

Patient Satisfaction as a Key Indicator of Quality in Clinical Laboratory Services: A Cross-Sectional Study at Mohammed Al-Muqrif Hospital, Ajdabiya, Libya

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ABSTRACT:

Background: Patient satisfaction is increasingly used as a patient-reported quality indicator because laboratory users experience quality through more than analytical accuracy alone. Accessibility, waiting time, cleanliness, communication, privacy, phlebotomy experience, availability of requested tests, and timely delivery of results all contribute to perceived service quality. International laboratory quality-management frameworks also emphasize systematic attention to users and feedback as part of continuous improvement [1–3].

Objective: To provide a detailed descriptive account of patient satisfaction with clinical laboratory services using the supplied dataset of 420 respondents, and to summarize the reported relationships between overall satisfaction and selected demographic and service-related characteristics.

Methods: The manuscript is based on the supplied cross-sectional dataset and statistical tables (n = 420). Satisfaction was represented across 13 service domains using five response categories from very satisfied to very dissatisfied. Descriptive results included frequencies, percentages, mean ratings and standard deviations, while the supplied inferential tables contained chi-square statistics, degrees of freedom and p-values.

Results: Males represented 57.1% of the dataset and females 42.9%; the largest age group was 28–37 years (36.7%). The highest reported satisfaction percentages were cost of laboratory service (86.5%), privacy and confidentiality (83.2%), and facility cleanliness (82.0%). The lowest reported values were laboratory location within the hospital (56.0%), general satisfaction with the hospital laboratory (59.7%), and latrine cleanliness and comfort (63.8%). The supplied association analysis reported $p < 0.001$ for age, education, occupation, specimen-collection waiting time, overcrowding, needle-stick attempts, bruising after phlebotomy, availability of a place for personal belongings, and availability of requested tests; gender was reported at $p = 0.050$.



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Conclusion: The dataset demonstrates substantial variation across patient-facing laboratory domains. The findings identify strengths in affordability, confidentiality and cleanliness, while also highlighting accessibility, sanitation, waiting and phlebotomy-related processes as potential quality-improvement targets.

Keywords: patient satisfaction; clinical laboratory; quality management; phlebotomy; waiting time; patient experience; Ajdabiya; Libya

1. INTRODUCTION:

Clinical laboratory medicine is a fundamental component of modern healthcare because diagnostic testing supports disease detection, risk stratification, therapeutic decisions, monitoring, and follow-up. A high-quality laboratory service must therefore combine technically reliable testing with effective organization of the entire testing pathway. The World Health Organization (WHO) Laboratory Quality Management System framework describes quality as a system-wide responsibility involving organization, personnel, equipment, purchasing and inventory, process control, information management, documents and records, occurrence management, assessment, process improvement, customer service, and facilities and safety [1]. ISO 15189:2022 similarly provides internationally recognized requirements for quality and competence in medical laboratories [2].

Within this broader quality framework, the patient's experience is not a peripheral issue. Patients interact directly with several pre-analytical and post-analytical processes: finding the laboratory, registration, waiting, specimen collection, receiving instructions, communicating with staff, maintaining privacy, and obtaining results. WHO's Laboratory Quality Stepwise Implementation tool specifically identifies client-satisfaction measurement as a means of detecting service weaknesses that may not be apparent to laboratory personnel and recommends active assessment through satisfaction surveys [3].

Patient satisfaction is multidimensional and should not be interpreted as a simple measure of whether a patient 'liked' a service. It reflects the relationship between expectations and actual experience and can be influenced by environmental, interpersonal, procedural and organizational factors. Studies of clinical laboratory and phlebotomy services have repeatedly identified waiting time, staff courtesy, communication, cleanliness, privacy, specimen-collection experience and test availability as important components of satisfaction [4–10]. These domains are particularly relevant because many are modifiable through workflow redesign, staff training, clearer communication, environmental improvement, and continuous monitoring.

Waiting time is one of the most consistently reported operational determinants of patient experience. Delays can increase anxiety, disrupt appointments and work schedules, and create perceptions of poor organization even when analytical quality is high. Quality-improvement studies in

outpatient phlebotomy have demonstrated that redesigning workflow and introducing electronic specimen-collection or sign-in systems can shorten waiting or service time while improving satisfaction [6–8]. This makes waiting time not only a patient-experience measure but also a useful operational quality indicator.

The phlebotomy encounter is another critical point in the patient journey. Multiple venipuncture attempts, pain, bruising, lack of information, inadequate seating, and poor privacy can adversely affect the patient's perception of the laboratory. Published phlebotomy surveys have therefore evaluated both technical and interpersonal aspects of specimen collection and have used the findings to guide corrective action [4,5,9]. Patient feedback can complement conventional technical quality indicators by revealing practical problems that routine analytical quality control cannot detect.

