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ORIGINAL ARTICLE

Assessment of Quality of Medical Laboratory Services Provision and Associated Factors in Public Health Facilities at Gondar Town, Amhara Regional State, Northwest Ethiopia

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SUMMARY

Background: **A quality medical laboratory service is an important part of the health care system. In developing countries like Ethiopia, the laboratory quality system remains weak due to several factors. Therefore, assessing the factors affecting quality of medical laboratory service is highly important in order to improve service quality.**
Objective: **Assessment of factors affecting the quality of medical laboratory service in Gondar town public health facilities, Amhara regional state, Northwest Ethiopia, 2018.**
Methods: **An institution based cross-sectional study was conducted at Gondar town governmental health facilities from March to April 2018. A pretested, self-administered, semi-structured questionnaire and checklist was used to collect the socio-demographic information of the study participants and to assess factors affecting the provision of quality medical laboratory services. Data were checked for completeness, entered, and analyzed using SPSS version 20 (IBM Corporation, Armonk, NY, USA). Data were reported in tables and figures. The strength of association between the dependent and independent variables was assessed by the chi-square test. A p-value < 0.05 was considered statistically significant.**
Results: **A total of 103 medical laboratory professionals participated in the study. Of these, 62 (60.2%) were males. The majority of the study participants, 63 (61.2%), were laboratory technologists. Of these participants, 72 (69.9%) did not attend laboratory refresher training and 93 (90.3%) of participants were not satisfied with their salary. Sixty-three (61.2%) of the participants reported that their laboratory did not provide quality laboratory service. Lack of quality and adequate equipment, non-adherence to standard operating procedures, no continuing professional development, unavailability of adequate supplies and reagents, no customer service management, no regular internal and external quality assessment activity, no diagnostic service for all requested tests, no result verification, and laboratory safety were the major factors significantly associated with poor quality laboratory service (p < 0.05).**
Conclusions: **A high proportion of the study participants reported that their laboratory did not provide quality laboratory services. The shortage of adequate equipment, reagents, and lack of motivation and employees' recognitions are the major factors that affect the quality of laboratory services.**
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KEY WORDS

quality, medical laboratory, Ethiopia

LIST OF ABBREVIATIONS

EQA - External Quality Assurance
IQC - Internal Quality Control
QA - Quality Assurance
SOP - Standard Operating Procedure
SPSS - Statistical Package for Social Science
WHO - World Health Organization

INTRODUCTION

The clinical laboratory is a critical component of the health care system and plays a central role in public health, disease control, and surveillance in patient diagnosis and care [1]. In developed countries, the vast majority of medical decisions are based on medical laboratory tests. In the United States, billions of laboratory tests are performed annually, influencing an estimated 70% of all medical decisions [2].The World Health Organization (WHO) recognizes quality laboratory services as the key to improve global health and reaching millennium development goals [3].
Quality medical laboratory service provision is important in order to enhance diagnostic value and save lives of patients [4]. The qualities of medical laboratory procedures are driven by technical skills, quality management systems, and the motivation of staff. Reliable and timely results from laboratory investigations are critical elements for decision-making in almost all aspects of healthcare and are essential for the surveillance and control of diseases of public health importance [5]. Laboratory service quality is influenced by the competence of the laboratory service providers [6]. A poor quality assurance (QA) program in health laboratories incorporates all the factors that may influence the generation of reliable test results [7]. To reduce those errors, WHO continues to provide technical support to strengthen Internal Quality Control (IQC), External Quality Assurance (EQA), and its integration into health laboratories at various levels of the health care system [8]. The poor quality of laboratory results can lead to inappropriate interventions, adversely affect the credibility of the laboratory results, and may also lead to inappropriate treatment of patients [9].
The provision of health care service in sub-Saharan Africa is a complex problem, because policy makers, clinicians, and the public frequently fail to understand that laboratory diagnosis is essential to the prevention and treatment of disease [10]. Medical laboratories encountered the various challenges preventing them from providing reliable test results. Clinical misdiagnosis, dilapidated infrastructure, lack of laboratory policies, limited synergies between clinical and research laboratories, poor laboratory infrastructure, poor laboratory management and accreditation were reported [1,3,9,11]. In many resource-limited countries like Ethiopia, the quality of laboratory results is substandard [12]. It is therefore imperative that laboratory systems should be strengthened within broader efforts toward strengthening the health service system [13,14]. Due to various factors, the qualities of reports generated from these laboratories are highly questionable [15].
In Ethiopia various efforts have focused on expanding basic laboratories with new technologies at different levels of the health system, both in terms of the quality of equipment and technology by increasing the number of test menus such as clinical chemistry tests, medical microbiological, medical parasitological, urinalysis serological, hematology and immune-hematological tests, which require additional skills for implementation. However, many laboratories that have implemented new technologies have not effectively supported the process of developing technical skills with appropriate training. Therefore, the aim of this study was to assess the factors affecting the quality of laboratory services at government health institutions in Gondar town.

