



**Addis Ababa University College of Health Sciences**

**School of Public Health**

**Master of Hospital & Health Care Administration**

**Reducing Turnaround Time for CD4 Laboratory Test Results in Wukro Hospital**

**By Alem Gebretsadik**

Primary Advisor: **Mesfin Addise** (MD, MPH) Addis Ababa University

Secondary Advisor: **Christina Yuan** (MPH) Yale University

**A final capstone report submitted to Addis Ababa University, College of Health science, School of Public Health in partial fulfilment of the requirement for the degree of Masters in Hospital and Health Care Administration**

October 2013

Wukro, Tigray, Ethiopia

# Addis Ababa University College of Health Sciences

## School of Public Health

### Master of Hospital & Health Care Administration

#### Capstone Project Submission Form

Name of investigator	Alem Gebretsadik, Medical Laboratory Technologist
Name of advisor	Mesfin Addise (MD , MPH) Addis Ababa university
	Christina Yuan (MPH) Yale university
Full title of the project	Reducing Turnaround Time for CD4 Laboratory Test Results in Wukro Hospital, in Wukro, Tigray, Ethiopia.
Study project	Pre-post study on January to march and June to August 2013 respectively
Area of the project	Wukro Hospital, Tigray
Total cost of the project	6,050 Ethiopian birr
Address of investigator	Mobile: +251914754564
	E-mail: <a href="mailto:aglab2006@gmail.com">aglab2006@gmail.com</a>

October 2013

Wukro, Ethiopia

## **Acknowledgements**

I am grateful to thank God with his mom St. Mary, the almighty for giving me health and availing me the strength and patience to complete this capstone research.

I am thankful to my advisors **Dr. Mesfin Addisse** and **Christina Yuan** for their continuous support providing me valuable comments and suggestions for my project work.

I am indebted to Wukro hospital Medical Director, **Dr. Mehari Desalegn**, and my colleagues at Wukro hospital laboratory for their unreserved support in my project.

Many thanks go to **Dawit Tatek** , **Zahirah**, **S/r Haregeweiny Alemu** and **Adrienne Hall** for their support and direction.

My sincere thanks go to Tigray Regional Health Bureau, Addis Ababa University, School of Public Health, Master of Health Care and Hospital Administration program, and Yale University for providing admission to this program.

## Table of Contents

## Page

List of Tables	5
List of Figures	5
Abbreviations	6
<b>Summary</b>	<b>7</b>
<b>1. Introduction</b>	<b>8</b>
1.1 Health Facility	8
1.2 Statement of the problem	9
1.3 Objectives	10
1.4 Root cause	10
1.5 Literature review	13
<b>2. Methodology</b>	<b>17</b>
2.1 Project Area and Study Design	17
2.2 Source Population	17
2.3 study population	17
2.4 Sampling/study unit	17
2.5 Data Collection Procedure	17
2.6 Data quality assurance	17
2.7 Measurement and data analysis	18
2.8 Ethical consideration	18
2.9 Plan for dissemination	18
2.10 Operational definitions	18
<b>3. Strategic Options</b>	<b>19</b>
<b>4. Interventions</b>	<b>19</b>
<b>5. Implementation</b>	<b>20</b>
<b>6. Results</b>	<b>21</b>
<b>7. Discussion</b>	<b>24</b>
<b>8. Strength and limitations</b>	<b>26</b>
<b>9 Conclusion and recommendations</b>	<b>27</b>
<b>10. Annexes</b>	<b>27</b>
<b>11. References</b>	<b>29</b>

## List of Tables

page

<b>Table 1:</b> Number of employees by Profession in Work Hospital ,Tigray region Northern Ethiopia 2005 E.C	Page 8
<b>Table 2:</b> Comparison of Pre and Post Intervention data of Turnaround time of CD4test results in Wukro Hospital, Tigray region northern Ethiopia 2013	Page 18
<b>Table 3:</b> Comparative Analysis of Strategic Options by using quantitative Decision Matrix in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 19
<b>Table 4:</b> Project Work Plan to solve the long turnaround time of CD4test results in Wukro Hospital , Tigray region northern Ethiopia 2013.	Page 20
<b>Table 5:</b> the Pre and Post Intervention Data Sample collection in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 21
<b>Table 6:</b> Pre Intervention results for turnaround time of CD4 test in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 21
<b>Table 7:</b> Post Intervention results for turnaround time of CD4 test in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 22

## List of Figures

<b>Figure 1:</b> fishbone diagram contains the generated root causes for long turnaround time of CD4 test result in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 11
<b>Figure 2:</b> Pre post Comparison of Turnaround time for CD4 test results from Sample Collection up to result receiving in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 22
<b>Figure 3:</b> Pre post Turnaround time mean for CD4 test results in Wukro Hospital, Tigray region northern Ethiopia 2013.	Page 23

## Abbreviations

ART	Anti-Retrovirus Treatment
CD4	Cell Differentiations
CEO	Chief Executive Officer
EHNRI	Ethiopian Health and Nutrition Research Institute
EHRIG	Ethiopian Hospital Reform Implementation Guidelines
EQAS	External Quality Assessment Scheme
IQC	Internal Quality Control
KPI	Key Performance Indicator
MCH	Maternal and Child Health
MOH	Ministry of Health
OPD	Outpatient Department
QC	Quality Control
SLMTA	Strengthening Laboratory Management Towards Accreditation
SMT	Senior Management Team
SOP	Standard Operational Procedure
TAT	Turnaround Time
TRHB	Tigre Regional Health Bureau
WHO	World Health Organization

## Summary

Laboratory turnaround time is defined as the length of time from when a test is ordered to the time the result is reported. Various factors such as the type of test, level of urgency, and varying operational procedures have an impact on the turnaround time of laboratory investigations, with longer turnaround times having a negative impact on patient and staff satisfaction. The standard operational procedure for Wukro Hospital is to collect samples from 8:00am to 12:00pm and begin processing at 2:00pm. Under this process patients wait up to 6 hours for tests results which negatively satisfaction. In order to improve the quality of service delivery and increase patient and staff satisfaction the overall efficiency of the laboratory needs to be addressed. This project focuses on the impact of immediate processing of CD4 tests in reducing turnaround time and increasing patient and staff satisfaction at Wukro Hospital.

**Objective:** To reduce turnaround time of CD4 tests from 3-6 hours to an average of 2 hours in Wukro Hospital by the end of August 2013.

