

Delayed verification and communication of critical laboratory results in a Nigerian tertiary hospital: a case based quality improvement report

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Case Report

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Abstract

Background: Timely communication of critical laboratory results is a core patient- safety function of the total testing process. Its effectiveness depends on analytical quality and also on result authorisation, communication channels, acknowledgement and clinical action. In Nigeria, critical value notification practices are reported to be variable and often unsupported by written policy

Case presentation: A blood specimen from a 57 year old man admitted to the ICU was received at 4:35 p.m. and processed using a Selectra Pro XL analyser, with processing completed at approximately 4:50 p.m. Markedly abnormal biochemical results were identified, and the sample was rerun for verification, with quality-control procedures performed. Results (sodium 120 mmol/L, potassium 6.4 mmol/L, chloride 92 mmol/L, bicarbonate 8 mmol/L, urea 40.5 mmol/L, creatinine 1005 µmol/L; calculated anion gap 20 mmol/L) were confirmed by rerun with acceptable quality control and prepared at about 5:10 p.m. Supervisory verification occurred at 8:05 a.m. the next day (15 h 30 min after receipt), and the results were obtained by a resident at about 10:00 a.m., when the author was informed the patient was in shock. No formal critical result policy, critical value list, after hours verification arrangement or clinician contact process existed. The patient's outcome is unknown, and causation cannot be inferred.

Discussion: The reported timeline suggests a substantial interval between result preparation, supervisory verification and the clinical team obtaining the results. Although analytical processing was completed promptly, the absence of a formal critical result communication pathway raises concerns about after hours verification, timely notification, escalation and documentation.

Conclusions: Rapid analysis does not guarantee timely clinical awareness. Laboratories and clinical teams should establish clear responsibilities, accessible contact details, documented notification procedures and confirmation of receipt to strengthen patient safety.

Background

Critical laboratory results are results that could point to a potentially fatal condition and need to be communicated right away to a clinician so they can take appropriate action [1]. The idea originated with Lundberg's demand that outcomes be "acted on" rather than just reported [2]. The post-analytical phase is a recognized source of laboratory related risk since a result that has been created but has not reached the competent clinician contributes nothing to patient treatment [1,3]. According to international standards, laboratories must specify crucial intervals and quickly notify the requesting clinician of such results [4]. Critical result reporting is an established patient safety goal in accreditation frameworks [4,5].

Evidence from Nigeria is limited. A nationwide survey of secondary and tertiary tier laboratories (134 respondents) found that critical value notification was practised by 69 laboratories, of whom 23 reported a written policy, and concluded that practice was variable and often suboptimal in the absence of guiding policies and national recommendations [6]. That survey was conducted in late 2015 and published in 2023, so current practice may differ, and its findings cannot be applied to every hospital.

This report analyses one incident in a tertiary hospital laboratory. Its purpose is to show, using a documented timeline, how a laboratory can analyse a life-threatening result promptly and still fail to deliver it, and to propose practical, locally feasible corrections.

Methods

Setting

The event occurred in the clinical chemistry section of the laboratory of a Nigerian tertiary teaching hospital July, 2026. At the time, two interns and one scientist on call was present. Under the hospital's established laboratory hierarchy, results required verification and authorisation by an adequately designated senior laboratory professional, such as a senior medical laboratory scientist or pathologist with substantial experience and advanced training, was required to verify and authorize the results. Before results are approved for clinical use. This supervisory verification procedure is meant to enhance quality assurance, verify the validity of reported findings, and make sure that all relevant quality control and result release standards are met.

Chemistry analysis was performed on a Selectra Pro XL analyser. The hospital had no written critical result policy, no laboratory specific critical value list and no routine mechanism for contacting requesting clinicians.

Design and data sources

This is a single incident analysis written by the medical laboratory scientist who performed the test. Clinical information was limited to what was recorded on the request form (age, sex, ward). No provisional diagnosis or clinical details were provided, and no clinical records were accessed. The request was not marked urgent.

