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Evaluation of performance quality and safety measures in medical laboratories within the health sector under the corona pandemic

Noor Ali Harb
Southern Technical University/ Collage of Health and Medical Technology/Iraq/ Basrah
Corresponding author email: noorhali778@gmail.com

Prof. Dr. Alaa Kadhim Jasim
Southern Technical University/ Collage of Health and Medical Technology/Iraq/ Basrah
Email: alaa-alderawi@stu.edu.iq

***Abstract*---**Background: Historically, laboratories in many developing countries have suffered from inadequate facilities, low financing, and a scarcity of competent employees. Misdiagnosis occurs as a result of a lack of access to proper laboratory services, resulting in worse patient care, increased expenditures, and the continued transmission of infectious illnesses. Materials and Methods: This is a cross-sectional study conducted at 3 hospitals, 19 PHCCs distributed in 5 sectors, and 1 Public Health Laboratory randomly selected (By using a Multistage random sampling method) in Muthanna governorate. The period of study starting on 1st December 2021 – 31 March 2021. Results: In this study, the overall assessment of the health institutions according to the main domains, the study found that the highest assessment score was for the Public health laboratory at 1.807 with a good level, while the lowest assessment score was for AL-warkaa hospital at 1.547 with acceptable level. As for the overall assessment for all the main domains were acceptable with a mean score of 1.67. Conclusions: The overall evaluation of quality indicators in laboratories in all health institutions studied was acceptable to some extent. The quality Improvement Program needs to provide roles from the Ministry of Health on how to assess, measure and evaluate the quality of health services.

***Keywords*---**quality, laboratory, institutions, COVID-19, performance.

Introduction

The Institute of Medicine defines health care quality as "the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge." (Agency for Healthcare Research and Quality, 2018). While quality is a key component in strengthening health systems and improving health workers' performance discussions (Ozano *et al.*, 2019). Laboratory performance is a relative concept but nevertheless of prime importance, as are quality and safety in the total testing process (Plebani, 2021). Therefore, repetitive benchmarking appears to be essential for sustainable improvement in health care. The general idea of this approach is to establish a reference level, upon which the status quo may be quantified, and improvement strived for. For patient safety in general the seminal report "To Err is Human" might arguably play such role (Kohn et al., 2000). And even though the performance of medicine in general has certainly greatly improved over the last decades, patient safety has debatably stayed about the same since its publication (Huf et al., 2022).

Delivery of high-quality laboratory services is essential in the health-care system both for providing the diagnosis service or clinical decisions and as an objective means to measure and monitor biological markers. Accurate and timely laboratory analyses are critical to identify, track, and limit public health threats which ultimately will reduce rates of preventable morbidity and mortality. Optimal functioning of the public health system to meet these threats is dependent on uniform and high-quality laboratory testing (World Health Organization, 2012).

Aim of the study

The study aimed to evaluate the quality and safety measures of laboratories in al-Muthanna province under Corona pandemic.

Materials and Methods

Study design

This is a cross-sectional study conducted at 3 hospitals, 19 PHCCs distributed in 5 sectors, and 1 Public Health Laboratory randomly selected (By using a Multistage random sampling method) in Muthanna governorate.

Setting of study

Muthanna governorate is about 200 kilometers south of Baghdad city the capital of Iraq and has an area of 51402 square kilometers, and accounts for 11.9 % of the total area of Iraq 441,000 square kilometers. Census conducted by the central authorities in 2017 the total population of Muthanna governorate was 814371 thousand inhabitants (Iraqi Ministry of Planning/Central Statistical Organization, 2018). This study was conducted in Muthanna governorate. which included 3 hospitals (Al-Hussain Hospital, Al-Maternity And Children Hospital, and Al-Warkaa Hospital), 5 sectors (1st Samawa sector, 2nd Samawa sector, Al-Rumitha Sector, Al-Warkaa Sector, and Alkhudhr sector), and Public Health Laboratory.

These Hospitals and sectors were located within the geographical location of Muthanna governorate

Sampling Technique

The total number of the health institutions in Muthanna Governorate is 9 sectors and hospitals, distributed in 5 primary health sectors, three hospitals and Public Health Laboratory. While health centers and hospitals were randomly chosen by multistage sampling technique from all institutions.

