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DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Assessment of Patient satisfaction and Turnaround time while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia

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This is to certify that the thesis prepared by Mecca Yesuf, entitled: Assessment of patient satisfaction and turnaround time while using electronic laboratory information management system along with associated factors in selected public hospitals Addis Ababa, Ethiopia and submitted in partial fulfillment of the requirements for master of science degree in clinical laboratory sciences (clinical laboratory management and quality assurance) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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List of Abbreviations/Acronyms

LIMS	Laboratory Information Management System
TAT	Turnaround Time
TASH	Tikur Anbessa Specialized Hospital
SPMHMC	St Paul's Hospital Millennium Medical College
ALERT	Alert Comprehensive Specialized Hospital
SPSS	Statistical Package for Social Sciences
SOP	Standard Operating Procedure
Lab	Laboratory
Gov't	Government
Freq	Frequency

Abstract

Background; It is crucial and well documented to evaluate patient perception of laboratory service and turnaround time in order to provide high quality service. Although laboratory information management system are crucial for enhancing patient care and turnaround time, variables pertaining to LIMS that impact them must be investigated because there is lack of research in Ethiopia that focus on this area.

Objective; To assess Patient satisfaction and Turnaround time while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia.

Methods; A Hospital-based cross-sectional study was conducted at selected public hospitals by using both quantitative and qualitative data collection methods. The hospitals were selected using a simple random sampling method from a list of 13 public hospitals. Data was collected from 422 patient interviews and TAT recording for hematology and clinical chemistry tests as well as purposive selection of laboratory staffs with a total of 30 participants for structured questionnaire and in-depth interview. The collected data was coded and entered into excel and transferred to SPSS version 25 for further analysis. Both binary and multiple logistic regression analysis was used to see the association between dependent and independent variables. The findings were taken as significant with a p value of ≤ 0.05 at 95% confidence interval and results were presented with text, graph and tables.

Result; The study's response rate was 100%. 52.8% of respondents were male. The three hospitals' overall mean scores for patient satisfaction was 3.3. Lab price and the courtesy and respect of staff were main sources of satisfaction; cleanliness of the latrines and seating arrangements, which were a major issues in all hospitals, were the main sources of dissatisfaction. Hematology tests that achieve target TAT was TASH 40.7%, SPMHMC 34.7% and ALERT 23%, also TAT achieved for clinical chemistry was TASH 52.7%, SPMHMC 56.7% and ALERT 39.3%. Turnaround time and patient care are impacted by issues like equipment failure, power outages, system outages, and unstable networks.

Conclusion; Patient satisfaction and TAT in laboratory services is mostly dependent on effective laboratory management and infrastructure. Even though LIMS adoption has had a positive impact on operational efficiency; technical issues must be resolved, staff must be well trained, and a steady power and network supply must be ensured.

Keywords; Laboratory information management system (LIMS), Turnaround time (TAT), Patient satisfaction.

1. Introduction

1.1 Background of the study

An important component of high-quality healthcare services is patient satisfaction. Patients are more likely to feel more confident in the healthcare system and believe they are receiving higher-quality care when they receive quick and correct laboratory findings (1).

The assessment of healthcare services from the perspective of the patient is supported by patient satisfaction. It also makes it easier to identify problem areas and produces ideas for how to solve them (2).

Patient satisfaction is a useful metric for evaluating healthcare services since it not only puts light on the patient's viewpoint but also makes it easier to pinpoint issues and come up with solutions (3). In addition, assessing patient satisfaction with healthcare services is clinically important because research indicates that satisfied patients are more likely to follow medical advice from physicians, actively participate in their own care, comply with treatment, and stay loyal to a particular healthcare system. Inversely, clients who are dissatisfied with a service could have worse results than others because they might skip sessions, ignore recommendations, or give up on treatment plans (4).

For laboratory services, turnaround time which is the amount of time between sample collection and result reporting is a crucial performance measure (5). It is a measure of punctuality and is often regarded as one of the determinants of laboratory efficiency and quality. (6). Because humans are naturally impatient, everything must be done quickly, even clinical laboratory findings. As a result, people prefer hospitals that guarantee rapid service and don't make them wait for a long time to receive test results and accurate diagnoses, treatments, and issue management (7). Thus, this study intends to discover possible advancements in laboratory effectiveness and the overall efficacy of healthcare delivery by evaluating the effect of LIMS on turnaround time.

In the past Laboratory information management system emerged as a system for tracking laboratory sample movements. In fact, Laboratory information management system grew as one integrated solution for storing sample records, tracking tests done, servicing customers and billing for services provided (8, 9).

The implementation of computerized systems in laboratories for healthcare purposes is referred to as Laboratory information management system (10). A Laboratory information management system is an application used in a laboratory setting to handle samples, analysis outcomes and data collection. These days, its ability to lower laboratory expenses and boost efficiency has captured the interest of healthcare facilities around the world (11).

The first Laboratory information management system was created as a way to monitor the flow of samples through a laboratory. Following that, Laboratory information management system has grown to become an integrated platform to all laboratory data handling requirements, including sample record keeping, test performance tracking, client management, and billing management. As a result, alternative laboratory data management options including portals for patients, barcodes tracking systems, financial software, and ELNs (Electronic Laboratory Notebooks) have been gradually replaced by the Laboratory information management system (9, 12, 13).

The healthcare system in Ethiopia, is confronted with a number of difficulties, such as insufficient funding, a large patient population, and ineffective laboratory procedures such as; lack of equipment and resources, inadequate training and capacity, poor quality control and quality assurance, inefficient sample management and lack of standardization (14) . Longer turnaround times for laboratory findings are frequently the result of these difficulties, which can have negative impacts on patient care, alternatives to therapy, and general satisfaction (15).

Furthermore, it is necessary to take into account associated factors that affect how the Laboratory information management system affects turnaround time and patient satisfaction. Workflow in the laboratory, employee education, system usability, resource limitation, and work load are a few examples of these variables (14). Since there is limited research done on this subject in Ethiopia, this study will help gaining knowledge of these variables and how they interact with the installation and implementation of LIMS can be extremely helpful in ensuring that the system is successfully incorporated into the current healthcare system.

Thus evaluating the influence of Laboratory information management system on patient satisfaction will provide insight into the system’s potential to increase interaction among providers and patients, improve the patient experience, and support patient-centered treatment.

1.2 Statement of the Problem

Patient satisfaction is the most important aspect for the improvement of healthcare service. Using a paper-based laboratory service has several drawbacks. Errors may arise during the collection and transfer of patient data; information sharing throughout hospital departments may take longer; patients may find it more difficult to access outside of their primary healthcare facility; missing of patient data and system integration may be poor; Patients may also get dissatisfied of repetitive testing as a result of sample loss caused due to lack of sample registration (16).

Turnaround time (TAT) is a crucial indicator of quality of testing processes as well as patient and healthcare provider satisfaction. There are three phases in determining TAT: Pre-analytical, analytical, and post-analytical phases. During the pre-analytical phase, sample collection, transportation, and preparation takes place. The number of patients determines how long it takes to collect and analyze patient samples in batches. Because batch collection takes time. In the analytical phase machine/equipment failure and malfunction of system as well as manual registration of patient information can cause delays. In the post analytical phase the patients collect their test result in hard copy and show them to the physicians, in this phase their might be printer malfunction, power interruption and disorganization or missing of test result leads to delayed TAT (5, 6).

In resource limited countries like Ethiopia the implementation of Laboratory information management system is not fully functional. Health practitioners in public hospitals (ALERT) where the electronic laboratory information management system is newly implemented, are expected to document information both on paper and computer because of system failure, unstable power supply, software maintenance issue and lack of well-trained laboratory professional to use the system software; Which cause frustration, loosing of patient test results and delay in TAT (17).

Laboratory information management systems (LIMS) are becoming more popular among health care facilities with the goal of improving efficient data management, enhanced accuracy and quality control, improved turnaround time, data security and privacy (17). Hospital systems hold an increasing amount of patient data on a daily basis, and this data must be correct.

In the past decades, there was a state of disorganization in the gathering and organizing of patient data. They were applying a manual system, which is less accurate and involves more time and

work (18). The majority of the free text in the paper-based record is unstructured or weakly structured (19). Overall, the quality of record handling was poor. There was little control over how documents were disposed of, accuracy of records could not be guaranteed, and sharing information with coworkers was challenging (20).

Laboratory information management system is being implemented more rapidly to healthcare organizations in developing countries, which lack adequate framework and technical staff with the necessary training to operate the systems. Shortage of computers, unstable poor and network, poor work flow and improper communication are some factors that affect the working process (14).

Additionally, the importance of laboratory information management systems on turnaround time and patient satisfaction is not well understood there is a lack of research on how these systems affect the efficiency and quality of laboratory services, as well as the factors that may influence their implementation and use in these healthcare settings. It is important to investigate the relationship between laboratory information management systems, turnaround time, patient satisfaction, and associated factors in order to improve the quality of healthcare services and patient outcomes in public hospitals in Addis Ababa, Ethiopia.

1.3 Significance of the Study

This study, aims to assess patient satisfaction and turnaround time while using an electronic laboratory information management system (LIMS) in Addis Ababa, Ethiopia. Firstly, it identifies areas for improvement in laboratory operations, leading to more efficient healthcare delivery. Secondly, understanding how LIMS affects patient satisfaction can enhance the overall patient experience and build trust in the healthcare system by providing timely and accurate laboratory findings. Thirdly, by analyzing variables that influence the impact of the system, the study will inform LIMS deployment plans, helping healthcare organizations overcome obstacles and maximize its benefits.

2. Literature Review

2.1 Patient satisfaction

A descriptive cross-sectional study conducted in Addis Ababa, Ethiopia assessed the level of patient satisfaction towards laboratory service among patients attending in nine public hospitals; ART clinics. Out of 406 respondents most of them were females 62.8%. The finding showed that the overall level of satisfaction was 85.5% with high score in provider's respect, clean blood drawing area, confidentiality and laboratory result completeness. On the other hand respondents show dissatisfaction in latrine usage and cleanliness. Additionally, the study showed that there was statistically significant association between overall satisfaction and availability of ordered laboratory tests, waiting time to get blood drawing service and waiting time to get laboratory result (21).

An institutional based cross-sectional study conducted in Addis Ababa, Ethiopia, Evaluated Patients' satisfaction with clinical Laboratory Services in Public Hospitals, with a complete response rate of 100% from a total of 2399 respondents majority of them were females 53.1% and 73.2% were married. The study revealed that the overall satisfaction score was 78.6%, with highest score in courtesy of laboratory personnel (67.3%), the presence of laboratory personnel during working hours at reception (77.3%) and price of services (83%). Nevertheless, respondents were dissatisfied in blood collection procedure, latrine cleanliness (47.3%), inadequate sitting arrangement (45%) and waiting times. (1).

