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Medical Laboratory request form completeness, associated factors and the financial impact of non - communicated results in two public hospitals of Addis Ababa, Ethiopia

BY: Mulualem Kelkay (BSc)

Advisors Fatuma Hassen (BSc, MPH)

Kassu Desta (BSc, MSc, PhD candidate)

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This is to certify that the thesis is prepared by **Mulualem Kelkay**,

Entitled:

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Signed by the Examining Committee:

External Examiner	_____	Signature	_____	Date	_____
Internal Examiner	_____	Signature	_____	Date	_____
Advisor:	Kassu Desta	Signature	_____	Date	_____
Advisor:	Fatuma Hassen	Signature	_____	Date	_____

Chairman of the Department or Graduate program coordinator

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Table of Contents

II. List of tables

IV. List of Abbreviations

AAHB	Addis Ababa health bureau
DRERC	Departmental Research and Ethical Review Committee
ICU	Intensive Care Unit
IPD	Inpatient Department
LIS	Laboratory information system
LRF	Laboratory request form
OPD	Out Patient Department
PI	Principal Investigator
RDDMH	Ras Desta Dametaw Memorial Hospital
SPHMMC	St. Paul`s Hospital Mellinium Medical College
SPSS	Statistical package for social science
TAT	Turnaround Time
TFT	Thyroid Function Tests

Operational definition

- Non-communicate is a laboratory results that were not collected from the laboratory after one week from the last date of data collection.
- Direct cost is the cost of specific test which establish within the laboratory

Abstract

Background: Laboratory request forms provide information about the laboratory test being requested for. It carry demographic data and other information such as location of patient, laboratory number, doctor's name, signature, telephone number. If one of this information is missed it may lead to laboratory errors. Appropriately designed and properly completed request forms are vital for quality laboratory work and patient management.

Objective: The objective of this study was to evaluate request forms submitted to the laboratory to determine their completeness, associated factor and the financial impact of non-communicated results in two public hospitals of Addis Ababa, Ethiopia.

Methods: Cross-sectional study design was employed .Laboratory request forms submitted to the laboratory from June 12 to July 11, 2017 at Ras Desta Damtew Memorial Hospital and St Paul Hospital Millennium Medical College were collected, reviewed and assessed for completeness using data collection sheet .Non-communicated requested results we reviewed using laboratory results that were not collected from the laboratory after one week from date of request. Factors contributed to improper completion and failed collection were assessed by asking clinicians using pre-structured questionnaire. Data were analyzed using SPSS version 24 and excel sheet. Nominal /categorical data was described in number and percentage. Data were presented in tables and figures.

Results; A total of nine thousand six hundred ninety one request forms were studied. Our assessment revealed that, name and laboratory investigation were written 100% in all requests. Age and gender were missed on 7.5% and 8.2% of the forms received at RDDMH laboratory while 2.6% and 2% of the forms received at SPHMMC respectively. One fifth (20.5%) of test results were uncollected and 74 (12.0 %) of them were CBC and an estimated 14,063 birr (44 %) [168756.00 birr annually] was lost from monthly RDDMH budget.

Conclusion: Our finding showed that the quality of test request forms in both hospitals do not to the level of expected standards. Clinician's awareness is some what low and efforts should be made to improve communication between clinicians and laboratory personnel in order to improve the service provision and save costs due to uncommunicated results..

Key Words: - Lab request, Incompleteness, Financial impact, cost

1. Introduction

1.1. Background post

The clinical laboratory plays an increasingly important role in the patient centered approach to the delivery of health care services. Physicians rely on accurate laboratory test result for proper disease diagnosis and for guiding therapy; it is estimated that more than 70% of clinical decisions are based on information delivered on laboratory test results [1].

Medical laboratory services are essential to patient care and therefore have to be available to meet the needs of all patients and the clinical personnel responsible for the care of those patients. laboratory services have three phase those are pre-examination,examination and post examination

Pre-examination processes start ,in chronological order,from the clinicians request and include examination of request,pereparetion and identifecation of patient, collection of primary sample (s),and transportation to and within the laboratory ,and end when analytical examination begins

Examination processes have set of operations having the object of determining the value of characterstics of a property.

Post-examination processes following the examination includings review of results retention and storage of clinical material,sample disposal,and formatting.releasing,reporting and retention of examination results

Laboratory request form is the first line of communication between clinician and laboratory personnel. Laboratory request forms provide information about the laboratory test requested for. They contain demographic data such as name(s), date of birth, subject's address, age, and sex. Other details include the ward, laboratory number, doctor's name, signature of the doctor, telephone or fax number of the doctor, clinical details, fasting status of the subject and the date of request. Omission of information on the forms may lead to laboratory errors [2].

Clinical laboratory error directly lead to health care costs and decrease patient satisfaction. Error can arise at any of the three stages, studies show that the pre-analytical phase account for 46% to 68.2% of error observed during the total testing process [3]. Considerable advance in laboratory instrumentation have a significantly reduced the error rate during the analytical phase. However, despite the improvement in pre analytical automation, the pre-analytical phase the most error-prone part of the laboratory testing due to its complexity that is due to the presence of many steps that occur both before and after the specimen reach the laboratory [4].

More than one-fourth of all pre-analytical error is the result of unnecessary investigation or inappropriate patient care, thus resulting financial burden on health care system [5].This will affect patient care, including delay in result reporting, unnecessary redraw, misdiagnosis, and improper treatment. Sometimes, these errors may even be fatal [6].

Audit has been defined as a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change. It is a part of continuous quality improvement process and a key element of clinical governance. Laboratory- based audits evaluate components of laboratory services; providing feedback to staff and users of the laboratory [7].

Appropriately designed and properly completed request forms are vital for the performance of all laboratory tests to the benefit of the patient and the satisfaction of the requesting physician.

