College of Health Sciences

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Assessment of intravenous antibiotics to oral conversion practice, predictors and impacts among hospitalized patients, at Tikure Anbessa Specialized Hospital, Addis Ababa Ethiopia: Prospective observational Study.

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February, 2025 G.C

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A Thesis submitted to Addis Ababa University, college of Health sciences, School of Pharmacy, Department of pharmacology and clinical Pharmacy, in partial fulfillment of the requirement for the M.Sc. program in clinical Pharmacy.

February, 2025 G.C

Addis Ababa, Ethiopia

Addis Ababa University

School of Graduate Studies

This is to certify that the thesis prepared by Mulualem Tesfaye, entitled: **"Assessment of intravenous antibiotics to oral conversion practice, predictors and impacts among hospitalized patients at Tikure Anbessa Specialized Hospital, Addis Ababa Ethiopia: Prospective observational Study**." and submitted in partial fulfillment of the requirements for the Degree of Master of Pharmacy in Pharmacy Practice, Complies with the regulations of Addis Ababa University and meets the accepted standards regarding originality and quality.

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Abstract

Background: Antimicrobials are the most prescribed medications both in hospital and community to relive and treat infectious disease. Antibiotic overuse and incorrect usage are critical factors contributing to antimicrobial resistance (AMR), which is a major worldwide health challenge. Early intervenous (IV) to oral (PO) antibiotic conversion strategy is critical for optimising its utilisation in hospitalised patients. However, the prolonged use of injections when oral formulations would be more suited is a common practice around the world.

Objective: To assess conversion practice of interavenouse antibiotics (IV) to oral (PO) counterparts, associated factors and impacts among hospitalized patients at Tikure Anbessa specialized hospital.

Method: A prospective observational study was conducted from July to October 2024 on 162 consequetively sampled patients admitted to TASH. The study assessed the practice of an early antimicrobial IV to PO conversion, its predictors and impacts. All Patients who met the inclusion criteria during the study period were included. Data entry was performed using Epidata V.4.6, and the exported data was analyzed using SPSS V.27. Descriptive statistics was used to analyze Sociodemographic and clinical characteristics of respondents. Statistical significance variables was declared at p-value < 0.05 in a multivariate binary logistic regression model, and an adjusted odds ratio with its 95% confidence interval was reported to measure the strength of association.

Result: Of 162 (52.5% female) study participants, 71 (43.8%) of them had their intravenous antibiotics promptly switched to oral forms. The most commonly used conversion practice was sequential 34(47.9%). Compared to the converted group, patients whose antibiotics were not promptly converted had a higher risk of hospital-acquired infections (91% versus 9%, P<0.001). The delay or failure to convert intravenous antibiotics to oral administration led to unnecessary expenditures, averaging 1,526.59 ± 878.28 ETB. Besides, the odds of remaing on IV antibiotics among patients with longer hospital stays, was about two times (AOR 1.95; 95% CI 1.52-2.50, P=0.001).

Conclusion: In the current study setting, IV to PO antibiotics practice is better as compared to the previous studies, but there is a need for strengthening and evaluating the implementation of the national guideline for the Antimicrobial Stewardship Program in TASH.
Keywords: *antimicrobial, intravenous, paroral, antimicrobial stewardship.*

Acknowledgment

I would like to express my heartfelt gratitude to Addis Ababa University College of medicine and health science department of pharmacology and clinical pharmacy next to God for giving opportunity to conduct this study. I also want to thank my advisor Teshale Ayele (Assistant professor) for his valuable assistance. My deepest heartfelt and great thanks go to Debre Tabor university for providing the chance for sponsorship.

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Abbreviation and Acronyms

ABURPs	Antimicrobial Use–Related Problems
AMR	Antimicrobial Resistance
CAP	Community Acquired Pneumonia
CDI	Clostridium defficile infection
GITI	Gastro intestinal Tract Infection
HAIs	Hospital Acquired Infections
IV	Intravenous
LOHS	Length of Hospital stays
LRTIs	Lower Respiratory Tract Infection
PO	Per Oral
RTI	Respiratory Tract Infection
SSI	Skin and Soft Tissue Infection
TASH	Tikur Anbessa Specialized Hospital
UTI	Urinary Tract Infection
WHO	World Health Organization

1. Introduction

1.1 Background

Antimicrobials are the most prescribed medications both in hospital and community to relive and treat infectious disease (1). Excessive and incorrect consumption of antibiotics are among important factors leading to antimicrobial resistance (AMR)—a serious worldwide health concern(2). A standardised cross-sectional point prevalence survey in Thailand in 2023 demonstrated antibiotic use was common in hospitalised patients, ranging from 14.3% to 73.4%, and antimicrobial- resistant illnesses caused a minimum of 3.24 million extra days of admission and 38 481 deaths (2). This is due to inappropriate utilization of antibiotics.

Inappropriate use of antimicrobial agents could result in antimicrobial resistance that could impact clinical outcomes (by increasing morbidity in terms of increased adverse events and risk of secondary and hospital-acquired infections and mortality) and increase costs to health care institutions (3). Thus, appropriate antimicrobial use is vital for balancing patient safety, costs and is therefore a focus for health care institutions (3). The use of inappropriate or incorrectly prescribed antimicrobials can also lead to undesirable sequelae such as Clostridium difficile infection (CDI), adverse drug responses, and antimicrobial resistance, all of which have been linked to increased patient mortality and duration of stay (4). One of the commenst means of inappropriate antibiotics utilization in hospitalized patients is prolonged use of IV formulation.

According to the World Health Organisation (WHO), irrational use of drugs is a worldwide problem that costs both patients and the health care sector (5). One of the primary causes of irrational medicine use is the overuse of injectable while medication taken by mouth would be more appropriate

Antibiotic transition from intravenous(IV) to oral (PO) is a key initiative of antimicrobial stewardship programs (6). Antimicrobial Stewardship Strategy of Intravenous to oral conversion state that the strategy has numerous benefits for patients and results in lower health care costs including reductions in adverse effects related to the intravenous catheter (e.g., infection, thrombus formation), health care worker workload, patient length of stay, and hospital costs (7,8). However, all patients may not be candidate for oral therapy.

The patient's state and the site of infection determine whether antibiotics are administered orally (PO) or intravenously (IV), for example patients with infective endocarditis, meningitis, osteomyelitis and staphylococcus auras bacteremia should treated with IV antibiotics for full course of treatment, but urinary tract infection, community or hospital acquired pneumonia , skin and soft tissue infection, intraabdominal infection and other infections may be treated with both IV and PO antibiotics, IV until they being stable then continue with oral antibiotics. The oral method of administration has numerous benefits over the IV route since it is the most convenient, easy to use, safe, simple to prepare and less costly than the IV route (8,9).

Intravenous(IV)-to-oral (PO) antibiotic switching programs have been adopted in many countries way back in the 1990s and many studies were conducted to assess the safety, efficacy and cost effectiveness of early conversion (10). But the implementation is still poor in worldwide as literatures indicated.

