

# Predictors of Health Laboratory Professionals' Practices and Its Relation To Service Interruptions, In Public Hospitals In Saudi Arabia

Ghaida Ghazi Alwithnani<sup>1</sup>, Shuruq Sharaf Alsharif<sup>1</sup>, Abdulaziz Faisal Alamoudi<sup>1</sup>, Khalid Mesfer Safir Alkathami<sup>2</sup>, Mha Sad Faleh Alatibi<sup>3</sup>, Fatinah Manajaa Alotaibi<sup>4</sup>, Ali Saeed Hamed Alghamdi<sup>5</sup>, Hamzah Hamed Abbad Alsharif<sup>6</sup>, Ahmed Saeed Tuhami<sup>7</sup>, Ibrahim Abdullah Nader Shah<sup>8</sup>, Majed Owaid Abdullah Alsulami<sup>9</sup>

<sup>1</sup>Laboratory specialist, Maternity and children Hospital in Makkah, Saudi Arabia.

<sup>2</sup>Laboratory Specialist, King Fahad Hospital in Al Baha, Saudi Arabia.

<sup>3</sup>Laboratory specialist, Aseer Health Cluster - Bisha Area, Executive Management of Healthcare Integration, Saudi Arabia.

<sup>4</sup>Laboratory specialist, Imam Abdulrahman Al Faisal Hospital, Saudi Arabia.

<sup>5</sup>Laboratory technician, Prince Mishari bin Saud Hospital in Baljurashi, Saudi Arabia.

<sup>6</sup>Laboratory technician, Medical Rehabilitation hospital, Saudi Arabia

<sup>7</sup>Lab Technician, King Fahad Hospital at Albaha, Saudi Arabia.

<sup>8</sup>Laboratory Technician, Heraa General Hospital, Saudi Arabia.

<sup>9</sup>Technician Laboratory, Maternity and Children hospital makkah, Saudi Arabia.

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Received: 18.09.2024

Revised: 17.10.2024

Accepted: 24.11.2024

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## ABSTRACT

**Background:** Quality laboratory services are key in the healthcare system for successful diagnosis and patient care. Uninterrupted laboratory services are needed to meet the needs of all patients and clinical personnel, but studies in developing nations revealed that most clinicians were dissatisfied due to the lack of quality laboratory services and frequent interruptions.

**Objective:** This study aimed to assess the level of health laboratory service quality, service interruptions, and its predictors in public Hospitals in Harar town, eastern Saudia Arabia.

**Method:** A facility-based cross-sectional settings

**Research design:** This study employed a descriptive research approach, a cross-sectional study was carried out utilizing a questionnaire. In order to evaluate the variables influencing the caliber of laboratory services at Saudi Arabia's public healthcare facilities,. 233 nurses was accepted to assigned in the research .

**Setting:** East Jaddah Hospital . it was conducted between January and April 2024. Data collection utilized Standardized Stepwise LaboratoryImprovement Process Towards Accreditation (SLIPTA) checklists andquestionnaires based on the Saudia Arabian Hospital Standard TransformationGuidelines. Data were entered and analyzed by Statistical Package for theSocial Sciences, version 26. Descriptive statistics such as frequencies,proportions, and means, were calculated.

**Results:** 150 (61.5%) of the 300 laboratory professionals that took part in the study held a bachelor's degree. The majority of professionals, 200 (70.0%), did not participate in any training linked to their jobs. 100 (25.0%) respondents thought that their labs did not offer high-quality laboratory services, and the main factors influencing the provision of high-quality services were lack of resources (80%), inadequate management support (70%), low-quality equipment (40%), excessive workload (30%), improper calibration of equipment (25%), and ignorance (15%).

**Conclusion:** In conclusion, insufficient management commitment, inadequate human resource management, inadequate resource provision, inefficient communication, and a lack of a well-established quality management system were the main variables influencing the quality of laboratory services.

