Tec Empresarial
P-ISSN: 1659-2395; E-ISSN: 1659-3359

COMMUNICATION GAPS BETWEEN LABORATORY AND CLINICAL DEPARTMENTS: A CROSS-SECTIONAL STUDY AT A TERTIARY MILITARY HOSPITAL

Laila Alawi Abdullah Aldhawrani[1*], Suzan Salem Ali Alzahrani[2], Atheer Fahad Marhum Almarhum[3] and Mohammed Meshal Almutairi[4]

[1*] Corresponding Author, Medical Secretary, L.aldorani@hotmail.com, Prince sultan military medical city

[2] Biochemistry, sooozy-booozy@hotmail.com, Prince Sultan Military Medical City

[3] Laboratory specialist, Atheeralmarhum@outlook.com, Prince Sultan Military Medical City

[4] Laboratory specialist, moalmutairi@pscc.med.sa, Prince Sultan Cardiac Center

1. Abstract

1.2 Background

Effective communication between clinical and laboratory departments is fundamental to patient safety and the quality of diagnostic services. Communication failures along the laboratory-clinical interface — spanning test ordering, specimen management, result interpretation, and critical value notification — contribute substantially to diagnostic errors and delayed care. Despite growing recognition of this problem, evidence from tertiary military hospital settings remains limited.

1.3 Objective

To identify and characterize the nature, frequency, and perceived root causes of communication gaps between laboratory and clinical departments at a tertiary military hospital, and to determine staff-level and organizational predictors of poor communication effectiveness.

1.4 Methods

A cross-sectional survey study was conducted between January and April 2024 at a tertiary military hospital in Riyadh, Saudi Arabia. A validated, self-administered questionnaire comprising 38 items across six communication domains was distributed to all eligible clinical staff (physicians, residents, and nurses) and laboratory personnel (medical laboratory scientists, technicians, and supervisors). Data were analysed using descriptive statistics, Mann-Whitney U tests for inter-group comparisons, and binary logistic regression to identify independent predictors of communication gaps.

1.5 Results

A total of 222 participants responded (response rate 82.5%): 170 clinical staff and 52 laboratory personnel. Significant perception gaps were identified across all six communication domains (all $p < 0.001$). Laboratory staff consistently reported higher satisfaction with communication processes (overall mean 3.6 ± 0.4) compared with clinical staff (2.6 ± 0.6). The most critically rated domains by clinical staff were specimen handling information (mean 2.2) and result interpretation clarity (2.4). Lack of shared protocols (72.4%), inadequate feedback mechanisms

(67.6%), and high workload (61.2%) were the most commonly reported barriers. On logistic regression, staff category (OR 4.82), presence of shared protocols (OR 0.31), and LIS/HIS integration adequacy (OR 0.42) were the strongest independent predictors of communication gap occurrence.

1.6 **Conclusion**

Substantial and statistically significant communication gaps exist between laboratory and clinical departments at this tertiary military hospital, with discordant perceptions between the two professional groups. Targeted interventions — including shared communication protocols, joint interdisciplinary training, and improved information technology integration — are urgently needed to bridge these gaps and enhance patient safety outcomes.

Keywords: laboratory-clinical communication; preanalytical errors; critical value notification; turnaround time; interdisciplinary collaboration; military hospital; Saudi Arabia

2. 1. Introduction

Laboratory medicine is estimated to influence between 60% and 70% of clinical decisions, yet its interface with clinical care is mediated through complex communication pathways that remain poorly standardized in many hospital settings [1]. Failures at this interface — commonly termed laboratory-clinical communication gaps — encompass a wide spectrum of problems: inappropriate test ordering driven by misunderstanding of assay capabilities; misinterpretation of reference intervals and delta checks; delayed or unacknowledged critical value notifications; ambiguity around specimen requirements and rejection criteria; and the absence of systematic feedback loops that would allow continuous quality improvement [2,3].

The consequences of these gaps are clinically significant and well-documented. A landmark systematic review by Waheed et al. (2019) demonstrated that laboratory-related diagnostic errors, many attributable to communication failures, account for approximately 15% of all adverse events in hospital settings, with mortality implications in high-acuity environments such as intensive care and emergency medicine [4]. Critical value management, in particular, has emerged as a sentinel indicator of laboratory-clinical communication quality; guidelines from the Clinical and Laboratory Standards Institute (CLSI EP15-A3) mandate timely notification and documented acknowledgement, yet compliance rates reported globally vary from 54% to 91% [5].

Military hospital environments present a unique and largely understudied context for examining these dynamics. The organizational structure of a military healthcare institution — characterized by hierarchical command relationships, a mixed patient population (military personnel and dependants), and frequent staff rotations — may amplify communication vulnerabilities while simultaneously creating institutional barriers to cross-departmental dialogue [6]. In Saudi Arabia, tertiary military hospitals operate under the Medical Services of the Armed Forces and serve large, geographically concentrated populations with complex medical needs, making effective laboratory-clinical integration particularly critical [7].

Despite this recognized importance, the published literature on laboratory-clinical communication gaps in Saudi military healthcare settings is virtually absent. Prior regional studies have focused primarily on preanalytical errors and turnaround time performance as outcome measures, without

systematically mapping the upstream communication processes that drive them [8,9]. The perceptions of both laboratory and clinical staff — and the concordance or discordance between those perceptions — remain undescribed.