One of the strategies to convert antibiotics from interavenous (IV) to oral (PO) way of administration selection of antimicrobial based on bioavailability, availability of the corresponding dosage form, and potency of the antibiotics (8). Based on this there are three conversion strategies: sequential, switch and step-down therapies (8). A sequential therapy consists of converting from IV to PO agents with the same compound;while, a switch therapy is converting with an identical potency; and a step-down therapy is converting with a reduced potency (8,11,12). Sequential therapy is the practice of replacing an intravenous form of a medication with its counterpart of the same compound; switch therapy is conversion of intravenous (IV) drug to oral (PO) equivalent; within the same class and has the same leve[i]l of potency, but of a different compound; and step down therapy is converting of intravenous drug to an oral counterpart from other class or to a different medication within the same class, however, the frequency, dose, and course of antimicrobials may not be entirely the same (8,11).

Antimicrobials that have high bioavailability and available in both intravenous and oral formulations (e.g., fluoroquinolones, linezolid, cotrimoxazole, fluconazole) are prime candidates for an IV to PO conversion program and should be given orally if the patient has a functioning gastrointestinal tract, because in such cases there is no advantage to IV administration (13).

Other antimicrobials can be switched to oral agents that have similar activity (e.g., Cefazolin to cephalexin) when the patient's clinical condition has improved according to predefined criteria (e.g., afebrile, white blood cells normalize, gastrointestinal tract functioning) (13). The benefit of early IV to oral conversion therapy are significant including decreased chance of diseases caused by IV catheters, reduced additional costs and low or no risk of thrombophlebitis (11). Moreover, Administering injections involves a skilled professional, which puts an extra cost on the patient and takes away vital nursing time for caring for them (9). Despite those advantages the practice is inadequate due to different influencing factors.

Barrier that affecting IV to PO conversion practices includes clinical course relate barrier and patients related barrier (13). Comorbidity was the most generally seen barrier for patients, followed by age, failure of taking oral medication, and noncompliance with treatment (11,13). Among clinical course barriers dyspnea and patients are still ill the commonly seen barriers that is following patient feels ill, fever, dyspnea with fever and thermodynamically unstable (13). There are also other diagnostic hurdles, the most prevalent of which are ESR elevation, secondary infection, and a lack of culture availability. Physician-related barriers: the most common barrier is the physician's lack of knowledge and expertise, followed by another obstacle that is, a switch to oral agent is conceivable but left behind, and the characteristics of prescribed drugs such as the unavailability of oral formulations (14).

While physicians often believe that intravenous (IV) medications have greater bioavailability than oral medications, patients may actually experience quicker symptom relief when receiving a full course of IV therapy (5). However, for many antibiotics, the bioavailability is practically the same whether administered intravenously or orally. Furthermore, they believe that giving a full IV course of antibiotics will reduce the likelihood of reinfection(13). As a result, physicians usually opt to decide on intravenous therapy at the time of admission and continue until the patient is discharged (5).

1.2 Statement of problem

Irrational and inappropriate use of antimicrobials specifically antibiotics in humans, leads to the acceleration of the emergence of antimicrobial resistance (AMR) or antibiotic resistance (ABR). Recently, large proportion of the burden of infections occurs by resistant pathogens due to healthcare-associated infections (HAIs) (15,16). According to a standardised cross-sectional points of prevalence study undertaken in Thailand, antibiotic-resistant illnesses resulted in a minimum of 3.24 million additional inpatient days and 38 481 fatalities (1). This is because hospitalized patients experienced overuse and misuse of antibiotics, which ranged in prevalence from 14.3% to 73.4% (2). According to WHO 2024, antimicrobial resistance (AMR) has become one of the most serious worldwide public health and development risks as a result of inappropriate antibiotic usage, bacterial AMR is projected to have directly caused 1.27 million deaths worldwide in 2019 and contributed to 4.95 million fatalities (5). One of the practices responsible for inappropriate antimicrobial utilization is prolonged use of IV formulation in hospitalized patient.

Intravenous(IV)-to-oral (PO) antibiotic switching programs have been adopted in many countries way back in the 1990s and many studies were conducted to assess the safety, efficacy and cost effectiveness of early IV to PO conversion (9). Though studies demonstrated the significant benefit of early conversion of antibiotics from IV to PO formulation, the practice remains under utilized.

A retrospective observational study conducted in three Lebanese hospitals over a period of six months from 2013 to 2014, revealed out of the entire 452 antibiotic courses, 73.9% were not converted to PO in eligible patients and only 26.1% of IV antibiotics were switched to PO route (17). Another retrospective observational study involving medical chart reviews of 24 hospitalized patients in the United Arab Emirates found that only 20.8% of patients who met the criteria for switching had their antibiotics changed from IV to PO formulation (18). An investigation into the practice of switching antibiotics from IV to PO formulation over the course of six months, in a tertiary care facility in India revealed that only 43.68% of antibiotics were timely switched from IV to oral counterparts (19).

Similar studies conducted in developing countries showed the IV to PO antibiotics conversion practice remained below 50%. For example studies from Jimma specialized hospital, Gonder University of specialized hospital and Ambo university referral hospital indicated only 20.9%, 43.7% and 39.1% antibiotics respectively were timely converted (8,11,20).

Although initiating treatment with intravenous (IV) antimicrobial drugs can save lives from severe and life-threatening problems, maintaining for oral candidate patients is not always worthwhile, because it makes patients uncomfortable and leads to noncompliance as well as injection-related issues like secondary infections, lengthened hospital stays, higher costs for the time nurses, chemists and doctors spend inserting IV lines, preparing, dispensing and administering parentral medications, and Increased morbidity and mortality associated with catheter-related infections (7,8,20). After 72 hours of initial stabilisation, 83% of patients receive unnecessary IV antibiotics, resulting in a 200% increase in treatment costs and a longer hospital stay (21). This indicates that the use of parenteral antibiotics is extremely costly if the oral counterpart available and appropriate. The use of injectable antibiotics also exposes patients to additional complications such as infiltration (31.5%) and phlebitis (29.8%) (22).

According to a British demonstration on the economic analysis of lower respiratory tract infections (LRTIs), LRTIs are estimated to cost over a billion pounds per year in the United Kingdom, with hospitalised patients bearing 60% of the load. Interstingly, switching from IV to PO administration on time reduces treatment costs and saves up to £49 million, or roughly $73.5 million (22). A prospective study conducted in Ethiopia in 2019 revealed timely IV to PO antimicrobial conversion could have saved at least 29,434.72 ETB (925.33 US$) with no any additional negative clinical outcomes within three months (20). Besides, a significant difference in terms of mean length of hospital stay (LOS) (8.80±3.57 versus 3.17±0.74; p-value <0.0001) and in-hospital complication rate (p-value <0.0001) was observed (20).

However, timely antibiotic conversion from IV to PO was studied in the world, the practice is not adequately researched in resource-limited contexts, including TASH . So, this study aimed to assess the practice, predictors and impacts of the practice at TASH.

1.3 Significance of the study

Although assessment of intravenous antibiotics to oral conversion practice and barriers for the practices has been widely studied worldwide, just a few studies have been undertaken to assess the practice of early IV to PO conversion, barriers and impacts in Ethiopia, especially in TASH no study about it.