A cross-sectional study conducted in Addis Ababa, Ethiopia assessed the level of patient satisfaction towards clinical laboratory service. The study included 422 participants with 100% completeness rate of response. The broad level of patient satisfaction was 51.7%. High satisfaction score was recorded for courtesy and respect of laboratory personnel, communication and privacy and confidentiality during specimen collection (84.6%, 80.8% and 80.1% respectively). On the other hand dissatisfaction was recorded for unavailability of staff during working hours, latrine usage, privacy during sample collection and laboratory cleanliness (48.6%, 44.4%, 43.8% and 37.8% respectively). The study showed significant association between overall satisfaction and independent variables such as waiting times, availability of personal storage space in collection and latrine cleanliness. (22)

A cross-sectional study conducted in Addis Ababa, Ethiopia assessed the level of patient satisfaction in laboratory service which involved 210 patients at Tikur Anbessa Specialized Hospital (TASH). Majority of participants were male (57.1 %), aged between 28-37 (36.7%), married (44.3%) and with secondary education (68.5%). On Likert scale the overall mean satisfaction score was 3.21, with highest score in cost of service (4.12), staff competence (3.91) and facility cleanliness (3.84). The lowest score was from latrine accessibility (3.14) and laboratory location. Gender did not show statistically significant association with satisfaction, however females appeared slightly satisfied. Except gender and overcrowding issues other socio-demographic factors show significant association with satisfaction. (23)

A cross-sectional study conducted in Addis Ababa assessed client's satisfaction with quality of clinical laboratory services. The finding had 100% of complete respondent rate with a majority of females 54.3% and literate 86.7%. The overall level of satisfaction was 52.4%. Low satisfaction rare was recorded for cleanliness of latrine, provider's knowledge/explanation, cleanliness of blood drawing area, privacy and confidentiality and communication with healthcare providers (47.6%, 22.7%, 10.4% and 9% respectively). The study showed that there was no statistical significant association between overall patient satisfaction and independent variables such as: sex, age, marital status and educational level. (24)

An institutional based cross-sectional study conducted in worabe, Ethiopia examined the level of patient satisfaction and associated factors among patients attending clinical laboratory. In Likert scale the mean satisfaction score was 3.49 and an overall satisfaction rate of 50.2%. Respondents were highly satisfied in hospital cleanliness and staff professionalism (4.22 and 4.21). However they were dissatisfied in information given before sample collection and receive test result on time (2.87 and 3.02 respectively). The study showed significant association between overall patient satisfaction and socio-demographic characteristics such as gender and marital status but not with educational level, age and income. Females were 1.6.23 times more likely to be satisfied than males and married respondents were more satisfied than singles. (25)

Another cross sectional study conducted in Debremarkos, Ethiopia examined patient satisfaction with clinical laboratory services and associated factors among adult patients attending outpatient departments. The overall satisfaction rate in clinical laboratory service was 40.3%. The study showed there was significant association between patient satisfaction and educational background,

repeated laboratory result missing and availability of space to put personal belongings in the laboratory. respondents who were able to read and write and who had diploma and above were 0.41 times less likely satisfied than who were not able to read and write; respondents who did not miss there laboratory results were 0.34 times more likely satisfied than who missed there laboratory results; respondents who did not get space to put their personal belonging were less likely to be satisfied than who had space to put their personal belongings. (26)

Another cross-sectional study conducted in Jimma examined clients satisfaction with health delivery showed the overall level of satisfaction was 77%. From a total of 422 participants 51.7% were males, 59% were literate and 57.8% participant's payment method was insurance. Participants who got ordered laboratory tests were 51.7% satisfied. Additionally age of respondents and educational level showed statistical significant association with patient satisfaction. (27)

2.2 Turnaround Time

A study conducted in Korea assessed the analysis of turnaround time by subdividing three phases for outpatient chemistry specimens. A total of 13,594 chemistry specimens was included the study. The average TAT was 43.6 ± 7.7 minutes, with Pre-analytical TAT of 29.7 ± 6.9, analytical TAT 13.9 ± 4.1 and post-analytical TAT 0.02 ± 0.13 and the accounting percentage was 68.1%, 31.9% and 0.05% respectively. 98% of the specimen were reported within 60 minutes with an average TAT of 43.1 ± 6.7 minutes. The average of specimen reported between 60 – 90 minutes were 65.3 ± 5.8 minutes and specimen reported after 90 minutes was 96.9 ± 4.9 minutes. A major reason for delayed TAT in pre-analytical phase was waiting to give sample and specimen analysis; in analytical phase was repeated tests. (28)

A retrospective cross-sectional study conducted in Karachi determine delay in turnaround time and its causes of stat tests. A total of 20079 clinical chemistry samples were included the study. From the total samples 2.03% were informed after the standard turnaround time. Poor TAT performance was mostly seen in the morning shift with 59.3% of delay. In the evening and night shift the delay was 20.3% and 20.1% respectively. The Major reason for delayed TAT was reported as: oversight of staff during shift, analyzer maintenance delay, machine breakdown and computer shutdowns. (7).

A study conducted in India, determine the laboratory turnaround time in tertiary care hospital. From a total of 232 clinical chemistry samples only 183 were taken for analysis, of these 54.7% were done within the target TAT. From 45.4% delayed samples 57.8% of them had a TAT between 60 – 90 minutes, 26.5% were between 90 – 120 minutes, 10.8% were between 120 -180 minutes and 4.8% had a TAT more than 180 minutes. The reason for delayed TAT was stated as: sample transportation and instrumentation failure. (29)

Hospital-Laboratory based cross-sectional study conducted in Nepal determine the Turnaround Time in Clinical Chemistry laboratory. A total of 1737 clinical chemistry samples were used for analysis. The TAT was recorded as from billing to reporting and from collection to reporting. In the billing to reporting record only 2.7% of them were reported by 60 minutes, 42.8% had a TAT of 120 minutes and 72.3% were reported by 180 minutes; In the collection to reporting record only 10.9% were reported by 60 minutes, 66.4% were reported by 120 minutes and 91.2% were reported by 180 minutes. In this study the median for the time of billing to reporting and from collection to reporting was recorded as 138 and 98 minutes respectively; delayed mean TAT was54.6±7.78.4 minutes. The morning shift showed good performance than the night shift. (30)

A descriptive observational cross-sectional study carried out in Nepal showed factors affecting turnaround time in clinical laboratory. From a total of 36,108 samples only 24,644 were used for analysis. 48.4% of the total samples were reported as delayed due to error in cash unit, 24.5% were delayed due to repeated testing and 15.5% were delayed due to hemolysis. Additionally, sample transportation, test verification, payment error and sample error which accounts 48%, 32% and 17% respectively, was recorded as one factor for delayed TAT. (31)

A cross-sectional study conducted in Iran identify causes of laboratory turnaround time delay in the emergency department. The study showed that median TAT was 170, 225 and 195.5 minutes for hemoglobin, serum potassium and prothrombin respectively, with target of 45 minutes. In emergency department waiting time showed highest ratio and lowest ratio for specimen collection. The delayed TAT was 43.6±7.7 minutes. (32)

A prospective study carried out in Kenya, measure the therapeutic turnaround time for common laboratories in tertiary hospital. From a total of 418 samples 356 were used for analysis which includes 155 hematology and 201 clinical chemistry tests. The average TAT for hematology test was 1218 ± 20 minutes and clinical chemistry test was 1332 ± 21 minutes. Delayed mean TAT

was for hematology 8.3 ± 1.29 and for clinical chemistry 8.5 ± 1.18. The main reason for this delay was reported as: printing, sorting and dispatching of results. Tests which were done in the early morning had longer TAT than tests which were done in the evening. (33).

A hospital based cross-sectional study conducted in Addis Ababa examined laboratory performance, associated factors and staff awareness towards achieving turnaround time. A total of 422 sample with 100% completeness rate were included. The frequency distribution of TAT for hematology and clinical chemistry tests were examined which accounts 40.1% and 59.9% respectively. From this only 21.9% of hematology tests and 16.2% of clinical chemistry tests meet there target TAT of 60 minutes for hematology and 90 minutes for clinical chemistry. In this study the average delayed TAT for hematology and clinical chemistry were 139.85± 88.118 and 184.69±74.928 respectively. The main challenges faced while trying to meet target TAT were daily workload, interrupted computer system, improper work flow, inexperience sample collector, delayed maintenance and computer shutdowns. (14)

A retrospective cross-sectional study conducted in Baherdar determine the Magnitude of delayed turnaround time of laboratory results by using a total of 34,233 samples. From the total TAT HIV viral load, gene expert and early infant diagnosis were delayed in a percentage of 76.5%, 53.8% and 68.1% respectively. The main challenges and reason for delayed TAT was reported as: unavailability of reagent, machine failure, and high workload due to high number of patient flow, staff shortage and improper workflow which lead to overlapping. (34)

2.3 Laboratory information management system

A study conducted in western university assessed the implementation of laboratory information system in a simulated laboratory. The study included 18 participants which were asked about the ease of using Laboratory information system. 88.9% respondents had a positive feedback, Out of this 38.9% of them responded as fairly easy, 50% responded as easy and 11.1% of them responded as very easy. On the other hand they showed dislike due to manual recoding of results, downtime of system software and out dated computers. However, the usage of LIS make improvement in work flow management and easy laboratory process. (10).

A study conducted in Peru, examined a web-based laboratory information system to improve quality of care. The study showed that the implementation of laboratory information system brings

a positive impact in patient administration, controlling of laboratory workflow and process, on time delivery of patient result, enhanced quality control, better data management, improved laboratory monitoring and result documentation, time and money management and test repetition. However, it also showed that there were drawback in the system which need improvement like: trained personnel, resource limitation and time taken for transportation. (35).

A study conducted in Boston, determine the importance of implementing electronic specimen collection module by making before and after implementation of electronic system. The study used factors like: satisfaction of patients, mistakes in pre-analytical phase, duration of waiting and time to get service to assess the importance of electronic module. The result findings revealed that after the implementation of electronic system there was an increase in satisfaction of patients, reduction in per-analytical error, reduction in waiting times to get services. On the other hand difficulties were observed such as: staff training and system downtime. (36).

3. Objective

3.1 General Objective

To determine patient satisfaction and turnaround time while using Electronic laboratory information management system along with associated factors in selected public hospitals, Addis Ababa, Ethiopia.

3.2 Specific Objective

- To assess patient satisfaction in selected public hospitals in Addis Ababa, Ethiopia.
- To determine the average turnaround time for hematology and clinical chemistry laboratory test in selected public hospitals in Addis Ababa, Ethiopia.
- To investigate factors associated with turnaround time and patient satisfaction in selected public hospitals, Addis Ababa, Ethiopia.

4. Materials and Methods

4.1 Study Area

Ethiopia is found in the Horn of Africa, which is the northeastern region of Africa. With a population of roughly 110.14 million, the country is 1,112,000 square kilometers in size. About 85% of people are found in rural areas of the country. The economically active age group, which comprises people between the ages of 14 and 60, makes up almost 50% of the overall population, and the yearly population growth rate is 3.09% (38). Addis Ababa is the capital city of Ethiopia. An approximate area of 526.99 square kilometer. Addis Ababa has an estimated 3,686,068 people, of which 1,527,478 are women and 1,389,817 men. All people live in urban areas. There are 13 public Hospitals in Addis Ababa. The study was conducted in 3 public hospitals which are Tikur Anbessa Specialized Hospital (TASH), St Paul's Hospital Millennium Medical College (SPHMMC), and Alert comprehensive specialized Hospital (ALERT). (39).

Tikur Anbessa Specialized Hospital (TASH) with more than 700 beds is Ethiopia's largest specialized hospital and the primary teaching facility for the majority of academic disciplines' preclinical and clinical training. Committed to delivering healthcare services, the TASH staff comprises 115 additional health professionals, 379 nurses, and 200 doctors. Additionally, 950 contract and permanent administrative employees work at the hospital to support its operations (40).

St Paul's Hospital Millennium Medical College (SPHMMC), was founded by the late Emperor Haile Selassie in 1968 and the medical school's opening was in 2007. The college employs more than 2800 people in support, academic, clinical, and administrative capacities. Despite having more than 700 inpatient beds, the college treats 1200 emergency and outpatient patients on average each day. (41).

ALERT comprehensive specialized hospital was founded in 1934 first focusing on leprosy-related health conditions, then developed into a comprehensive facility giving general medical services, undertaking significant research and providing vital training programs. (42)

4.2 Study Design and Period

A Hospital based cross-sectional study was conducted from March to May 2025 in selected public hospitals in Addis Ababa, Ethiopia by using both qualitative and quantitative data collection method.

4.3 Population

4.3.1 Source population

All Patients that attend and receive medical treatment and all laboratory staffs utilizing services in the selected public hospitals.

4.3.2 Study population

All Patients that visit the laboratory and laboratory staff using LIMS in selected public hospitals.

4.4 Inclusion and Exclusion Criteria

4.4.1 Inclusion criteria

- Patients who are willing to participate in the study
- Patients who are requested for hematology and clinical chemistry test
- laboratory who are staff willing to participate

4.4.2 Exclusion criteria

- Patient with mental illness
- Patients with vision or hearing impairment
- Patients and lab staffs who are not willing to participate in the study.

4.5 Study Variables

4.5.1 Dependent variable

- Patient satisfaction
- Turnaround time

4.5.2 Independent variable

- Patient socio-demographic characteristics (Gender, age, marital status, educational level)
- payment method (in-payment, free and insurance)
- previous utilization of laboratory service
- Frequency of lab visits

4.6 Sample size calculation and Sampling method

4.6.1 sample size Calculation

The study contained three types of data collection tools, so that the study had different sample size determination. For quantitative data (patient survey through structured interview and turnaround time recording) Sample size (n) is calculated based on the single proportion population formula:

$$n = \frac{\left(\frac{Z\alpha}{2}\right)^2 p(1-p)}{d^2}$$

Considering the following assumption:

95% confidence interval (CI) [$Z\alpha/2$=1.96]

5% margin of error (d) = 0.05

Expected prevalence (p) 50%= 0.5, since there is no study conducted previously.

$$n = \frac{(1.96)^2 0.5(1-0.5)}{0.05^2}$$

n=384

Considering 10% as non-response rate, the final sample size will be **422** (for patient survey).

In this study a total of 422 patient were included as well as their samples was used to record Turnaround time for hematology and clinical chemistry tests. Thus, the total sample size was allocated proportionally for the three hospitals according to the average number of patient flow or sample test done per day. So that the average number of patient flow in TASH and SPHMMC is 400 per day and for ALERT is 250 per day. This distribution is based on the annual laboratory report. According to the proportion the samples size for TASH and SPHMMC was 150 and for ALERT was 122.

