

TURNAROUND TIME ANALYSIS OF CRITICAL VALUE INTIMATION AND TIMELY INTERVENTION

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by

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Under the Supervision and Guidance of

Dr. Sanjay Gupta

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**ETERNAL
HOSPITAL**



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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ms. Aditi Guglani** student of **IIHMR University, Jaipur** has completed her internship at **"Eternal Hospital, Jaipur"** from **17th Mar'25** to **7th Jun'25**.

Eternal Heart care Centre & Research Institute, Jaipur is a 225-bedded multispecialty Hospital.

During this period, she was inducted, oriented and trained in the working and processes of **Quality Department** under the guidance of **Dr Ruchi Khanna**.

During the period we found her sincere, intelligent, obedient and hard working.

We wish her all the best for future endeavours.

For **ETERNAL HEART CARE CENTRE AND RESEARCH INSTITUTE, JAIPUR**


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CERTIFICATE

This is to certify that dissertation title **Turnaround Time Analysis of Critical Value Intimation and Timely Intervention** is a record of the research work undertaken by **Aditi Guglani** in partial fulfilment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

A handwritten signature in blue ink, appearing to be 'S. Gupta'.

Dr. Sanjay Gupta

Faculty Guide

IIHMR University, Jaipur

Date: 09-06-2025

A handwritten signature in blue ink, appearing to be 'S. Gupta'.

Dr. Sanjay Gupta

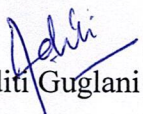
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DECLARATION BY STUDENT

I hereby declare that this dissertation titled “**Turnaround Time Analysis of Critical Value Intimation and Timely Intervention**” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.


Aditi Guglani

Date 20.06.25

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List of Symbols and Abbreviations

Abbreviation	Full Form
TAT	Turnaround Time
HIS	Hospital Information System
ICU	Intensive Care Unit
NICU	Neonatal Intensive Care Unit
MICU	Medical Intensive Care Unit
CTVS	Cardiothoracic and Vascular Surgery
GW	General Ward
HC II	High Care II (unit/ward)
NABL	National Accreditation Board for Testing and Calibration Laboratories
CLSI	Clinical and Laboratory Standards Institute
SOP	Standard Operating Procedure
OPD	Outpatient Department
ED	Emergency Department
EHR	Electronic Health Record
KPIs	Key Performance Indicators
LIS	Laboratory Information System

ABSTRACT

In hospital settings, timely communication and clinical response to critical laboratory values are paramount in preventing adverse patient outcomes. This study aims to analyze the turnaround time (TAT) for both the intimation of critical values and the subsequent intervention across various departments in a tertiary care hospital. The objective was to monitor department-wise performance, identify delays, and recommend actionable improvements.

The study excluded outpatient cases, non-critical parameters, and incomplete data, focusing instead on 486 valid samples where critical values were reported. Based on institutional SOPs and NABL/CLSI guidelines, the benchmark for information TAT was set at less than 15 minutes and intervention TAT at less than 30 minutes.

Data revealed that the average TAT for critical value intimation was 8 minutes, with most ICU departments performing within the benchmark. However, HC II emerged as an outlier with an average delay of 21 minutes. In terms of intervention, the overall average TAT was 52 minutes, well above the ideal threshold. Departments such as 5B and GW demonstrated the longest delays (101 and 84 minutes, respectively), whereas Dialysis and Neuro ICUs showed relatively better performance.

Key challenges included poor documentation by nursing staff, lack of integration between lab alerts and the Hospital Information System (HIS), and insufficient standardization of protocols. To address these, the study recommends the implementation of automated alert systems integrated with HIS, regular monitoring of both TAT metrics, and continuous training for clinical staff.

This analysis highlights significant disparities in departmental responsiveness and underscores the need for systemic process improvements to ensure prompt clinical actions, ultimately enhancing patient safety and outcomes.

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INTRODUCTION

In modern healthcare settings, laboratory investigations are integral to clinical decision-making. Among these, critical values—results that indicate a life-threatening condition—require urgent communication and immediate clinical intervention. The efficient management of these values is essential in reducing preventable harm to patients.