1.2. Statement of the problem

Laboratory testing process is the most complex clinical laboratories that invest time and effort in maintaining quality control program. Improving the quality services provided by clinical laboratories is critical as the laboratory results affects 70% 0f clinical decisions [8]. Remarkable achievements have been accomplished regarding of analytical phase as the result of entry of automation, advanced analytical technique sophisticated information technology, improvement of training and qualification of testing personnel and also establishment of effective external quality assessment scheme [8,9]

However, the improvement the quality of pre- analytical phase have been sluggish remains a source of up to 68% of the total laboratory errors [10]. This is due to complex time and labor-intensive nature of the activities in this phase. The pre- analytical phase include many error-prone activities that cannot be solved with in the available technological advancement [11,12].The error originating from this phase have been reported to lead to further inappropriate investigation. Unjustifiable increasing in cost, increase work load on laboratory personnel and inappropriate patient care [13]. The increasing turnaround time (TAT) have also found to be partly resulted from unnecessary laboratory test repetition that require patient to return to specimen collection for replacement [14]. Fronting incomplete laboratory request form (LRF) the most common pre analytical error and study show that the standard of completion of LRF is poor and essential information required on the forms are often missing. This can lead to limited advice given by laboratory personnel and may increase the potential for errors [7]

know aday Audit of LRFs are presented to almost all the laboratories. It will provide valuable information that will assist both laboratory, physicians and clinicians in improving the standard and quality of laboratory results. This is expected to have positive impact on patient care. Collection of laboratory results and their delivery to the requesting physician is also an essential phase of the clinical laboratory testing process. Results that never reach the physician affect the quality of patient care and unnecessarily waste financial health resources. A study reports a significant amount of the laboratory budget is wasted on laboratory test reports that are never collected from the laboratory [15]. Study in Ethiopia show that lack of emphasis on the relevance of completeness of data on laboratory request test and the rate of non-communicated data was also high , There is no doubt it will cause the overall health care resource wastage. The limitation of study that done in Ethiopia was research do not include the actual amount of

financial impact of non-communicated result and the duration data collection was short. So, the aim of this study will be to evaluate request forms submitted to the laboratory to determine the frequency of incompletely filled forms and the financial impact of uncollected reports at Ras Desta Damtew and St. Paul`s Hospital in three months period.

1.3. Significance of the study

The study provides current information on LRF completeness and the financial impact of uncollected result to clinicians.

The result may show what the clinicians know how to use rational ordering system and the actual practices. It can also indicate factor influencing incomplete LRF ordering and solution for improving it.

The result obtained in this study may give information for future studies in other health institute and 6the country at large.

2. Literature review

According to retrospective observational study conducted in New York the laboratory issued 22,445 patient reports with more than 150,000 biochemistry analyses. Of these, 464 (2.1%) were uncollected laboratory reports. When compared to the representative period, patients who never collected their laboratory reports were younger or suffering from some chronic disease. Routine biochemistry tests were the most prevalent (50%). The majority of routine biochemistry tests were almost equally represented during the study and representative period, while molecular diagnostic tests were several times more frequently uncollected .Reports with electrolytes, metabolites and glucose were the least likely to be uncollected . The total cost for those tests were 30% of the average monthly laboratory budget [13].

A study conducted in Rio de Janeiro, Brazil 12,000 biopsies performed in the two laboratories on 647 request papers showed that diagnostic hypothesis and clinical data were completed correctly in 28.7% and 65.22% of the forms respectively. And the other completed item resulted as follows, sex 89.5%, age 89.6%, name 97.2%, requesting institution 97.2%, requesting physician 98%, date of delivery of material 99.0%, and signature of the physician who prepared the request was 99.5% [16]

Based on prospective study conducted in North India; the screening of the lab request forms were done, and result was as follows the name of the patient was recorded in all the forms whereas their age was not mentioned in 1.41%, sex of patients was not mentioned in 1.32% and the registration number was missing in 0.99% of the patients. The details pertaining to whether the patient had been registered at the OPD, Ward, ICU or Emergency was missing in 3.6% of the forms. The treating physician's names were missing in 13.1% of the forms and these were not signed by them in nearly 13.4%. Clinical details were illegible or difficult to decode in 89.25% of the lab request forms. The diagnosis was not mentioned in 61.2% of the patients. Diagnosis was mentioned in abbreviated forms in nearly 1.98%. Of these abbreviated diagnosis nearly 6.6% were not standard abbreviations. In addition the type of specimen was not also mentioned in 61.6% of the forms, date of collection of the specimen was missing in 13%. [18].

According to a retrospective study conducted in South Africa, 482 request forms for Thyoid Function Tests were received. The worst parameter completed by requesting clinicians was that of medication details; 74.5% of the forms lacked this parameter; 65.2% had no contact

details for the clinician; 20.8% had no diagnosis, and 25.3% had a diagnosis but in an abbreviated form. Patient and clinic details were relatively well filled in, but this might have been due to most forms being pre-stamped with clinic details, and patient identification stickers are often used. The type of specimen collected was not stated on 3.3% of the forms; 7.5% did not state the date and 36.3% did not state the time of collection. [2]

In another study from South Africa,a total of 2550 request forms were analyzed. Medication(s) used by the patient (89.6%) and doctor's contact number (61.2%) were more incomplete parameters. No diagnosis was provided on 19.1% of forms, and when a diagnosis was present it was an abbreviated form in 37.3%. This resulted in 35.5% of diagnosis not being recorded by reception staff. Incomplete ward information was found on 4.9% of forms. In a separate research, the impact of 151 request forms (collected over a period of eight months), with incomplete ward location information and corresponding to critical results was assessed. Critical results were not communicated by telephone to clinicians in 19.9% of cases. [19]

Another study conducted in Nigeria, determine a type and frequency of incomplete relevant data on laboratory request forms. This reveled that mostly omitted data was patient's age, observed in 48.3% of request forms reviewed. Complete documentation was only observed in respect to patients name and signature of attending physician. The name of the attending physician, however, was missing in 19.8% of forms audited. Information regarding patient's gender and location (ward) in the hospital was absent in 1.1%, and 20.1% cases respectively. 6.4% of audited forms were void of working diagnosis in 36.8 % cases. [20]

Another study conducted in Lagos Nigeria, they tried to assess pre and post education completion performance on 527 laboratory request forms and resulted as follows; name 100% in pre and post as well, age 78% in pre and 97% in post, sex 95% in pre and 99% in post, Hospital number 42% in pre and 67% in post, ward 81% in pre and 85% in post, clinical diagnosis 82% in pre and 99% in post, type of specimen 88% in pre and 93% in post education completion performance.[21]

According to a retrospective study in Ghana conducted to evaluate the completeness of information supplied on the request form, out of all the required information only the patient's name and the laboratory test being ordered were present on all 3,000 forms. The patient's age was not supplied on 25.6% of the forms, while patient's gender was present on 67.3% of the forms. The location of the patient was missing on 47.8% of the forms. Only 77.3 % of the

request forms evaluated contained the clinical details of the patient. With respect to physician information; the nam0pe of the physician ordering the test was provided on 55.4% of the forms, while 75.7% were signed by the doctor. The date the test was ordered was present on 62.7% of the forms. None of the 3,000 request forms had the requesting physician's telephone / fax number or the time the specimen was collected [22].