Pre-analytical and analytical procedures

Venous blood was collected by a phlebotomist at about 4:30 p.m. into a plain gel-separator serum container and delivered to the laboratory, where it was received at 4:35 p.m. Serum was assayed; it was clear on visual inspection, with no visible haemolysis, icterus or lipaemia. Because abnormal values were obtained, the sample was rerun and gave the same results. Internal quality control was performed. Reference intervals were those used routinely by the laboratory for adult males and were established by manufacturer's of labkit reagent and local verification of controls.

Analysis of contributing factors

Contributing factors were identified by the author from direct knowledge of the workflow and organised with a fishbone framework (people, process, policy, equipment/information systems, environment) and a "5 whys" sequence. These are the author's analysis and not the findings of a formal institutional.

Results

Patient and biochemical results

The patient was a 57 year-old man admitted to the ICU. The request form carried no provisional diagnosis, history, medication or previous results, and none could be obtained retrospectively. Accordingly, the indication for testing, previous renal function, haemodynamic status, ECG findings, treatment and final outcome are unknown to the author. The patient's biochemical results and the corresponding laboratory reference intervals are presented in Table 1.

Table 1 : The patient's biochemical laboratory findings

Analyte	Result	Rerun	Reference interval (adult male)	Flag
Sodium	120 mmol/L	120 mmol/L	136–148	Low
Potassium	6.4 mmol/L	6.3 mmol/L	3.0–5.5	High
Chloride	92 mmol/L	92 mmol/L	98–110	Low
Bicarbonate	8 mmol/L	8 mmol/L	20–30	Low
Urea	40.5 mmol/L	40.5 mmol/L	2.5–7.5	High
Creatinine	1005 µmol/L	1003 µmol/L	62–124	High
Anion Gap (Without Potassium)	20 mmol/L	20 mmol/L	8–12	High

The results are internally coherent, with severely reduced bicarbonate and markedly raised urea and creatinine, is consistent with a high anion gap metabolic acidosis of the kind seen in advanced renal failure. Albumin was not measured, so the gap could not be albumin corrected, and blood gas analysis was not available to confirm the acid–base disorder. Sodium, potassium and bicarbonate would each fall within commonly published critical or alert limits (for example, potassium at or above about 6.0–6.5 mmol/L, bicarbonate at or below about 10 mmol/L, and sodium at or below about 120–125 mmol/L, depending on the list) [8]

Reliability of the results

Several features argue that the values were genuine and not pre analytical artefact. The sample reached the laboratory within about 5 minutes of collection, limiting the risk of delayed separation pseudohyperkalaemia and in-vitro bicarbonate loss. The serum was visually free of haemolysis, the rerun reproduced the values, and quality control was acceptable. The sequence of events, from specimen receipt and processing to supervisory verification and subsequent collection of the results by the resident, is summarised in Table 2.

Table 2 : Timeline of events

Time	Event	Interval
4:30 p.m., Day 1	Blood collected on the ward	–
4:35 p.m., Day 1	Specimen received in the laboratory	0
About 4:50 p.m., Day 1	Analysis completed; markedly abnormal results; rerun and quality control performed	15 min
About 5:10 p.m., Day 1	Results prepared, awaiting supervisory verification	35 min
8:05 a.m., Day 2	Supervisory verification completed	15 h 30 min
About 10:00 a.m., Day 2	Results obtained by a resident during a ward round; the author was informed the patient was in shock	17 h 25 min
Thereafter	Clinical course and outcome unknown	–

Following preparation at approximately 5:10 p.m, the results remained pending, requiring supervisory verification until 8:05 a.m. the following day. After verification, the results were prepared and left for collection by, or submission to, the clinician who had requested the investigation. The resident reportedly obtained the results at approximately 10:00 a.m from the laboratory. No telephone call was made to the ICU or ward to communicate the critical findings before the results were obtained. Although the laboratory scientist recognised the clinical significance of the abnormalities, the laboratory did not have an established policy or routine practice for direct critical result notification. Consequently, no formal telephone notification or escalation process was initiated. The patient was reportedly in shock when the resident obtained the results, however, the patient's subsequent clinical course and final outcome were unknown to the reporting author. The principal contributing factors identified from this incident,are summarised in Table 3.

