number of patients treated. Equipment costs were calculated using the useful life of the items, using Consumer Price Index (CPI) to account for depreciation and additional usage within the hospital. Depreciation was calculated for the fiscal year, considering the study period [79]. This evaluation was conducted through interviews with appropriate personnel and review logbooks and hospital records. Activities unrelated to SUDs patients were excluded from the study.

5.6.2 Data collection instruments

The intervention time frame for this cost and cost-effectiveness study was from **July 2022 to July 2023 (2015 E.F.Y)**. This period was chosen because it covered a full Ethiopian fiscal year and allowed for reasonable treatment outcomes, as SUD patients require extended duration to fully recover or experience disability or death. Data collection instruments included questioners adapted from comprehensive **Drug Abuse Treatment Cost Analysis Program** (DATCAP)[81].

Part I: Patient information obtained from SUDs treatment charts and phone interviews

A. Socio-demographic data

B. Clinical record and histories given by the study participants

Part II: Information collected from patient charts and phone interviews

A. Direct nonmedical costs

B. Indirect costs (opportunity costs)

C. Direct costs (investigation, consultation, drug costs, nursing care and physician visits)

Part III: Health care provider's cost

A. Interviewing service provider's

1. Building costs
2. Personnel's costs

B. Medical equipment and supplies costs for the provision of SUDs treatment

5.6.3 Validation of research instruments

To maintain the quality of data, data collection tools were adopted from costing guideline aligned with the study's objectives. The principal investigator submitted a draft to the advisor and colleagues for feedback and incorporating their comments into the final version. Input from psychiatrists and other health professionals treating SUDs patients were also sought, and their suggestions were included to refine the instrument, enhancing its ability to measure the study domain and ensure validity. The questioner was validated through a pilot study involving 9% of the sampled population (310*9%=28). These 28 participants were excluded from the final study, resulting in a total of 282 study participants included in the analysis.

5.7 Operational definitions for substance use disorders

1. Substance Use Disorders (SUDs): an entity that comprises both "Substance dependence" and "Harmful pattern of substance use". (ICD-11)

2. Alcohol Use Disorders (AUDs): Alcohol only &/or alcohol with any other substance(s).

3. Drug Use Disorders (DUDs): Multiple drug use excluding alcohol and tobacco.

4. Other SUDs: Tobacco only &/or tobacco in combination with other substance(s).

5. Remission: A period of at least 12 months without meeting the criteria for SUDs**.**

5.1 Partial Remission: Some, but not all, criteria for the disorder are currently met.

5.2 Full Remission: No criteria for the SUDs are currently met.

5.2.1 Early Full Remission: No criteria for the SUDs are currently met for 3 to12 months.

5.2.2 Sustained Full Remission: No criteria for the SUDs are met for 12 months or longer.

6. Abstinence: Complete cessation of substance use.

7. Recovery: Voluntarily and self-directed sustained control of substances use with symptom free and prioritizing health and wellbeing for a year.

8. Relapse: The recurrence of SUDs criteria after a period of remission.

9. Drop out: A patient who interrupted the treatment before the intended therapeutic goals or the prescheduled time**.**

10. Readmission: A return of an individual to an inpatient treatment center after a prior discharge.

11. Treatment success rate: Defined as a rate of abstinence and remission.

12. **Death:** Death occurring from any causes during SUDs treatment

5.8 Data quality assurance and management plan

The validity and reliability of instruments pertain to the quality of data and the appropriateness of methods used in the research. These, the English version questioner adopted from DATCAP [81] were translated into Amharic by experts to be used in this study. Training was given to supervisors and data collectors to ensure the collection of high quality desired data. Pretesting was carried out on the tools to look for any editable content. The whole research process was supervised by the principal investigator.

5.10 Ethical consideration

The research proposal was submitted to the Research Ethical Committee of school of public health, Addis Ababa University for approval and ethical clearance. An official approval letter was requested from the school of public health to SUDs treatment hospitals explaining the study's objective and significance. Ethical clearance was then obtained from St. Paul HMMC, St. Amanuel MSH and, Addis Ababa Public Health and Emergency Management Directorate to forward the request to the concerned departments and facilitate data collection.

5.11 Dissemination of results

Upon completing the study, the finding were presented and submitted to the School of Public Health, College of Health Sciences at Addis Ababa University. The results were shared with St. Paul HMMC, Amanuel MSH, and the Addis Ababa Public Health and Emergency Management Directorate (Zewuditu Memorial Hospital) through both soft and hard copies.

Chapter VI: Results

6.1 Socio-demographic characteristics of study participants

Among a total of 282 study participants, the majority 271(96.1%) were males and 11(3.9%) were females. Regarding the age distribution, the median age was 33 years with range of 18 to 64 years, with 165 (58.51%) in the age group of 18–34 years. The majority were single (193[68.44%]), followed by married (51[18.09%]), and divorced (38[13.48%]). Most of the participants, 231(81.91%) were attended secondary education and higher. Regarding the occupation, unemployed (139 [49.29%]) and employed (113 [40.07%]) were the most recorded amongst the participants, and most 212 (75.18%) living with family and 203 (71.99%) were from study area (**Table 7**).

Table 7: Socio-demographic characteristics of the study participants N (%) 2015 E.F.Y

Demographic Variables	Descriptions	Treatment Category		Totals
		ITC	OTC	
Sex	Male	137(97.16)	134(95.04)	271(96.1)
	Female	4(2.84)	7(4.96)	11(3.90)
Age Category (Years)	18-24	16(11.35)	29(20.57)	45(15.96)
	25-34	63(44.68)	57(40.43)	120(42.55)
	35-44	34(24.11)	40(28.37)	74(26.24)
	45-54	20(14.18)	13(9.22)	33(11.70)
	55-64	8(5.67)	2(1.42)	10(3.55)
	65+	0(0.00)	0(0.00)	0(0.00)
Marital Status	Single	93 (65.96)	100(70.92)	193 (68.44)
	Married	25 (17.73)	26(18.44)	51 (18.09)
	Divorced	23 (16.31)	15 (10.64)	38 (13.48)
Educational Level	No Formal Education	1 (0.71)	0 (0.00)	1 (0.35)
	Primary Education	28 (19.86)	22 (15.60)	50(17.73)
	Secondary Education	50 (35.46)	65 (46.10)	115 (40.78)
	Above College/University	63 (43.97)	54 (38.30)	116 (41.13)
Occupational Status	Student	9 (6.38)	17 (12.06)	26 (9.22)
	Unemployed	72 (51.06)	67 (47.52)	139 (49.29)
	Employed	58(41.13)	55 (39.01)	113 (40.07)
	Retired	2 (1.42)	2 (1.42)	4 (1.42)
Living Arrangement	With family	99 (70.21)	113 (80.14)	212 (75.18)
	Alone	35 (24.82)	22 (15.60)	57 (20.21)
	Unspecified	7 (4.96)	6 (4.26)	13 (4.61)
Residence	Addis Ababa	90 (63.83)	113 (80.14)	203 (71.99)
	Outside Addis Ababa	51 (36.17)	28 (19.86)	79 (28.01)
Total		141(100%)	141(100%)	282(100%)

6.2 Clinical characteristics of the study participants

Among the participants, 218(77.30%) had alcohol use disorder (AUD), 26(9.22%) drug use disorder (DUD), and 38(13.48%) other SUDs (e.g., tobacco). Substance use duration was <10 years for 130 (46.10%), 10-19 years for 102 (36.17%), and >20 years for 50 (17.73%).

Table 8: Clinical characteristics of study participants N (%) 2015 E.F.Y

Clinical Variables	Descriptions	Treatment Category		Totals
		ITC	OTC	
Type of Substance(s) Use Disorder	AUD	118(83.69)	100(70.92)	218(77.30)
	DUD	10(7.09)	16(11.35)	26(9.22)
	Other SUDs	13(9.22)	25(17.73)	38(13.48)
Duration of Substance use (years)	< 10	61(43.26)	69(48.94)	130(46.10)
	10 – 19	47(33.33)	55(39.01)	102(36.17)
	20+	33(23.40)	17(12.06)	50(17.73)
Psychiatric Co-morbidity	Yes	87(61.70)	90(63.83)	177(62.77)
	No	54(38.30)	51(36.17)	105(37.23)
Type of Psychiatric Co-morbidity	Psychotic disorder (schizophrenia + SIP)	58(66.67)	65(72.22)	123(69.49)
	Mood disorder(depression+ bipolar)	15(17.24)	13(14.44)	28(15.82)
	Anxiety disorder	7(8.05)	3(3.33)	10(5.65)
	Mood & Psychotic disorder	3(3.45)	6(6.67)	9(5.08)
	Epilepsy	0(0.00)	3(3.33)	3(1.69)
	Personality disorder	1(1.15)	0(0.00)	1(0.56)
	Epilepsy& Psychotic disorder	1(1.15)	0(0.00)	1(0.56)
	Mood & Anxiety disorder	1(1.15)	0(0.00)	1(0.56)
	Gambling disorder	1(1.15)	0(0.00)	1(0.56)
Previous SUDs treatment	Yes	54(38.30)	67(47.52)	121(42.91)
	No	87(61.70)	74(52.48)	161(57.09)
Category	New	87(61.70)	74(52.48)	161(57.09)
	Relapse	44(31.21)	57(40.43)	101(35.82)
	After drop out	10(7.09)	10(7.09)	20(7.09)
Type of treatment	PST and PCT	141(100)	92(65.25)	233(82.62)
	PST only	0(0.00)	49(34.75)	49(17.38)
Duration [No visits] (days)	**<=14**[<=3]	40(28.37)	93(65.96)	133(47.17)
	15-28[4-5]	30(21.28)	28(19.86)	58(20.57)
	>28 [>5]	71(50.35)	20(14.18)	91(32.26)
Discharge status	Treatment completed	134(95.04)	103(73.05)	237(84.04)
	Dropout	7(4.96)	38(26.95)	45(15.96)
Treatment Outcome	Abstinence	22(15.60)	22(15.60)	44(15.60)
	Remission	77(49.65)	82(58.16)	152(53.90)
	Relapse	46(32.62)	34(24.11)	80(28.37)
	Died	3(2.13)	3(2.13)	6(2.13)
Total		141(100)	141(100)	282(100)

PST= Psychosocial therapy **PCT=** Pharmacotherapy

Psychiatric co-morbidities were present in 177 (62.77%), mainly psychotic 123 (69.49%) and mood disorders 28 (15.82%). A previous SUDs treatment history was reported by 121 (42.91%).

Of those treated, 196(69.5%) achieved treatment success, with higher rate at OTC (104[74%]) than ITC (92[65%]), indicating better treatment success rate (TSR) at OTC than ITC.

6.3 Substance use disorders (SUDs) treatment costs

6.3.1 Healthcare payer's costs for SUDs treatment

From healthcare payer's perspective, the cost of SUDs treatment includes direct medical, non-medical costs, and indirect costs due to lost productivity. Direct medical costs include services like laboratory expenses, pharmacotherapy, psychotherapy, and hospitalization. SUDs treatment utilized various medications classes, such as antipsychotics, antidepressants, anticonvulsants, mood stabilizers, and analgesics. The mean direct medical costs were USD 4309.63 at Inpatient Treatment Centers (ITC) and USD 271.33 at Outpatient Treatment Centers (OTC). The primary contributor to direct medical costs at ITC was hospitalization, totaling USD 3486.69, which includes expenses for accommodation, meals, nursing care, physician visits, and other procedures. For OTC, pharmacotherapy was the largest expenses, at USD 105.93. Psychotherapy was the lowest cost component for both ITC and OTC, at USD 269.69 and USD 33.78, respectively (**Table 9**).

Table 9: SUDs treatment costs from healthcare payer's perspective (2022 USD)

Cost variables	Descriptions	Treatment Category	
		ITC	OTC
Direct Medical Costs (USD)	Laboratory costs	286.77	64.42
	Pharmacotherapy costs	274.71	105.93
	Psychotherapy costs	269.69	33.78
	Hospitalization costs	3486.69	67.20
	Sub totals (USD)	**4309.63**	**271.33**
Direct Non-Medical Costs (USD)	Transportation costs	-	82.65
	Meal costs	-	188.85
	Accommodation costs	-	19.20
	Miscellaneous costs	1378.68	41.69
	Sub totals (USD)	**1378.68**	**332.38**
Indirect Costs (USD) (Productivity loss)	Hospital visits	337.51	11.93
	Premature death	5830.70	25348.63
	Sub totals (USD)	**6168.21**	**25360.56**
	Grand totals (USD)	**11856.53**	**25964.27**

The mean direct non-medical costs for SUDs treatment at ITC were USD 1378.68, while costs at OTC averaged USD 332.38. The direct non-medical costs at ITC were grouped as 'Miscellaneous' due to the lack of separate data for transportation, meal, and accommodation, making disaggregation challenging. Costs at OTC were mainly driven by food expenses (USD 188.85) and transportation

(USD 82.65). Accommodation costs at OTC contributed the least to direct non-medical expenses, at USD 19.20. In terms of indirect costs, productivity time loss due to illness related hospital visits or premature death, were also significant. The mean [SD] time lost due to hospitalization at ITC was 35.65[24.72] days, whereas hospital visit to access treatment at OTC resulted in an average [SD] time loss of 3.17[2.20] days. The mean indirect costs were USD 6168.21 at ITC**,** and USD 25360.56 at OTC. Premature death contributed the most to indirect costs, with USD 5830.70 at ITC and USD 25348.63 at OTC. Therefore, from payer's perspective, the total cost of treating SUDs was USD 11856.53 at ITC compared to USD 25964.27 at OTC, making treatment at ITC roughly half the cost of treatment at OTC.