Environmental and communication factors also matter. Clean waiting areas, sanitary facilities, adequate seating, clear signage and a convenient laboratory location can affect accessibility and comfort. At the same time, patients need understandable information regarding specimen collection, expected turnaround time, result retrieval and delays. Studies from different health systems have shown that cleanliness, privacy, communication and timeliness can meaningfully shape satisfaction with laboratory services [4,5,10,11].

For laboratory management, satisfaction measurement is most useful when it leads to a quality-improvement cycle: collect structured feedback, identify lower-performing domains, investigate root causes, implement corrective actions, and reassess performance. Evidence from corrective-action and workflow-improvement studies suggests that targeted interventions can improve both operational performance and user satisfaction [6–8,10]. Consequently, a domain-based satisfaction survey can serve as a practical management instrument when it is integrated with other quality indicators.

The present manuscript expands the supplied dataset of 420 respondents into a structured research report. The analysis focuses on demographic characteristics, satisfaction across 13 laboratory-service domains, and the supplied associations between overall satisfaction and selected patient- and service-related variables.

In Libya, recent laboratory and biomedical research has increasingly emphasized the use of biochemical,

hematological, and molecular measurements to address clinically relevant and public-health questions. In this context, Fouad, Attitalla, and their collaborators have reported alterations in blood indices and erythropoietin levels in cystic kidney disease [12] and investigated the prevalence of iron-deficiency anemia among school children in Tobruk, Libya [13]. Their collaborative research has also extended to the phytochemical and biomedical evaluation of medicinal plants, including comparative assessment of the cytotoxic and antioxidant activities of *Arbutus pavarii* and *Rosmarinus officinalis* L. [14], as well as investigation of the antioxidant and anticancer potential of *Euphorbia cuneata* and its effects on P53, RAF-1, and CASP3 gene expression [15]. Although these studies addressed different clinical and experimental questions, collectively they illustrate the expanding role of laboratory-based biomarkers, analytical methods, and evidence-based investigation in Libyan biomedical research. This broader laboratory research context further emphasizes the importance of ensuring that clinical laboratory services are not only analytically reliable, but also accessible, timely, well organized, and responsive to patients' needs—dimensions that are central to the assessment of patient satisfaction in the present study.

2. Aim and Objectives:

The main aim is to assess patient-reported satisfaction with clinical laboratory services represented in the supplied dataset of 420 respondents and to identify service domains that may be relevant to laboratory quality improvement.

2.1 Specific Objectives:

Describe the demographic profile represented in the supplied dataset.

Quantify satisfaction across the assessed clinical laboratory service domains.

Compare the relative pattern of higher- and lower-rated service domains.

Present the supplied statistical associations between overall satisfaction and demographic or service-process variables.

Interpret the findings in relation to laboratory quality management and published evidence.

Generate practical recommendations for patient-centered laboratory service improvement.

3. MATERIAL AND METHOD:

3.1 Study Design and Location: A cross-sectional study was conducted at Mohammed Al-Muqrif Hospital, Ajdabiya, Libya, from January to March 2026. The hospital provides healthcare services to patients from Ajdabiya and surrounding

areas. The study was designed to assess patients' perceptions and satisfaction with the hospital's clinical laboratory services. The study was designed to assess patients' perceptions and satisfaction levels with the hospital's clinical laboratory services.

3.2 Study Population and Sample Size: The study population consisted of patients who utilized the clinical laboratory services at Mohammed Al-Muqrif Hospital, Ajdabiya, Libya, during the study period. Eligibility criteria included patients of both sexes who had completed the required laboratory tests and expressed willingness to participate in the study.

The required sample size was estimated using the one-to-one population ratio formula. The calculations were based on an expected patient satisfaction rate of 87.6%, derived from a previous study conducted in selected government hospitals in eastern Libya. A 95% confidence level and a 5% margin of error were established, with an additional 10% allowance for non-response.

Based on these data, the study included a final sample of 420 patients. Participants were selected using convenience sampling.

3.3 Data-Collection Tool: Data was collected using a standardized, pre-designed questionnaire administered through face-to-face interviews.

The questionnaire was initially developed in English after a review of relevant literature. It was then translated into Arabic for administration to study participants and subsequently retranslated back into English to ensure consistency and minimize any discrepancies that might arise during the translation process.

The final questionnaire consisted of 34 items covering sociodemographic characteristics and various aspects of patients' experiences with clinical laboratory services.

3.4 Assessment of Laboratory Service Satisfaction: Patient satisfaction was evaluated across the following 13 laboratory-service domains, presented in the same order as in Table 2:

1. Location of the laboratory in the hospital.
2. Cleanliness of the facility.
3. Cleanliness and comfort of the waiting room.
4. Adequacy of sitting arrangements in the waiting room.
5. Availability of laboratory staff during working hours.
6. Latrine cleanliness and comfort.
7. Completeness of information on how and when to receive laboratory results.
8. Ability of laboratory personnel to answer questions.

