



FACTORS AFFECTING CLINICAL LABORATORY QUALITY PERFORMANCE IN LIBYA

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Abstrak

Penelitian ini meneliti faktor-faktor yang memengaruhi kinerja kualitas laboratorium klinik di Elmarj, Libya, berdasarkan persepsi 100 staf laboratorium. Metode survei kuantitatif digunakan untuk mengumpulkan data terkait pemeliharaan alat, pemilihan alat, kalibrasi, dan pengendalian kualitas, yang merupakan komponen penting dalam memengaruhi kinerja laboratorium. Hasil penelitian menunjukkan bahwa keempat faktor tersebut secara signifikan memengaruhi kinerja kualitas laboratorium klinik, dengan pengendalian kualitas menjadi faktor paling dominan karena memiliki koefisien regresi tertinggi. Pemeliharaan alat memastikan peralatan laboratorium berfungsi dengan baik, sedangkan pemilihan alat dan kalibrasi yang tepat meningkatkan akurasi dan efisiensi. Pengendalian kualitas melalui pemantauan dan evaluasi sistematis menjamin hasil laboratorium sesuai standar dan konsisten. Temuan ini memberikan wawasan praktis bagi manajemen rumah sakit untuk meningkatkan layanan laboratorium dan kualitas pelayanan pasien. Selain itu, penelitian ini memberikan kontribusi pada literatur akademik dengan bukti empiris tentang faktor yang memengaruhi kinerja laboratorium dan menjadi referensi penelitian di masa depan.

Kata Kunci: Laboratorium Klinik, Kinerja Kualitas, Pemeliharaan Alat, Kalibrasi, Pengendalian Kualitas

Abstract

This study investigates the factors influencing clinical laboratory quality performance in Elmarj, Libya, based on the perceptions of 100 laboratory staff. A quantitative survey method was employed to collect data regarding instrument maintenance, selection tools, calibration, and quality control, which are critical components affecting laboratory performance. The results indicate that all four factors significantly influence clinical laboratory quality performance, with quality control being the most dominant factor, as it has the highest regression coefficient. Instrument maintenance ensures that laboratory equipment functions reliably, while proper selection tools and calibration improve accuracy and efficiency. Quality control, through systematic monitoring and evaluation, guarantees that laboratory results meet standards and are consistent. These findings provide practical insights for hospital management to enhance laboratory services and ensure better patient care. Moreover, the study contributes to academic literature by identifying empirical evidence on factors affecting laboratory performance and serves as a reference for future research in similar contexts.

Keywords: *Clinical Laboratory, Quality Performance, Instrument Maintenance, Calibration, Quality Control*

BACKGROUND

Clinical laboratory quality performance is a crucial component of hospital services, as it directly supports accurate diagnosis and effective patient care. High-quality laboratory performance depends on adherence to standardized procedures and professional practices. However, laboratory processes, particularly in the pre-analytical phase, are highly prone to errors due to their complexity and involvement of multiple personnel outside the laboratory,

such as doctors and nurses (Westgard, 1990). Therefore, continuous monitoring and quality control are essential to minimize errors and ensure reliable results.

Globally, clinical laboratory performance still faces several challenges, including inadequate instrument maintenance, lack of routine scheduling, insufficient safety measures for chemical hazards, and poor implementation of reagent storage and laboratory procedures. These issues are also evident in Libya, where laboratory performance remains suboptimal. Common problems include the absence of effective monitoring systems, limited external quality assessment schemes, inaccurate analysis, and inadequate calibration and method selection practices.

Laboratory quality performance is influenced by multiple factors, including individual competencies (knowledge, skills, and motivation), leadership quality, teamwork, and organizational systems such as infrastructure and work processes (Fort & Voltero, 2004). These factors play a significant role in improving laboratory performance when effectively implemented. Given the existing challenges in Elmarj, Libya, this study aims to analyze the factors influencing clinical laboratory quality performance based on laboratory staff perceptions using a quantitative survey approach.

RESEARCH METHOD

Research Design

The research design used in this study was cross-sectional. Cross-sectional studies involve data collected at a defined time. They are often used to assess the prevalence of acute or chronic conditions or to answer questions about the causes of disease or the results of interventions. They may also be described as censuses. Cross-sectional studies may involve special data collection, including questions about the past, but they often rely on data originally collected for other purposes. They are moderately expensive and are not suitable for the study of rare diseases. Difficulty in recalling past events may also contribute to bias.