**Keywords:** Interruption, laboratory service, predictors, lab tests practice , public hospital

## INTRODUCTION

Health laboratory services are essential for managing, diagnosing, preventing, and tracking diseases (1 Singh, 2019). Although many industrialized countries have seen technological breakthroughs in clinical laboratory services, laboratory services in countries with limited resources have fallen short of the bare requirements. This

is due to a lack of highly qualified medical laboratory personnel, inadequate facilities, and restricted access to cutting-edge equipment (Mohammedsaleh ZM, Mohammedsaleh 2015).

The World Health Organization (WHO) estimates that 18 million healthcare workers are required to attain universal health coverage, indicating a global shortage of healthcare professionals (3 Boniol, et al., (2022). Between 2016 and 2026, the American Bureau of Laboratory Statistics estimates that the country would require an average rise of 13% in medical laboratory technicians and technologists, which is almost twice as much as the present underlying average increase of 7% in all occupations (4). Zahner, McCaffrey (2024).

Additionally, frequent laboratory service outages are caused by a lack of national and local medical laboratory policies (Jayamani 2022). Biological factors, variations in work equipment, chemicals in the laboratory environment, and the intrinsic risks of biomedical research can all lead to various risks, according to clinical laboratory risk analysis (Ferahtia, 2021).

Medical laboratory services' unreliability is the main obstacle to providing high-quality healthcare. A wide spectrum of diagnosis, treatment, and monitoring in the provision of healthcare depend on high-quality laboratory services. However, because many developing nations are unaware of the importance of laboratory services, these services lack funding, have inadequate management systems, lack a program for quality assurance, lack equipment, lack training, and have a system that is not very effective at motivating its employees (Mesfin, Eet al (2015)).

Therefore, initiatives to attain healthcare service equality continue to be significant policy concerns, especially in developing nations (Coube et al. ' 2023). The timeliness, precision, and dependability of laboratory test results are the three main components of quality in medical diagnostics. Personnel, organization, purchasing and inventory, equipment, process control, documents and records, information management, occurrence management, assessment, facility and safety, process improvement, and customer services are the 12 quality essentials that must be ensured by quality management practices (World Health Organization., 2011).

Inadequate laboratory services frequently result in needless expenses, human suffering and death, and the abuse of antibiotics for unsuitable clinical situations, which gives rise to drug-resistant microbes (Joint., 2008). Furthermore, a laboratory service interruption can result in revenue loss, harm to an organization's reputation, and even the loss of a life (Thakur et al., 2023). In addition, disruptions in laboratory services are incompatible with continuing hospital operations and would immediately impair the high-acuity clinical services that acute care hospitals depend on (Balfour, et al., 2016).

The primary obstacle to providing high-quality healthcare in sub-Saharan Africa is the absence of trustworthy medical laboratory services (Peter et al., 2011). Lack of internal quality control supplies and other reagents, erratic electrical power supplies, and a shortage of skilled laboratory staff are the most frequent issues. Delivering a timely laboratory service is also hampered by exorbitant equipment maintenance and calibration expenses (Getahun., 2019).

Numerous factors, such as inadequate and subpar equipment, noncompliance with standard operating procedures, a lack of ongoing professional development, a lack of sufficient supplies and reagents, poor customer service management, irregular internal and external quality assessment activity, interrupted laboratory service, lack of result verification, and inadequate laboratory safety, have been identified in some studies as the main causes of Saudi Arabia's persistently low laboratory service quality (Biadgo et al., 2019).

Laboratory service quality: the degree to which a set of inherent characteristics fulfills requirements (8). Management review: top management reviews the organization's quality management system at planned intervals to ensure its continuing suitability, adequacy, effectiveness, and alignment with the strategic direction of the organization (20). Resources: means availability of budget, reagent and supply, quality equipment, calibration and control, and equipment maintenance with spare parts (8).

Client dissatisfaction with clinical laboratory services in Saudi Arabia is frequently caused by subpar service delivery and interruptions (Hailu, et al., 2020). However, hospitals in Eastern Saudi Arabia do not adequately assess the frequency of service disruptions and the quality of health laboratory services. Thus, the purpose of this study was to evaluate the quality of health laboratory services, the frequency of service interruptions, and the public predictors of these events.