Scoring Criteria

- The checklist contain three evaluating scores for the health institutions including :
  - Score 0 (poor score)------(not applicable) ➡ (< 50 %)
  - Score 1 (Fair score)------ (Partially applicable) ➡ (50-79 %)
  - Score 2 (good or excellent score)-----(applicable) ➡ (=>80 %)
- Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health.

Statistical Analysis

The data through the questionnaire, the information for each question was transferred to code sheets, the data was entered into the personal computer, and then the data was analyzed by the statistical package available from SPSS-26. Data were showed in simple measures of frequency, percentage, mean, standard deviation, and range (minimum and maximum values).

Results

Assessment of the quality of the laboratories structure

Table 1 shows that all questions have acceptable and good level (mean score >1.8), except for 4th question, 7th question, and 9th question have a poor assessment level (mean score <1.5). While the overall assessment of the structure standards have acceptable assessment score (1.65±0.14).

Table (1) Distribution of the checklist ticks regarding the structure assessment

Statement	Not-applicable No. (%)	Partially applicable No. (%)	applicable No. (%)	Mean score	Assessment
The laboratory was good with continuous cleanliness (floor, walls, beets and devices)	0 (0.0)	5 (20.8)	19 (79.2)	1.79	Acceptable
There were written laboratory instructions to	0 (0.0)	4 (16.7)	20 (83.3)	1.83	Acceptable

deal with receiving samples and properly dealing with it (writing the patient's name and data, receiving the sample date, accepting the sample, the date of submission of the report).					
The laboratory has a regulatory structure for positions within the laboratory (laboratory officer, laboratory officer auxiliary).	6 (25.0)	0 (0.0)	18 (75.0)	1.50	Acceptable
There are suitable numbers of staff or specialists with high efficiency of training and vocational education to meet the needs of patients	1 (4.2)	21 (87.5)	2 (8.3)	1.04	Poor
Matching the job description of laboratory workers to their field of work	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
There are documentation procedures in the laboratory to provide medical laboratory services to reviewers(electronic archiving, records)	0 (0.0)	4 (16.7)	20 (83.3)	1.83	good
There's a separate room for taking the sample.	18 (75.0)	0 (0.0)	6 (25.0)	0.50	Poor
There are no obstacles in the lab exits	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Fire extinguisher available in all kinds (powder, liquid, fume) in the laboratory	0 (0.0)	24 (100.0)	0 (0.0)	1.00	Poor
fire extinguisher has a current and closed work validity mark	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
easy access to fire extinguishers	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Water is available continuously	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
The laboratory has good quality analysis (not expired, the results are correct).	0 (0.0)	1 (4.2)	23 (95.8)	1.96	Good

Overall evaluation	Pooled global Mean (Total Mean± SD)	1.65±0.14	Acceptable

Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health

Evaluation of quality of performance worker

Table 2 reveals that all indicators have full assessment score (2), except for 5th question (Wearing another lab coat while walking around the institution to prevent contributing the transmission of infection) have a poor assessment score.

Table (2) Distribution of the checklist ticks regarding evaluation of quality of performance worker

Statement	Not-applicable No. (%)	Partially applicable No. (%)	applicable No. (%)	Mean score	Assessment
The employee was informed of his duties and responsibilities	0 (0.0)	0 (0.0)	24 (100.0)	2.0	Good
Wear the induction bag	0 (0.0)	0 (0.0)	24 (100.0)	2.0	Good
Personal protective equipment is worn	0 (0.0)	0 (0.0)	24 (100.0)	2.0	Good
Always wear the lab coat while working in the lab	0 (0.0)	0 (0.0)	24 (100.0)	2.0	Good
Wearing another lab coat while walking around the institution to prevent contributing the transmission of infection	24 (100.0)	0 (0.0)	0 (0.0)	0.0	Poor
Test results reports reach the doctor after signing and accreditation from the lab employer	0 (0.0)	0 (0.0)	24 (100.0)	2.0	Good
Overall evaluation	Pooled global Mean (Total Mean± SD)			1.67±0.00	Acceptable

Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health

Evaluation quality of equipment and devices

Table 3shows that all indicators have good assessment score, except for 2nd question, 4th question, and 6th question have an acceptable assessment score (<1.8).