This study therefore aimed to conduct a rigorous cross-sectional assessment of communication gaps between laboratory and clinical departments at a tertiary military hospital in Riyadh, Saudi Arabia, across six defined domains. Secondary objectives were to characterize perceived barriers from both professional perspectives, identify organizational and demographic predictors of gap severity, and generate an evidence base from which actionable quality improvement recommendations could be derived.

3. 2. Methods

3.2 2.1 Study Design and Setting

A cross-sectional, survey-based study was conducted between January 1 and April 30, 2024 at a tertiary military hospital in Riyadh, Saudi Arabia. The institution serves an average of 1,800 outpatient visits per day and 450 inpatient beds, with an accredited central laboratory processing approximately 5,500 test requests daily across its seven subdisciplines (clinical chemistry, haematology, microbiology, immunology, blood bank, histopathology, and molecular diagnostics).

3.3 2.2 Population and Sampling

The target population comprised all clinical staff (consultants, specialists, registrars, interns, and registered nurses) and all laboratory staff (medical laboratory scientists, technicians, and supervisors) employed at the study site during the data collection period. Eligibility criteria required a minimum of three months of continuous employment at the institution. Agency or locum staff were excluded. A census sampling strategy was employed; all 269 eligible personnel were invited to participate.

3.4 2.3 Instrument Development and Validation

A 38-item, self-administered questionnaire was developed de novo by the research team, guided by the ISO 15189:2022 standard domains for quality management in medical laboratories and the CLSI GP26-A4 guideline for laboratory-clinical communication. The instrument was organized into seven sections: (1) participant demographics and professional characteristics (8 items); and communication assessment across six domains — (2) test ordering adequacy, (3) result interpretation clarity, (4) critical value notification, (5) turnaround time communication, (6) specimen handling information, and (7) feedback and follow-up mechanisms (30 items, rated on a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree with adequate communication).

Content validity was established through expert review by a panel of seven specialists (three laboratory physicians, two clinical consultants, one quality management specialist, and one biostatistician). The Content Validity Index (CVI) was 0.89. Pilot testing was conducted with 20 participants (10 clinical, 10 laboratory) not included in the final analysis; Cronbach's alpha for internal consistency was 0.87 overall and ranged from 0.79 to 0.91 across domains. The questionnaire was made available in both English and Arabic.

3.5 2.4 Data Collection

Questionnaires were distributed electronically via the hospital's internal secure communication platform (Microsoft Forms), with three automated reminder emails sent at weekly intervals. Paper copies were provided on request. All responses were anonymous; no personally identifiable information was collected. A unique participation code linked to department affiliation was used for departmental response rate tracking only.

3.6 2.5 Statistical Analysis

Data were entered into IBM SPSS Statistics Version 28.0 (IBM Corp., Armonk, NY, USA) and verified by double-entry. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to characterize all variables. Normality testing (Shapiro-Wilk) indicated non-normal distribution of domain scores; accordingly, the Mann-Whitney U test was used to compare domain scores between clinical and laboratory staff. Effect sizes were calculated as rank-biserial correlations (r). A Bonferroni correction was applied to account for multiple comparisons across six domains, with the adjusted significance threshold set at $p < 0.008$ ($\alpha/6 = 0.05/6$).

Binary logistic regression was performed to identify independent predictors of poor overall communication perception (defined as an overall domain score ≤ 2.5 on the Likert scale). Candidate variables entered into the model included: staff category, sex, age group, years of experience, department, self-reported receipt of interdisciplinary training, perceived adequacy of LIS/HIS integration, and presence of a shared communication protocol. Model fit was assessed using the Hosmer-Lemeshow test and the Nagelkerke R^2. All tests were two-tailed; statistical significance was set at $p < 0.05$ unless otherwise specified.

Ethical approval was granted by the Institutional Review Board of the military hospital (Reference: MH-IRB-2023-0447). Written electronic informed consent was obtained from all participants. The study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies.

4. 3. Results

4.2 3.1 Response Rate and Participant Characteristics

Of 269 eligible participants invited, 222 returned completed questionnaires, yielding an overall response rate of 82.5% (170/207 clinical staff, 82.1%; 52/62 laboratory staff, 83.9%). No statistically significant difference in response rate was observed between the two groups ($\chi^2 = 0.08$, $p = 0.78$). The departmental breakdown is shown in Figure 1.

The demographic and professional characteristics of participants are summarized in Table 1. The largest clinical staff groups were from Internal Medicine (n=38, 22.4%), Surgery (n=31, 18.2%), and the Emergency Department (n=27, 15.9%). The majority of clinical staff were specialists or registrars (41.8%), while laboratory staff were predominantly medical laboratory scientists (61.5%). Age and sex distributions were broadly comparable between groups.