6.3.2 Healthcare provider's costs for the treatment of SUDs

From healthcare provider's perspective, the costs of treating SUDs are divided into capital and recurrent costs. The total capital costs, which include building and equipment expenses, were USD 5125.46 at ITC and USD 231.39 at OTC. The main cost driver for both was building expenses, which amounted to USD 3340.12 at ITC and USD 156.94 at OTC. For recurrent costs, which cover personnel's and supplies, the total costs were USD 16643.78 at ITC and USD 840.64 at OTC. Personnel's costs were the largest contributor for recurrent costs, totaling USD 14803.91 at ITC and USD 720.80 at OTC. Thus, from provider's perspective, the mean life time cost of treating SUDs was USD 21769.24 at ITC compared to USD 1072.03 at OTC, making treatment at ITC approximately 20 times more expensive than at OTC.

Table 10: SUDs treatment costs from healthcare provider's perspective (2022 USD)

Cost variables		**Treatment Category**	
		ITC	OTC
Capital costs (USD)			
Building costs		3340.12	156.94
Equipment costs		1785.34	74.45
	Sub totals (USD)	**5125.46**	**231.39**
Recurrent costs (USD)			
Personnel's costs		14803.91	720.80
Supplies costs		1839.87	119.84
	Sub totals (USD)	**16643.78**	**840.64**
	Grand totals (USD)	**21769.24**	**1072.03**

An independent t-test was conducted, since the assumptions of normality was tested and met (F-test two sample for variances, P>0.05) the independent t-test deemed appropriate, to compare the treatment costs of ITC and OTC. The results showed that the mean costs for ITC were USD

33678.84 (SD=1045.99), while the mean costs for OTC were USD 27103.91(SD=1062.03). The 95% confidence interval for cost difference was estimated to be [USD 6326.34, USD 6823.52]. The result indicates that ITC costs were significantly higher than OTC costs from the societal perspective, with the true difference in costs likely falling within this range. The statistically significance of this difference is supported by the t-test result (t (118) =1.96, p<0.0001).

6.4 Cost Effectiveness Ratio (ACER & ICER) of SUD treatment at ITC and OTC

The average cost-effectiveness ratio (ACER) of SUD treatment at ITC would require USD 102 per DALY averted, while at OTC USD 82 per DALY averted would be needed. The lower the value of the ACER, the more cost-effective is the intervention(78). In this regard, OTC intervention was a preferred option. Furthermore, the ITC has incremental cost-effectiveness ratio (ICER) of USD 3710 per DALY averted compared to OTC intervention as shown on table 11, which is above the threshold of one and three times the average national GDP per capita of Ethiopia, using WHO-CHOICE approach (53). This implies SUD treatment at ITC is not cost-effective approach, with more cost and insignificant difference in DALYs, compared to OTC intervention (**Table 11)**.

Table 11: Cost-effectiveness ratios per DALY averted all referencing common baseline value

Treatment type	**Cost** (USD)	**Incremental costs**(USD)	**Effectiveness** [DALY]	**Incremental Eff.** [DALY]	**ACER** [USD/DALY]	**ICER** [USD/DALY]
OTC	27036	-	330.88	-	**82**	-
ITC	33626	**6589**	329.11	**1.78**	**102**	**3710**

6.5 Sensitivity Analysis

The cost-effectiveness analysis is challenged with input uncertainty, like transition probability values, costs and disability weight for DALY estimation and the calculation of ICER. Sensitivity analysis both one way (tornado diagram) and probabilistic (PSA) sensitivity analysis were employed to measure and manage the uncertainty so that to ensure the robustness of the results. A sensitivity analysis conducted in this study evaluates how variations in the independent variable affect the cost-effectiveness analysis under a defined set of assumptions. Input data for one way (tornado) and probabilistic (PSA) sensitivity analysis was based on Table 3 and for

distribution of standard deviation ±20% was assumed from the mean value[82]. All the transition probability and disability weight values for SUDs were from literature reviewed for this study.

6.5.1 One Way (tornado diagram) Sensitivity Analysis

The tornado diagram presents the results of multiple one way sensitivity analysis as it shows the effect of change in a single parameter to the results while keeping other parameters constant. Its conical structure, sorted from highest to lowest impact on ICER value, create a chart resembling a tornado cone. The input parameter lists on tornado diagram are very important to show the effect in the one way sensitivity analysis that model parameters were found to be cost effective on the ICER at base case value of ITC compared to OTC. The ICER represents how much SUD treatment at ITC would cost patients to avert one DALY, over the effect at OTC.

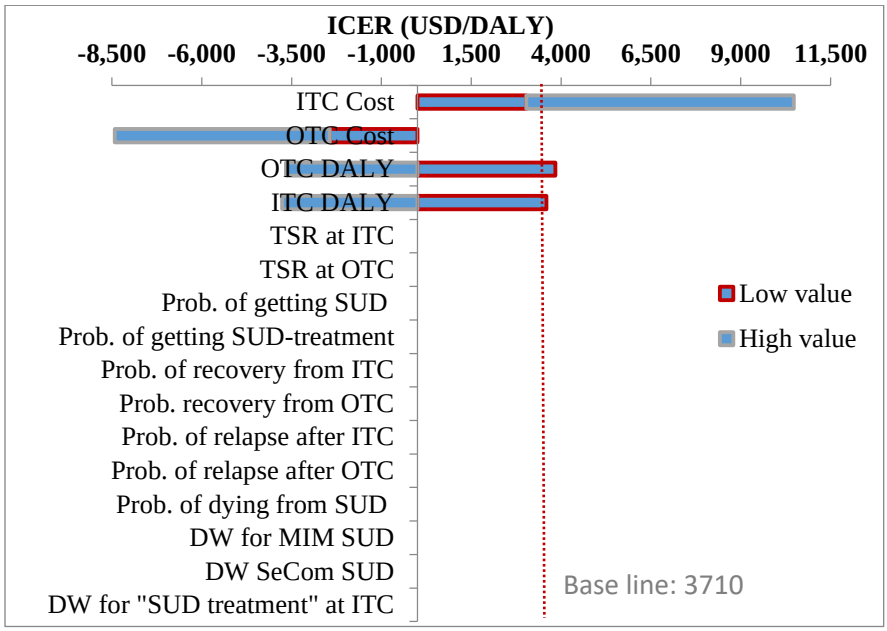

Figure 4: Tornado Diagram for ICER Sensitivity Analysis

The tornado diagram identified the four most influential input parameters impacting ICER value: ITC cost, OTC cost, ITC DALY, and OTC DALY. The ICER is highly sensitive to variations in these key cost and outcome parameters. For instances, increases in ITC cost or decreases in ITC DALYs averted worsen cost-effectiveness, while reductions in OTC cost or increases in OTC DALYs improve it. This emphasizes that cost and health outcome variations in both treatment settings are critical determinants of cost-effectiveness, making them priority areas for policy intervention and resource allocation.

On the other hand, the tornado diagram shows that ICER is less sensitive to variations in other parameters that contribute to overall model uncertainty but their impact on ICER is relatively minor compared to the key cost and outcome variables. This suggested that cost-effectiveness decisions are mainly driven by the treatment costs and effectiveness in reducing DALYs. Consequently, policy efforts should prioritize optimizing treatment costs and improving health outcomes (DALY averted) to improve the cost-effectiveness of SUD treatment in resource-limited settings like Ethiopia.

The one way sensitivity analysis result in Figure 5 indicates that for SUD treatment at ITC to remain cost-effective, its cost must be below USD 33500 and USD 35500 when WTP threshold set at one and three times the GDP per capita per DALY averted, respectively.

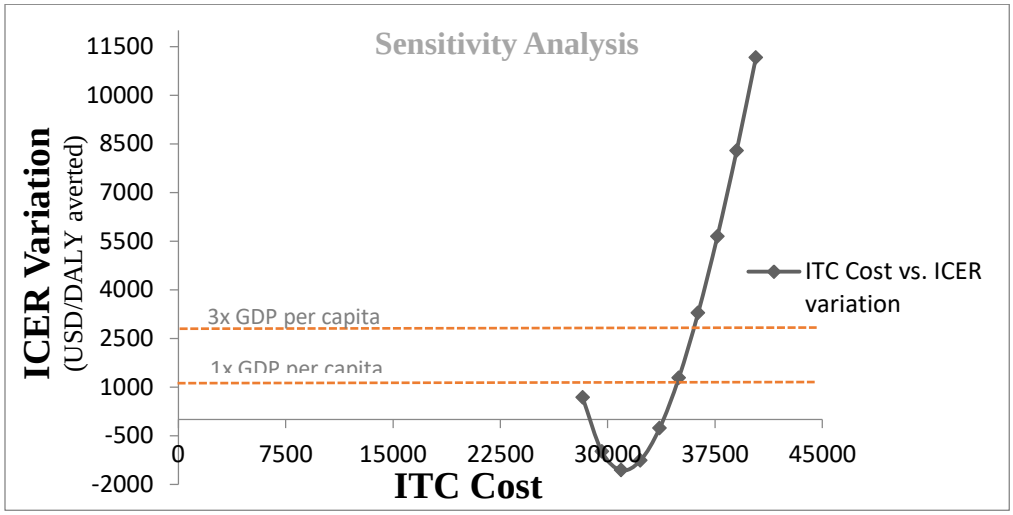

Figure 5: Level of SUD treatment cost at ITC to be cost-effective compared to OTC

6.5.2 Probabilistic Sensitivity Analysis (PSA)

The probabilistic sensitivity analysis (PSA) was performed using a Monte Carlo simulation (of 1000 iterations) to assess the uncertainty in ICER values between inpatient (ITC) and outpatient (OTC) treatment centers for SUDs. The PSA accounted for variations in key parameters, including treatment costs and DALYs, and provided a more robust understanding of the potentials range of cost-effectiveness estimates for each treatment estimates.

The results showed that ITC incurred higher mean costs but yielded slightly lower DALYs compared to OTC. The mean cost of ITC was found to be USD 33626 per patient, whereas OTC had a significantly lower mean cost of USD 27036 per patient. Despite this cost difference, ITC

yielded only a marginal reduction in DALYs, with an average of 329.11 DALYs per patient compared to 330.88 DALYs per patient for OTC. These findings highlight that while ITC is more resource-intensive, it may not always translate into significantly better health outcomes. Given the financial constraints in low resource settings like Ethiopia, assessing cost-effectiveness beyond absolute health gains is essential in determining the most viable treatment approach.

To assess the cost-effectiveness of ITC versus OTC, ICER was calculated. The result showed that ITC had an ICER of USD 3710 per DALY averted, which exceed one to three times GDP per capita of Ethiopia and it is deemed less cost-effective than OTC, making it a financially challenging option in Ethiopia's resource-limited healthcare system.

6.5.2.1 Incremental Cost-effectiveness Ratio (ICER) Scatter Plot

The scatter plot on Figure 6 illustrates the ICER of ITC versus OTC of SUD treatment. The ICER values predominantly fall within Quadrants **I** and **VI.** In Quadrant **I**, ITC averts more DALY but at forgone higher cost, making its costs-effectiveness uncertain and dependent on comparison with the national GDP per capita. However, the remaining ICER values concentrated on quadrant **IV,** where ITC is both costlier and less effective than OTC. This indicates that ITC is dominated by OTC, making it undesirable option for SUD treatment and one that policy makers should reject. In conclusion, the ICER scatter plot distribution across quadrant **I** and **VI** reflects the cost and effectiveness trade-off in SUD treatment. While ITC offers better health outcomes, its higher cost limits its feasibility in low resource settings like Ethiopia, requiring careful evaluation of funding strategies and treatment prioritization.