For Qualitative data (In-depth interview) the sample size was determined purposively for laboratory staff participants and the size of the collected data was determined by saturation point. In addition to the in-depth interview there was also a quantitative (structured) questionnaire related to TAT. A total of 30 participants' (10 lab professional for each hospital) which includes 1 lab head, 1 lab quality officer, 1 department head and 3 laboratory technologist in hematology section

and 1 department head and 3 lab technologist in clinical chemistry section was carried out. The quantitative sample size includes those patients/laboratory tests that come from every department/unit of outpatients during the study period.

4.6.2 Sampling method

A simple random sampling method was used to select the three hospitals (TASH, SPHMMC and ALERT). For quantitative data, a systematic random sampling was used to select 422 patients from patients visiting the laboratory, for structured interview and TAT recording. By using lottery method the random number (k=4) was identified. Accordingly, every 4 patient was selected and interviewed after consent, also there sample was used to measure turnaround time. For qualitative data, In-depth interview a purposive sampling method was used to select laboratory professionals to assess the factors affecting Turnaround time and patient satisfaction while using the Laboratory information management system.

4.7 Measurement and Data collection

4.7.1 Data collection procedure

A quantitative data for patient survey was collected about the perspective of patients towards laboratory service, challenges faced and overall satisfaction. A well-trained 2 data collectors and the principal investigator were involved. This survey was conducted in patients who were willing to participate in the study and signed a consent form. The data collectors made face to face interview on structured questionnaire. (Annex 4)

Turnaround time was recorded in every phase (pre-analytical, analytical & post analytical) by using recording log sheet. Data collectors recorded every minutes from sample collection to result dissemination with patient background information. By following data collection criteria, data collectors communicated information such as which patient sample to record with each other. (Annex 5)

A qualitative data for In-depth interview was conducted by using open ended questions. The laboratory professionals signed an informed consent to participate in the study. Data collectors made an in-depth interview about the perspective of laboratory professionals towards Laboratory information management system regards to usability, training, resource, accessibility and maintenance who were selected purposively and willing to participate. Besides to the in-depth

interview, laboratory personnel's were given a close ended questionnaire about turnaround time and factors affecting TAT. (Annex 6)

4.8 Data Quality Assurance

The survey and In-depth interview guide were pre-tested by using 5% of the total sample size which is 422 (a total of 21 patients with 7 patients for each hospitals, which were not included in the total sample size) whether it is appropriate and understandable. The questionnaire and In-depth interview guide were prepared in English and translated to local language (Amharic), after data collection then again it was translated to English. Before the beginning of data collection training was given for data collectors by the principal investigator. The overall data collection procedure was monitored by the principal investigator. An In-depth interview was conducted in a quiet place at the hospitals with laboratory professionals. Every collected data were kept in a locked cabinet of the principal investigator. Lastly, during and after data gathering, qualitative finding procedures including audit trials and member checks were used to ensure reliability.

4.9 Data Analysis and Interpretation

After data collection, the data was checked for quality and completeness. The quantitative data was entered into excel and analyzed by using SPSS version 25. A Likert scale was used to measure the level of satisfaction rating 1=very-dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied and 5=very-satisfied. In order to determine the level of patient satisfaction on different laboratory services, very satisfied and satisfied were considered as satisfied and neutral, dissatisfied and very dissatisfied were considered as dissatisfied. By dividing the number of satisfied or unsatisfied responses by the total number of respondents, the percentage of satisfaction or dissatisfaction was determined. The mean 3.3 of the overall satisfaction score was used to categorize respondents as satisfied or dissatisfied (above mean= satisfied and below mean= dissatisfied).

Qualitative data was analyzed by using thematic analysis; interview with lab personnel about LIMS was translated from Amharic to English language then coded and categorized manually based on the similarity of response.

In order to measure TAT, the TAT for each tests were compared with the pre-established standards set by the selected hospitals which was 270 minutes for clinical chemistry and 90 minutes for hematology (the three selected hospitals had established the same target TAT). Then overall mean

TAT and mean TAT for pre analytic, analytic and post analytic phases of testing was calculated. Finally mean score was calculated to measure the overall satisfaction level of patients. Tabulated percentage, mean and range of variables were produced by using descriptive statistical analysis. Additionally, binary and multiple logistics regression analysis were used to find out significant association between dependent and independent variables. P value of <0.05 at a 95% confidence interval indicate that the results will be considered as significant. Following that text, graphs and tables were used to present the results.

4.10 Operational Definition

Laboratory information management system (LIMS): computer based system used to manage, store and transfer test order and test result report within the laboratory.

Turnaround Time (TAT): the duration between the time a sample is received in the laboratory and the time the final result is reported. TAT was measured in minutes by subtracting the time of sample receipt from the time of result reporting. TAT less than and equal to the time/minute stated in the target TAT of the selected hospital laboratories was termed as TAT achieved, and TAT greater than target TAT of the selected hospital laboratories was termed as TAT not achieved.

Satisfied: In overall satisfaction rating, patients are said satisfied if there rate of satisfaction is above the mean.

Dissatisfied: In overall satisfaction rating, patients are said dissatisfied if there rate of satisfaction is below the mean.

4.11 Ethical Consideration

Ethical clearance to conduct the study was obtained from the Department Research and Ethics Committee (DREC) from the department of medical laboratory science, Addis Ababa University. A permission letter was obtained from selected public hospitals to conduct the study. Study participants were informed about the purpose of the study and patients were asked to fill and sign a written informed consent. Participating in the study was volunteer and refusal was accepted. To ensure confidentiality, participant data were recorded by using unique code as well as their identification number and unauthorized person would not have permission to access the participant

data. The study participant did not receive any payment or other payment for participating in the study.

4.12 Dissemination of the Result

The research finding will be evaluated by a responsible body and submitted to the Department of Medical Laboratory Sciences, College of Health Sciences, Addis Ababa University. Then disseminated to selected public hospitals. The research will be published to be posted on the internet so that many could get and use it as a reference for further researches and work on intervention plan.

5 Result

5.1 Patient socio-demographic characteristics

A total of 422 patients were involved in these study, with a response rate of 100%. Among these, more than half, 233 (52.8%) were male, the age of patients range from 7 – 90 years and majority of the participants 153 (36.3%) were 16 – 30 years. Majority of the participants 145 (34.4%) had an educational level of 7-12 grade. Most of the participants were involved in other activities 110 (26.1%), students 72 (17.1%), house wife 81 (19.2%) and gov't employee 37 (19.2%), others were merchant 41 (9.7%) and unemployed 81 (8.8%). Regarding income majority 204 (48.3%), of the participants earn less than 1500 Ethiopian Birr per month. Regarding marital status, the majority, were married 175 (41.5%). (Table1)

Table 1. Socio-demographic characteristics of study participants at selected public hospitals Addis Ababa, Ethiopia, 2025, (n=422)

Variables	Categories	Frequency	Percent (%)
Gender	Male	223	52.8
	Female	199	47.2
Age group	1 - 15	24	5.7
	16 – 30	153	36.3
	31 – 45	118	28
	46 – 60	86	20.4
	Above 61	41	9.7
Educational level	No reading & writing	49	11.6
	only reading & writing	15	3.6
	1-6	85	20.1
	7-12	145	34.4
	Diploma & above	128	30.3
Current occupation	Student	72	17.1
	House wife	81	19.2
	Gov't employee	37	8.8
	Merchant	41	9.7

	Unemployed	81	19.2
	Other	110	26.1
Monthly income	<1500	204	48.3
	1600-3000	69	16.4
	3500-5000	61	14.5
	5500-7000	40	9.5
	>8000	48	11.4
Marital status	Single	141	33.4
	Married	175	41.5
	Divorced	72	17.1
	Widowed	34	8.1

5.2 Types of laboratory services

Many of the study participants payment method was insurance 228 (54%) and which visit the laboratory rarely 238 (56.4%). out of the total participants 280 (66.4%) receive there lab results on time where the higher number was from TASH 138 (92%) and SPMHMC 102 (68%) whereas most of ALERT participants 40 (32.8%) respond as they didn't receive their results on time. 371 (87.9%) will come again to get the service for the reason; availability of many services 88 (20.9%), health talk 84 (19.9%) and good service quality 77 (18.2%). (Table 2)

Table 2. Overall laboratory services in selected public hospitals Addis Ababa, Ethiopia, 2025

Overall service	Name of Hospitals				Total %
		TASH	SPMHMC	ALERT	
Payment method	In-payment	67 (44.7%)	56 (37.3%)	38 (31.1%)	161 (38.2%)
	Free	7 (4.7%)	19 (12.7%)	7 (5.7%)	33 (7.8%)
	Insurance	76 (50.7%)	75 (50%)	77 (63.1%)	228 (54.0%)
Frequency of lab visit	Mostly	55 (36.7%)	63 (42%)	66 (54.1%)	184 (43.6%)
	Rarely	95 (63.3%)	87 (58%)	56 (45.9%)	238 (56.4%)

Receive results on time	No	12 (8%)	48 (32%)	82 (67.2%)	142 (33.6%)
	Yes	138 (92%)	102 (68%)	40 (32.8%)	280 (66.4%)
Will come again to get service	No	11 (7.3%)	19 (12.7%)	21 (17.2%)	51 (12.1%)
	Yes	139 (92.7%)	131 (87.3%)	101 (82.8%)	371 (87.9%)
Reason to come again	Convenient hr.	4 (2.7%)	10 (6.7%)	0 (0%)	14 (3.3%)
	Get service early	11 (7.3%)	6 (4%)	1 (0.8%)	18 (4.3%)
	Good quality service	34 (22.7%)	27 (18%)	16 (13.1%)	77 (18.2%)
	Availability of many services	25 (16.7%)	43 (28.7%)	20 (16.4%)	88 (20.9%)
	Want to be anonymous	6 (4%)	2 (1.3%)	5 (4.1%)	13 (3.1%)
	Health talk	30 (20%)	27 (18%)	27 (22.1%)	84 (19.9%)
	Cheaper fee	18 (12%)	8 (5.3%)	24 (19.7%)	50 (11.8%)
	Prefer providers here	10 (6.7%)	7 (4.7%)	15 (12.3%)	32 (7.6%)
	Other	12 (2.9%)	20 (4.7%)	14 (3.3%)	46 (10.9%)

5.3 Level of patient satisfaction towards laboratory services

The overall mean rate of patient satisfaction for laboratory services across the three hospitals was 3.3: TASH had a total mean of 3.2, with satisfaction percentage ranging from (13.3%) to (93.3%); The highest satisfaction was for waiting times, courtesy and respect of lab personnel, privacy during specimen collection, and lab fee rating 105 (70%), 113 (75.3%), 114 (76%) and 140 (93.3%) respectively, while the lowest percentage satisfaction were for adequacy of sitting arrangements and latrine cleanness at 20 (13.3%) and 28 (18.6%).

In contrast, SPMHMC had a higher total mean satisfaction of 3.4, with percentage ranging from (34.6%) to (76.6%), the highest rating were for courtesy, privacy, communication and lab fee, rating 103 (68.7%), 96 (64%), 95 (63.3%) and 115 (76.7%) respectively, with the lowest percentage satisfaction for latrine cleanness at 52 (34.7%).

ALERT reported a total mean satisfaction of 3.2, with satisfaction percentage ranging from (19.6%) to (75.4%); the highest satisfaction came from courtesy, lab location, availability of requested tests and lab fee at 82 (67.2%), 92 (75.4%), 91 (74.5%) and 88 (72.1%), while the lowest satisfaction were for sitting arrangement and latrine cleanness at 24 (19.7%) and 49 (40.2%). (Table 3)

Table 3. Overall patient satisfaction in laboratory service with in selected public hospitals.