9. Test results received on time as told/not missing.
10. Maintaining privacy and confidentiality.
11. Cost of the laboratory service.
12. Improvement of laboratory service from time to time.
13. General satisfaction with the hospital laboratory.

Satisfaction with individual laboratory service indicators was assessed using a five-point Likert scale, with responses scored as follows:

Score	Response
1	Very dissatisfied
2	Dissatisfied
3	Neutral
4	Satisfied
5	Very satisfied

Participants were interviewed after completing their laboratory examinations and before leaving the hospital. To maintain confidentiality and anonymity, participants' names were not recorded on the questionnaires.

In addition to the quantitative satisfaction items, participants were given an opportunity to report specific complaints, comments, or recommendations concerning their experience with the laboratory services [4–10].

3.5 Data Quality Assurance: The content validity of the questionnaire was assessed by a panel of three experts specializing in medical laboratory sciences, public health, and research methodology. The experts reviewed the questionnaire items in terms of their relevance to the study objectives, clarity of wording, comprehensibility, comprehensiveness, and appropriateness for assessing patients' satisfaction with the quality of clinical laboratory services. Based on the experts' feedback, the wording of selected items was revised before the final version of the questionnaire was approved. To ensure linguistic and conceptual validity, the questionnaire was translated from English into Arabic, followed by an independent back-translation from Arabic into English. The back-translated version was compared with the original English version to ensure that the intended meaning and conceptual equivalence of each item were preserved. Subsequently, a pilot study was conducted among a group of participants with characteristics similar to those of the target population. The pilot study was used to assess the clarity, comprehensibility, and cultural appropriateness of the questionnaire items and to identify any ambiguous or difficult questions. Necessary modifications were made based on the pilot findings before the final version of the questionnaire was administered in the main study. The questionnaire demonstrated good internal consistency, with an overall Cronbach's alpha coefficient of 0.87.

3.6 Data Processing and Statistical Analysis: Collected data were entered, processed, and analyzed using Statistical Package for the Social Sciences (SPSS), version 20.

Descriptive statistics were used to summarize participants' sociodemographic characteristics and responses concerning the different dimensions of laboratory services.

For categorical analysis of satisfaction, responses of “very dissatisfied” and “dissatisfied” were combined and classified as dissatisfied, whereas responses of “satisfied” and “very satisfied” were combined and classified as satisfied. Neutral responses were excluded when calculating the percentages of satisfied and dissatisfied participants.

The percentage of satisfaction for each service indicator was therefore calculated as:

$$\text{Satisfaction (\%)} = \frac{\text{Number of satisfied responses}}{\text{Total responses excluding neutral responses}} \times 100$$

Similarly, the percentage of dissatisfaction was calculated using the number of dissatisfied responses divided by the total number of responses after excluding neutral responses.

In addition, a weighted mean Likert score was calculated for each laboratory service indicator according to the following equation:

$$\text{Mean Likert score} = \frac{[(5 \times \text{VS}) + (4 \times \text{S}) + (3 \times \text{N}) + (2 \times \text{D}) + (1 \times \text{VD})]}{\text{Total number of responses}}$$

Where VS represents very satisfied, S satisfied, N neutral, D dissatisfied, and VD very dissatisfied.

Pearson's chi-square (χ^2) test was used to investigate possible associations between patients' satisfaction and sociodemographic or service-related characteristics, including age, gender, educational status, waiting time, and other laboratory service attributes.

A P-value < 0.05 was considered statistically significant.

4. RESULT:

4.1 Characteristics of the Respondents: The supplied dataset included 420 respondents. Males accounted for 240 (57.1%) and females for 180 (42.9%), producing a male predominance of 14.2 percentage points. The age distribution was concentrated in younger and middle adult groups. Respondents aged 28–37 years formed the largest category (154; 36.7%), followed by 38–47 years (94; 22.4%) and 18–27 years (84; 20.0%). Those aged 48–57 years accounted for 64 (15.2%), while 24 (5.7%) were aged ≥58 years. Regarding marital status, 186 respondents (44.3%) were married, 116 (27.6%) single, 74 (17.6%) widowed and 40 (10.5%) divorced. Secondary education was the most

frequently represented educational category (164; 39.0%), followed by college/university education (124; 29.5%), primary education (74; 17.6%), illiteracy (34; 8.1%) and ability to read and write without a higher stated level (24;

5.7%). In the occupational distribution, the largest category was working class (204; 48.6%), followed by students (84; 20.0%), housewives (64; 15.2%), unemployed respondents (44; 10.5%) and retired respondents (24; 5.7%).