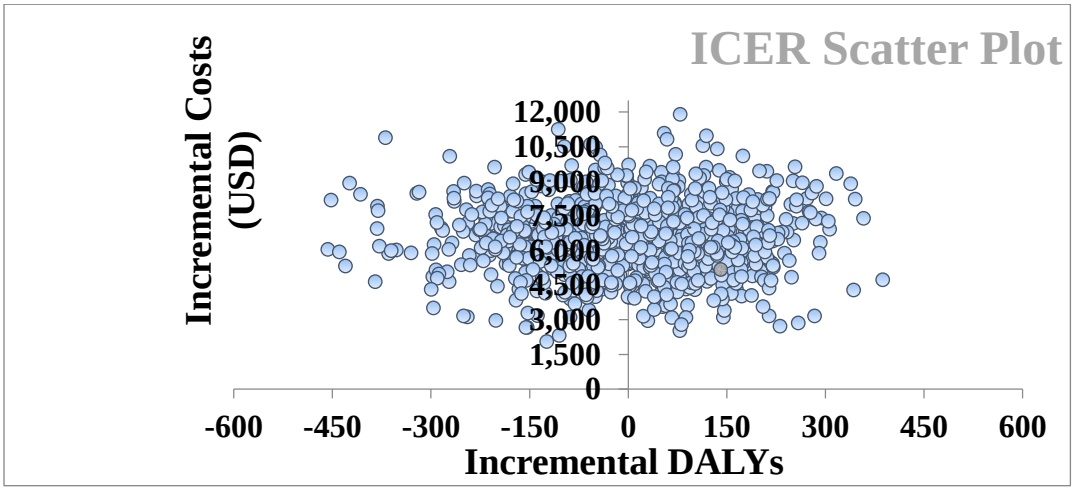

Figure 6: ICER scatter plot of ITC vs. OTC (of 1000) Monte Carlo simulations

6.5.2.2 Cost-Effectiveness Acceptability Curves (CEACs)

The ICER was analyzed across various willingness-to-pay (WTP) thresholds to determine the likelihood of each treatment being cost-effective. The Cost-Effectiveness Acceptability Curves (CEACs) on Figure 7 showed the range of cost-effectiveness threshold (WTP per DALY averted). As it's shown by the graph below, OTC was more likely to be cost-effective at lower WTP thresholds. However, as the threshold increased, ITC became a more favorable option.

The CEACs indicate that at a WTP threshold below one times GDP per capita per DALY averted, OTC was cost-effective in 55-100% of simulations, while ITC was cost-effective in only 45%. This suggests that OTC is the more viable option in Ethiopia's current economic conditions. However, as the WTP threshold increased to one to three times GDP per capita, ITC's cost-effectiveness probability matched OTC at 47%, making it a favorable option in higher-resource settings or for severe SUDs patients requiring intensive care. Thus, the finding supports a policy recommendation prioritizing OTC while reserving ITC for complex cases where OTC may be ineffective.

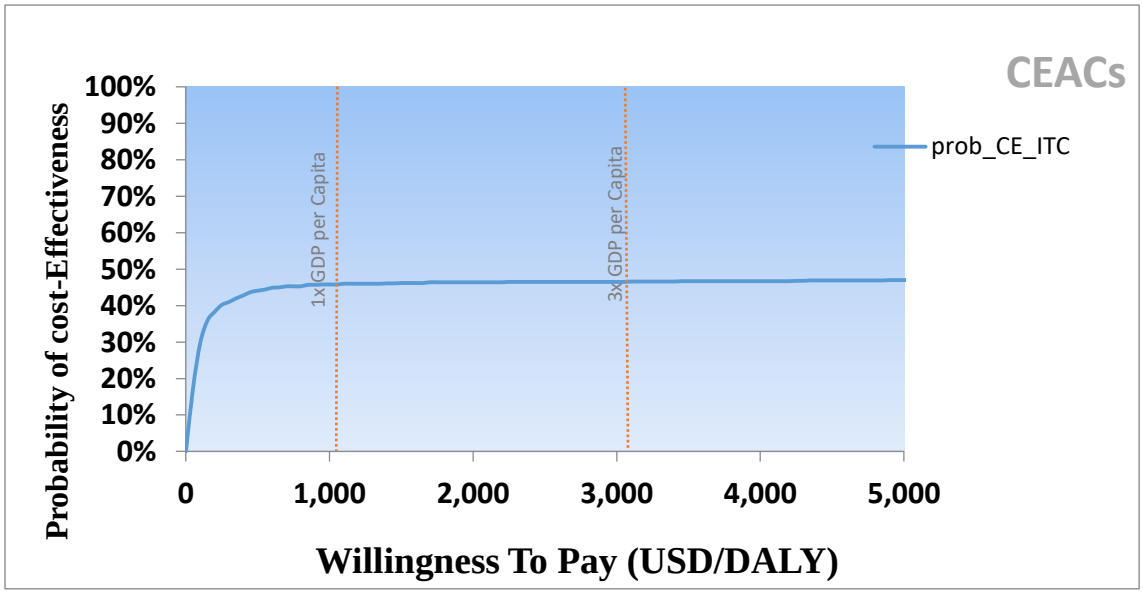

Figure 7*:* Cost-effectiveness acceptability curve of ITC compared to OTC for SUD treatment. The dashed line indicates WTP at one times (USD 1027) and at three times (USD 3081) GDP per capita of Ethiopia for 2022.

Chapter VII: Discussion

The estimated cost of SUD treatment was USD 33,626 for ITC and USD 27,036 for OTC. The ACER indicates that USD 102 per DALY averted is required for ITC, while only USD 82 per DALY averted is needed for OTC. As a result, OTC is deemed the preferred option. The study further revealed that the provision of SUDs treatment at ITC was not a cost-effective intervention, with an ICER of USD 3710 per DALY averted-which surpass the cost-effectiveness threshold of one to three times the average GDP per capita of Ethiopia. In contrast, the study identified SUD treatment at OTC as a cost-effective alternative.

The gender distribution in this study, 271(96.1%) were males and 11(3.9%) were females, closely reflects the facility level data of 1401(94.5%) males and 81(5.5%) females from 1482 SUD patients treated during the study period [76]. This aligns with national reports indicating that SUDs disproportionately affect males [7], who are also more likely to seek treatment. The 1.6% point difference suggests minimal deviation, and a Chi-square test (χ^2 =1.174, p =0.279) confirmed no significant difference (p >0.05) between the study sample and facility level data. While females appear slightly underrepresented, this likely represented real-world trends rather than sampling bias.

The study found that 239 (84.75%) of participants were aged 18 to 44, showing the significant impact of SUDs on the youth and economically productive population. Moreover, 139 (49.29%) were unemployed, aligning with previous studies that identify SUDs as a major public health threat, especially among working-age males [7]. Psychiatric co-morbidity was present in 177 (62.77%) of participants, making treatment more complex and costly, especially in LMICs like Ethiopia. This cost was due to both direct medical expenses and indirect costs from lost productivity and frequent hospital visits. Additionally, 79 (28.01%) of participants were traveled from outside the study area for specialized SUD treatment, increasing financial burdens for both patients and healthcare providers. To address these challenges, WHO advocates for integrating mental, neurologic, and substance use (MNS) disorder treatment into primary health care to improve accessibility and reduce costs [42].

The study found that the total costs from the payer's side for SUDs treatment at ITC (USD 11856.53) were approximately half of those at OTC (USD 25964.27). This was mainly related to the significant indirect cost (USD 25360.56) incurred due to SUD related premature deaths among patient groups at OTC. This implied that in the long term ITC was effective in decreasing indirect costs compared to OTC. Moreover, the cost of SUDs treatment at ITC highlighted the distribution of direct medical, non-medical and indirect costs. While ITC involved significant direct costs (USD 4309.63), the societal burden of indirect costs (USD 6168.21), particularly from premature deaths (USD 5830.70), remained a critical concern. These finding suggested that the importance of investing in effective treatment strategies to minimize the long term indirect costs related to SUDs, thereby alleviating the financial and societal burden of SUDs.

The treatment costs of SUDs from the payer's perspective varied based on the country's economic status and the type of treatment model implemented. Compared to previous studies, the patient costs of SUDs treatment at ITC were lower than those reported in the U.S. but higher than those in Kenya and Nigeria [48,54,55]. These differences could be attributed to variations in treatment models, differences in the currency year of exchange rate at the time of the studies, and disparities in cost components. For instance, some countries like Nigeria did not include patient's indirect costs in their analyses. Moreover, the U.S. study incorporated crime-related costs as part of the indirect costs, further complicating direct comparisons. This highlights the need for standardized cost evaluations across different settings to better inform health policy and resource allocation for SUDs treatment.

The study also indicate that the total costs from the providers' perspective for SUDs treatment at ITC (USD 21769.24) were about twenty times higher than at OTC (USD 1072.03). This finding highlighted the resource-intensive nature of SUDs treatment at ITC, reflecting its reliance on greater infrastructure, expensive and specialized equipment, large amounts of medical supplies, and larger work force investments to provide comprehensive care for SUDs patients. The high costs underscored the complexity and scale of treatment at ITC, which required a well-equipped facility and skilled staff. While these costs were considerable, they were important for ensuring effective, high quality SUDs treatment, which is essential to address the complex needs of SUDs patients, especially those associated with psychiatric co-morbidity. The total treatment cost of

SUDs at ITC from the providers' perspective is higher than the treatment costs of Multi drug resistance tuberculosis (MDR-TB) in Ethiopia, which stands at USD 8,550.86 [83].

Compared to ITC, the cost of OTC (USD 25964.27) for SUDs treatment from payer's side were approximately twofold. The difference was mainly driven by the indirect costs (USD 25360.56), which were largely driven by premature deaths (USD 25348.63), with a very small contribution from lost productivity due to hospital visits. These finding revealed the long term economic burden of managing severe SUDs with psychiatric-comorbidities at OTC. Despite the lower direct costs associated with OTC, the high indirect costs highlighted the importance of early intervention to prevent premature mortality and reduce the broader societal impact of untreated SUDs.

This finding highlights that while early-stage treatment at OTC appears more affordable in the short-term, its long-term cost-effectiveness is questionable without proper preventive strategies and adequate follow-up care. The total cost of SUDs treatment at OTC from payer's perspective (USD 25964.27) is considerably higher compared to previous studies in Nigeria[48]. However, the discrepancy may be due to differences in cost components, as the Nigerian study did not account for direct non-medical and indirect costs.

The lower provider cost of OTC (Capital [USD 231.39] and Variable [USD 840.64]) reflected its modest infrastructure, minimal staffing, and minimal equipment and supply requirements, making it a less resource-intensive alternative to ITC. This affordability supports its scalability in resource-limited settings like Ethiopia. However, the lower costs also indicate the more basic care model for mild SUDs cases, with limited suitability for complex cases. Compared to other studies, the total cost at OTC (USD 1072.03) is significantly lower than in Thailand (USD 5263.94 to 59759.48) [46]. Furthermore, it is also lower than the treatment costs of MDR TB in Ethiopia, which amounts to USD 5266.06 [83]. These findings support OTC as a cost-effective and scalable solution in constrained health systems, aligning with WHO recommendations favoring community-based treatment for broader population coverage at lower cost.

This study conducts full economic evaluation using Markov model to compare the cost-effectiveness of Inpatient (ITC) versus Outpatient (OTC) Treatment Centers in Addis Ababa, Ethiopia. The study demonstrated that SUDs treatment at ITC was not cost-effective intervention

compared to SUDs treatment at OTC, with an ICER of USD 3710 per DALY averted. This value is above one to three times GDP per capita of Ethiopia, not meeting the WHO-CHOICE WTP cost-effectiveness thresholds for LMICs. The ICER in this study was closest to USD 3785.8 reported in Kenya but lower than USD 23600 per abstinent case and USD 11800 per case of reduced substance use in the U.S. [54,55].

The relatively higher ICER in this study may be attributed to the high patient's costs, such as direct medical and non-medical costs coupled with provider's costs from infrastructure, personnel, medical equipment and supply costs of SUDs treatment at ITC. Moreover, the high relapse rate, significant co-morbidities, and prolonged treatment duration without substantial improvement in outcomes may have contributed to the higher costs observed at ITC. Additionally, the differences in currency exchange rate and variations in costing structure across countries could further explain the cost discrepancies compared to the previous studies.

The ICER reported in this study was considerably higher compared to those of other public health interventions in Ethiopia, such as MDR TB treatment and malaria prevention programs, which have ICERs of USD 1641 and USD 1403, respectively [84,85]. The elevated ICER value for SUDs treatment is may be due to the chronic and relapsing nature of these disorders, which often required prolonged and multiple treatment episodes involving costly pharmacotherapy drugs to achieve lasting sobriety. Additionally, the substantial indirect costs associated with lost productivity due to premature deaths and the high SUDs treatment costs from provider's side further contribute to the higher ICER.