Variables		Name of hospitals			Total %
		TASH	SPMHMC	ALERT	
Waiting to get lab service	Satisfied	105 (70%)	74 (49.3%)	67 (54.9%)	246 (58.3%)
	Dissatisfied	45 (30%)	76 (50.7%)	55 (45.1%)	176 (41.7%)
Courtesy and respect of lab personnel	Satisfied	113 (75.3%)	103 (68.7%)	82 (67.2%)	298 (70.6%)
	Dissatisfied	37 (24.7%)	47 (31.3%)	40 (32.8%)	124 (29.4%)
Privacy during specimen collection	Satisfied	114 (76%)	96 (64%)	44 (36.1%)	254 (60.1%)
	Dissatisfied	36 (24%)	54 (36%)	78 (63.9%)	168 (39.9%)
Location of lab	Satisfied	88 (58.7%)	72 (48%)	92 (75.4%)	252 (59.7%)
	Dissatisfied	62 (41.3%)	78 (52%)	30 (24.6%)	170 (40.3%)
Availability of requested tests	Satisfied	99 (66%)	80 (53.3%)	91 (74.6%)	270 (64%)
	Dissatisfied	51 (34%)	70 (46.7%)	31 (25.4%)	152 (36%)
Adequacy of sitting arrangement in waiting area	Satisfied	20 (13.3%)	75 (50%)	24 (19.7%)	119 (28.2%)
	Dissatisfied	130 (86.7%)	75 (50%)	98 (80.3%)	303 (71.8%)
Cleanness of lab	Satisfied	55 (36.7%)	89 (59.3%)	53 (43.4%)	197 (46.7%)
	Dissatisfied	95 (63.3%)	61 (40.7%)	69 (56.6%)	225 (53.3%)
Communication with lab personnel	Satisfied	31 (20.7%)	95 (63.3%)	56 (45.9%)	182 (43.1%)
	Dissatisfied	119 (79.3%)	55 (36.7%)	66 (54.1%)	240 (56.9%)
Lab fee	Satisfied	140 (93.3%)	115 (76.7%)	88 (72.1%)	343(81.3%)
	Dissatisfied	10 (6.7%)	35 (23.3%)	34 (27.9%)	79 (18.7%)
Cleanness of latrine	Satisfied	28 (18.7%)	52 (34.7%)	49 (40.2%)	129 (30.6%)
	Dissatisfied	122 (81.3%)	98 (65.3%)	73 (59.8%)	293 (69.4%)

5.4 Association between levels of patient satisfaction with socio-demographic variables

Based on the result of chi square test, there were a statistically significant association between age group (0.019), marital status (0.007), current occupation (0.01), payment method (0.010) and previous utilization of service (0.037) with patient satisfaction as indicated by the low p-value ($p<0.05$). (Table 4)

Table 4. Chi-square analysis for patients' satisfaction indicators towards clinical laboratory service

Variables	Satisfaction, n(%)		Chi-square value		
	Satisfied	**Dissatisfied**	***df***	χ^2	***P*-value**
Gender			10	4.805	0.904
Male	97 (48.5)	126 (56.8)			
Female	103 (51.5)	96 (43.2)			
Age group			40	60.678	0.019
<15	8 (4)	16 (7.2)			
16-30	79 (39.5)	74 (33.3)			
31-45	48 (24)	70 (31.5)			
46-60	43 (21.5)	43 (19.4)			
>61	22 (11)	19 (8.6)			
Patient edu. level			40	53.584	0.074
No reading & writing	25 (12.5)	24 (10.8)			
Only read & write	7 (3.5)	8 (3.6)			
1-6	35 (17.5)	50 (22.5)			
7-12	74 (37)	71 (32)			
Diploma & above	59 (29.5)	69 (31.1)			
Marital status			30	52.282	0.007
Single	66 (33)	75 (33.8)			
Married	80 (40)	95 (42.8)			
Divorced	35 (17.5)	37 (16.7)			

Widowed	19 (9.5)	15 (6.8)			
Current occupation			50	76.345	0.01
Student	33 (16.5)	39 (17.6)			
House wife	47 (23.5)	34 (15.3)			
Unemployed	16 (8)	21 (9.5)			
Merchant	22 (11)	19 (8.6)			
Gov't employee	36 (18)	45 (20.3)			
Other	46 (23)	64 (28.8)			
Payment method			20	31.188	0.010
Insurance	83 (63.4)	68 (45.3)			
Free	7 (5.3)	11 (7.3)			
Payment	41 (31.3)	71 (47.3)			
Previously utilize the lab service			10	19.242	0.037
No	52 (26)	49 (22.1)			
Yes	148 (74)	173 (77.9)			
Frequency of lab visit			10	10.327	0.412
Mostly	84 (42)	100 (45			
Rarely	116 (58)	122 (55)			

According to the result of binary logistics regression analysis, the overall satisfaction of patients towards laboratory service showed that there is statistically significant association between patient satisfaction with current occupation, average monthly income, payment method and TAT for clinical chemistry test ($P<0.05$). On the other hand gender, age group, educational level, marital status, previous utilization of laboratory service, frequency of lab visit, will come again and TAT for hematology doesn't show statistically significant association ($P>0.05$). (Table 5)

After adjusted odds ratio is calculated, statistically significant association was found between the overall satisfaction and current occupation, average monthly income, payment method and TAT for clinical chemistry test ($P<0.05$).

Patients who are gov't employees were 3.082 times more likely to be satisfied than student (AOR=3.082; CI: 1.336-7.112). Similarly, patients who had an average monthly income of between (5,500 - 7,000) were 3.598 times more likely to be satisfied than whose average income were <1500 (AOR=3.598; CI: 1.496-8.654).

As shown in the table patients who got free service as there payment method were 1.932 times more likely to be satisfied than who got the service in payment (AOR=1.932; CI: 1.212-3.077). Additionally, patients who had clinical chemistry TAT of achieved were 1.539 times more likely to be satisfied than whose clinical chemistry TAT had not achieved (AOR=1.539; CI: 1.001-2.366). (Table 5)

Table 5. Determinants of patient satisfaction towards laboratory service across three public hospitals, Addis Ababa, Ethiopia, 2025, (n=422)

Variables	Overall satisfaction			Odds Ratio (95% CI)		
	Sat. (no., %)	Dissat. (no., %)	Crude	P-Value	Adjusted	P-Value
Gender						
Male	97 (48.5)	126 (56.8)	1			
Female	103 (51.5)	96 (43.2)	0.718 (0.489-1.053)	0.09		
Age group						
1-15	8 (4)	16 (7.2)	1			
16-30	79 (39.5)	74 (33.3)	0.432 (0.152-1.231)	0.116		
31-45	48 (24)	70 (31.5)	0.922 (0.462-1.840)	0.818		
46-60	43 (21.5)	43 (19.4)	0.592 (0.290-1.211)	0.151		
Above 61	22 (11)	19 (8.6)	0.864 (0.410-1.820)	0.700		
Educational level						
No reading & writing	25 (12.5)	24 (10.8)	1			
Only read & write	7 (3.5)	8 (3.6)	1.128 (0.63.-2.355)	0.557		
1-6	35 (17.5)	50 (22.5)	1.023 (0.350-2.990)	0.966		
7-12	74 (37)	71 (32)	0.819 (0.470-1.425)	0.479		
Diploma & above	59 (29.5)	69 (31.1)	1.219 (0.757-1.962)	0.415		
Marital status						
Single	66 (33)	75 (33.8)	1			
Married	80 (40)	95 (42.8)	0.695 (0.327-1.476)	0.343		
Divorced	35 (17.5)	37 (16.7)	0.665 (0.317-1.393)	0.279		

Widowed	19 (9.5)	15 (6.8)	0.747 (0.329-1.695)	0.485		
Current occupation						
Student	33 (16.5)	39 (17.6)	1		1	
House wife	47 (23.5)	34 (15.3)	1.117 (0.647-2.142)	0.593	1.216 (0.451-3.276)	0.700
Unemployed	16 (8)	21 (9.5)	**1.923 (1.075-3.441)**	**0.028***	1.86 (0.692-4.998)	0.218
Merchant	22 (11)	19 (8.6)	1.060 (0.499-2.250)	0.879	0.992 (0.364-2.703)	0.987
Gov't employee	36 (18)	45 (20.3)	1.611 (0.783-3.314)	0.195	**3.082 (1.336-7.112)**	**0.008****
Other	46 (23)	64 (28.8)	1.113 (0.624-1.987)	0.717	1.788 (0.866-3.691)	0.116
Average monthly income						
<1500	103 (51.5)	101 (45.5)	1		1	
1600-3000	30 (15)	39 (17.6)	**2.477 (1.254-4.890)**	**0.009****	2.756 (0.914-8.307)	0.072
3500-5000	35 (17.5)	26 (11.7)	1.868 (0.853-4.090)	0.118	2.233 (0.899-5.544)	0.083
5500-7000	18 (9)	22 (9.9)	**3.269 (1.464-7.298)**	**0.004****	**3.598 (1.496-8.654)**	**0.004****
>8000	14 (7)	34 (15.3)	1.987 (0.824-4.793)	0.126	2.278 (0.876-5.923)	0.091
Payment method						
Payment	67 (33.5)	94 (42.3)	1		1	
Free	11 (5.5)	22 (9.9)	1.615 (1.074-2.427)	0.21	**1.932 (1.212-3.077)**	**0.006****
Insurance	122 (61)	106 (47.7)	0.701 (0.319-1.544)	0.378	0.729 (0.3.7-1.732)	0.475
Previously utilize lab service						
Yes	148 (74)	173 (77.9)	1			
No	52 (26)	49 (22.1)	1.240 (0.793-1.941)	0.345		
Frequency of lab visit						
Mostly	84 (42)	100 (45)	1			
Rarely	116 (58)	122 (55)	0.883 (0.601-1.299)	0.529		
Will come again						
Yes	181 (90.5)	190 (85.6)	1			
No	19 (37.3)	32 (14.4)	0.623 (0.341-1.139)	0.124		
Chem lab TAT						
Not achieved	125 (62.5)	117 (52.7)	1		1	
Achieved	75 (37.5)	105 (47.3)	**1.496 (1.014-2.207)**	**0.043***	**1.539 (1.001-2.366)**	**0.049***
Hema lab TAT						
Not achieved	69 (34.5)	72 (32.4)	1			
Achieved	131 (65.5)	150 (67.6)	1.097 (0.732-1.645)	0.653		

* Statistically significant P<0.05. **statistically high significant P<0.005. Reference categories are indicated by 1 and Adjustment was done for variables with p-value ≤ 0.25 listed in crude odd ratio.

5.5 Turnaround time for clinical chemistry and Hematology test

A total of 844 clinical chemistry and hematology patient samples were systematically selected with 100% completeness rate. Among these, 422 were allocated for both clinical chemistry and hematology. From the expected time 270 min for clinical chemistry (which is the same across the three hospitals); TASH (52.7%), SPMHMC (56.7%) and ALERT (39.3%) achieved the target time. For hematology from the expected time 90 min (same across the three hospitals); TASH (40.7%), SPMHMC (34.7%) and ALERT (23%) achieved the target time as shown in the figure.

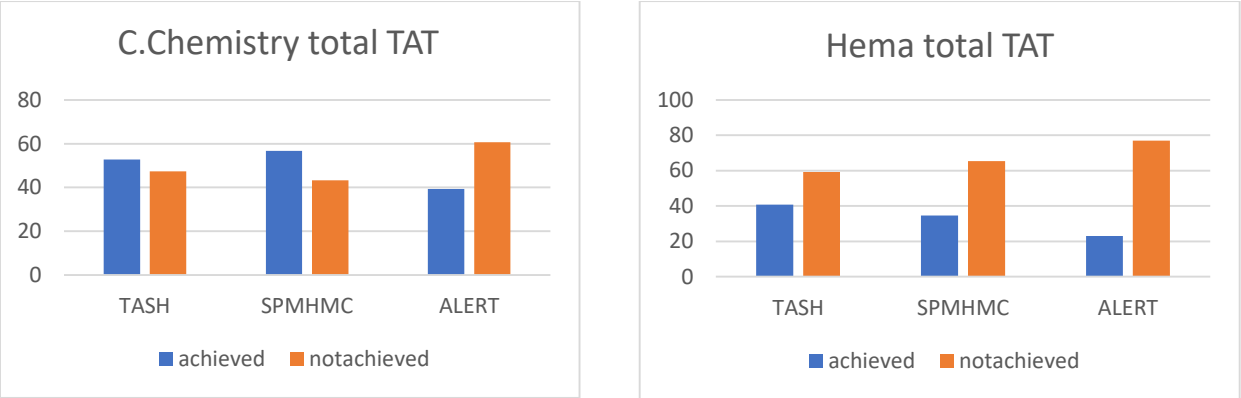


Figure 1. Frequency distribution of clinical chemistry and hematology TAT

In this finding the mean TAT for clinical chemistry; for TASH was 272.64±119.689, SPMHMC was 220.96±98.811 and ALERT was 362.68±205.244. Moreover, the pre-analytical mean TAT for TASH was 55.87±29.339, SPMHMC 15.74±10.239 and ALERT was 72.87±33.899. Analytical mean TAT for TASH was 138.75±103.089, SPMHMC 191.22±103.232 and ALERT was 219.77±216.839. Post-analytical mean TAT for TASH was 83.35±90.097, SPMHMC was 17.4±28.451 and ALERT was 70.04±60.061.