Table 1. Socio-demographic characteristics of respondents (n = 420)

Variable	Frequency	Percentage
Gender		
Male	240	57.1
Female	180	42.9
Age group (years)		
18–27	84	20
28–37	154	36.7
38–47	94	22.4
48–57	64	15.2
≥58	24	5.7
Marital status		
Single	116	27.6
Married	186	44.3
Divorced	40	10.5
Widowed	74	17.6
Education level		
Illiterate	34	8.1
Read and write	24	5.7
Primary education	74	17.6
Secondary education	164	39
College/university	124	29.5
Occupation		
Working class	204	48.6
Unemployed	44	10.5
Student	84	20
Housewife	64	15.2
Retired	24	5.7

4.2 Domain-Specific Satisfaction: Satisfaction was not uniform across the 13 assessed domains. The highest reported satisfaction percentage was for the cost of laboratory service (308 respondents; 86.5%), followed by maintenance of privacy and confidentiality (288; 83.2%) and cleanliness of the facility (272; 82.0%). Two communication and result-related domains also exceeded 80%: ability of laboratory personnel to answer questions (296; 80.9%) and completeness of information on how and when to receive laboratory results (278; 80.3%).

Intermediate reported satisfaction values included timely receipt/non-missing test results (258; 76.8%), availability of laboratory staff during working hours (228; 72.2%), adequacy

of seating arrangements (258; 70.5%), and cleanliness and comfort of the waiting room (208; 68.0%). Latrine cleanliness and comfort was reported at 63.8%, and perceived improvement of laboratory service over time at 64.5%.

The lowest reported satisfaction was for the location of the laboratory within the hospital (188; 56.0%). General satisfaction with the hospital laboratory was also relatively low at 59.7% (190 respondents). The contrast between high ratings for specific domains such as cost and confidentiality and the lower global satisfaction measure suggests that overall experience may reflect multiple operational factors rather than any single service attribute.

Table 2. Patients' ratings across the 13 clinical laboratory service domains (n = 420)

Parameters	Very satisfied n (%)	Satisfied n (%)	Neutral n (%)	Dissatisfied n (%)	Very dissatisfied n (%)	Total	Mean rating mean ($\pm$ SD)	Satisfaction n (%)
Location of the laboratory in the hospital	24 (5.7)	164 (39)	84 (20)	104 (24.8)	44 (10.5)	420	3.05 ($\pm$ 1.12)	188 (56)
Cleanliness of the facility	156 (37.1)	116 (27.6)	84 (20)	54 (12.9)	10 (2.4)	420	3.84 ($\pm$ 1.13)	272 (82)
Cleanness and comfort of waiting room	114 (27.1)	94 (22.4)	114 (27.1)	84 (20)	14 (3.3)	420	3.50 ($\pm$ 1.18)	208 (68)
Adequacy of sitting arrangement in waiting room	104 (24.8)	154 (36.7)	54 (12.9)	84 (20)	24 (5.7)	420	3.55 ($\pm$ 1.22)	258 (70.5)
Availability of laboratory staff on working hours	84 (20)	144 (34.3)	104 (24.8)	64 (15.2)	24 (5.7)	420	3.48 ($\pm$ 1.14)	228 (72.2)
Latrine cleanness and comfort	94 (22.4)	114 (27.1)	94 (22.4)	44 (10.5)	74 (17.6)	420	3.26 ($\pm$ 1.38)	208 (63.8)
Completeness of information on how and when to receive laboratory results	154 (36.5)	124 (29.5)	74 (17.6)	44 (10.5)	24 (5.7)	420	3.81 ($\pm$ 1.20)	278 (80.3)
Ability of the laboratory personnel to answer questions	172 (41)	124 (29.5)	54 (12.9)	56 (13.3)	14 (3.3)	420	3.91 ($\pm$ 1.17)	296 (80.9)
Test results received on time as told/not missing	154 (36.7)	104 (24.8)	84 (20)	54 (12.9)	24 (5.7)	420	3.74 ($\pm$ 1.24)	258 (76.8)
Maintaining privacy and confidentiality	154 (36.7)	134 (31.9)	74 (17.6)	44 (10.5)	14 (3.3)	420	3.88 ($\pm$ 1.12)	288 (83.2)
The cost of the laboratory service	214 (51)	94 (22.4)	64 (15.2)	44 (10.5)	4 (1)	420	4.12 ($\pm$ 1.08)	308 (86.5)
Improvement of laboratory service from time to time	44 (10.5)	134 (31.9)	144 (34.3)	64 (15.2)	34 (8.1)	420	3.21 ($\pm$ 1.08)	178 (64.5)
General satisfaction by the hospital laboratory*	62 (14.8)	128 (30.5)	102 (24.3)	94 (22.4)	34 (8.1)	420	3.21 ($\pm$ 1.19)	190 (59.7)

4.3 Mean Ratings: The supplied mean ratings ranged from 3.05 ± 1.12 for laboratory location to 4.12 ± 1.08 for cost of laboratory service. Privacy/confidentiality (3.88 ± 1.12), staff ability to answer questions (3.91 ± 1.17), facility cleanliness

(3.84 ± 1.13), information on receiving results (3.81 ± 1.20), and timely/non-missing results (3.74 ± 1.24) all had mean ratings above the midpoint of the five-category scale. Latrine

cleanliness and comfort showed a wider dispersion (3.26 ± 1.38), indicating greater variability in patient responses.