The cost-effectiveness analysis found OTC to be the more cost-effective option for SUDs treatment at WTP threshold below one times Ethiopia's GDP per capita. However, as the WTP threshold increased to one to three times GDP per capita, the cost-effectiveness likelihood of OTC and ITC became nearly equivalent, suggesting that ITC may be a favorable option in higher-resource settings or for severe SUDs patients. This findings aligns with previous studies supporting OTC as a cost-effective approach [86]. Despite ITC's higher costs, its lower effectiveness may be attributed to the lack of an aftercare programs for discharged SUDs patients. Research highlights that well-designed and quality aftercare programs play a crucial role in improving long-term treatment outcomes of SUDs patients [24].

Chapter VIII: Limitations and Strengths

This study employed a full economic evaluation using a Markov model to compare the cost-effectiveness of SUD treatment at inpatient (ITC) and outpatient (OTC) centers. The study has the following strength: to the best of our knowledge; the study is the first of its kind in Ethiopia to assess the cost-effectiveness of SUD treatment strategies, adopts a holistic approach by analyzing costs from a societal perspective, we utilized a Markov modeling techniques to capture lifetime costs and effects, and incorporated primary local cost data into the model parameters to ensure contextual relevance, and demonstrates its robustness through sensitivity analysis.

Despite these strengths, the findings of this study should be interpreted carefully because of several limitations. First, its retrospective cohort design introduced potential recall and information bias, given reliance on existing records and participant recollections. Second, key cost components, such as caregiver expenses and patient costs incurred before and after treatment, were not included, possibly underestimating the total economic burden. Third, data on the effectiveness of SUD treatment and health state transition probabilities are not available in Ethiopia. We used data from similar contexts in other countries, which may have affected the accuracy of the ICER. Fourth, the model did not distinguish between different types of substances or co-occurring psychiatric conditions, both of which may significantly affect treatment outcomes and cost. Last, the comparison of findings with high-income countries like United States, may limit the generalizability of findings to low-income settings, making SUD treatment outcomes highly context-dependent.

Chapter IX: Conclusions and Recommendations

9.1 Conclusions

Substance use disorder significantly affecting the youth and productive-age group of the population, with 84.75% of study participants aged between 18 and 44 years. 139 (49.29%) of the participants were unemployed. Substance use duration was <10 years for 130(46.10%), 10-19 years for 102(36.17%), and >20 years for 50 (17.73%). Among the participants, 177 (62.77%) were psychiatric co-morbidities, mainly psychotic 123(69.49%) and mood disorders 28(15.82%).

SUD treatment in Ethiopia imposes a substantial economic burden; OTC drives high payer costs, while ITC demands significant provider resources, particularly for patients with psychiatric co-morbidities or hospitalizations. Prevention and early intervention are vital to reduce this burden, as failure to act may worsen youth unemployment and poverty. The ICER for ITC versus OTC was USD 3,710 per DALY averted, exceeding Ethiopia's cost-effectiveness threshold (1-3× GDP per capita), indicating ITC is not cost-effective. At WTP thresholds below 1× GDP per capita, OTC was cost-effective in 55–100% of simulations, compared to 45% for ITC. At higher thresholds (1-3× GDP), both had equal likelihoods of cost-effectiveness (47%). These findings underscore OTC as the more cost-effective option, especially in low-resource settings.

In conclusion, the findings of study revealed the critical clinical and financial trade-off between ITC and OTC modality. Inpatient care, despite higher costs, offers structured support that may improve short-term recovery but faces high relapse risks post-discharge. Outpatient treatment, while more cost-effective and accessible, yet requires sustained engagement to prevent relapse.

9.2 Recommendations

Substance use disorders pose significant public health challenges, linked to various adverse outcomes such as increased healthcare utilization, reduced work productivity, and a significant economic burden on both individuals and society. Addressing these challenges requires effective SUD treatment approaches, which has been shown to mitigate the social, medical, psychological, and economic costs associated with SUDs.

To address the burden of SUDs, expanding public education and awareness campaigns, in schools and youth centers, targeting young population groups. These efforts are essential to

reduce behavioral risks related to substance use and minimizing the risk of transition into SUDs from pre-addiction state at early stages. SUDs treatment costs are not covered by the national community health insurance scheme, leaving patients reliant on out of pocket (OOP) payments. Integrating these treatments into the scheme and establishing social security measures, such as social income insurance or disability benefits, can help to mitigate productivity losses, reduces household financial strain, and improve treatment adherence. This is particularly important as most of treated SUD patients were unemployed and came from outside of the study area.

In line with **WHO mhGAP intervention guide model**, it is advisable to integrate the SUDs treatment and prevention services into the existing primary health care system to increase access to care [42]. These perspectives emphasizes the importance of ongoing, lower resource-intensive continuing care approaches, compared specialized outpatient (OTC) and inpatient (ITC) care model, more resource-intensive approaches, should be reserved for more severe SUD patients. Therefore, it is crucial for both treatment providers and policymakers to advocate for a continuing care model to SUDs treatment, shifting the focus from acute intervention to long-term chronic care model. This approaches improves post-treatment outcome of SUDs, regardless of whether they are discharged from inpatient or outpatient treatment centers [24].

Despite the growing public health challenges of SUDs in Ethiopia, there is dearth of published cost-effectiveness analysis on SUDs prevention and treatment. More research is urgently needed to fill this gap and to provide evidence-based prevention and treatment strategy to inform policymakers. Researchers are encouraged to contribute to this field and publish their findings to support the high demand of cost-effectiveness studies on SUDs treatment. Moreover, future qualitative research should explore barriers to treatment access for females, as their lower representation may indicate unmet needs or structural challenges. Gender sensitive interventions could help improve accessibility and treatment uptake among women.

Finally, this cost-effectiveness analysis can serve as a valuable resource for the **Federal Ministry of Health** (FMoH) of Ethiopia and donor organizations, providing evidence-based insights to support policymakers in optimizing SUDs treatment investments.

10. References:

1. United Nations : Office on Drugs and Crime [Internet]. [cited 2023 Dec 11]. World Drug Report 2023. Available from: //www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2023.html

2. UNODC World Drug Report 2023 [EN/AR/RU/ZH] - World | ReliefWeb [Internet]. 2023 [cited 2023 Dec 11]. Available from: https://reliefweb.int/report/world/unodc-world-drug-report-2023-enarruzh

3. Angkurawaranon C, Nitsch D, Larke N, Rehman AM, Smeeth L, Addo J. Ecological Study of HIV Infection and Hypertension in Sub-Saharan Africa: Is There a Double Burden of Disease? PLoS ONE [Internet]. 2016 Nov 17 [cited 2023 Nov 28];11(11):e0166375. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113946/

4. Mudie K, Jin MM, Tan, Kendall L, Addo J, dos-Santos-Silva I, et al. Non-communicable diseases in sub-Saharan Africa: a scoping review of large cohort studies. J Glob Health [Internet]. 2019 Dec [cited 2023 Nov 28];9(2):020409. Available from: http://jogh.org/documents/issue201902/jogh-09-020409.pdf

5. Odejide AO. Status of Drug Use/Abuse in Africa: A Review. Int J Ment Health Addict. 2006;4(2):87–102.

6. Ethiopia - Demographic and Health Survey 2011 - waterdata [Internet]. [cited 2023 Dec 11]. Available from: https://wbwaterdata.org/dataset/ethiopia-demographic-and-health-survey-2011

7. Girma E, Mulatu T, Ketema B. Polysubstance use behavior among the male population in Ethiopia: Findings from the 2016 Ethiopia Demographic and Health Survey. Ethiop J Health Dev [Internet]. 2020 Oct 22 [cited 2024 Oct 23];34(3). Available from: https://www.ajol.info/index.php/ejhd/article/view/201331

8. View of A Meta-Analytic Review of Gender Disparity in the Magnitude of Substance Use among Young People in Ethiopia | Ethiopian Medical Journal [Internet]. [cited 2023 Nov 13]. Available from: https://emjema.org/index.php/EMJ/article/view/861/533

9. Abajobir AA, Kassa GM. ORIGINAL ARTICLE MAGNITUDE OF SUBSTANCE USE AMONG YOUNG PEOPLE IN ETHIOPIA: A META-ANALYTIC REVIEW.

10. Gebremariam TB, Mruts KB, Neway TK. Substance use and associated factors among Debre Berhan University students, Central Ethiopia. Subst Abuse Treat Prev Policy [Internet]. 2018 Apr 5 [cited 2023 Nov 26];13(1):13. Available from: https://doi.org/10.1186/s13011-018-0150-9

11. Atnafie SA, Muluneh NY, Getahun KA, Woredekal AT, Kahaliw W. Depression, Anxiety, Stress, and Associated Factors among Khat Chewers in Amhara Region, Northwest Ethiopia. Depress Res Treat [Internet]. 2020 Sep 26 [cited 2023 Nov 18];2020:7934892. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7533749/

12. Tobacco Atlas [Internet]. [cited 2023 Dec 29]. Global Tobacco Control Information & Statistics I Tobacco Atlas. Available from: https://tobaccoatlas.org/

13. Recovery Centers of America [Internet]. [cited 2023 Nov 23]. Economic cost of substance abuse disorder in the United States, 2019. Available from:

https://recoverycentersofamerica.com/resource/economic-cost-of-substance-abuse-disorder-in-united-states-2019/

14. Prevention and control of noncommunicable diseases in Ethiopia: The case for investment, including considerations on the impact of khat | WHO | Regional Office for Africa [Internet]. [cited 2023 Nov 28]. Available from: https://www.afro.who.int/publications/prevention-and-control-noncommunicable-diseases-ethiopia-case-investment-including

15. Memirie ST, Dagnaw WW, Habtemariam MK, Bekele A, Yadeta D, Bekele A, et al. Addressing the Impact of Noncommunicable Diseases and Injuries (NCDIs) in Ethiopia: Findings and Recommendations from the Ethiopia NCDI Commission. Ethiop J Health Sci [Internet]. 2022 Jan [cited 2023 Nov 28];32(1):161–80. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8864405/

16. May 19 P on, Harm 2023 in Alcohol, Development OT, Policy, Research, Development S. Movendi International. [cited 2023 Nov 20]. World Health Statistics 2023 Show Progress on Alcohol Use and Need for Accelerated Action As Risk Exposure Remains High. Available from: https://movendi.ngo/science-digest/world-health-statistics-2023-show-progress-on-alcohol-use-and-need-for-accelerated-action-as-risk-exposure-remains-high/

17. Myers B, Louw J, Fakier N. Alcohol and drug abuse: removing structural barriers to treatment for historically disadvantaged communities in Cape Town. Int J Soc Welf [Internet]. 2008 [cited 2023 Nov 22];17(2):156–65. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-2397.2007.00546.x

18. Pasche S, Kleintjes S, Wilson D, Stein DJ, Myers B. Improving addiction care in South Africa: Development and challenges to implementing training in addictions care at the University of Cape Town. Int J Ment Health Addict. 2015;13(3):322–32.

19. Zewdu S, Hanlon C, Fekadu A, Medhin G, Teferra S. Treatment gap, help-seeking, stigma and magnitude of alcohol use disorder in rural Ethiopia. Subst Abuse Treat Prev Policy. 2019 Jan 18;14(1):4.

20. Benegal V, Chand PK, Obot IS. Packages of Care for Alcohol Use Disorders in Low- And Middle-Income Countries. Patel V, editor. PLoS Med [Internet]. 2009 Oct 27 [cited 2023 Nov 15];6(10):e1000170. Available from: https://dx.plos.org/10.1371/journal.pmed.1000170

21. Dua T, Barbui C, Clark N, Fleischmann A, Poznyak V, Ommeren M van, et al. Evidence-Based Guidelines for Mental, Neurological, and Substance Use Disorders in Low- and Middle-Income Countries: Summary of WHO Recommendations. PLOS Med [Internet]. 2011 Nov 15 [cited 2023 Nov 19];8(11):e1001122. Available from: https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001122

22. World Health Organization. mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings: mental health Gap Action Programme (mhGAP) [Internet]. version 2.0. Geneva: World Health Organization; 2016 [cited 2023 Nov 15]. 174 p. Available from: https://iris.who.int/handle/10665/250239

23. Salwan J, Katz CL. A review of substance [corrected] use disorder treatment in developing world communities. Ann Glob Health. 2014;80(2):115–21.

24. Proctor SL, Herschman PL. The Continuing Care Model of Substance Use Treatment: What Works, and When Is “Enough,” “Enough?” Psychiatry J [Internet]. 2014 [cited 2024 Dec 27];2014:692423. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4007701/

25. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders [Internet]. Fifth Edition. American Psychiatric Association; 2013 [cited 2023 Nov 13]. Available from: https://psychiatryonline.org/doi/book/10.1176/appi.books.9780890425596

26. Murray CJL. Findings from the Global Burden of Disease Study 2021. The Lancet [Internet]. 2024 May 18 [cited 2025 Mar 15];403(10440):2259–62. Available from: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(24)00769-4/abstract

27. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Disability Weights [Internet]. Institute for Health Metrics and Evaluation (IHME); 2020 [cited 2023 Nov 25]. Available from: http://ghdx.healthdata.org/record/ihme-data/gbd-2019-disability-weights

28. Charlson FJ, Diminic S, Lund C, Degenhardt L, Whiteford HA. Mental and substance use disorders in Sub-Saharan Africa: predictions of epidemiological changes and mental health workforce requirements for the next 40 years. PloS One. 2014;9(10):e110208.