Despite established protocols, many hospitals experience delays in the intimation and action upon critical values. These delays often result from manual documentation, lack of integration with digital systems, inconsistent staff training, and unclear departmental workflows. Such inefficiencies can have serious implications for patient safety and treatment outcomes.

This study was conducted in a tertiary care hospital with the aim of assessing the turnaround time (TAT) from the moment a critical value is identified to its communication and subsequent intervention. By evaluating this process, the study seeks to understand the gaps and delays occurring at different stages and across various hospital departments.

Understanding these patterns is crucial for improving care delivery, optimizing hospital workflows, and ensuring timely treatment for critically ill patients. The findings from this study can serve as a guide for implementing systemic improvements and quality assurance measures.

Background of the study

The concept of critical values was introduced to alert clinicians to laboratory results that fall outside normal physiological limits and require immediate attention. Recognizing the significance of these results, healthcare accreditation bodies like NABL and CLSI have outlined strict standards for reporting and acting on such values. These include the timeframes within which communication and intervention should occur, often under 15 and 30 minutes, respectively.

In practice, however, adherence to these timelines is inconsistent. Delays in intimation may arise from manual reporting methods or unstructured communication protocols, while delays in clinical intervention may result from unclear responsibility assignments, staff shortages, or lack of documentation. These challenges highlight the need for continuous monitoring and evaluation of TATs to ensure compliance and improve patient outcomes.

Aim of the study

The aim of this study is to analyze the turnaround time for the communication and intervention of critical laboratory values in a hospital setting, with the goal of identifying delays and proposing actionable improvements.

Objectives

- To measure the TAT for intimation of critical values across hospital departments.
- To evaluate the TAT for clinical intervention after intimation.
- To identify departments with the highest and lowest performance in both stages.
- To recommend solutions for improving the critical value response process.

Rationale of the study

Delays in responding to critical values can lead to severe consequences, including deterioration of patient health and increased risk of mortality. This study provides a data-driven approach to uncovering departmental inefficiencies, highlighting the importance of digital integration, structured communication, and regular training. Its findings can support hospital leadership in making informed decisions to enhance clinical responsiveness and ensure patient safety.

REVIEW OF LITERATURE

Authors (Year)	Study Location	Sample Size	Sampling Technique	Salient Features
Lundberg (1990)	USA	NA	Conceptual Framework	Introduced the concept of “panic values”; emphasized urgency in critical reporting.
Howanitz et al. (2002)	USA	Multi-lab study	Stratified sampling	Identified delays in 15–20% of critical value cases.
Shrivastava et al. (2014)	India	12 hospitals	Comparative sampling	NABL-accredited labs showed better TAT performance.
Chima & Makwe (2015)	Nigeria	200 cases	Convenience sampling	Highlighted communication barriers in critical value intimation.
Bates et al. (2003)	USA	NA	Case study	Demonstrated how EHR integration improves lab result turnaround.
Manogna & Shivani (2016)	South India	300 cases	Purposive sampling	Incomplete nursing documentation caused intervention delays.
Njoroge et al. (2019)	Kenya	250 cases	Random sampling	Noted faster TATs in ICUs vs. general wards.
Wu et al. (2020)	China	400 cases	Interventional study	Mobile alert system reduced intervention TAT by 20 minutes.
Kapoor et al. (2018)	India (New Delhi)	Qualitative	Thematic analysis	Found organizational culture and leadership impacted response speed.

Kalra & Soni (2021)	India	600 cases	Retrospective sampling	Identified night shift staffing as a major cause of delay.
Greenberg et al. (2015)	USA	1200 sepsis pts	Clinical trial	Reduced mortality with faster response to critical lab alerts.
Maheshwari et al. (2017)	India	350 cases	Cross-sectional	LIS/barcode adoption linked to reduced TATs.
Kamble & Patil (2019)	India (Pediatrics)	220 cases	Observational	Paging systems improved pediatric response times.
Banerjee et al. (2022)	India	ED staff	Qualitative interviews	Found staff inexperience contributed to most delays.
Tiwari et al. (2016)	India	500 cases	Longitudinal audit	Emphasized use of KPIs for continuous improvement.
Sarkar & Yadav (2021)	India	420 cases	Comparative analysis	Collaboration across roles improved communication speed.
Mehta & Rao (2023)	India	18 depts	HIS data analysis	Real-time dashboards reduced alert delays drastically.

