A survey of doctors' perspectives on critical laboratory result communication in Cape Town, South Africa

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Background. Critical laboratory results indicate that a patient is in imminent danger without timely intervention, and prompt communication can improve patient safety. Our laboratory has been trialling different methods of communication to improve our service, including the patient referral application Vula.

Objective. To evaluate clinicians' perceptions of critical laboratory results reported by the Tygerberg Hospital Chemical Pathology Laboratory in South Africa (SA) at various levels of care to identify current challenges, areas for improvement, and preferred communication methods.

Methods. A cross-sectional survey was utilised to explore medical professionals' perceptions at different levels of health facilities within Cape Town, SA. The electronic survey targeted clinicians employed at the study sites and excluded auxiliary healthcare staff and was distributed from 10 September 2024 to 31 December 2024. The survey collected data on participants' demographics, experiences, preferences, and expectations regarding critical result communication methods.

Results. A total of 76 responses were obtained; 2 were incomplete and excluded. Over half of the respondents had at least 4 years of clinical experience across various disciplines. The majority (n=71, 95.9%) found the communication of critical results to impact patient care. Direct phone calls were favoured by 45.9% (n=34), whereas 44.6% (n=33) preferred mobile methods such as short message service (SMS) or WhatsApp.

Conclusion. This study provides insights into clinicians' perceptions of critical laboratory result reporting in healthcare facilities in Cape Town. The findings will help enhance communication practices and develop a standard operating procedure for the Tygerberg Hospital Chemical Pathology Laboratory.

Keywords. Laboratory critical results, results notification, patient safety

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Contribution of the study

This study provides insights into clinicians' perspectives of critical laboratory result reporting from different levels of care within Cape Town, South Africa. It highlights both the value of existing communication practices and the areas that require improvement. The findings will support the development of standardised communication strategies aimed at enhancing patient care.

Critical laboratory results, first described by Lundberg in 1972, are defined as test results indicating that a patient is in imminent danger without timely intervention.[1] Reporting of critical laboratory results is a key accreditation requirement in clinical laboratories. The International Organization for Standardization (ISO) 15189 is an international standard that outlines the requirements for quality and competence in medical laboratories.[2] The 2022 update to the standard emphasises the importance of patient safety and risk management, where a key aspect of this standard is the communication of critical laboratory results. It states that the user or another authorised person should be notified 'as soon as relevant', based on available clinical information.[2] Prompt communication of critical laboratory results can assist in decreasing patient morbidity and mortality.[3]

Despite its significance, challenges remain in managing critical result reporting. Communication of critical results is often heterogeneous among laboratories, both internationally and within the same country.[4] This heterogeneity is influenced by variations in staffing resources, patient demographics, and organisational frameworks.[5] An identified issue is the notification process, including the methods of communication and the personnel responsible for accepting and acknowledging critical results.[6] Studies have highlighted additional challenges, such as physicians not answering calls when off duty.[7,8] These factors underscore the need for improved communication strategies to enhance the effectiveness of critical laboratory result reporting.

In South Africa (SA), the National Health Laboratory Service (NHLS) Chemical Pathology Expert Committee determines critical result notification values. These values are nationally harmonised and undergo regular review (*Supplementary Material 1*). Currently, the Tygerberg Hospital (TBH) Chemical Pathology Laboratory relies predominantly on telephonic communication of critical results, which is labour-intensive as multiple factors delay reporting to clinicians.[9] The laboratory information system (LIS) (InterSystems TrakCare Lab Enterprise, USA) cannot automatically send critical laboratory results to clinicians via the web-based application. However, a short message

service (SMS) can be automatically sent to clinicians' cell phones to alert them of critical results. Regrettably, this often does not occur, for reasons including incomplete laboratory request forms lacking a Health Professions Council of South Africa (HPCSA) registration number with a linked cell number or no contact details assigned via the LIS, preventing an SMS from being sent.

To improve our current practices, we are exploring supplementary methods of communication of critical laboratory results. One such method is the utilisation of a mobile-based application (app) – Vula.[10] This secure mobile patient referral app has been available in SA since 2014 and complies with the Protection of Personal Information Act (POPIA). The app was developed in SA to provide prompt access to specialist advice and referrals. Different specialities have adopted this mobile app, and improvements in service delivery have been reported.[11] More than 36 000 healthcare professionals and over 2 000 healthcare facilities across SA are registered on this platform which can be downloaded on Android and iOS devices.[10] We have been trialling this app at various sites to communicate critical chemistry laboratory results, achieving varying levels of clinician acceptance of this method of communication. There is currently a paucity of literature regarding critical laboratory result notification from the clinicians' perspective in resource-limited settings.