According to a study conducted in Tanzania. A total of 195 filled laboratory request form were audited .The result showed that patient surname (100%);patient first name (99%);date of births or age (93%); patient identification number (97%); and patient gender (99%) were adequately completed by ordering clinicians. However, date and time the result are required is (2.6%), the time sample was collected (2%) and the time sample was ordered (3%) therefore 100% of LRF audited were incompletely checked for all information as required [13].

Based on study conducted in Pakistan the total number of uncollected tests reviewed in the audit was 1972 Total number of tests requested by Ob/Gyni department including Emergency laboratory room were 56.2%. Out of this majority of tests included complete blood cout (CBC) 36.9% and blood sugar level(BSL) 13.6% The total number of tests requested by all other departments of the hospital were 40.5%. Approximate cost of these tests if done in a private sector, works out to be approximately R*9s576700 [16].

Another study conducted in Pakistan showed that out of 22445 laboratory tests 9026 (40%) and 5046 (22%) diagnostic test reports were not collected from the Chemical pathology and Hematology departments respectively. Financial impact of uncollected reports from all the departments at AFIP collectively amounted to Pakistani Rupees (PKR) 3338201[17].

In Ethiopia based on a study conducted by Mulubrhan Ali; The content of Hawassa university referal hospital(HURH) empty medical laboratory request form to the standard was 16 (72.7%) and Adare hospital 9 (40.9%). A total of one thousand nine hundred request forms were studied. The assessment revealed that, none of the request form was completely filled. 100% of the request forms studied revealed three or more gaps in the completion of the items assessed. From request reviewed 23.8% was uncollected and from this 83 (33.1%) was CBC [17].

3. Objective

3.1. General objective

The objective of this study was to evaluate request forms submitted to the laboratory to determine the frequency of incompletely filled forms, associated factor and the financial impact of non-communicated results at Ras Desta Damtew Memorial Hospital and St. Paul`s Hospital Millennium Medical College Addis Ababa Ethiopia.

3.2. Specific objectives

- To determine frequency of incompletely filled laboratory request forms at Ras Desta Damtew Memorial hospital and St. Paual`s Hospital Millennium Medical College Addis Ababa Ethiopia.
- To assess the proportion and type of non-communicated laboratory result at Ras Desta Damtew Memorial hospital Addis Ababa Ethiopia.
- To determine the financial impact of uncollected laboratory reports at Ras Desta Damtew Memorial hospital Addis Ababa Ethiopia.
- To identify factors contributed to incomplete laboratory request form and failed collection of the laboratory request form by clinicians at Ras Desta Damtew Memorial hospital and St. Paual`s Hospital Millennium Medical College Addis Ababa Ethiopia.

4. Material and methods

4.1. Study area

The study was conducted at St. Paul`s Hospital Millennium Medical College and Ras Desta Damtew memorial Hospital. Which are located in Addis Ababa, the capital city of Ethiopia.
St. Paul`s Hospital is a teaching and a referral hospital located at the western part of Addis Ababa, Gulele Sub city, Woreda 09. The hospital built in 1969 E.C and the medical college started in 2007 G.C. St. Paul`s Hospital Millennium Medical College is the 2nd largest specialized teaching public Hospital in Ethiopia with the mission to provide, promote preventive, curative and rehabilitative health care services in the country. Since then it has been a source of medical care for the underserved population .The hospital serves above 700 patients daily including private wing. And it has more than 340 beds. The hospital has over 1486 clinical and non-clinical staffs. From these 605 are clinical staffs. The Hospital has different departments including diagnostic laboratory and most recently launching its hemodialysis and renal replacement department.

Ras Desta Damtew memorial Hospital is also one of the most popular Hospitals found in Arada Sub city, Woreda 04. The hospital was built in 1924 E.C, its mission was the same as the above mentioned Hospital and the Hospital has 219 clinical and 159 non clinical staffs. The Hospital provides services to the people in Addis Ababa and patients referred from other places .The Hospital has 100 beds.

4.2. Study design

Cross-sectional descriptive study design was conducted at St. Paul`s Hospital Millennium Medical College and Ras Desta Damtew memorial hospital from June 12 to July 11 2017.

4.3. Population

4.3.1. Source of population

All laboratory request forms and clinicians in St. Paul`s Hospital Millennium Medical College and Ras Desta Damtew Memorial Hospital.

4.3.2. Study population

Laboratory Request forms which were generated from patient who were visiting Ras Desta Damtew Memorial Hospital and St. Paul`s Hospital Millennium Medical College laboratory during the study period and all volunteer clinicians who were requesting laboratory investigation from June 12-July 11 2017.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria

All laboratory request forms submitted to the laboratories and clinicians during the study period were included in the study.

4.4.2. Exclusion criteria

LRFS that requested to laboratory investigations but not done for some reasons like reagent stock out were excluded from the study

4.5. Sample size

A total of nine thousand six hundred ninety one (9691) request form was studied and 102 clinicians were involved in the study.

4.6. Sampling methods

Convenient sampling method was used to collect information from the participating hospitals from June12-July 11/2017.

4.7. Study variables

4.7.1. Dependent variables

- The Completeness of filled information on laboratory request form
- Proportion of non-communicated report
- Financial impact of non-communicated reports

4.7.2. Independent variable

- Educational level of the clinician
- Clinicians have taken some clinical laboratory course in university stay
- Work experience

4.8. Data collection Tools

4.8.1. Data collection for information incompleteness

Permission to assess patient files was obtained, and data were collected with the assistance of data collectors. The information was recorded on the data collection sheet after orientation was given for data collectors. In the data collection sheet there were different categories which state all the required information like patient information, clinician information, and specimen information. After the request paper was received to the laboratory and regular sample collection was completed, data collectors were received the request form and recorded all the required and available information on the request form to data collection sheet. The collection was made by tallying the numbers on the specific space provided. Subsequently, the data collectors were received the laboratory request form again and recorded all available information of the laboratory request form on the data collection sheet before they leave the laboratory. Data collection process was continued until we reach the last date of our data collection.

4.8.2. Data collection for non-communicated laboratory report and financial impact of uncollected report

For assessment of the non-communicated report, laboratory report that were not collected from the laboratory after one week starting from last date of data collection was assessed at Ras Desta Mamtew Memorial Hospital only. Total number of tests performed at Ras Desta Damtew memorial hospital laboratory during the study period and number of uncollected reports were noted, proportion of uncollected data is analysed and costs were also calculated using this information. The financial impact of the uncollected reports is also calculated by getting information from the accounts office. Cost per test was taken as only the direct cost of the test and the total cost of each test were calculated by cost per test times number of uncollected reports.