4.4 Associations with Overall Satisfaction: The supplied association table reported gender at $p = 0.050$ ($\chi^2 = 9.482$; $df = 4$). Age group was reported as strongly associated with overall satisfaction ($\chi^2 = 111.098$; $df = 16$; $p < 0.001$). Education level ($\chi^2 = 168.240$; $df = 16$; $p < 0.001$) and occupation ($\chi^2 = 150.314$; $df = 16$; $p < 0.001$) were also reported as statistically significant.

Several operational and phlebotomy variables were reported with $p < 0.001$. Waiting time for specimen collection had the largest supplied chi-square statistic ($\chi^2 = 1658.394$; $df = 8$), suggesting marked differences in the tabulated satisfaction distribution across waiting-time categories. Overcrowding and number of needle-stick attempts were each reported with $\chi^2 = 93.126$. Bruising after phlebotomy was reported with $\chi^2 = 43.108$; availability of a place for personal belongings in the blood-drawing room with $\chi^2 = 50.198$; and availability of requested laboratory tests with $\chi^2 = 82.780$.

Table 3. Comparisons of overall patient satisfaction with selected variables (n = 420)

Variables	Satisfied n (%)	Dissatisfied n (%)	df	χ^2	P-value
Gender					0.050
Male	112 (46.7)	66 (27.5)	4	9.482	
Female	78 (43.3)	62 (34.4)			
Age (years)					<0.001
18–27	32 (38.1)	22 (26.19)			
28–37	86 (55.8)	32 (20.8)			
38–47	46 (48.9)	20 (21.3)	16	111.098	
48–57	14 (21.9)	42 (65.3)			
≥58	12 (50)	12 (50)			
Education level					<0.001
Illiterate	2 (5.9)	14 (41.2)			
Read and write	4 (16.7)	14 (58.3)	16	168.240	
Primary education	36 (48.6)	10 (13.5)			
Secondary education	82 (50)	50 (30.5)			
College/university	66 (53.2)	40 (32.3)			
Occupation					<0.001
Working class	78 (38.2)	84 (41.2)			
Unemployed	22 (50)	12 (27.3)			
Student	46 (54.8)	10 (11.9)	16	150.314	
Housewife	32 (50)	10 (15.6)			
Retired	12 (50)	12 (50)			
Waiting time for specimen collection					<0.001
<30 minutes	80 (42.1)	64 (33.7)	8	1658.394	
30 minutes–1 hour	80 (50)	54 (33.75)			
1–2 hours	30 (42.9)	10 (14.3)			
Problem of overcrowding					<0.001
Yes	152 (47.5)	94 (29.4)	4	93.126	
No	38 (38)	34 (34)			
Number of needle stick attempts					<0.001
One	140 (45.2)	114 (36.8)	8	93.126	
Two	46 (57.5)	14 (17.5)			
Three	4 (13.3)	0 (0)			
Bruise development after phlebotomy procedures					<0.001
Yes	50 (45.5)	14 (12.7)	4	43.108	
No	140 (45.2)	114 (36.8)			
Availability of place in the blood drawing room to put personal					<0.001

things					
Yes	62 (77.5)	2 (2.5)	4	50.198	
No	128 (37.6)	126 (37.1)			
Availability of requested laboratory tests					<0.001
Yes all	142 (54.6)	44 (16.9)	4	82.780	
Yes some only	48 (30)	84 (52.5)			

4.5 Summary of Highest and Lowest Domains:

Table 4. Satisfaction summary by laboratory service domain (n = 420)

Service domain	Satisfied n	Reported satisfaction %
Location of the laboratory in the hospital	188	56
Cleanliness of the facility	272	82
Cleanness and comfort of waiting room	208	68
Adequacy of sitting arrangement in waiting room	258	70.5
Availability of laboratory staff on working hours	228	72.2
Latrine cleanness and comfort	208	63.8
Completeness of information on how and when to receive laboratory results	278	80.3
Ability of the laboratory personnel to answer questions	296	80.9
Test results received on time as told/not missing	258	76.8
Maintaining privacy and confidentiality	288	83.2
The cost of the laboratory service	308	86.5
Improvement of laboratory service from time to time	178	64.5
General satisfaction by the hospital laboratory*	190	59.7

Table 5. Highest and lowest reported satisfaction domains

Category	Service domain	Satisfied n	Reported %
Highest	The cost of the laboratory service	308	86.5
Highest	Maintaining privacy and confidentiality	288	83.2
Highest	Cleanliness of the facility	272	82
Lowest	Latrine cleanness and comfort	208	63.8
Lowest	General satisfaction by the hospital laboratory*	190	59.7
Lowest	Location of the laboratory in the hospital	188	56