To address this gap, this study aimed to determine clinicians' perceptions regarding critical laboratory results reported by the TBH Chemical Pathology Laboratory. By determining the perceptions of medical professionals working at different levels of care, we aim to identify current challenges and areas of improvement and the preferred methods of communication.

Methods

Ethical considerations

This study was approved by the Stellenbosch University Health Research Ethics Committee (ref. no. S24/05/104_Sub Study S22/07/139) and was performed in accordance with the Declaration of Helsinki. Permission was obtained from each facility's management to conduct the survey. Participant information was provided before survey questions were displayed on the electronic survey. This described that consent was given by completing the survey and assured that no identifying data were collected, to maintain confidentiality.

Study setting

The study was conducted across multiple healthcare facilities in Cape Town, SA, spanning different levels of care. These included TBH, a tertiary referral centre; Karl Bremer Hospital (KBH) and Eerste River Hospital (ERH), both secondary district hospitals; and Elsies River Community Health Centre (CHC), Kraaifontein CHC, and Delft CHC, which are primary healthcare facilities. The study targeted clinicians at different levels of training employed at the study sites and excluded auxiliary healthcare staff. The TBH Chemical Pathology Laboratory, situated at a tertiary care centre, processes approximately 120 000 samples each month from across the region. Qualified chemical pathologists, registrars and medical technologists communicate critical laboratory results to inpatient and outpatient care facilities, including the above study sites.

Study design and data collection

This study employed a cross-sectional survey design to explore medical professionals' perceptions of laboratory critical result reporting across various levels of care. The survey was developed electronically using REDCap (Vanderbilt, USA) and was adapted from the survey used by Shapkaitz and Levy.[9] The updates and additions made by the authors aimed to address specific local needs. The survey collected data on participants' demographics, including job title, years of clinical experience, primary clinical setting, hospital of employment, and medical specialty. In addition, the survey explored clinicians' experiences with current critical result communication practices, their preferred methods of notification, and their expectations regarding the timeliness of result reporting. Specific questions assessed whether clinicians received automated SMS alerts, how they confirmed verbally communicated results, and their preferences for the mode of communication. Participants were also asked about the appropriate timeframe for acknowledging digital notifications, the necessity of reporting repeat critical results, and the preferred recipients of inpatient and outpatient critical results. To ensure clarity and usability on the platform, the survey underwent pretesting with chemical pathologists and registrars within the division. The responses from the pretesting phase were excluded from the final dataset. The electronic survey targeted clinicians employed at the study sites and excluded auxiliary healthcare staff (e.g. nursing and administrative clerks). The survey was distributed between 10 September 2024 and 31 December 2024. An electronic advertisement containing a quick reader (QR) code and a hyperlink to the survey was sent to clinical managers of each hospital and heads of clinical divisions. Additionally, QR codes linked directly to the survey were displayed on posters in the wards and outpatient departments of TBH between 11 September 2024 and 31 December 2024. To encourage participation, fortnightly reminders were sent to representatives from the various sites to promote survey completion.

Statistical analysis

The data collected through the REDCap survey were exported and analysed using Microsoft Office Excel (Microsoft Corporation, USA). Descriptive statistics were applied to summarise the data, and categorical variables were presented as frequencies and percentages.

Results

A total of 76 responses were obtained; however, 2 were incomplete and excluded from the analysis. The response rate for the survey could not be calculated owing to the predominantly electronic distribution methods.

Table 1 summarises the demographics of the respondents, with more than half having at least 4 years of clinical experience and ranging among various clinical disciplines. Among those surveyed, 60.8% (n=45) were employed at TBH, 33.8% (n=25) worked at district hospitals (KBH and ERH), and 5.4% (n=4) were employed at primary care facilities (Kraaifontein CHC and Delft CHC). No responses were received from Elsies River CHC.