4.8.3. Data collection for factor contributes to incomplete laboratory request form and failed collection of laboratory report

We have collected information using pre-structured questionnaire from the clinicians who were working at Ras Desta Damtew and St. Paul`s Hospital Millennium Medical College

4.8.4. Questionnaire

A structured questionnaire including information of the participating facilities and clinicians were self-administered. The questionnaires had sub-components like: clinician information, educational background and service, clinician's attitude towards the laboratory service and extent of laboratory utilization, clinician's attitude and practice towards laboratory request form completion (filling), information concerning curriculum and some pre service orientations.

4.9. Data quality assuance

All consecutive laboratory request forms during the study period was collected to avoid collection bias, proper transcription of data to data collection sheet (check list) was maintained to avoid transcription errors, and proper data collector's orientation was given to avoid inappropriate data collection. And intensive supervision of data collectors was made during the entire data collection.

4.10. Statistical analysis and interpretation

Data were entered and analyzed using SPSS for windows version 24. Nominal/categorical data were described in number and percentage. Data were presented in tables and figures.

4.11. Ethical consideration

The study was approved by the "departmental research and ethical review committee" (DRERC) of the department of medical laboratory science, school of allied health sciences, Addis Ababa university. Official letters was written to the participating facilities which were **SPHMMC** and RDDMH to get permission. Data capturing format was unsigned and we used our own identification number. Consent forms were prepared in English to be read and Signed (if agreed) by the participating clinicians. Participants had the right not to participate or withdraw from the study any time whenever they want.

5. Results

5.1. Socio-demographic and other information filled by requesting clinician on medical laboratory request form

A total of nine thousand six hundred ninety one (9691) request forms were studied, of this 684 (69%) of the laboratory request forms were from St. Paul`s Hospital Millennium Medical College and 3007 (31%) of LRFs were from Ras Desta Damtew memorial Hospital. The assessment revealed that, only name of the patient and laboratory investigation were complete in all LRFS. Concerning other demographic data details such as age and gender, the patient ages were supplied on 6510 (97.4%) of the forms at St. Paul`s Hospital Millennium Medical College and 2782 (92.5%) of the forms at Ras Desta Damtew Memorial Hospital, Patient gender was present on 6550 (98%) of the forms from St. Paul`s Hospital Millennium Medical College and 2761 (91.8%) of the forms from Ras Desta Damtew Memorial Hospital (Table- 1).

Table-1 Socio demographic and other informations filled by requesting clinician on medical laboratory request forms of the two Hospitals collected from June 12 to July11, 2017.

Variable	**RDDMH** =(3007) N (%)	**SPHMMC** =(6684) N (%)
Name	3007 (100)	6684 (100)
Age	2782 (92.5)	6510 (97.4)
Sex	2760 (91.8)	6549 (98.0)
Patients address	21 (0.7)	63 (0.9)
Lab investigation	3007 (100.0)	6684 (100.0)
ClinicalDiagnosis	1829 (60.8)	4208 (63.0)
Type of specimen	3007 (100.0)	6566 (98.2)
Date of request	2925 (97.3)	6528 (97.7)
Clinicians name	1284 (42.7)	5244 (78.5)
Clinicianssignature	1695 (56.4)	5568 (83.3)
Patients card no.	2997 (99.7)	6684 (100)

5.2. Laboratory personnel information

With respect to the laboratory personnel information, of reporting personnel 2435 (80.1%) date of report, 2372 (78.9%), name and date of verification 1758 (58.5%) were provided on the request forms at RDDMH. In SPHMMC 2771 (41.45%) was provided with the name and date of the reporting personnel and signature as well but there verification system pass with in loboratory information system (Table 5.2)

Table -2 Laboratory personal information on request form the two hospitals collected from June 12 to July11, 2017.

variable	RDDMH=(3007) N (%)	SPHMMC=(6684) N (%)
Name & signature of reporting personnel	2435 (81.0)	2771 (41.5)%
Date of report	2372 (78.9)	2771 (|41.5)%
Name & signature of verifying personnel	1758 (58.5)	00.0
Date of verification	1758 (58.5)	0.00
Proper documentation before leaving the lab	3007(100.0)	6684 100.0

5.3. Proportion of non-comunicated laboratory report to the total clinical laboratory request form reviewd at RDDMH

A total of 3007 tests were performed at RDDMH out of which 616 reports were not collected which makes about 20.5% of the total reports. Large number of uncollected reports were CBC 74 (12.0%) followed by creatinine 50 (8.12%).When we see in respect to cost, from a total of 31,916 birr monthly budget 14,063birr (44%) was waste without the management of patient. The highest cost was troponin (20.77%). (Table.3)

Table-3 Proportion of non-communicated laboratory report to the total clinical laboratory request form reviewed at RDDMH

.Type of non-communicated result	Number of non-communicated result	Cost per test	Total Cost	Percentage of non-communicated results of the total	Percentage of cost of the total
Urinalysis	44	6	264	7.14	1.88
Stool	10	6	60	1.62	0.43
Creatinine	50	10	500	8.12	3.56
Alkaline phosphatase	38	10	380	6.17	2.70
GOT	43	10	430	6.98	3.06
GPT	43	10	430	6.98	3.06
Bilirubin-T	26	10	260	4.22	1.85
Bilirubin-D	26	10	260	4.22	1.85
Glucose	27	10	270	4.38	1.92
K	2	10	20	0.32	0.14
Na	2	20	40	0.32	0.28
Cl	2	20	40	0.32	0.28
Ica	2	20	40	0.32	0.28
Tca	2	20	40	0.32	0.28
RF	14	30	420	2.27	2.99
CBC	74	20	1480	12.01	10.52
ESR	21	6	126	3.41	0.90
Blood group	7	5	35	1.14	0.25
FT3	9	73.2	658.8	1.46	4.68
FT4	10	73.2	732	1.62	5.21
TSH	8	75.2	601.6	1.30	4.28
Troponin	19	153.75	2921.25	3.08	20.77
CK-MB	10	128.75	1287.5	1.62	9.16
VDRL	10	30	300	1.62	2.13
Total cholesterol	16	20	320	2.60	2.28
TG	14	20	280	2.27	1.99
TPS0A	11	78	858	1.79	6.10
WWF	14	20	280	2.27	1.99
H pylori	1	71	71	0.16	0.50
Aso	2	30	60	0.32	0.43
Hcv	7	35	245	1.14	1.74
HBSAg	6	35	210	0.97	1.49
Total protein	3	20	60	0.49	0.43
BHCG	1	83	83	0.16	0.59
Gene x pert	42	0	0	6.82	0.00
Total	616		14063.2	100.00	100.00