29. Approaches to Treatment of Substance Abuse [Internet]. [cited 2023 Nov 28]. Available from: https://www.who.int/publications-detail-redirect/approaches-to-treatment-of-substance-abuse

30. Grant M. Alcohol And Emerging Markets: Patterns, Problems, And Responses. Routledge; 2013. 375 p.

31. Getachew T, Defar A, Teklie H, Gonfa G, Bekele A, Bekele A, et al. Magnitude and predictors of excessive alcohol use in Ethiopia: Findings from the 2015 national non- communicable diseases STEPS survey. Ethiop J Health Dev.

32. Teklie H, Gonfa G, Getachew T, Defar A, Bekele A, Bekele A, et al. Prevalence of Khat chewing and associated factors in Ethiopia: Findings from the 2015 national Non- communicable diseases STEPS survey. Ethiop J Health Dev.

33. Defar A, Getachew T, Teklie H, Bekele A, Gonfa G, Gelibo T, et al. Tobacco use and its predictors among Ethiopian adults: A further analysis of Ethiopian NCD STEPS survey-2015. Ethiop J Health Dev.

34. The NCDI Poverty Network [Internet]. [cited 2023 Dec 10]. The Ethiopia NCDI Commission Report. Available from: https://www.ncdipoverty.org/ethiopia-report

35. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet Lond Engl [Internet]. 2018 Nov 10 [cited 2023 Nov 24];392(10159):1789–858. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6227754/

36. Ethiopia | The Institute for Health Metrics and Evaluation [Internet]. [cited 2023 Nov 18]. Available from: https://www.healthdata.org/research-analysis/health-by-location/profiles/ethiopia

37. Teferra S. SUBSTANCE-RELATED DISORDERS TREATMENT SERVICE IN A GENERAL HOSPITAL IN ETHIOPIA: EXPERIENCE, CHALLENGES AND OPPORTUNITIES.

38. Connery HS, McHugh RK, Reilly M, Shin S, Greenfield SF. Substance Use Disorders in Global Mental Health Delivery: Epidemiology, Treatment Gap, and Implementation of Evidence-Based Treatments. Harv Rev Psychiatry [Internet]. 2020 [cited 2023 Nov 14];28(5):316–27. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8324330/

39. Health M of. National mental health strategy, 2020-2025 (2013-2017 EFY). 2020 Jan 1 [cited 2023 Dec 10]; Available from: http://repository.iphce.org/xmlui/handle/123456789/1423

40. Funk M, Saraceno B, Drew N, Faydi E. Integrating mental health into primary healthcare. Ment Health Fam Med [Internet]. 2008 Mar [cited 2023 Nov 19];5(1):5–8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2777555/

41. Tadesse Gebremedhin L, Giorgis TW, Gerba H. Policies, delivery models, and lessons learned from integrating mental health and substance abuse services into primary health care in Ethiopia. FASEB BioAdvances [Internet]. 2021 Sep [cited 2023 Nov 16];3(9):694–701. Available from: https://onlinelibrary.wiley.com/doi/10.1096/fba.2020-00145

42. Dua T, Barbui C, Clark N, Fleischmann A, Poznyak V, Van Ommeren M, et al. Evidence-Based Guidelines for Mental, Neurological, and Substance Use Disorders in Low- and Middle-Income Countries: Summary of WHO Recommendations. PLoS Med [Internet]. 2011 Nov 15 [cited 2024 Oct 23];8(11):e1001122. Available from: https://dx.plos.org/10.1371/journal.pmed.1001122

43. Organization WH, Crime UNO on D and. International standards for the treatment of drug use disorders: revised edition incorporating results of field-testing [Internet]. World Health Organization; 2020 [cited 2023 Nov 11]. Available from: https://iris.who.int/handle/10665/331635

44. Peterson C, Li M, Xu L, Mikosz CA, Luo F. Assessment of Annual Cost of Substance Use Disorder in US Hospitals. JAMA Netw Open [Internet]. 2021 Mar 5 [cited 2023 Nov 23];4(3):e210242. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7936257/

45. Li M, Peterson C, Xu L, Mikosz CA, Luo F. Medical Costs of Substance Use Disorders in the US Employer-Sponsored Insurance Population. JAMA Netw Open [Internet]. 2023 Jan 24 [cited 2023 Nov 23];6(1):e2252378. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9972180/

46. Suanrueang P, Wongsin U. Cost Analysis of Outpatient Care for Mental and Behavioral Disorders due to Psychoactive Substance Use: A Study of Four Community and Two General Hospitals in Thailand. Asia Pac J Health Manag [Internet]. 2023 Apr 8 [cited 2024 Nov 6];18(1). Available from: https://journal.achsm.org.au/index.php/achsm/article/view/1669

47. Pathayanant N, Ratniyom A. AN ANALYSIS OF ECONOMIC COSTS OF DRUG ABUSE TREATMENT AT THANYARAK INSTITUTE(**การวิเคราะห์ต้นทุนทางเศรษฐศาสตร์ในการรับการบำบัดรักษาผู้ติดยาเสพติด ณ สถาบันธัญญารักษ์**). J Med Health Sci [Internet]. 2011 Apr 19 [cited 2024 Jan 1];18(1):8–20. Available from: https://he01.tci-thaijo.org/index.php/jmhs/article/view/59809

48. Ilomuanya M, Amaeze O, Umeche C, Mbata U, Shonekan O, Olajide A. Direct Medical Cost of Treating Substance Use Disorders in Two Tertiary Hospitals in South-West, Nigeria: A Cross-Sectional Study. Mundt MP, editor. J Addict [Internet]. 2022 Jan 15 [cited 2023 Nov 9];2022:1–8. Available from: https://www.hindawi.com/journals/jad/2022/6320141/

49. Transforming our World: The 2030 Agenda for Sustainable Development .:. Sustainable Development Knowledge Platform [Internet]. [cited 2023 Dec 10]. Available from: https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

50. Finney JW, Hahn AC, Moos RH. The effectiveness of inpatient and outpatient treatment for alcohol abuse: the need to focus on mediators and moderators of setting effects. Addict Abingdon Engl. 1996 Dec;91(12):1773–96; discussion 1803-1820.

51. Brorson HH, Ajo Arnevik E, Rand-Hendriksen K, Duckert F. Drop-out from addiction treatment: a systematic review of risk factors. Clin Psychol Rev. 2013 Dec;33(8):1010–24.

52. Fenwick E, Byford S. A guide to cost-effectiveness acceptability curves. Br J Psychiatry [Internet]. 2005 Aug [cited 2023 Nov 22];187(2):106–8. Available from: https://www.cambridge.org/core/journals/the-british-journal-of-psychiatry/article/guide-to-costeffectiveness-acceptability-curves/FD000EBD3012372C9C99976912637E29

53. Baltussen R, M. Adam T, Tan-Torres Edejer T. Making Choices in Health - WHO Guide to Cost Effectiveness Analysis: WHO Guide to Cost-Effectiveness Analysis [Internet]. Albany: World Health Organization; 2003 [cited 2023 Nov 19]. 330 p. Available from: https://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=284627

54. French MT, Zavala SK, McCollister KE, Waldron HB, Turner CW, Ozechowski TJ. Cost-effectiveness analysis of four interventions for adolescents with a substance use disorder. J Subst Abuse Treat. 2008 Apr;34(3):272–81.

55. Kuria W. Cost effectiveness of community based and institution based detoxification and rehabilitation of alcohol dependent persons in Kenya. 2010 Jan 1 [cited 2024 Nov 6]; Available from: https://www.academia.edu/90047473/Cost_effectiveness_of_community_based_and_institution_based_detoxification_and_rehabilitation_of_alcohol_dependent_persons_in_Kenya

56. Addis Ababa, Ethiopia Metro Area Population 1950-2023 [Internet]. [cited 2023 Nov 22]. Available from: https://www.macrotrends.net/cities/20921/addis-ababa/population

57. Srivastava T, Strong M, Stevenson MD, Dodd PJ. Improving Cycle Corrections in Discrete Time Markov Models: A Gaussian Quadrature Approach [Internet]. medRxiv; 2020 [cited 2023 Dec 5]. p. 2020.07.27.20162651. Available from: https://www.medrxiv.org/content/10.1101/2020.07.27.20162651v1

58. Ethiopia data | World Health Organization [Internet]. [cited 2023 Nov 20]. Available from: https://data.who.int/countries/231

59. Lopez-Quintero C, Hasin DS, de Los Cobos JP, Pines A, Wang S, Grant BF, et al. Probability and predictors of remission from life-time nicotine, alcohol, cannabis or cocaine dependence: results from the National Epidemiologic Survey on Alcohol and Related Conditions. Addict Abingdon Engl. 2011 Mar;106(3):657–69.

60. Ali FRM, Agaku IT, Sharapova SR, Reimels EA, Homa DM. Onset of Regular Smoking Before Age 21 and Subsequent Nicotine Dependence and Cessation Behavior Among US Adult Smokers. Prev Chronic Dis. 2020 Jan 16;17:E06.

61. Volkow ND, Han B, Einstein EB, Compton WM. Prevalence of Substance Use Disorders by Time Since First Substance Use Among Young People in the US. JAMA Pediatr. 2021 Jun 1;175(6):640–3.

62. Volkow ND, Koob GF, McLellan AT. Neurobiologic Advances from the Brain Disease Model of Addiction. N Engl J Med. 2016 Jan 28;374(4):363–71.

63. Blanco C, Okuda M, Wang S, Liu SM, Olfson M. Testing the drug substitution switching-addictions hypothesis. A prospective study in a nationally representative sample. JAMA Psychiatry. 2014 Nov;71(11):1246–53.

64. Scott CK, Foss MA, Dennis ML. Pathways in the relapse--treatment--recovery cycle over 3 years. J Subst Abuse Treat. 2005;28 Suppl 1:S63-72.

65. Flórez-Salamanca L, Secades-Villa R, Budney AJ, García-Rodríguez O, Wang S, Blanco C. Probability and predictors of cannabis use disorders relapse: results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). Drug Alcohol Depend. 2013 Sep 1;132(1–2):127–33.

66. Dawson DA, Goldstein RB, Grant BF. Rates and Correlates of Relapse Among Individuals in Remission From DSM-IV Alcohol Dependence: A 3-Year Follow-Up. Alcohol Clin Exp Res [Internet]. 2007 Dec [cited 2023 Dec 5];31(12):2036–45. Available from: https://onlinelibrary.wiley.com/doi/10.1111/j.1530-0277.2007.00536.x

67. García-Rodríguez O, Blanco C, Wall MM, Wang S, Jin CJ, Kendler KS. Toward a comprehensive developmental model of smoking initiation and nicotine dependence. Drug Alcohol Depend [Internet]. 2014 Nov 1 [cited 2023 Dec 5];144:160–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4253146/

68. Timko C, Debenedetti A, Moos BS, Moos RH. Predictors of 16-year mortality among individuals initiating help-seeking for an alcoholic use disorder. Alcohol Clin Exp Res. 2006 Oct;30(10):1711–20.

69. Degenhardt L, Randall D, Hall W, Law M, Butler T, Burns L. Mortality among clients of a state-wide opioid pharmacotherapy program over 20 years: risk factors and lives saved. Drug Alcohol Depend. 2009 Nov 1;105(1–2):9–15.

70. Coviello DM, Zanis DA, Wesnoski SA, Alterman AI. The effectiveness of outreach case management in re-enrolling discharged methadone patients. Drug Alcohol Depend. 2006;85(1):56–65.

71. Zanis DA, Woody GE. One-year mortality rates following methadone treatment discharge. Drug Alcohol Depend. 1998 Nov 1;52(3):257–60.

72. Our World in Data [Internet]. [cited 2025 Feb 4]. Mental health and substance use disorders death rate. Available from: https://ourworldindata.org/grapher/death-rate-from-mental-health-and-substance-use-disorders-who

73. Sanders GD, Neumann PJ, Basu A, Brock DW, Feeny D, Krahn M, et al. Recommendations for Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses: Second Panel on Cost-Effectiveness in Health and Medicine. JAMA. 2016 Sep 13;316(10):1093–103.

74. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Disability Weights [Internet]. Institute for Health Metrics and Evaluation (IHME); 2020 [cited 2023 Dec 9]. Available from: http://ghdx.healthdata.org/record/ihme-data/gbd-2019-disability-weights

75. Salomon JA, Vos T, Hogan DR, Gagnon M, Naghavi M, Mokdad A, et al. Common values in assessing health outcomes from disease and injury: disability weights measurement study for the Global Burden of Disease Study 2010. Lancet Lond Engl. 2012 Dec 15;380(9859):2129–43.

