وزارة الصحة
Ministry of Health

National Key Performance Indicators for Diagnostic Medical Laboratories

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Acronyms

CA	Corrective Action
CAP	Correction Action Plan
CLIA	Clinical Laboratory Improvement Amendments
CRE	Carbapenem-Resistant Enterobacteriaceae (CRE)
CRYO	Cryoprecipitate
CSF	Cerebral Spinal Fluid
DLS	Diagnostic Laboratories Services
DGPDC	Directorate General of Pharmacy &Drug Control
DGSMC	Directorate General of Specialized Medical Care
ED	Emergency Department
EQA	External Quality Assurance
FFP	Fresh frozen plasma
FNA	Fine Needle Aspiration
HIS	Hospital Information System
HOD	Head of Department
INR	International Normalized Ratio
IQC	Internal Quality Control
IRLS	Incident Reporting & Learning System
IT	Information Technology
KAIs	Key appraisal indicators
KPI	Key Performance Indicator
LIMS	Laboratory Information Management System
LQMS	Laboratory Quality Management System
MDRO	Multidrug Resistant Organism
MOH	Ministry of Health
MRSA	Methicillin Resistant Staph. Aureus
MSBO	maximum surgical blood order schedule policy
NC	Non – Conformities

NCF	Non – Conformities Form
NICE	National Institute of Clinical Excellence
PA	Preventive Action
PDCA	Plan, Do, Check, and Analyze
PLTs	Platelets
PRBC	Packed red blood cell
QC	Quality Control
QMS	Quality Management System
QP	Quality Procedure
RCA	Root Cause Analysis
SE	Sentinel Event
SMART	Specific, Measurable, Achievable, Relevant, and Time-Bound
SOP	Standard operating procedure
TAT	Turnaround time
TTP	Total Testing Process

Definitions

- Performance Measurement: A regular monitoring of quantifiable outcomes and results.
- The Key performance indicators (KPIs): A quantifiable measure of performance over time for an evidence-based standard, or for a specific objective and target.
- Process Owner: a staff accountable and responsible for managing a process from end- to-end, and overseeing its objectives and performance through Performance Indicators.
- Dashboard: a simple visual display of the performance information that facilitates comparison of performance over time or desired targets.
- Scorecard: a statistical record that measures progress or achievement towards a set performance indicator.
- An action plan: Detailed time-based activities and tasks required to achieve a goal or more.
- Benchmarking: process of measuring the performance of certain organization services against those of another organization considering to be best organization.
- Trend: a key type of pattern indicating a general direction of condition (decrease or increase) over period of time.

Chapter One

1. Introduction:

Laboratory Key Performance Indicators (KPIs) are measures of the performance of the laboratory and its activities, such as projects, processes, products, or services. KPIs in laboratories are also used to track the performance of the inventory, devices, environment, data, and results. The main aim of having KPIs is to optimize the performance of your lab. KPIs are essential to running an outcome-driven lab. KPIs are high-level, often strategic, measures of performance towards a long-term goal. They are typically designed to provide insight into whether your laboratory is on track to future success. Laboratories can use KPIs to evaluate the health of their operations by providing feedback on progress towards high-level goals or strategic initiatives related to safety, finance, quality, and people. The usage of KPIs allows laboratories to intelligently update their operations based on KPI results. KPIs can be a valuable process to initiate at your laboratory. Even breaking down the meaning of KPIs, key performance indicators can help to develop an evaluation of the current performance:

- Key: The most important
- Performance: Directly related to the success of the lab
- Indicators: Shows direction and provides clear feedback around if current performance is aligned with the goals

Then first implementing KPIs, you may begin to view the collected data from a completely new perspective. This enhanced visibility can help you easily identify opportunities for process improvement or highlight existing deficiencies. KPIs indicate the optimal performance levels that should be maintained to support consistent and seamless workflows. By sustaining these levels, the quality of work is naturally enhanced, which in turn strengthens the overall business process. Ultimately, these improvements contribute to better overall satisfaction.

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How to develop your laboratory KPI:

- Find a starting point by reviewing data that has already been collected. This may include the number of procedural deviations, cost of lab supplies per month, or perhaps products or reports generated per day/week/month.
- Determine which data points matter most to the business and to the end or ensure you understand which metrics are most critical to the business and to the end users.
- Confirm the data have measurable evaluations that are meaningful and easy to analyze. The data should be easily quantifiable, Subjective data should be avoided.
- Select data that can derive action. If data is collected for a KPI that is out of your control, it may not be a valuable use of your time and effort. For example, tracking the frequency of price increases from vendors may be financially informative, but if you cannot act on this data, it may not serve as an effective KPI.
- Start small and focused. Once you know your data, select one to three KPIs that can be established based on the criteria above and can be realistically implemented.
- Monitor, evaluate, act, and re-evaluate KPIs

  There is little advantage to developing a KPI system if routine monitoring and action plans are not included. Having this plan in place gives the space and dedication needed to ensure targets can be achieved. Once KPIs are set and a baseline is established, a system for continued monitoring should be developed. This may include frequency of updating, timelines of data to be reported, reporting format, delivery of report to stakeholders, and a plan to address the results. Re-evaluation will be part of this process, and should review KPIs definitions (right targets, right data, right time frames, etc.), effectiveness (are you meeting or missing targets consistently?), or if new KPIs are needed. Your KPIs must be actionable. A KPI that consistently misses the target levels, with no correction made, warrants discussion. Laboratory leaders can use KPIs to develop a more detailed understanding of performance and determine whether the lab is on track to succeed. By taking the necessary time to establish actionable KPIs, lab leaders will ensure that they have the right information at their fingertips to make more educated decisions about safety, quality, operations, sales, and staffing within their businesses.

It is advisable to keep optimizing only a few KPIs at a time, otherwise, it might become too overwhelming for the staff. To select lab KPIs start by setting the goals. When setting the goals, you can use the SMART framework. SMART goals are Specific, Measurable, Attainable, Relevant and Time-bound.

The Diagnostic Laboratory Services, at Directorate General of Health Services & Programs (DGHSP), Ministry of Health (MOH), provides a national guidance towards the establishment of Medical Laboratories Key Performance Indicators (KPI) at different health care institutions through this manual and also through referring to the national laboratories Quality policies & procedure Manual (MoH/DGMSC/P&P/022/Version.01December 2022).

2. Scope:

This document is applicable to all diagnostic medical laboratories at national level; Governmental (civil and military) and private.

3. Purpose:

KPIs are evidence-based, data driven measure that provide healthcare decision-maker with the tools to:

- Optimize laboratory's services quality& Reliability.
- Assess and enhance overall laboratory's performance.
- Enforce diagnostic accuracy and efficiency.
- Track changes overtime and hence identifying laboratory performance waste, therefore, aid to minimize them.
- Identify areas that need further study and investigation.
- Support equitable service delivery by highlighting variations across users or locations

Chapter Two

4. Procedure:

Each organization has its valued objectives that work to achieve and to do so, the organization needs to address the required tools and processes. Laboratory Quality Management System (LQMS) is a systematic process and designed framework to identify effective quality measurement and improvement. LQMS guideline summarizes the structures of good practice associated with performance indicators which accordingly highlighted by sub-process strongly reinforced their value by evidence. Please follow the national KPI guidelines for detailed steps in KPIs development (MoH /DGQAC/GUD/001/Vers.01), which are detailed and objective and applicable in laboratory setting.

4.1 Laboratory KPI identification cards (KPI ID card):

- The KPI ID card is a designed documentation form that structures the most relevant information regarding a given indicator. Important items in the form include: indicator definition, its calculation formula and target.
- Key performance indicators involve processes within the laboratory workflow which have to be justifiable, credible, feasible and evidence-based.
- Before setting up the indicators:
  - Check the availability of indicators requirements, such as related policies and documents, approved codes and supported information management system.
  - Ensure that all necessary details are clearly defined, including the need for the indicator, target goals, data-collection intervals, test urgency, size of the data collected, and the expected impact of the KPI on quality improvement.
- After selecting the KPI and before implementation, the laboratory should:
  - Use the designed KPI documentation card. Refer to Annex 8.1.
  - Fill the required information in KPIs card.

- Approve KPI card by the relevant top management.
- Review and update relevant information regularly and when needed.

- The following KPI cards represent some basic requirements needed by medical laboratories for quality improvement. However, laboratory has the flexibility to select its own KPIs based on its specific requirements and priorities provided that the selected KPIs fulfilled the above-mentioned criteria. For example, KAIs for staff (training, education, appraisal), KAIs for engagement with patients and users (patient experience, end user's satisfaction), KAIs (resources management such as consumables) ...Etc.

4.2 General laboratory KPIs:

- General laboratories KPIs includes all the minimum mandatory and fundamental required KPIs that all laboratories are obligated to develop and maintain.
- These general KPIs comprehensively cover phases of laboratory operations, including pre-analytical (eg. laboratory Samples Rejection Rate, no Test Request Rate), analytical (eg. Unacceptable Internal Quality Control Performance Rate), and post-analytical stages (eg. Corrected (Recalled) Report Rate. Refer to annex 8.3 that gives suggestions of the most common set of quality indicators that covers Total Testing Process (TTP):
- The systematic use of these, listed below, general KPIs is crucial for identifying trends, addressing inefficiencies, and making data-driven decisions that contribute to operational excellence.