The importance of this study is to assess the practice of intravenous antibiotics conversion to oral and will point out the impact of the practice on the patient at TASH. This study also will encourage physicians to improve the reasonable early prescribing of oral antibiotics for candidate patients that will save the patient from unwanted money lose, and for the hospital it will reduce inappropriate utilization of antibiotics. This study will also inspire the antibiotics stewardship program at TASH to identify the practice gap on the conversion practice of IV antibiotics to PO counterparts. Since there is no study in TASH about IV to PO conversion practice, predictors, and consequence, The results of this research will provide one input data for defining and developing an action plan to enhance rational antibiotic usage at TASH.

2. Literature Review

Antimicrobials are the most prescribed medications both in hospital and community to relive and treat infectious disease (1). Antibiotic overuse and incorrect use are critical factors leading to antimicrobial resistance (AMR), a serious worldwide health challenge (2). A standardized cross-sectional point prevalence survey in Thailand in 2023 demonstrated the prevalence of antibiotics utilization in hospitalized patient is high and ranged from 14.3% to 73.4% and the antibiotic-resistant infections resulted in at least 3.24 million additional days of hospitalizations and 38 481 deaths (2). This is due to inappropriate utilization of antibiotics.

IV to PO conversion practice

Since the 1990s, IV to PO antibiotic conversion programs have been established in several countries; since then, many studies have been carried out that have convincingly proved the efficacy, safety, and cost effect in a health institution (19). Appropriate conversion practice from IV to PO which benefits to the patients, health care teams and hospitals by reducing risk of adverse event related to IV route; decrease the risk of hospital acquired infection, reducing time required to administer and monitor, risk of needle stick injuries, drug acquisition cost for IV formulation and reduce hospital stay (3,8,9,23) . However, the practice is poor as different studies indicated.

A retrospective observational study conducted in three Lebanese hospitals over a period of six months from 2013 to 2014 showed that 0ut of the total 452 antibiotic courses, 334 (73.9%) were not converted to PO route and continued beyond three days, and 118 (26.1%) of IV antibiotics were switched to PO route (17).

An investigation into the practice of switching antibiotics from IV to PO formulation over the course of six months, from November 2015 to April 2016, in a tertiary care facility in India revealed that 43.68% of antibiotics were converted from IV to oral formulation (19). Sequential treatment was used more frequently than switch and step-down therapy for all IV to oral conversions. Patients' LOHS had considerably decreased after switching from IV to oral antibiotics (19).

In 2015, a prospective cohort research about the efficiency of sequential IV to PO antibiotic switch therapy in hospitalized patients was conducted with a retrospective comparison cohort at Spanish referral institutions. There were 247 patients overall, 115 in the prospective group and 132 in the retrospective group. The outcome showed that 66% who switched without adhering to the suggested algorithm and 34% who did not transition to oral antibiotics (24).

An intervention study was done on 215 patients in Basel, Switzerland from April to July of 2006 and 2007 for 12 months showed that 38% of were not converted from IV to PO antibiotics. While Patients candidate for converting to oral antibiotics on the third day 61.4% were switched (9).

A retrospective observational medical chart review study conducted on 24 hospitalized patients between July 2010 and June 2011 in United Arab Emirates, the result of the study revealed that only (20.8%) patient's antibiotics were switched from IV to PO antibiotics among the patients that fulfill switching criteria. Lower respiratory tract infections (LRTIs) are estimated to cost over a billion pounds annually in the United Kingdom, with hospitalized patients bearing 60% of the load, according to a British demonstration on economic analysis of LRTIs. By switching from IV to PO administration, it was possible to reduce treatment and save as much as £49 million, or roughly $73.5 million (22).

Early IV to PO conversion had the following effects, according to a 12-month interventional research in the British Society (Mertz et al., 2009): Patients candidate for converting to oral antibiotics on the third day in 38% of episodes of continued intravenous antibiotic therapy, and 61.4% were switched. There was a 19% (95% confidence interval 9%-29%, P50.001; median, 6.0-5.0 days) decrease in the number of days of intravenous antibiotic therapy without a rise in complications (9).

A study was conducted on patients with CAP from January to March of 2001, 2002 and 2004 in Michigan, result revealed that the duration of treatment with IV antibiotics was decreased, and Clinical success on day 3 of therapy was improved since conversion of IV to PO formulation was done. In addition to this antibiotic costs were significantly reduced by $110/patient, in the pharmacy intervention sequential group (25).

Over a 12-month period, a prospective study to switch patients from parenteral to oral antibiotics was assessed to ascertain its Pharmaco economic effects on antibiotic acquisition and hospital stay. 242 patients had their clinical end goals and financial information monitored (200 converted and 42 not converted but meeting criteria). The average number of therapy days for patients who were changed to oral therapy was 1.53 days less than for patients who were not ($p=0.003$). Purchase of drugs and duration of stay both resulted in cost savings of $15,149.24 and $161,071.88, respectively (26).

Prospective Observational Study in Hospitalized Patients at Jimma University Specialized Hospital in 2014 conducted on 142 patients. Of whom two-thirds (67.6%) of the patients were eligible for IV to PO antimicrobial conversion, but the conversion was made on 20.9% of them. The study revealed that the converted group saved a total of Ethiopian birr 3074.84 (n=20), and an additional Ethiopian birr 4080.06 (n=44) could have been saved if non-converted patients had also been timely converted (11).

A prospective Comparative study at Ambo university referral hospital demonistreted that 78.6% of the study participants were clinically stable within 72 hours. Hence, timely IV to PO antibiotics conversion was done only for 39.1%, this resulted in an unwarranted spending of at least 29,434.72 Ethiopian Birrs (ETB) (671.39 USD) over three months. The intervention and comparator groups had significantly different mean lengths of hospitalisations (8.80±3.57 versus 3.17±0.74; p-value <0.0001), in-hospital complication rates (p-value <0.0001), and mean healthcare costs in ETB (652.29±403.29 versus 126.67±29.47; p-value <0.0001) (20).

Factors for conversion of antimicrobial from IV to PO

Numerous researches on the variables influencing IV to PO conversion practices have been done. Barriers to an early switch from intravenous to oral antibiotic therapy in hospitalized patients with CAP: A multicenter prospective cohort examination of adult patients admitted for IV CAP therapy in Europe found that both patient- and physician-related factors influenced early conversion from IV to PO. 149 (92%) of the 162 patients and 97 (91%) of the 107 doctors questioned had been patients. A switch to oral antibiotics was possible in 46% of patients on day 3 of treatment but was not performed in 40%. Surprisingly, 91 (94%) of the 97 physicians interviewed were unaware of guideline advice (13).

The prospective, nonrandomized, multicenter pilot trial was performed in Canton Bern and Switzerland on hospitalized SSTI patient suggest the reasons for prolonged IV treatment may include inadvertence, fear of unfavorable outcomes, or reliance on erythema or laboratory values for decision making (27).

A prospective study using observations was done for six months in Saudi by Tamilselvan (2021), on barriers of intravenous to oral antibiotics conversion and its practice in a tertiary care hospital revealed that 68.25% were timely converted from IV to oral while 31.75% were not converted. Since we got a high number of converted cases, therefore, the days of therapy (68.68%), length of hospital stay (62.21%), duration of IV therapy (60.63%) were increased for converted groups than the not converted group. Calculated estimated cost (Rs.471.59) for the treatment shown increased for the not converted group (28). Timely conversion of parentral to oral antibiotics in patients with at least 24 hours of IV therapy can shorten the duration of IV therapy and minimise treatment expenses without affecting the outcome of treatment (28).