MATERIALS AND METHODS

Study area and period

The study was conducted in Gondar town governmental health facilities from March to April 2018 which are located in the Amhara region, Northwest Ethiopia, at a distance of 738 km from Addis Ababa (the capital city of Ethiopia). Its elevation is 2,133 m above sea level. Currently, the town has one referral hospital and eight Health centers. The University of Gondar specialized hospital, which is a teaching as well as referral hospital, serves more than five million people of the north Gondar zone and people of the neighboring district.

Study design and population

An institution-based, cross-sectional study was conducted among medical laboratory professionals who are working in health facilities in Gondar town. All laboratory professionals who have more than six months work experience in Gondar town government health facilities were included.

Data collection, analysis, and interpretation

Data like socio-demographics, educational background, work experience, motivation, communication, training, quality assurance activities, and other factors affecting quality of laboratory service were collected by the investigators at Gondar town government health facilities using a semi-structured questionnaire and check list. Data was checked for completeness, repeatedly entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20 (IBM Corporation, Armonk, NY, USA). Data were reported as percentages and figures. The strength of association between the variables

Table 1. Socio-demographic characteristic of laboratory professionals working in public health in facilities in Gondar town, Ethiopia, 2018.

Variable		Frequency	Percentage
Gender	Male	62	60.2
	Female	41	39.8
Age group	20 - 30	47	45.6
	31 - 40	43	41.7
	> 40	13	12.6
Educational level	Diploma	26	25.2
	Bachelor of Science degree	63	61.2
	Master of Science and above	14	13.6
Working experience in laboratory field	1 - 2 years	6	5.8
	3 - 5 years	24	23.4
	6 - 8 years	30	29.1
	9 - 11 years	20	19.4
	> 11 years	23	22.3
Position	Laboratory head (supervisor)	6	5.8
	Quality officer	13	12.6
	Technical staff	81	78.6
	Persons working on instrument processing (sterilization room)	3	2.9
Laboratory discipline (department)	General laboratory	51	49.5
	Clinical chemistry	7	6.8
	Hematology	4	3.9
	Parasitology	8	7.8
	Immunology/Serology	10	9.7
	Microbiology	7	6.8
	Urine analysis	6	5.8
	Blood bank	2	1.9
	Reception	8	7.8

was assessed by Pearson's chi-square test. A p-value < 0.05 was considered statistically significant.

Data quality control

The questionnaire was tested for its accuracy and consistency prior to actual data collection. Furthermore, feedback and corrections were provided on a daily basis to the data collectors. Completion, accuracy, and clarity of the collected data were checked carefully on a regular basis. The questionnaires were randomly selected for quality control purpose and rechecked by experienced laboratory personnel. In addition, the study participants were clearly informed about the purpose and usefulness of the survey.

Ethical consideration

The study was conducted after obtaining ethical clearance from the ethical review committee of the University of Gondar, School of Biomedical and Laboratory Sciences. The participants recruited to the study were informed about the objectives of the study. A written consent was obtained from all study participants involved in the study. Data collected during the study period was used only for the study objectives and respondents participated only once. Information obtained at any course of the study will be confidential.

RESULTS

Socio-demographic characteristic of laboratory professionals

A total of 103 medical laboratory professionals participated in the study. Of these, 62 (60.2%) were males. Most of the study participants were between the ages of 20 - 30 years (45.6%). The majority of the study partici-

Table 2. Awareness and laboratory management activity of laboratory professionals in Gondar town public health facilities, Northwest, Ethiopia, 2018.