4.2.1 General KPI: Laboratory Samples Rejection Rate (pre analytical phase):

Indicator # 1	**Performance Indicator Title** Laboratory Samples Rejection Rate	**Dimension** Efficiency

Description

The rate at which the samples are rejected, according to laboratory internal policy.

Rational	**Type**
• Improve the patient care and satisfaction. • To reduce recollection of samples and thus reducing effort and cost.	input

Quality Indicator requirements:

1. Lab policy for sample rejection and acceptance criteria.
2. Communicate the laboratory samples rejection reasons in LIMS.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Number of samples rejected based on lab sample rejection and acceptance criteria	Total number of the samples received in the lab	▪ Inclusion and exclusion should be based on lab policy for sample rejection and acceptance criteria. ▪ Exclude all referral samples (in or out)

Equation:

$$\frac{\text{Number of samples rejected based on lab sample rejection and acceptance criteria}}{\text{Total number of samples received in the lab}} \times 100\%$$

Data Elements

1. Sample and Patient number.
2. Date
3. reasons of rejection
4. Source (location/department /ward /clinics / in- house / referral /others
5. Investigation requested
6. Requester if feasible
7. Clinical details / diagnosis
8. Blood collection tubes

Limitations

Nil

Data Source(s)	**Data Collection**
Using Laboratory Information System, Record the total number of Specimens received, and the number of rejected specimens for decided period, and the main	**Frequency** Monthly

	reason each specimen was rejected.	
9. Sample type 10. Sample requirement if feasible		
Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible personnel	**Performance Indicator reporting Frequency** Based on laboratory management decision, ideally monthly.	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.
Target Based on laboratory management rejection rate recommendation (which can be based on the progress and improvement of the performance of KPI in the lab).	**Benchmarking** **<0.5%** Reference: Collage of American Pathologists (CAP)	**Related Performance Indicator** All TAT KPIs

Quality improvement:
If the rate is unaccepted, find the main sources that submit unsuitable (rejected) samples, ensure that they have a copy of rejection criteria, create corrective actions, and take preventative measures accordingly to resolve the problem with the cooperation of the source, phlebotomist and quality department. Improve staff competency: e.g phlebotomists, scientists, doctors.

4.2.2 General KPI: No test requested rate (pre analytical phase):

Indicator # 2	**Performance Indicator Title** No Test Request Rate	**Dimension** Efficiency Patient safety
Description This indicator includes counting all specimens submitted for testing to the chemistry, hematology/blood bank, and microbiology sections. Using LIMS system, auditor will record the total number of specimens received, and the number of specimens received with no test requests.		
Rational To determine the rate of samples that have been collected and received in the lab without electronic test orders.		**Type** Input
Quality Indicator requirements: 1. Standardized policy for not requested sample 2. Standardized codes to be used to release the not requested sample 3. Documentation form or book to register your data		
Numerator Total number of samples that received from all departments without electronic Test Order.	**Denominator** Total number of samples that received from all departments	**Inclusion:** All wards, all test in the lab **Exclusion Criteria:** NILL

<table>
<tr><td colspan="3">Equation:
$\frac{\text{Total number of samples that received from all departments without electronic Test Order.}}{\text{Total number of samples that received from all departments}} \times 100\%$</td></tr>
<tr><td rowspan="2">Data Elements:
1. Sample / Patient number.
2. Date of time receiving
3. Source (location /department/ward /clinics/ in-house / referral /others
4. Requester if feasible
5. Specimen/sample type
6. Clinical details / diagnosis</td><td colspan="2">Limitations
Lack of patient clinical information</td></tr>
<tr><td>Data Source(s)
Using Laboratory Information System, Record the total number received sample, and the total number of samples without electronic request</td><td>Data Collection Frequency
Recommended Monthly</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the name of responsible person.</td><td>Performance Indicator reporting Frequency
Based on laboratory management decision, recommended to be monthly</td><td>Performance Indicator reported in which report
reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
</table>

Target	Benchmarking	Related Performance Indicator
Based on laboratory management which can be based on progression and improvement of the performance of KPI in the lab.	Use national / international benchmark. The target was adapted from College of America Pathologists which is (≤ 5 %)	
Quality improvement: Analyze all the data to determine which departments are delivering samples without an electronic request if the rate is unacceptable. Then, arrange for a meeting with the concerned department to present the statistics and discuss suggestions for improvement.		

4.2.3 General KPI: Rate of unacceptable internal quality control performance (analytical phase):

Indicator # 3	Performance Indicator Title	Dimension
	Rate of unacceptable internal quality control performance	effectiveness
Description It measures how often internal quality controls fail, which reflects the reliability and consistency of laboratory testing processes.		
Rational • To improve IQC performance • To assure appropriate IQC troubleshooting • to protect patients from unacceptable risk of harm from incorrect or medically unreliable results		**Type** Outcome

Quality Indicator requirements:

- Internal Quality Control SOP
- IQC troubleshooting policy
- IQC data management and archiving system
- Non-conformance recording system with the corrective actions in case of violated IQC

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of IQC result outside the defined limits during a specific period	Total number of IQC result for the selected assay during the same period	Inclusion: All unacceptable IQC result as per the laboratory protocol. Exclusion: exclude all acceptable IQC result

Equation

$$\frac{\text{Total number of IQC result outside the defined limits during a specific period}}{\text{Total number of IQC result for the selected assay during a specific period}} \times 100$$

Data Elements	**Limitations**	
IQC data Test name Names and types of IQC	IIQC monitoring system or Software IQC archiving and retrieval system IQC SOP improper implementation	
IQC lot number, expiry date IQC range/ limits IQC Leavy-Jenin chart QC recording sheet or Software Staff involved if possible. Corrective action sheet	Alternation in the examination method (upgrade, modification, replacement)	
	Data Source(s) LIMS or IQC recording system. Calculate the unacceptable IQC result and record the unacceptable QC result	**Data Collection Frequency** Monthly

Performance Indicator Monitoring Based on laboratory management which can be based on the progress and improvement of the performance of KPI in the lab.	**Performance Indicator reporting Frequency** Based on laboratory management decision	**Performance Indicator reported in which report** It may be reported in the annual reports, annual service plans, quarterly performance reports, budget requests or others.
Target Based on laboratory management which can be based on the progress and improvement of the performance of KPI in the lab.	**Benchmarking** 5% is the accepted failure rate in the IQC (CLSI, EP 23-A)	**Related Performance Indicator**

Quality improvement: If the rate is unacceptable:

- Check the IQC monitoring and recording system
- Monitor the implementation of IQC procedure
- Continuous education on IQC monitoring and troubleshooting to all laboratory personnel
- Improve KPI by root cause analysis for the frequently failed control.

4.2.4 General KPI: Corrected (recalled) reports rate (post analytical phase):

Indicator # 4	**Performance Indicator Title** Corrected (recalled) Reports Rate	**Dimension** Patient safety Effectiveness

Description

The rate of corrected or re-called reports that have been amended (results that have been released and reported by the laboratory but found to be wrong after some time due to pre-analytical or laboratory errors). e.g. Finding that sample is clotted after reporting.

Rational	**Type**
• Evaluate the rate of corrected reports to identify laboratory errors. • Detect and reduce adverse events related to errors in lab reports.	Outcome

Quality Indicator requirements:

- Create a policy for corrected lab reports.
- Develop a documentation system (e.g log sheet or phone log in the LIMS) to record the modified result reports.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Number of laboratory reports that were **corrected or recalled** during a specific period	Total number of laboratory reports issued during the same period.	Exclusion: • supplementary (attachments) reports • Provisional reports. • Referral out samples reports.

Equation:

$$\frac{\text{Total number of corrected or recalled reports.}}{\text{Total number of released samples}} \times 100\%$$

Data Elements	Limitations
1. Source of request (location /department/ward /clinics / referral	Non

/others) 2. Patient demography 3. Patient clinical details 4. Date and time 5. Number of Corrected reports 6. Total number of received samples	**Data Source(s)** Using the Laboratory Information System, record of the total number of reports	**Data Collection Frequency** To be decide by laboratory
7. Contacts of requesting physician or nurse in charge to be informed	that have been recalled or amended and the reason for re-reporting, and a record of total number of released samples.	management or ideally monthly
Performance Indicator Monitoring The laboratory management decides on the indicator monitoring duration and the name of responsible personnel	**Performance Indicator reporting Frequency** Based on laboratory management decision	**Performance Indicator reported in which report** To be decided by the laboratory management. For example, the performance indicator may be reported monthly in laboratory meetings, senior meetings, meetings with directorate of quality assurance, directorate of Hospital administration

Target	Benchmarking	Related Performance Indicator
Based on laboratory management of amended reports rate recommendation Each hospital should establish their own target(benchmark)	<2.8% Reference: College of American Pathologists (CAP)	

Quality improvement:

If the rate is unaccepted, analyze all the data and find out root cause of sending the result wrongly, correlate it with shifts, staff names, type of errors, mode of sending the results (automatic or manual (transcription errors)) , then educate the department and implement the possible solutions .