**Methodology:** A pre-post study was conducted in wukro hospital From January to March 2013 baseline data was collected on CD4 result turnaround times for 586 patients under the batch processing method and Follow-up data was collected on the turnaround time for receiving CD4 tests results from 640 patients after immediate processing was introduced during June to August 2013.

**Results:** Before the intervention, the average TAT for CD4 test results was 4.38 hours (4.27-4.49 95% CI). The mean TAT decreased to 2.01 hours (2.00-2.04 95% CI) after the intervention ( $P < 0.0001$ ). After introducing the immediate processing method the maximum TAT was 2.5 hours, with the majority of patients **556/640 86.9 %** receiving their results in 2 hours or less.

### **Work Plan and Budget:**

The study was conducted from January - August 2013, with a total required cost of 6,050ETB.

### **Conclusion:**

Processing CD4 tests immediately after sample collection was effective in reducing turnaround time and increasing patient, staff, and community satisfaction. With a more efficient system of laboratory service the hospital can communicate to the community its commitment to service quality by setting the expectation standard for Wukro Hospital at 2 hours for CD4 exam results.

### **Recommendations**

Acceptance TAT of CD4 test is important for health facilities.

It is important to assess the turnaround time of the other laboratory tests.

# 1 Introduction

## 1.1 Health facility

Wukro is located 850 kilometres from the capital city of Ethiopia, Addis Ababa, and 46kilometers north of Mekele in the Tigre Regional State of Ethiopia.

Work Hospital began as a clinic during the imperial regime of Hail Selassie. During the military regime in the 1970<sup>s</sup> it was renamed as a health center although no new infrastructures were added. In 1993 G.C. the health centre was renamed as district hospital serving a population around 200,000.

Based on the 2005 E.C. report for Work Hospital a total of 55,000 patients were served and 34,000 laboratory tests were done during the same year. Currently the hospital has 194 employs (98 technical, and 96 administrative), has 90 operational beds, serves a population above 500,000 from nearby surrounding Woredas, and has an inpatient average length of stay of 5 days.

**Table 1: Number of employees by Profession in Work Hospital, Tigray region Northern Ethiopia 2005 E.C**

<b>S.N.</b>	<b>Profession</b>	<b>Number</b>
1	Physician (Medical Doctor)	3
2	Physician (Dentist)	0
3	Clinical Nurse	48
4	Laboratory Technologist	2
5	Laboratory Technician	7
6	Pharmacist	3
7	Pharmacy Technician	8
8	Midwife (Diploma)	7
9	Health Officer	5
10	Nurse (BSc)	6
11	X-Ray (Diploma)	3
12	Anaesthesia Nurse	1
13	Physiotherapist (Diploma)	1
14	Ophthalmic Nurse	1
15	Dentist Technician	1
16	Emergency Surgeon	1
17	Paediatrician	1
18	Administrator	96
	<b>Total</b>	<b>194</b>

**The vision** of Work Hospital is: To be a model hospital in high quality care, operational research and community ownership in Ethiopia.

**The mission** of Work Hospital is: To reduce morbidity, mortality, and disability by: providing basic curative & rehabilitative services, encouraging community participation, collaborating with other stakeholders, conducting operational research and creating a conducive hospital environment to retain a well-qualified health personnel for the benefit of the community.

## **Major Services**

Work hospital offers the following services to the catchment population:

- Outpatient
- Inpatient
- Emergency
- Major and Minor Operation
- Maternal and Child Health
- Comprehensive ART care and support,
- Delivery service
- Ophthalmic, Dental, and physiotherapy services.
- Diagnostic Services (laboratory and x-ray)
- Pharmacy Services
- Training and Capacity Building

### **1.2 Statement of the problem**

Long turnaround time of CD4 test results in Work Hospital

- The time taken to receive results was more or delayed.
- Turnaround times of laboratory investigation and reporting for CD4 tests in Work hospital was long and non-standardized.

Long turnaround time results in complaints from patients and staff, crowdedness of waiting areas, most of the ART patients are sensitive so they complain due to delay to receive results

Long turnaround time of laboratory results causes dissatisfaction of patients and clinicians, unwanted wastage of money due to wait for long time,

Due to this reason the hospital management decides to solve the problem caused by long turnaround time of CD4 test results

a process intervention was introduced in order to reduce laboratory turnaround times, and improve patient and staff satisfaction.

## 1.3 Objectives

### General Objective:

To reduce Turnaround Time for CD4 Laboratory Test Results in Wukro Hospita

### Specific Objectives:

- To reduce turnaround time for CD4 Laboratory Test Results from 3-6 hrs to 2 hrs in Wukro hospital by the end of August 2013.
- To decrease waiting time of patients for CD4 result by reducing TAT.
- To decrease complains of patients due to delayed CD4 results.

## 1.4 Root Cause Analysis

In order to identify the root cause of delayed TAT for CD4 test results a focused group discussion was conducted with professionals from key departments concerned with the effect on ART patients. (See Annex 1: Focus Group Participants). The group explored the potential root causes and for long turnaround times of lab investigations.