Table 2 presents the responses regarding perceptions of critical result communications. Other methods for escalation for communicating a critical result if the clinician could not be reached included contacting the on-call consultant, directly contacting the clinician on call or contacting another clinician willing to act on the result. Less than 10% of respondents indicated a preference for using Vula as the preferred method of communication, and all of these respondents were from TBH, KBH, and ERH. Furthermore, 40.5% of respondents (n=30) expressed that adopting Vula for communicating critical laboratory results would be appropriate in their current work environment. In contrast, 21.6% (n=16) were uncertain about its appropriateness. Direct phoning methods were preferred by 45.9% (n=34), while 44.6% (n=33) preferred mobile methods such as SMS or WhatsApp. Half of the participants preferred contacting the on-call clinician for inpatient critical laboratory

Table 1. Respondent demographics, ranks and years of clinical experience in Cape Town, South Africa, 10 September to 31 December 2024

	n (%)
What is your current job title?	
Medical intern	19 (25.7)
Medical officer	22 (29.7)
Registrar	25 (33.8)
Consultant	7 (9.5)
Head of department	1 (1.4)
How many years of clinical experience do you have?	
1 - 3	30 (40.5)
4 - 7	21 (28.4)
8 - 10	10 (13.5)
>10	13 (17.6)
In which division do you work?	
Medical intern	16 (21.6)
Internal medicine	3 (4.05)
Surgery	14 (18.9)
Obstetrics & gynaecology	8 (10.8)
Orthopaedics	2 (2.7)
Anaesthetics	9 (12.2)
Psychiatry	2 (2.7)
Family medicine	5 (6.8)
Emergency medicine	10 (13.5)
Paediatrics	3 (4.1)
Other	2 (2.7)

results, whereas 48.6% (*n*=36) indicated that the clinician who ordered the test should be contacted for outpatient critical laboratory results.

Fig. 1 illustrates the tests respondents believe should not be reported by the TBH Chemical Pathology Laboratory. Among the analytes, triglycerides were most frequently selected, with 23.0% (*n*=17). Amikacin, gentamicin, and vancomycin were the only tests not selected by any respondent as those that the laboratory should not communicate.

Discussion

This is one of the few studies from a sub-Saharan African setting that explores clinician perceptions of laboratory critical result reporting. We found that almost all respondents reported that critical results notification impacts patient care, and the preferred method of communication is direct telephonic communication.

A retrospective audit of critical laboratory results at TBH and their impact on patient outcomes performed by the authors in 2023 revealed a mortality rate of 33.3% among 120 patients who were admitted with critical results, demonstrating the link between critical laboratory findings and poor patient outcomes.[12] A survey conducted by Kavuri *et al.*[13] in the USA in 2024 explored how providers perceive receiving critical results. Their findings revealed that 58% of respondents found these results useful, but only 14% considered them indispensable for patient care. Additionally, 35% found critical result calls distract them from patient care.[13] In contrast, almost all respondents in the present survey noted that the communication of critical laboratory results significantly impacts patient care, highlighting the crucial role communication of these results plays. To effectively support clinicians and ensure timely patient management, these communication practices should be improved to meet clinician needs, ensure timely communication of results and not disrupt clinical services.

Most clinicians in our study expected critical results to be communicated within 60 minutes. However, this expectation is challenging to meet as the TBH Chemical Pathology Laboratory does not have direct access to the clinician on call at the various healthcare facilities, and retrieving this information from the hospitals' central directory is challenging in our resource-limited setting. Given this limitation, we attempted to utilise the healthcare communication app Vula as a means of communication at different sites. Benefits of the utility of Vula were described by Gloster *et al.*[14] where they evaluated the utility of Vula and its effect on the coordination of care at ERH in Cape Town over 6 months in 2019. They reported that using Vula resulted in fewer inappropriate referrals, and the clinicians using the app perceived that it improved the coordination of clinical care.[14] Additionally, Mzamo *et al.*[15] also compared the initial management and clinical outcomes of patients with open tibia fractures referred to a tertiary orthopaedic unit using Vula compared with handwritten referrals from 1 January 2018 to 31 December 2019 in KwaZulu-Natal, SA. They reported fewer complications in those referred by Vula (6%) than those referred by handwritten referrals (24%). Of note, they reported that the Vula referrals consistently had more complete data included, such as the name of the referring and receiving clinician, mechanism of injury and associated injuries.[15] Regrettably, we have experienced limitations with attempting to introduce the app in our setting as not all divisions or healthcare centres are available on the platform, an acknowledgement is not sent back indicating that the critical result was received, or the on-call clinician is not indicated via the app. As fewer than 10% of participants selected Vula as their preferred communication method, this may suggest potential limitations in adopting it as an additional critical laboratory result communication method.