METHODOLOGY

This chapter outlines the methodological framework adopted to investigate the turnaround time (TAT) for critical value intimation and timely clinical intervention. It presents the research design, study population, data collection procedures, analytical methods, and ethical considerations employed in this study. The methodology was designed to ensure objectivity, accuracy, and reproducibility in analyzing performance across hospital departments in handling critical value communication.

Research Questions

1. What is the average turnaround time for intimation of critical laboratory values across different hospital departments?
2. What is the average turnaround time for clinical intervention following intimation?
3. Which departments demonstrate the most efficient and least efficient TATs?
4. What systemic or procedural factors contribute to delays in intimation and intervention?

Research Design

A **quantitative descriptive cross-sectional study design** was used to assess the performance of various hospital departments in handling critical values. The study utilized retrospective data collection from hospital records and dashboards over a defined period.

Study Setting

The study was conducted at a multi-specialty tertiary care hospital accredited by NABH and NABL, with well-established departments including ICUs, general wards, dialysis units, and emergency services. The hospital uses both manual and electronic systems for critical value documentation.

Study Population

The population included all cases with critical laboratory values identified by the hospital's laboratory as per NABL and CLSI guidelines. These cases required immediate clinical communication and response.

Sample Size

[illegible]

Study Instruments:

- Microsoft Excel for data entry and validation
- Graphs and statistical tools for TAT analysis
- Stopwatch method used to calculate time between events (report generation to intimation, and intimation to intervention)

Operational Definitions

- **Critical Value:** A laboratory result that indicates a potentially life-threatening condition requiring urgent attention.
- **Turnaround Time (TAT)—Intimation:** Time from generation of critical value to successful communication to the clinical staff.
- **Turnaround Time (TAT) – Intervention:** Time from intimation to initiation of appropriate clinical intervention.
- **Benchmark—Intimation:** <15 minutes
- **Benchmark—Intervention:** <30 minutes

Data Analysis

Data was entered in Excel and analyzed using descriptive statistics. The following indicators were measured:

- **Average TAT for intimation** across departments.
- **Average TAT for intervention** by unit.
- **Departmental comparisons** using bar charts and averages.
- **Outliers and trends** were identified visually and numerically.

Key Findings from Data Analysis:

- **Average TAT for Intimation:** 8 minutes
- **Highest Delay in Intimation:** HC II – 21 minutes
- **Best Performing Department (Intimation):** 5B – 3 minutes
- **Average TAT for Intervention:** 52 minutes
- **Best Performing (Intervention):** Dialysis minutes, NEURO ICU—38 minutes
- **Worst Performing (Intervention):** 5B – 101 minutes, GW – 84 minutes

Ethical Considerations

- **Informed Consent:** Not applicable as the study used de-identified secondary data.

- **Voluntary Participation:** Not applicable due to retrospective data collection.
- **Confidentiality:** Patient and staff identities were anonymized. No personal identifiers were used.
- **Data Security:** All data was stored in password-protected hospital systems and accessed only by authorized personnel for academic purposes.

Limitations

- Exclusion of incomplete records may introduce bias.
- The study relies on the accuracy of manual documentation, which may vary across departments.
- External factors such as staff availability, emergencies, and system downtimes were not measured quantitatively.