5.4. Socio-demographic characteristics of clincians who were ordering laboratory investigations

The mean age of the participant clincians were 30 years.57 (56%) and 45 (44%) of particpants were male and female respectively. Among the particpants 54 (53%) were intern 29 (28.4%) were general practitioner and 19 (18.6%) were specialists. From all the partcipants 84 (82.4%) had less than two years expérience followed by 12 (11.8%) who had more than five years. (table-4)

Table -4 Socio-démographic characteristics of clinicians who were ordering laboratory investigations

Variable	Number(n)	Percent(%)
Sex		
• Female	57	56
• Male	45	44
Age in years		
• 20-30	77	70.6
• 31-40	17	16.7
• >40	13	12.7
Educational Levels		
• Intern	54	53
• General practitioner	29	28.4
• Specialist	19	11.8
Work experiance		
• <2 years	84	82.4
• 2-5 years5r	6	5.8
• >5years	12	11.8

5.5. Clinicians attitudes and practces towards laboratory services and extent of laboratory utilization.

When clinicians asked about their attitudes about the laboratory service in general 81 (79.4%) stated that it is always important followed by 18 (17.6%) those said important most of the time. The clinicians attititude about hospital laboratory service 80 (78.4%) stated thier attititude is positive. (Table -5)

Table-5 Clinicians attitude and practies towards laboratory service and extent of laboratory utilization

Variable	Number(n)	Percentage(%)
Clinicians attitude about importance of laboratory service in general		
• Always important	81	79.4
• Important most of the time	18	17.6
• Important some times	3	4
Clinicians attitude towards the Hospital laborartory services		
• Positive	81	79.4
• Negative	3	4
• Neutral	18	17.6
Clinicians laborartory utilization		
• Over utilization	21	20.6
• Proper utilization	48	47.1
• Under utilization	33	32.4
Reasons for over utilization		
• Payment fee of laboratory service	3	2.9
• Fear of uncertainity	9	8.8
• Lack of awareness about laboratory cost	3	2.9
• None	3	2.9
Reasons for Under utilization		
• Lack of confidence on laboratory service	3	2.9
• Unavailability of the lab service	21	20.6
• Longer laboratory report issue time	9	8.8
Number of lab request send to the laboratory daily		
• Less than 5	54	52.9
• From 15-25	36	35.3
• More than 25	12	11.8
Reasons to order laboratory investigations		
• To confirm clinical impression and for prognosis	87	85.3
• To do complete work up	15	14.7

5.6. Clinician attitude and practice of laboratory request form

When physician were asked about the importance of writing clinical diagnosis on the laboratory request form 58.8% agreed that it is necessary, while 32.4% said that it is necessary but not every test and 8.8 % said it is not necessary. (Table 5-6)

Table -6 Clinician attitude and practice of laboratory request form

Variable	Number(n)	Percentage(%)
Importance of writing clinical dx		
• Necessary in all case	60	58.8
• Necessary but not in every case	33	32.4
• Not necessary	9	8.8
Experiance of writing clinical dx		
• Yes	87	85.3%
• No	15	14.7%
Importance of filling all informations		
• Yes	81	79.4
• No	9	8.8
• Sometimes	12	11.8
Experiance of writing all information on the request		
• Yes	66	
• No	36	64.7
		35.3
Reasons of unability to write all informations		
• Increased work load	46	45.1
• I dont think it is important	35	34.3
• Since i have seen such a trend of filling	21	20.6
Have information about entire laboratory test		
• **Yes**	20	19.6
• **No**	53	52
• **Have some infomation**	29	28.4
Taken some clinical laboratory course		
• Yes	72	70.6
• No	30	29.5
Importance of including some clinical laboratory course in the curriculum		
• Yes	96	94.1
• No	6	5.9
Ever got some orientation (a kind of in service training)		
• Yes	36	35.3
• No	66	64.7

Importance of lab orientation for newly employed clinicians		
• Yes	90	98.2
• No	12	11.8
Experiance of collection of all laboratory investigation report		
• Yes	81	79.4
• No	21	20.6
Reasons for uncollected laboratory reports		
• I am not confident with the laboratory service	21	20.6
• I sent it to reassure the pt. so I don`t need	21	20.6
• Long stay time to receive the lab result	60	58.8
Result delivery system to clinicians		
• Patient	12	11.8
• Patient relative	24	23.5
• Porter	51	50
• nurse	15	14.7
By whom result delivery system do you perfer		
• patient	6	5.9
• patient relative	9	8.8
• porter	78	76.5
• nurse	6	5.9
• lab personnel	3	2.9
Result collection system contributes to increased number of non-communicated report		
• yes	87	85.3
• no	15	14.7
Availablity of test menu at working area		
• yes	18	17.6
• no	84	82.4
Awareness about the cost of each laboratory tests		
• Yes	9	8.8
• No	93	91.2
Importance of knowing the price of lab investigation		
• To reject less important and more expensive test	37	36.3
• For rational ordering of lab test	64	62.7
• To check patient able to pay	1	1

5.7. Associations of clinician's clinical laboratory request form completion and extent of laboratory report collection with some selected independent variables

In multivariable logistic regression analysis unadjusted and adjusted for work experience, educational level and taken some clinical lab course, clinicians have being interns (AOR 6.833.,95% CI 2.161-21.604 P Value 0.001) were found to be significantly associated with writing all information on request. Associations of completeness of request form and utilization of laboratory result by clinician with some selected independent variables in Ras Desta Damtew Memorial Hospital and St. Paul`s Hospital Mellennium Medical College June 12-July 11,2017. (Table 5-3)

Table -7 Associations of clinician's clinical laboratory request form completion and extent of laboratory report collection with some selected independent variables