Interestingly, a quarter of respondents preferred WhatsApp as their communication method of choice. WhatsApp is a free messaging application available on both Android and iOS platforms. It is widely used by clinicians, particularly in the developing world, where it has proven to be a valuable adjunctive tool for both clinical and administrative purposes, facilitating communication among various healthcare teams.[16] However, the use of WhatsApp in the healthcare setting poses several challenges. Communication of critical laboratory results often involves sharing identifiable patient details, including names, surnames, and hospital folder numbers. As WhatsApp was not specifically designed for communicating sensitive medical information, it raises significant concerns about patient confidentiality. Additionally, the informal nature of the mobile app can create prioritisation challenges, where non-urgent messages may compete with critical notifications, or constant alerts may lead to notification fatigue.[17]

We found that less than a quarter of participants received an automatic SMS for critical result communication. This may be attributed to incomplete laboratory request forms, where essential details such as the clinician's name or registration number are often omitted. These omissions prevent the LIS from triggering the Auto SMS function. A study by Nutt *et al.*[18] at TBH in 2007 reviewed 2 550 laboratory request forms over a 5-day period to assess the frequency and impact of incomplete data. The study revealed that 7.4% of forms lacked a clinician's name, 61.2% omitted the clinician's contact number, and 4.9% did not include ward location. Additionally, they reported that 19.9% of critical results were not called out in cases where ward information was missing.[18] This poses a significant challenge for the laboratory in contacting clinicians to communicate critical results. A total of 45.9% of participants preferred telephonic communication to report critical results. However, 6.8% of participants failed to confirm these critical results on TrakCare, while 24.3% confirmed them only sometimes.

Table 2. Perceptions of respondents to critical result communication practices in Cape Town, South Africa, 10 September to 31 December 2024

	n (%)
Does the communication of laboratory critical results impact patient care?	
Yes	71 (95.9)
No	2 (2.7)
I do not know	1 (1.4)
Are you currently receiving an automated SMS from the NHLS to alert you of a patient's critical laboratory result?	
Yes	16 (21.6)
No	58 (78.4)
When receiving a verbal critical laboratory result from non-laboratory personnel (such as a ward sister), do you confirm the result on TrakCare?	
Yes	51 (68.9)
No	5 (6.8)
Sometimes	18 (24.3)
If a clinician cannot be reached to communicate a critical result, what steps should be taken?	
No further steps should be taken	2 (2.7)
Phone the matron on call	17 (23.0)
Phone the hospital superintendent	0 (0.0)
Phoning at least three times within 1 hour. If unable to relay the result, the laboratory should abort trying to call out the result	16 (21.6)
Any of the above	18 (24.3)
Other	21 (28.4)
Which mode of communication would you prefer critical results to be communicated?	
Phone doctor's cell phone	16 (21.6)
Phone the ward, where auxiliary staff can also accept results	10 (13.5)
Phone the ward, where only a clinician can accept results	8 (10.8)
SMS	14 (18.9)
Email	0 (0.0)
WhatsApp	19 (25.7)
POPIA-compliant application, such as Vula	7 (9.5)
Is it important for the laboratory to directly contact you with first-time critical results?	
Yes	66 (89.2)
No	8 (10.8)
Should the laboratory communicate repeat critical laboratory results?	
Only the first critical result	19 (25.7)
Each critical result (including repeat critical results)	29 (39.2)
If the critical result is improving, there is no need to communicate repeat critical results	26 (35.1)
Who should an inpatient critical result be reported to?	
Doctor who ordered the test	13 (17.6)
Doctor directly involved in patient's care	14 (18.9)
Doctor on call	37 (50.0)
Staff nurse	0 (0.0)
Administrative staff (such as ward clerk)	0 (0.0)
Any of the above	9 (12.2)
Other	1 (1.4)
On average, how quickly do you expect inpatient critical results to be communicated after they become available?	
0 - 30 min	32 (43.2)
30 - 60 min	39 (52.7)
>60 min	3 (4.1)
If outside of business hours (8h00 - 16h00), to be communicated the following day	0 (0.0)
Who should an outpatient critical result be reported to?	
Doctor who ordered the test	36 (48.6)
Doctor directly involved in patient's care	16 (21.6)
Doctor on call	9 (12.2)
Staff nurse	1 (1.4)
Administrative staff (such as ward clerk)	2 (2.7)
Any of the above	10 (13.5)
Other	0 (0.0)
On average, how quickly do you expect outpatient critical results to be communicated after they become available?	
0 - 30 min	19 (25.7)
30 - 60 min	22 (29.7)
>60 min	13 (17.6)
If outside of business hours (8h00 - 16h00), to be communicated the following day	20 (27.0)