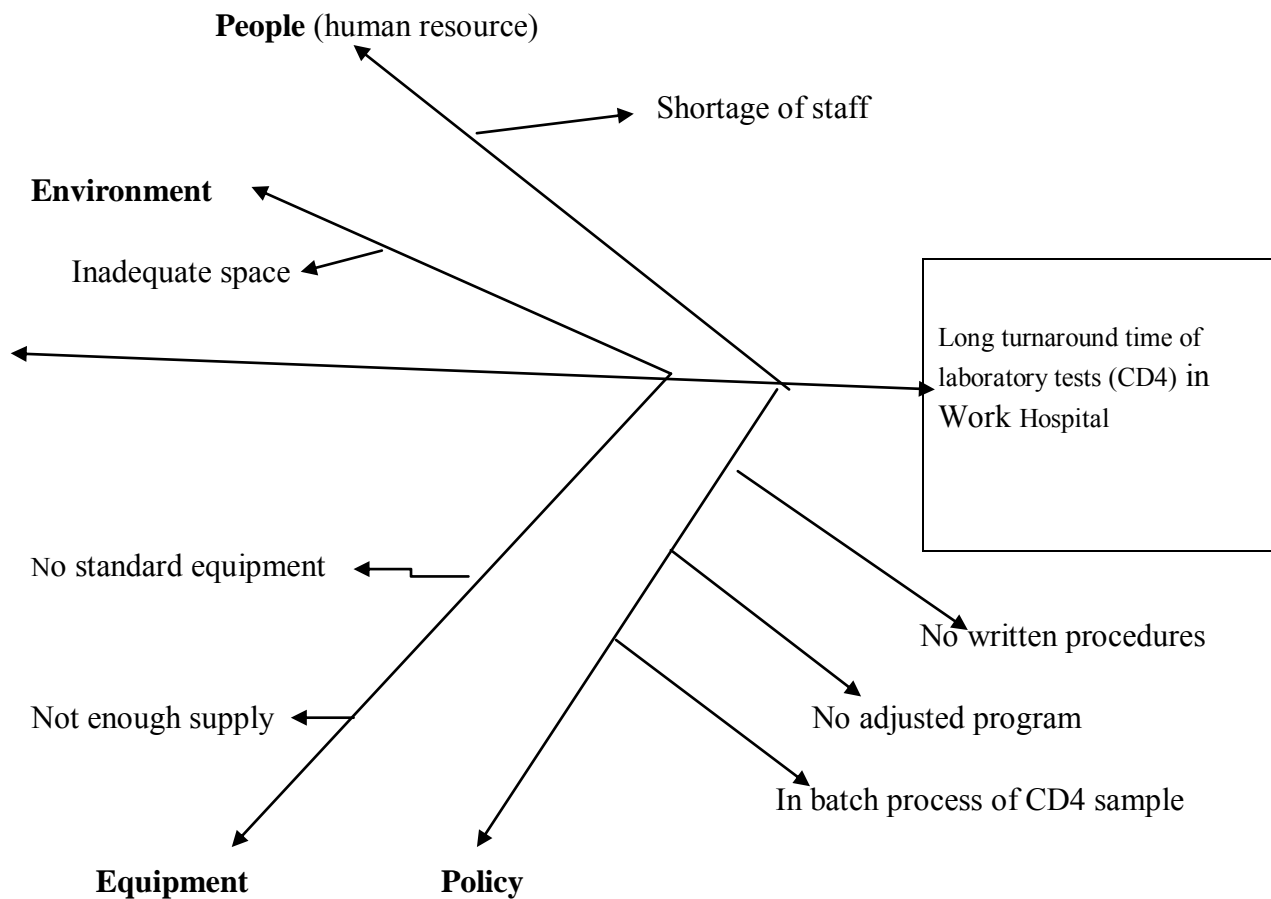
➤ The participant in the group discussion raises the following causes for the problem

Shortage of staff, in adequate space, No standard equipments

No enough supply, in batch process of CD4 sample

No adjusted program or assigned laboratory personnel to analysis CD4 frequently, No written procedure for CD4 machine was the listed causes of the problem.

These causes was organized in the fish bone diagram as follow



**Figure 1: fishbone diagram contains the generated root causes for long turnaround time of CD4 test result in Wukro Hospital, Tigray region northern Ethiopia 2013.**

**Analyze the above Root Cause to Identification the real root cause of the problem**

- **Shortage of Staff:** There are 9 laboratory personnel at Work Hospital, which is below the standard of 12. Staffing constraints were less believed to among the contribute to long TAT.
- **Non-standard Equipment:** Not having standardized equipment and instruction manuals on procedural steps was identified as a contributing factor but there is standard machine for CD4 analysis.
- **Shortage of Supplies:** On rare occasions a shortage of testing supplies exists, but cannot cause high turnaround times, unless not done at that time.
- **No Assigned Laboratory Personnel:** There is no assigned staff personal for CD4 tests during the sample collection period, for this reason batches are collected and processed using the auto machine. A dedicated CD4 laboratory staff person is needed in order to process test results immediately.

- **Batch Processing: Patients** were arriving for CD4 tests throughout the morning (8am – 12pm), yet the CD4 machine is only operated during a small window period (12pm – 2pm); this creates long turnaround times as all tests are processed at once.
- **No Written Procedure**: there are posted each procedure for each test performed in the laboratory
- **Inadequate Space**: The laboratory department at Work Hospital is small and not up to standard (the standard is separate rooms for each section, store room, laboratory office, toilet, shower etc.).Bringing the laboratory facility up to standard in terms of space allocation is beyond the hospital capacity in terms of cost, time, and approval.

The above information from the focus group discussion were evaluated based on severity, feasibility, cost, and time to identify the main root causes for delay of patients'CD4 test results so the main root causes were

- **No adjusted program or no assigned lab personnel**: If there is no programme or assigned laboratory personnel to do CD4 it may be missing to do because if no responsible person to do CD4 test it may be forgotten and extends time
- **Batch Processing**: First the sample was collected after a time processing the sample so this indicates delaying to receive results especially the first visit patients

## 1.5 Literature Review

Laboratory service provides information to clinicians to accurately assess the status of a patient's health (1).

Laboratory service used to make accurate diagnosis, formulate treatment plans & monitor the effect of treatment (1)

Turnaround time is one of the most noticeable sign of laboratory service and often used as a key performance indicator of laboratory performance. (2)

Quality of care is an important aspect of health care delivery system that is given a priority. Quality is a multidimensional concept that has been defined in various ways. Variation in quality of care between different health care facilities is thought to reflect differences in efficiency and other organizational factors. (3)

Laboratory results are required for making a large proportion of medical decisions.

In developed countries, an estimated 60% to 80% of patient management decisions are based on laboratory data. Laboratory investigations are often more sensitive and specific than clinical decision criteria alone. (4)

Diagnostics and clinical patient management have an interdependent relationship; laboratory data provide justification for clinical decision making, while clinical signs or the clinical management protocol often-prompt laboratory testing. (5)

TAT is defined as the time from receipt of the sample until time of availability of the result. (6)

Quality can be defined as the ability of a product or service to satisfy the needs and expectations of the customer. Over 80% of laboratories receive complaints about TAT. (7)

Average laboratory turnaround time decreased significantly by 15.5 minutes per test assay for tests generated by using the intervention which is computerized pathology test order entry for wards following system implementation(8)

Global programs of anti-HIV treatment depend on sustained laboratory capacity to assess treatment initiation thresholds and treatment response over time.