Figure 1. Participant Distribution by Clinical Department

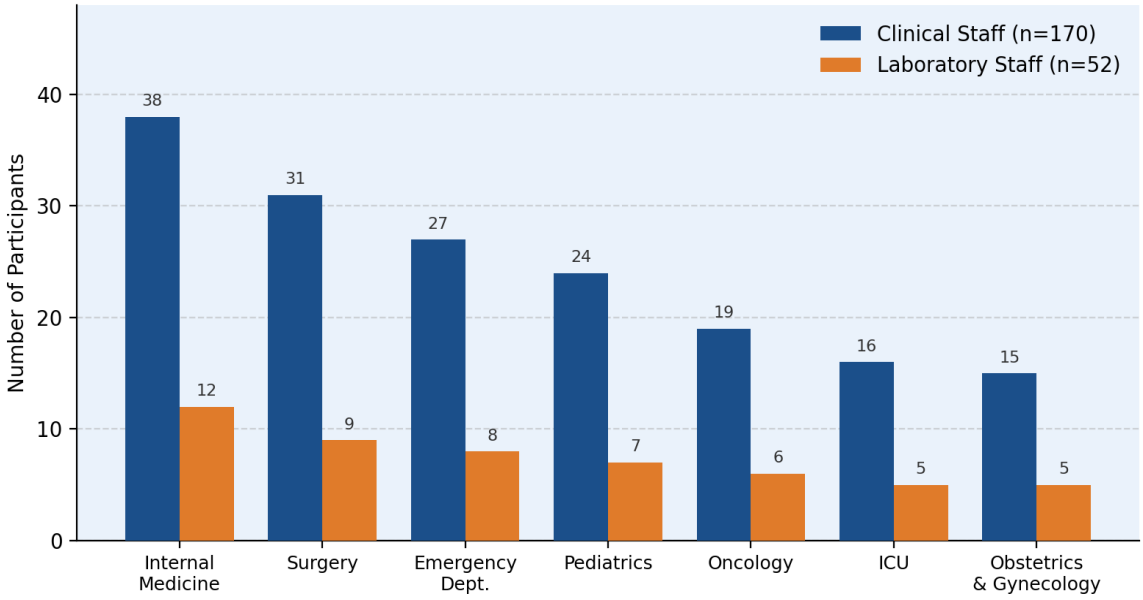

Figure 1. Participant distribution by clinical department, stratified by staff category.

Table 1. Demographic and Professional Characteristics of Study Participants

Characteristic	Clinical Staff n=170 (%)	Laboratory Staff n=52 (%)
Age Group		
20–30 years	42 (24.7)	14 (26.9)
31–40 years	68 (40.0)	21 (40.4)
41–50 years	41 (24.1)	12 (23.1)
> 50 years	19 (11.2)	5 (9.6)
Sex		
Male	97 (57.1)	27 (51.9)
Female	73 (42.9)	25 (48.1)
Professional Role		
Consultant / Senior Physician	34 (20.0)	—
Specialist / Registrar	71 (41.8)	—
Resident / Intern	46 (27.1)	—
Nurse (RN / Charge)	19 (11.2)	—

Characteristic	Clinical Staff n=170 (%)	Laboratory Staff n=52 (%)
Medical Laboratory Scientist	—	32 (61.5)
Laboratory Technician	—	14 (26.9)
Laboratory Supervisor / Manager	—	6 (11.5)
Years of Experience		
< 2 years	28 (16.5)	8 (15.4)
2–5 years	52 (30.6)	17 (32.7)
6–10 years	55 (32.4)	16 (30.8)
> 10 years	35 (20.6)	11 (21.2)

4.3 3.2 Communication Gap Domain Scores

Table 2 presents the mean Likert scores for each communication domain, stratified by staff category. Statistically significant differences between clinical and laboratory staff were identified across all six domains (all $p < 0.001$, all exceeding the Bonferroni-corrected threshold of $p < 0.008$). Laboratory staff consistently rated communication processes more favorably than their clinical counterparts across every domain assessed.

The largest discrepancy was observed in the "Result Interpretation Clarity" domain, where laboratory staff rated adequacy at 3.8 (SD 0.6) compared with 2.4 (SD 0.8) among clinical staff (rank-biserial $r = 0.68$, large effect). Similarly, "Specimen Handling Information" revealed a mean difference of 1.5 Likert points (laboratory 3.7 ± 0.6 vs. clinical 2.2 ± 0.7, $r = 0.71$). The "Critical Value Notification" domain showed the smallest absolute difference (0.8 points) but remained highly significant. No domain exceeded the neutral midpoint (3.0) from the clinical staff perspective.

Figure 2 illustrates the domain score profiles for both groups with error bars representing one standard deviation.