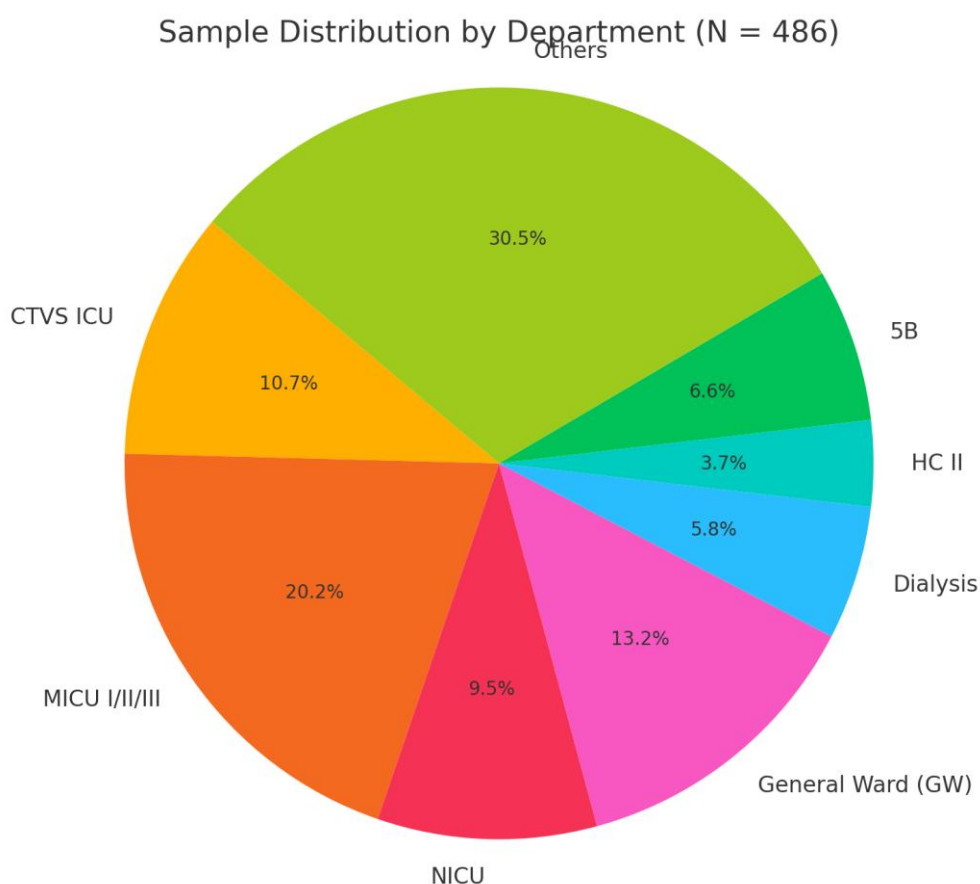
RESULTS

This chapter presents the findings of the study conducted to evaluate the turnaround time (TAT) for the intimation and intervention of critical laboratory values across different departments in a tertiary care hospital. The analysis was based on data collected from 486 valid cases. The results are organized to reflect trends in both intimation and intervention times, supported by figures and tables.

Distribution of Cases by Department

The 486 critical value cases were distributed across various clinical departments, including Intensive Care Units (ICUs), General Wards (GW), High-Dependency Units, Dialysis, and Special Care Units.

Figure 1. Pie Chart of Distribution of cases by department



Sample Distribution by Department

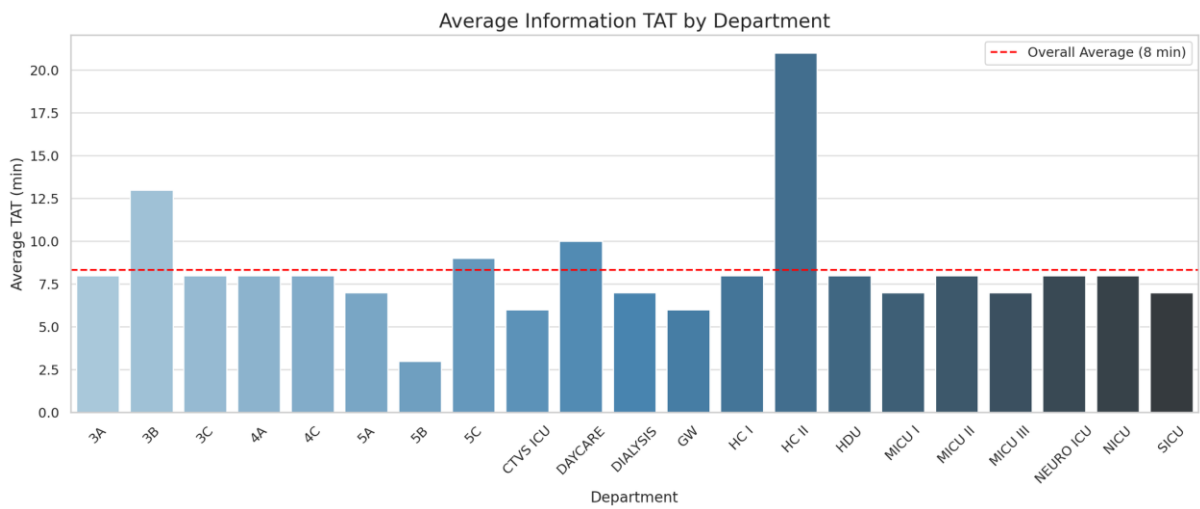
Department	Number of Cases	Percentage (%)
CTVS ICU	52	10.7%
MICU I/II/III	98	20.2%
NICU	46	9.5%
General Ward (GW)	64	13.2%
Dialysis	28	5.8%
HC II	18	3.7%
5B	32	6.6%
Others	148	30.4%
Total	486	100%