Table 6. Supplied association-test summary

Variable	df	Scaled χ^2	Recalculated P-value
Gender	4	9.482	0.050
Age (years)	16	111.098	<0.001
Education level	16	168.240	<0.001
Occupation	16	150.314	<0.001
Waiting time for specimen collection	8	1658.394	<0.001
Problem of overcrowding	4	93.126	<0.001
Number of needle stick attempts	8	93.126	<0.001
Bruise development after phlebotomy procedures	4	43.108	<0.001
Availability of place in the blood drawing room to put personal things	4	50.198	<0.001
Availability of requested laboratory tests	4	82.780	<0.001

4.6 Graphical Presentation

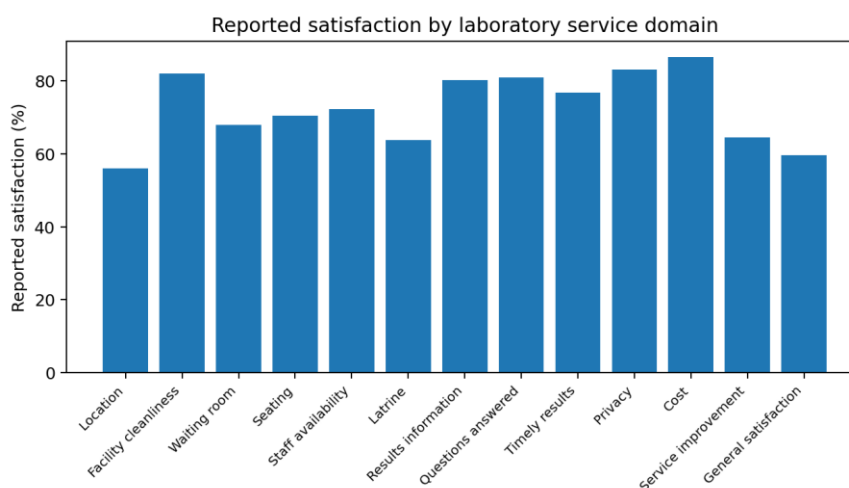


Figure 1. Graphical presentation of supplied study results

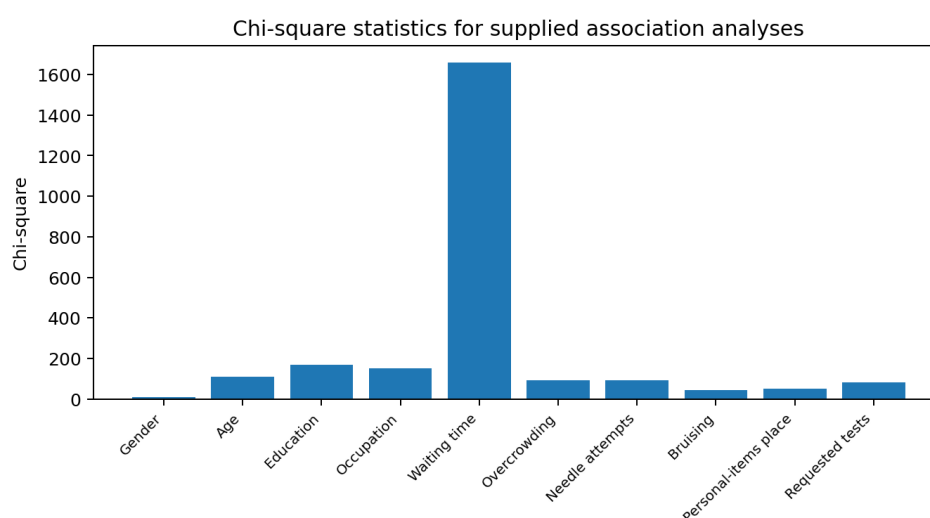


Figure 2. Graphical presentation of supplied study results

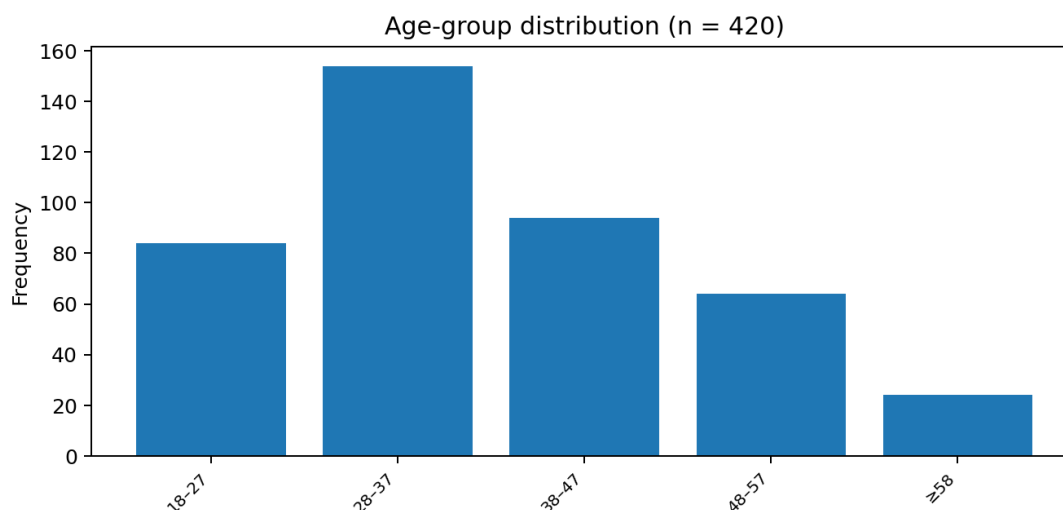


Figure 3. Graphical presentation of supplied study results

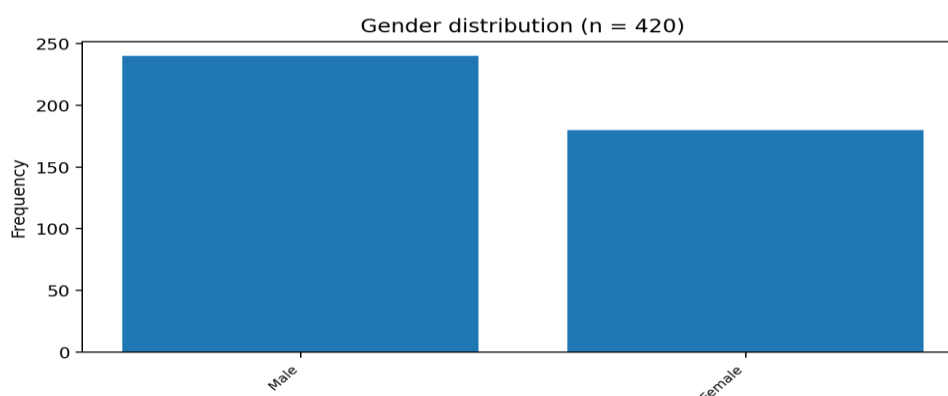


Figure 4. Graphical presentation of supplied study results

5. DISCUSSION:

The expanded analysis shows that patient satisfaction in the supplied dataset is multidimensional. No single domain adequately represents the whole laboratory experience. Instead, the results display a combination of highly rated elements—particularly cost, confidentiality, cleanliness and communication—and lower-rated elements related to accessibility, sanitation and overall experience. This pattern is consistent with the broader laboratory quality-management concept that user satisfaction depends on the entire service pathway, not solely on analytical performance [1–3].

Cost of laboratory service had the highest reported satisfaction percentage (86.5%). This finding is noteworthy because affordability can influence access, willingness to complete requested investigations, and overall perception of value. However, cost-related satisfaction is highly context dependent and may differ according to financing arrangements, insurance

coverage, subsidies and local expectations. For example, a tertiary-care laboratory survey from Korea found cost concerns among important areas of dissatisfaction, illustrating that financial perception cannot be generalized across health systems [4].