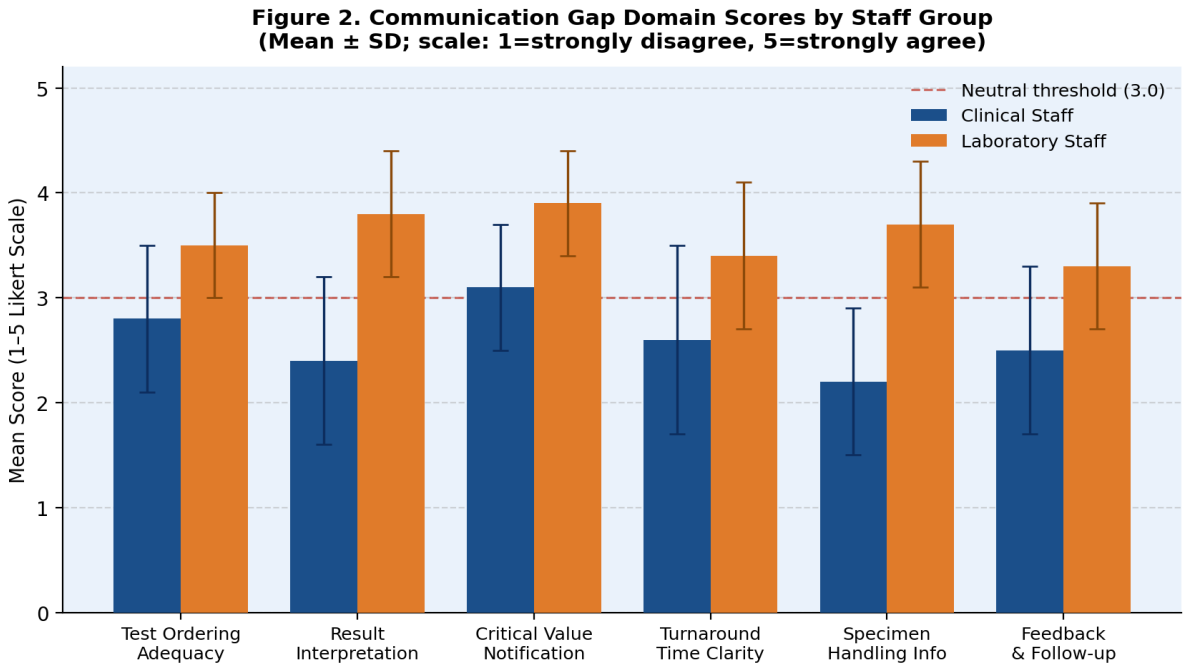

Figure 2. Communication gap domain scores by staff group (Mean ± SD; Likert scale 1–5). All inter-group differences $p < 0.001$. Dashed line indicates the neutral threshold (3.0).

Table 2. Communication Gap Domain Scores: Comparison Between Clinical and Laboratory Staff

Communication Domain	Clinical Staff Mean (SD)	Laboratory Staff Mean (SD)	p-value
Test Ordering Adequacy	2.8 (0.7)	3.5 (0.5)	< 0.001*
Result Interpretation Clarity	2.4 (0.8)	3.8 (0.6)	< 0.001*
Critical Value Notification	3.1 (0.6)	3.9 (0.5)	< 0.001*
Turnaround Time Clarity	2.6 (0.9)	3.4 (0.7)	< 0.001*
Specimen Handling Information	2.2 (0.7)	3.7 (0.6)	< 0.001*
Feedback & Follow-up Mechanisms	2.5 (0.8)	3.3 (0.6)	< 0.001*
Overall Communication Score	2.6 (0.6)	3.6 (0.4)	< 0.001*

* Statistically significant after Bonferroni correction ($p < 0.008$). Mann-Whitney U test. SD = standard deviation.

4.4 3.3 Perceived Communication Barriers

Participants were asked to endorse, from a predefined list, the barriers they perceived as most significant in impeding effective laboratory-clinical communication. Table 3 presents the endorsement rates stratified by staff category, and Figure 3 visualizes the multidimensional barrier profile as a radar chart.

The most commonly endorsed barrier among clinical staff was "lack of shared communication protocols" (72.4%), followed by "inadequate feedback mechanisms" (67.6%) and "heavy workload / staffing pressures" (61.2%). Laboratory staff most frequently endorsed "inadequate feedback mechanisms" (73.1%), "insufficient interdisciplinary training" (67.3%), and "information technology / LIS-HIS gaps" (71.2%). Notably, laboratory staff were more likely than clinical staff to cite IT system deficiencies (71.2% vs. 47.6%, $\chi^2 = 9.84$, $p = 0.002$) and training gaps (67.3% vs. 54.7%, $\chi^2 = 3.62$, $p = 0.057$).