Table 3 : Contributing factors

Domain	Contributing factor identified
Policy	No written critical-result procedure, critical-value list or notification time target
Process	Release of all results required supervisory authorisation, with no delegated or on call verifier for the evening shift
Process	Results were routinely sent to wards or collected by doctors or nurses, with no active notification and no read back
Information	Request form lacked clinical details and a reliable clinician or ward telephone contact
People/staffing	Two Medical Laboratory intern and a scientist on call with no supervisor to verify results.
Culture/organization	Bench scientists did not consider direct notification of a clinician before final authorisation to be part of their role
Clinical interface	No documented clinician-initiated follow-up of a pending ICU result over about 15 hours.

A “5 whys” sequence summarises the chain: the clinician did not know the result because it had not been communicated; it was not communicated because it was awaiting authorisation; authorisation was delayed because no after-hours verifier was authorised; no notification occurred because no policy permitted or required bench level notification; and no policy existed because the post-analytical phase had not been formally governed within the laboratory or between the laboratory and clinical departments.

Post event actions

The incident was reported verbally to the Director of Laboratory Services following concerns raised by the clinical team, whose clinician attributed the patient's reported shock to the delay in obtaining the laboratory results. This attribution reflects the clinician's concern and does not establish a causal relationship between the reporting delay and the patient's clinical condition.

Discussion

Principal observation

This incident shows a process failure that was invisible to conventional laboratory quality measures. Analytical performance was good: the sample was analysed within 15 minutes of receipt, the abnormal values were rerun and quality control was performed. The failure lay in the post-analytical phase, where a result describing severe hyperkalaemia, acidosis and renal failure waited about 15 hours for a signature and was then collected passively. Analytical turnaround time is therefore a poor proxy for the time taken

for a clinician to learn a result, and laboratories should measure the interval from result availability to clinician acknowledgement [2,3,7].

We cannot say whether the delay contributed to the patient's shock. The patient was already in the ICU, the clinicians may have been managing a known renal problem, shock may have had other causes such as sepsis or hypovolaemia, and the outcome is unknown. What can be said is that a potassium of 6.4 mmol/L with severe acidosis is a recognised indication for urgent clinical assessment, ECG and treatment [8], and that for 15 hours nobody with the ability to act was told of it.

Verification and urgency are not opposites

The central practical lesson is that result authorisation and result communication are separate functions and should not be chained together. Supervisory authorisation protects the quality of the final report. It was never intended to prevent a bench scientist from telling a clinician that a patient may be in danger. International guidance does not require final authorisation before a critical result is communicated. ISO 15189 requires laboratories to define critical intervals and communicate them promptly [9, 10], and CLSI GP47 describes defined risk results, defined time frames, designated recipients and documentation of the communication, including read-back [11,12]. In practice, the bench scientist who has run, rerun and quality controlled a result is the most appropriate person to make the first call, and the report can be authorised afterwards.

I suggest the following hierarchy of safe options, from most to least immediately feasible in a resource-limited hospital:

1. Bench-level telephone notification of designated critical results by the scientist who performed the test, to the ICU or ward nurse in charge or the responsible clinician, with read-back and a written log, before and independent of authorisation.
2. Delegated verification by a named competent scientist, within defined competency and professional-regulatory limits, so that urgent results can be released outside normal hours.
3. On-call authorised verifier, reachable by telephone, with the authority to release critical results remotely or by return to the laboratory.
4. Information-system support, where a LIS exists: critical flags, auto-verification rules for results that pass defined checks, and an escalation alert if a critical result is unacknowledged.

Options 1 and 2 require no new technology and could be introduced by local policy within weeks. The additional risk of communicating a result before authorisation is small when the result has already been repeated and passed quality control, and it is outweighed by the risk of silence.