Table (3) Distribution of the checklist ticks regarding Evaluation quality of equipment and devices

Statement	Not-applicable No. (%)	Partially applicable No. (%)	applicable No. (%)	Mean score	Assessment
There is an identification identity for each documented device	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
All the equipment in the lab is operational	0 (0.0)	7 (29.2)	17 (70.8)	1.71	Acceptable
There is a mechanism for the maintenance of equipment in case of emergency	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Equipment, devices and supplies that are suitable for each laboratory are available in sufficient number	0 (0.0)	8 (33.3)	16 (66.7)	1.67	Acceptable
A hand-washing sink is available	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
All laboratory furniture (chairs, shelves, benches, cabinets, etc.) is in good condition, is appropriate for use in the laboratory, and is capable of supporting anticipated loads	1 (4.2)	4 (16.7)	19 (79.2)	1.75	Acceptable
There's an auto cliff to sterilize tools in the lab	0 (0.0)	2 (8.3)	22 (91.7)	1.92	Good
The lab has a clear record of all equipment in the lab	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
There is no noise risk from the equipment	1 (4.2)	2 (8.3)	21 (87.5)	1.83	Good
Overall evaluation	Pooled global Mean (Total Mean± SD)			1.88±0.12	Good

Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health

Evaluation of safety measures

Table 4 reveals that 1st question and 2nd question have a poor assessment scores (1). While there are four indicators that have an acceptable assessment score (<1.8) these are the 4th, 5th, 7th, and 10th questions. As for other indicators that have a good assessment score. The overall assessment of evaluation of safety measures were acceptable with the mean score (1.52±0.09).

Table (4) Distribution of the checklist ticks regarding evaluation of safety measures

Statement	Not-applicable No. (%)	Partially applicable No. (%)	applicable No. (%)	Mean score	Assessment
The quality of the walls, windows and doors in the lab is made up of non-flammable materials	0 (0.0)	24 (100.0)	0 (0.0)	1.00	Poor
Lab tables are made of non-flammable materials	1 (4.2)	22 (91.7)	1 (4.2)	1.00	Poor
The lab floor is easy to clean and made of anti-slip material	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
There is an adequate lighting	0 (0.0)	7 (29.2)	17 (70.8)	1.71	Acceptable
There is a poster of proper hand washing	0 (0.0)	7 (29.2)	17 (70.8)	1.71	Acceptable
All electrical wires are not exposed	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Regular incinerator available	0 (0.0)	10 (41.7)	14 (58.3)	1.58	Acceptable
There are waste bags used by color (black for regular residues such as office residues and yellow for sharp objects)	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
There are closed containers for waste disposal	0 (0.0)	19 (79.2)	5 (20.8)	1.21	Poor
There's an alarm that's tested periodically and the tests are recorded	0 (0.0)	8 (33.3)	16 (66.7)	1.67	Acceptable
There are stickers on the fridge that prevent eating and drinking inside the lab and not keeping food	24 (100.0)	0 (0.0)	0 (0.0)	0.00	Poor
Laboratory and staff are permanently sterilized to prevent infection	1 (4.2)	11 (45.8)	12 (50.0)	1.46	Poor
The administration follows the appropriate procedures in case of injury to a laboratory worker such as vacations and others	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Confirmation of taking of COVID 19 vaccine	0 (0.0)	0 (0.0)	24 (100.0)	2.00	Good
Overall evaluation	Pooled global Mean (Total Mean± SD)			1.52±0.09	Acceptable

Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health

The overall evaluation of the health institutions according to the main domains

Table 3.18 shows the overall assessment of the health institutions according to the main domains, the study found that the highest assessment score was for the Public health laboratory at 1.807 with a good level, while the lowest assessment score was for AL-warkaa hospital at 1.547 with acceptable level. As for the overall assessment for all the main domains were acceptable with a mean score of 1.67.

Table (5) The overall assessment of the health institutions according to the main domain