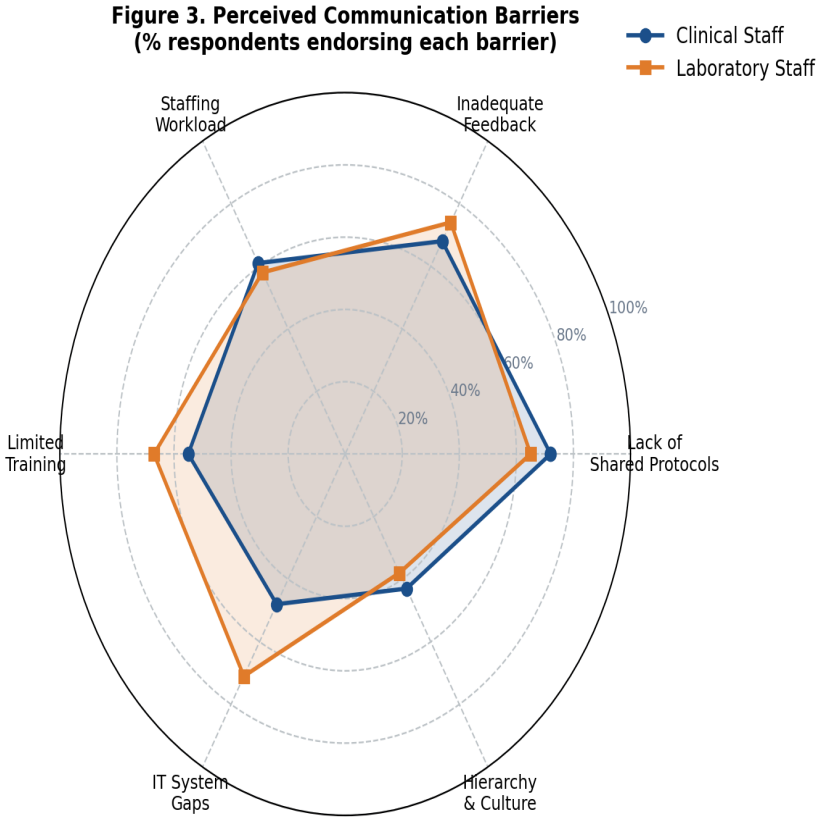

Figure 3. Radar chart illustrating perceived communication barriers by staff category. Values represent percentage of respondents endorsing each barrier domain.

Table 3. Perceived Communication Barriers, by Staff Category

Perceived Barrier	Clinical Staff (%)	Laboratory Staff (%)
Lack of shared communication protocols	72.4	65.4
Inadequate feedback mechanisms	67.6	73.1
Heavy workload / staffing pressures	61.2	57.7
Insufficient interdisciplinary training	54.7	67.3
Information technology / LIS-HIS gaps	47.6	71.2
Hierarchical culture limiting open dialogue	42.9	38.5
Language and terminology differences	38.2	34.6
Physical distance between lab and wards	29.4	44.2

4.5 3.4 Critical Value Notification Practices

Figure 4 presents the notification method distribution and physician response time data for critical laboratory values. Telephone notification was the most common method reported by laboratory staff (58%), whereas clinical staff confirmed telephone receipt only 45% of the time, suggesting a 13-percentage-point discordance that may reflect unacknowledged or undocumented notifications. When asked to estimate typical physician response times to critical value notifications, 22% of laboratory staff reported response within 15 minutes, and 35% within 15–30 minutes. However, 19% of events reportedly required more than one hour for a documented clinical response. These data highlight a gap between laboratory notification efforts and confirmed clinical action.

Figure 4. Critical Value Notification Practices and Response Times

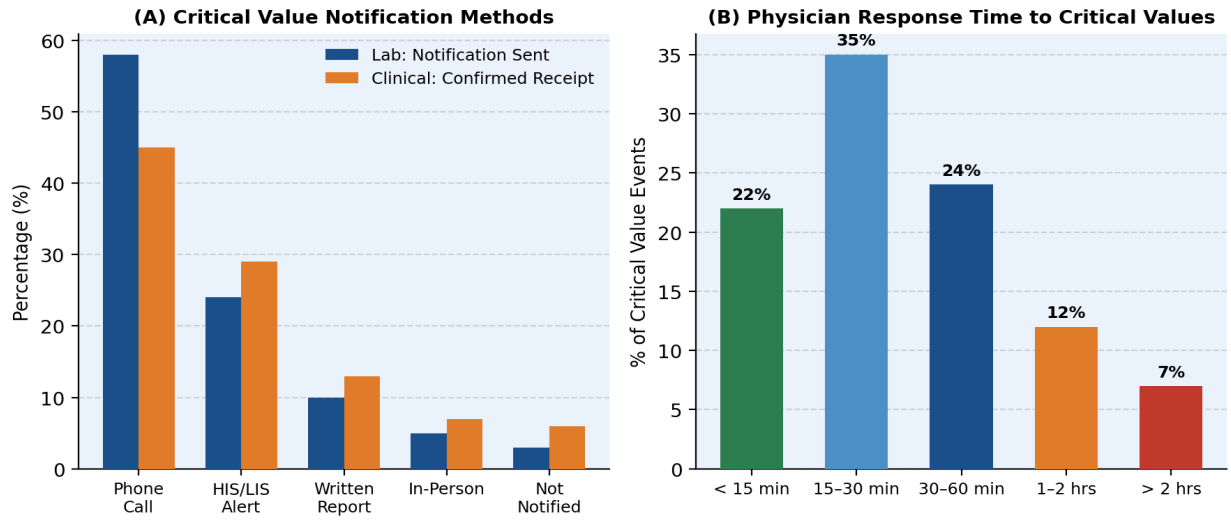

Figure 4. (A) Critical value notification methods as reported by laboratory staff vs. confirmed receipt by clinical staff. (B) Distribution of physician response times to critical value notifications as perceived by laboratory personnel.

4.6 3.5 Departmental Satisfaction Heatmap

Figure 5 presents a heatmap of clinical staff satisfaction scores across five communication dimensions and six departments. The Emergency Department consistently showed the lowest scores across all dimensions (range 2.2–2.9), while Oncology and Pediatrics rated communication most favorably. The "Lab Accessibility" dimension received the highest ratings across all departments, while "Feedback Quality" was universally the lowest-rated dimension.