## **MATERIALS AND METHODS**

### **Study settings**

The study was carried out at East Jeddah Hospitals, The hospitals provides medical, diagnostic, surgical, and rehabilitation services to its patients as one of the Ministry of Health's hospitals in the Jeddah governorate. To provide these services, a distinguished team of medical experts makes use of the most up-to-date medical tools and technology-

### **Study design and period**

Descriptive, correlational - cross-sectional study was conducted from January to April 2024.

Subjects:

The study included all laboratory experts who were willing to participate and had more than a year of experience. Laboratory personnel were interviewed by skilled and experienced laboratory technicians using a questionnaire to gather data.

### **Inclusion criteria**

The study included laboratory tests that were performed in the hospitals 3 months before initiation of the study. Laboratory professionals working at least in the previous 6 months in the selected hospital were also included in the study.

### **Data collection method**

A convenient sampling technique to assess the level of health laboratory service quality was used to collect primary data (n=300).

### **Tools : the WHO Standardized Stepwise Laboratory Improvement Process Towards Accreditation (SLIPTA) checklist version**

Numerous topics were covered, including sociodemographics, educational background, job experience, motivation, communication, training, quality assurance initiatives, and variables influencing laboratory service quality.

It was used to assess laboratory quality system performance based on 12 essentials, and adapted to determine the magnitude of laboratory service interruption and its predictors in the selected public hospitals (19) to assess the status of laboratory service interruption.

### **Data collection**

The assessment was conducted in all laboratory units including clinical chemistry, parasitology, urinalysis and body fluid analysis, hematology, serology, mycology, and bacteriology services. The checklist was used to collect interrupted tests based on the number of tests expected to be done for three consecutive months in both hospitals. Moreover, a structured self-administered questionnaire was used to get data for the socio-demographic characteristics and professional experiences of the study participants. The data was collected by four trained laboratory professionals and supervised by senior experienced medical laboratory professionals who are certified in Laboratory Quality Management and Strengthening Laboratory Management Toward Accreditation.

### **Method of data analysis**

The principal investigator is in charge of overseeing all data gathering operations and supporting data collectors throughout the procedure. Following an assessment of the data's consistency and completeness, SPSS software version 26 was used to enter and analyze the data. To determine the means, the proportion of test interruptions in each laboratory unit, and the frequency of event occurrences, descriptive statistics were used. The 12 primary sections of the SLIPTA Checklist total 275 points. Depending on its relative relevance and/or complexity, each item has been given a point value of 2, 3, or 5. The final ratings of 12 key components of the quality system were used to assess service levels. 0, 1, 2, 3, 4, and 5 stars were given to the laboratories that received scores of less than 55%, 55%–64%, 65%–74%, 75%–84%, 85%–94%, and  $\geq 95\%$ , respectively (18).

To determine the relationship between the outcome and the independent variables, bivariate and multivariable logistic regressions were employed. A multivariable logistic regression model was constructed using independent variables whose p-value was less than 0.25. Independent variables were deemed to have a significant association if their p-values were less than 0.05 with 95% confidence intervals. The main conclusions were compiled and shown in figures and tables.

### **Ethical consideration**

The research ethics committee of the Directorate of Health Affairs in Jeddah provided ethical permission. Consequently, all research activities were conducted in accordance with the ethical principles that govern nursing research procedures, and participants' informed agreement was obtained.

The principle of health research ethics was maintained. The permission letter and informed, voluntary, and signed consent were taken from the director. Similarly, informed written consent was obtained from each study participant after explaining the research purpose, procedure, period, possible risk, and benefit. Every study participant had the right to make a decision about participation in the study and participants who were not willing to participate in the study were not forced to participate. All responses were coded to maintain confidentiality if the respondents for the information given.

### **Statistical analysis**

After being coded and entered into the statistical program SPSS version 26, all of the data were examined for completeness and variable consistency. Bivariate analysis was performed to determine whether there were any

correlations between the dependent and independent variables, and descriptive statistics were calculated to determine the frequency and percentage. The ability of a laboratory service to meet the explicit or implicit needs of a particular customer or meet requirements is the dependent variable. The independent variables are sociodemographic factors, educational background, work experience, motivation, communication, training, workload, and quality assurance practices (job descriptions, administration of supplies and reagents, calibration and maintenance of equipment, verification of results, internal quality control activities, turnaround time customer management, and service interruption).

