Pak. J. Biochem. Mol. Biol., 2024, 57(2):1-5

Research Paper

Timely Reporting of Critical Alerts; a Key Performance Indicator in Clinical Laboratories

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ABSTRACT

Timely reporting of critical laboratory results is crucial for patient safety and clinical decision-making. Critical alerts, also known as panic values, necessitate immediate communication with clinicians to enable prompt intervention. This study evaluates the frequency and timeliness of critical alert reporting as a key performance indicator in a specialized kidney institute's clinical laboratory. A retrospective cross-sectional study was conducted at the Multan Institute of Kidney Diseases over 2.5 years (April 2021–October 2023). Data on critical alerts were extracted from the Laboratory Information System (LIS) and analyzed using Microsoft Excel. The study assessed the incidence of critical values across different lab sections and evaluated adherence to the 30-minute reporting benchmark. A total of 1,015,285 tests were processed, with 18,540 (2.5%) yielding critical values. The majority of alerts originated from chemical pathology (83.4%), followed by hematology (16.6%). Despite a stringent reporting target of 30 minutes, the compliance rate was high, with hematology achieving 99.82% and chemical pathology 96.72% of timely notifications. Serum electrolytes, creatinine, and complete blood count (CBC) tests were the most frequently flagged parameters. Notably, the outpatient department (OPD) accounted for the highest number of critical alerts due to higher test requisition rates. The study highlights the effectiveness of structured protocols and digital tools in enhancing the timeliness of critical result reporting. While the laboratory demonstrated high compliance with CAP-recommended reporting timeframes, occasional delays were attributed to system workload and recipient response time. Continuous staff training and the integration of automated alert systems could further optimize reporting efficiency and patient care.

KEYWORDS: Critical alerts, laboratory medicine, key performance indicators, patient safety, clinical decision-making, quality assurance.

INTRODUCTION

The term "critical result," also known as panic values or critical alerts, was first introduced in the field of laboratory medicine by Dr. Lundberg (1). Due to their potential to pose an immediate threat to patients' well-being, urgent notification of these alerts to clinicians, concerned staff, or patients is crucial. A study revealed that 95% of physicians consider urgent communication of critical alerts a useful tool, as approximately two-thirds of lab alerts must result in changes in clinical decisions and treatment options. However, to enhance the usefulness of this tool, laboratory staff and caregivers other than physicians must be aware of the pathophysiological factors leading to an alarming test result (2). Therefore, staff training and education should be conducted extensively and regularly.Critical values symbolize a unique clinic-laboratory connection. When critical alerts are promptly communicated to the key caregiver, they directly influence treatment strategies and outcomes, positively impacting patient safety and well-being. In addition to physicians and nurses, patients can also be informed about their critical results, enabling them to make informed choices regarding any clinical intervention (3).

After the implementation of accreditation and certification programs in clinical laboratories, prompt reporting of critical alerts has emerged as a key indicator for quality assurance (4). Numerous laws, regulations, and accreditation programs, such as the College of American Pathologists (CAP), mandate early reporting (5). CAP guidelines emphasize the recognition of critical values and their notification methods, such as call centers and phone calls(6). These guidelines have also established cutoffs for critical results; for example, CAP declares

hemoglobin levels ≤6 g/dl as an alert (7). In our organization, preliminary critical values lists are provided by the physicians of clinical wards. Following meetings with all department heads, nursing heads, and hospital administration, the most crucial tests are selected for inclusion in the critical list, and their cutoffs are defined taking into account CAP recommendations. This process facilitates the development of the laboratory's critical list and notification policy standard operating procedures (SOP)(8).

Reporting critical alerts should be the most prioritized aspect of the post-analytical phase. Its entire process involves the identification of alerts by laboratory personnel and communication with the primary healthcare provider (9). The Laboratory Information System (LIS) is the software utilized by various laboratories, autonomously warning users by displaying alarming lab results in a separate window. Staff address each alert according to the critical reporting SOP(10). After notifying critical alerts to the primary caregiver via a phone call using MicroSIP, they record it in a critical window in the LIS and then approve the result by adding remarks. To minimize communication errors, the listener on the receiving end of the phone call is advised to read back the result just heard. The incidence of critical alerts and the timeliness of notification to responsible staff within the target time may serve as key performance indicators.

In the present study, we investigated the frequency and timeliness of critical values in our lab sections to identify areas for improvement in lab's reporting.

MATERIALS AND METHODS

This retrospective, cross-sectional study was conducted at the Multan Institute of Kidney Diseases, Multan, over a period of 2.5 years, from April 2021 to October 2023. Following approval from the Institutional Review Board, relevant data were extracted from the Laboratory Information System (LIS).The information was systematically recorded in a Microsoft Excel spreadsheet specifically designed for data collection, incorporating all necessary variables. The compiled data were subsequently exported and analyzed using Microsoft Excel. All laboratory samples received during the study period were included, except for those that were rejected.