Currently, there is no valid alternative to CD4 count testing for monitoring immunologic responses to treatment, but laboratory cost and capacity limit access to CD4 testing in resource-constrained settings. Thus, methods to prioritize patients for CD4 count testing could improve treatment monitoring by optimizing resource allocation. (9)

Poor core laboratory performance that causes delays in diagnosis and treatment is an impediment to optimal patient care, particularly in high-volume patient care areas such as the emergency department(ED). (10)

It is important to choose TAT goals that lead to improved patient care and clinician efficiency and to improved satisfaction for both patients and clinicians. Ideally, all common laboratory tests should be reported as rapidly as possible by methods yielding high quality results, and this currently means an hour or less from order entry to results reporting under optimal conditions. (11)

For effective management of resources and improvement in patient satisfaction, it is especially important to report outpatient results promptly. (11)

Quality control (QC) in healthcare laboratories ensures that the results are accurate, reliable, and reproducible. It comprises of two key components: internal quality control and external quality assessment scheme. (12)

Internal quality control (IQC) includes appropriate measures taken during day-to-day activities to control all possible variables that can influence the outcome of laboratory results. This is a continuous process that operates concurrently with each laboratory analysis. (12)

External quality assessment scheme (EQAS) is necessary to ensure comparability of results among laboratories. (12)

According to WHO guide lines of SLMTA laboratory results are reported in timely manner to promote client or patient satisfaction. (13)

Laboratory for the biological, microbiological, immunological, chemical, haematological, biophysical, cytological, immune haematological, pathological or other examination of materials derived from the human body for the purpose of providing information for the diagnosis, prevention and treatment of disease in, or assessment of the health of, human beings, and which may provide a consultant advisory service covering all aspects of laboratory investigation including the interpretation of results and advice on further appropriate investigation. (14)

Along with accuracy and reliability, timely reporting of laboratory test results is now considered an important aspect of the services provided by the clinical laboratory. Whether or not, faster turnaround time can make any medical difference, patients and their physicians want reports as rapidly as possible. It has also been shown that outcomes in certain situations such as operation theaters and in emergency departments have been affected by timely reporting of lab tests results. (15)

This retrospective cross-sectional study was conducted at Aga Khan University (AKU) from August till October 2001. AKU is 495 bedded hospital located in a populated area of Karachi City. (15)

During this period majority of reporting was delayed for more than 60 minutes (45.3%) of samples..(15)

Clinical laboratories take pride in being extremely data driven. Many quality indicators are continuously monitored, analyzed, and used to allocate resources and improve service. These quality indicators include the turnaround times (TATs) necessary to report laboratory results to clinical staff. The total TAT for laboratory assays includes the entire interval from ordering of the test to the clinician's awareness of the result (i.e., "brain-to-brain"). It consists of the intervals from order placement to specimen collection, as well as the time necessary for transport to the laboratory, accessioning in the laboratory, centrifugation, aliquoting, additional preanalytic steps if necessary, transport times within and between laboratories, analysis time, the time after completion of analysis until result verification, and the time it takes for the clinical team to be informed of the result. (16)

The Department of Laboratory Medicine at Asan Medical Center provides a special one-stop service to allow both doctors and outpatients to receive routine outpatient test results in a timely manner within 1 hr. We developed a new Laboratory Information System (LIS)-based monitoring system that records the laboratory turnaround time (TAT) in 3 phases and analyzes the time to complete each phase with relevant specimens. TAT is subdivided into preanalytical, analytical, and post analytical phases based on the 4 time points when data are entered automatically into the LIS. The average TAT for 13,594 outpatient routine chemistry specimens with the one-stop service was  $43.6 \pm 7.7$  min. Completion times of the preanalytical, analytical, and post analytical phases were  $29.7 \pm 6.9$ ,  $13.9 \pm 4.1$ , and  $0.02 \pm 0.13$  min, respectively; 98.0% of the specimens were reported within 60 min. The remaining 2.0% were reported after 60 min with an average TAT of  $68.7 \pm 11.3$  min. Preanalytical phase delays were primarily responsible for the specimens reported between 60 and 90 min, and analytical phase delays were largely responsible for the few specimens (0.2%) reported after 90 min. For specimens reported between 60 and 90 min, the preanalytical phase was found to need improvement in order to shorten TAT; the main target for improvement was identified as the "waiting time for phlebotomy" step (17)

Turnaround time (TAT) is one of the most noticeable signs of laboratory service and is often used as a key performance indicator of laboratory performance. This review summarises the literature regarding laboratory TAT, focusing on the different definitions, measures, expectations, published data, and associations with clinical outcomes and approaches to improve TAT. It aims to provide a consolidated source of benchmarking data useful to the laboratory in setting TAT goals and to encourage introduction of TAT monitoring for continuous quality improvement. A 90% completion time (sample registration to result reporting) of <60 minutes for common laboratory tests is suggested as an initial goal for acceptable TAT. (2, 18)

Laboratory analytical turnaround time is a reliable indicator of laboratory effectiveness. Our study aimed to evaluate laboratory analytical turnaround time in our laboratory and appraise the contribution of the different phases of analysis towards the same. The turnaround time (TAT) for all the samples (both routine and emergency) for the outpatient and hospitalized patients were evaluated for one year. TAT was calculated from sample reception to report dispatch. The average TAT for the clinical biochemistry samples was 5.5 h for routine inpatient samples while the TAT for the outpatient samples was 24 h. The turnaround time for stat samples was 1 h. Pre- and Post-analytical phases were found to contribute approximately 75% to the total TAT. The TAT demonstrates the need for improvement in the pre- and post-analytical periods. We need to tread the middle path to perform optimally according to clinician expectations. (19)

The average TAT for the clinical biochemistry samples was 5.5 h for routine inpatient samples while the TAT for the outpatient samples was 24 h. The turnaround time for stat samples was 1 h. Pre- and Post-analytical phases were found to contribute approximately 75% to the total TAT. The TAT demonstrates the need for improvement in the pre- and post-analytical periods. We need to tread the middle path to perform optimally according to clinician expectation time the reports are dispatched (19)

## **2 Methodology**

### **2.1 Project area**

This project was conducted in Work hospital located 850 km from the capital city of Ethiopia (Addis Ababa) & 46km north of Mekele in Tigray.

### **2.2 Study design**

Pre post study using baseline data from laboratory service by taking data collection from the TAT registration book in three months January – March and June – August 2013 respectively was conducted

### **2.3. Source population**

All ART patients in Work hospital

### **2.4. Study Population**

- . All ART patients in Work hospital in the specified period which is January-march and June – august 2013 for pre-post intervention

### **2.5 . Sample /study unit**

A pre-post study of all patients who undergo CD4 test in laboratory TAT record in three months January , February and March for base line(586) and June, July and August 2013 after intervention(640) were included.