Out come Variable	Explanatory		Number	Unadjusted odd ratio	95%CI	PV	Adjusted Oddratio	95%CI	Pv
Proper writing of all infomation on request	Work Experiance	<1 years	84	.474	(.140-1.607)	.230	2.111	(.623-7.156)	.230
		2-5 years	6	1.000	(.141-7.099)	1.000	1.000	(.141-7.099)	1.000
		>5 years	12	1.000	_	-	1.000	-	-
	Educational Level	Intren	54	.146	(.046-.463)	.001	6.833	(2.161-21.604)	.001
		G.practitioner	29	.243	.071-.834)	.025	4.117	(1.199-14.137)	.025
		Specialist	19	2.167	_	.117	-	-	.117
	Taken some clnical laboratory course in the university	Yes	72	2.216	(.841-5.836)	.107	.451	(.171-1.188)	.107
		No	30	1.000			1.000		
Proper clinical diagnosis writting	Work Experiance	<1 years	84	4.33	(.921-20.379)	.063	4.333	(.921-20.379)	.063
		2-5 years	6	.000	.000	.999	2.399	.000	.999
		>5 years	12	1.000	_	-	1.000	_	
	Educational Level	Intren	54	2.133	(.5530-8.579)	.286	2.131	(.5530-8.579)	.286
		G.practioner	29	1.280	(.296-5.537)	.741	1.280	(.296-5.537)	.741
		Specialist	19	3.750	_	.019	-	_	.019
	Taken some clinical laboratory course in the university	Yes	72	.556	(.145-2.131)	.391	.556	(.145-2.131)	.391
		No	30	1.000	-	-	1.000	-	-

6. Discussion

The study revealed that overall of completion of laboratory forms were inadequte. Only the name and laboratory investigation of the patient appeared on all the forms evaluated. This result is similar to that obtained by studies from which showed that the patient's name and laboratory investigations were stated on all the request forms they evaluated [30]. This high percentage may be owing to the fact that if the name and laboratory investigation of the patient are missing on the request form it is returned to the concerned department and the request is not processed further. Age and gender were missing on 7.5% and 8.2% of the forms received at Ras Desta Damtew Memorial Hospital laboratory, while on 2.6% and 2% of the forms received at St. Pauel`s Hospital Millennium Medical College respectively. This is similar to a study conducted in North India; age and gender were not mentioned 1.41% and 1.32% of the forms respectively [23]. This is much less than from study conducted in Pakistan; Age and gender were not mentioned on 48% and 55% of the forms received at chemistry aboratory while on 72% and 71% of the forms received at AFIP respectively[22]. One of the reasons entering age of patient may be that more clients served in both of our study Hospitals were from urban area, even those who come from rural area were most of the time accompanied with relative from urban. Age and gender are extremely important considering that the reference ranges for a number of analysis are age and sex dependent [33].

Our study shows that clinical diagnosis was not provided in 39.2% of the request forms at Ras Desta Damtew Memorial Hospital laboratory and from St. Paul`s Hospital Millennium Medical College the clinical diagnosis was not provided in 37% of the request forms. This is lower than the study conducted in northern India the diagnosis was not mentioned in 61.2% of the patients [23]. Absence of clinical information or misleading information leads to unnecessary additional tests. But when clinical diagnosis is provided properly it helps the laboratory personnel to focus on some vital test and in turn it saves time and resource.

In our study, type of specimen was not supplied on 1.8% of the request forms in St. Paul`s Hospital Millennium Medical College this is consistent to a study conducted in South Africa indicated that the type of specimen collected was not stated only in 3.3% of the request forms [25] and in a study conducted in Nigeria which was not stated in 2.7% of form assessed [26] and which is lower than in a study conducted in Ethiopia. Type of specimen was provided only in 70 (5.4%) of the forms of Hawassa university referal hospital lab request forms and no place designed for specimen type in one of the hospital is laboratory request form[30]. In the absence

of information regarding type of sample collected, bloody pleural aspirate or cerebrospinal fluid can easily be taken for blood by the laboratory staff, resulting inappropriate diagnostic technique, reference ranges and ultimately misleading results.

In the present study clinicians did not write their name on ordering investigation on 57.3% and 21.5% of the form at RDDMH and SPHMMC respectively while 43.6% and 16.7% of the request forms were not signed by clinicians at RDDMH and SPHMMC respectively. This result is highly disagreed with similar study conducted in Rio de Janeiro, Brazil. Which is requesting physician names were not provided in 2%, and signature of the physician 0.5% [20]. writing information concerning clinician is important to communicate critical result immediately and it proofs accountability when necessary especially in medico-legal case. In the study date of request was not supplied on 2.7% of RDDMH and 2.3% of SPHMMC this similar study conducted in Ethiopia date of request was not present on 6.6% of HURH and 2.4% of Adare and less than study was conducted in Ghana. The date of request was not provided on 37.3% [28]. Date of request is crucial to report critical result immediately and to evaluate whether or not the laboratory result delivered to physicians within turnaround time and to monitor TAT.
Our study showed that laboratory personnel information such as name and signature of reporting personnel were not written on 19% and 58.5% of RDDMH and SPHMMC respectively which is higher than similar study conducted in Rio de Janeiro, Brazil, that states signature of the physician who prepared the report was not found to be 0.5%[20] and higher disagreed with similar study conducted in Ethiopia the name and signature of reporting personnel were not provided on all the request form of HURH and 90.2% of request forms were provided Adare hospitals[30]. Date of report were not present on 21.1% of RDDMH and 58.5% SPHMMC. Name and signature of verifying personnel and date of verification were not written on all the request form of SPHMMC but in RDDMH 41.5% were not written on request forms. This is equivalent with similar study conducted in Ethiopia there is no place for date of verification, verifying personnel signature, name of verifying personnel. Even if Quality and accountability are the focus of current concern in laboratory medicine result verification system minimizes the laboratory error [30].
In the current study, When physicians were asked about the importance of writing clinical diagnosis on the laboratory request forms, 60 (58.8%) agreed that it is necessary in all cases while 33 (32.4%) said that it is necessary but not in every case. And 9 (8.8%) said that it is not necessary Which is comparable with a study conducted in Pakistan and Ethiopia When

physicians were asked, 55% and 43% agreed that it is necessary in all cases while 45% and 45.2% said that it is necessary but not In every case respectively [21,30] .

Moreover, in our study 87 (85.7%) of the physicians claimed that they wrote clinical diagnosis most of the time while 15 (14.3%) negated writing clinical diagnosis. This is equivalent with similar study conducted in Pakistan 73% of the physicians claimed that they wrote clinical notes most of the time while 18% negated writing clinical diagnosis [22].