Time and Location

The object of this study was the staff working in three hospitals in Elmarj, Libya. The locations of the study were: a. Ahmed Alghuryani Hospital b. Khaled Dawood Hospital c. Saleem Ashaim Hospital. The study was conducted from February 2 to February 28, 2015.

Population and Sample

Population is the total number of objects (entities or individuals). The population in this study consisted of all clinical laboratory staff in Elmarj, Libya. The total population in this research was 100 respondents from three hospitals. The sample is a portion of the population. The sampling technique used in this study was purposive sampling with judgment sampling, to select samples based on certain criteria. The criteria for the sample were consultants or laboratory technicians working in hospitals in Libya. This research used three hospitals, and each hospital contributed 20 samples, so the total number of samples was 60 respondents, consisting of consultants or laboratory technicians working in hospitals in Libya.

Research Procedures

The procedures in this research were as follows: a. Making the questionnaires b. Testing validity and reliability by distributing the questionnaires to the respondents c. Making data tabulation d. Conducting analysis and interpretation e. Making conclusions to answer the research problems

Data Collection Method

The data collection method used was the questionnaire technique distributed to the respondents. A questionnaire is a number of written questions used to obtain information from respondents in terms of their personal statements or things that they know (Arikunto, 1998). The questionnaires were distributed directly to the respondents by the researchers. The variables and data collection methods in this study are presented as follows: a. Clinical laboratory quality performance - Questionnaire - Regression b. Instrument maintenance - Questionnaire - Regression c. Method and selection evaluation - Questionnaire - Regression d. Calibration - Questionnaire - Regression e. Quality control - Questionnaire - Regression

Table 1. Data collection method

No.	Data	Technique to get the data	Instrument	Analysis Data
1	Clinical laboratory quality performance	Questionnaire	Questionnaire	Regression
2	Instrument maintenance	Questionnaire	Questionnaire	Regression
3	Method and selection evaluation	Questionnaire	Questionnaire	Regression
4	Calibration	Questionnaire	Questionnaire	Regression
5	Quality Control	Questionnaire	Questionnaire	Regression

Data Analysis

The data analysis technique used in this research was multiple regression analysis using SPSS. Regression was used to analyze the relationship between independent variables and the dependent variable. The regression equation was:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$$

Where:

Y = Clinical laboratory quality performance in Libya

a = Constant

b₁-b₄ = Regression coefficients

X₁ = Instrument maintenance

X₂ = Method and selection evaluation

X₃ = Calibration

X₄ = Quality control

The degree of confidence used was 95%.

Table 2. Durbin Watson Indicator

Durbin Watson	Conclusion
< dL	Autocorrelation occurred
dL - dU	No conclusion
dU - 4 dU	No autocorrelation
4dU - 4dL	No conclusion
> 4 -dL	Autocorrelation is ocured

RESULT AND DISCUSSION

Results

The result of validity of questionnaires could be shown as table below:

Table 3. Validity Result for Instrument Maintenance

No	Item no	r count	r table	Decision
1	Q1	0.344	0.254	Valid
2	Q2	0.488	0.254	Valid
3	Q3	0.531	0.254	Valid
4	Q4	0.384	0.254	Valid
5	Q5	0.268	0.254	Valid

From the Table 3., it can be say that r counted (corrected item total correlation) > r table (0.254) so the five questions of the instrument maintenance variable be said valid.

Table 4. Validity Result for Selection Tools

No	Item no	r count	r table	Decision
1	Q1	0.405	0.254	Valid
2	Q2	0.516	0.254	Valid
3	Q3	0.289	0.254	Valid
4	Q4	0.415	0.254	Valid
5	Q5	0.265	0.254	Valid

From the Table 4., it can be say that r counted (corrected item total correlation) > r table (0.254) so the five questions of the selection tools variable could be said valid.

Table 5. Validity Result for Calibration

No	Item no	r count	r table	Decision
1	Q1	0.277	0.254	Valid
2	Q2	0.412	0.254	Valid
3	Q3	0.549	0.254	Valid
4	Q4	0.377	0.254	Valid
5	Q5	0.288	0.254	Valid

From the Table 5., it could say that r counted (corrected item total correlation) > r table (0.254) so the five questions of the calibration variable could be said valid.

Table 6. Validity Result for QC

No	Item no	r count	r table	Decision
1	Q1	0.517	0.254	Valid
2	Q2	0.275	0.254	Valid
3	Q3	0.456	0.254	Valid
4	Q4	0.441	0.254	Valid
5	Q5	0.398	0.254	Valid

From the Table 6., it could say that r counted (corrected item total correlation) > r table (0.254) so the five questions of the QC (Quality Control) variable could be said valid.