Why this gap persists in a tertiary institution

The absence of a policy in a tertiary teaching hospital deserves explanation and not only description. The Nigerian survey linked variable practice to the absence of guiding policies and national

recommendations for post-analytical procedures [6]. Based on this incident, we suggest several plausible and testable contributors, which should be regarded as hypotheses. First, the laboratory may be regarded as a service that produces reports and not as a clinical partner responsible for delivery, so “collection by the ward” becomes the default. Second, authorisation hierarchies may be applied rigidly to all results, with no delegated pathway. Third, request forms often lack diagnoses and reliable contact details, which makes direct notification harder. Fourth, evening and night laboratory staffing is typically thin, so the person most able to authorise is least available. Finally, formal accreditation and external requirements that would force a critical-result policy, such as ISO 15189 or national regulatory requirements, are not yet routine in many laboratories. Laboratories that did report telephone notification in the national survey were more often private than public hospital laboratories [6], which suggests that institutional setting influences practice.

Failure is shared between laboratory and wards

A critical result needs a recipient who is looking for it. In this case no one appears to have chased an ICU result for about 15 hours, and the request form gave the laboratory no way to reach the clinician. A closed loop process therefore needs both ends: laboratory-initiated notification with read-back, and clinical-unit procedures that define who receives results, how pending urgent tests are followed up, and how results are escalated in ICUs. Introduction of a combined laboratory–ICU agreement is likely to be more effective than a laboratory only policy.

Recommendations

To strengthen patient safety and improve the timely communication of critical laboratory results, several recommendations are proposed, including the development of a formal critical result notification policy, establishment of an after hours verification and escalation pathway, direct communication of critical findings to the responsible clinical team, documentation of notification and acknowledgement, and regular audits of compliance. These recommendations are summarised in Table 4.

Table 4. Recommendations for improving critical laboratory result communication and patient safety

Priority	Action	Feasibility in a resource-limited hospital	Suggested measure/target
Immediate	Written one page critical-result SOP authorising bench-level telephone notification with read-back, before authorization	High; no cost	SOP approved and in use
Immediate	Interim critical value list drawn from published lists and agreed with ICU and medical leads	High	List approved; reviewed annually
Immediate	Critical-result log: result, time available, recipient, time, read-back confirmed	High; paper log is adequate	100% of critical results logged
Immediate	Request forms to include ward, clinician and telephone contact	High	At least 95% of forms completed
Short term	Named delegated or on-call verifier for evenings, nights and weekends	Moderate; needs governance approval	No result held longer than a locally agreed limit; urgent results released within 1 hour
Short term	Escalation steps if the recipient cannot be reached (nurse in charge, on call resident, duty manager)	High	Escalation documented in every failed contact
Medium term	Joint laboratory clinical agreement on receipt and follow-up of urgent results	Moderate	Agreement signed by laboratory and ICU
Medium term	Audit of time from result availability to acknowledgement	Moderate; logbook-based audit is feasible	Notification within 30 minutes (acceptable range 30–60 min, to be set locally) in at least 90% of critical results
Long term	LIS flags, alerts and secure messaging; progress to ISO 15189 accreditation	Lower in the short term	Alerts functioning; accreditation achieved

Limitations

This report describes one event. It cannot establish prevalence, nor causal links between the delay and the patient's shock. The patient's clinical history, treatment and outcome were not available. Whether blood gas analysis, ECG or repeat potassium were performed is unknown. Haemolysis was assessed visually, and previous results were not available for delta checking, so a pre-analytical contribution to potassium and bicarbonate cannot be entirely excluded, although the coherent overall pattern argues against it. The contributing factors are the author's analysis and not a formal root cause investigation,

and the author's involvement in the event is a potential source of bias. Individuals are not identified, and the report concerns systems and not individual blame.

A small retrospective audit of how often abnormal or urgent results wait overnight for authorisation, and how long they take to reach clinicians, would turn this account into evidence and is the logical next step.

Conclusions

A laboratory can analyse a life threatening result within minutes and still fail the patient if the result is not authorised, communicated and acknowledged. In this incident, a result consistent with severe hyperkalaemia, metabolic acidosis and renal failure waited about 15 hours for authorisation and was then collected passively, in a hospital without a critical-result policy. Authorisation and notification should be separated, with bench-level telephone notification and read-back, an authorised after-hours verifier, accurate contact details, escalation steps and routine audit. These are inexpensive and achievable even without an information system, and tertiary hospitals, regulators and professional bodies in Nigeria should consider making them a minimum standard.