4.3 Microbiology section KPIs:

- These KPIs cover phases of Microbiology laboratory operations, including pre-analytical (ex. laboratory samples rejection rate, no test requested rate), analytical (eg. unacceptable internal quality control performance rate), and post-analytical stages (eg. Blood culture contamination rate, Critical values successfully notified rate, CSF microscopy exceeded Turnaround Time, Typical MDRO culture exceeded TAT rate and Corrected (recalled) reports rate) as follows:

4.3.1 Microbiology section KPIs**:** Blood culture contamination rate (post analysis phase):

Indicator # 5	**Performance Indicator Title** Blood culture contamination rate	**Dimension** Efficiency
Description The rate of contaminated blood culture bottles with specific clinically insignificant bacterial isolates which are discordant from the acceptability criteria. - The auditors consider a blood culture bottle to be contaminated if they find one or more of the following organisms in only one of a series of blood culture specimens: Coagulase-negative Staphylococcus; Micrococcus; Alpha-hemolytic viridans group streptococci; Propionibacterium acnes; Corynebacterium sp. (diptheroids); or Bacillus sp.		
Rational **1.** To eliminate the release of false positive blood culture results. **2.** To raise the patient safety. **3.** To reduce the wastage of blood culture bottles. **4.** To save time and effort.		**Type** Input
Quality Indicator requirements: 1. Standardized releasing codes of blood culture contaminated bottles. 2. Blood culture acceptance criteria SOP that clarifies the significance of result with correlation of clinical details.		

<table>
<tr><td>Numerator

Number of contaminated blood culture bottles</td><td>Denominator

Total number of blood culture bottles received in the laboratory</td><td colspan="2">Inclusion: All wards, all type of blood culture bottles, all bottles received in all shifts

Exclusion Criteria: Nill</td></tr>
<tr><td colspan="4">Equation:

$$\frac{\text{total number of contaminated blood culture bottles}}{\text{Total number of blood culture bottles received}} \times 100$$</td></tr>
<tr><td rowspan="2">Data Elements:

1. Patients age.
2. Date of receiving
3. Type of blood culture bottle (pediatric, adult).
4. Source (location /department/ward /clinics/ in-house / referral /others
5. Requester if feasible
6. Clinical details / diagnosis
7. Site and type of blood collected.</td><td colspan="3">Limitations

Lack of clinical LIMS information</td></tr>
<tr><td>Data Source(s)

Using LIMS, Record the total number of blood culture bottles received, and the number of contaminated specimens for decided period, and the name of contaminant isolates.</td><td>Data Collection Frequency

To be decide by laboratory management, as an advice monthly</td></tr>
<tr><td>Performance Indicator Monitoring

Based on laboratory management which can be based on the progress and</td><td>Performance Indicator reporting Frequency

Based on laboratory</td><td colspan="2">Performance Indicator reported in which report</td></tr>
</table>

improvement of the performance of KPI in the lab.	management decision	The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.
Target Based on laboratory management contamination rate recommendation and the performance of KPI	**Benchmarking** **(< 2.17 %)** Use national / international benchmark. The target was adapted from College of America Pathologists which is	**Related Performance Indicator** Balanced set of indicators if relevant
Quality improvement: If the rate is unaccepted, find the main sources that submit unsuitable (contaminated) bottles, ensure the conduction of phlebotomist training program and create corrective actions accordingly to resolve the problem with the cooperation of the source, phlebotomist and quality department.		

4.3.2 Microbiology section KPIs: Critical values successfully notified rate (post analysis phase):

Indicator # 6	**Performance Indicator Title** Rate of critical values successfully notified (microbiology)	**Dimension** Patient safety & Effectiveness & timely interventions
Description Auditors will track positive critical values as an indicator to evaluate critical value notification process in microbiology. Using LIMS, auditors will record the total number of critical values monitored and the number with documentation of successful notification. The critical values report in Microbiology lab is: positive blood culture smear, positive MDRO infection control test, positive CSF culture and critical bacterial growth.		
Rational **1.** To raise the patient safety. **2.** Speedup the immediate action taken for the patient e.g (isolation and/or giving antibiotics) **3.** To save time and effort.		**Type** Outcome
Quality Indicator requirements: 1. Standardized policy for critical values result. 2. Provisional release and pop-up message system 3. Standardized codes for documentation of released result (mentioned the name of person informed and time) 4. Documentation form or book to register the critical values report daily.		
Numerator Number of critical values successfully notified To the responsible clinician or healthcare provider.	**Denominator** Total number of critical values released During the same period	**Inclusion:** All wards, All critical test in the lab **Exclusion Criteria:** referral out test

<table>
<tr><td colspan="3">Equation:

$$\frac{\text{Total number of critical values successfully notified}}{\text{number of critical values released}} \text{ Total} \times 100$$</td></tr>
<tr><td rowspan="2">Data Elements:
1. Patients age.
2. Date of receiving
3. Source (location /department/ward /clinics/ in-house / referral /others
4. Requester if feasible
5. Clinical details / diagnosis</td><td colspan="2">Limitations
The lack of documentation of the successful calls
Aborted attempts of calling</td></tr>
<tr><td>Data Source(s)

Using LIMS, record the total number critical test released, and the total number of successful critical value notified for decided period,</td><td>Data Collection Frequency

To be decide by lab management
However, advised to be monthly</td></tr>
<tr><td>Performance Indicator Monitoring

The laboratory management decide on the indicator monitoring duration and the name of responsible personnel</td><td>Performance Indicator reporting Frequency

Based on laboratory management decision</td><td>Performance Indicator reported in which report

The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
</table>

Target	Benchmarking	Related Performance Indicator
Based on laboratory management recommendation and the performance of KPI	(100 %) Use national / international benchmark. The target was adapted from College of America Pathologists	Balanced set of indicators if relevant
Quality improvement: If the rate is unaccepted, analyze all the data and find out which staff release without notifying or documenting and list down the reason then, educate and re train the staff about the critical value report policy.		

4.3.3 Microbiology section KPIs: Rate of CSF microscopy exceeded Turnaround Time (post analysis phase):

<table>
<tr><td>Indicator # 7</td><td>Performance Indicator Title
Rate of CSF microscopy exceeded Turnaround Time</td><td>Dimension
Efficiency</td></tr>
<tr><td colspan="3">Description
CSF Microscopy test is a critical request and it should be testing and releasing within 2 hours from the time receiving in the lab. The auditor will track all the CSF microscopy sample received in a period of time and count the turnaround time rate (from time receiving till the time releasing of microscopy result).</td></tr>
<tr><td colspan="2">Rational
1. To eliminate the rate of urgent CSF microscopy TAT
2. To raise the patient safety.</td><td>Type
Process</td></tr>
<tr><td colspan="3">Quality Indicator requirements:
1. Standardized CSF microscopy SOP
2. Standardize releasing of critical test SOP
3. Examination offered by lab for end users (document the TAT)
4. Use the QR of KPI TAT calculation, Annex8.2.</td></tr>
<tr><td>Numerator
Total number of CSF microscopy which exceeded the TAT</td><td>Denominator
The total number of CSF microscopy received</td><td>Inclusion: All wards, All CSF microscopy test
Exclusion Criteria:
Exclude samples received during LIS system breakdown.
exclude add on tests (test added after the sample arrival in the laboratory)
exclude the referral out request</td></tr>
</table>

Equation:

$$\frac{\text{Total number of CSF microscopy which exceeded the TAT}}{\text{Total number of CSF microscopy received}} \times 100$$

Data Elements:	**Limitations**	
1. Patients age. 2. Date of receiving 4. Source (location /department/ward /clinics/ in-house / referral /others 5. Requester if feasible 6. Clinical details / diagnosis	Transferring the data manually from Al IMS to excel sheet	
	Data Source(s) Using Laboratory Information System, Record the total number of CSF sample received.	**Data Collection Frequency** To be decide by laboratory management, however, suggested to be monthly
Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible person	**Performance Indicator reporting Frequency** Based on laboratory management decision	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.

Target	Benchmarking	Related Performance Indicator
Based on laboratory management and lab improvement in the KPI	Use national / international benchmark. The target was adapted from College of America Pathologists which is (< 5 %)	Balanced set of indicators if relevant

Quality improvement:

If the rate is unaccepted, analyze the data, find the specimen exceeded the TAT (for example: 2 hours), then start investigating and set a corrective action accordingly.

4.3.4 Microbiology section KPIs: Typical MDRO culture exceeded TAT rate (post analysis phase):

Indicator # 8	**Performance Indicator Title** Typical MDRO culture exceeded TAT rate	**Dimension** Patient safety Effectiveness
Description Atypical MDRO (Methicillin Drug Resistance Organism) culture TAT is 4 days of direct culturing manually, the auditor will track all the positive MDRO received in specific period of time and count the turnaround time rate (from time receiving till time of provisionally releasing). The MDRO test include: CRE, MRSA, VRE, CAS and any other multidrug resistance cultured isolates Screen.		
Rational **1.** To demonstrate the rate of positive MDRO culture exceeded TAT **2.** To raise the patient safety. **3.** To save time and effort.		**Type** Process
Quality Indicator requirements: 1. Standardized MDRO culture SOP for lab staff 2. Standardize provisional releasing policy 3. Examination offered by lab for end users (document the TAT) 4. Use the QR of KPI TAT calculation, Annex 8.2.		
Numerator Number of typical MDRO culture which exceeded TAT of 4 days from sample receipt to result provisionally released	**Denominator** Total number of screening test MDRO received from all departments	**Inclusion:** All wards, All MDRO test **Exclusion Criteria:** Exclude the add on tests and any other LIMS breakdown and referral out request

Equation:

$$\frac{\text{Total number of typical MDRO culture which exceeded 4 days from sample receipt to result provisionally released}}{\text{Total number of screening test MDRO received from all departments}} \times 100$$

Data Elements:	**Limitations**	
1. Patients age. 2. Date of receiving 4. Source (location /department/ward /clinics/ in-house / referral /others 5. Requester if feasible 6. Clinical details / diagnosis	Transfer the data manually from LIMS to excel sheet	
	Data Source(s) Using Laboratory Information System, Record the total number of Specimens received, and the number of typical MDRO culture which exceeded 4 days	**Data Collection Frequency** To be decide by laboratory management, advised to be monthly

Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible person	**Performance Indicator reporting Frequency** Based on laboratory management decision	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.
Target Based on lab management and feasibility of improvement	**Benchmarking** Use national / international benchmark. The target was adapted from College of America Pathologists which is (< 5 %)	**Related Performance Indicator** Balanced set of indicators if relevant
Quality improvement: If the rate is unaccepted, analyze the data, find the MDRO request exceeded the TAT which 4 days, then start investigating and set a corrective action accordingly.		