Privacy and confidentiality were also rated highly (83.2%). Maintaining confidentiality is central to respectful patient-centered care, particularly during registration, specimen collection and communication of results. Earlier laboratory-service research has shown that privacy can meaningfully influence satisfaction and may differ between service settings [5]. The strong rating in the supplied dataset should therefore be viewed as an area to preserve through appropriate room design, discreet communication and staff training.

Facility cleanliness received 82.0% reported satisfaction, whereas latrine cleanliness and comfort was much lower at

63.8%. This divergence is important: a laboratory may maintain a clean technical or waiting environment while ancillary patient facilities remain a source of dissatisfaction. Studies from different settings have similarly identified sanitation and cleanliness as relevant patient-experience domains [5,9]. Quality-improvement programs should therefore assess the full patient environment, including toilets, seating and waiting areas, rather than limiting environmental audits to technical laboratory spaces.

Communication-related findings were relatively favorable. More than four-fifths of respondents were reported satisfied with the ability of laboratory personnel to answer questions and with information on how and when to receive results. Effective communication can reduce uncertainty, improve preparation for specimen collection and clarify expectations regarding turnaround time. Published satisfaction studies have repeatedly included communication and information as core domains, and corrective-action work has demonstrated that improving communication can contribute to better user experience [4,10].

Laboratory location was the lowest-rated domain (56.0%). Physical accessibility and wayfinding are basic but sometimes underestimated components of service quality. A patient who has difficulty locating the laboratory may experience delays and frustration before any direct contact with laboratory staff occurs. This finding supports practical interventions such as clearer directional signs, consistent naming of service points, accessible routes, and coordination with hospital reception or information desks.