Declarations

Ethics statement

According to the guidance provided by the hospital, separate ethics committee approval was not required for publication of this case report. Permission to publish the laboratory case was granted by the Director of Laboratory Services. Consent for publication was obtained from the patient's next of kin. Patient confidentiality was maintained by excluding identifying information.

Clinical trial number

Not applicable.

Availability of data and materials

The data supporting this report are contained within the article. Further inquiries can be directed to the corresponding author.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author Contribution

Abigail was responsible for the conception of the case study, investigation and documentation of the laboratory incident, collection and interpretation of the available information, literature review, and preparation of the manuscript. Abigail reviewed and approved the final version of the manuscript and accepts responsibility for the integrity of the work.

References

1. Lippi G, Mattiuzzi C. Critical laboratory values communication: summary recommendations from available guidelines. *Annals of Translational Medicine* 2016 Oct 1;4(20):400. Available from: <https://doi.org/10.21037/atm.2016.09.36>
2. Lundberg GD. Acting on significant laboratory results. *JAMA* 1981 May 1;245(17):1762. Available from: <https://doi.org/10.1001/jama.1981.03310420052033>
3. Krleza JL, Honovic L, Tanaskovic JV, Podolar S, Rimac V, Jokic A. Post-analytical laboratory work: national recommendations from the Working Group for Post-analytics on behalf of the Croatian Society of Medical Biochemistry and Laboratory Medicine. *Biochemia Medica* 2019 Apr 14;29(2):228–61. Available from: <https://doi.org/10.11613/bm.2019.020502>
4. Lippi G, Mattiuzzi C. Critical laboratory values communication: summary recommendations from available guidelines. *Annals of Translational Medicine* 2016 Oct 1;4(20):400. Available from: <https://doi.org/10.21037/atm.2016.09.36>
5. Davids A, Zemlin AE, Kruger EC. Challenges with communication of critical laboratory results in a resource-limited setting in South Africa Davids | *African Journal of Laboratory Medicine*. 2024. Available from: <https://ajlmonline.org/index.php/ajlm/article/view/2457/2981>
6. Imoh LC, Mohammed IY, Nnakenyi ID, Egbuagha EU, Adaja TM, Onyenekwu CP. Critical values notification: A nationwide survey of practices among clinical laboratories across Nigeria. *African*

- Journal of Laboratory Medicine 2023 Dec 15;12(1):2249. Available from:
<https://doi.org/10.4102/ajlm.v12i1.2249>
7. Dawande PP, Wankhade RS, Akhtar FI, Noman O. Turnaround time: an efficacy measure for medical laboratories. *Cureus* 2022 Sep 6;14(9):e28824. Available from:
<https://doi.org/10.7759/cureus.28824>
 8. Jung B, Martinez M, Claessens YE, Darmon M, Klouche K, Lautrette A, et al. Diagnosis and management of metabolic acidosis: guidelines from a French expert panel. *Annals of Intensive Care* 2019 Jan 1;9(1):92. Available from: <https://doi.org/10.1186/s13613-019-0563-2>
 9. Lam Q, Ajzner E, Campbell CA, Young A. Critical Risk Results - An Update on International Initiatives. *EJIFCC*. 2016 Feb 9;27(1):66-76. PMID: 27683507; PMCID: PMC4975218.
 10. ISO 15189:2022. Medical laboratories — Requirements for quality and competence. Geneva: International Organization for Standardization; 2022.
 11. Clinical and Laboratory Standards Institute. GP47: Management of Critical- and Significant-Risk Results. 1st ed. Wayne, PA: CLSI; 2015.
 12. Rodríguez J a. D, García MIP, Cobo CG, Más ARP, Alabern IL, Bauça JM. Assessment of a laboratory critical risk result notification protocol in a tertiary care hospital and their use in clinical decision making. *Biochemia Medica* 2019 Jul 17;29(3):513–21. Available from:
<https://doi.org/10.11613/bm.2019.030703>