Similarly, the overall mean TAT of Hematology tests showed for TASH was 191.95±139.112, SPMHMC was 146.59±92.378 and ALERT was 131.31±45.549. Furthermore, pre-analytical mean TAT for TASH was 44.75±28.575, for SPMHMC was 16±11.272 and ALERT was 69.94±37.918. Analytical mean TAT for TASH was 84.71±83.932, for SPMHMC was 113.53±92.446 and ALERT was 42.71±31.21. Post analytical mean TAT for TASH was 64.89±93.402, for SPMHMC was 17.13±21.202 and ALERT was 18.72±11.046.

Additionally, from overall TAT mean delay was calculated. For clinical chemistry; for TASH was 395.75±92.109, SPMHMC was 339.24±45.891 and ALERT was 470.35±196.011. For hematology; for TASH was 272.54±128.085, SPMHMC was 189.89±86.141 and ALERT was 151.69±28.357.

5.6 Associated factors affecting turnaround time and patient satisfaction

5.6.1 Laboratory personnel Socio-demographic characteristics

From a total of 30 lab personnel the majority were male 18 (60%). Age was categorized as <30 and >30 years which most of them were <30, 20 (66.7%). Most of them 16 (53.3%) had educational qualification of BSc. Half of the participants 50 (50%) had an experience of 5-10 years. regards to position in lab, the majority were 18 (60%) lab experts. (Table 6)

Table 6. Socio-demographic characteristics of laboratory staff at selected public hospitals, Addis Ababa, Ethiopia, (n=30)

Variables	Categories	Frequency	Percent
Gender	Male	18	60
	Female	12	40
Age group	<30	20	66.7
	>30	10	33.3
Educational level	BSc	16	53.3
	MSc	14	46.7
Work experience	<5	7	23.3
	5-10	15	50
	>10	8	26.7
Position in lab	Lab head	3	10
	Quality officer	3	10
	Dep't head	6	20
	Lab expert	18	60

5.6.2 Laboratory personnel information about turnaround time

Almost all respondents reported that they have adequate information about TAT at all of the selected hospitals. SPMHMC and ALERT reported 100% of respondents received adequate refreshment training but for TASH was only (30%). Laboratory staffs of TASH reported that, mostly (90%) customers need were meet, and ALERT reported (60%) customer need were not always meet. Almost all hospitals respondents agreed that optimum TAT and higher advanced equipment improve laboratory service. In SPMHMC, lab staffs reported a high percentage 80% of analytical phase delays due to instrument malfunction; other hospitals responded Malfunction of instruments, difficulties with methods/standards/controls, and other reasons like power interruption and workload contributed to analytical phase delays. A significant percentage of respondents TASH 50%, SPMHMC 90% and ALERT 70% indicated that result verification and retesting contribute to analytical phase delays. Most respondents TASH 90%, SPMHMC 80% and ALERT 100% agreed that staff shortages are associated with analytical phase delays. Equipment failure, workload, and a combination of all factors were identified as reasons for poor TAT. A high percentage 90% of respondents at TASH perceived the lab workload as very high. (Table 7)

Table 7. Laboratory personnel information about turnaround time across three hospitals Addis Ababa, Ethiopia, 2025

Variables		Name of hospitals			Total %
		TASH	SPMHMC	ALERT	
Adequate info about TAT	Yes	10 (100%)	9 (90%)	9 (90%)	30 (100%)
	No	0 (0%)	1 (10%)	1 (10%)	
Adequate refreshment training	Yes	3 (30%)	10 (100%)	10 (100%)	30 (100%)
	No	7 (70%)	0 (0%)	0 (0%)	
Freq of meeting customer need	Not always	1 (10%)	4 (40%)	6 (60%)	30 (100%)
	Mostly	9 (90%)	5 (50%)	4 (40%)	
	Not at all	0 (0%)	1 (10%)	0 (0%)	
Optimum TAT improve lab service	Yes	10 (100%)	8 (80%)	10 (100%)	30 (100%)
	No	0 (0%)	2 (20%)	0 (0%)	

Higher advanced equipment improve TAT	Yes	10 (100%)	10 (100%)	10 (100%)	30 (100%)
	No	0 (0%)	0 (0%)	0 (0%)	
Reason of analytical phase delay	Malfunction of instrument	4 (20%)	8 (80%)	3 (30%)	30 (100%)
	Difficult with method, standard, control	2 (20%)	1 (1%)	1 (10%)	
	Other	4 (40%)	1 (10%)	6 (60%)	
Result verification & retesting delay analytical phase	Yes	5 (50%)	9 (90%)	7 (70%)	30 (100%)
	No	5 (50%)	1 (10%)	3 (30%)	
Staff shortage associate with analytical phase delay	Yes	9 (90%)	8 (80%)	10 (100%)	30 (100%)
	No	1 (10%)	2 (20%)	0 (0%)	
Reason for poor TAT	Equipment failure	1 (10%)	1 (10%)	1 (10%)	30 (100%)
	Workload	3 (30%)	5 (50%)	4 (40%)	
	all	6 (60%)	4 (40%)	5 (50%)	
Perceived lab work load	Very high	9 (90%)	3 (30%)	5 (50%)	30 (100%)
	High	1 (10%)	5 (50%)	5 (50%)	
	Fear	0(0%)	2 (20%)	0 (0%)	

5.6.3 Factors affecting turnaround time

TASH and SPMHMC record specimen arrival and release time with 100% rate of respondents but ALERT do not record time 100% and there reason for not recording TAT were workload 50%, poor staff motivation 30% and other reason like not told by upper management 20%. All hospitals largely follow SOP with a slight deviation in ALERT where 20% do not. Client satisfaction survey are generally with ALERT showing highest rate 100%. Communication with upper management

was mostly positive across all hospitals. Effective communication within hospitals varies, TASH 70%, SPMHMC 60% and ALERT 20%. regarding having adequate equipment for better TAT opinions differ with ALERT 80% and SPMHMC 70% reporting higher positive response compared to TASH 30%. (Table 8)

Table 8. Factors affecting turnaround time across the three public hospital laboratories, Addis Ababa, Ethiopia, (n=30)

Variables		Name of hospitals			Total %
		TASH	**SPMHMC**	**ALERT**	
Record time of specimen arrival & release	Yes	10 (100%)	10 (100%)	0 (%)	30 (100%)
	No	0 (0%)	0 (0%)	10 (100%)	
Reason not to record TAT	Workload	0 (%)	0 (%)	5 (50%)	30 (100%)
	Poor staff motivation	0 (0%)	0 (%)	3 (30%)	
	other	10 (100%)	10 (100%)	2 (20%)	
Follow SOP	Yes	10 (100%)	10 (100%)	8 (80%)	30 (100%)
	No	0 (0%)	0 (0%)	2 (20%)	
Client satisfaction survey done in your lab	Yes	8 (80%)	7 (70%)	10 (100%)	30 (100%)
	No	2 (20%)	3 (30%)	0 (0%)	
Communication with upper management	Yes	7 (70%)	9 (90%)	8 (80%)	30 (100%)
	No	3 (30%)	1 (10%)	2 (20%)	
Effective communication in your lab	Yes	7 (70%)	6 (60%)	2 (20%)	30 (100%)
	No	3 (30%)	4 (40%)	8 (80%)	
have adequate equipment for better TAT	Yes	3 (30%)	7 (70%)	8 (80%)	30 (100%)
	No	7 (70%)	3 (30%)	2 (20%)	

5.7 Qualitative findings from Laboratory personnel response regards to LIMS usage

In TASH 10 laboratory staff were interviewed about their experience in using LIMS. Majority of the participants responded that (90%) they receive training on how to use the LIMS, 60% of them

responded that there is insufficient number of computers and the available ones are outdated which leads to delayed TAT, staff dissatisfaction and inability to manage workload. Unstable network, system downtime and power outages were among the difficulties faced while utilizing LIMS. 70% of the participants said they rarely to mostly face technical problem and downtime. Power outages have been linked to higher workload, data loss, and longer TAT. Participants listed advantages of using LIMS as: reduction in result missing, good for data storage and backup, time management, minimized workload and overlapping, better TAT performance and quality of data. On the other hand they listed the disadvantages as: requirement for constant power and internet connection and one respondent said the system does not show tests that were received separately. But, 50% of respondents said there was no disadvantage in using LIMS.

At SPMHMC most of the participants 60% did not receive training; and responded that there are sufficient number of computers for use while 40% of them said that insufficient number of computers lead to higher workload and delayed TAT. Major challenges when using LIMS were stated as: unstable network and power supply and technical problems by most of respondents (80%). It was frequently observed that power outage causes to stop the system, increase workload, delay TAT and data loss. Advantages of using LIMS were reported as: reduce effort, better time management, easy accessibility of patient result, reduce manual error, better data recording and documentation and decrease TAT. However there are challenges in using the system such as: the system rely on stable network and power source, staff difficulty in system adaptation and loss of data due to power outage.

In ALERT hospital participants generally responded that there is no fully computerized system, paper is still in laboratory work even though, they did not receive training on LIMS usage. Majority of them responded that there is enough amount of computers for usage. Most of the participants reported that they face difficulties while utilizing the system, such as power outages and unstable network conditions, which result in prolonged TAT and work overlap. The majority of test requests are sent on paper, which slows down lab work and delays timely patient results delivery, though patients are experiencing issues like where to pick up their results and result loss.

6. Discussion

According to this research patients overall level of satisfaction for the three hospitals were TASH 52.8% (3.2), SPMHMC 56.7% (3.4) and ALERT 52.9% (3.2) which is less than other findings form prior studies in Addis Ababa 85.5% and 78.6%. [21, 1] The reason for this variation might be as the interview was done in the hospital and face to face patient's may not feel free to express their unhappiness about the services On the other hand this study was comparable with studies conducted in Addis Ababa 51.7%, and Werabe 50.1% However, a research carried out in Debremarkos which revealed satisfaction level of 40.3%, show that this study is higher and the reason for this difference might be the case that this study was carried out in referral hospitals with high number of qualified medical specialist and advanced equipment for diagnosis.[22, 25,26]

Among the various services provided by the laboratory, patients expressed a degree of satisfaction with the courtesy and respect of the lab personnel as well as the lab fee (TASH 75.3%, SPMHMC 68.6%, ALERT 67.2%) and (TASH 93.3, SPMHMC 76.6%, ALERT 72.1%), respectively. This is less than to a studies that was conducted in Addis Ababa (86.5%, 84.6%). This difference may be due to the service provider lack of prioritizing patients care and lab free due to inflation. [22, 23] privacy during specimen collection in was TASH 76% and SPMHMC 64% which is higher and ALERT was 36.1% which is lower than a study conducted in Addis Ababa 43.8% this variation might be due to lack of attention to patient confidentiality at ALERT hospital which leads to less focus on maintaining patient privacy during sample collection. [22]

This study showed relative dissatisfaction of patients in cleanness of latrine (TASH 18.7%, SPMHMC 34.7%, ALERT 40.2%) which is less than three findings conducted around Ethiopia 47.3% and in Addis Ababa (44.4%, 63.5%, 63.8%) and this variation in level of satisfaction might be for the reason that even if there is some improvements in cleanliness of latrine still it doesn't satisfy the patients, there is unavailability of water for toilet usage. [1, 21, 22, 23] Additionally patients were dissatisfied in the adequacy of sitting arrangements (TASH 13.3%, SPMHMC 50% and ALERT 19.7%) which is less to a study conducted in Addis Ababa Ethiopia 45.1% and 61.1% the reason for this variation might be: as the hospitals are referral with better specialists there is high number of patient flow so that the available sitting will not be equivalent to the number of patients, and maybe due resource limitation to add sitting arrangements. [1, 22]

In this study patients were relatively satisfied in location of laboratory TASH 58.7%, SPMHMC 48% and ALERT 75.4% which was higher than a study conducted in public hospitals in Ethiopia 19% for this variation the reason might be their study includes several hospitals, however it was less than a study conducted in Addis Ababa 79.1% this variation might be, the patients in these study were not able to find the laboratory easily. [1, 22]

The current study show that patients were dissatisfied in cleanness of laboratory sample collection area and patient communication with lab personnel TASH 36.7% and 20.7% and ALERT 43.4% and 45.9% respectively, but in SPMHMC 59.3% and 63.3% patients were satisfied towards cleanliness of laboratory sample collection area and patient communication with lab personnel respectively even though it was higher than a study carried out in Addis Ababa 10.4% and 9% respectively. The reason for this difference might be the application of latest advancements that that enhance the experience of patients. [24]

About 66%, 53.3% and 74.6% form TASH, SPMHMC and ALERT respectively reported that they were satisfied in getting the requested laboratory tests during the study period which is higher than a study carried out in Jimma 51.74%, this difference of satisfaction maybe be: since this three hospitals are found in the capital city and are referral centers, they have greater access to resources and variety of diagnostic tests enabling them to more effectively satisfy patient's needs. [27]