4.4. Biochemistry section KPIs:

- These KPIs cover phases of biochemistry laboratory operations, including pre-analytical (eg. laboratory samples rejection rate, no test requested rate), analytical (eg. unacceptable internal quality control performance rate), and post-analytical stages (eg. Urgent Troponin result exceeded Turnaround Time rate, Plasma Ammonia result TAT rate, Lactate exceeded TAT rate, Potassium Critical value successful notification rate, and corrected (recalled) reports rate,) as follows:

4.4.1. Biochemistry section KPIs**:** Urgent Troponin result exceeded Turnaround Time rate (post analysis phase):

<table>
<tr><td>Indicator # 9</td><td>Performance Indicator Title

Urgent Troponin result exceeded Turnaround Time</td><td>Dimension
Timeliness</td></tr>
<tr><td colspan="3">Description
The rate of urgent Troponin samples that are exceeding the intra laboratory TAT using the local laboratory standards (60 min).</td></tr>
<tr><td colspan="2">• Rational
• To ensure that the patients are receiving appropriate timely care.
• To improve the Troponin assay TAT that impacts the laboratory efficiency.
• To increase the customer satisfaction and help physicians to provide more effective treatment plans.</td><td>Type

Process</td></tr>
<tr><td colspan="3">Quality Indicator requirements:
• Troponin Standard Operating Procedure
• Prober LIMS system to collect the data
• Use the QR of KPI TAT calculation, Annex 8.2</td></tr>
</table>

<table>
<tr><td>Numerator
Total number of urgent Troponin results which are exceeding the acceptable TAT.</td><td>Denominator
Total number of urgent Troponin results received in the laboratory</td><td colspan="2">Inclusion/ Exclusion Criteria
Exclude urgent Troponin samples received during analyzer or LIS system breakdown
Exclude add on Troponin tests (Troponin test added after the sample arrival in the laboratory)
Point of Care Troponin samples.</td></tr>
<tr><td colspan="4">Equation
$\frac{\text{Number of urgent Troponin results exceeding the TAT}}{\text{Total urgent Troponin tests performed in the laboratory}} \times 100$</td></tr>
<tr><td rowspan="2">Data Elements
Sample receiving date and time.
Sample loading time on the analyzer, if possible.
Result reporting date and time
Sample ordering location (Ward, Clinics)
Requesting Physician, if needed.</td><td colspan="3">Limitations
Unavailable LIMS system or software for data collection.
Unavailable IT support to collect the required data.</td></tr>
<tr><td>Data Source(s)
Laboratory Information System.
Calculate the Troponin TAT and record any Troponin samples which exceed the TAT</td><td>Data Collection Frequency
To be decided by the laboratory
Advised to monthly</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the</td><td>Performance Indicator reporting Frequency
Based on the laboratory management decision.</td><td>Performance Indicator reported in which report</td></tr>
</table>

responsible laboratory personnel.	Ideally monthly.	The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, management review or others
Target Based on lab management and feasibility of improvement	**Benchmarking** 60 min (College of American Pathologists, CAP guidelines) Exceeded urgent Troponin samples should be ≤ 5 % of lab TAT	**Related Performance Indicator**
Quality improvement: If the rate is unacceptable, correlate the exceeded time with factors such as: peak working hours (ex. morning time or out of hours) or frequently repeated staff to obtain the main source of the problem, ensure adherence to the Troponin TAT and create corrective actions accordingly to resolve the problem.		

4.4.2. Biochemistry section KPIs: Plasma Ammonia result TAT rate (post analysis phase):

Indicator # 10	**Performance Indicator Title** Plasma Ammonia result TAT rate	**Dimension** Timeliness

Description

The rate of Ammonia samples that are exceeding the intra laboratory TAT using the local laboratory standards (recommended 60 minutes)

• **Rational** • To ensure that the patients are receiving appropriate timely care. • To improve the Ammonia assay TAT that impacts the laboratory efficiency. • To increase the customer satisfaction and help physicians to provide more effective treatment plans.	**Type** Process

Quality Indicator requirements:

- Ammonia assay Standard Operating Procedure
- Prober LIMS system to collect the data
- Use the QR of KPI TAT calculation, Annex 8.2

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of Ammonia samples which are exceeding the acceptable standard TAT	Total number of Ammonia samples received in the Laboratory	Exclude Ammonia samples received during analyzer or LIMS system breakdown

Equation

$$\frac{\text{Total number of Ammonia samples which are exceeding the acceptable standard TAT}}{\text{Total number of Ammonia samples received in the laboratory}} \times 100$$

Data Elements	**Limitations**
Sample receiving date and time. Sample loading time on the analyzer, if possible. Result reporting date and time Sample ordering location (Ward, Clinics) Requesting Physician, if needed.	Unavailable LIS system or software for data collection. Unavailable IT support to collect the required data.

<table>
<tr><td rowspan="2">Performance Indicator Monitoring
The laboratory management decide on the
indicator monitoring duration and the responsible laboratory personnel.</td><td>Data Source(s)
Laboratory Information System. Calculate the Ammonia TAT and record any Ammonia samples which exceed the acceptable TAT</td><td>Data Collection Frequency
To be decided by the laboratory
Ideally monthly.</td></tr>
<tr><td>Performance Indicator reporting Frequency
Based on the laboratory management decision.
Ideally monthly.</td><td>Performance Indicator reported in which report
The reporting method to be decided by the laboratory management.</td></tr>
<tr><td>Target
Based on lab management and feasibility of improvement</td><td>Benchmarking
60 min (College of American Pathologists, CAP guidelines), samples should not exceed ≤ 5of lab TAT (Laboratory Turnaround Time Review Article)</td><td>Related Performance Indicator</td></tr>
<tr><td colspan="3">Quality improvement:

If the rate is unacceptable, correlate the exceeded time with the working hours’ peak (morning time or out of hours) or frequently repeated staff to obtain the main source of problem, ensure adherence to the Ammonia TAT and create corrective actions accordingly to resolve the problem.</td></tr>
</table>

4.4.3.Biochemistry section KPIs: Lactate exceeded TAT rate (post analysis phase):

Indicator # 11	**Performance Indicator Title** Lactate exceeded TAT rate	**Dimension** Timeliness, Efficiency, patient centeredness

Description

The rate of Lactate samples that are exceeding the intra laboratory TAT using the local laboratory standards. (recommended 60 min)

• **Rational** • To ensure that the patients are receiving appropriate timely care. • To improve the Lactate assay TAT that impacts the laboratory efficiency. • To increase the customer satisfaction and help physicians to provide more effective treatment plans.	**Type** Process

Quality Indicator requirements:

- Lactate assay Standard Operating Procedure
- Prober LIMS system to collect the data
- Use the QR of KPI TAT calculation, Annex 8.2

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of Lactate samples which are exceeding the acceptable standard TAT	Total number of Lactate samples received in the laboratory	Exclude Lactate samples received during analyzer or LIMS system breakdown.

Equation

$$\frac{\text{Total number of Lactate samples which are exceeding the acceptable standard TAT}}{\text{Total number of Lactate samples received in the laboratory}} \times 100$$

Data Elements	**Limitations**
1. Sample receiving date and time. 2. Sample loading time on the analyzer, if possible. 3. Result reporting date and time 4. Sample ordering location (Ward, Clinics) 5. Requesting Physician, if needed.	Unavailable LIS system or software for data collection. Unavailable IT support to collect the required data.

	Data Source(s) Laboratory Information System. Calculate the Lactate TAT and record any Lactate samples which exceed the acceptable TAT	**Data Collection Frequency** To be decided by the laboratory Ideally monthly.
Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the responsible laboratory personnel.	**Performance Indicator reporting Frequency** Based on the laboratory management decision. Ideally monthly.	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, management review or others
Target Based on lab management and feasibility of improvement	**Benchmarking** 60 min (College of American Pathologists, CAP guidelines), samples should not exceed ≤5 % of lab TAT (Laboratory Turnaround Time Review Article)	**Related Performance Indicator**
Quality improvement: If the rate is unacceptable, correlate the exceeded time with the peak working hours (morning time or out of hours) or frequently repeated staff to obtain the main source of problem, ensure adherence to the Lactate TAT and create corrective actions accordingly to resolve the problem.		

4.4.4.Biochemistry section KPIs: Potassium critical value successful notification rate (post analysis phase):

Indicator # 12	**Performance Indicator Title** Potassium Critical Value successful Notification rate	**Dimension** Patient safety Effectiveness

Description

The end users (physicians or nurses) receive critically **(Potassium (K) <2.5 mmol/L or > 6.0 mmol/L)** once the result released for immediate patient management.