### **2.6. Data Collection Procedure**

Data was collected from the TAT registration book by a laboratory technician and collect sample collection time and result receiving time in base line and after intervention was used 586 patient record samples during January to March 2013 to assess base line data.

These data were compared to 640 patient samples from June to August 2013 after the intervention was introduced.

### **2.7. Data quality assurance**

There is standard TAT registration book so every time I was check all important information was recorded especially date, time of sample collection and time of result receiving in the registration book for reliable data collection.

## 2.8. Measurements and Data Analysis

- Comparisons of laboratory turnaround time of CD4 test before and after intervention were made using a T-Test analysis by using excel sheet, which produced a  $P < 0.001$  so the difference in average TAT is statistical significant.
- The mean turnaround time for the pre-intervention group ( $M=4.38$ ,  $SD=1.3563$ ,  $N=586$ ) was significantly larger than the turnaround time for the post-intervention group ( $M=2.01$ ,  $SD=0.2452$ ,  $N=640$ ) using the two-sample t-test for unequal variances,  $t(620) = 1.9638$ ,  $p \leq 0.001$
- The calculated t-value is 3.10 and  $t(620)$  at critical value of 95 % CI is 1.96 since the t-calculated was greater than critical value at 95 % it is statistical significant.

**Table 2: Comparison of Pre and Post Intervention data of Turnaround time of CD4test results in Wukro Hospital, Tigray region northern Ethiopia 2013.**

	Pre intervention	Post intervention
Patient CD4 Sample	N = 586	N = 640
Mean (average time taken in hrs)	4.38	2.01
Standard Deviation	1.36	0.25
T-value	3.1039E-182	
P-value	P < 0.0001	

## 2.9. Ethical Consideration

Ethical clearance was obtained from the Institutional Review Board (IRB) of the College of Health sciences, AAU. Supporting letters were obtained from Tigray Health Bureau to the selected study Hospital. Hospital Managers was contacted and permission was secured. The filled documents were archived properly to ensure confidentiality and no third person had an access to the data.

## 2.10. Plans for Dissemination

First the study result will be presented to Addis Ababa University College of Health Science and School of Public Health, Master of Hospital and Health Care Administration after comments are incorporated, hard copies of the findings will be disseminated to Tigray regional health bureau, to Work hospital and to different organization that have a contribution on improving TAT of CD4 investigation. It will also be presented in various seminars and workshops held in the region. And finally the study will be published into a reputable journal.

## 2.11 Operational definitions

**Turnaround time:** Laboratory turnaround time is defined as the length of time from when a test is ordered to the time the result is reported.

### 3. Strategic options

After analysing the root causes of the problem based on severity, feasibility, cost, and time to identify the main root causes for delay of patients' CD4 test results were the following

- **No adjusted program or no assigned lab personnel:** If there is no programme or assigned laboratory personnel to do CD4 it may be missing to do because if no responsible person to do CD4 test it may be forgotten and extends time
- **Batch Processing:** First the sample was collected after a time processing the sample so this indicates delaying to receive results especially the first visit patients

For the above root causes the following intervention was taken to solve the problem

- ❖ Assign laboratory personnel to do CD4 samples
- ❖ Process CD4 samples directly after collection(immediate processing of CD4 test)

**Table 3: Comparative Analysis of Strategic Options by using quantitative Decision Matrix in Wukro Hospital, Tigray region northern Ethiopia 2013.**

Strategies	Impact on problem	Expense	Time	Political feasibility	Total score
Assign laboratory personnel to do CD4 samples	4	4	4	4	16
<b>Process CD4 samples directly after collection</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>16</b>

#### 3.2 The Best Strategic Option

*Process CD4 samples directly after collection* and assign laboratory personnel to do CD4 samples were the best solution to reduce turnaround time of CD4 test results.

### 4. Interventions.

**Introduce immediate processing** as soon as arriving the patient to the laboratory sample was collected after few time process the sample and the patient was receive their result on time with in 2hrs or less .

Adjust the programme and assigned laboratory personnel to do CD4 test

- Discuss with laboratory personnel and ART personnel about how to solve the problem and make decision to solve by the intervention
- The ART personnel was made to give full information to the patients about the system
- Adjust the programme to assigned laboratory personnel to do CD4 test

- As soon as arriving the patient to the laboratory sample was collected after few time process the sample and the patient was receive their result on time with in less than 2hrs
- The intervention was conducted during the months of June, July and August 2013
- The actual implementation process was followed by principal investigator and the laboratory personnel was implemented the strategy which was introducing immediate process of CD4 test

#### **4.1. Advantages of the Intervention**

If the identified problem will be solved by using the above interventions, it will have the following out comes or relevance to public health, patients and the hospital staff

1. To shorten the turnaround time of laboratory investigations (CD4) reporting time
2. To improve laboratory staff and clinicians in communicating panic results that require special attention and urgency
3. To increase patient and staff satisfaction
4. To reduce waiting time of patients due to CD4 results
5. To create an efficient system in the laboratory and making turnaround time as one of the achievable indicators
6. Performance evaluation/efficiency measurement
7. To decrease the length of hospital stay or improve timely patient care

### **5. Implementation**

The study was conducted from January - August 2013, with a total required cost of 6,050ETB.

#### **5.1 Table 4: Project Work Plan to solve the long turnaround time of CD4test results in Wukro Hospital, Tigray region northern Ethiopia 2013.**

S. No.	Activities	Responsible person	Timeline
1	Select capstone topic	SMT	January 15/3/2013
2	Baseline assessment	Investigator	February 2013
3	Collect the baseline data	Data collector	February 2013
4	Measure the base line	Investigator	March 2013
5	Writing capstone proposal	Investigator	March 2013
6	Final report capstone proposal	Investigator	APRIL 2013
7	Collecting data	Data collector	June, July, August 2013
8	Measure the data	Investigator	September 2013
9	Writing capstone report	Investigator	September 2013
10	Final report capstone research	Investigator	September 2013

Note: In each step communicate with my advisors, accepting comments, and accommodating them was mandatory.