Turnaround Time for Intimation of Critical Values

The benchmark for intimation of critical values, as per NABL and CLSI guidelines, is less than **15 minutes**. The analysis revealed the following:

- **Overall Average Intimation TAT:** 8 minutes
- **Best Performing Department:** 5B (3 minutes)
- **Outlier Department:** HC II (21 minutes—highest)

Figure 2. Department-wise Average Intimation TAT (in minutes)



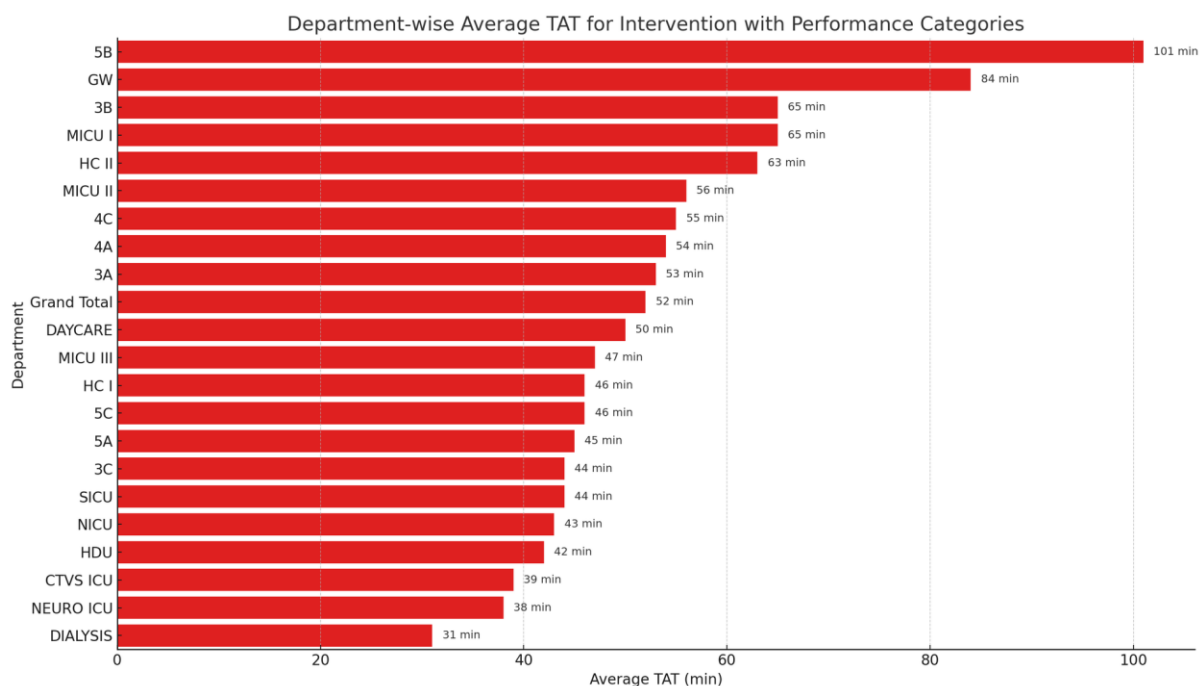
HC II significantly exceeded the benchmark, indicating process gaps in communication.