Rational	**Type**
• To ensure that all serum Electrolytes Profile results with K < 2.5 mmol/L, (first time, inpatient of electrolyte profile of >24 h with previous low Potassium or outpatient, as per the laboratory protocol) to be notified to end user. • To reduce number of un-notified cases with K <2.5 mmol/L or > 6.0 mmol/L. • To reflect clinical effectiveness, patient safety and operational efficiency.	Outcome

Quality Indicator requirements:

Critical Value Standard Operating Procedure

Critical value notification policy

Use the QR of KPI TAT calculation, Annex 8.2

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of successful notified critical values	Total number of critical values release (including the un-notified)	Inclusion: ▪ All Electrolytes samples with K< 2.5 mmol/L or >6.0 mmol/L. Exclusion: ▪ Electrolyte profile samples with normal Potassium results.

Equation

$$\frac{\text{Total number of critical potassium results successfully notified}}{\text{Total } \textbf{Critical} \text{ Potassium Results released (including the un−notified)}} \times 100$$

Data Elements	**Limitations**
1. Source of request (location /department/ward /clinics / referral	Lack of traceability of the notifying evidence if not well documented.

/others) 2. Phone extensions 3. Patient demography 4. Patient clinical details 5. Number of un-notified critical values 6. Number of critical values to be notified 7. Date and time	**Data Source(s)** Using LIMS, Record of the total number Potassium results that needs to be notified and the record of un-notified samples for decided period of time.	**Data Collection Frequency** Monthly or as per the laboratory policy
Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible personnel	**Performance Indicator reporting Frequency** Based on laboratory management decision, ideally twice in a year	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.

Target	**Benchmarking**	**Related Performance Indicator**
Based on laboratory management recommendation	Suggested to be 100%	

Quality improvement:

If the rate is unaccepted, find the main cause of the problem e.g staff is not notifying, or the end users are not responding to laboratory call, and create corrective actions accordingly to resolve the problem. E.g:

- Raise non-conformance report against the responsible staff.
- Educate all the staff on importance of critical result management.
- Regular review of staff competency who are releasing lab results.

To have an alternative method for communication with the end user e.g pop-up notification or SMS.

4.5.Hematology & blood bank KPIs:

- These KPIs cover phases of heamatology & blood bank laboratory operations, including pre-analytical (ex. laboratory samples rejection rate, no test requested rate), analytical (eg. unacceptable internal quality control performance rate), and post-analytical stages (eg. Crossmatch / transfusion ratio (CT Ratio), Blood Product wastage rate, Exceeded CBC turnaround time rate in Emergency Department (ED), exceeded turnaround time rate of urgent INR test (international normalized ratio), hemoglobin critical value successful notification rate and Corrected (recalled) reports rate) as follows:

4.5.1. Hematology & blood bank KPIs**:** Crossmatch / transfusion ratio (CT Ratio) (post analysis phase):

<table>
<tr><td>Indicator # 13</td><td>Performance Indicator Title
Crossmatch / transfusion ratio (CT Ratio)</td><td colspan="2">Dimension
Efficiency
Effectiveness</td></tr>
<tr><td colspan="4">Description
The ratio of total crossmatched Packed red blood cells units per total transfused units</td></tr>
<tr><td colspan="3">Rational
• Reducing unnecessary cross match tests, therefore improves efficiency of blood and reagent usage, and reduce running cost.
• Reducing number of unnecessary red cell unit reservation.
• Improve inventory management and ensure timely availability of red cell units for necessary transfusion.</td><td>Type
Outcome</td></tr>
<tr><td colspan="4">Quality Indicator requirements:
1. Create crossmatch test S.O.P for laboratory personnel.
2. Create policy for blood inventory and stock management.
3. Monthly statistics of cross matches and transfusion records.
4. Create Maximum Surgical Blood Order Schedule (MSBOS) policy.
5. Provide the indications for blood transfusion (e.g. low Hb) from different specialties e.g Gyne, Medicine, Surgical etc.
6. Establish guidelines for indications of red cells transfusion that ordering physician shall follow.</td></tr>
<tr><td>Numerator
Total number of the crossmatched blood units</td><td>Denominator
Total number of transfused blood units
e.g if 450 cross matched, and 150 transfused, therefore the ratio is:
450: 150
3:1</td><td colspan="2">Inclusion/ Exclusion Criteria
Inclusion:
▪ All cross matched units accepted, processed, and entered in the LIS have to be included.
Exclusion:
Cross match requested which was accepted but not processed for any reason e.g not fitting MSBOS policy (kept as standby in case blood needed).
** each lab should follow their own standards and policies to decide what to include and what to exclude</td></tr>
</table>

<table>
<tr><td colspan="3">Equation
$\frac{\text{Total number of the crossmatched blood units}}{\text{Total number of transfused blood units}} \times 100$</td></tr>
<tr><td rowspan="2">Data Elements
8. Source of request (location /department/ward /clinics / referral /others)
9. Patient demography
10. Patient clinical details
11. Number of cross matched PRBC
12. Number of transfused PRBC.
13. Date and time</td><td colspan="2">Limitations
Lack of traceability of the fate of the unit in the wards (e.g not used but not returned)</td></tr>
<tr><td>Data Source(s)
Using Laboratory Information System, Record of the total number of crossmatched PRBC, and the total number of transfused PRBC for decided period of time per specialty.</td><td>Data Collection Frequency Monthly</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the name of responsible personnel.</td><td>Performance Indicator reporting Frequency
Based on laboratory management decision, ideally monthly and annually.</td><td>Performance Indicator reported in which report The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
</table>

Target	Benchmarking	Related Performance Indicator
Based on laboratory management CT ratio recommendation (which can be based on the progress and improvement of this KPI in the lab)	< 2.5:1 1:1 is ideal and means all crossmatched blood is transfused	None

Quality improvement:

If the rate is unacceptable, find the main sources (specialty) that request unnecessary crossmatches (cross matched units that are not transfused), ensure that they have a copy of maximum surgical blood order schedule policy (MSBO) and guidelines of indications for blood transfusion. Create corrective actions accordingly to resolve the problem with the cooperation of the source, requesting doctors and quality department.

4.5.2. Hematology & blood bank KPIs: Blood Product wastage rate (post analysis phase):

Indicator # 14	**Performance Indicator Title** Blood Product wastage rate	**Dimension** Efficiency

Description

Wastage refers to any blood component which is discarded rather than administered to a patient. This can occur for several reasons and a certain level of blood component wastage is acceptable to ensure blood components are available when it is required.

Blood wastage may occur for many reasons which includes:

- Time expired, once the blood component reached the expiry date mentioned on the label and not been utilized.
- Discarded wasted units contains units that was discarded prior to its expiration date because of, but not limited, to miss-handling or storage errors such as leakage, breakdowns, blood that is medically or surgically ordered but not used, failure to return unused units before their temperature exceeded allowable limit, haemolysed red cell contamination, clotted or miscellaneous.

Therefore, Blood Product wastage rate is the rate of blood components (PRBC, FFP, CRYO, PLTs) wasted out (expired+ discarded) of total blood component transfused.

Rational	**Type**
• To reduce wastage of blood components therefore improving inventory management and reducing unnecessary collection of blood donation.	Outcome

Quality Indicator requirements:

1. Create blood component wastage policy for PRBC, FFP, CRYO, PLTs.
2. Wastage should be monitored against national benchmark (depending on hospital category tertiary, secondary or primary) to ensure appropriate inventory levels are determined so wastage is minimized.
3. Hospitals and laboratories should monitor and record the wastage of blood products (both expired and discarded) monthly.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of wasted (expired + discarded) blood components (PRBC, FFP, CRYO, PLTs).	Total number of the blood component (PRBC, FFP, CRYO, PLTs) transfused plus total number of wasted (expired + discarded).	None

Equation

$$\frac{\text{Total number of wasted blood components}}{\text{Total number of the blood component transfused + wasted}} \times 100$$

** Wasted= (expired +discarded)

Data Elements

1. Source of request (location /department/ward /clinics / referral /others)
2. Donation details (collection, testing, transportation, preparation)
3. Patient demography
4. Patient clinical details
5. Number of transfused components.
6. Date and time
7. Number of discarded components
8. Number of expired components

Limitations

- Lack of traceability of the fate of the unit in the wards (e.g not used but not returned).
- Number of units splitted and mother unit discarded.

Data Source(s)

Using the LIMS records of the blood products transfused, and the total number of discarded + expired blood products for a decided period of time.

Data Collection Frequency

To be decide by laboratory management:

- monthly
- yearly

Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible personnel, ideally to do: • Monthly statistics. • Yearly review.	**Performance Indicator reporting Frequency** Based on laboratory management decision, ideally: • Monthly statistics. • Yearly review.	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.
Target Based on laboratory management blood component wastage rate recommendation Each hospital should establish their own target (benchmark) taking into account blood component availability and turnaround time in providing and issuing blood products in emergency cases.	**Benchmarking** Based on guidelines and studies in management blood component wastage rate recommendation < 2.0-3.0% for PRBC <12.0-18.0% for PLTs <10.0% for FFP There is no current target for CRYO	**Related Performance Indicator** Nil

	Reference: Australian National Blood Authority (2013) Wastage reduction strategy 2013-17.	

