Immediate Notification of Critical Laboratory Results

ISSUE

All laboratory test results have its corresponding normal range. Critical limits are boundaries beyond which harm could result to the patient. Values beyond upper and lower critical limits are termed critical values (fig.1). Here, immediate notification and prompt medical attention is required. Its delay could result in grave consequences to the patient.

The use of a set guideline outlining notification procedures, the presence of a critical test list and its values as well as proper documentation are among safe laboratory practices that are universally acknowledged and applied across various types of health care settings.

Results from a 2007 preliminary study (Phase 1) showed that the importance of critical value reporting was poorly recognized in MOH hospital laboratories across the country. This prompted the research team to develop an intervention package before implementing an intervention trial in 2008 to assess its effectiveness. This document gives an overview of the intervention as well as the performance of MOH hospitals both prior to, and after implementing the intervention.

Key Messages

- It is crucial to recognise the importance of institutionalising procedures for notifying critical laboratory values in all health care settings.
- Each laboratory should have a list of critical tests and its corresponding values. Now, only half of all hospital laboratories have this.
- Having a step-by-step guide outlining procedures for good immediate notification practices coupled with a directory of critical tests and its values helps!
- Improvements in critical value reporting cannot occur by having guidelines alone. Committed supervisory roles are required to enable proper conduct and adherence to guidelines.
Key Considerations for Policy Makers
- Laboratories play a crucial role in notifying critical laboratory results to health care providers in an effort to improve patient safety
- Institutionalise the use of a critical test list, its values and to have guidelines on immediate notification procedures as a reference for all staff in all health care centers
- Consider monitoring immediate notification of critical values as a performance indicator for improving patient safety

Key Considerations for Health Care Providers/ Practitioners
- A need to create awareness on the importance of identifying and notifying critical laboratory values throughout all categories of healthcare providers
- Performing audits in itself can improve notification practices
- To adopt and adapt this intervention package in individual hospital settings, as a continuous quality improvement initiative
- Sound execution of this chain of notification procedures can only be achieved when all health care providers recognize their roles and play them adequately
- In the laboratory, personnel must be able to differentiate test requests based on level of urgency and be competent in identifying critical results before promptly notifying the relevant ward
- In the ward, personnel on the receiving end must be able to read-back what was said by the laboratory, document the values and immediately inform the responsible health care provider
- Throughout the whole process, there should be adequate and accurate documentation
- Consistent supervision is essential to ensure all steps in this chain of procedures are adequately practiced

**BACKGROUND**
Clinical laboratory services are crucial in supporting patient management. Enhancing safe laboratory practices is therefore one of the cornerstones of improving patient safety. However, performing an indicated test is only part of the battle won. Being able to identify critical results and the urgency to notify alarming results to the appropriate practitioner are crucial initial steps in the communication loop. Properly executing this chain of events requires effective communication among caregivers, the lack of which is the cause of many avoidable adverse events2. The aim of this study was to assess how critical values were dealt with before and after implementing an intervention package that consisted of a Quickflip Guide, posters, record books plus supervisory role enforcement. Findings from this study are meant to support national and local level efforts in implementing similar initiatives to improve operational effectiveness of laboratories, and hence patient safety as a whole.

**DISCUSSION**
A summary of notification procedures adopted in this study is illustrated in flowchart 1 below.

**Table 1: Performance in Critical Result Notification according to Type of Hospital**

<table>
<thead>
<tr>
<th>Type of Hospital</th>
<th>Total Critical Results</th>
<th>Notification by lab</th>
<th>Received by ward</th>
<th>Recorded by ward</th>
<th>Notified to Doctor (Dr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention (I)</td>
<td>Control (C)</td>
<td>Intervention (I)</td>
<td>Control (C)</td>
<td>Intervention (I)</td>
<td>Control (C)</td>
</tr>
<tr>
<td>Count</td>
<td>%</td>
<td>Count</td>
<td>%</td>
<td>Count</td>
<td>%</td>
</tr>
<tr>
<td>Major Specialist Hospital</td>
<td>Pre (I=128)</td>
<td>Post (I=126)</td>
<td>128</td>
<td>100.0</td>
<td>58.8</td>
</tr>
<tr>
<td>Minor Specialist Hospital</td>
<td>Pre (I=12)</td>
<td>Post (I=11)</td>
<td>51</td>
<td>75.8</td>
<td>6.2</td>
</tr>
<tr>
<td>Non-Specialist Hospital</td>
<td>Pre (I=234)</td>
<td>Post (I=243)</td>
<td>42</td>
<td>51.6</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**KEY FINDINGS**
There were a total of 4 intervention and 4 control hospitals. In each group, there was a major specialist, a minor specialist and two non-specialist hospitals. Total critical values detected throughout the seven-day period of data collection ranged between 0.6 to 27.0% in the pre-intervention stage and 0.8 to 5.6% in the post-intervention stage. Of these, on average 2.9% of total critical values discovered in the pre-intervention stage were NOTIFIED. The value was significantly higher in the post-intervention stage, p < 0.001 (fig.1). However, overall in the control group, 2.3% critical values were notified at first assessment, with no significant improvement noticed after the second assessment, p > 0.05 (fig.2) with the exception of one control hospital (fig.4). This was thought to be attributed by the awareness created during the conduct of the first audit. Successful conduct of this chain of procedures needs effective communication between laboratory personnel and health care providers, as well as committed supervision. Despite significant improvement in number of critical value notifications by the lab post intervention, it is interesting to note that a decline in figures were observed as we progressed along the chain of procedures across all types of hospitals (table 1). This ‘dropping-off’ trend resulting in lesser numbers of critical value notifications to the doctor must be addressed.

This study has therefore shown that the lab alone cannot successfully implement this. It requires equal vigour and participation from health care providers in the ward as well. Implementing the intervention therefore could likely have averted 328 adverse events can potentially be averted per year by implementing this intervention!!

**Figure 2**: Results from the Intervention Group

**Figure 3**: Results from the Control Group

**Figure 4**: Effect of Intervention

<table>
<thead>
<tr>
<th>%</th>
<th>Total Critical Results (Pre) = 401</th>
<th>Total Critical Results (Post) = 255</th>
</tr>
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<tbody>
<tr>
<td>82.8</td>
<td>62.0</td>
<td>25.5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>%</th>
<th>Total Critical Results (Pre) = 401</th>
<th>Total Critical Results (Post) = 783</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.7</td>
<td>8.4</td>
<td>1.5</td>
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</table>

**Future research**
- a) to assess the extent of action taken by doctors upon receiving a notification in order to complete the communication loop
- b) assess for timeliness of notification

328 adverse events can potentially be averted per year by implementing this intervention!!

Literature has shown that an estimated 13% of late critical value notification can result in adverse events. By extrapolating for the total number of admissions in the four control hospitals as 93,565 and using data from table 1, fig.2 and 3:

Proportion of test requests with critical values in control hospitals: 4.5%
Difference in total critical values notified by the lab at post-intervention (intervention – control) : 74.1%
Difference in total critical values notified to doctor at post-intervention (intervention – control) : 14.1%

Assuming that each admission represents one test request, 4,210 patients in 2007 would have had a critical value. As control hospitals lagged by 60% in notification practices, this would translate to 2,526 patients with critical values that were not notified to a doctor.

Implementing the intervention therefore could likely have averted 328 adverse events attributed to the critical value itself.