Prospective study conducted in Ethiopia in 2014 Jimma University specialize hospital assessed factors that affect early conversion of IV antibiotics to PO and showed that presence of comorbidity was the factor that influences the practice (11). Similar study conducted at Gonder university specialized hospital determined that the poor conversion practice of IV to PO antibiotics is due to no availability of oral counterparts ; knowledge and skill of prescribers and the health care policy (8).

Generally based on the above literatures demonstration factors that influence the conversion practice of IV to PO antibiotics summarized in the following conceptual framework.

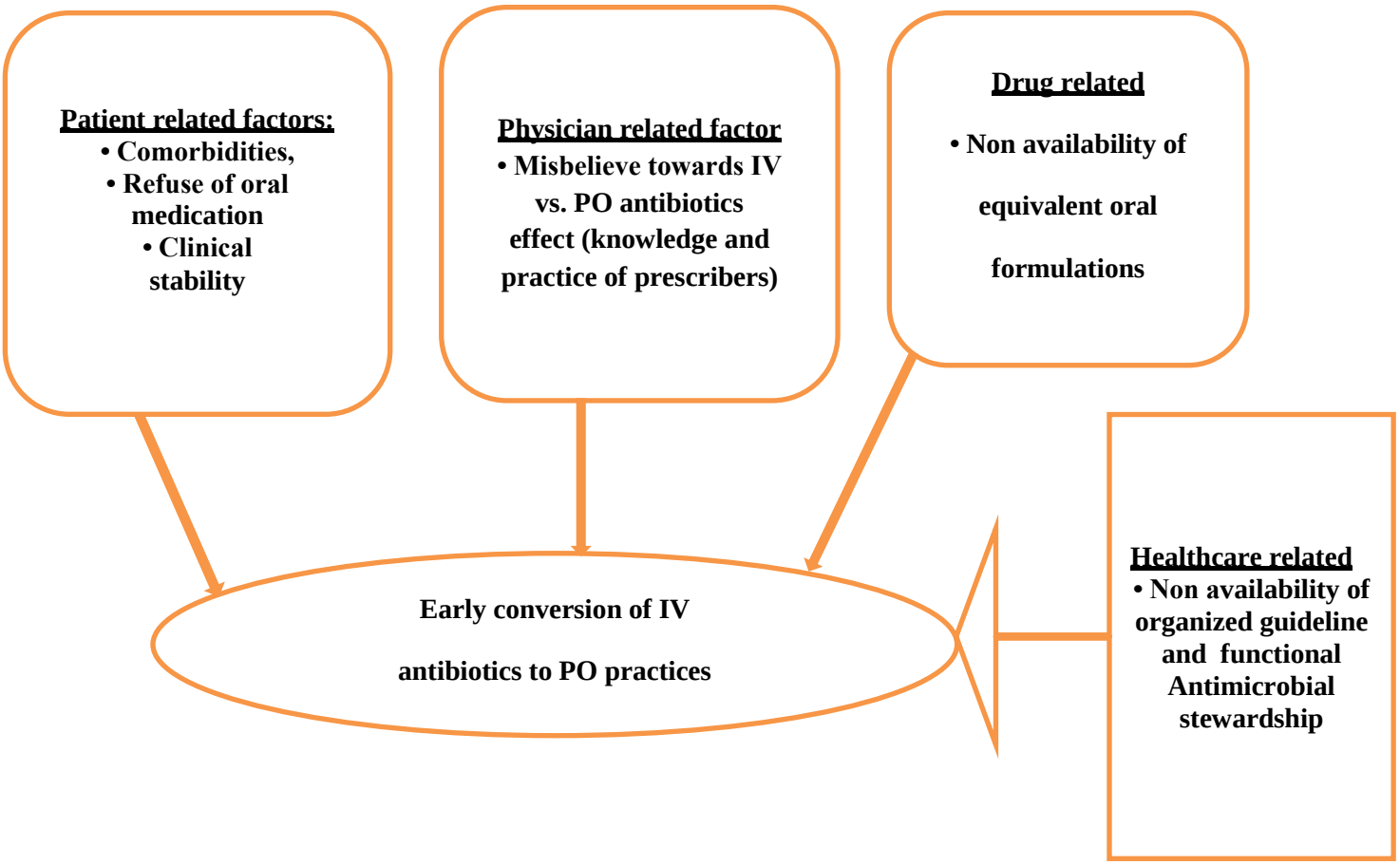

Figure 1: *Conceptual framework for factors that influence early conversion of IV antibiotics to PO based on the above literature*

3. Objective

3.1. General objective

- To assess the practice of intravenous antibiotics to oral antibiotics conversion, impacts and its predictors in hospitalized patients at Tikur Anbessa Specialized Hospital

3.2. Specific objective:

- To assess the conversion practice of antibiotics from intravenous (IV) to oral (PO)
- To determine the impact of intravenous to oral conversion practice of antibiotics
- To identify factors that associated with timely conversion of antibiotics from intravenous to oral formulation

4. Methods

4.1 Study area and period

The study was conducted at Tikure Anbessa Specialized Hospital on admitted patients in medical ward, surgical and gynecological wards from July 2023 to October, 2023. Tikur Anbessa Specialized Hospital is the largest referral hospital in the country, with 700 beds, was transferred to the School by the Federal Ministry of Health, and it has since become a University teaching hospital. The Tikure Anbessa Specialized Hospital is presently the premier teaching hospital for both clinical and preclinical training of most specialities. It is also an institution that provides specialised clinical services to the entire country that are not available at other public or private institutions. The TASH employs 200 doctors, 379 nurses, and 115 other health workers to provide healthcare services. Patient care in the hospital is provided by the School of Medicine's numerous departments, faculties, and residents undergoing speciality training. The hospital also employs 950 permanent and contract administrative personnel to support hospital operations. Furthermore, the School of Medicine provides clinical services and training at practically all regional and federal hospitals in Addis Ababa. TASH's Medical wing contains about 90 beds and treats patients with a variety of medical ailments. The medical ward is divided into four subwards: haematology, neurology, infectious disease, and cardiology.

4.2 Study Design

Hospital based prospective observational study was employed.

4.3 Source population

All patients admitted to medical, surgical and gynecology ward with the confirmed diagnosis of infectious conditions.

4.4 Study Population

All patients who meet the inclusion criteria during the study period and are admitted to a medical, surgical, or gynecological ward with a confirmed diagnosis of an infectious disease and started on intravenous antibiotics.

4.5 Inclusion and Exclusion criteria

4.5.1 Inclusion criteria

All admitted patient with the infectious disease like respiratory tract infections, urinary tract infections, Skin & soft tissue infections and gastrointestinal infections. Patients who have functional gastrointestinal tract (able to take oral food or fluid or medication and free from known mal-absorption syndrome). Patients that receiving an IV antibiotic for more than or equal to 48 hours and whom signs and symptoms of infection resolving (fever relief, normal WBC count, blood culture negative) were included in the study.