Quality improvement:

If the rate is unacceptable, find the main causes for each blood component wastage (PRBC, FFP, CRYO, PLTs), and then create corrective actions accordingly to resolve the problem.

Waste reduction strategies:

- Effective inventory management is paramount to reduce expiry-related waste.
- Timely movement of blood components between health services to ensure units can be transfused before expiry.
- Increasing the use of visual prompts in blood fridges, freezers, and platelet incubators. For example, short expiry dates.
- Simplifying procedures, production of and compliance with a maximum blood ordering schedule (MSBOS: Maximum Surgical Blood Order Schedule).

4.5.3. Haematology & blood bank KPIs: Exceeded CBC turnaround time rate in Emergency Department (ED) (post analysis phase):

Indicator # 15	**Performance Indicator Title** Exceeded CBC turnaround time rate in Emergency Department (ED) (Note: minimum requirement for the national KPI monitoring, individual labs are allowed to apply it to all departments)	**Dimension** Patient safety Timeline

Description

The turnaround time (TAT) is the time from the registration of the sample in the lab till the results are released in LIMS within 60 minutes**.**

Rational	**Type**
• To reduce the turnaround time of CBC samples received from emergency department. • Increase the satisfaction of end users in relation to urgent CBC test.	process outcome

Quality Indicator requirements:

1. Create primary sample user manual that includes urgent CBC test with its agreed turnaround time for the end users and the laboratory staff
2. Using available software that calculates TAT of urgent CBC samples from receiving until releasing of the final result.
3. Use the QR of KPI TAT calculation, Annex 8.2.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Number of the received CBC samples from Emergency department which exceed the agreed TAT	Total number of CBC samples received from Emergency department	Inclusion: ▪ All CBC samples received from Emergency department within the month, processed, and entered in the MIS have to be included. Exclusion: ▪ Rejected samples and samples that received without electronic request in system. ▪ Recalled / corrected or modified reports. ▪ Samples received during analyzer or MIS system breakdown. ▪ Tests added after the sample arrival in the laboratory (when the physicians call to add a test).

<table>
<tr><td colspan="3">Equation

$\frac{\text{Number of the received CBC samples from Emergency department which exceed the agreed TAT}}{\textit{total number of CBC samples received from ED}} \times 100$</td></tr>
<tr><td rowspan="2">Data Elements
1. Source of request (Emergency department)
2. Patient clinical details
3. Number of CBC samples received from emergency dept.
4. Number of the received CBC samples from Emergency department which exceed the agreed TAT within a month.
5. Number of CBC samples of emergency dept. that are rejected.
6. Number of corrected or modified reports.
7. Date and time</td><td colspan="2">Limitations
Nil</td></tr>
<tr><td>Data Source(s)
Using Laboratory Information System, record of the total number of CBC samples that are received from emergency department. , and the number of CBC samples of emergency department that are released after agreed TAT.</td><td>Data Collection Frequency Monthly</td></tr>
<tr><td>Performance Indicator Monitoring

The laboratory management decide on the indicator monitoring duration and the name of responsible personnel.
Advised to be monthly.</td><td>Performance Indicator reporting Frequency

Based on laboratory management decision, ideally monthly and annually.</td><td>Performance Indicator reported in which report
The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
</table>

Target	**Benchmarking**	**Related**
Based on laboratory management TAT rate recommendation	Outlier of TAT rate for CBC from emergency department exceed the agreed TAT from primary sample user manual ≤5% Reference: Royal hospital accepted TAT	**Performance Indicator** none

Quality improvement:

If the rate is unaccepted, correlate the exceeded time with the peak working hours (morning time or out of working hours) or frequently repeated staff to obtain the main sources of problem, ensure the adherence to the urgent TATs in the primary sample user manual and create corrective actions accordingly to resolve the problem. E.g:

1. Coordination with biomedical engineers and technical affairs, in case of machine failure or equipment breakdown.
2. Contact the IT department, for down times or interface or transmission issues.
3. Ensure staff competency in performance of urgent tests.

4.5.4. Haematology & blood bank KPIs: Exceeded turnaround time rate of urgent INR test (international normalized ratio) (post analysis phase):

Indicator # 16	**Performance Indicator Title** Exceeded turnaround time rate of urgent INR test ((international normalized ratio)	**Dimension** Patient Safety Effectiveness Timeline

Description

The turnaround time (TAT) is the time from the registration of the sample in the lab till the results are released in LMIS **within 60 min.**

Rational	**Type**
• To reduce the turnaround time of urgent INR samples. • Increase the satisfaction of end users in relation to urgent INR test.	process

Quality Indicator requirements:

1. Create primary sample user manual that includes urgent INR test with its agreed turnaround time for the end users and the laboratory staff.
2. Using available software that calculates TAT of urgent INR samples from receiving until releasing of result.
3. Use the QR of KPI TAT calculation, Annex 8.2.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Number of the received urgent INR samples which exceed the agreed TAT	Total number of the urgent INR samples received	Inclusion: ▪ All urgent INR samples received within the month, processed, and entered in the LIS have to be included. Exclusion: ▪ Rejected samples and samples that received without electronic request in system. ▪ Recalled / corrected or modified reports. ▪ Referral out samples.

Equation:

$$\frac{\text{Number of the received urgent INR samples which exceed the agreed TAT}}{\text{total number of urgent INR samples received}} \times 100$$

<table>
<tr><td rowspan="2">Data Elements
1. Source of request (department/ward /clinics/others)
2. Patient clinical details
3. Number of urgent INR samples received in lab.
4. Number of the received INR samples which exceed the agreed TAT within a month.
5. Number of rejected urgent INR samples.
6. Number of corrected or modified reports.
7. Date and time</td><td colspan="2">Limitations
Nil</td></tr>
<tr><td>Data Source(s)
Using LIMS, record of the total number of urgent INR samples that are received, and the number of urgent INR samples that exceeds the agreed TAT.</td><td>Data Collection Frequency
Ideally Monthly, or to be decided by the laboratory management.</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the name of responsible personnel</td><td>Performance Indicator reporting Frequency
Based on laboratory management decision, ideally monthly and annually.</td><td>Performance Indicator reported in which report
The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
<tr><td>Target
Based on laboratory management recommendation.</td><td colspan="2">Benchmarking
Outlier of TAT rate for urgent INR exceeds the agreed TAT from primary sample user manual not more than 5%
Reference: Royal hospital accepted TAT.</td><td>Related Performance Indicator
none</td></tr>
</table>

Quality improvement: If the rate is unaccepted, correlate the exceeded time with the peak working hours (morning time or out of working hours) or frequently repeated staff to obtain the main sources of problem, ensure the adherence to the urgent TATs in the primary sample user manual and create corrective actions accordingly to resolve the problem. E.g:

1. Coordination with biomedical engineers and technical affairs, in case of equipment breakdown.
2. Contact with the IT department, for down times or interface or transmission issues.
3. Ensure staff competency in performance of urgent tests.

4.5.5. haematology & blood bank: Hemoglobin Critical Value Successful Notification rate (post analysis)

Indicator # 17	**Performance Indicator Title** Hemoglobin Critical Value Successful Notification rate	**Dimension** Effectiveness Patient safety

Description

The end users (physicians or nurses) receive critically low Hb values of **(Hb < 7 g/dl)** once the result released for immediate patient management.

Rational	**Type**
• To ensure that all CBC results with HB < 7 g/dl, (first time, inpatient or outpatient) are notified to end user. • To reduce number of un-notified cases with Hb < 7 g/dl. • To reflect clinical effectiveness and patient safety.	outcome

Quality Indicator requirements:

1. Create Critical Values S.O.P for laboratory personnel.
2. Create policy for notification process of critical values to the end user.
3. Create a system for recording the notified critical values.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of successfully notified critical values.	Total number of critical values released	Inclusion: ▪ All CBC samples with Hb < 7 g/dl for the first time inpatient or outpatient. Exclusion: ▪ Known case of low Hb< 7 g/dl ▪ All CBC samples with Hb > 7 g/dl *Each lab should follow their own standards and policies to decide what to include and what to exclude.

Equation:

$$\frac{\text{Total number of successfully notified critical values.}}{\text{Total number of critical values released}} X100$$

Data Elements	**Limitations**
1. Source of request (location /department/ward /clinics / referral /others)	Lack of traceability of the notifying evidence if not well documented.

2. Phone extensions 3. Patient demography 4. Patient clinical details 5. Number of un-notified critical values 6. Number of critical values to be notified 7. Date and time	**Data Source(s)** Using Laboratory Information System, Record of the total number of CBC samples that needs to be notified (Hb<7 g/dl) and the record of un-notified samples for decided period of time.	**Data Collection Frequency** ▪ Monthly or every 6 months
Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible personnel	**Performance Indicator reporting Frequency** Based on laboratory management decision, ideally twice in a year	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.
Target Based on laboratory management recommendation.	**Benchmarking** 100 % of critical values to be notified and documented.	**Related Performance Indicator** None

Quality improvement:

If the rate is unaccepted, find the main cause of the problem e.g staff is not notifying, or the end users are not responding to laboratory call, and create corrective actions accordingly to resolve the problem. E.g:

- Raise non-conformance report against the responsible staff.
- Educate all the staff on importance of critical result management.
- Regular review of staff competency who are releasing lab results.