RESULTS AND DISCUSSION

The dataset comprised a total of 1,015,285 tests requested by clinicians in the clinical laboratory of MIKD, Multan., Pakistan. Of these, the indoor, outdoor, and emergency departments accounted for 44.07%, 41.63%, and 14.29% of the requisitions, respectively. Regarding laboratory sections, chemical pathology & hematology performed 70.55% & 17.92% of tests, respectively with an overall yield of critical results of 2.5% (18,540). Between the sections, chemical pathology had the highest ratio of lab alerts (83.4%), followed by hematology (16.6%) (Figure 1).

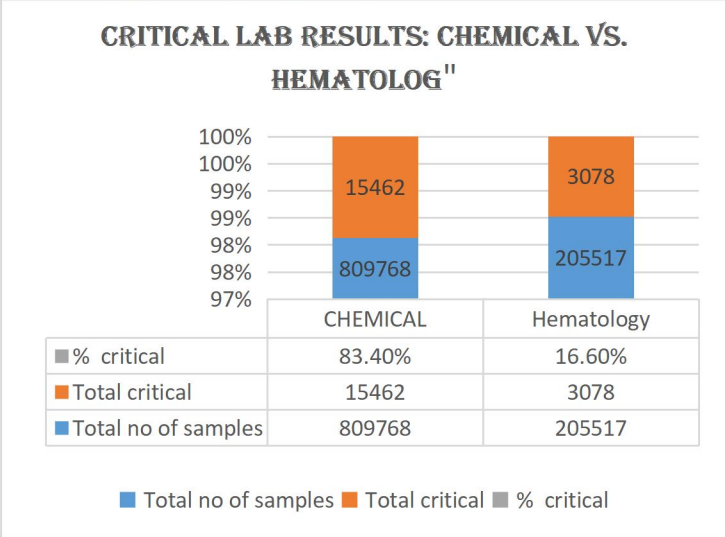

Figure 1: Chemical and Hematology lab tests results.

In terms of assessing timeliness, sections were unable to meet their target benchmark of 100% critical reporting within a 30-minute time window. However, they achieved near-to-goal performances, with hematology at 99.82% and chemical pathology at 96.72% of the target point. As a specialized kidney institute clinical laboratory, it was unsurprising to find that creatinine, serum potassium, and complete blood count (CBC) tests led to the most recurrent and frequent critical alerts.

Out of 1,015,285 investigations requested during the 28-month duration, 18,540 tests resulted in critical findings (Figure 2). It is noteworthy that the most frequent alerts were related to serum electrolytes as shown in the table 1.

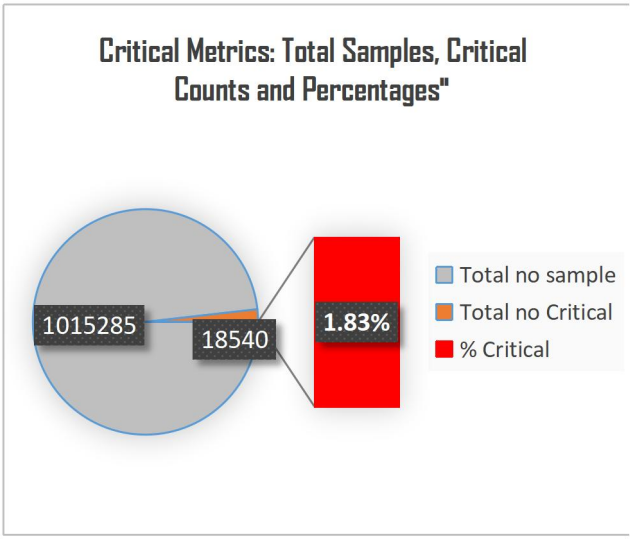

Figure 2: Critical metrics: Total samples tested and critical test count.

Parameters	No. of alerts	ER	IPD	OPD
CBC	2880	927	846	1107
CREATININE	5523	2671	729	2123
LFT	785	229	330	226
APTT	54	6	17	31
PT	107	32	26	49
CALCIUM	968	360	259	349
RETICS	14	0	9	5
S. ELECTROLYTE	8142	2474	1802	3866
S.ALBUMIN	44	10	17	17
MP ICT	23	2	19	2
TOTAL	18540	6711	4054	7775

Table 1: Key parameters conducted during this study.

Given that MIKD hospital specializes in kidney diseases, it's common for patients to present with renal failure, leading to disturbances in electrolyte homeostasis. This aligns well with our findings and is supported by Agarwal et al. (11); they also identified serum electrolytes as the most commonly notified lab alerts.