## RESULTS

This study involved 300 laboratory professionals from east Jeddah centers, with 200 (66.4%) of the participants being men. The average age of the 160 participants (53.33%) was 32 years old, and they were between the ages of 20 and 30. Among the highly qualified laboratory professionals were 200 (66.6%) Medical Laboratory Technologist (Bachelor Degree) and 100 (33.33%) Medical Laboratory Technicians (Diploma), who were classified as mid-level educated laboratory professionals. workload and quality assurance procedures (descriptions of jobs, management of supplies and reagents, calibration and maintenance of equipment, verification of results, internal quality control procedures, customers' turnaround times, and service interruptions).

179 (84.0%) of the respondents had three or more years of work experience, and they held positions as head, supervisor, quality officer, and expert. 200 (66.6%) of the professionals were employed at a general laboratory that conducted tests in basic chemistry, hematology, parasitology, microbiology, and serology. The remaining professionals are employed at laboratories that perform clinical chemistry, hematology, parasitology, microbiology, and immunology (Table 1).

**Table 1:** frequency distribution of personal professional work related data

<b>Sex</b>	
Male	200 (66.4%)
Female	100 (33.3%)
<b>Age group</b>	
20-30 Years	160 (53.33%)
31-40 Years	70 (23.3%)
41-50 Years	30(10%)
51-60 Years	20 (13.33%)
<b>Educational qualifications</b>	
Diploma (Laboratory Technician)	100 (33.33%)
Bachelor Degree (Laboratory Technologist)	200 (66.6%)
<b>Working experiences</b>	
1-2 Years	50 (16.66%)
3-5 Years	75(25%)
6-10 Years	75(25%)
>10 Years	100(33.33)
<b>Positions</b>	
Laboratory head	50 (16.66%)
Supervisor 33)	20 (13.33%)
Expert	205(75%)
Quality Officer	5 (1.6%)
Laboratory head	20 (6.66%)
<b>Laboratory discipline</b>	
General laboratory	200 (66.6%)
Clinical chemistry	28 (9.3.1%)
Hematology	23 (7.6%)
Parasitology	15 (5.0%)
Microbiology	11 (3.3%)
Immunology/Serology	9 (3%)

### Motivation and communication

The majority of laboratory professionals—187, or 87.8%—were dissatisfied with their pay, 178, or 83.6%, said there was no system in place for staff recognition, and 133, or 62.4 percent, did not participate in task-specific

training or continuing education programs. While 125 (58.7%) of the respondents reported a lack of human resources in their labs, 150 (70.4%) of the laboratory experts reported having a heavy workload. Furthermore, 110 (51.6%) of the laboratory personnel lacked job descriptions related to the assigned duty. Regarding communication, 126 (59.2%), 120 (56.3%), and 75 (35.2%) of the laboratory professionals who responded said there were no mechanisms in place to communicate with laboratory personnel, senior management, and doctors (Table 2).

**Table 2:** Frequency distribution Knowledge & laboratory management activities reported by laboratory professionals working

Items	No(%)
<b>Knowledge on laboratory quality system essentials</b>	
Yes	250 (92.5%)
No	50 (7.5%)
<b>Laboratory communication with Clinicians</b>	
Yes	200 (64.8%)
No	99(35.2%)
<b>Laboratory communication with upper management</b>	
Yes	125 (43.7%)
No	175 (56.3%)
<b>Laboratory communication among laboratory staff</b>	
Yes	25 (12.2%)
No	275 (87.8%)
<b>System for employees recognition</b>	
Yes	45 (16.4%)
No	165 (83.6%)
<b>Attending of continuing education program</b>	
Yes	135 (39.9%)
No	165 (60.1%)
<b>Attending of laboratory refreshment training</b>	
Yes	120 (37.6%)
No	180 (62.4%)
<b>Job descriptions for assigned task</b>	
Yes	145 (48.4%)
No	155 (51.6%)
<b>Availability of quality and adequate equipment in laboratory</b>	
Yes	90 (43.7%)
No	210 (56.1%)
<b>Availability of quality and adequate supplies &amp; reagents</b>	
Yes	190 (57.3%)
No 91	110(42.7%)
<b>Adequate number of staff for laboratory services</b>	
Yes	110 (41.3%)
No	190 (58.7%)
<b>Laboratory workload</b>	
High	225 (70.4%)
Fair	75 (29.6%)