Table 7. Validity Result for Clinical Laboratory Quality Performance

No	Item no	r count	r table	Decision
1	Q1	0.435	0.254	Valid
2	Q2	0.517	0.254	Valid
3	Q3	0.485	0.254	Valid
4	Q4	0.301	0.254	Valid

From the Table 7., it could say that r counted (corrected item total correlation) > r table (0.254) so the four questions of the clinical laboratory quality performance variable could be said valid.

Table 8. Reliability Result

No	Variable	Cronbach' Alpha	Aplha	Decision
1	Instrument Maintenance	0.618	0.5	Reliable
2	Selection tools	0,659	0.5	Reliable
3	Calibration	0.613	0.5	Reliable
4	QC	0.777	0.5	Reliable
5	Clinical Laboratory Quality	0.655	0.5	Reliable

From the Table 8., it could say that Cronbach's Alpha was 0.618 > 0.5 so the instrument maintenance variable could be said reliable.

Characteristic of Participants

Table 9. Characteristic Participants Demographic

	Frequency	Percentages (%)
Gander	26	43,3
Male	34	56,7
Female		
Age:		
18-24	17	28,3
25-35	27	45,0
36-45	13	21,7
46-55	2	3,3
>55	1	1,7
Education		
High Diploma	32	53,3

University	21	35,0
Master degree	7	11,7
Martinal Status		
Married	37	61,7
Single	23	38,3
Time Visiting		
< 1 times	5	8,3
1-3 times	28	46,7
>3-5 times	14	23,3
>5	13	21,7

Based in Table 9., it could say that male participants was more than the female. From a total of 60 participants, 55.6% were accountable for 34 males, while the 43.3% were accountable for 26 females.

Respondents' Perception

Respondent's respons of questionnaires instrument maintenance could be reflected in the table below:

Table 10. Respondents' Perception

	Instrument Maintenance	Selection Tools	Calibration	QC	Laboratory quality performance
Quesioner 1	4,1 ± 0,75	4,35 ± 0,65	4,22 ± 0,66	4,23 ± 0,77	4,37 ± 0,71
Quesioner 2	4,18 ± 0,62	4,15 ± 0,69	4,17 ± 0,69	3,97 ± 0,69	4,35 ± 0,76
Quesioner 3	4,22 ± 0,66	4,17 ± 0,82	4,22 ± 0,73	3,83 ± 0,89	4,27 ± 0,69
Quesioner 4	4,13 ± 0,65	4,10 ± 0,81	4,18 ± 0,82	3,8 ± 0,86	4,00 ± 1,06
Quesioner 5	4,40 ± 0,73	3,55 ± 1,26	4,05 ± 0,90	1,85 ± 1,44	

Based on the Table 10., it could know that the average of participant's response of question 1 instrumen maintenance were 4.1 with standard deviation 0,75.

Classic Assumption Test Result

Normality Test

The researcher concludes that the data was normally distributed. This conclusion was taken by seeing Figure 4.1. Normal P-P Plot in Figure 4.1., that shows scattered data around the diagonal line and follow the direction of diagonal line indicates that the data was normally distributed.

Normal P-P Plot of Regression Standardized

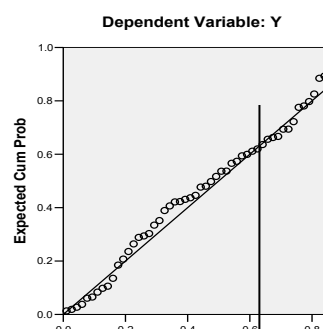


Figure 1. Normal P-P Plots

Multicollinearity Test

Table 11. Multicollinearity Test

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-2,360	1,610		-1,466	,148		
	X1	,234	,114	,258	2,056	,045	,294	3,398
	X2	,177	,054	,251	3,264	,002	,778	1,285
	X3	,342	,143	,337	2,388	,020	,232	4,313
	X4	,297	,072	,360	4,151	,000	,614	1,628

a. Dependent Variable: Y

Based on Table 11. shows tolerance > 0,10 and VIF < 10. Thus, independent variables used in this research were free from multicollinearity.

Heteroscedasticity Test

Heteroscedasticity test has purpose to see whether there was inequality of variance of the residuals of the observations to other observations. If variance of residuals was fixed, it was called homoscedasticity. Otherwise, it was called heteroscedasticity. A good regression model was homoscedasticity. The result of heteroscedasticity test could be seen from Figure 2.