4.5.2 Exclusion Criteria

Patients who require IV antibiotics for prophylaxis, medical conditions that require a prolonged IV antibiotic use for osteomyelitis, meningitis, Staphylococcus auras bacteremia, and endocarditis, febrile neutropenia on cancer chemotherapy with absolute neutrophil count <1000 cells/mm3, unreliable oral antimicrobial response (severe nausea, vomiting, or diarrhoea), difficulty swallowing, or unconsciousness (haemodynamic instability).

4.6 Sampling technique and sample size

A consecutive sampling technique was used to collect data from all patients who fulfilled the inclusion criteria during the study period. The formal sample size calculation was not calculated due to a lack of registered data on the number of infectious diseases appropriate for a shorter duration of IV antibiotics. To manage selection bias we clearly define the target populations with clearly stated inclusion criteria and follow closely.

4.7 Study variable

4.7.1 Dependent variable

IV to PO conversion practices

4.7.2 Independent Variable

Patient related

Demographic data: sex, age, ward type

Clinical parameters: swallowing status, tolerance of Oral fluid

Length of hospital stays

Drug related

Types of antibiotics and cost of both IV and PO antibiotics

Duration of antibiotics administered

Time of switch

Disease related

Documented diagnosis (indication for antibiotic therapy),

Comorbidity and

Clinical improvement

4.8 Data collection method and tool

The principal investigator and data collectors created a patient data extraction tool and recorded data without interfering with the outcomes. The lead investigator and two data collectors checked patient charts and prescription records on a daily basis to ensure that conversion practices of interavenouse (IV) to oral (PO) were suitable, and data was gathered using a pretested data collecting abstraction format. The tool had four sections. The first portion includes socio demographic data of respondents; the second part includes indication for antibiotics, co-morbidities, allergies, and microbiological results if available. The third part includes all about antibiotics, type, rout of administration, and duration of IV administration, price of both the IV and PO. Additionally, monitoring parameters like CBC, Temperature, heart rate, respiratory rate and microbiological results were also included on the fourth part. The price of each antibiotic was obtained from the pharmacy department and from the patient.

A tool that contains standard criteria for conversion was taken from southern national guideline. To make sure the applicability of the criteria for our country, the tool was commented by experienced physicians who work at different hospitals in Addis Ababa. Based on the commented criteria, the participants were selected and followed closely.

4.9 Data Quality Assurance

In order to assure the quality of data, pretest was done in the data abstraction format before the main data be collected and appropriate adjustment was done on the data abstraction format. In addition to this, the principal investigator was closely supervising the data collectors during data collection. The collected data was checked for completeness and consistency on daily basis.

4.10 Data analysis and interpretation

Abstracted data was coded and entered in to epidemiological information (EPI INFO) version 7 and exported to statistical package for social science software (SPSS) version 27 for data analysis. Sociodemographic characteristics are presented using frequency, percentage, means and standard deviations. The connection between independent and dependent variables has been examined using multivariable logistic regression analysis. A univariate logistic regression was conducted to identify variables for inclusion in the multivariable binary logistic regression. Variables with a p-value less than 0.25 in the bivariate analysis were considered candidates. Collinearity test was conducted before proceeding with the final multivariable binary logistic regression model. Statistical significance defined as a p-value < 0.05. Statistically significant variables were established at p-value < 0.05 in a multivariable logistic regression model, and an adjusted odds ratio with a 95% confidence interval was reported to measure the strength of association. In addition to the regression t-test and chi square were done to test the difference among the timely converted and non converted group.

4.11 Ethical Consideration

First an official permission and formal letter was received from Addis Ababa University, Faculty of Health Science, research and ethics committee as well as permission also was taken from, internal medicine ward. Next, the respondents were informed about the objective and purpose of the study and also they were informed about the right of not participating in the study or withdraw at any time. Verbal informed consent was obtained from study participants after the objective of the study made clear and permission for cooperation was asked politely.

4.11 Operational definitions

- **Sequential therapy**: refers to the act of substituting a parenteral form of a drug with its oral equivalent of the same chemical.
- **Switch therapy**: depicts the conversion of an IV antibiotic to a PO counterpart; within the same class and with the same level of potency, but with a different chemical.
- **Step down therapy**: is converting parenteral antibiotics to oral equivalents with a lower potency.
- **Outcome report :** injectable antibiotics timely converted or not converted.
  - **Timely converted**: injectable antibiotics converted to counterpart oral antibiotics within 72hours.
  - **Not timely converted**: the IV antibiotics converted to PO after 72hours or not converted throughtout the full treatment for clinical stable patients

4.12 Dissemination of result

The final finding of the study will be disseminated for concerned bodies of School of pharmacy Faculty of Health Science, Addis Ababa University and Antimicrobial stewardship program group.

5 Result

5.4 Demographic characteristics of patients

Although 169 patients initially satisfied the inclusion requirements, 7 of these individuals did not finish the study. A total of 162 participants answered the questionnaire, yielding a 100% response rate. Of them 86(53.1%) patients from internal medicine ward, 43(26.5%) from gynecology ward and 33 (20.4%) from surgical ward. Majority of the participants were female 85(52.5%) and 77(47.5%) of them were male. The mean age of the participants was 38.13± 13.566. Regarding the educational background of the participants majority 43(26.5%) of them were grade 10 completed followed by those who completed college or university 41(25.3%). The table below showed demographic characteristics of the participant *(Table 1).)*

Table 1*: *Demographic Characteristics of the patient who admitted to TASH, Ethiopia (N=162

Variable	Category	Frequency	Percentage (%)
Sex of the patient	Male	77	47.5%
	Female	85	52.5%
Mean Age of patient(in years)	Mean = 38.13 SD = 13.566	_	_
Level of education	Illiterate	12	7.4%
	Read and write	28	17.3%
	Grade 10 Completed	43	26.5%
	Grade 12 Completed	38	23.5%
	College or university	41	25.3%
Type of ward	Surgical	33	20.4%
	Gynecology	43	26.5%
	Internal	86	53.1%
Total (N)		**162**	**100%**

Source: own survey SD, standared devation

5.5 Types of prescribed antibiotics and conversion practice

From a total of 162 patients who were on antibiotics and candidates for PO antibiotics, 71(43.8%) of patients' antibiotics were timely converted from intravenous to oral antibiotics. Most 66(40.7%) of the patents received ceftriaxone followed by ceftriaxone plus metronidazole 55(34%) and ampicillin 21(13%). Of those who took ceftriaxone, 56(85%) of them were on their IV antibiotics throughout the course of the treatment. From 55 patients who were on ceftriaxone plus metronidazole the antibiotics were converted from IV to PO for only 29(52.7%) of them. According to this study, high rate of IV to PO conversion was done for ampicillin and ciprofloxacin 19 (90.47%) and 9(64.28%) respectively (Table 2).

Table 2: ***Types of prescribed antibiotics and conversion practice*** **at TASH** ***(N=162)***

Variable	**Category**	**Conversion**			
				Timely converted F (%)	**Not timely converted F (%)**
		Frequency	**Percent**		
Antibiotics that the patient taken	Ceftriaxone	66	40.7	10(15)	56(85)
	Metronidazole	3	1.9	3(100)	0(00)
	Ampicillin	21	13.0	19(90.47)	2(9.53)
	Ciprofloxacin	14	8.6	9(64.28)	5(35.71)
	Ceftriaxone + Metronidazole	55	34.0	29(52.7)	26(47.3)
	Clindamycin	3	1.9	1(33.33)	2(66.66)
Type of conversion	Sequential	34	47.9		
	Switch	15	21.1		
	Step down	0	0		
	Sequential +Switch	22	31.0		

Source: own survey

Out of 71 (43.8%) timely conversions, sequential conversions were the most common, followed by sequential+switch conversions at 34 (49.9%) and 22 (31.0%) (Table 2).