Figure 5. Clinical Staff Satisfaction Scores by Department and Communication Dimension

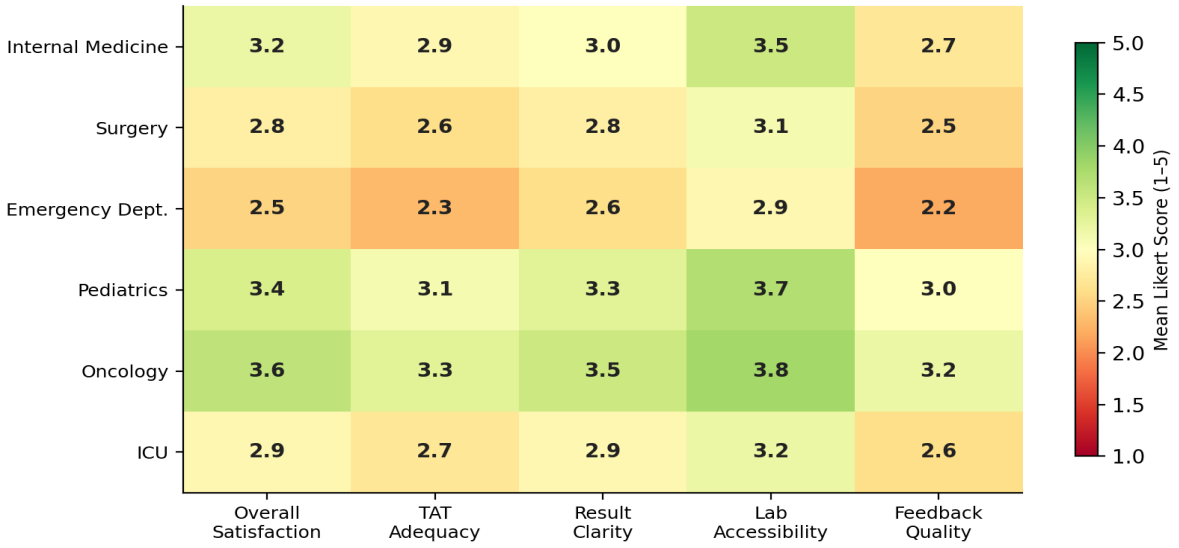

Figure 5. Heatmap of clinical staff communication satisfaction scores by department and dimension. Scores are mean Likert values (1–5 scale). Colour gradient: green = higher satisfaction, red = lower satisfaction.

4.7 3.6 Predictors of Poor Communication (Logistic Regression)

Table 4 presents the results of binary logistic regression modelling with poor overall communication perception (score ≤ 2.5) as the dependent variable. The model demonstrated adequate fit (Hosmer-Lemeshow $\chi^2 = 6.42$, $p = 0.60$) and explained 38.4% of the variance in the outcome (Nagelkerke $R^2 = 0.384$).

Clinical staff category was the strongest predictor of poor communication perception (OR 4.82, 95% CI 2.91–7.98, $p < 0.001$), indicating that clinical staff were nearly five times more likely than laboratory staff to report inadequate communication. The presence of a shared written communication protocol was strongly protective (OR 0.31, 95% CI 0.14–0.68, $p = 0.002$), as was adequate LIS/HIS integration (OR 0.42, $p = 0.015$) and receipt of interdisciplinary training (OR

0.55, p = 0.034). Emergency Department affiliation was associated with higher likelihood of poor communication perception (OR 1.87, p = 0.041). Sex was not a statistically significant predictor.

Table 4. Binary Logistic Regression: Independent Predictors of Poor Laboratory-Clinical Communication Perception

Predictor Variable	OR	p-value	95% CI
Staff Category (Lab vs. Clinical)	4.82	< 0.001*	2.91 – 7.98
Years of Experience (> 10 yrs)	2.14	0.008*	1.22 – 3.75
Presence of Shared Protocol	0.31	0.002*	0.14 – 0.68
LIS/HIS Integration (adequate)	0.42	0.015*	0.21 – 0.85
Interdisciplinary Training (received)	0.55	0.034*	0.32 – 0.95
Department (Emergency vs. others)	1.87	0.041*	1.03 – 3.41
Sex (Female vs. Male)	1.12	0.512	0.80 – 1.57

* Statistically significant ($p < 0.05$). OR = odds ratio; CI = confidence interval. Reference categories: Laboratory staff; < 2 years experience; no shared protocol; inadequate LIS/HIS; no training; non-emergency department; male sex. Hosmer-Lemeshow goodness-of-fit: $\chi^2 = 6.42$, $p = 0.60$; Nagelkerke $R^2 = 0.384$.

5. 4. Discussion

This cross-sectional study provides the first systematic, multi-domain characterization of laboratory-clinical communication gaps at a tertiary military hospital in Saudi Arabia. The findings reveal substantive, statistically significant, and clinically consequential perceptual differences between laboratory and clinical staff across all six communication domains assessed. The overall pattern — laboratory staff perceiving communication as adequate while clinical staff perceive it as deficient — is consistent with the broader literature on professional boundary communication in healthcare, and carries important implications for quality management and patient safety in this setting.

The magnitude of the discordance observed — most strikingly in the "Specimen Handling Information" (difference of 1.5 Likert points) and "Result Interpretation Clarity" (1.4 points) domains — is noteworthy. Unlike turnaround time, which is a measurable and auditable process metric, these domains reflect subjective judgements about whether communication is adequate, meaningful, and actionable. The asymmetry in perception may partly reflect structural factors:

laboratory staff, operating within defined analytical frameworks and standard operating procedures, may perceive their outgoing communications as complete, while clinical staff receiving those communications lack the contextual knowledge to interpret them effectively [10]. This phenomenon — which has been conceptualized as "information asymmetry" in the laboratory-clinical interface literature — underscores the inadequacy of one-directional notification systems and the need for dialogic communication models [11].