Oğuzhan Özcan et al. (12) conducted a pilot study involving 197,654 tests, resulting in a 1.02% incidence of critical results over 2 months, with a target reporting timeframe of 15 minutes. However, they achieved only 86.9% success in reporting lab alerts within the specified time frame. In contrast, our laboratory achieved a 97.2% success rate in meeting the target reporting time, with only 2.8% of alerts notified beyond the half-hour mark. The lower success rate reported by Oğuzhan Özcan et al. (12) compared to ours may be attributed to the shorter timeframe used in their study. Conversely, our clinical laboratory demonstrates satisfactory practices and staff performance. In a study by Dighe et al. (13), they found that out of 14 million tests conducted, 37,503 critical alerts occurred, representing a 0.25% occurrence rate. The majority of alerts originated from the chemical section, with the most frequent analyte being serum potassium. This finding aligns closely with our own, as most alerts in our laboratory also originated from the chemical pathology section, as described previously. This could be attributed to the bigger range of analytes covered by the chemical pathology section compared to hematology (12,13)

It was important to note that most of the alerts originated from the outpatient department (OPD), as depicted in the table above. This could be attributed to the higher test requisition rate from the OPD. Additionally, the limited indoor setup, with just 100 beds across all clinical wards, results in lower turnover from the inpatient department (IPD). In contrast, a large number of patients visit filter and consultant clinics in the OPD six days a week, leading to a higher sample turnover. Our findings differ from those of Dighe et al. (13) and Oğuzhan Özcan et al. (12), who found the highest number of critical alerts originating from the IPD. This disparity may be attributed to the larger size and IPD structure with numerous beds in their hospitals (12,13).

According to CAP, a post-analytical 15-30-minute timeframe can serve as a realistic benchmark for major indoor critical reports (14). Whereas, our critical reporting SOP orders the lab staff to report alerts of all departments, even for OPDs, within a 30-minute timeframe. This

stringent protocol guided by CAP signifies good lab practices & quality care in our hospital.

Over the decades, medical laboratories have been using diverse visual/audio alerts and tools such as phone calls, texts, and electronic reports to avoid any delays in critical reporting (15). Nevertheless, phone calls exist as the most prevalent practice in clinical labs because of their cost-effectiveness, user convenience, and the application of the 'read-back' technique (16). In 2009, Piva et al. (4) studied the comparison of the effectiveness of critical notification via telephone call (30 min cutoff) vs. computerized alerts (11 min cutoff), with 50.9% and 10.9% of delayed notifications respectively. They inferred that an automatic computerized system leads to reduced notification time and, thus earlier reporting (4). Our lab currently doesn't have a computerized alert facility, but as soon as our staff receives the critical result, they verify it by rerunning, correlating it with patient clinical history in HIMS (Hospital management information system), then informing the primary caregiver on the phone using the SBAR method. As we use the MicroSIP system, it's pretty useful in our setting as it raises a red flag with remarks of 'lab critical' on the receiver's phone screen. Moreover, it records all the conversations along with the track of time, date & extension number. These features make it a very helpful tool for root-cause analysis, evidence & audits. Our study revealed that 99.0% of the critical reports met the 30-minute benchmark successfully and there was a 1.0% failure to inform within the defined timeline. The principal causes behind this failure were mainly the slowing down of LIS due to high workload, shortage of staff on public holidays, and lack of response at the recipient's end due to an increased amount of work.

Howanitz et al. (6) narrated that about 71.4% of their study participants did not formulate any policy on dealing with repeated critical alerts. Furthermore, 94.9% of the physicians & 20.8% of nursing supervisors among participants declared the critical list as a valuable tool. In contrast to those, our hospital has well-defined SOPs for informing and reporting fresh as well as recurring critical alerts. Moreover, all doctors & nursing offices have displayed lists on their notice boards as they consider it a very effective tool (6).

In past literature on hematology, there's no clear agreement on which factors and values should be deemed critical (17). However, many laboratories have defined critical value cut-offs for platelets, leukocytes, and hemoglobin. Whereas, many other laboratories have listed finding blast cells and malaria parasites in the smear as an alert. In addition to the above-mentioned five parameters, our critical list for hematology includes prothrombin time, activated partial prothrombin time, schistocytes, and reticulocyte count as well. A greater number of parameters as compared with the literature depicts a robust protocol, a high level of care & quality assurance by our lab staff.

CONCLUSION

Present study emphasizes how important it is for hospitals to disclose test alerts promptly and efficiently. Regardless of workload and limited resources, there was evident conformance to the set protocols. For high-quality reporting, personnel training must occur regularly. By adopting guidelines and utilizing the right technology, laboratory personnel can optimize the effectiveness of critical reporting, boosting both patient safety and quality assurance.

ACKNOWLEDGEMENTS

We are deeply grateful to the IT department, MIKD for their seamless data retrieval support, which saved us considerable time. Special thanks to Mr. Ahmad Hasan, lecturer at Islamia University of Bahawalpur for his meticulous reference and correction of grammatical mistakes. Their invaluable contributions significantly enhanced the quality of our research.

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