5.3 Disease related characteristics of patients

5.3.1 Diagnosed infections

In this study majority 59(36.4%) of the participants were diagnosed with community acquired pneumonia. The second highest infection for cause of patient admission was GI related infections 29(17.9%) followed by Surgical site infection 26(16%) and gynecological related infection 22(13.6%). The result also showed that majority 105(64.8%) of the participants had comorbidity along with the infection. From those patients who have comorbidity; the highest percentage of comorbidity type reported was cardiovascular disease' 25(23.8%) (*Table 3)*.

Table 3: ***Disease related Characteristics of patients admitted at TASH, Ethiopia*** *(N=162)*

Variable	Category	Frequency	Percent
Type of infection	Community aquired Pneumonia	59	36.4
	GI related infection	29	17.9
	Gynecological related infection	22	13.6
	Urinary tract infection	18	11.1
	Soft tissue infection	8	4.9
	Surgical site infection	26	16.0
Presence of comorbidity	Yes	105	64.8
	No	57	35.2
Type of comorbidity	RVI	15	14.3
	DM	8	7.6
	DM+ Hypertension +HF	24	22.9
	Hypertension	10	9.5
	Heart failure	13	12.4
	TB	6	5.7
	Asthma	4	3.8
	Other cardiovascular disease	25	23.8

Source: own survey

5.4. Short term Impacts of intravenous antibiotics to preoral antibiotics conversion practice

As the result in *Table 4* below revealed; there was asignificant difference among the patients whose antibiotics timely converted and the non converted once interms of length of hospital stay , hospital aquired complication, pain complaing and treatment cost. There was a significant difference in hospital stay among patients whose intravenous antibiotics were not timely converted to the oral formulation. Non-converted group had longer hospital stays than that of the converted group (6.90±2.489 vs 15.25±4.396;*p<0.0001).* From the total participants 55(34.%) were developed hospital acquired infection, of those 50 (91%) of them were patients whose IV antibiotics were not converted to oral alternatives, this indicated prolonged use of IV antibiotics had high rate of hospital acquired infections compared to antibiotics that timely converted to oral counterparts (91% vs 9%, P<0.001). Also the rate of complain of injection site pain among the timley converted and not converted group was significantly different (33% vs 67% *P<0.003*).

The result revealed that the lost cost due to lack of conversion from IV to PO showed that unnecessary expenditure of treatment cost. On average 1,514.89birr ±878.942 was lost due to lack of timely converting antibiotics from IV to PO form. This was significant difference on treatment cost among the converted and non converted patients (*P<0.001).* If the conversion was made on time, a total expected cost savings of 107,557.19 EBC might be achieved in four months. The true cost might be higher than this if indirect cost and cost of productivity was calculated. Due to such need of additional money, 12(16.9%) of those patients whose antibiotics were not timely converted to oral formulation were not able to adhere to their treatment.

Table 4:*short term impacts of early IV to PO antibiotics conversion practice*

Variable	**Category**	**Frequency (%)**	**Timely conversion**		**p- value**
			Yes N (%)	**No N (%)**	
Develop hospital acquired infections(HAI)	Yes	55(34.0)	5(9)	50(91)	<0.001 *
	No	107(66.0)	66(62)	41(38)	
Complain pain	Yes	94(58.0)	31(33)	63(67)	<0.003*
	No	68(42.0)	40(59)	28(41)	
Develop injection site infection	Yes	5(3.1)	0(0)	5(100)	-
	No	157(96.9)	71(45)	86(55)	
Non-adherence due to cost	Yes	12(7.4)	3(25)	9(75)	0.172
	No	150(92.6)	68(45)	82(55)	
Mean Lost cost from not converted(in birr)			-	**1,526.6 ±878.9**	< ***0.001*****
Mean Length of hospital stay (in days)			**6.90±2.849**	**15.25±4.396**	**0.000****

Source: own survey chi-square, t-test***

5.5 Factor associated with the conversion practice of interavenouse to oral antibiotics

According to the results of the multivariable logistic regression, type of infection and length of hospital stay (LOHS) were found to be substantially connected with the timely conversion practice of antibiotics from IV to PO counterparts.

The type of infection significantly affects conversion likelihood; for instance, patients diagnosed with urinary tract infections (UTIs) significantly reduce the risk of IV antibiotics being not timely converted to oral counterpart compared to pneumonia (AOR: 0.181 CI: 0.02-0.32, P= 0.031). Our investigation revealed that patients with longer hospital stay increased the probability of antibiotics not being converted to oral equivalents (AOR 1.95; 95% CI 1.52-2.50, P=0.001). *(Table 5)*. The results demonstrated that the length of hospital stay (LOHS) had diminished dramatically following IV to oral conversion.

Table 5: ***Factors associated with the conversion of Antibiotics from IV to PO at TASH, Ethiopia(N=162)***

Variable	Category	Timely conversion Iv to po		COR (95%CI)	p-value	AOR (95% CI)	P-value
		Yes	No				
Sex	Male	24	53	2.73 (1.43-5.20)	0.002	2.69 (0.56-12.87)	0.215
	Female	47	38	1		1	
Age				1.07 (1.04-1.10)	0.001	1.00 (0.95-1.05)	0.970
LOH				1.76 (1.49-2.10)		1.95 (1.52-2.50)	**0.001***
Type of ward	Surgical	18	15	1		1	
	Gynecology	34	9	0.32 (0.12-0.87)	0.025	0.40 (0.05-3.13)	0.383
	Internal	19	67	4.23 (1.80-9.94)	0.001	0.50- 20.71	0.219

Infection types diagnosis	Pneumonia	10	51	1		1	
	gi infection	10	19	0.37(0.134-1.04)	0.058	0.68 (0.08-5.94)	0.725
	gyn infection	18	4	0.04 (0.01-0.16)	0.001	2.61 (0.11-63.17)	0.554
	UTI	11	7	0.12 (.04-0.40)	0.001	0.18 (0.02-0.32)	**0.031***
	soft tissue infection	22	10	0.09 (0.03-0.24)	0.001	0.27 (0.04-2.02)	0.200
Comorbidity	Yes	35	36	0.20 (0.10-0.38)	0.001	0.60 (0.14-2.69)	0.508
	No	72	19	1		1	
Hospital acquired infections	Yes	5	66	14.73 (5.43-39.97)	0.001	0.48 (.06-3.93	0.496
	No	48	43	1		1	
Pain complaining	Yes	31	40	2.63 (1.38-4.98)		0.86 (.20-3.62)	0.836
	No	61	30	1		1	
Improvement	Yes	45	26	0.11 (0.06-0.24)	0.001	0.78 (0.18-3.47)	0.749
	No	15	76	1		1	
Non-adherence	Yes	3	9	0.40 (0.10-1.54)	0.184	0.42 (0.0-244.41)	0.791
	No	68	82	1		1	

⁎Significance (P < 0.05). AOR, adjusted odds ratio; TASH, Tikure Anbessa Specialized hospital; CI, confidence interval; IV, intravenous; PO, per oral.