76. Amanuel Mental Specialized Hospital, St. Paul Hospital Millinium Medical College, Zewuditu Memorial Hospital. Annual HMIS Report on Substance Use Disorder Treatment Outcomes (July 2022 – July 2023). Addis Ababa, Ethiopia: Department of Psychiatry, Amanuel Mental Specialized Hospital; St Paul Hospital Millinium Medical College and Zewuditu Memorial Hospital; 2024.

77. Essentials of Monte Carlo Simulation [Internet]. [cited 2023 Nov 25]. Available from: https://link.springer.com/book/10.1007/978-1-4614-6022-0

78. YHEC - York Health Economics Consortium [Internet]. [cited 2023 Nov 26]. Incremental Cost-Effectiveness Ratio (ICER). Available from: http://yhec.co.uk/glossary/incremental-cost-effectiveness-ratio-icer/

79. Santerre RE, Neun SP. Health Economics: Theory, Insights, and Industry Studies. Cengage Learning; 2009. 624 p.

80. Shiell A, Donaldson C, Mitton C, Currie G. Health economic evaluation. J Epidemiol Community Health. 2002 Feb;56(2):85–8.

81. French MT. Drug Abuse Treatment Cost Analysis Program.

82. Baltussen RMPM, Hutubessy RCW, Evans DB, Murray CJM. UNCERTAINTY IN COST-EFFECTIVENESS ANALYSIS: Probabilistic Uncertainty Analysis and Stochastic League Tables. Int J Technol Assess Health Care [Internet]. 2002 Jan [cited 2024 Dec 13];18(1):112–9. Available from: https://www.cambridge.org/core/journals/international-journal-of-technology-assessment-in-health-care/article/abs/uncertainty-in-costeffectiveness-analysis/969C1E9FCF495E196BF734E4B0DA290C

83. Cost-effectiveness of treating multidrug-resistant tuberculosis in treatment initiative centers and treatment follow-up centers in Ethiopia - PMC [Internet]. [cited 2025 Jan 22]. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7384609/

84. Hailu A, Lindtjørn B, Deressa W, Gari T, Loha E, Robberstad B. Cost-effectiveness of a combined intervention of long lasting insecticidal nets and indoor residual spraying compared with each intervention alone for malaria prevention in Ethiopia. Cost Eff Resour Alloc CE. 2018;16:61.

85. (82) Cost-Effectiveness of MDR-TB Treatment in Addis Ababa, Ethiopia [Internet]. [cited 2025 Jan 2]. Available from: https://www.academia.edu/86190105/Cost_effectiveness_Analysis_of_Multi_Drug_Resistant_Tuberculosis_at_Treatment_Initiative_and_Follow_up_Centers_in_Addis_Ababa_Ethiopia

86. Nadkarni A, Endsley P, Bhatia U, Fuhr DC, Noorani A, Naik A, et al. Community detoxification for alcohol dependence: A systematic review. Drug Alcohol Rev. 2017 May;36(3):389–99.

11. Annexes

11.1 Information sheet and Consent form in English/ በአማርኛ

11.1.1 Information sheet and Consent form in English

ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE
SCHOOL OF PUBLIC HEALTH

Questionnaire code: _____ Name of the health facility: _____
Interviewer name: _____ Signature_____
Name of supervisor: _____ Signature_____
Date of interview _____

To participate in this research project titled: "**A Comparative study of the Effectiveness and Cost-Effectiveness of Inpatient and Outpatient Treatment Centers for Substance Use Disorder: The case of one General and two specialized hospitals in Addis Ababa, Ethiopia**" obtaining your consent is highly required. Your participation in this study entails providing information related to the topic. The aim of this study is to compare the effectiveness and cost-effectiveness of inpatient and outpatient treatment center for substance use disorder in one General and two specialized hospitals in Addis Ababa. If you take part in this study, you will contribute in avoiding financial risk results from illness-related expenditures by identifying the most cost effective intervention. This invitation is extended to join a study conducted by student's belonging to Addis Ababa University School of Public Health. Your participation is voluntary and your response will be kept confidential and will be used for the research purpose only. Besides, you have a full right to withdraw at any time without any negative consequences. By signing this consent form, you indicate your willingness to participate in this study.

If you are willing to participate in this study, you will be requested to engage your time for about 60 minutes. The interview will focus on estimating the direct and indirect costs related to substance use disorder, and you have an option not to answer specific questions that are inconvenient for you. The data collected from this research project will be securely stored and anonymized. Access to the data will be limited to researchers linked to this project. The research findings may be disseminated in academic journals or reports while ensuring participant privacy and confidentiality.

By participating, you acknowledge understanding and agreement with this consent form, and as well as your willingness to take part in this project. For inquiries related to the project, please contact the principal investigator: Addisu Tsehay via draddisun16@gmail.Com or +251928510702.

Thank you for your valuable input and collaboration!

11.1.2 የቃለ መጠየቅ የፍቃድ ቅጽ/ በአማርኛ

በአዲስ አበባ ዩኒቨርሲቲ ጤና ሳይንስ ኮሌጅ የህብረተሰብ ጤና ህክምና ትምህርት ክፍል

የመጠይቁ ኮድ_____ የህክምና መስጫው ስም: _____
የቃለመጠየቅ አድራጊው ስም _____ ፊርማ _____
የጥናቱ ሃላፊ ስም_____ ፊርማ _____
ቃለ መጠይቁ የተደረገበት ቀን _____

በአዲስ አበባ በአንድ አጠቃላይ እና በሁለት ስፔሻላይዝድ ሳይካትሪክ ሆስፒታሎች ውስጥ "በሱስ ማገገሚያ ማዕከላት ውስጥ በአስተኝቶ ህክምና እና በተመላላሽ ሕክምና መስጫ ማዕከላት መካከል ያለውን ውጤታማነት እና ወጪ ቆጣቢነት" በሚል ርዕስ በተዘጋጀው የምርምር ፕሮጀክት ላይ መረጃ ለመሰብሰብ የርስዎን ፈቃድ ማግኘት በጣም አስፈላጊ ሆኖ ተገኝቷል። ስለሆነም የሚኖሮዎት ተሳትፎ ከርዕሱ ጋር የተያያዘ መረጃ መስጠትን ያጠቃልላል። የዚህ ጥናት ዋና አላማ በአዲስ አበባ በአንድ አጠቃላይ እና በሁለት ስፔሻላይዝድ ሆስፒታሎች ውስጥ የሚገኝውን የአስተኝቶ ህክምና እና የተመላላሽ ህክምና የሱስ ማገገሚያ ማእከል ውጤታማነት እና ወጪ ቆጣቢነት ማወዳደር ነው። በዚህ ጥናት ውስጥ ሲሳተፉ፣ ከህክምና ወጪዎች ጋር በተያያዘ የሚመጣ የገንዘብ ችግርን ለማስወገድ ከፍተኛ ወጪ ቆጣቢውን የህክምና አይነት ለመለየት በሚደረገው ጥናት ከፍተኛ አስተዋፅዖ ያደርጋሉ። ይህ ግብዣ በአዲስ አበባ ዩኒቨርሲቲ የህብረተሰብ ጤና ትምህርት ቤት አባል የሆነው ተማሪ በሚያጠናው ጥናት ላይ እንዲሳተፉ ነው። የእርስዎ ተሳትፎ በፈቃደኝነት ነው፤ እናም ምላሽዎ በሚስጥር ይጠበቃል እና ለምርምር ዓላማ ብቻ ጥቅም ላይ ይውላል። በተጨማሪም ያለ ምንም አሉታዊ ውጤት በማንኛውም ጊዜ የመውጣት ሙሉ መብት አለዎት። ይህን የስምምነት ቅጽ በመፈረም በዚህ ጥናት ውስጥ ለመሳተፍ ፈቃደኛ መሆንዎን ያሳያሉ።

በዚህ ጥናት ለመሳተፍ ፍቃደኛ ከሆኑ፣ ከጊዜዎ ለ60 ደቂቃ ያህል ለተሳተፎ ይጠየቃሉ። ቃለ-መጠይቁ የሚያተኩረው ከሱስ ህክምና ጋር የተያያዙ ቀጥተኛ እና ተዘዋዋሪ ወጪዎችን በመገመት ላይ ነው። ነገር ግን ለእርስዎ የማይመቹ የተወሰኑ ጥያቄዎች ካሉ ያለመመለስ አማራጭ አለዎት። ከዚህ የምርምር ፕሮጀክት የሚሰበሰበው መረጃ ደህንነቱ በተጠበቀ ሁኔታ ይቀመጣል፤በተጨማሪም ማንነትዎ አይገለጽም። የመረጃው መዳረሻ ከዚህ ፕሮጀክት ጋር ለተገናኙ ተመራማሪዎች ብቻ የተገደበ ይሆናል። የጥናት ግኝቶች የተሳታፊዎችን ግላዊነት እና ሚስጥራዊነት ጠብቀው በአካዳሚክ መጽሔቶች ወይም ሪፖርቶች ውስጥ ሊሰራጭ ይችላል።

የዚህን የስምምነት ቅጽ መረዳትዎን እና በዚህ የምርምር ፕሮጀክት ውስጥ ለመሳተፍ ፈቃደኛ መሆንዎን እውቅና ይሰጣሉ። ማንኛውም ከዚህ ፕሮጀክትጋር ለተያያዙ ጥያቄዎች መረጃ ለማግኘት የዚህን የምርምር ፕሮጀክት ዋና ባለቤት አዲሱ ፀሃይን በ draddisun16@gmail.com ወይም +251928510702 በመጠቀም መጠየቅ ይችላሉ።

ስለ ጠቃሚ ግብአትዎ እና ትብብርዎ እናመሰግናለን!

11.2 Data collection tool/ ቃለ መጠየቅ

11.2.1 Questioners/ English version

Part I: Participant's Information (from patient's treatment chart and patient Interview)

A. Socio-demographic characteristics of study participants:		Remark
Questions	Circle and/or fill answers on the answer line	
Q1. Address of study participants	1. Addis Ababa 2. Out of Addis Ababa	
Q2. Age of study participants (years)	_____years	
Q3. Gender of study participants	1. Male 2. Female	
Q4. Marital status	1. Married 3. Widowed 2. Single 4. Divorced	
Q5. Level of Education	1. No formal education 3. Secondary education 2. Primary education 4. College/University & above	
Q6. Occupational Status (Current)	1. Employed 3. Student 2. Unemployed 4. Retired	
Q7. Living arrangement	1. With family 2. Alone 3. Unspecified	
B. Patient clinical and follow-up status (from patient's treatment chart and interviews)		
Q8. Type of substance(s) used	1. Alcohol 4. Cannabis 2. Tobacco 5. Opioids 3. Khat 6. others (specify)_____	
Q9. Duration of substance use in years?	1. < 10 years 2. 10 – 19 years 3. 20+ years	
Q10. Did you have psychiatric co-morbidity?	1. Yes 2. No(**Go to Q12**)	
Q11.The diagnosis of psychiatric co-morbidity?	1. Schizophrenia 4. Anxiety disorder 2. Depression 5. Others (specify)_____ 3. Substance induced psychosis ()	
Q12. Did you have been treated for SUDs treatment before?	1. Yes 2. No (**Go to Q15**)	
Q13. Type of treatment modality for the previous treatment?	1. Hospital inpatient 2. Hospital outpatient 3. Non-hospital rehabilitation center 4. Others (specify)_____	
Q14. Treatment outcome of previous treatment?	**1**. Remission **2.**drop out **3.** Died	
Q15. Type of current treatment program?	1. Inpatient Treatment Center (ITC) 2. Outpatient Treatment Center (OTC)	
Q16. When did you start this program?	DD/MM/YY_____ _____ _____	
Q17. How long you stayed in ITC or Number of visits at OTC (in days)	_____days	
Q18.Clinical category of patient at the start of treatment?	1. New 3. After drop out 2. Relapse 4. Others (specify) _____	
Q19. Type of treatment received during the current treatment plan?	1. Psychosocial therapy (**PST**) 2. Pharmacotherapy (**PCT**) 3. Others (specify) _____	
Q20. Discharge status?	1. Treatment completed 2. Drop out(**Go to Q21**) 3. Died(**Go to Q21**)	
Q20.1 Treatment outcome	1. Remission 3. Relapse 2. Abstinence 4. Died	

Part II: Direct medical, non-medical and indirect costs (from patient's chart and interview)