Our study showed that from total 3007 of reviewed request 616 (20.5%) of test reports were not collected which is much higher than a study conducted in New York which the uncollected report accounts 2.1% [19]. Also a study conducted in Pakistan stated that about 13% of the total reports were not collected [22] and which is similar with a study conducted in Ethiopia 23.5% reports were not collected.[30]. In our study 14,063birr (44%) was waste from average monthly Hospital budget without the management of patient which is higher than a study conducted in New York 30% of the average monthly budget have been wasted[19]. This cause unnecessary wastage of health care resource budgets in addition to increases the workload of already overburdened laboratory staff. Also prevents the introduction of newer and more important tests due to loss of a considerable amount of the laboratory budget on useless investigations reached to requested physicians.

When physicians asked about collection of all laboratory investigation from the laboratory 81 (79.4%) said collected all result but 21 (20.6) said did not collected all of the laboratory results this is equivalent to a similar study conducted in Ethiopia 74.8% of physicians were said they collected all laboratory result from the laboratory but 25.8% were said not all[30]. When inquired about the reason for not collected 60 (58.8%). They said it is due to a long stay time to receive the laboratory result it is less than similar study conducted in Ethiopia 75% said due to a long stay time to receive the laboratory result [30]. One reasons physicians are in the habit of ordering a panel of tests for a particular condition with only one or two investigations out of them contributing towards clinical use. Therefore rest of the tests are never collected. Another reason may be that those patients who are entitled to free healthcare services make sure that their entire test profile is done and then never bother to collect the reports as they do not have to pay for them [22].

Limitations

- Most of the study conducted in this area were not focus on information filled by laboratory personnel but it is crucial to release accurate, reliable and timely result so this part was not discuss in detail.
- The financial impact of non-communicated result were done only at RDDMH but not in SPHMMC. It is difficult due to result collection system. Because the results collected from the laboratory when the physician needs the result the runner, nurse or physician come to laboratory and collect it.
- Lack of literature regarding on non-communicated result, these made the results not well discussed and challenging for comparison

Strengths

- The duration of data collection is long; This helped to incorporate a large amount of samples that in turn would gave a better sample size.
- The paper includes the cost of non-communicated results; This enables to know the financial impact of the result and a better analysis can be done in monetary terms.

7. Conclusions and recommendation

7.1. Conclusion

- A total of nine thousand six hundred ninety one (9691) request forms were studied, of this, six hundred eighty four (69%) of the laboratory request form was from St. Paul`s Hospital Millennium Medical College and 3007 (31%) of LRF was from Ras Desta Damtew Memorial Hospital. The assessment revealed that, none of the request forms were completely filled except name and laboratory investigation.
- With respect to the laboratory personnel information, of reporting personnel 2435 (80.1%) date of report, 2372 (78.9%), name and date of verification 1758 (58.5%) were provided on the request form of request form. In St Paul Hospital 2771 (41.45%) were provided with the name and date of the reporting personnel and signature as well but there verification system pass with in loboratory information system
- A total of 3007 tests were performed at RDDMH out of which 616 reports were not collected which makes about 20.5% of the total reports. The highest number of uncollected reports was CBC 74 (12.0%) followed by creatinine 50 (8.12%). When we see in respect to cost, from a total of 31,916 birr monthly budget 14,063birr (44%) was waste without the management of patient. The highest cost was troponin (20.77%).
- In multivariable logistic regression analysis unadjusted and adjusted for work experience, educational level and taken some clinical lab course, clinicians have being interns (AOR 6.833.,95% CI 2.161-21.604 P Value 0.001) were found to be significantly associated with writing all information on request

7.2. Recommandation

In conclusion we recommend that that there should be adequate communication between laboratory personnel and clinicians.

Clinicians, Medical students and health officers should be adequately exposed to all information about medical laboratory and should be briefed about the logical approach pertaining to test ordering and should be informed about the hazards and financial burden of unnecessary test requests.

The laboratory personnel shall be prepare SOP for sample rejection criteria including about LRFS completeness and communicate the SOP with all medical staff

As a strict check patient's samples accompanied by incompletely filled request forms should be rejected since it may lead to inappropriate diagnosis.

Lastly computerized physician order entry forms along with electronic delivery systems of laboratory reports to the requesting physician might help reduce the number of uncollected reports.

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Annexes

Annex-1: information sheet and consent form

1.1 English version of participant information sheet, consent form

Department of medical laboratory science, collage of health sciences, Addis Ababa University

Medical Laboratory request form completeness, the financial impact of non- communicated results and factors contribute to improper completion and failed collection of laboratory result to clinicians at Ras Desta Damtew Memorial Hospital and St. Paul`s Hospital Millennium Medical College Addis Ababa Ethiopia

First of all I would like to thank you in advance for your cooperation and consent in participate in the study, please read the general information of the study and ask freely if you have any question regarding the study

Background information

Laboratory request forms provide information about the laboratory test being requested for. They carry demographic data and other information such as location of patient, laboratory number, Doctor's name, Doctors signature, telephone number of the requesting doctor. Omission of information on the forms may lead to laboratory errors. Appropriately designed and properly completed request forms are vital for the performance of all laboratory tests to the benefit of the patient and the satisfaction of the requesting physician.

The aim of this study

Evaluating laboratory request forms submitted to the laboratory to determine the frequency of incompletely filled forms and the financial impact of uncollected reports can have a significant importance to decrease the error encounter during the pre- analytical phase which account 68% of the mistake in the total testing process .It can also avoid test result dalliance, unnecessary redraws, improper patient treatment, misdiagnosis of any laboratory order, wrong patient identification, misidentification of clinical samples, and un-satisfaction of patient. In addition it minimizes the average cost of the organization that occur due to the uncollected result and minimize the work load.

Benefits for participant

The study participants will not have any financial incentive and other inducement from participating on this study, however; it helps to clinicians /participants to get accurate and reliable result from the laboratory and to give proper treatment to patient.

Risk and complication

There is no risk to the participants in participating in the study

Confidentiality

In order to maintain the confidentiality of participants' information the name will not be given. However, I will used only own code as identification number. The participant will not be prohibited to stop or withdrawal at any time from the study. No personal information will be disclosed to third part or will not appear in any report from this study

Assurance of principal investigator

I put my signature below to confirm you that I take all the responsibility for the scientific ethical and technical conduct of research project and for providing of progress report for all stake holders of research project

Mulualem Kelkay (PI): signature _____ Date _____

Note: - if you have any questions about the study you can ask now and at any time throughout the study by using my address.

Principal investigator address-

Mulualem Kelkay:- Department of medical laboratory sciences, college of health science, Addis Ababa university, Addis Ababa, Ethiopia.