In this study statistically significant association were shown between current occupation, average monthly income, payment method and TAT for clinical chemistry test. This is different from studies conducted in Addis Ababa, Jimma and Werabe [21, 22, 23, 24, 25]

The findings demonstrated that the three hospital laboratories ability in achieving TAT in clinical chemistry and hematology was considerably poor; for clinical chemistry tests TAT in TASH 52.7%, SPMHMC 56.7% and ALERT 39.3% which was less than a study conducted in Korea 98% this difference might be due to having a machine more than one which function properly and having stable power supply. But is higher than a study conducted in Addis Ababa 16.3% this difference might be because those hospitals has better way of managing testing duration for short TAT and staff availability on working hours. However this study was comparable to a study conducted in Karachi 59.3% and India 54.6%. [28, 14, 7, 29]

The mean delay for clinical chemistry tests on TAT in this study was TASH 395.75±92.109, SPMHMC 339.24±45.891 and ALERT 470.35±196.011, which was higher than the delays for studies carried out in Addis Ababa 184.96±74.928, Korea 43.6±7.7 and Nepal 54.6±7.78.4 minutes, this delaines difference might be due to power outage, LIS interruption, high number of patient flow and failure of laboratory equipment. [14, 28, 30] The average mean delay for Hematology tests in this study was TASH 272.54±128.085, SPMHMC 189.89±86.141 and ALERT was 151.69±28.357, this finding was higher than a study conducted in Addis Ababa 139.85±88.118 and Iran 43.6±7.7 minutes. [14, 32] However, the current study was less than a study conducted in Kenya for clinical chemistry 1332±20.76 and hematology 1218±19.86 minutes this variation could be due to poor work flow and less advanced equipment in Kenya. [33]

The Current study showed that for clinical chemistry the pre-analytical mean delay TAT for TASH was 55.87±29.339, for SPMHMC was 15.74±10.239 and ALERT was 72.87±33.899; the analytical mean delay TAT for TASH was 138.75±103.089, for SPMHMC was 191.22±103.232 and ALERT was 219.77±216.839; the post-analytical mean delay TAT for TASH was 83.35±90.097, for SPMHMC was 17.4±28.451 and ALERT was 70.04±60.061 respectively, which was higher than a study conducted in Korea pre-analytical, analytical, and post-analytical phases were 29.7±6.9, 13.9±4.1, and 0.02±0.13 min, respectively. This difference in the findings might be less advanced equipment, power outage and malfunction of machines. [28]

In this study laboratory personnel were asked about factors affecting turnaround time, from different reasons one of it was result verification & retesting that delay analytical phase TASH 50%, SPMHMC 90% and ALERT 70% which is similar to study conducted in Nepal. [31] Additionally resource limitation, system downtime, malfunction of machine, problem with control, method and standard and shortage of staff relative to workload demand and high number of patient flow/workload were factors affecting turnaround time, which is similar to a finding conducted in Bahirdar. [34] The reason for this similarity might be the difficulties healthcare facilities have in maintaining operational effectiveness and managing resources.

The current study across the three hospitals showed that LIMS positively impact management of workload, data storage and quality, patient care and turnaround time, this is comparable to a study carried out in western university that showed LIMS is beneficial in management of workflow; in Peru showed that using LIMS in resource limited countries enhance quality of data, patient care

and overlapping of test.; in Boston showed that using electronic system reduce error in pre-analytical phase and increase patient satisfaction. This similarity might be understanding of the benefit of LIMS in laboratory service provision. [10, 36, 37]

Regards to resource limitation, across the three hospitals besides to the benefit of LIMS drawbacks were disclosed. In TASH and SPMHMC the major reason for delayed TAT were outdated hardware, inadequate number of computers and outage of system and network. This is similar to a study carried out in western university. [10]

Additionally, this finding showed that staff training varied across the three hospital, TASH 90% and SPMHMC 40% of the participants received training on how to use the system but, ALERT was 0% they didn't receive training which leads to be unfamiliarity with the system. This is comparable to a study conducted in western university that showed laboratory staff faced a problem in adapting the system and study in Boston showed that staff training is helpful in minimization of error. [10, 37]

This study showed that the patient satisfaction, turnaround time and factors affecting them. As shown in the result TASH and SPMHMC had relatively higher patient satisfaction and turnaround time than ALERT this comparison showed that using computerized system improves patient satisfaction and turnaround time by reducing laboratory personnel workload, manageable workflow and good patient care ALERT uses computer and paper in parallel which leads to lab personnel lack of motivation, overlapping of work, confusion of patients how to collect result and longer TAT due to lack of management because they doesn't record TAT the upper management don't know where improvements should be implemented.

Generally, these findings indicates that LIMS may significantly enhance laboratory productivity, data accuracy, and patient care. However, for optimal performance comprehensive staff training, regular technical support and reliable infrastructure like stable network and power supply with adequate number of computer are required. To ensure that LIMS fulfils its objective in improving patient outcomes and laboratory operations, these components should be addressed in future installations, particularly in situations with limited resources.

7. Strength and Limitation of the study

7.1 Strength

- The study contain both patients and laboratory services provider perception which gives deeper understanding in challenges faced in laboratory.
- Includes both qualitative and quantitative data to gain a clearer understanding of the difficulties facing laboratory services.
- Have a 100% response rate from lab personnel and patients which can reduce bias due to non-response and improve the accuracy of the finding.

7.2 Limitations

- The study was carried out in Addis Ababa, and the results might not accurately reflect laboratory services in other parts of Ethiopia.
- Data was collected in the hospital so that satisfaction rate might be influenced by patient's unwillingness to freely criticize the service.

8. Conclusion

The current study determine the level of patient satisfaction, turnaround time and associated factors across three public hospitals: TASH, SPMHMC and ALERT. The result revealed difference in patient satisfaction within the three hospitals: with SPMHMC highest, followed by TASH and ALERT. Major source of satisfaction were privacy during sample collection, courtesy and respect of laboratory personnel, and laboratory fee.

Regarding TAT performance, the result showed that clinical chemistry and hematology tests often took longer time than the standard TAT. In clinical chemistry more than half of the tests in TASH and SPMHMC had achieved the target TAT. Hematology tests performance across the three hospitals were poor. A major challenge for delayed TAT in per-analytical phase was batch collection and transportation; in analytical phase was equipment failure, shortage of staff and unstable network and power.

Patients who are gov't employees were more likely to be satisfied than others. Similarly, patients who had an average monthly income of between 5,500 - 7,000 were more likely to be satisfied than others. When comparing the three hospitals by their LIMS usage and integration TASH and SPMHMC had good TAT performance and Patient satisfaction than ALERT which uses paper parallel to computer system leading to poor TAT and patient dissatisfaction. TAT was affected by shortage of computers, insufficient staff training, frequent power interruption, workload and equipment failure.

9. Recommendation

- In order to improve patient satisfaction measures should be taken such as: improving latrine cleanliness and waiting areas, maximizing seating arrangements and patient interaction techniques and improve workflow management to ensure on time delivery of test results by the upper management of the hospital.

- Based on the current finding TAT was poor across all hospitals so that the laboratory head should make improvements in pre-analytical phase there should be sample transportation and batch collection management; in analytical phase updated and sufficient number of computers with regular maintenance should be strengthen as well a fully automated system should be implemented (ALERT) to reduce delay and manual error.

- The upper management by collaborating with IT experts who developed the system should provide training to staff on how to use LIMS, and make sure the power supply and network are stable to minimize system outage.

- Hospital administration and laboratory head and quality officer should involve in improving resource allocation to reduce workload and boost staff motivation, carry out routine audits to track TAT and patient feedback and promote improved communication between higher management and laboratory staff.

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Annexes

Annex 1. Participant Information Sheet

Research Title: Assessment of Patient satisfaction and Turnaround time while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia

Principal Investigator: Mecca Yesuf [+251910092630, meccayesuf2083@gmail.com]

Institution: Addis Ababa University, College of Health Sciences, Department of Medical Laboratory Science

Advisor: Fatuma Hassen (MPH, PhD), [+251911418062, fatumahassen2000@gmail.com].

Dear Participant, you are invited to participate in a research study conducted by Mecca Yesuf, an MSc student from Addis Ababa University, College of Health Sciences, Department of Medical Laboratory Sciences. The study aims to Assessment of Turnaround time and Patient satisfaction while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia. The findings from this research will provide valuable insights into improving the efficiency and quality of laboratory services in the healthcare system of Addis Ababa.

Study Purpose: - The purpose of this research is to gain insights into how the implementation of LIMS influences the turnaround time for laboratory processes, patient satisfaction, and the various factors associated with these outcomes in healthcare settings.

Your Participation: - Your participation in this study is voluntary. If you agree to participate, you may be asked to share your experiences, perceptions, and opinions related to the influence of Laboratory information management system on turnaround time and patient satisfaction. Your input will be crucial in contributing to a comprehensive understanding of the topic.

Confidentiality: - Your identity and personal information will be kept confidential. Data collected will be used for research purposes only and will not be disclosed to any unauthorized individuals. Your anonymity will be strictly maintained in any reports or publications resulting from this research.

Benefits and Risks: - While there are no direct benefits to you, your participation will contribute to the advancement of knowledge in the influence of the Laboratory Information Management System (LIMS) on turnaround time and patient satisfaction.

Procedures: - You will be required to fill out a questionnaire if you decide to take part. It is estimated that your participation will take about ten minutes.

Ethical Considerations: - This study has received ethical approval from the relevant ethics committee at Addis Ababa University. Your participation in this study is subject to your voluntary agreement after understanding the information provided in this participant information sheet.

Consent: - By agreeing to participate, you indicate that you have read and understood this information sheet. You will be provided with a consent form to sign before participating in the study.

Contact Information: - If you have any questions or concerns about the study, you may contact Mecca Yesuf [+251910092630, meccayesuf2083@gmail.com] or the advisor,

Fatuma Hassen (MPH, PhD), at [+251911418062, fatumahassen2000@gmail.com].

Thank you for considering participating in this research study.

Sincerely,

Mecca Yesuf

Principal Investigator

Addis Ababa University, College of Health Sciences, Department of Medical Laboratory Sciences

[+251910092630, meccayesuf2083@gmail.com]

Annex 2. Consent Form (study participants)

Principal investigator: Mecca Yesuf

Research title: Assessment of Turnaround time and Patient satisfaction while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia.

I have read or had this document read to me in a language that I understand, and I understand the purposes, procedures, and risks of this research project as described within it. I understand that at any time I may withdraw from this study without giving a reason. I have had an opportunity to ask questions, and I am satisfied with the answers I have received. I know that. There will be no special payment for being a participant in the study. I freely agree to participate in this study, as described. I understand that I was given a signed copy of this document to keep.

Name of participant_____ Age___ Address_____ Signature_____ Date_____
Interviewer's name_____Signature_____
Principal investigator Name Mecca Yesuf Signature_____

Annex 3. Assent form (study participants)

Principal investigator: Mecca Yesuf

Research title: Assessment of Turnaround time and Patient satisfaction while using Electronic laboratory information management system along with associated factors in selected public hospitals in Addis Ababa, Ethiopia.

Introduction: We are conducting a study to understand more about the patient's laboratory service experience.

Purpose of the study: To understand what makes laboratory service good or bad experience of patients.

What participation involves: If you agree to participate in this study you will be asked some questions about your experience. This will take about 15 minutes.

Voluntary participation: You don't have to take part in this study if you don't want to. If you choose to participate, you can stop at any time, and it won't affect your relationship with the hospital.

Confidentiality: Your answers will be private. We will not use your name in any reports, and only the research team will see your answers.

Contact information: If you have any questions, you can ask me know or later. You can also contact Mecca Yesuf [+251910092630]

Assent: If you agree to participate in this study, please sign below:

Participant's name: _____

Participant's signature: _____

Date: _____

Annex 4. Patient Satisfaction Questionnaire

Dear Patient,

Thank you for participating in our study aimed at understanding the influence of Laboratory Information Management System (LIMS) on turnaround time and patient satisfaction. Your feedback is crucial to improving our services. Please take a moment to answer the following questions. Your responses will remain confidential.