To have an alternative method for communication with the end user e.g pop-up

4.6.Histopathology KPIs:

- These KPIs cover the following stages of hematology and blood bank laboratory operations: pre-analytical (eg. no test requested rate), analytical (eg. unacceptable internal quality control performance rate), and post-analytical stages (eg. Urgent histopathology samples TAT rate, Rate of Attention histopathology samples exceeded TAT, Rate of Attention histopathology samples exceeded TAT, routine histology TAT and corrected (recalled) reports rate,)

4.6.1. Histopathology KPIs: Urgent histopathology samples TAT rate (post analysis):

Indicator # 18	**Performance Indicator Title** Urgent histopathology samples TAT rate	**Dimension** Timeline
Description This document outlines the reference turnaround time for reporting urgent histopathology specimens. Specimens are labeled as "urgent" by the pathologist assigned to the case depending on the clinical history and diagnosis, irrespective whether the case is from within the hospital or referred from other hospitals. The request forms are stamped "urgent" with red ink stamp. These include small biopsies e.g. endoscopic biopsies, core-needle biopsies, etc. as well as resection specimens like mastectomy, gastrectomy, colectomy, etc. The selection of urgent analysis must be appropriate; as inappropriate use might lead to delay of genuine cases. Grossing and reporting of these specimens depends on their state of fixation, size, diagnosis and ancillary tests required. Majority of the small biopsies will be reported in 2-5 working days (intra and inter hospitals' samples). Whereas the large specimens will be reported in 5-10 working days (intra and inter hospitals' samples). If additional blocks, cuts, special stains or immunohistochemistry are still needed, then reporting may take up to a maximum of 10 working days. **Turnaround time** is defined as the total number of working days, from the time of receiving of the specimen in the laboratory till the release of the final report.		

Rational	**Type**
1. To demonstrate the rate of urgent histopathology cases exceeded TAT. **2.** To save time and effort. **3.** To ensure that the patients are receiving appropriate diagnosis and timely care	Process

Quality Indicator requirements:

- Standardized urgent histopathology samples SOP.
- Standardize releasing of urgent cases SOP.
- Examination offered by lab (document the TAT
- Standardized releasing codes.
- Use the QR of KPI TAT calculation, Annex 8.2.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of urgent cases which exceeded the TAT on specific periods of time	The total number of urgent Cases diagnosed on same periods of time	1. Sending abroad cases as second opinion. 2. Sending abroad cases for further test and investigation 3. Recalled / corrected or modified reports

Equation

For small tissue: TAT is 5 days

$$\frac{\text{Total number of urgent cases of small tissues which exeede the TAT}}{\text{Total number of urgent cases diagnosed on same period}} X100$$

For large tissue: 10 days

$$\frac{\text{Total number of urgent cases of large tissues which exeede the TAT}}{\text{Total number of urgent cases diagnosed on same period}} X100$$

Use the sum of both TAT rates to get the overall rate of urgent histology samples TAT

<table>
<tr><td rowspan="2">Data Elements
Date of receiving.
Date of releasing.
Type of tissue.
Ancillary tests required
e.g Immunohisto- chemistry (IHC) and special stains
Non conformity if applied</td><td colspan="2">Limitations
Checking manually all exceeded cases one by one using laboratory sample ID.</td></tr>
<tr><td>Data Source(s)
Using Laboratory Information System, Record the total number of Specimens diagnosed as urgent cases, and the numbers of cases exceed TAT for decided period</td><td>Data Collection Frequency
To be decide by laboratory management and HOD, (quarterly)</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the name of responsible person</td><td>Performance Indicator reporting Frequency
Based on laboratory management decision, biannually</td><td>Performance Indicator reported in which report
The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others</td></tr>
</table>

Target	Benchmarking	Related Performance Indicator
Based on lab management decision and improvement feasibility	Use national / international benchmark. The target was adapted from College of America Pathologists which is(< 95 %)	Balanced set of indicators if relevant
Quality improvement: If the rate is unaccepted, analyze the data. Start investigating the causes and set a corrective action accordingly.		

4.6.2. **Histopathology KPIs:** Rate of Attention histopathology samples exceeded TAT (post analysis) :

Indicator # 19	**Performance Indicator Title** Rate of Attention histopathology samples exceeded TAT	**Dimension** Timeline

Description

This outlines the reference turnaround time for reporting attention histopathology specimens. Specimens which are not urgent but need priority over other routine samples are categorized as "Attention" samples. Assigned pathologist decides the category of such samples. The specimen request is stamped "attention" with blue ink stamp.

The specimens in this category include oral biopsies, skin biopsies, endometrial curetting, lip biopsy and eye/ conjunctival biopsy (with suspicious history).

Also soft tissue (with intermediate malignant potential or with ambiguous history), pediatric specimen (especially from neonates), some bone biopsies, etc. These specimens are generally small to medium in size and usually do not require overnight fixation.

The above-mentioned cases gain priority over routine cases but after urgent cases, they are submitted to the pathologist after all the "urgent" cases. Many of these cases require additional levels, special stains and also immunohistochemistry.

Attention samples will be reported within 7 working days.

Except in some cases of skin biopsies, which usually require liaison with dermatologist, hence will be reported in 10 working days and cases that require special and immunohistochemistry staining.

Turnaround time is defined as the total number of working days, from the time of receiving the specimen in the laboratory till the release of the final histopathology report.

Rational	**Type**
1. To demonstrate the rate of Attention histopathology cases exceeded TAT. **2.** To save time and effort. **3.** To ensure that the patients are receiving appropriate diagnosis and timely care	Process

Quality Indicator requirements:

- Standardized Attention histopathology samples SOP.
- Standardize releasing of Attention cases SOP.
- Examination offered by lab (document the TAT
- Use the QR of KPI TAT calculation, Annex 8.2.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of Attention cases which exceeded the TAT on specific periods of time (10 working days)	The total number of Attention Cases diagnosed on same periods of time	2. Sending abroad cases as second opinion. 3. Sending abroad cases for further test and investigation 4. Recalled / corrected or modified reports

Equation:

$$\frac{\text{Total number of Attention cases which exceeded the TAT on specific periods of time (10 working days)}}{\text{The total number of Attention Cases diagnosed on same periods of time}} X100$$

Data Elements

- Date of receiving.
- Date of releasing.
- Type of tissue.
- Ancillary tests required
- e.g Immunohisto- chemistry (IHC) and special stains
- Non conformity if applied

Limitations

Checking manually all exceeded cases one by one using laboratory sample ID.

Data Source(s)

Using Laboratory Information System, Record the total number of Specimens diagnosed as Attention cases, and the numbers of cases exceed TAT for decided period.

Data Collection Frequency

To be decide by laboratory management and HOD,

(advised to be quarterly collected)

Performance Indicator Monitoring The laboratory management decide on the indicator monitoring duration and the name of responsible person	**Performance Indicator reporting Frequency** Based on laboratory management decision, advised to be biannual)	**Performance Indicator reported in which report** The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others
Target Based on laboratory management recommendation.	**Benchmarking** Use national / international benchmark. The target was adapted from College of America Pathologists which is (95%)	**Related Performance Indicator**
Quality improvement If the rate is unaccepted, analyze the data. Start investigating the causes and set a corrective action accordingly.		

4.6.3. Histopathology KPIs: Routine Histology TAT (post analysis):

Indicator # 20	**Performance Indicator Title** Routine Histology TAT	**Dimension** Effectiveness Timeline

Description

Many of the samples received are not a priority, as they do not require an urgent management; these are therefore treated as "routine" samples. They include specimens like products of conception, appendix, gall bladder, cutaneous cysts, sinuses, placenta, simple cysts of the ovary, etc. These specimens will be reported within 12 working days.

Rational	**Type**
1. To demonstrate the rate of routine histopathology cases exceeded TAT. **2.** To save time and effort. **3.** To ensure that the patients are receiving appropriate diagnosis and timely care	process

Quality Indicator requirements:

- Standardized routine histopathology samples SOP.
- Standardize releasing of routine cases SOP.
- Examination offered by lab (document the TAT
- Standardized releasing codes.
- Use the QR of KPI TAT calculation, Annex 8.2.

Numerator	**Denominator**	**Inclusion/ Exclusion Criteria**
Total number of routine cases which exceeded the TAT on specific periods of time	The total number of routine Cases diagnosed on same periods of time	1. Sending abroad cases as second opinion. 2. Sending abroad cases for further test and investigation 3. Recalled / corrected or modified reports

Equation:

$$\frac{\text{Total number of routine cases which exceeded the TAT on specific periods of time)}}{\text{The total number of routine Cases diagnosed on same periods of time}} X100$$

<table>
<tr><td rowspan="2">Data Elements
Date of receiving.
Date of releasing.
Type of tissue.
Ancillary tests required
e.g Immunohisto- chemistry (IHC) and special stains</td><td colspan="2">Limitations
Checking manually all exceeded cases one by one using laboratory sample ID.</td></tr>
<tr><td>Data Source(s)
Using Laboratory Information System, Record the total number of Specimens diagnosed as urgent cases, and the numbers of cases exceed TAT for decided period</td><td>Data Collection Frequency
To be decide by laboratory management and HOD, biannually</td></tr>
<tr><td>Performance Indicator Monitoring
The laboratory management decide on the indicator monitoring duration and the name of responsible person</td><td>Performance Indicator reporting Frequency
Based on laboratory management decision, annually recommended</td><td>Performance Indicator reported in which report
The reporting method to be decided by the laboratory management. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget</td></tr>
</table>

		requests, or others
Target Based on lab management decision and improvement feasibility	**Benchmarking** Use national / international benchmark. The target was adapted from College of America Pathologists which is (95 %)	**Related Performance Indicator** Balanced set of indicators if relevant
Quality improvement: If the rate is unaccepted, analyze the data. Start investigating the causes and set a corrective action accordingly.		