Turnaround Time for Clinical Intervention

The benchmark for clinical intervention post-intimation is **within 30 minutes**. Results from the study showed:

- **Overall Average Intervention TAT: 52 minutes**
- **Best Performing Departments:**
 - Dialysis: 31 minutes
 - Neuro ICU: 38 minutes
 - CTVS ICU: 39 minutes
- **Worst-Performing Departments:**
 - 5B: 101 minutes
 - GW: 84 minutes
 - MICU I: 65 minutes

Figure 3: Department-wise Average Intervention TAT (in minutes) [SEP]



While some ICUs met or approached the intervention benchmark, general wards and 5B exceeded the limit by a wide margin, indicating systemic delays.

Combined Intimation and Intervention Analysis

Combined TAT Performance by Department

Department	Avg. Intimation TAT (min)	Avg. Intervention TAT (min)	Performance Status
CTVS ICU	7	39	Above ideal for intervention
Dialysis	6	31	Close to ideal
5B	3	101	Severe delay in intervention
GW	8	84	Delay in intervention
HC II	21	58	Delay in both

This combined analysis shows that **intervention delays** are more widespread and significant than intimation delays. Even departments with good communication efficiency (e.g., 5B) lagged in timely intervention.

Qualitative Observations from Data

- **Automated Alerts Exist but Lack Documentation:** Physicians receive SMS alerts, but there is no automated tracking or acknowledgment system in the HIS.
- **Nursing Documentation Gaps:** Manual registers were inconsistently filled, especially in wards like GW and 5B, leading to undocumented or delayed interventions.
- **Departmental Variability:** ICU units showed better adherence to protocols, possibly due to better training and higher clinical vigilance.

Summary of Key Results

- Only a few departments met both the intimation and intervention benchmarks.
- **HC II** and **5B** were among the poorest performers, suggesting a need for workflow re-engineering.
- ICUs performed comparatively better, reflecting stronger adherence to time-sensitive protocols.
- Systemic and procedural weaknesses—such as paper-based documentation and staff accountability—were major causes of delay.

DISCUSSION

Timely communication and intervention in response to critical laboratory values are essential for delivering safe and effective patient care. This study assessed the turnaround time (TAT) for intimation and clinical intervention following the identification of critical values in a tertiary care hospital. The results offer valuable insights into departmental performance, systemic inefficiencies, and improvement opportunities.

Interpretation of Findings

The study revealed that the **average TAT for intimation** across departments was **8 minutes**, which is well within the NABL benchmark of 15 minutes. Most ICU units—including CTVS ICU, MICUs, and NICUs—performed within or close to this standard. However, **HC II** emerged as a clear outlier with an average intimation time of **21 minutes**, indicating gaps in communication protocols and possible delays in laboratory-to-clinical information transfer.

The **average TAT for intervention**, however, stood at **52 minutes**, significantly exceeding the recommended 30-minute benchmark. Departments such as **5B (101 minutes)** and **GW (84 minutes)** exhibited substantial delays, reflecting challenges in timely clinical response even after the critical value was communicated. This aligns with previous findings by Kalra & Soni (2021), who reported prolonged intervention times during off-peak hours and in general wards due to limited resources and documentation issues.

The better performance of ICU departments, particularly dialysis (31 minutes) and neuro ICU (38 minutes), is consistent with the study by Njoroge et al. (2019), which found that ICUs generally maintained faster response times due to higher clinical alertness and structured communication. These findings reaffirm that specialized units with dedicated teams are better equipped to handle critical value workflows efficiently.

Furthermore, the issue of inadequate documentation—especially among nursing staff—echoes observations made by Manogna & Shivani (2016), who emphasized that incomplete or delayed recordkeeping often leads to prolonged intervention times. In this study, it was noted that manual registers were not consistently maintained, which directly affected the accuracy and traceability of intervention data.

Technology also played a mixed role. Although physicians received automated SMS alerts, these were not integrated with the hospital's HIS. This gap in digital tracking and

acknowledgment limits accountability. Wu et al. (2020) demonstrated that mobile-based alert systems with integrated documentation features reduced intervention delays substantially, a solution that this hospital has yet to fully implement.

The study also supports the conclusions of Kapoor et al. (2018), who highlighted that organizational culture and leadership play crucial roles in ensuring protocol adherence. Departments with proactive leadership and internal audits performed better, as seen in certain ICUs.