Currently, verbal telephonic methods are the most used approach for notifying critical results.[19] In this process, it is crucial for the recipient to accurately document and confirm the details. Effective reporting of critical results depends on clear communication between laboratory and hospital staff; however, this method is prone to errors.[20,21] A prospective audit conducted by Rensburg *et al.*[8] in 2008 examined the accuracy of notification of critical chemical pathology results at TBH, where the recipient was required to repeat the result along with the patient's name and folder number. Of the 472 outgoing telephone calls for critical result notifications, there was a 10.8% error rate, and calls to the clinician had the highest error rate at 20%.[8] Therefore, it is essential to confirm verbally reported results to minimise potential harm to patients.

Half of the respondents preferred inpatient critical results to be communicated directly to the on-call clinician. Additionally, the alternative escalation pathways suggested included contacting the division's on-call consultant or clinician if the requesting clinician could not be reached. This aligns with previous studies reporting that physicians often do not answer calls when off duty.[18,22] Given the nature of critical results and their impact on patient care, it is essential to ensure communication with clinicians on-site who can promptly initiate medical intervention. Improved collaboration with healthcare facility management to streamline access to on-call clinicians' contact details could significantly enhance current practices and support timely patient care.

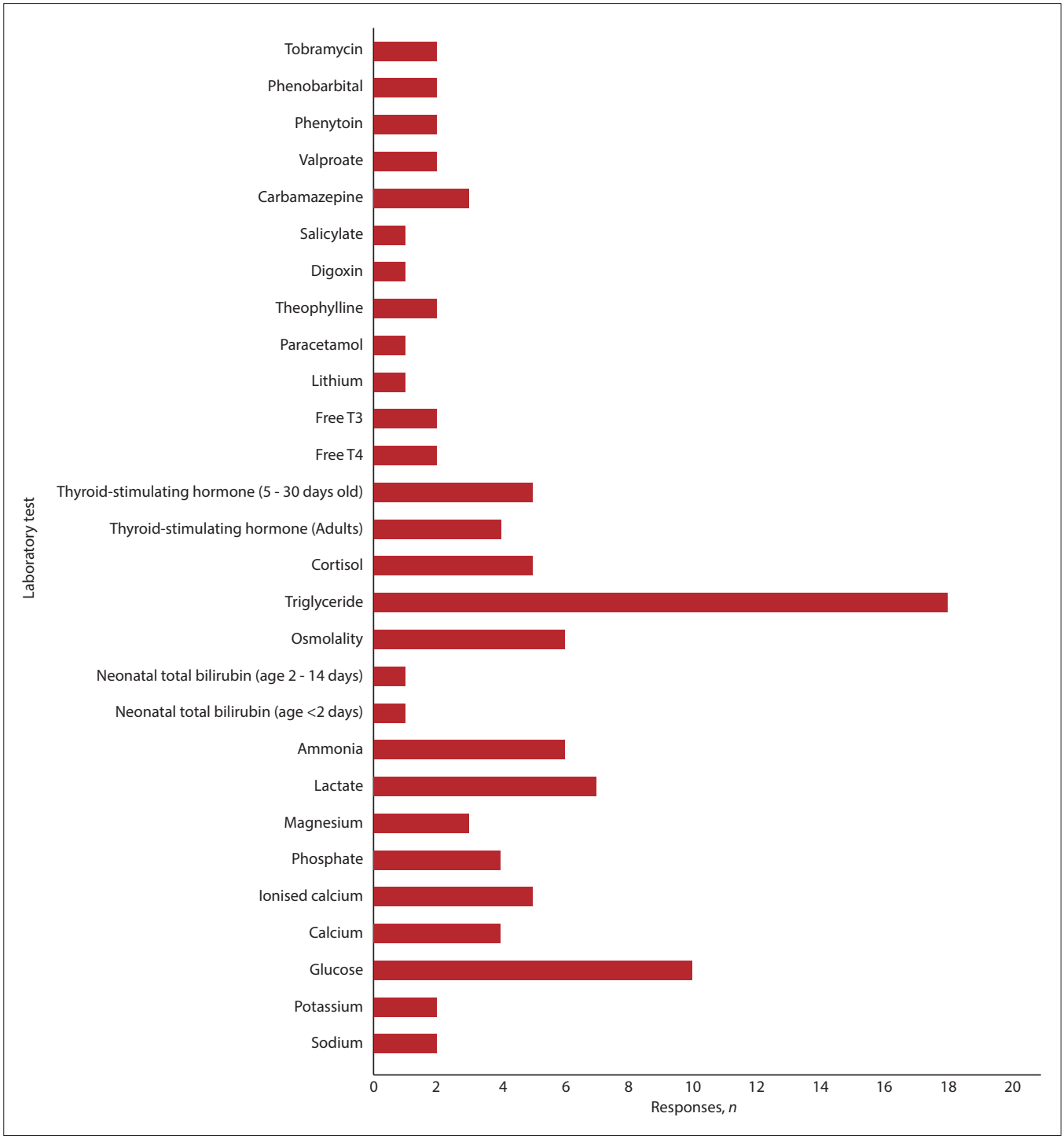

Fig. 1. Clinician perceptions of laboratory tests to be excluded from critical result callout list in Cape Town, South Africa, 10 September to 31 December 2024.

Multiple tests were selected and were considered unnecessary to be communicated by the laboratory. Almost 23.0% (n=17) of respondents considered communicating elevated triglyceride levels unnecessary. Severe hypertriglyceridaemia is a risk factor for acute pancreatitis, with an estimated 5% risk when triglyceride levels exceed 11.2 mmol/L, increasing to 10 - 20% at levels above 22.4 mmol/L.[23] Therefore, the NHLS chemistry critical laboratory callout list includes significantly elevated triglycerides given this association. Additionally, 5.4% (n=4) of respondents preferred that phosphate not be communicated. A previous study by Hoffmann *et al.*[24] reviewed hypophosphataemia at TBH between January 2003 and June 2004. Of the 621 patients with moderately and severely low phosphate levels, 30% demised during their hospital admission.[24] Given this high mortality rate, phosphate is included in the NHLS critical result notification list. The survey by Kavuri *et al.