## 6 Results

586 and 640 pre and post patients respectively have been reviewed in this study. Pre and Post intervention data were collected from the TAT registration book from January to March and June to August 2013 respectively

**Table 5 : the Pre and Post Intervention Data Sample collection in Wukro Hospital, Tigray region northern Ethiopia 2013.**

Month	Sample collected	Month	Sample collected
January	240	June	244
February	156	July	156
March	140	August	240
<b>Total</b>	<b>586</b>	<b>Total</b>	<b>640</b>

**Table 6: Pre Intervention results for turnaround time of CD4 test in Wukro Hospital, Tigray region northern Ethiopia 2013.**

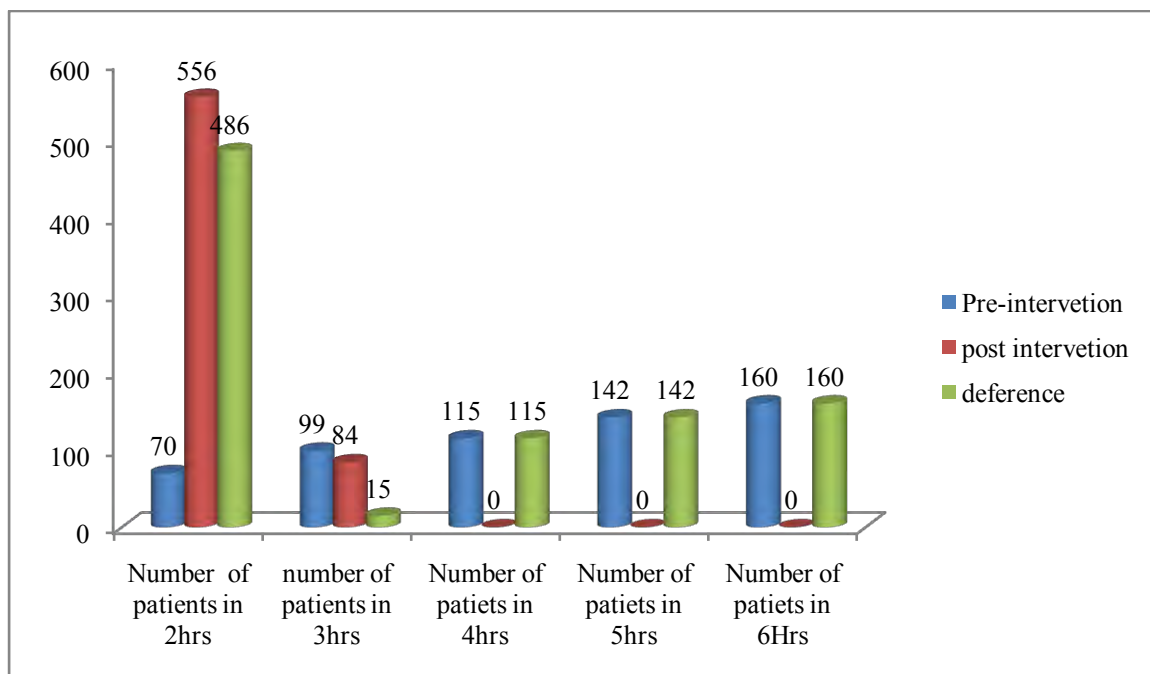
<i>Pre Intervention results</i>			
Number of Patients	Sample Collection Time	Result Receiving Time	Average TAT (hours)
160	8:00am	2:00pm	6
142	9:00am	2:00pm	5
115	10:00am	2:00pm	4
99	11:00am	2:00pm	3
70	12:00pm	2:00pm	2
<b>586</b>			

this table indicates the time of sample collection and result receiving so based on the above table the maximum time patients wait to receive results was 6 hrs the minimum was 2hrs which is the standards in the pre intervention result the average time to receive results was 4 hrs so if we compare to standard it is very long.

**Table 7: Post Intervention results for turnaround time of CD4 test in Wukro Hospital, Tigray region northern Ethiopia 2013.**

<i>Post Intervention results</i>			
Number of Patients	Sample Collection Time	Result Receiving Time	Average TAT (hours)
170	8:00am	10:00am	2
150	9:00am	11:00am	2
166	10:00am	12:00pm	2
84	11:00am	1:30pm	2.5
70	12:00pm	1:30pm	1.5
<b>640</b>			

this table indicates the time of sample collection and result receiving so based on the above table the maximum time patients wait to receive results was 2.5 hrs the minimum was 1.5hrs which is the standards in the post intervention result the average time to receive results was 2 hrs so if we compare to standard it is accurate so the intervention taken was effective.

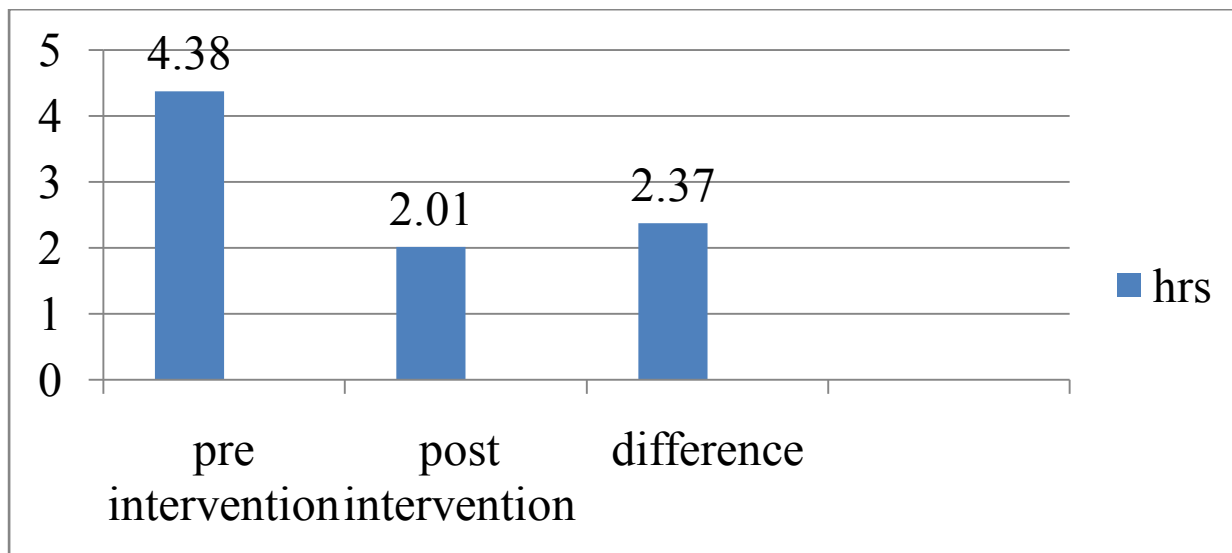


**Figure 2: Pre post Comparison of Turnaround time for CD4 test results from Sample Collection up to result receiving in Wukro Hospital, Tigray region northern Ethiopia 2013.**

The above figure indicates before intervention the maximum time taken to receive CD4 result was 6 hrs. After intervention it is 2.5 hrs or less.