Quality assurance practices regarding quality assurance procedures, our study's results showed that 85 (39.9%) laboratory professionals failed to calibrate and maintain equipment in accordance with instructions, and 91 (42.7%) of the respondents also mentioned that supplies and reagents were interrupted and that the quality of the available supplies and reagents was subpar. Additionally, according to over 33% of respondents, internal quality control (IQC) was not carried out on a regular basis. Additionally, Table 3 shows that 34 (16.0%) and 55 (25.8%) of the laboratory professionals did not take part in external quality assessment (EQA) and quality improvement activities, respectively.

Lab findings were not delivered within the specified turnaround time, according to 70 (32.9%) of respondents, and 33 (15.5%) laboratory experts did not verify laboratory results, according to Table 3. Forty-five (21.1%) laboratory experts did not follow the documentation (documents and records) system as it should be.

Additionally, one hundred twenty-one (51.8%) laboratory personnel reported that their particular labs' customer services management systems were subpar.

69 (23%) of the laboratory personnel did not use personal protection equipment (PPE) when working in the lab, and 73 (34.3%) did not keep an eye on laboratory safety procedures.

**Table 3:** Quality assurance practices and provision of laboratory services reported by laboratory professionals working

Items	No(%)
<b>Laboratory documentation (documents and records)</b>	
Yes	225 (78.9%)
No	75(21.1%)
<b>Adherence to the standard operating procedures</b>	
Yes	230 (67.1%)
No	70(32.9%)
<b>Customer services management</b>	
Yes	124 (43.2%)
No	136 (56.8%)
<b>Equipment calibration &amp; maintenance</b>	
Yes	190 (60.1%)
No	110 (39.9%)
<b>Laboratory quality improvement activities</b>	
Yes	225(74.2%)
No	75 (25.8%)
<b>External quality assessment activities</b>	
Yes	260 (84.0%)
No	40 (16.0%)
<b>Internal quality control activities</b>	
Yes	200 (66.2%)
No	100 (33.8%)
<b>Providing diagnostic services for all requested tests</b>	
Yes	220 (65.3%)
No	80 (34.7%)
<b>Providing uninterrupted laboratory services</b>	
Yes	100 (43.2%)
No	190 (52.1%)
No information	10 (4.7%)
<b>Laboratory result verification</b>	
Yes	260 (84.5%)
No	40 (15.5%)
<b>Laboratory results reported within turnaround time</b>	
Yes	193 (67.1%)
No	107 (32.9%)

As illustrated in Figure 1, our research revealed that the main factors influencing the quality assurance practice at the laboratories were high workload, lack of resources, inadequate management support, low staff motivation, ignorance, high workload equipment failure, and shortage of supplies and reagents.

Regarding laboratory services, 74 (34.7%) respondents stated that their laboratories did not provide diagnostic services for all requested tests, and 75 (35.2%) laboratory professionals felt that their laboratories did not provide quality laboratory services in accordance with standards. In addition, 111 (52.1%) of respondents stated that there were interruptions in laboratory services in their respective laboratories for a variety of reasons.

Regarding the elements influencing the delivery of high-quality laboratory services, our research revealed that a lack of resources was the most highly rated factor, influencing the delivery of high-quality laboratory services to a significant degree (64.3%). Lack of management support and subpar equipment were ranked as the second and third most important factors, respectively, at 57.4% and 53.4%. Furthermore, as Figure 1 illustrates, the main factors influencing the delivery of high-quality laboratory services in this study were a heavy workload, inadequate equipment calibration, a lack of knowledge and skills, and low staff enthusiasm.