Source: own survey

6. Discussion

This study was a four months prospective observational study conducted on 162 patients who fulfilled our inclusion criteria and admitted to medical, surgery, and gynecology and obstetrics wards. The primary aim of this study was to assess intravenous antibiotics to oral antibiotics conversion practice, asses the predictors and its impacts on hospitalized patients at Tikure Anbessa Specialized hospital. This study revealed that majority of respondents were from internal medicine and surgical ward 76(57%); majority of the respondents were female 85(52.5%). The mean age with standared devation was 38.13± 13.566 and 43(26.5%) of them completed grade 10.

In this study of 162 patients ; only 43.8% of the patients' antibiotics were timely converted from intravenous to perioral. This indicates beyond half percent of antibiotics utilization was inappropriate in this study area. Similarly; studies conducted at University of Gondar Specialized hospital and Ambo university referral hospital reported a total of 34.57% and 39.1% of patients who were taking IV antibiotics their antibiotics was converted to PO (8,20). Also a study conducted at Jimma specialized hospital showed that timely conversion of IV to PO for those patients' under study was only 20.9% (11). In parallel; studies conducted in India, Lebanon and United Arab Emirates showed that the proportion of antibiotics converted from IV to oral formulation for sample patients under study was 43.68%, 26.1% and 20% respectively (19,17,18). This indicates the early conversion practice of IV antibiotics to PO alternatives is advantages but still poorly practiced in the world.

The finding of this study also showed that ceftriaxone 66(40.7%) followed by ceftriaxone plus metronidazole 55(34%) were highly prescribed in study setting. Comparable evidence also reported that; ceftriaxone was the most commonly recommended antibiotic for empiric treatment (45.4%), followed by metronidazole (33.2%) (8).

Moreover; the sequential type of conversion 34(47.9%) commonly practised followed by sequential +switch 22(31.0%) . Sequential type of conversion is also reported in different studies as a frequent practice (17,19). Parallel study in Ethiopia also reported the most frequently utilized type of conversion practice was 'Sequential' (23.1%), followed by the' Switch' type of conversion (7.4%) (8).

Evidence demonstrated that unnecessary utilisation of intraveounse antibiotics resulted in higher risk of infusion reactions, prolonged hospital stay, a higher risk for antimicrobial resistance and medical management costs. In this study of 162 patients investigated, 55 of them developed hospital-acquired infections (HAI). The difference is statistically significant as compared to those who experienced timely IV to PO conversion; 50 (91%) verses 5(9%), *P< 0.001.* Complaints of injection site pain were reported from 94 respondents, and of them 63(67%) were under the group whose IV antibiotics were not timely converted. According to a study conducted on 'Transition to Oral Antibiotic Therapy for Hospitalised Adults With Gram-Negative Bloodstream Infections'; extended treatment with intravenous antibiotics in the hospital or in the outpatient setting poses risks, such as phlebitis, venous thromboembolism, catheter occlusions, and catheter-related bloodstream infections, in addition to major patient discomfort and nursing workload (33). Further a recent cohort study reported; the proportion of individuals who died was higher in the group receiving prolonged IV treatment (34).

The result showed that the duration of hospital stay has dramatically lowered following the IV to PO switch. Our study showed that patients who fulfilled the conversion criteria of parentral antibiotics to oral alternatives and timely translation had a shorter average length of hospitalization than that of the non-converted (6.90±2.849 vs 15.25±4.396;P<0. 001). Similar evidence from India shows that length of hospital stay for patients had significantly decreased following IV to PO conversion of antibiotics in comparison to patients whose antibiotics were not converted from IV to PO formulation ($p<0.05$). In conversion practice of IV to PO therapy, a verage period of hospital stay of patients was 6.84 days whereas, in case of non-converted antibiotics , mean period of hospitalization of patients was 8.71 days (19). A study from Switzerland also reported the median duration of hospitalization was 5 days for those whose IV was converted to PO and 8 days for the comparable group (27). Comparable study from India also showed; mean LOHS for IV to oral converted cases was 4.58days and 5.86days for non-converted cases (28). This might increase hospital complication and increase the need of additional treatment cost. Literatures also showed that the conversion of IV to PO form antibiotic reduce the number of days of IV antibiotic treatment by 19% with no increase in complications and complain of pain (9). Similarly, compared with those who stayed for less or equal to 20 days, patients that stayed for ≥ 21 days were about 4 times more likely to have Antimicrobial use–related problems (35). This fact is also supported by several studies; most

studies evaluating IV to PO conversion programs have demonstrated favorable economic outcomes and a positive impact on clinical outcomes (3). Our result also supported by study conducted in Gondar hospital stay of more than 10.78 days increased the probability of IV medicine not being translated to oral antibiotics by 1.82 times compared to patients who stayed for less than 10.78 days (8). Similarly studies conducted at Ambo and Jimma supported our result (20, 11). This finding is supported by the fact that; one of the advantages of IV to PO conversion is earlier discharge. Early switch over to oral medications can help to overcome the requirement of injection administration in hospital setting and facilitate early discharge (18,24).

Due to prolonged use of intravenous antibiotics, economic burden on the patient as well as on the health service is common. Our result showed that the mean cost difference among the converted and non-converted groups was significant (1,514.89 birr ± 878.942; $P < 0.001$). If the conversion was made on time, a total expected cost savings of 107,557.19 EBC might be achieved in four months. Associated with this unnecessary cost expenditure there were non-adherence to complete the full course of treatment. Non-compliance with treatment was also noted, which could be attributed to a prolonged hospital stay and the need for extra treatment. Of 162 patients, 12 (7.4%) were unable to adhere to their treatment. This finding is in line with a study conducted in Ethiopia that reported; a significant difference in terms of the mean cost of healthcare in ETB (652.29±403.29 versus 126.67±29.47; P <0.0001) between the converted and not converted group respectively (20). According to data from a prospective cost-minimization analysis interventional study conducted in India, the average antimicrobial treatment cost for a patient in the IV medication and converted groups was Rs 4519.50 and Rs 3167, respectively. Antibiotic treatment costs were lowered by Rs. 1352 per patient **(7).** Evidences also showed that; by switching from IV to PO administration, it was possible to reduce treatment and save as much as £49 million, or roughly $73.5 million (22,21). This indicates that the conversion of IV to PO forms of antibiotics decreases a medical cost for both the patients and the hospital in general.

According to the results of the multivariable logistic regression, type of infection and length of hospital stay (LOHS) were found to be strongly correlated with the timely conversion practice of antibiotics from IV to PO counterparts.

The results revealed that the duration of hospital stay had dramatically shortened following IV to PO conversion. Our study found that patients with lengthy hospital stays had a higher risk of

antibiotics not being switched to oral counterparts on time (AOR 1.95; 95% CI 1.52-2.50, *P=0.001*) (Table 5). A research in Gondar found that patients who were in the hospital for more than 10.78 days had a 1.82 times higher probability of IV antibiotics not being converted to PO antibiotics compared to those who stayed for less than 10.78days (8). Similarly studies conducted at Ambo and Jimma showed shorter duration of IV therapy was recorded for converted compared to non converted patients (8.80±3.57 versus 3.17±0.7 p <0.0001) and (2.80±1.87 versus 8.50±6.32, *P*=0.009) respectively (20, 11).