Before interventions only 70 patients receive results within 2hrs 516 patients receive results more than 3 hrs out of 160 receives results by waiting for 6hrs.

After intervention 556 patients receive their results within 2 hrs only 84 patients wait up to 3 hrs to get results.



**Figure 3: Pre post Turnaround time mean for CD4 test results in Wukro Hospital, Tigray region northern Ethiopia 2013.**

The above figure indicates in pre intervention the average Turnaround time of CD4 test result was 4.38 but in post intervention the average Turnaround time of CD4 test result was 2.01 so after the intervention taken patients were reduced to receive CD4 test results by 2.37 hrs .so the intervention taken was effective.

- Prior to the intervention ART patients waited up to 6 hours to receive their CD4 test results **516/586 88.1 %** of patients wait to receive results more than 2 hrs
- Only 70/586 11.9 % receive results at 2hrs or less.
- After introducing the immediate processing method the maximum TAT was 2.5 hours, with the majority of patients **556/640 86.9%** receiving their results in 2 hours or less.
- Only 84/640 13.1% remain up to 2.5 hrs to receive results.

## 7. Discussion

According to the World Health Organization guide lines of strengthening laboratory management towards accreditation in 2011 in Ethiopia laboratory results are reported in timely manner to promote client or patient satisfaction So my project also takes an intervention to reduce long turnaround time to satisfied patients.(2)

The study conducted in Singapore; TanTock Seng Hospital in 2007 states that over 80% of laboratory complaints are about long turnaround time of test results (7)

This study also similar to our hospitals because above 80 % of the complaints are due to result waiting for more time.

A pre-post study conduct in German hospitals states that average laboratory TAT decreased by 15.5 minutes for test by using the intervention computerized pathology test order entry.(8)

But in our hospital by using the immediate analysis and assign laboratory personnel to do CD4 average laboratory TAT decrease from 4.38 to 2.01 hrs which is 2.37 hrs so the intervention taken was effective.

The study conducted on 2005 in America states that Poor core laboratory performance that causes delays in diagnosis and treatment is an impediment to optimal patient care, particularly in high-volume patient care areas such as the emergency department(ED). (10)

The cause of this study was directly related to our study.

The study conducted on 2001 in American society of clinical pathology states that it is important to choose TAT goals that lead to improved patient care and clinician efficiency and to improved satisfaction for both patients and clinicians (11)

Our study also if the intervention taken achieves improve patient and staff satisfaction.

A retrospective cross-sectional study was conducted at Aga Khan University (AKU) from August till October 2001. AKU is 495 bedded hospital located in a populated area of Karachi City Total 20079 stat samples were received from August 2001 till October 2001. Four hundred eight (2.03%) samples were reported after the acceptable turnaround time (15)

during this period majority of reporting was delayed for more than 60 minutes. The breakup for delay in reporting of stat tests for this period is showed that 0-15 minutes delay was noted in 68 (16.7%) samples, 16-30 minutes delay in 80(19.6%) samples, 31-60 minutes. delay in 76 (18.6%) samples and more than 60 minutes delay in 185 (45.3%) of sample Reasons for delay in TAT were as follows: n = 163 (40%) due to machine breakdown, n=147(36%) due to delay in the maintenance of analyzers, n=73 (18 %) due to overlook of the staff during shift change (e.g. night shift to morning shift) and n=

25 (6%) due to computer shutdown.(15) My study was more than 86.9 % samples get their results within 2 hrs or less.

The study was conducted on the Columbia University Medical Center (CUMC) campus of the New York-Presbyterian Hospital (NYPH; New York, NY) academic medical centre Mean delays were 32 minutes for all specimen groups. (16)

The mean delay of our problem was 4.38 hrs but there is a standard turnaround time for each laboratory tests.

The study conducted in Republic of Korea Department of Laboratory Medicine at A san Medical Center provides a special one-stop service to allow both doctors and outpatients to receive routine outpatient test results in a timely manner within 1 hr. We developed a new Laboratory Information System (LIS)-based monitoring system that records the laboratory turnaround time (TAT) in 3 phases and analyzes the time to complete each phase with relevant specimens. TAT is subdivided into pre analytical, analytical, and post analytical phases based on the 4 time points when data are entered automatically into the LIS. 98.0% of the specimens were reported within 60 min. The remaining 2.0% were reported after 60 min with an average TAT of  $68.7 \pm 11.3$  min. Pre analytical phase delays were primarily responsible for the specimens reported between 60 and 90 min, and analytical phase delays were largely responsible for the few specimens (0.2%) reported after 90 min. For specimens reported between 60 and 90 min, the pre analytical phase was found to need improvement in order to shorten TAT. (17) In this study the acceptance TAT was 60 minutes so 98% of the sample receives results within 60 minutes in our study the acceptance TAT was 2hrs 86.9% of the patients get results within 2hrs or less so the intervention taken was vital.

The study conducted in national institutes of health in USA Turnaround time (TAT) is one of the most noticeable signs of laboratory service and is often used as a key performance indicator of laboratory performance. This review summarises the literature regarding laboratory TAT, focusing on the different definitions, measures, expectations, published data, and associations with clinical outcomes and approaches to improve TAT. It aims to provide a consolidated source of benchmarking data useful to the laboratory in setting TAT goals and to encourage introduction of TAT monitoring for continuous quality improvement. A 90% completion time (sample registration to result reporting) of <60 minutes for common laboratory tests is suggested as an initial goal for acceptable TAT (2, 18) In case of our study 86,9 % of the sample was in acceptance TAT which is 2hrs or less .

The study conducted in Govind Ballabh Pant Hospital We have not included those instances when the TAT was prolonged due to machine breakdowns or other unforeseen problems like lack of uninterrupted electricity and water supply. The average turnaround time for clinical biochemistry samples from the wards ranges from 4.5 to 5.5 h from the time the samples are received by us to the Laboratory analytical turnaround time is a reliable indicator of laboratory effectiveness. Our study aimed to evaluate laboratory analytical turnaround time in our laboratory and appraise the contribution of the different phases of analysis towards the same. The turnaround time (TAT) for all the samples (both routine and emergency) for the outpatient and hospitalized patients were evaluated for one year. TAT was calculated from sample reception to report dispatch. The average TAT for the clinical biochemistry samples was 5.5 h for routine inpatient samples while the TAT for the outpatient samples was 24 h. The turnaround time for stat samples was 1 h. Pre- and Post-analytical phases were found to contribute approximately 75% to the total TAT (19)

This study was similar to our study the TAT was averagely 5.5hrs and 4.38 hrs respectively.