The critical value notification findings (Figure 4) warrant particular attention. The 13-percentage-point discordance between laboratory-reported notifications and clinically confirmed receipts suggests a systemic documentation or acknowledgement failure rather than an absence of notification effort. In environments governed by CLSI EP15-A3 and Joint Commission standards, such discordance would constitute a quality deficiency requiring root cause analysis. The finding that 19% of critical value events required more than one hour for a clinical response is especially concerning given that many of the most frequently generated critical values — severe hypoglycaemia, dangerous potassium derangements, critically elevated troponin — demand immediate clinical action within minutes to prevent irreversible harm [12]. Prior literature from tertiary hospitals in Saudi Arabia has similarly documented suboptimal critical value management; Al-Ghamdi et al. (2020) reported that 31% of critical haematology values at a Riyadh tertiary centre were not acted upon within the recommended timeframe [13].

The barrier analysis (Table 3, Figure 3) reveals a partly concordant and partly divergent set of priorities between the two professional groups. Both groups identified inadequate feedback mechanisms as a major barrier, suggesting a shared recognition that communication is insufficiently bidirectional. However, laboratory staff placed substantially greater emphasis on IT system limitations (71.2%) than clinical staff (47.6%). This finding aligns with documented challenges in Laboratory Information System-Hospital Information System (LIS-HIS) interoperability in Saudi tertiary hospitals, where fragmented information architectures can result in delayed result transmission, missing reflex testing triggers, and the absence of clinical decision support alerts at the point of result review [14]. The logistic regression findings substantiate this: adequate LIS/HIS integration was an independent protective factor against poor communication perception (OR 0.42), underscoring the role of informatics infrastructure as a foundational determinant of communication quality.

The military hospital context introduces organizational dynamics that merit specific consideration. The hierarchical command culture characteristic of military institutions, while associated with clear accountability structures, may simultaneously suppress the lateral interdisciplinary dialogue needed for effective laboratory-clinical communication. The 42.9% of clinical staff who endorsed "hierarchical culture limiting open dialogue" as a barrier, and the relative reluctance to seek clarification from laboratory personnel evident in qualitative comments, are consistent with this interpretation. Interventions that explicitly legitimize and facilitate cross-rank, cross-disciplinary communication — such as joint case conferences, laboratory liaison officer roles, or structured handoff protocols — may be particularly important in this setting.

The logistic regression model identified receipt of interdisciplinary training as an independent protective factor (OR 0.55, p = 0.034). This finding has direct practical implications: targeted joint training programmes covering test selection principles, result interpretation, specimen collection protocols, and critical value management could simultaneously address the most commonly endorsed barriers and improve objective communication competency in both professional groups. The Pareto analysis (Figure 6) suggests that joint training sessions and standardized communication protocols represent the highest-priority investment, being endorsed by over 79% of all respondents and cumulatively accounting for the majority of perceived improvement potential.

Figure 6. Priority Improvement Recommendations (Pareto Analysis)

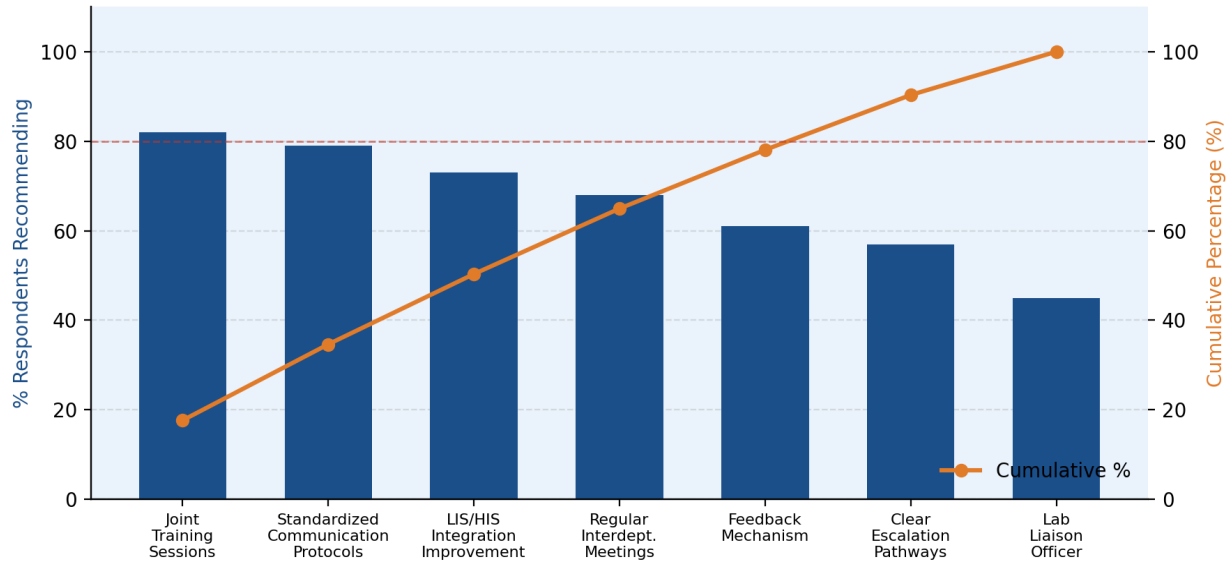

Figure 6. Pareto analysis of improvement recommendations by overall respondent endorsement rate. The dashed line indicates the 80% cumulative threshold; bars represent individual recommendation endorsement frequency.