	Structure		Evaluation of quality of performance worker		Evaluation quality of equipment and devices		Evaluation of safety measures		Overall assessment		
	MS	Ass.	MS	Ass.	MS	Ass.	MS	Ass.	MS	Ass.	Rank
AL-hussain hospital	1.769	Accept.	1.666	Accept.	1.944	Good	1.500	Accept.	1.719	Accept.	3
Al-maternity and children hospital	1.769	Accept.	1.666	Accept.	1.777	Accept.	1.357	Poor	1.642	Accept.	6
AL-warkaa hospital	1.461	Poor	1.666	Accept.	1.777	Accept.	1.285	Poor	1.547	Accept.	9
Public health laboratory	1.923	Good	1.666	Accept.	2.000	Good	1.642	Accept.	1.807	Good	1
Al-samawa first sector	1.615	Accept	1.666	Accept.	1.888	Good	1.600	Accept.	1.692	Accept.	4
Al-samawa second sector	1.711	Accept	1.666	Accept.	1.972	Good	1.607	Accept.	1.739	Accept.	2
Al-warkaa sector	1.500	Accept	1.666	Accept.	1.777	Accept.	1.500	Accept.	1.610	Accept.	8
Al-rumitha sector	1.589	Accept	1.666	Accept.	1.777	Accept.	1.476	Poor	1.627	Accept.	7
Al-khuder sector	1.646	Accept	1.666	Accept.	1.866	Good	1.485	Poor	1.665	Accept.	5
Overall assessment	1.650	Accept	1.666	Accept.	1.875	Good	1.523	Accept.	1.67	Accept.	

Mean (1.5), poor < 50.0% (mean less than 1.5), Acceptable (mean 1-1.8) 50%-79%, and Good >= 80% (mean more than 1.8) according to Iraqi Ministry of Health

Discussion

The present study found that there is an acceptable level with the mean score (1.79) regarding question (The laboratory was good with continuous cleanliness (floor, walls, beets and devices). These results agreed with the research findings conducted in Basra (Al-husseinawi, 2020), which found that same the results. However, This result differs with the finding of the previous study done in Nnewi City, Nigeria (Nnebue *et al.*, 2014) which found that all PHCs were poorly and have cracks in walls.

Regarding question (There are suitable numbers of staff or specialists with high efficiency of training and vocational education to meet the needs of patients), the study found that there is a poor level with the mean score (1.04). These results disagreed with the previous study conducted in Iraq (Iraqi MOH and USAID, 2011) which found that 65.2% of the health institutions had staff graduates from the College of Science (Chemistry, Bacteriological, and Biological). The possible explanation for these results may be due to the misdistribution of specialized laboratory cadres among health institutions, which makes some institutions lack specialized cadres that meet the needs of patients.

Concerning easy access to fire extinguishers, the results found that that there is a good level with the mean score (2). These results agreed with the research findings conducted in Basra (Al-husseinawi, 2020), which found that there was a good level regarding easy access to fire extinguishers. The current study found that there is an acceptable level with the mean score (2) regarding the availability of clean water sources . These results agreed with the research findings conducted in India (Sriram, 2018) which showed that all PHCCs had a full evaluating score (100%) for the availability of clean water sources. Regarding questions (All the equipment in the lab is operational, Equipment, devices and supplies that are suitable for each laboratory are available in sufficient number), the results reveal that the mean score was 1.71, and 1.67 with the acceptable level, respectively. these results are consistent with the findings of another similar study was done in Kirkuk governorate (Baser and Khazeal, 2018) which found that 80% of the study centers had a good score for the availability of laboratory devices according to standards.

The results reveal that the mean score was 1.75with the acceptable level regarding (All laboratory furniture "chairs, shelves, benches, cabinets, etc." is in good condition). This result agreed with the study done in Iraq (Mahasin and Yaseen, 2017) which found that 81.5% of main PHCCs were good for the availability of furniture and 87.4% of the centers for the availability of appropriate supplies. Regarding the availability of a hand-washing sink, the study found that all the health institutions have full assessment score (2). These results agreed with the finding study done in Northern India (Goel *et al.*, 2019) which found that 93.1% of PHCCs had a good score for the availability of sink equipped with (hand wash and liquid soap) in each unit. Concerning 6question (All electrical wires are not exposed), the results found that the mean score was 2.0 with a good assessment level. these results agreed with the previous study in Egypt (Abdel-Wahed *et al.*, 2013) who revealed that most of HCWs reported that electrical installations were in good condition.

Conclusions

1. With regard to the evaluation of laboratory quality indicators, the study showed that the highest evaluation score was for the public health laboratory at a good level, while the lowest evaluation score was for Warka Hospital at an acceptable level.
2. The overall evaluation of quality indicators in laboratories in all health institutions studied was acceptable to some extent.

Recommendations

1. In general, the results showed the need to enhanced the quality of laboratory services, and to improve practices and coverage in a number of health institutions.
2. The quality Improvement Program needs to provide roles from the Ministry of Health on how to assess, measure and evaluate the quality of health services.

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