Variables	Response	Frequency	Percentage
Knowledge on laboratory quality system essentials	Yes	99	96.1
	No	4	3.9
Laboratory communication with clinician	Yes	85	82.5
	No	18	17.5
Engaged in quality management system related trainings	Yes	55	53.4
	No	48	46.6
Laboratory communication with upper management	Yes	55	53.4
	No	48	46.6
Laboratory communication among laboratory staff	Yes	89	86.4
	No	14	13.6
Laboratory staff satisfied with their salary	Yes	10	9.7
	No	93	90.3
System for employees' recognition	Yes	30	29.1
	No	73	70.9
Attending continuing professional education development	Yes	44	42.7
	No	59	57.3
Attending refresher laboratory training	Yes	31	30.1
	No	72	69.9
Job description for assigned task	Yes	79	76.7
	No	24	23.3
Availability of quality and adequate equipment in laboratory	Yes	41	39.8
	No	62	60.2
Availability of quality and adequate supplies and reagent	Yes	24	23.3
	No	79	76.9
Adequate staff for laboratory services	Yes	38	36.9
	No	65	63.1
Fair laboratory workload	Yes	32	31.1
	No	71	68.9

pants, 63 (61.2%), were laboratory technologists. About 81 (78.6%) participants were technical staff. Almost half of the study participants 51 (49.5) were working in general laboratory (Table1).

Awareness and Laboratory Management Activity of Laboratory Professionals

A total of 103 medical laboratory professionals were asked to assess their perception on the different laboratory and management activities in their laboratory. Of all participants, 99 (96.1%) had awareness on laboratory quality system essentials.

Of all participants, 72 (69.9%) had not attended laboratory refresher training, 93 (90.3%) of the participants were not satisfied with their salary, and 85 (82.5%), 55 (53.4%), and 89 (86.4%) of participants communicated effectively with clinicians, upper management, and laboratory staff, respectively (Table 2).

Quality assurance practices and provision of laboratory services

About 63 (61.2%) participants agreed their laboratories were not providing quality laboratory service, about half of participants responded their laboratory had no customer service management, and 71 (68.9%) of respondents reported that their laboratory had no regular equipment calibration and maintenance service. Seventy (68%) of participants reported their laboratory did not provide uninterrupted laboratory service (Table 3).

The extent of factors affecting quality of laboratory service

A total of 103 study participants were asked to identify what factors mostly affect quality of medical laboratory service and to what extents. Of these participants, poor

Table 3. Quality assurance practices and provision of laboratory services in Gondar town public health facilities in 2018.

Variable	Response	Frequency	Percentage
Laboratory result and occurrence documentation	Yes	90	87.4
	No	13	12.6
Adherence to the standard operating procedures	Yes	76	73.8
	No	27	26.2
Customer service management	Yes	51	49.5
	No	52	50.5
Equipment calibration and maintenance	Yes	32	31.1
	No	71	68.9
Laboratory quality improvement activity	Yes	54	52.4
	No	49	47.6
External quality assessment activity	Yes	67	65.0
	No	36	35.0
Internal quality assessment activity	Yes	73	70.9
	No	30	29.1
Providing diagnostic service for all requested test	Yes	36	35.0
	No	67	65.0
Providing uninterrupted laboratory service	Yes	33	32.0
	No	70	68.0
Laboratory result verification	Yes	72	69.9
	No	31	31.1
Laboratory results reported within turnaround time	Yes	67	65.0
	No	36	35.o
Laboratory safety practice	Yes	62	60.2
	No	41	39.8
Provision of quality laboratory service	No	63	61.2
	Yes	40	38.8

staff motivation (49.5%), lack of knowledge and skill (54.4%), using non-calibrated equipment (66%), poor equipment quality (51.5%), and shortage of resources (71.8%) were believed to affect quality of laboratory service to a very large degree (Figure 1).

Association of different factors with the provision of quality laboratory services

The result showed that lack of continuing educational development ($p = 0.03$), shortage of quality and adequate laboratory equipment ($p = 0.003$), unavailability of quality and adequate supplies and reagents ($p = 0.024$), no adherence to the standard operating procedures ($p = 0.009$), no customer service management ($p = 0.029$), and absence of laboratory result verification and laboratory safety ($p = 0.021$, 0.004) were significantly associated with poor quality of laboratory services (Table 4).

DISCUSSION

In a developing country like Ethiopia, medical laboratory scientists work under high workload without job descriptions, continuing professional development or training. However, studies revealed that continuing professional development, training, and staff motivation are the factors for good performance of quality service, because non-satisfied professionals can be costly to the laboratory system due to inaccurate test results [16]. In this study, different factors were found to affect provision of quality medical laboratory services. Among these, lack of laboratory supplies, lack of motivation, shortage of resources, high work load, lack of training, inadequate staff, lack of equipment, lack of quality practice and, laboratory management are the major factors.

This study indicated that about 38.8% of the study par-

Table 4. Association of different factors with the provision of quality laboratory services.