Email- mulish8@gmail.com

Tel- +251912155266

1.2 Informed consent

I decide to put my signature after I read the provided information on participant information sheet and I accept the study is very beneficial without major health risks to me and agreed to participate in the study.

Signature of participant: _____

Annex-2: Questioner

The information is collected by principal investigator with in the study period

Instruction: encircle on the appropriate choice on the response category

Code	Question	Response category	Remark
101	Age in years	_____	
102	Sex	1.male _____ 2.female _____	
103	When did you graduate?	1.less than two year 2.2-5 years 3.more than five years _____	
104	What is your professional status?	1.intern 2.general practitioner 3.specialist 4.othaers ,specify_____	
105	How long has it been since you started working in the present hospital?	1.less than two year 2.2-5 years 3.more than five years _____	
106	What do you think about the importance of laboratory service?	1.always important 2.important most of the time 3.did not contribute to patent management 4.important some times	
107	What is your attitude towards your hospital laboratory service?	1.negative 2.positive 3.Neutral	
108	What do you think of your laboratory utilization?	1.over utilized 2.properly utilized	

		3.under utilized	
109	If over utilization is the answer for question number 108, why?	1.Free laboratory service 2.Fear of uncertainty 3.unawear about the cost of laboratory investigation 4.Lack of experience	
110	If underutilization is the answer for question number 108, why?	1.I am not confident with the laboratory service 2. unavailability of lab service 3.since the laboratory examination fee is expensive 4. Since the time to issue laboratory report is too long.	
111	How many laboratory requests do you sent to your hospital laboratory daily?	1.Less than 15 2.from 15-25 3.more than 25_____	
112	What do you think of factor which motivates physicians to request laboratory investigation?	1.conformation of clinical impression 2. Reassurance of patient that something was being done, even if the result will not affect the diagnosis. 3.desire to do a complete work- up	
113	Why do you order laboratory investigation?	1.To confirm clinical impression 2.To reassure patient 3.To do a complete work	
114	What do you think of the importance of writing clinical	1. necessary in all case 2.nessasary but not in every case	

	diagnosis in laboratory request form?	3. not necessary	
115	Do you write clinical diagnosis when you order laboratory investigation?	1.No 2.Yes 3.Sometimes 4.Rarely	
116	Do you think that it is important to write all the information on the request form?	1.Yes 2.No 3. Sometimes	
117	Do you write all information's on the request form when you order laboratory investigation?	1.Yes 2.No 3.sometimes	
118	If the answer for no 117 is no, why?	1.due to increased work load 2.I don't think it is important 3. Since It needs much time to fill it.	
119	Do you have full information about the entire laboratory test you ordered?	1.No 2.Yes 3. I have some information.	
120	Have you taken some laboratory courses which give you some information about clinical laboratory in your university stay?	1.Yes 2.No	
121	Do you think including some clinical laboratory courses in your curriculum is important?	1.Yes 2.No	
122	Have you ever get some orientation or a kind of in-service training about laboratory request	1.Yes 2.No	

	form completion and laboratory activity in general?		
123	Do you think general laboratory orientation for newly employed clinician is important?	1.Yes 2.No	
124	Do you collect all laboratory investigations report you send to the laboratory?	1.Yes 2.No 3.Sometimes	
125	If no is the answer for 123, why?	1.when I am not interested with the result, since it doesn't contribute to patient management 2. Since I sent it to reassure patient I am not bothered to collect the result. 3. Due to the time interval to issue the report is too long.	
126	Who delivers the laboratory results to the clinicians in your health facility	1. Patient 2. Patient relative 3. Porter 4. Nurse 5. Laboratory personnel	
127	Preferably, by whom should the result be delivered to you	1. Patient 2. Patient`s relative 3. Porter 4. Nurse 5. Laboratory personnel	
128	Do you think that laboratory result collection system contributes to raise in the number of non-communicated report?	1. Yes 2. No	

129	Is test menu available at your working area?	1. Yes 2. No	
130	Do you know the cost of each laboratory test in your hospital?	1. Yes 2. No	
131	What is the important of knowing the price of laboratory investigation	1.To reject less important and more expensive test 2.For rational ordering of laboratory tests 3. other(specify)_____	

Annex- 3: checklist

2.1 Data collection format (check list) on study to check completeness of LRF at the point of entry

Name of hospital _____

Parameter	G		M		I		S		E	
	P	A	P	A	P	A	P	A	P	A
Age										
Sex										
Card no (MRN)										
Address										
Laboratory investigation being ordered										
Clinical diagnosis										
Use of abbreviation										
Type of specimen										
Time of collection										
Date of request										

Clinicians name										
Clinicians signature										

Date ----------

Signature of data collector ----------

Key-M-for medical OPD, G-for gyni and Pedi OPD, I-for all inpatient, S-surgical OPD, E- Emergency laboratory , P-present, A-absent

2.2 Data collection format (check list) on study to check completeness of LRF after test is done before the result release from the laboratory

Parameter	G		M		I		S		E	
	P	A	P	A	P	A	P	A	P	A
Signature of reporting personnel										
Date of report										
Signature of verifying personnel										
Date of verification										
Proper documentation before leaving the lab										

Date ----------

Signature of data collector ----------

Key-M-for medical OPD, G-for gyni and Pedi OPD, I-for all inpatient, S-surgical OPD, E- Emergency laboratory, P-present, A-absent

2.3 Data collection format (check list) for patient cards on study to check laboratory request form completeness and number, type and financial impact of non-communicated result

Name of Hospital_____

Number of medical record reviewed_____

Type of non-communicated result	Number of non-communicated result	Cost per test	Total cost	Remark

Name of PI _____

Signature of PI _____

Date _____

Annex-4: Declaration

Title of Project: Medical Laboratory request form completeness, the financial impact of non-communicated results and factors contribute to improper completion and failed collection of laboratory result to clinicians at Ras Desta Damtew Memorial Hospital and St Paul Hospital Millennium Medical College Addis Ababa Ethiopia.

I, the undersigned, declare that this MSc research project is my original work. It has not been presented for a degree in any other University. False statements could be cause for invalidating this research project and may lead to other administrative or legal action.

Principal investigator: **Mulualem Kelkay**

Address: Department of Medical Laboratory Sciences, AAU

Signature: _____ Date: _____

Advisors: **Kassu Desta (BSc, MSc, PhD Candidate)**

Address: Department of Medical Laboratory Sciences, AAU

Signature: _____ Date: _____

Fatuma Hassen (BSc,MPH)

Address: Department of Medical Laboratory Sciences, AAU

Signature: _____ Date: _____