English Questionnaire

Part I. Demographic Information:

No	Questions	Coding category	Skip to
101	Age of respondents	Age in years _____ Don't Know …..…… 0 No answer ……. 1	
102	Sex of respondents	Male …… 0 Female ……..…. 1	
103	What is the highest level of education you completed?	Cannot read and write …… 0 Only read and write ……..... 1 1 to 6 grade ……. 2 7 to 12 grade ……... 3 Collage & above…….……. 4	
104	What is Your current marital status?	Single ..……... 0 Married ……...……. 1 Divorced ……..... 2	

		Widowed ……. 3	
105	How much is your estimated monthly income?	_____ ETB	
106	What is Your occupation?	Student …….. 0 House wife …… 1 Un employed ……. 2 Merchant ……... 3 Government employee …….. 4 Working in the family business …… 5 Other specify _____ _____ 6	

Part II. Patient interview on the overall service

No	Questions	Coding Category	Skip to
201	Are the services you are getting in this laboratory paid or free?	In payment…… 0 Free……..…. 1 Insurance …….. 2	
202	Did you know this hospital laboratory before?	This is my first time …….…...……. 0 Have come before ……..…….. 1	
203	How often do you visit the laboratory for medical service?	Mostly …….. 0 Rarely …… 1	

204	How long did you recive laboratory result on time?	No ……..……..……..….. 0 Yes …….……...…..…. 1	
205	Did you feel that the schedule (opening & closing) hours of the laboratory were convenient for you?	No ……... 0 Yes …….. 1 Don't know the opening hour ……..... 2	
206	Would you come again to this hospital laboratory?	No ……. 0 Yes …… 1 I don't know …….. 2	If no skip to Q 209
207	If yes, what makes you to decide to come again? (one or more answer possible)	Convenient opening hour ……... 0 Get the service early ……...…… 1 Good-quality services ……...…..…. 2 Availability of many services …… 3 Want to be anonymous ……..…. 4 Have other reasons to come here (e.g., immunizations, health talks) ……... 5 Cheaper service fee ……. 6 Prefer provider here ……..… 7 Other(specify)_____ _____ _____ 8	

208	If no, what makes you to decide not to come again? (one or more answer possible)	Inconvenient opening hour …….. 0 Long waiting time …… 1 Poor-quality services …… 2 Availability of few services …….. 3 Expensive service fee …… 4 Not preferring service provider here …. 5 Other(specify)_____ _____ _____ 6	

Part III. Patient interview on clinical laboratory services satisfaction

		Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied	
301	How much are you satisfied with the time spent waiting to get the laboratory result?	1	2	3	4	5	
302	How satisfied are you with the courtesy and respect of the laboratory personnel during your visit?	1	2	3	4	5	
303	How satisfied are you with measures taken to assure privacy during specimen collection (e.g. during blood drawing)	1	2	3	4	5	

304	How satisfied are you with the location of the laboratory?	1	2	3	4	5	
305	How satisfied are you with the availability of requested testes in the laboratory?	1	2	3	4	5	
306	How satisfied are you with the adequacy of sitting arrangement in waiting area?	1	2	3	4	5	
307	How much are you satisfied with the Cleanliness of the blood drawing area?	1	2	3	4	5	
308	How satisfied are you with the Communication of laboratory service provider?	1	2	3	4	5	
309	How satisfied are you with the service fee (cost) in this hospital laboratory?	1	2	3	4	5	
310	How satisfied are you with the Cleanness of Latrine?	1	2	3	4	5	

Thank you for your valuable input! Your feedback contributes to the success of our research.

Annex 5. Turnaround time recording format (TAT)

TAT Format

Serial No	Code. No	Test request	Start time for sample collection	Arrival time for analysis	Arrival time for reporting	Final time for reporting

Annex 6. Questionnaire for laboratory personnel

Name the Facility_____ Sub City_____

Institution code_____ Kebele_____

Part I. Socio- Demographic Information

No	Questions	Response	Code
101	Sex	1. Male 2. Female	
102	Age	In Years_____	
103	What is your qualification?	1. Diploma 2. BSc. Degree 3. MSc. Degree	
104	Work experience	1. < 5 Years 2. 5 – 10 Years 3. > 10 years	
105	Position in the laboratory	1. Laboratory head 2. Section/Department head 3. Laboratory expert 4. Other specify_____	

Part II. Information in laboratory TAT

No	Questions	Response	code
201	Do you have adequate information in laboratory TAT?	1. Yes 2. No	
202	Adequate refreshment training	1. Yes 2. No	
203	How frequently your laboratory meets customer needs?	1. Not always 2. Mostly 3. Not at all	

204	Do you think optimum laboratory TAT improve laboratory service?	1. Yes 2. No	
205	Do you think higher advanced equipment improve optimum laboratory TAT?	1. Yes 2. No	
206	What are the main reasons for delay in analytical phase?	1. Malfunction with instrument 2. Difficult with methods, standards, controls 3. Other specify_____	
207	Do result verification and retesting result in delay analytical phase?	1. Yes 2. No	
208	Does staff shortage associate with delay in analytical phase?	1. Yes 2. No	
209	Do result waiting for supervisor approval could delay TAT?	1. Yes 2. No	
210	Possible reason for poor TAT	1. Equipment failure 2. Workload 3. Poor staff motivation 4. Other specify	
211	Perceived Lab work load	1. Very high 2. High 3. Fair	

Part III. Factors affecting Laboratory TAT

No	Questions	Response	Code
301	Do you record time for specimen arrival and release?	1. Yes 2. No	
302	What are the possible reasons not to record laboratory TAT?	1. The workload 2. Poor resource allocation 3. Poor staff motivation 4. I don't know 5. Other specify	
303	Do you follow SOP?	1. Yes 2. NO	
304	Reason not to follow SOP	1. No sops 2. The procedures are known 3. Other specify	
305	Do client satisfaction survey done in your lab?	1. Yes 2. No	
306	Do you have frequent Communication with clinicians in lab. Services?	1. Yes 2. No	
307	Do have communication with the upper management?	1. Yes 2. No	
308	Do you think there is effective communication in your laboratory?	1. Yes 2. No	
309	Do you have adequate equipment for better TAT?	1. Yes 2. No	

For computer Based laboratory

Part IV. Electronic Laboratory Information Management System

401. Did you get any training on how to use LIMS software?

_____

_____

402. Is there adequate number of computer for laboratory usage? If no, explain the challenges of not having enough computers.

_____

_____

403. What upgrades or additions would you like to see made to the LIMS software that your lab currently uses?

_____

_____

404. Does the LIMS have any failures or technical problems? If Yes, how frequently?

_____

_____

405. Did you had any power outages while utilizing LIMS? If so, what effects does a power outage have on your lab's LIMS usage?

_____

_____

406. Advantages of using LIMS?

_____

_____

407. Disadvantages of using LIMS?

_____

_____

Thank you for your valuable input! Your feedback contributes to the success of our research.

Amharic version / አማረኛ ትረጉም

አባሪ 1. ለተሳታፊዎች መረጃ መስጫያ ሰነድ

የጥናት ርዕስ፡ - የኤሌክትሮኒክስ ላብራቶሪ መረጃ አስተዳደር ስርዓን በሚጠቀሙበት ጊዜ የውጤት መመለሻ ጊዜ እና የታካሚ እርካታ ከተያያዙ ምክኒያቶች ጋር ግምገማ በተመረጡ የመንግስት ሆስፒታሎች አዲስ አበባ፣ ኢትዮጵያ።

ተቋም፡- አዲስ አበባ ዩኒቨርሲቲ፣ የጤና ሳይንስ ኮሌጅ፣ የሕክምና ቤተ ሙከራ ሳይንስ ትምህርት ክፍል

ዋና መርማሪ፡ መካ የሱፍ [+251910092630፣ meccayesuf2083@gmail.com]

አማካሪ፡ ፋጡማ ሀሰን (ኤምፒኤች፣ ፒኤችዲ) ፣ [+251911418062, fatumahassen2000@gmail.com]

መግቢያ፡ - ውድ ተሳታፊዎች በምርምር ጥናታችን ውስጥ እንዲሳተፉ ተጋብዘዋል። መካ የሱፍ እባላለሁ በአዲስ አበባ ዩኒቨርሲቲ የማስተርስ ተማሪ ነኝ። በአዲስ አበባ ውስጥ በተመረጡ የመንግስት ሆስፒታሎች፣ የላብራቶሪ መረጃ አስተዳደር ስርዓት (LIMS) የውጤት መመለሻ ጊዜ እና በታካሚ እርካታ ላይ ያለውን ተጽእኖ መገምገም ላይ ጥናት እያደረግኩ ነው። የዚህ ጥናት ግኝቶች በአዲስ አበባ የጤና አጠባበቅ ሥርዓት ውስጥ ያለውን የላብራቶሪ አገልግሎት ቅልጥፍና እና ጥራት ለማሻሻል ጠቃሚ ግንዛቤዎችን ይሰጣሉ።ለመሳተፍ ከመወሰንዎ በፊት ጥናቱ ለምን እንደሚካሄድ፣ የእርስዎ ተሳትፎ ምን እንደሚያመጣ፣ እና ከተሳትፎ ጋር የተያያዙ ማንኛውንም ስጋቶችን ወይም ጥቅሞችን መረዳትዎ አስፈላጊ ነው።

የጥናት ዓላማ፡ - የዚህ ጥናት ዓላማ የላብራቶሪ መረጃ አስተዳደር ስርዓት (LIMS) ትግበራ የላቦራቶሪ ሂደቶችን፣ የውጤት መመለሻ ጊዜ ፣ የታካሚን እርካታ በጤና አጠባበቅ ተቋማት ውስጥ ከእነዚህ ውጤቶች ጋር በተያያዙት የተለያዩ ምክንያቶች ላይ ተጽዕኖ እንደሚያሳድር ግንዛቤዎችን ለማግኘት ነው።

የእርስዎ ተሳትፎ፡ - በዚህ ጥናት ውስጥ ያለዎት ተሳትፎ በፈቃደኝነት ነው። ለመሳተፍ ከተስማሙ፣ የላብራቶሪ መረጃ አስተዳደር ስርዓት (LIMS) በውጤት መመለሻ ጊዜ እና በታካሚ እርካታ ላይ ካለው ተጽእኖ ጋር የተያያዙ የእርስዎን ልምዶች፣ ግንዛቤዎች እና አስተያየቶች እንዲያካፍሉ ሊጠየቁ ይችላሉ። ለርዕሰ-ጉዳዩ አጠቃላይ ግንዛቤ አስተዋፅዎ ለማድረግ የእርስዎ ግብዓት ወሳኝ ይሆናል።

ምስጢራዊነት፡ - ማንነትዎ እና የግል መረጃዎ በሚስጥር ይያዛሉ። የተሰበሰበው መረጃ ለምርምር ዓላማዎች ብቻ የሚውል ሲሆን ለማንም ያልተፈቀዱ ግለሰቦች አይገለጽም። በዚህ ጥናት ምክንያት በሚመጡ ሪፖርቶች ወይም ህትመቶች ውስጥ ማንነትዎ አለመታወቁ በጥብቅ ይጠበቃል።

ጥቅማጥቅሞች እና ስጋቶች፡ - ምንም አይነት ቀጥተኛ ጥቅማጥቅሞች ባይኖሩም የእርስዎ ተሳትፎ የላቦራቶሪ መረጃ አስተዳደር ስርዓት (LIMS) በመመለሻ ጊዜ እና በታካሚ እርካታ ላይ ያለውን ተፅእኖ ማወቅ ለዕውቀት እድገት አስተዋፅዖ ያደርጋል።

ሂደቶች፡ - ለመሳተፍ ከወሰኑ መጠይቁን መሙላት ይጠበቅብዎታል። የእርስዎ ተሳትፎ አሥር ደቂቃ ያህል ይወስዳል ተብሎ ይገመታል።

የሥነ ምግባር ጉዳዮች፡ - ይህ ጥናት በአዲስ አበባ ዩኒቨርሲቲ ከሚመለከተው የሥነ ምግባር ኮሚቴ፤ የሥነ ምግባር ማረጋገጫ አግኝቷል። በዚህ ጥናት ውስጥ ያለዎት ተሳትፎ በዚህ የተሳታፊ መረጃ ወረቀት ላይ የቀረበውን መረጃ ከተረዱ በኋላ በእርስዎ የፍቃድ ስምምነት ላይ የተመሠረተ ነው።

ስምምነት፡ - ለመሳተፍ በመስማማት ይህንን የመረጃ ወረቀት እንዳነበቡ እና እንደተረዱት ያሳያሉ። በጥናቱ ከመሳተፍዎ በፊት ለመፈረም የስምምነት ቅጽ ይሰጥዎታል።

የእውቂያ መረጃ፡ - ስለ ጥናቱ ማንኛውም አይነት ጥያቄ ወይም ስጋቶች ካሉ መካ የሱፍ [+251910092630, meccayesuf2083@gmail.com] ወይም አማካሪዋን ፋጡማ ሀሰን (MPH, PhD) በ [+251911418062, fatumahassen2000@gmail.com] ማግኘት ትችላላችሁ።