Variable	Response	Provision of quality medical laboratory service n (%)		Chi-square	p-value
		Yes	No		
Attending of continuing professional development	Yes	12 (27.27)	32 (72.73)	4.3	0.03
	No	28 (45.5)	31 (52.5)		
Availability of quality and adequate equipment	Yes	23 (56.1)	18 (43.9)	8.5	0.003
	No	17 (27.42)	45 (72.58)		
Availability of quality and adequate reagent and supplies	Yes	14 (58.33)	10 (41.67)	5.0	0.024
	No	26 (32.9)	53 (67.1)		
Adherence to the standard operating procedures	Yes	35 (46.05)	41 (53.95)	6.3	0.009
	No	5 (18.5)	22 (81.5)		
Customer service management	Yes	25 (49.02)	26 (50.98)	4.4	0.029
	No	15 (28.85)	37 (71.15)		
External quality assessment activity	Yes	32 (47.76)	35 (52.24)	6.4	0.009
	No	8 (22.2)	28 (77.8)		
Internal quality assessment activity	Yes	34 (46.6)	39 (53.4)	6.3	0.01
	No	6 (20)	24 (80)		
Providing diagnostic service for all requested test	Yes	19 (52.8)	17 (47.2)	4.5	0.028
	No	21 (31.3)	46 (68.7)		
Laboratory result verification	Yes	33 (45.8)	39 (54.2)	4.9	0.021
	No	7 (22.6)	24 (77.4)		
Laboratory safety practice	Yes	31 (50)	31 (50)	8.1	0.004
	No	9 (21.95)	31 (78.05)		

ticipants believed that their laboratory provides good quality laboratory service as per standards, which is in contrast with the study done in Addis Ababa, Ethiopia, indicated that about 75% of the participants believed their laboratory was providing good quality laboratory services as per standards [11]. The difference might be due to the experience of laboratory personnel, presence of sufficient laboratory materials and reagents, educational status, and attitude of the customers towards medical laboratory services.

The study finding indicates that 93 (90.3%) of study participants were not satisfied with their salary and there was no employees' recognition mechanism which is in line with the study done in Addis Ababa, Ethiopia, which indicated that low salary, absence of risk payment, and absence of overtime payment were affecting the provision of good laboratory service [3,11]. It is also incongruent to previous studies [6,17] where more than 83% of the professionals were not satisfied with their salary and staff recognition system, as well as poor communication. However, it is well understood that motivation could be brought with a simple letter of recognition [18] and effective communication also contributes to quality of services [19]. However, a study in southern Ethiopia identified significant room for improvement in the services provided from clinical laboratories. Corrective actions for the less satisfied service categories and continuous monitoring of laboratory activities are essential for the development of quality in clinical laboratories of health institutions [20].

Most study participants responded that they were communicating well with clinicians 82.5%, upper laboratory management 53.4%, and among laboratory staff 86.4%, which was in contrast with a study done in Iran. Sri Lanka and Nyahururu District Hospital, Kenya, reported that poor communication with coworkers and upper management affected quality laboratory services provision [21-23]. Poor communication with clinicians and poor quality management systems directly affect the provision of quality laboratory services as well as patient and health care services at large. Therefore, health professionals should improve their attitude towards good laboratory service provision and understand the advantages of good laboratory service.

The current study also indicated, slightly more than 60% of study participants were not attending continuing professional development and refresher trainings. This study is comparable with the studies done in Hawasa referral hospital, southern Ethiopia. Iran and Addis Ababa, Ethiopia, indicated that absence of good laboratory