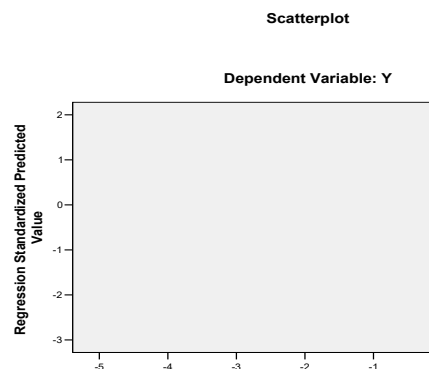


Figure 2. Heteroscedasticity Test

In Figure 2. there was no clear pattern likedots that form certain regular pattern like collects in the middle, narrowed and then widened or otherwise widened and then narrowed dots scattered above and below 0 of Y-axis. Thus, the researcher concludes that there was no heteroscedasticity.

Autocorrelation Test

To determine whether there is autocorrelations can be seen from the DW (Durbin Watson) test with the following conditions.

Null Hypothesis	Decision	If
There is no positive autocorrelation	Rejected	$0 < d < dl$
There is no positive autocorrelation	No Decision	$dl \leq d \leq du$
There is no negative autocorrelation	Rejected	$4 - dl > d > 4$
There is no negative autocorrelation	No Decision	$4du \leq d \leq 4 - dl$
There is no positive or negative autocorrelation	Not Rejected	$Du < d < 4 - du$

Note: dl = durbin lower; du = durbin upper; d = durbin watson test

Table 12. Durbin-Watson Test

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,864 ^a	,746	,727	1,11057	1,860

a. Predictors: (Constant), X4, X2, X1, X3

b. Dependent Variable: Y

Based on the results of the regression analysis on the data value Manufacturing companies Durbin-Watson (d) is 1.860, DW-table size: dU (within limits) = 1.5; 4-dU. Because $dU < d < 4-dU$ so these results indicate that the regression model is there is no autocorrelation.

Hypothesis Testing

The hypothesis testing use in this research was multiple regression analysis.

Tabel 11. Multiple Regression Analysis

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	V
1	(Constant)	-2,360	1,610		-1,466	,148		
	X1	,234	,114	,258	2,056	,045	,294	
	X2	,177	,054	,251	3,264	,002	,778	
	X3	,342	,143	,337	2,388	,020	,232	
	X4	,297	,072	,360	4,151	,000	,614	

a. Dependent Variable: Y

The results of t-test were as follow:

1) Hypothesis 1 (H_1) (X1)

H_1 in this research was the relationship between instrument maintenance and clinical laboratory quality performance. Coefficient of regression of 0.258 means the higher the instrument maintenance, the higher clinical laboratory quality performance. Then, p-value of 0.045 with level of significance 0.05 means that H_1 is accepted.

2) Hypothesis 2 (H_2) (X2)

H_2 in this research was the relationship between selection tools and clinical laboratory quality performance. The coefficient of regression, 0.251 means that the better selection tools, the higher clinical laboratory quality performance. Then p-value of $0.002 < 0.05$ (level of significance) so H_2 was accepted.

3) Hypothesis 3 (H_3) (X3)

H_3 in this research was the relationship between calibration and clinical laboratory quality performance. The coefficient of regression, 0.337 means that the higher calibration, the higher clinical laboratory quality performance. Then p-value of $0.020 < 0.05$ (level of significance) so H_3 was accepted.

4) Hypothesis 4 (H_4) (X4)

H_4 in this research was the relationship between QC and clinical laboratory quality performance. The coefficient of regression, 0.360 means that the higher QC, the higher clinical laboratory quality performance. Then p-value of $0.000 < 0.05$ (level of significance) so H_4 was accepted.

CONCLUSION

Based on the result, the conclusion in this research were: 1. Instrument maintenance affect clinical laboratory quality performance. 2. Selection tool of the laboratory affect clinical laboratory quality performance. 3. Calibration affect clinical laboratory quality performance. 4. Quality Control affect clinical laboratory quality performance. 5. The most dominant variable affecting clinical laboratory quality performance was Quality Control because the highest coefficient regression.

SUGGESTION

The recommendation in this research as follows: 1. The hospital should be aware of the factors affecting laboratory quality performance, such as instrument maintenance, Selection tool of the laboratory, Calibration and Quality Control. 2. In the future research could be added more samples, or more variables affecting laboratory quality performance.

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