በዚህ የምርምር ጥናት ላይ ለመሳተፍ ስላሰቡ እናመሰግናለን።

ከሰላምታ ጋር

መካ የሱፍ

ዋና መርማሪ

አዲስ አበባ ዩኒቨርሲቲ፣ የጤና ሳይንስ ኮሌጅ፣ የሕክምና ቤተ ሙከራ ሳይንስ ትምህርት ክፍል

[+251910092630፣ meccayesuf2083@gmail.com]

አባሪ 2. የፍቃደኝነት ማረጋገጫ ቅጽ

የጥናቱ ርእስ:- የኤሌክትሮኒክስ ላብራቶሪ መረጃ አስተዳደር ስርዓን በሚጠቀሙበት ጊዜ የውጤት መመለሻ ጊዜ እና የታካሚ እርካታ ከተያያዙ ምክኒያቶች ጋር ግምገማ በተመረጡ የመንግስት ሆስፒታሎች አዲስ አበባ፣ ኢትዮጵያ።

የአጥኝው ስም:- መካ የሱፍ

የተቋሙ ስም:- አዲስ አበባ ዩኒቨርሲቲ የህክምና ጤና ሳይንስ ኮሌጅ፣ የሕክምና ላቦራቶሪ ትምህርት ክፍል

እኔ ይህን ሰነድ አንብቢያለሁ ወይም ይህ ሰነድ በሚገባኝ ቋንቋ ተነቦልኝ በውስጡ የተገለፁት ከጥናቱ የሚገኘው ጥቅም፣ የጥናቱ ሂደት እና ከጥናቱ ጋር ተያይዞ የሚመጣ ጉዳት በሚገባ ተረድቼዋለሁ። በማንኛውም ጊዜ እራሴን ከጥናቱ የማግለል መብቴ የተጠበቀ መሆኑን አውቃለሁ። ስለ ጥናቱ ተጨማሪ ጥያቄ የመጠየቅ እድል ተሰቶኝ የገኘሁት መልስ አጥጋቢ ነበር። እዚ ጥናት ላይ በመሳተፌ የሚሰጠኝ ምንም ጥቅምም ሆነ ክፍያ እንደሌለ አውቃለሁ። በራሴ ፈቃደኝነት እዚህ ጥናት ለይ ለመሳተፍ መስማማቴን በፈርማዬ አረጋግጣለሁ።

የተሳታፊው ስም ..... እድሜ ..... አድራሻ.....

ፊርማ..... ቀን .....

የአጥኚው ስም:- <u>መካ የሱፍ</u> ፊርማ ..... ቀን.....

አባሪ 3. የፍቃደኝነት ማረጋገጫ ቅጽ (ከ 18 አመት እድሜ በታች)

የጥናቱ ርእስ:- የኤሌክትሮኒክስ ላብራቶሪ መረጃ አስተዳደር ስርዓን በሚጠቀሙበት ጊዜ የውጤት መመለሻ ጊዜ እና የታካሚ እርካታ ከተያያዙ ምክኒያቶች ጋር ግምገማ በተመረጡ የመንግስት ሆስፒታሎች አዲስ አበባ፣ ኢትዮጵያ።

መግቢያ፡- ስለ በሽተኛው የላብራቶሪ አገልግሎት ልምድ የበለጠ ለመረዳት ጥናት እያደረግን ነው.

የጥናቱ ዓላማ፡- የታካሚዎችን የላብራቶሪ አገልግሎት ጥሩ ወይም መጥፎ ተሞክሮ የሚያደርገው ምን እንደሆነ ለመረዳት።

ተሳትፎ ምን ያካትታል፡ በዚህ ጥናት ለመሳተፍ ከተስማሙ ስለ ልምድዎ አንዳንድ ጥያቄዎች ይጠየቃሉ። ይህ 15 ደቂቃ ያህል ይወስዳል.

በፈቃደኝነት ተሳትፎ፡ ካልፈለጉ በዚህ ጥናት ውስጥ መሳተፍ የለብዎትም። ለመሳተፍ ከመረ፣ በማንኛውም ጊዜ ማቆም ይችላሉ፣ እና ከሆስፒታሉ ጋር ያለዎትን ግንኙነት አይጎዳውም.

ምስጢራዊነት፡ የእርስዎ መልሶች የግል ይሆናሉ። በማንኛውም ሪፖርቶች ውስጥ የእርስዎን ስም አንጠቀምም፣ እና የጥናት ቡድኑ ብቻ መልሶችዎን ያያሉ።

የእውቂያ መረጃ፡ ማንኛውም አይነት ጥያቄ ካሎት አሁን ወይም በኋላ ሊጠይቁኝ ይችላሉ። እንዲሁም መካ የሱፍን [+251910092630] ማግኘት ይችላሉ።

ፍቃድ፡ *በዚህ ጥናት ለመሳተፍ ከተስማሙ፣ እባክዎ ከዚህ በታች ይፈርሙ፡*

የተሳታፊው ስም፡ _____

የተሳታፊ ፊርማ፡ _____

ቀን፡ _____

አባሪ 4. የታካሚ እርካታ መጠይቅ

ውድ ታካሚ፣

የላቦራቶሪ መረጃ አስተዳደር ስርዓት (LIMS) በተመላሽ ጊዜ እና በታካሚ እርካታ ላይ ያለውን ተጽእኖ ለመረዳት በምናደርገው ጥናት ላይ ስለተሳተፉ እናመሰግናለን። አገልግሎቶቻችንን ለማሻሻል የእርስዎ አስተያየት ወሳኝ ነው። እባክዎን የሚከተሉትን ጥያቄዎች ለመመለስ ትንሽ ጊዜ ይውሰዱ። የእርስዎ ምላሾች ሚስጥራዊ ሆነው ይቆያሉ።

ክፍል 1 የማህበረሰባዊ ጉዳይ መረጃ መጠየቂያ ፎርም

ተ.ቁ	ጥያቄ	አማራጭ መልስ በኮድ	ወደ ተ.ቁ----- ይለፉ
101	እድሜህ(ሽ) ስንት ነው?	እድሜ በአመት _____ አላውቅም ..... 0 መልስ የለም 1	
102	ፆታ	ወንድ ..... 0 ሴት 1	
103	የትምህርት ደረጃዎ ምን ያህል ነው	መጻፍና ማንበብ የማይችል(ትችል) ..... 0 መጻፍና ማንበብ ብቻ ..... 1 ከ1ኛ እስከ 6ኛ ክፍል ..... 2 ከ7ኛ እስ12ኛ ክፍል ..... 3 ኮሌጅ ዲፕሎማና ከዛ በላይከ 4	
104	የጋብቻ ሁኔታዎ----------?	ያላገባ/ ች ..... 1 ያገባ/ ች ..... 2 የፈታ/ ች ..... 3 ባል/ሚስትየሞተበባት/በት 4	

105	አማካኝ ወርሃዊ ገቢዎ ምን ያህል ነው?	_____ ብር	
106	የስራ ሁኔታ	ተማሪ ..... 0 የቤት እመቤት ..... 1 ስራ የሌለው(ላት) ..... 2 ነጋዴ ..... 3 የመንግስት ሰራተኛ ..... 4 የቤተሰብ ንብረት የሚያስተዳድር ..... 5 ሌላ ካለ ይግለጹ _____ _____ 6	

ክፍል 2 ተገልጋዩን ስለአጠቃላይ አገልግሎት መጠየቂያ ፎርም

ተ.ቁ	ጥያቄ	አማራጭ መልስ በኮድ	ወደ ተ.ቁ. ይለፉ
201	በላቦራቶሪው የሚያገኙት አገልግሎት በነጻ ነው ወይስ በክፍያ	በክፍያ ..... 0 በነጻ ..... 1 በመድህን 2	
202	ከዚህ በፊት በዚህ ሆስፒታል ላቦራቶሪ አገልግሎት አግኝተው ያውቃሉ	ለመጀመሪያ ጊዜዬ ነው ..... 0 ከዚሄ በፊት መጥቼ አውቃለው 1	
203	የሆስፒታሉን ላብራቶሪ ምን ያህል ጊዜ ይጎበኛሉ	አብዛኛውን ጊዜ ..... 0 አልፎ አልፎ 1	
204	የላብራቶሪ ውጤት በተባሉት ግዜ ደርሶል	የለም..... 0 አዎ..... 1	

205	ወደዚህ ሆስፒታል ላቦራቶሪ በድጋሚ አገልግሎት ለማግኘት ትመጣለህ/ሽ?	የለም ..... 0 አዎ 1	መልሱ የለም ከኾነ ወደ ተ.ቁ 124 ይለፉ
206	አዎ ካለ(ች) ድጋሚ ለመምጣት የወሰንክበት ምክንያት? (ከአንድ በላይ መልስ መስጠት ይቻላል)	ምቹ በሆነ ሰዐት ስለሚከፈት ..... 0 አገልግሎቱን ቶሎ ስለማገኝ ..... 1 ጥራት ያልው አገልግሎት ስላለ ..... 2 ብዙ አገልግሎት ስላለ ..... 3 ከሰዎች ጋር ለመመሳሰል ..... 4 ሌላ የመጣሁበት ምክንያት ስላለ(ለምሳሌ ክትባት፣የጤና ውይይት ወዘተ..... 5 ክፍያው እርካሽ ስለሆነ ..... 6 እዚህ ያሉ በለሙያዎችን ስለምመር..... 7 ሌላ ካለ ይግለጹ _____ _____ 8	
207	የለም ካለ(ች) አዚህ ላለመምጣት የወሰንክበት ምክንያት? (ከአንድ በላይ መልስ መስጠት ይቻላል)	ምቹ ባልሆነ ሰዐት ስለሚከፈት ..... 0 አገልግሎቱን ቶሎ ስለማላገኝ ..... 1 ጥራት ያልው አገልግሎት ስለሌለ ..... 2 ብዙ አገልግሎት ስለሌለ ..... 3 ክፍያው እርካሽ ስለሆነ ..... 4 እዚህ ያሉ በለሙያዎችን ስለማልመርጥ .. 5 ሌላ ካለ ይግለጹ_____ _____ 6	

ክፍል 3 ታካሚውን/ተገልጋዩን ስለአገልግሎት እርካታ መጠየቂያ ፎርም

		በጣም እረክቻለሁ	እረክቻለው	ምንም	አልረካሁም	በጣም አልረካሁም
301	የላብራቶሪ አገልግሎት ለማግኘት በሚኖረው ቆይታ ምን ያክል እረክተሀል (ሽል)?	1	2	3	4	5
302	አገልግሎት የሚሰጡት የላብራቶሪ ባለሙያዎች በሚያሳዩት ከበሬታ እና ጥሩ አቀባበል ምን ያክል እረክተሃል(ሽል)?	1	2	3	4	5
303	የሚሰጠው አገልግሎት ሚስጥራዊነቱን እንዲጠብቅ በሚደረገው እርማጃ ምን ያክል እርካታ አግኝተሀል (ሽል)? ለምሳሌ የግል ክፍል የተከለለ ቦታ ወዘተ....	1	2	3	4	5
304	የላቦራቶሪ ክፍል በሚገኝበት ቦታ ምን ያህል እረክተሃል(ሽል)?	1	2	3	4	5
305	የታዘዙትን ምርመራዎች ከማግኘት አካያ ምን ያህል እረክተዋል?	1	2	3	4	5
306	በሆስፒታሉ ተራ መጠበቂያ የ መቀመጫ (ወንበር) መጠን (በቁጥር) ምን ያህል ረክተዋል (ለመቀመጥ የ ወንበር ብዛት...)	1	2	3	4	5
307	በደም ናሙና መስጫው ስፍራ ንጽህና ምን ያህል አርካታ ተሰምቶሀል/ሽል?	1	2	3	4	5

308	የላቦራቶሪው ባለሙያ ናሙና ከመስጠትህ በፊትና ስትሰጥ በነገረህ መረጃ ምን ያህል ረክተሀል/ሻል?	1	2	3	4	5
309	በላቦራቶሪ የአገልግሎት ክፍያ ዋጋ ምን ያህል ረክተዋል?	1	2	3	4	5
310	በመፀዳጃ ቤቱ ንፅህና ምን ያህል ረክተዋል?	1	2	3	4	5

ስለ ጠቃሚ ግብአትዎ እናመሰግናለን! የእርስዎ አስተያየት ለጥናታችን ስኬት አስተዋጽኦ ያደርጋል።

Declaration

I, the undersigned, declare that this M.Sc. thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been duly acknowledged.

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Date of submission: _____

This thesis has been submitted with our approval as advisors.

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Signature: _____

Date: _____

Place: Addis Ababa, Ethiopia.