Chapter Three

5. Responsibilities:

5.1. Laboratory management shall:

- Supervise and review the process implementation and outcomes
- Ensure the quality indicator requirement availability
- Communicate the quality indicators to concerned department.

5.2. Quality manager/ officer shall:

- Ensure the quality indicator requirement availability
- Perform the correct data collection with the IT support.
- Monitor the approved quality indicators.
- Coordinate with laboratory staff to ensure target achievement.
- Encourage the initiation of non-conformance corrective action process, record it, and follow up the implementation in case of failure to achieve target.
- Conduct root cause analysis accordingly.
- Record, and follow up the plan timeline and implementation.
- Evaluate the actions effectiveness.
- Regularly report the actions and results to lab management for reviewing their effectiveness.
- Communicate the quality indicators to all laboratory staff.

5.3. Responsible staff shall:

- Implement the related laboratory quality policies and protocols to the indicator.
- Facilitate the data collection.
- Collaborate with quality manager/ officer to ensure target achievement.
- Participate in the immediate action, root cause and the implement of the corrective action process.

Chapter Four

6. Document history and version control table:

Version	Description	Review date
1	Initial Release	April 2029

7. References:

Title of book/ journal/ articles/ Website	Author	Year of publication	Page
KPIs Guideline , MOH, Oman, Directorate General Quality Assurance, MoH /DGQAC/GUD/001/Vers.01	Mrs Faiza Al-Balushi	-	1-32
MoH/DGQAC/GUD/001/FRM001/Vers.2	Mrs Faiza Al-Balushi	-	1-32
https://www.labmanager.com/author/todd-mcevoy- phd	Todd,McEvoy , PhD	2023	1
https://www.labmanager.com/author/todd-mcevoy- phd	Kate , Neetz	2023	1
Quality manual policies & procedures-MOH ,	Quality manual development task force	-	3
quality indicators procedure , Royal hospital, PLN/IND/01,	LQMS department	5/2/2022 REV 11	1 to 3
A critical review of laboratory performance Indicators, https://doi.org/10.1080/10408363.2019.1641789	Eline R. et.al	2019	VOL. 56, no.7, 458–471
Biochemistry samples rejection in laboratory medicine report, Nizwa hospital	Dr. Buthaina al Bahri	-	-
Key assurance indicators for pathology services	Dr. Bridget Wilkins,	November	1-26

	Maria Farrero-Feo, Kate Stewart.	2019	
Key performance indicators in pathology	The Royal College of Pathologists	May 2011	1-22
key performance indicators in pathology	The Royal College of Pathologists	April 2013	1-23
International Federation of Clinical Chemistry and Laboratory Medicine, Working Group "Laboratory Errors and Patient Safety", quality indicators	IFCC WG-LEPS: MQI-KP-	January 2017	Revision 1to10 p
International Organization for Standardization 15189:2012 (E)	ISO 15189	2012	-
Clinical Laboratory Improvement Amendments (CLIA) Complaints, Department of health & Human Services- USA.	Center for Medicare & Medicaid Services (CMS)	August 2009	-
Supplement to the laboratory quality management system training toolkit, module 16 - documents and records quality manual version 2013	WHO	2013	-
CLIM Center Infectiology Lao -Christophe Mérieuxquaity manual	CLIM	2017	-
Complaints and investigation, Bureau of Health Care Quality and Compliance (BHCQC)	(BHCQC)		-
To err is human: Building a safer healthcare system	IOM	1999	
Management of continual improvement for facilities and activities: A structured approach. https://www-pub.iaea.org/MTCD/publications/PDF/te_1491_web.pdf	IAEA	April 2006	1-78
Complete guide to corrective action vs. preventive action https://advisera.com/blog/2021/07/19/complete-guide- to-corrective-action-vs-preventive-action/	Mark Hammar	2021	-
Risk-based thinking replacing preventive action in ISO 9001:2015 – The benefits	Ohn Nolan	2015	-
14.3 Problem Solving and Decision Making in Groups https://open.lib.umn.edu/communication/chapter/14-3-problem-solving-and-decision-making-in-groups/	The University of Minnesota Libraries	2009	-

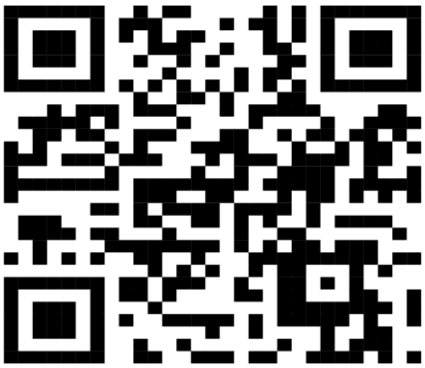
Project Controls: What is it and why is it important? https://projectcontrolsonline.com/definition-and- importance-of-project-controls	Project control online (repository)	18th January 2014	
CAP Internal Auditing Course – Sample Content http://appsuite.cap.org/appsuite/learning/QMED/eStore/ Internal Auditing 2020 Sample Content Store 062620.pdf	College of American Pathologists	2020	
Tips for Performing Internal Lab Audits https://labmedicineblog.com/2019/06/17/tips-for- performing-internal-lab-audits/	Wojewoda. C et al	June 2019	
RCpath key performance indicators	RCpath	2013	-
RCpath Key Insurance indicators	RCpath	2019	-
International Federation of Clinical Chemistry and Laboratory Medicine Working Group "Laboratory Errors and Patient Safety"	IFCC	2016	-
Performance Indicator Emergency department, vers 1, 1rst edition	MOH, GQAC	2016	-
Quality indicators for the total testing process, 37 http://dx.doi.org/10.1016/j.cll.2016.09.015	Clin Lab Med	2017	187–205
Basic Lessons in Laboratory Quality Control Greg Cooper., Inc. Quality Systems Division.	Bio-Rad Laboratories	2008	-
https://www.isobudgets.com/7-performance-metrics-to- optimize-laboratory-quality-and-productivity/.			
https://www.labmanager.com/business- management/the-smart-lab-part-ii- 5536#.XIE8VYhKiUk.			

8. Annexes:

8.1.: Template of designed KPIs form:

<table>
<tr><td>Indicator #</td><td colspan="2">Performance Indicator Title
Exact title of the performance indicator</td><td>Dimension
Quality Dimension</td></tr>
<tr><td colspan="4">Description
Description of the performance indicator including a description of the target population.</td></tr>
<tr><td colspan="3">Rational
Rationale for the measurement of the performance indicator</td><td>Type
System Component (structure, process, outcome)</td></tr>
<tr><td>Numerator
The subset of the target population that meets the criteria as defined in the indicator</td><td colspan="2">Denominator
The target population includes all services, users, or events that qualify for inclusion in the measurement process</td><td>Inclusion/ Exclusion Criteria</td></tr>
<tr><td rowspan="2">Data Elements
Provide any other information relevant to the performance indicator (variables)</td><td colspan="3">Limitations
Indicate any factors or characteristics of the indicator or its data elements that might compromise the accuracy of results.</td></tr>
<tr><td colspan="2">Data Source(s)
Indicate what data source(s) will be used for the performance indicator; for example, data sources include administrative databases, medical records, national health information resources, and/or survey data.</td><td>Data Collection Frequency
Indicate how often the data to support the performance indicator will be collected
□Daily □Weekly □Monthly □Quarterly □Bi-annually □Annually
□Other – give details:</td></tr>
<tr><td>Performance Indicator Monitoring
Indicate how often the KPI will be monitored and by whom</td><td colspan="2">Performance Indicator reporting Frequency
Indicate how often the performance indicator will be reported
□Daily □Weekly □Monthly □Quarterly □Bi-annually □Annually
□Other – give details:</td><td>Performance Indicator reported in which report
Indicate where the performance indicator will be reported. For example, the performance indicator may be reported in annual reports, annual service plans, quarterly performance reports, budget requests, or others.</td></tr>
<tr><td>Target
Indicate the target for the performance indicator – a target should be set for the performance indicator to inform progress towards an acceptable level of performance.</td><td colspan="2">Benchmarking
Indicate if this performance indicator is collected in other jurisdictions outside of your country and therefore allows for international comparison.</td><td>Related Performance Indicator
Balance set of indicators if relevant</td></tr>
</table>

8.2.: QR of KPI TAT calculation, scan the code by camera and download the Excel sheet to your computer.



8.3. The following are suggestions of the most common set of quality indicators that covers total testing process (TTP):

Pre – examination phase	**Examination phase**	**Post – examination phase**
1. sample rejection rate 2.Sample received without test order	1.External Quality assessment (EQA) 2.Internal Quality assessment (IQC)	Examples of Urgent Tests Turnaround Time (TAT)**:** 1.Hematology: hemoglobin 2.Biochemistry: Troponin, Potassium 3.Microbiology: Positive blood culture smears report, typical MDRO (Multi Drug Resistant Organism), CSF microscopy 4. Histopathology / cytology: Histopathology urgent Cytology FNA
		Contamination of blood culture bottles
		Critical results notification in all sections
		Corrected Results in all sections
		Biopsy Correlation Performance
		Blood Product wastage rate