*[13] found that 15% of the respondents considered blood glucose, particularly hyperglycaemia, to be an important critical result that should be notified. Additionally, many of the respondents felt that none of the critical values currently reported should be excluded from the list of critical laboratory results callouts.[13] In comparison, our study found that 13.5% (n=10) of respondents viewed the communication of glucose results as unnecessary. Lastly, among the 31 tests on our laboratory's critical callout list, 28 (90.3%) were selected at least once by respondents who preferred not to receive communication on them. This contrast highlights the different preferences of critical result communication in different settings and the need for the laboratory to adapt communication protocols with the input of clinicians while ensuring patient safety.

Strengths

This is one of the few studies to explore clinicians' perceptions of how critical laboratory results are communicated in sub-Saharan Africa. It encompasses clinicians from diverse healthcare settings, ranging from primary care facilities to tertiary hospitals. Additionally, the study primarily includes clinicians with at least 3 years of experience, providing insights from those with clinical exposure.

Limitations

The limitations of this study include a relatively small sample size, which restricts the generalisability of our findings to other settings. Additionally, it limits stratification by different characteristics, such as years of experience, speciality, or division; thus, descriptive statistics were utilised in the present study. Furthermore, given the small sample size with predominant responses from TBH, institutional bias may have been introduced. The response rate for the survey could not be determined; however, despite this limitation, the collected data offers valuable insights into clinicians' perceptions of laboratory critical result reporting. An unvalidated survey was utilised, which may affect the reproducibility of our results in different study settings. Lastly, the distribution methods were primarily digital. Incorporating more physical distribution methods at the various study sites might have resulted in a higher response rate.

Conclusion

This study provides valuable insights into clinicians' perceptions of critical laboratory result reporting across various levels of healthcare in Cape Town. These findings will be utilised to enhance our current communication practices and guide the development of a standard operating procedure for the TBH Chemical Pathology Laboratory. Additionally, the study underscores the importance of ongoing collaboration with clinicians to ensure that laboratory practices are optimised to support and add value to patient care.

Data availability. The data used for this study are available from the authors on request.

Declaration. None.

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