This study showed that the type of infection that the patient was diagnosed with was one of the factors that influenced the conversion practice of IV antibiotics to PO alternatives; UTI was less likely to be in the category of IV antibiotics not timely converted to oral counterparts compared to pneumonia (AOR 0.18; 95% CI 0.02-0.32 P=0.031). According to the literature, urinary tract infections, some Gram-negative bacteremia, acute exacerbations of chronic lung illness, and skin and soft tissue infections are suitable for the early conversion of IV antibiotics to PO formulations (31). The other contrast evidence also showed; Community-acquired pneumonia (CAP) patients switched early had fewer days on IV antibiotics, shorter duration of inpatient antibiotic treatment, shorter LOS, and lower hospitalization costs (32).

7. Strength and Limitation of study

7.1. Strength

This prospective observational study provides useful insights by collecting both objective and subjective data on the timely conversion of intravenous antibiotics to preoral counterparts. It encourages health professionals to focus on this critical practice, since this study attempted to magnify the influence of conversion practice on hospital complications and economic burden**.**

7.2 Limitation of study

This study has various limitations that should be taken into account when evaluating the results. The study's first disadvantage was its small sample size and single-center design, which limits its generalisability. The second issue was that this study attempted to assess just the short-term impacts, not the impacts after discharge. On cost assesment only direct medical cost was calculated.

8. Conclusion

The finding of this study showed that the percentage of antibiotics conversion practice from intravenous (IV) to oral (PO) was below 50%, but it showed better progress as compared to the previous studies. The finding also revealed that unnecessary treatment expenses, extended hospital stays, and health-care-related issues were identified as short-term impacts of conversion practice. Type of infection and length of hospital stay were identified factors that significantly colerated to conversion practice. Generally, timely conversion of IV antibiotics to PO counterparts for candidate patients is essential to the patient as well as the hospital.

9. Recommendation

Based on the finding of this study the following recommendation is drawn:

To Tikure Anbessa specialized hospital

- Promote the importance of IV to PO conversion practice among health care professionals by providing trainings and awareness creation programs
- Arrang and schedule patient education program about the benefit of PO therapy.

To Ethiopian Ministry of health

- Strengthening and monitor the implementation of a functional Antimicrobial Stewardship Program in Hospitals.
- Evaluate the utilization of the national guideline for Antimicrobial Stewardship Program in Hospitals

To future researchers

- Explore the impact of IV to PO conversion on antimicrobial resistance: The study found that prolonged courses of IV antibiotics are associated with increased length of hospital stay and increased costs. Researchers can explore the impact of IV to PO conversion on antimicrobial resistance, as inappropriate and unnecessary antimicrobial usage can lead to an increase in healthcare costs and pathogen resistance.
- Investigate the impact of in-hospital observation period after a patient is changed to oral treatment. Researchers can investigate the impact of in-hospital observation period after a patient is changed to oral treatment, including the impact on clinical outcomes, cost-effectiveness, and patient satisfaction
- Develop and test interventions to increase IV to PO conversion rates: This study discovered that a large proportion of patients are not converted from IV to PO. Researchers can create and test methods to enhance IV to PO conversion rates, such as educational interventions, clinical decision support systems, and quality improvement initiatives:.

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Annex I: Data Collecting Tool

MRN…….…….

Date of admission----------

Ward…….

PART I-Patient Related Factors

	Demographic variables		**Mark✓ that apply**
	Item questions		
1	Gender	Male	
		Female	
2	Age in years		
3	Educational status		
4	Marital status	Single	
		Married	
		Divorced	
		Widowed	
5	Income level		
6	Residence	Rural	
		Urban	
	Clinical parameters		
7	Able to swallow and tolerate oral fluids	Yes	
		No	
8	Length of hospital stays(LOHS)		
9	Final status of the patient	**a)** improved and discharged	
		b**)** develop hospital infection (HAI)	
		c) develop injection site pain	

		d) IV line infection (ISI)	
		e) non-adherence due to cost issue	

Part II: Drug Related Factors

	Item questions	**Mark ✓ that apply**	
1	Drug allergy history(hx)	Yes _____	No_____
1.1	Type of antibiotics (Name and dose)	_____	
2	IV antibiotics start dated	_____	
2.1	Duration of IV antibiotics	_____	
3	Time of switch		
4	Patient candidate for PO antibiotics (*based on the criteria*)	Yes	No
	The IV antibiotics statues		
5	Is the IV antibiotic converted to PO?	Yes	No
5.1	If not (describe the reason)		
5.2	If yes , from what IV to what oral antibiotic	_____ IV	to_____oral
5.3	If yes :type of conversion	Sequential	
		Switch	
		Step-down	
5.4	Price of IV antibiotics		
	Cost per dose	_____	
	Total cost of the iv antibiotics	_____	
5.5	Price of the corresponding oral antibiotics		
	Cost per dose		
	Total cost oral antibiotics		
5.6	Lost cost from not converted	_____ ____	

PART III: Disease related factors

	Item questions	**Mark ✓ on that apply**

1	Documented diagnosis (indication for antibiotic therapy),		
2	Presence of comorbidity	Yes___	No_____
3	Type of comorbid		
4	Clinical improvement		
	Temperature less than 100°F for at least 24 hours	Yes___	No_____
	Heart rate <100bpm for previous 12hrs	Yes___	No_____
	White blood cell count decreasing toward normal range	Yes___	No_____
	Improving chest X-ray findings	Yes___	No_____

Annex II:

IV to PO conversion criteria Prepared from northern health Clinical Practice Standard guideline and Society for healthcare epidemiology of American (SHEA),

Convert the drug from parenteral to oral option if all the following criteria are fulfilled (if all parameters show "YES")

A: Diagnosis		
The patient DOES NOT HAVE any of the following exclusions. *(Meningitis have encephalitis or brain abscess other CNS infections; Endocarditis; Deep-seated infection e.g., abscess/empyema; Necrotising soft tissue infection; Staphylococcus aureus bacteremia; Infected implant or prostheses; Osteomyelitis; Septic arthritis or orbital cellulitis and endophthalmitis)*	□ Yes	□ No
B1: patient condition		
The patient DOES NOT HAVE the following hemodynamic instability of exclusion. *(Tachycardia (HR>100 b/m), hypotension (SBP <90 mmHg), tachypnoea (RR <20 breaths/min), or signs of sepsis/shock*	□ Yes	□ No
B2: patient condition		
Is the patient clinically improving? *(Afebrile for >24 hours)*	□ Yes	□ No
Is the patient clinically improving? *(Normalizing or decreasing WBC, normal ESR or other sepsis markers (CRP) if available)*	□ Yes	□ No
C: oral intake		
Does the patient tolerate oral (or NGT) foods/fluids? *(Patient can take oral food/medications, or oral absorption is not compromised ,no severe vomiting and diarrhea, No gastrointestinal obstruction, ileus, malabsorption syndrome, active gastrointestinal (GI) bleed)*	□ Yes	□ No
D. Antibiotics exposure		
Is the patient take IV antibiotics for treatment for more than or equal to 48hrs?	□ Yes	□ No