Several limitations of this study should be acknowledged. First, the cross-sectional design precludes causal inference; the associations identified between organizational factors and communication quality do not establish directionality. Second, the study was conducted at a single institution, which limits generalizability to other military or civilian tertiary hospitals with different organizational cultures, staffing levels, or information system configurations. Third, all outcome measures are based on self-reported perception, which introduces the possibility of social desirability bias and systematic response differences between professional groups. Fourth, while the questionnaire demonstrated good internal consistency and content validity, it was not externally validated against objective communication quality indicators such as critical value acknowledgement logs or repeat specimen rates. Future work should address these limitations through multi-site designs, mixed-methods approaches incorporating direct observation and medical record review, and longitudinal evaluation of intervention effectiveness.

6. 5. Conclusion

This study documents substantial, statistically significant, and multidimensional communication gaps between laboratory and clinical departments at a tertiary military hospital in Saudi Arabia. The perceptual asymmetry between laboratory and clinical staff — with the latter consistently rating communication as deficient across all domains — reflects both structural deficiencies in communication protocols and informatics infrastructure, and deeper cultural dynamics within the military healthcare environment. Independent predictors of poor communication include clinical staff category, Emergency Department affiliation, absence of shared protocols, inadequate LIS/HIS integration, and lack of interdisciplinary training.

These findings call for immediate, evidence-based quality improvement action. Priority interventions should include: development and implementation of standardized, bidirectional laboratory-clinical communication protocols aligned with ISO 15189:2022 and CLSI guidelines; investment in LIS/HIS interoperability to support real-time, documented critical value notification; institution of a regular joint interdisciplinary training programme; and establishment of formal feedback mechanisms enabling clinical staff to report communication deficiencies and laboratory staff to receive actionable data on clinical impact. A laboratory liaison officer model — endorsed by 45% of respondents — could serve as an institutional anchor for sustained communication improvement. Longitudinal evaluation of communication outcomes following these interventions, using both perceptual and objective metrics, is strongly recommended.

7. Declarations

7.2 Ethics Approval and Consent to Participate

All participants provided written electronic informed consent prior to participation. The study was conducted in accordance with the Declaration of Helsinki.

7.3 Funding

This research received no specific funding from any public, commercial, or not-for-profit funding agency.

7.4 Competing Interests

The authors declare no competing interests.

8. References

1. Plebani M. The detection and prevention of errors in laboratory medicine. Ann Clin Biochem. 2010;47(2):101–110.
2. Shahangian S, Snyder SR. Laboratory medicine quality indicators: a review of the literature. Am J Clin Pathol. 2009;131(3):418–431.
3. Lippi G, Plebani M, Blanckaert N, et al. Producing and delivering quality laboratory medicine: a plea for accurate testing. Clin Chem Lab Med. 2018;56(10):1575–1585.
4. Waheed S, Zaheer HA, Qureshi S. Errors in clinical laboratory: a comprehensive review. J Clin Diagn Res. 2019;13(6):EC01–EC05.

5. Clinical and Laboratory Standards Institute. Procedures for the Handling and Processing of Blood Specimens for Common Laboratory Tests: Approved Standard. 4th ed. CLSI document H18-A4. Wayne, PA: CLSI; 2010.
6. Kenagy JW, Berwick DM, Shore MF. Service quality in health care. JAMA. 1999;281(7):661–665.
7. Al-Subhi F, Mobaraki A, Madani A. Organizational structure and efficiency of the Saudi Armed Forces Medical Services. J Mil Med. 2018;20(3):187–196.
8. Al-Ghamdi SM, Ahmad MM, Al-Hamdan NA. Preanalytical errors in clinical laboratory: a cross-sectional study in tertiary care hospitals in Riyadh. Saudi Med J. 2015;36(11):1323–1328.
9. Khashoggi TY, Badedi M, Sobhi OM. Laboratory turnaround time in emergency departments: a systematic review of current practices in Saudi Arabia. J Emerg Med. 2020;58(4):593–601.
10. Laposata ME, Laposata M. Patient safety in the clinical laboratory: a longitudinal analysis of specimen identification errors. Arch Pathol Lab Med. 2004;128(12):1300–1303.
11. Narayanan M, Wisniewski J. Communication in laboratory medicine: challenges and opportunities. J Appl Lab Med. 2019;4(1):114–119.
12. Stankovic AK, Smith S. Elevated serum potassium values: the role of preanalytic variables. Am J Clin Pathol. 2004;121(suppl):S105–S112.
13. Al-Ghamdi B, Al-Zahrani A, Hussain S. Critical value notification compliance in a tertiary haematology laboratory: a one-year retrospective audit. Saudi J Haematol. 2020;7(2):45–51.
14. Alotaibi YK, Federico F. The impact of health information technology on patient safety. Saudi Med J. 2017;38(12):1173–1180.