A. Q21. Please list down the direct medical costs of SUDs patients during the inpatient or outpatient treatment centers?
Q21.1 Total investigation costs of this particular patient during the fiscal year in ETB? (Unit price* frequency of order) _____**ETB**
Q21.2 Total costs from drugs or pharmacotherapy for this particular patient during the fiscal year in ETB? _____**ETB**
Q21.3 Total costs from psychotherapy sessions for this particular patient during the fiscal year in ETB? _____**ETB**
Q21.4 Total costs from other service like bed charges, nursing care, physician visit and any other procedures for this particular patient during the fiscal year? _____**ETB**
Q21.5 The total direct medical cost for this particular patient's during the fiscal year in ETB? (Q21.1+ Q21.2+ Q21.3+ Q21.4) _____**ETB**
B. Q22. Direct non-medical costs to access treatment facility (during outpatient or inpatient treatment centers)
Q22.1 How many kilometers did you travel to get to this program? (One way) _____**Km**
Q22.2 how long did it take you to travel to this program? (One way) _____**hours**
Q22.3 Types of transport modality? 1. Walked 2. Cycled 3. Bus 4. Minibus 5. Private car 6. Others (specify) _____
Q22.4 How money times have you been hospitalized/follow up visits for SUDs treatment during 2015 E.F.Y? _____**times**
Q22.5 How much money did you spend for transportation in each of hospitalization/ follow up visit? (Two way) _____ **ETB**
Q22.6 Did you make any cash or in-kind payment (For ITC only) 1. Yes 2. No (**Go to Q22.8**)
Q22.7 Total amount of cost after monetizing into ETB for this particular patient during the fiscal year? _____ **ETB**
Q22.8 How much did you spend on food and drinks for the last visit (on the road, while waiting, lunch etc.), in total for you? (For OTC only) _____ **ETB**
Q22.9 What accommodation cost did you incurred when you pick up drugs last visit? **(For OTC only)** _____ **ETB**
Q22.10 What other cost did you spend during your treatment follow up? **(For OTC only)** _____ **ETB**
Q22.11 Total amount of direct non-medical costs for this particular patient during the fiscal year in ETB? _____ ETB
C. Q23. Indirect costs due to hospitalization and follow up visits (during Outpatient Treatment Center or Inpatient Treatment Center)
Q23.1 How many times did you hospitalized in this program in 2015 E.F.Y? _____**times**

Q23.2 In total, how much time did you spend at this program per hospitalization/visit? **___hrs.**	
Q23.3 When you were last employed?	1. Currently employed 2.Just before starting treatment, not currently 3.During the past 12 months (**Go to Q23.4**) 4.Longer than 12 months ago(**Go to Q23.4**) 5.Never employed (**STOP**)
Q23.3.1 If you are currently employed or just before starting treatment, does this treatment interfere with your work?	1.Yes 2. No(**Go to Q23.4**)
Q23.3.2 How many hours did you missed from work to attend this program? **_____hours**	
Q23.3.3 What type of a job did you have? (**N.B If there is >1 job, consider primary job or most recent job**) **_____**	
Q23.4 How many hours per day did you typically work in your last or current job? **____hours**	
Q23.5 What was your rate of pay in that job, before taxes, including tips and other compensation? (Rate of pay per hour) **_____ETB**	
Q23.6 Total indirect cost (by HCA) during hospitalization or follow up visit for this particular patient during the fiscal year in ETB? **_____ETB**	

Part III: Healthcare provider's costs (Interviewing administrative head, personnel's, and by observation)

A. Interviewing service provider's (for building and personnel's costs)

Name of health facility: _____
Case Team: _____
Name of case team coordinator: _____
Position: _____

1.Building costs (from administrative head and by observation)

Room No	Total area **(sqm)**	Usable space for SUDs **(%)**	Usable space for joint services **(%)**	Rental rate per **sqm (year) (ETB)**	Total annual lease price for SUDs **(ETB/Year)**	No of SUDS pts. per E.F.Y	TPD (days)	**LC/aPD (ETB per pt. day)**	**LCfeSP (ETB)**	Remark
Office 1	100	50%	50%							
Room 1	100	100%	-							
Office 2										
Room 2										
Grand total of LC/aPD										

Q24.What was the total lease cost for this particular patient during the fiscal year in ETB ?**_____ETB**
(***Total lease cost per Patient Day/OPD Visit* HLOS/ Number of OPD visit(s) of each patient*****)**

TPD: *Total Patient Days,* ***LC/PD:*** *Lease cost per all patient day,* ***LCfeSP: Lease Cost*** *for each* ***Sampled Patient***

2. Personnel's cost: (from administrative head and hospital payroll)										
List of personnel for SUD services			Time devoted to the program (%)	Annual salary **(ETB)**	Overtime payment* **(ETB)**	Other benefits **(ETB)**	Total costs **(ETB)**	TPD/TOV (days/N**o**)	**TPC/PD (ETB per pt. day)**	T**PC**fe **SP** (ETB)
S.No	Name	title								
1	Dr XXX	Psych.	25%	10K*0.25	5K	2K*0.25	8K	4569	8K/4569	
2										
3										
Total annual personnel costs										
Q25. What was the total personnel cost for this particular patient during the fiscal year? _____**ETB** (***Total personnel cost per Patient Day/OPD Visit* HLOS/ Number of OPD visit(s) of each patient***)										

TPC/PD: Total Personnel Cost per Patient Day, TPCfeSP: Total Personnel Cost for each Sampled Patient

B. Medical equipment and supplies costs for the provision of SUDs treatment

1. Medical equipment costs for SUD treatment														
S. No	Type of equipment	No of units (n)	**Initial purchasing cost, ETB (IP)**	Year of purchase (in months) P	Year in operation (in months) **O**	**Monthly lease/rental cost (ETB) R**	**Useful life (months) U=P+O**	**Depreciation cost per month per unit(ETB) D=IP/ P+O**	SUD patient Per month		Non-SUD patient Per month		**TMEC (R+ D)n**	**TMEC** for SUD pts. **UR* TMEC**
									No	UR	No	UR		
e.g.	XX	2	2500	24	18	200	42	60	90	0.64	50	.36	520	333
1														
2														
3														
Total annual equipment costs														
Q26. What was the total cost from medical equipment for this particular patient during the fiscal year? _____ **ETB** (***HLOS/OPD visit for each patient/Total Utilization Weights (PD or OPD Visits)*Total annual equipment cost***)														

2. Medical Supply Costs for SUD treatment													
S. No	**Type of supplies**	**Units**	No	**Unit Cost (ETB)**	MUR	**Monthly Cost (ETB)**	SUD pts. Per month.	Non-SUD pts. Per month.	**UR for SUD**	Monthly Cost for SUD	Annual Cost (ETB) **MC*12**	Annual Cost for SUD	remark
1	Drug x	Tab.	14	4.75	100	(4.75*100)/14=6650	90	50	0.64	4256	6650*12	4256*12	
2													
3													
Total annual medical supply costs													
Q27. What was the total cost from medical supplies for this particular patient during the fiscal year? _____**ETB** (***HLOS/OPD visit for each patient/Total Utilization Weights (PD or OPD Visits)*Total annual medical supply cost***)													

11.2.2 ቃለ መጠየቅ/ በአማርኛ:

<u>ክፍል 1</u>: <u>የታካሚው ማኅበራዊ እና የህክምና ሁኔታ</u> (<u>ከታካሚው ጋር በሚደረግ ቃለ መጠይቅ እና ከታካሚው ካርድ የሚሰበሰብ</u>)

ሀ. የታካሚው ማኅበራዊ ሁኔታ		ቁጥሩን
ጥያቄዎች	**እንደመልሱ አይነት በተሰጠው ቦታ ላይ መልስህን አስቀምጥ**	
Q1. የታካሚው አድራሻ	1. አዲስ አበባ 2. ከአዲስ አበባ ውጪ	
Q2. የታካሚው ዕድሜ	_____ዓመት	
Q3. የታካሚው ፆታ	1. ወንድ 2. ሴት	
Q4. የታካሚው የጋብቻ ሁኔታ	1. ያገባ 2. ያላገባ 3. የሞተበት 4. የፈታ	
Q5. የታካሚው የትምህርት ደረጃ/ሁኔታ	1. ያልተማረ 3. ሁለተኛ ደረጃ 2. የመጀመሪያ ደረጃ 4. ከሌጅ እና ከዚያ በላይ	
Q6. የታካሚው የስራ ሁኔታ (ያሁን)	1. ስራ ላ ይ ያለ 3. ተማሪ 2. ስራ አጥ 4. ጡረተኛ	
Q7. ታካሚው በቤት ውሰጥ ከማን ጋር ይኖራል?	1. ከቤተሰቡ ጋር 2. ብቻውን 3. ያልተገለፀ	
ለ. ስለ ታካሚው የበሽታ ሁኔታና የክትትል ደረጃ (*ከታካሚው ካርድ እና ከታካሚው ጋር በሚደረግ ቃለ መጠይቅ*)		
Q8. ታካሚው የሚወሰደው የሰብስታንስ ዓይነት?	1. አልኮል 4. ካናቢሰ 2. ቶባኮ 5.ኦፖይድሰ 3. ጫት 6. ሌላ ካለ ይገለጽ_____	
Q9. ታካሚው ሰብስታንሱን ለስንት ዓመት ወሰዱ?	1. < 10 ዓመታት 2. 10– 19 ዓመታት 3. 20+ ዓመታት	
Q10. ተያያዥ የአዕምሮ ህመም አለበዎት?	1. አዎ 2. የለብኝም **(ወደ Q12 ይለፉ)**	
Q11. የአዕምሮ ህመሙ ዓይነት?	1. ስኪዞፊሪኒያ 4. ከልክ ያለፈ ጭንቀት 2. ድባቴ 5. ሌላ ካለ ይገለጽ_____ 3. ከሰብስታንሱ ጋር የተያያዘ ሳይኮሲስ	
Q12. ከዚህ በፊት የሱስ ህክምና መስጫ ቦታ ታክመው ያውቃሉ?	1. አዎ 2. አላውቅም **(ወደ Q15 ይለፉ)**	
Q13. ባለፈው የታከሙበት የሱስ የህክምና መስጫ ማዕከል ምን ዓይነት ነበር?	1. የሆስፒታል አስተኝቶ ህክምና 2. የሆስፒታል ተመላላሽ ህክምና 3. ሆስፒታል ያልሆነ የሱስ ማገገሚያ ማዕከል 4. ሌላ ካለ ይገለጽ?_____	
Q14. ያለፈው ህክምና የመጨረሻ ውጤት?	**1**. ሰብስታንሱን የቀነሰ ግን ሙሉ በሙሉ ያላቆመ **2.** ህክምናውን ያቋረጠ **3.** የሞተ	
Q15. የአሁኑ የሱስ የህክምና መስጫ ማዕከል ዓይነት?	1. የሆስፒታል አስተኝቶ ህክምና 2. የሆስፒታል ተመላላሽ ህክምና	
Q16. በአሁኑ ህክምና መቼ ነበር የጀመሩት?	ቀን/ወር/ዓመት _____ _____ _____	
Q17. ለአሁኑ ህክምና ለምን ያህል ጊዜ ቆዩ?	_____ቀን	
Q18. ህክምናው ሲጀመር የታካሚው ዓይነት?	1. አዲስ 3. ህክምናውን ያቋረጠ 2. ወደቀድሞ ወይም ወደባሰ የሱስ ሁኔታ የተመለሰ 4. ሌላ ካለ ይገለጽ?_____	
Q19. በአሁኑ ህክምና ምን ዓይነት ህክምና ነው እየወሰዱ ያሉት?	1. ሳይኮሶሻል ህክምና 2. ፋርማኮቴራፒ ህክምና 3. ሌላ ካለ ይገለጽ?_____	
Q20. ታካሚው ከህክምና ሲወጣ የነበርበት ሁኔታ?	1. ህክምናውን የጨረሰ 2. ህክምናውን ያቋረጠ **(ወደ Q21 ይለፉ)** 3. የሞተ **(ወደ Q21 ይለፉ)**	
Q20.1 የታካሚው የመጨረሻ ህክምና ውጤት?	1. ሰብስታንሱን የቀነሰ ግን ሙሉ በሙሉ ያላቆመ 2. ሰብስታንሱን ሙሉ በሙሉ ያቆመ 3. ወደቀድሞ ወይም ወደባሰ የሱስ ሁኔታ የተመለሰ 4. የሞተ	