## **8. Strength and limitations**

### **Strength**

- establish acceptance TAT for CD4 test
- Clients know for how long they wait to receive results
- TAT indicator for CD4 was achieved
- Use of primary data for sample collection

### **Limitations**

- Machine may broken through long time switch on
- The study was limited only to reduce turnaround time of CD4 test results

## 9. Conclusion and Recommendations

### 9.1 Conclusion

Processing CD4 tests immediately after sample collection was effective in reducing long turnaround times the objective was achieved 86.9 % of the patients receive results in 2hrs or less.

In addition to the ART patient the staffs also satisfied no complains due to result delayed.

Crowdedness of patients in the waiting area was decreased due to patients receive results on time.

Patient care in short time to save life and to satisfy the client and the patient it is used to save unnecessary expenses while reaching on time to their home.

TAT indicator for laboratory service was met

### 9.2 Recommendations

This capstone was very important to the hospital, to the regional and country laboratories to give standard laboratory service in acceptance TAT.

It is important to assess the turnaround time of the other laboratory tests.

Hospital management should give attention for the sustainability of the system

## 10. Annexes

### Annex 1: Focus Group Participants

S. No.	Profession	Amount
1	Chief Clinical Officer (Dr)	1
2	Matron	1
3	HMIS Focal Person	1
4	Heads of All Case Teams	10
5	Physicians	1
6	Laboratory personnel	8
Total		22

## Annex 2: TAT Registration Book Form

S. No.	Date	Card no.	Sample accepted or rejected	Login time	Log out time	Signature
1						
2						
3						
4						

## Annexes 3:

### Summary Cost of the project reducing Turnaround time for CD4 laboratory test results in Wukro Hospital, Tigray region northern Ethiopia 2013.

S. No.	Type of Cost	Amount
1	Personnel Cost	2500
2	Stationary Cost	1200
3	Communication Cost	1800
4	<b>Sub total</b>	<b>5500</b>
5	Contingency 10%	<b>550</b>
6	<b>Total</b>	<b>6050 birr</b>

## Annexes 4:

### Cost Breakdown of the project reducing Turnaround time for CD4 laboratory test results in Wukro Hospital, Tigray region northern Ethiopia 2013.

Item No.	Description	Cost Type	Amount	Unit	Unit Price	Total
1	A4 paper for stationary	Stationary	5	Pad	200	1000
2	CDRW	Stationary	2	Each	50	100
3	Staples	Stationary	1	Each	100	100
<i>Stationary Cost Subtotal</i>						<i>1200</i>
4	Data Collector	Personnel	3	Day	150	450
5	Investigator	Personnel	3	Day	200	600
6	Secretary	Personnel	3	Day	150	450
<i>Personnel Cost Subtotal</i>						<i>2500</i>
7	Internet fee	Communication	20	Each	20	400
8	Mobile card data collector		4	Each	100	400
9	Mobile card investigator		10	Each	100	1000
<i>Communication Cost Subtotal</i>						<i>1800</i>
<b>Total Cost</b>						<b>6050</b>

## 11. References

1. Ministry of Health. Ethiopian Hospitals Reform Implementation Guide lines. Volume one. Addis Ababa: Ethiopia; May 2010.
2. Robert C. The Clinical Biochemist Reviews. Second edition .Hawkins; Nov 2007.
3. Ministry of Health. Assessment of laboratory test results to reduce turnaround time. Ethiop J Health Sci. 2011 August; 21(1): 49–58.
4. Trevor F, Peter D, Philip D. Impact of Laboratory Accreditation on Patient Care and the Health System in America. American Medical Journal.2009; 30(4): 179-84.
5. Donald M. Cost Challenges for laboratory medicine automation in South Africa. Pan Africa Medical Journal. September 2010; 28(5) : p 56
6. Bernhard B. Mapping Turnaround Times (TAT) to a Generic Timeline: A Systematic Review of TAT Definitions in Clinical Domains. American medical J. 2011; 20(6) :111-12
7. Dr. Robert H. Laboratory Turnaround Time of Pathology Department. 11<sup>th</sup> edition .Singapore: Tan Tock Seng ; November 2007.
8. Westbrook J, Georgiou A, Dimos A, Germanos T. Computerize pathology test order entry reduces laboratory turnaround times and influences tests ordered by Hospital clinicians: a controlled before and after study. Medical J in Germany .2006.
9. Livio Azzoni1. Prioritizing CD4 Count Monitoring in Response to ART in Resource Constrains Settings. Volume 9 .South Africa; April 2012.
10. Lorne L, Holland M, Linda L, Smith H. Reducing Laboratory Turnaround Time Outliers Can Reduce Emergency Department Patient Length of Stay .American Society for Clinical Pathology. 2005; 30(6):190-91.
11. Joan H, Howanitz M, Peter J. Laboratory Results Timeliness as a Quality Attribute and Strategy in America. American Society of Clinical Pathologists .2001.
12. Deoyo A, emetu Y. Improving Laboratory Services and Workforce in Rural Health Facilities. Medical J of Nigeria. February2012.
13. World Health Organization. Strengthening laboratory management towards Accreditation. Volume one. Addis Ababa, Ethiopia: March2011.
14. World Health Organization. International Standards Medical Laboratory Particular Requirements for Quality and Competence. Second edition. Addis Ababa, Ethiopia: April 2007.
15. Bilwani F, Siddiqui I, Vaqar S .Determination of delay in Turnaround time (TAT) of tests and its causes. Journal of Pakistan medical association, Pakistan. January 2008.

16. Brie A, Stotler M. Determination of Turnaround time in clinical laboratory accessioning to result time does not always accurately reflect laboratory performance. Med J of American clinical pathology. Columbia University. New York .2012.
17. Won-kim, Sail Chun. Analysis of Turnaround time by sub dividing three phase for outpatient chemistry specimen.med J of university of Ulsan. Republic of Korea.2009.vol 39.
18. Robert C, Hawkins . Laboratory Turnaround time.med J of clinical bio chemistry. USA.nov 2007.
19. Mallika V, Gupta K ,Chawla R .Turnaround time (TAT) as a bench mark of laboratory performance.med J of clinical biochemistry . Indian .sep 2010.