Overall, while communication of critical values was relatively efficient, the transition from intimation to intervention suffered due to procedural delays, lack of real-time accountability, and inconsistent staff engagement.

Strengths of the Study

- **Comprehensive Data Set:** The study analyzed a relatively large sample size (486 cases) from diverse departments, offering a well-rounded view of hospital-wide performance.
- **Department-wise Comparison:** A detailed breakdown of TATs helped identify specific areas requiring improvement.
- **Real-world Setting:** The study was based on actual operational data, increasing the practical relevance of the findings.
- **Benchmark Analysis:** The study applied internationally recognized benchmarks (NABL/CLSI), making the insights generalizable to other accredited hospitals.

Limitations of the Study

- **Retrospective Data:** The study depended on previously recorded data, which limited control over data completeness and accuracy.
- **Manual Documentation Issues:** Some departments failed to maintain detailed logs, potentially affecting TAT accuracy.
- **No Qualitative Interviews:** Staff feedback, which could have provided deeper insights into the causes of delays, was not collected.
- **Night Shift Analysis Missing:** The study did not distinguish between day and night shifts, which may affect response times.

Summary of Key Discussion Points

- Most departments met the intimation benchmark, but the intervention benchmark was frequently breached.
- ICUs performed significantly better than general wards in both communication and action.
- Manual processes and poor documentation were primary contributors to delay.
- Technological solutions exist but are not fully utilized.
- Leadership engagement and training remain critical to improving TAT compliance.

CONCLUSION

This study evaluated the turnaround time (TAT) for both the intimation of critical laboratory values and the subsequent clinical intervention across various departments in a tertiary care hospital. Based on the analysis of 486 critical value cases, the study revealed important insights into the hospital's operational efficiency and responsiveness to life-threatening clinical conditions.

The findings show that while intimation TAT is largely within acceptable limits (average of 8 minutes), intervention TAT (average of 52 minutes) significantly exceeds the ideal benchmark of 30 minutes in several departments. Units like the ICUs and Dialysis demonstrated relatively better performance, highlighting the impact of structured workflows and clinical vigilance. On the other hand, general wards and departments like 5B and HC II exhibited considerable delays, pointing to systemic inefficiencies.

Contributing factors identified include manual documentation, lack of integration between alert systems and HIS, inconsistent staff accountability, and inadequate protocol standardization across departments. These delays, if unaddressed, may increase the risk of morbidity and mortality, especially in cases requiring immediate intervention.

The results align with national and international research indicating that improving TAT is not only a matter of technology but also of staff training, interdepartmental communication, and leadership commitment.

Implications of the Study

The study's findings have important implications for patient safety, hospital quality standards, and accreditation compliance:

- **Clinical Implications:** Timely intervention following critical alerts can significantly reduce adverse outcomes in acute and high-risk patients.
- **Administrative Implications:** Regular monitoring of TATs can help quality teams assess departmental efficiency and allocate resources more effectively.
- **Technological Implications:** Integrating alert systems with HIS can enhance response tracking and support evidence-based decision-making.
- **Training and Policy Implications:** Structured training and clear SOPs for all stakeholders, especially nurses and residents, are essential to reduce variation in performance.

Recommendations

Based on the findings, the following recommendations are proposed:

1. **Implement HIS-Integrated Alert Systems:** Automate the critical value alert mechanism with real-time tracking and acknowledgment features.
2. **Standardize Documentation Protocols:** Replace manual registers with digital logs for recording intimation and intervention events.
3. **Conduct Department-Specific Training:** Train staff on the urgency of critical values and the need for rapid response, especially in underperforming units.
4. **Monitor TATs weekly or monthly.** Establish a continuous audit mechanism and develop dashboards to visualize department-wise TAT trends.
5. **Strengthen Accountability Structures:** Designate responsibility for both communication and action with clear escalation pathways.
6. **Encourage Interdepartmental Collaboration:** Facilitate joint meetings between lab staff, nursing teams, and clinical departments to discuss challenges and solutions.
7. **Evaluate Shift-Wise Performance:** Assess differences in TATs between day and night shifts to address staffing gaps during off-hours.

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