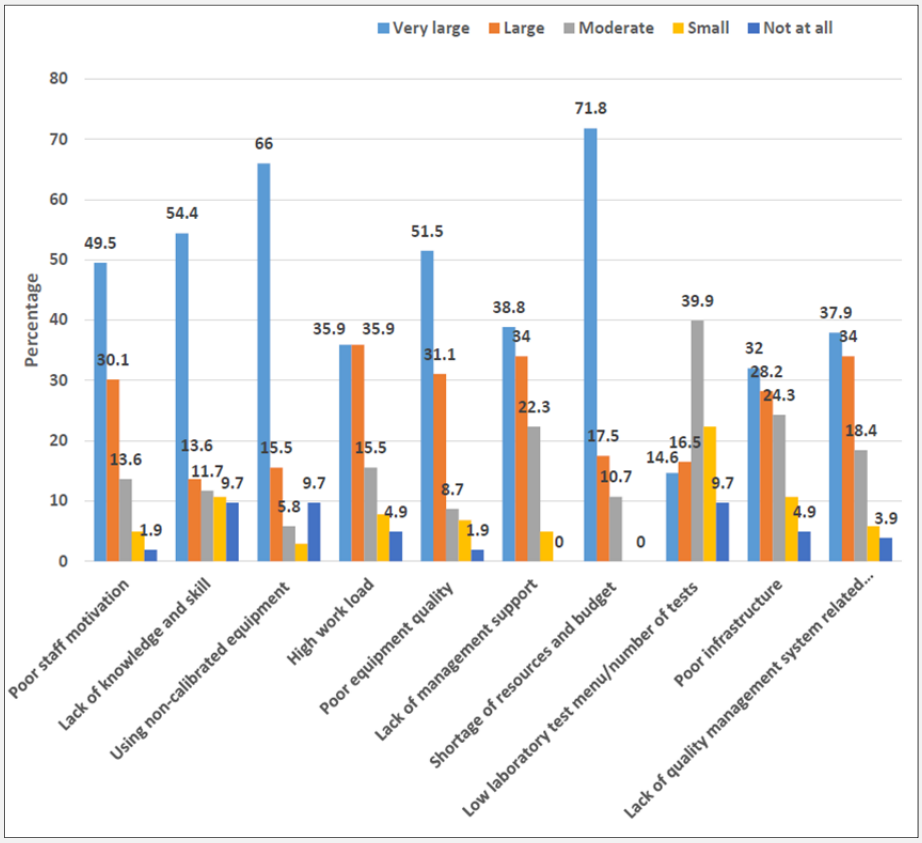

Figure 1. The extent of factors affecting quality laboratory service.

equipment, lack of enough training and adequate knowledge due to absence of continuing professional development were causes for skill gaps and low contribution of their time, effort, skill, and knowledge were a hindrance to improve quality of laboratory services [3,11,21,24]. This is also supported by research findings which reported that the laboratory professionals need continuous supervision and remedial actions for successful programs [25] and regular competency assessment and training should be mandatory to assure proper diagnosis and management [26].

Training of medical laboratory professionals regarding new technologies like point-of-care testing and laboratory information systems is important to ensure the validity and reliability of medical laboratory results to the customers [27].

More than 60% of the study participants in this study believed that no quality and/or adequate equipment, supplies, and reagents were available, and absence of adequate laboratory staff in their laboratory and high work load were the major factors affecting provision of quality laboratory service, which is in agreement with the study conducted in different parts of the world, in Iran, Sri Lanka, Addis Ababa, Ethiopia, and Jimma zone. This study indicated that shortage of laboratory equipment, reagents and supplies, staff, and high work load were the major factors affecting provision of good quality of laboratory services [3,11,21,22,24]. In addition, another study done in Ethiopia reported that lack of equipment maintenance, shortage of reagents and supplies, poor laboratory management, and lack of follow-up were identified as factors affecting the quality of laboratory service provision [28]. More than half of the study participants responded that absence of customer service management, lack of equipment calibration and maintenance, and lack of laboratory quality improvement activity affected quality of laboratory service. These studies are comparable with the studies conducted in different parts of the world, in Nepal, in Iran, Nigeria, Sri Lanka, Kenya, and in Addis Ababa, Ethiopia, which indicated that the lack of laboratory standardization (improvement activity), equipment repair and maintenance problems, poor leadership and management support affected provision of quality laboratory

services [11,21-23,29,30]. The present study also showed that the lack of diagnostic services for all requested tests and interruption of laboratory services are the other factors which cause poor quality laboratory services due to shortage of resources and high work load, which are in line with studies done in Ethiopia [11,24].

CONCLUSION

The major findings from this study were low salary, lack of staff motivation, shortage of resources, high work load, absence of continuing professional development, lack of management support, and lack of quality management system related training were reported to be the highly ranked problems causing poor quality laboratory services. To minimize the factors affecting provision of quality laboratory service, the government and stakeholders should support medical laboratory services by allocating sufficient budget and resources; providing quality and adequate supplies, reagents and equipment; considering appropriate allowance and motivating the laboratory staff; continuing professional development and training; and giving recognition for employees. These improvements are mandatory.

Author's contributions:
BB and AZ conceived and designed the study, TM, EG, MG, BB, AZ collected data, performed analysis, interpretation of data, drafted and finalized the manuscript. BB, AZ and MG performed analysis, interpretation of data and the critical review of the manuscript. All authors read and approved the final manuscript. All authors participated in final revision of the manuscript.

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Declaration of Interest:
The authors declare that they have no conflict of interests per and declaring that they have no competing interests.

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