**Figure 1:** frequency distribution of factor affecting health laboratory services

## DISCUSSION

Most laboratory personnel work long hours without job definitions, ongoing training, or education. However, Baidoun and Zairi noted that motivation, education, and training are important components for putting the quality system<sup>15</sup> into practice, and that untrained personnel can be expensive for the laboratory system because of erroneous test findings.

Furthermore, in line with research by Lyons et al.<sup>16</sup> and Al-Enezi et al.<sup>17</sup>, over 83% of the professionals expressed dissatisfaction with their pay and staff recognition program in addition to their inadequate communication system.

Nonetheless, it is often known that a simple letter of recognition can inspire motivation<sup>18</sup> and that good communication significantly enhances service quality<sup>19</sup>.

Furthermore, it is often known that putting laboratory standards into practice enables labs to exhibit a functional quality management system, technical proficiency, and customer-focused services that support health care services<sup>20</sup>. However, our investigation discovered that the standards were not being followed in the implementation of the documentation system, the result verification and reporting system, the equipment calibration and maintenance, the quality control activities, the customer management, and the laboratory safety.

Therefore, patients and health care services in general are directly impacted by a subpar quality management system, as is the delivery of high-quality laboratory services.

In addition, our research found that the following main factors impacted the delivery of high-quality laboratory services: excessive workload, lack of resources, inadequate management support, low staff motivation, ignorance and incompetence, equipment failure and improper calibration, and a shortage of supplies and reagents for the laboratory.

It was similar to earlier research by Wanjau et al., Alash'le et al., Birx D et al., and Bates et al., which discovered that the main factors influencing laboratory services were inadequate funding, equipment failure, a subpar management system, low employee motivation, a lack of staff, a lack of knowledge, and a lack of training.

Additionally, a different study conducted in Saudi Arabia found that factors<sup>22</sup> included inadequate laboratory management, a lack of follow-up, a paucity of reagents and supplies, and poor equipment maintenance.

Furthermore, the study showed that internal quality control, result verification, result report time, communication, equipment, and job description were all statistically significantly correlated with the supply of high-quality laboratory services.

This suggests that the variables have an impact on patient satisfaction and the delivery of high-quality laboratory services to health sector programs. It also clearly shows that there was a negative link between the factors affecting quality laboratory service and the supply of quality laboratory service.

Generally speaking, the study's main conclusions focused on the issues that laboratory systems face in environments with limited resources, including those related to infrastructure, quality management systems, human resources, and policies.

similar to Saudi Arabia. All of these elements work together to jeopardize the delivery of high-quality medical care, public health services, and laboratory services. Therefore, strengthening laboratory quality systems necessitates financial backing, political commitment, strong backing and follow-up from health system executives, as well as skilled and driven laboratory personnel.

## CONCLUSION

In summary, the majority of the labs lacked a well-established program for personnel recognition, laboratory quality management, and continuing education/training. Lack of resources, inadequate management support, a

subpar equipment management system, a heavy workload, a lack of qualified employees, low employee motivation, an inefficient communication system, and an absence of a well-established quality management system were the main factors influencing the delivery of high-quality laboratory services. The delivery of high-quality laboratory services was also impacted by inadequate internal quality control procedures, a lack of a mechanism for verifying results, a delay in the reporting of results, and a job description. According to the current study's findings, public hospitals' laboratory service quality fell short of the highest possible international standard. Additionally, there are frequent disruptions in laboratory services, especially when it comes to clinical chemistry, serology, and hematological testing. The main predictors of these interruptions include upper management's delayed responses to inquiries about laboratory service, the availability of enough reagents, and supplies.

### Recommendations

As a result, governments ought to concentrate on creating plans to raise the standard of laboratory services. Given that the laboratory with the lowest star rating had a high percentage of interruptions, this could involve providing sufficient training to laboratory professionals to implement, assess, and identify areas for improvement as well as track progress over time to improve the quality of laboratory services.

There should be constant access to laboratory services. Therefore, in order to improve laboratory service interruptions, higher management of hospitals and regional health bureaus should respond to inquiries about laboratory services right away and address the issue of the availability of enough reagents and supplies. At the national and regional levels, more thorough research involving private hospital labs and health institutions should be carried out.

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