ክፍል 2: ለህክምና ፤ ለህክምና ያልሆነ- ቀጥተኛ እና ኢ-ቀጥተኛ ወጪዎች

ሀ. Q21. እባክዎ ከታች በተቀመጠው ቦታ ላይ በተመላላሽ ወይም በአስተኝቶ የሱስ ህክምና ማዕከል ውስጥ የታካሚውን ቀጥተኛ የህክምና ወጪዎች ይዘርዝሩ?
Q21.1 በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ የምርመራ ወጪዎች? (ነጠላ ዋጋ * የትዕዛዝ ድግግሞሽ) _____ብር
Q21.2 በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ የመድኃኒት ወይም ፋርማኮቴራፒ ህክምና ወጪዎች? _____ብር
Q21.3 በበጀት ዓመቱ ለዚህ ታካሚ አጠቃላይ የሳይኮቴራፒ ህክምና ወጪዎች? _____ብር
Q21.4 በበጀት ዓመቱ የዚህ ታካሚ ሌሎች አጠቃላይ ወጪዎች? (እንደ የመኝታ ፣ የነርሲንግ እንክብካቤ፣ የሃኪም ጉብኝት እና ለሌሎች አገልግሎት ክፍያዎች) _____ብር
Q21.5 በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ ቀጥተኛ የሕክምና ወጪዎች? **(Q21.1+ Q21.2+ Q21.3+ Q21.4) _____ብር**
ለ. Q22. በተመላላሽ ወይም በአስተኝቶ የሱስ ህክምና ማዕከል ጊዜ የታካሚውን ቀጥተኛ ለህክምና ያልሆነ- ወጪዎች ይዘርዝሩ?
Q22.1 ከቤትዎ ወደዚህ ፕሮግራም ለመድረስ ስንት ኪሎ ሜትር ተጉዘዋል? (ለአንድ ጊዜ) _____**ኪ.ሜ**
Q22.2 ከቤትዎ ወደዚህ ፕሮግራም ለመጓዝ ምን ያህል ሰዓት ይወስድብዎታል?? (ለአንድ ጊዜ) _____**ሰዓት**
Q22.3 ምን አይነት የትራንስፖርት ይጠቀማሉ? — 1. በእግር; 2. በሳይክል; 3. በባስ; 4. ሚኒባስ; 5. የግል መኪና; 6. ሌላ ካለ ይገለጽ _____
Q22.4 በ2015 የበጀት ዓመት ለምን ያህል ጊዜ **የተመላላሽ** ወይም **የአስተኝቶ የሱስ ህክምና ማዕከልን** ጎብኝተዋል? _____**ጊዜ**
Q22.5 በእያንዳንዱ የተመላላሽ ወይም የአስተኝቶ የሱስ ህክምና ጉብኝት ጊዜ ለትራንስፖርት ምን ያህል ገንዘብ አውጥተዋል? (ለአንድ ዙር ጉዞ ብቻ)_____ **ብር**
Q22.6 በጥሬ ገንዘብ ወይም በዓይነት ተጨማሪ ክፍያዎችን ፈጽመዋል? (ለአስተኝቶ የሱስ ህክምና ብቻ) — 1. አዎ; 2. አልፈጽም **(ወደ Q22.8 ይለፉ)**
Q22.7 በበጀት ዓመቱ ለዚህ ታካሚ ወደ ብር ከተቀየረ በኋላ አጠቃላይ የወጪ መጠን? _____**ብር**
Q22.8 በድምሩ ለመጨረሻ ጉብኝትዎ ጊዜ ለምግብ እና ለመጠጥ ምን ያህል ገንዘብ አውጥተዋል? **(ለተመላላሽ የሱስ ህክምና ብቻ)** _____ **ብር**
Q22.9 በድምሩ ለመጨረሻ ጉብኝትዎ ጊዜ መድሃኒት ሲወስዱ ምን ያህል የመጠለያ ዋጋ አወጡ? **(ለተመላላሽ የሱስ ህክምና ብቻ)** _____**ብር**
Q22.10 በሕክምና ክትትል ወቅት ሌሎች ወጪዎች? **(ለተመላላሽ የሱስ ህክምና ብቻ)** _____**ብር**
Q22.11. በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ ቀጥተኛ የሕክምና ያልሆኑ ወጪዎች? _____ **ብር**
ሐ. Q23. በተመላላሽ ወይም በአስተኝቶ የሱስ ህክምና ማዕከል ጊዜ የታካሚውን ለህክምና ያልሆነ ኢ-ቀጥተኛ ወጪዎች ይዘርዝሩ?
Q23.1 በ2015 የበጀት ዓመት ስንት ጊዜ በዚህ ፕሮግራም ታክመዋል? _____ጊዜ

Q23.2 በአጠቃላይ በተመላላሽ ህክምና ጊዜ ወይም በአስተኝቶ የሱስ ህክምና ማዕከል ውስጥ ምን ያህል ጊዜ አሳልፈዋል? ____**ሰዓት**	
Q23.3 ለመጨረሻ ጊዜ ስራ የሰራኽው መቼ ነበር?	1. አሁን እየሰራሁ ነው 2. ልክ ወደ ህክምና ማዕከሉ ከመግባቴ በፊት 3. ባለፉት 12 ወራት ውስጥ (**ወደ Q23.4 ይለፉ**) 4. ከ 12 ወራት በፊት (**ወደ Q23.4 ይለፉ**) 5. ስራ ጀምሬ አላውቅም (**ጥያቄውን አቁም**)
Q23.3.1 በአሁኑ ጊዜ ወይም ህክምና ከመጀመርዎ በፊት ስራ የሚሰሩ ከሆነ ይህ የህክምና በስራዎ ላይ ጣልቃ ገብቷል?	1. አዎ 2. አይደለም(**ወደ Q23.4 ይለፉ**)
Q23.3.2 በአሁኑ ጊዜ ወይም ህክምና ከመጀመርዎ በፊት ስራ የሚሰሩ ከነበረ፤ አጠቃላይ በሳምንት በዚህ ሀመም ወይም ህክምና ምክንያት በግምት ሰንት የስራ ሰዓት አባክነሀል? _____**ሰዓት**	
Q23.3.3 የስራህ ዓይነት ምን ነበር?? (N.B > 1 ሥራ ካለህ፣ ዋናውን ሥራህን ወይም በጣም የቅርብ ጊዜ ሥራህን ተናገር) _____	
Q23.4 በአሁኑ ወይም በቀደመው ሥራዎ በቀን ስንት ሰዓታት በስራ ታሳልፍ ነበር? ____**ሰዓት**	
Q23.5 ከታክስ በፊት፣ ሌሎች ጥቅማጥቅም ጨምሮ በዚያ ሥራ ውስጥ ያለው የክፍያ መጠንዎ ምን ያህል ነበር? (የክፍያ መጠን በሰዓት)_____**ብር**	
Q23.6 በበጀት ዓመቱ ለዚህ ታካሚ ጠቅላላ ቀጥተኛ ያልሆነ የህክምና ወጪዎች _____**ብር**	

ክፍል 3፡ የጤና ተቀሙን ወጪ ለመገመት የተዘጋጀ ቃለ መጠይቅ

(የአስተዳደር ኃላፊዎችን ፣ ሠራተኞችን በ መጠይቅ እና በ ምልከታ የሚሞላ)

ሀ. የጤና አገልግሎት አቅራቢዎች ቃለ መጠይቅ (ለግንባታ እና ለሰራተኞች ወጪ)

የጤና ተቃሙ ሰም፡_____ **የሚሰራበት ክፍል:**_____

የተጠያቂው ስም: _____ **ሀላፊነት:**_____

1. የህክምና ማዕከሉ ህንጻ ወጪ (ከቲም ኮርዲኔተሩ እና በምልከታ የሚሞላ)										
የክፍሉ ቁጥር	የክፍሉ ስፋት (በካሬ ሜትር)	ምን ያህሉ ለሱስ ህክምና ውሏል (%)	ክፍሉ ለተጨማሪ አገልግሎት ውሏል (%)	የኪራይ ዋጋው በካሬ ሜትር (**ብር**)	አማካይ አመታዊ የኪራይ ዋጋ በካሬ ሜትር (**ብር**)	በአማካይ ምን ያህል የሱስ ታካሚ ይጠቀመዋል	ጠቅላላ የታካሚ ቀናት (**በቀን**)	የኪራይ ዋጋ ለታካሚ ቀናት (**ብር**)	የእያንዳንዱ ታካሚ የኪራይ ዋጋ (**ብር**)	ማርገጫ
ቢሮ 1	100	50%	50%							
ክፍል 1	100	100%	-							
ቢሮ 2										
ክፍል 2										
አጠቃላይ የኪራይ ዋጋ/በሁሉም የታካሚ ቀን										
Q24. በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ የህንጻ ኪራይ ወጪ ምን ያህል ነበር? _____**ብር** ***(የእያንዳንዱ ታካሚ የኪራይ ዋጋ * እያንዳንዱ ታካሚ የሆስፒታል ቆይታ ጊዜ/ የጉብኝት ብዛት)***										

2. የባለሙያ ወጪ (ከአስተዳደር ኃላፊ እና ከደመወዝ መዝገብ የሚሞላ)

የሰራተኞች ዝርዝር			ለፕሮግራሙ የተሰጠ ጊዜ (%)	ዓመታዊ ደመወዝ (ብር)	የትርፍ ሰዓት ክፍያ (ብር)	ሌሎች ጥቅማጥቅሞች (ብር)	አጠቃላይ ወጪዎች (ብር)	ጠቅላላ የታካሚ ቀናት (በቀን)	የሰራተኛ ደመወዝ ዋጋ ለታካሚ ቀናት (ብር)	የእያንዳንዱ ታካሚ የሰራተኛ ደመወዝ ዋጋ (ብር)
ቁጥር	ስም	ማእረግ								
1	Dr XXX	Psych.	25%	10K*0.25	5K	2K*0.25	8K	4569	8K/4569	
2										
3										
ጠቅላላ ዓመታዊ የሠራተኛ ወጪ										

Q25. በበጀት ዓመቱ የዚህ ታካሚ አጠቃላይ የሰራተኛ ወጪ ምን ያህል ይሆናል? _____**ብር**

***((የእያንዳንዱ ታካሚ የሰራተኛ ደመወዝ ዋጋ)* እያንዳንዱ ታካሚ የሆስፒታል ቆይታ ጊዜ/ የጉብኝት ብዛት))**

ለ. ለሱስ ህክምና የህክምና መሳሪያዎች እና አላቂ ዕቃዎች አቅርቦት ወጪ

1. የህክምና መሳሪያዎች ወጪ

ቁ/ር	የመሳሪያዎች አይነት	በቁጥር (n)	የመጀመሪያ ግዢ ዋጋ (ብር) ‹IP›	የተገዛበት ዓመት (በወር) ‹P›	በስራ ላይ የዋለበት ዓመት (በወር) ‹O›	ወርሃዊ ኪራይዋጋ (ብር) ‹ R›	ጥቅሞ ላይ የዋለበት ዓመት (ወር) ‹U=P+O›	የቅነሳ ጊዜ (በብር) ‹D=IP/ P+O›	የሱስ ታካሚ ብዛት (በወር)		ሌሎች ታካሚዎች ብዛት (በወር)		ጠቅላላ ወርሃዊ የመሣሪያዎች ወጪ (R+ D)n	ለሱስ ታካሚ. ወርሃዊ የመሣሪያዎች ወጪ UR* TMEC
									ቁ/ር	UR	ቁ/ር	UR		
e.g.	XX	2	2500	24	18	200	42	60	90	0.64	50	.36	520	333
1														
2														
3														
ጠቅላላ አመታዊ የመሳሪያ ወጪ														

Q26. በበጀት አመቱ ለዚህ ታካሚ ከህክምና መሳሪያዎች የሚወጣው አጠቃላይ ወጪ ምን ያህል ይሆናል? _____**ብር**

***(እያንዳንዱ ታካሚ የሆስፒታል ቆይታ ጊዜ/ የጉብኝት ብዛት/ጠቅላላ የታካሚ ቀናት)* አመታዊ የመሳሪያ ወጪ)**

2. የህክምና አላቂ ዕቃዎች አቅርቦት ወጪ

S. No	የአላቂ ዕቃዎች አይነት	መለኪያ	ብዛት	ነጠላ ዋጋ (ብር)	ወርሃዊ የፍጆታ መጠን	ወርሃዊ ወጪ (ብር)	የሱስ ታካሚ ብዛት (በወር)	ሌሎች ታካሚዎች ብዛት (በወር)	የሱስ ታካሚ የአጠቃቀም መጠን	የሱስ ታካሚ ወርሃዊ ወጪ	አመታዊ ወጪ (ብር) MC*12	የሱስ ታካሚ አመታዊ ወጪ	ምርመራ
1	Drug x	Tab.	14	4.75	100	(4.75*100)/14=6650	90	50	0.64	4256	6650*12	4256*12	
2													
3													
ጠቅላላ አመታዊ የህክምና አላቂ ዕቃዎች አቅርቦት ወጪ													

Q27. በበጀት ዓመቱ ለዚህ ታካሚ ከህክምና አላቂ ዕቃዎች አቅርቦቶች የሚያወጣው አጠቃላይ ወጪ ምን ያህል ይሆናል?

_____**ብር**

(እያንዳንዱ ታካሚ የሆስፒታል ቆይታ ጊዜ/ የጉብኝት ብዛት/ጠቅላላ የታካሚ ቀናት)* አመታዊ አላቂ ዕቃዎች አቅርቦት ወጪ)