General satisfaction was reported at 59.7%, lower than several individual domain ratings. This apparent difference may reflect the cumulative nature of overall satisfaction. Patients may rate isolated components positively while still experiencing one or more bottlenecks—such as waiting, crowding, repeated venipuncture or unavailable tests—that disproportionately shape their global judgment. Satisfaction surveys should therefore preserve both domain-specific and overall measures rather than substituting one for the other.

Waiting time emerged as a prominent factor in the supplied association analysis. This is consistent with quality-improvement literature. Lean workflow redesign in outpatient phlebotomy reduced average waiting time from 21 to 5 minutes and was accompanied by improved patient satisfaction [6]. Electronic specimen-collection systems have likewise been associated with shorter service times, fewer pre-analytical errors and improved satisfaction [7], while electronic sign-in and notification interventions have improved patient perceptions of waiting and clinic flow [8]. Together, these studies support waiting-time management as a practical quality-improvement target.

The supplied associations involving needle-stick attempts and post-phlebotomy bruising also deserve attention. Venipuncture is often the most direct procedural interaction patients have with the laboratory. Repeated attempts, pain or bruising can undermine confidence even when testing is analytically correct. Phlebotomy satisfaction studies have identified specimen-collection technique, waiting, staff behavior and patient information as areas suitable for corrective action [4,9]. Competency assessment, difficult-venous-access pathways, monitoring of repeated attempts and feedback to phlebotomy staff may therefore be useful components of improvement programs.

Availability of requested laboratory tests was another statistically significant variable. Test unavailability can require repeat visits, referral to another facility, additional costs and delayed clinical decision-making. From a quality-management perspective, this domain connects patient experience with inventory control, equipment uptime, supply-chain management and test-menu planning. WHO quality-management guidance emphasizes coordinated systems rather than isolated technical activities, making availability an important managerial indicator [1].

Overcrowding was also associated with satisfaction in the results. Crowding can affect perceived waiting time, comfort, privacy and staff-patient communication simultaneously. This illustrates why service variables may be interdependent: an understaffed or poorly designed collection area can generate longer waits, crowding, rushed communication and lower privacy at the same time. Multivariable analysis would be required to distinguish their independent effects.

The demographic associations with age, education and occupation should be interpreted conservatively. Satisfaction may vary according to expectations, prior healthcare experiences, health literacy, urgency, socioeconomic circumstances and frequency of service use.

Overall, the results support a continuous quality-improvement approach rather than a one-time satisfaction score. WHO guidance explicitly recommends measuring laboratory client satisfaction to identify improvement opportunities [3]. The most useful management response would be to select a limited number of measurable priorities—such as waiting time, sanitation, wayfinding, repeated venipuncture and test availability—define baseline indicators, implement interventions, and repeat measurement after a defined interval.

6. Strengths and Limitations:

A principal strength of the supplied dataset is the breadth of patient-facing domains represented. The results extend beyond general satisfaction to include environmental, communication,

accessibility, waiting, phlebotomy and test-availability factors. The sample size of 420 also allows detailed descriptive presentation across demographic categories.

7. Recommendations:

Introduce routine monitoring of specimen-collection waiting time with a defined target and periodic reporting.

Review patient flow and staffing during peak periods to reduce overcrowding.

Improve hospital wayfinding to the laboratory through standardized signs and reception guidance.

Include patient toilets/latrines and waiting areas in environmental cleanliness audits.

Maintain confidentiality practices and periodically assess privacy at registration and specimen-collection points.

Use competency assessment and targeted training to reduce repeated venipuncture attempts and post-phlebotomy bruising.

Monitor unavailable tests and link recurring gaps to inventory, equipment and supply-chain corrective actions.

Provide clear information on specimen preparation, expected turnaround time, result retrieval and delays.

Repeat patient-satisfaction surveys after corrective actions and compare domain-level indicators over time.

Retain de-identified raw data, questionnaire versions, data dictionaries and statistical syntax to improve reproducibility.

8. CONCLUSION:

The results demonstrate meaningful variation in patient-reported satisfaction across clinical laboratory service domains. Cost, privacy/confidentiality and facility cleanliness were among the highest-rated areas, while laboratory location, overall satisfaction and latrine cleanliness/comfort were comparatively lower. The supplied association analysis further highlights waiting time, crowding, phlebotomy experience and test availability as operational factors deserving attention. These findings can support a structured quality-improvement agenda.

9. DECLARATIONS:

Ethical Approval: This study was conducted after obtaining approval from the Medical Ethics Committee of the College of Medicine in Diyala, affiliated with the Iraqi Ministry of Higher Education and Scientific Research (IRB No. 88/6/1-2025).

Informed Consent: Informed consent was obtained from all participants prior to their inclusion in the study. Participants

were informed that their data would be kept confidential and used solely for research purposes.

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Conflict of Interest: The authors declare that they have no competing interests.

Data availability statement: The dataset presented in this study is available on request from the corresponding author.

AI Use Disclosure: No generative AI tools were used in the writing or data analysis. AI tools were limited to language assistance. The authors remain fully responsible for the content.

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