National University Hospital

POLICIES

Laboratory Services Operating Hours

CORE Chemistry, Haematology, Microbiology and Blood Transfusion Laboratories are open 24 hours.

Non-CORE Chemistry, Haematology, Flow Cytometry, Cytogenetics and Molecular Diagnosis Laboratories are open only office hours.

Laboratory Administration, Laboratory Information Services, and Point-of-Care Support Services are open during office hours.

For external NUH services the NUH Referral Laboratory (NRL) services is open Monday-Friday 830hrs – 1700hrs and Saturday 830hrs – 1200hrs.

All laboratories will be fully staffed during office hours. Laboratories operating on a 24-hour shift will have a reduced staff strength on Saturdays, Sundays, public holidays and after-office hours.

Specimens

Walk in patients	Requests for laboratory investigations, must be made by a medical doctor and can be made through the NUH Referral Laboratory.
Medico-Legal Testing	Medico-legal specimens will be referred to the Centre for Forensic Medicine of the Health Science Authority (HSA). Only in-house samples are accepted.
Test Referrals	Our Department may refer out tests that we do not perform in-house to other local or overseas laboratories.
Clinical Trials & Projects	Research projects are approved on an individual basis.
Animal Specimen	We do not accept animal testing in the laboratory.

Turnaround Times

Each test listed in the test catalogue has indicated the test frequency and turnaround times. Please allow and additional one to two days if the scheduled test falls on a public holiday. Turnaround times for URGENT tests can be found in Table 1.

Table 1: Expected turnaround time for URGENT tests

Test	URGENT TAT
General Chemistries	1.5 hours
Blood Gases	30 mins
Therapeutic Drugs	1.5 hours
Full Blood Count	40 mins (without film review)
PT/INR	45 mins

ABO Rh Group and Type	30 mins
Crossmatch	10-30 mins (30 mins with Type & Screen)
Blood Film for Malarial or Filarial Parasites	1.5 hours
Thyroid Hormones	2.0 hours
Tumour Markers	2.0 hours
Iron Panel	2.0 hours
Troponin	1.5 hours
Urine Formed Elements	1.0 hour
Glycated Haemoglobin	2.0 hours

For tests that are sent out to referral laboratories, the average turnaround time will vary from 7 to 14 days.

Unacceptable Specimens

Specimens will be rejected if the following conditions are unacceptable:

Specimen	• Insufficient volume • Incorrect specimen type (plasma, serum, etc) • Mislabeled specimen • Unlabelled specimen
Specimen Container	• Incorrect specimen container (metal-free, sterile, etc) • Transport medium
Patient Information	• Insufficient information • Incorrect information
Transport Condition	• Temperature (in ice, frozen, ambient, etc) • Protected from light

Note:

For patient safety reasons, unlabeled or mislabeled specimens will strictly be rejected and a fresh sample should be collected again.

Verification of “precious” samples are subjected to approval on a case by case basis. The doctor-in-charge is required to come to the laboratory to personally verify the correct patient identification and sign an incident form, stating that he/she will be held responsible for any consequences that may follow. An incident report will be raised to Medical Affairs.

The following samples may be considered “precious”

- Cerebrospinal fluid (csf)
- Blood culture
- Cord blood
- Stimulation/suppression tests

Handling of Results

- All laboratory results are treated with the strictest confidentially. We comply with the Personal Data Plan Act 2012 (PDPA) in all result handling and correspondence. All results conveyed

verbally to the ordering clinician or designee is documented for audit purposes. All patient results may be viewed in EPIC. For HIV, a double log in is required to access these results.

- A patient's laboratory results are released into EPIC with result verification in LIS. Results are released by test based completion and will not be limited to the completion of an order to transmit the results. Clinicians may then review and verify patient lab results from EPIC.
- Microbiology may release interim reports which will be superseded when final results are available.
- Complex results from referred laboratories will not be transcribed into LIS. The reports will be scanned and uploaded to EPIC for clinicians to review and verify.
- Scanned reports will be used for medico-legal toxicology reports, as well as some bone marrow, cytogenetics, flow cytometry and molecular diagnosis reports.
- For NUH patients no hardcopy reports are generated. However, a copy of a laboratory report may be generated from EPIC.
- For NUH Referral Lab clients hard copy reports will be generated from LIS on completion of the tests.

Amendment of Results

- Any amendments made to results after their release will be conveyed to the ordering doctor or designee by phone.
- Amended results released from LIS will overwrite previous erroneous results displayed in EPIC as a corrected result. Previous results, person corrected results have been reported to, and date and time of result amendment communication will also be included in the patient report.

Critical Results

- The following results are considered as "Critical Values" and are reported to the Ordering Clinician within one hour of availability.
- A number of the critical values are only reported within NUH (see Table 2).
- Table 3 is the list of drugs that we notify as "Alert Values" above which the drug concentrations can be considered toxic.

Table 2: Critical Values

Calcium, serum	< 1.75 or > 3.00 mmol/L
Glucose, serum	< 2.5 or > 20.0 mmol/L
Sodium, serum	< 120 or >160 mmol/L
Potassium, serum	< 2.5 or >6.0 mmol/L
Troponin I	> 26.2 ng/L on first presentation per admission (NUH only)
Ammonia	> 100 umol/L (NUH only)
Lactate	> 5.0 mmol/L (NUH only)
Bilirubin, neonatal	> 300 umol/L (NUH only)
APTT	>100 seconds
INR	$\geq$5.0
Haemoglobin	< 6 g/dL
White Blood Count	$\leq 1x10^9$/L or $\geq 50x10^9$/L on first presentation per admission
Platelets	$\leq 20x10^9$/L or $\geq 800x10^9$/L
Malaria/Filaria Parasite	Malarial/Filarial Parasite present on first presentation per admission

Blast Cells	Presence of Blast Cells
Glucose-6-phosphate Dehydrogenase, neonatal	Deficient or Indeterminate
AFB Smear	Positive
Blood Culture	Positive
CSF Smears (Gram, Indian Ink, Cryptococcal antigen	Positive

Table 3: Alert Values

Acetaminophen	>200 mg/L
Amikacin	>35 mg/L
Digoxin	>2.4 ug/L
Gentamicin	>13 mg/L
Lithium	>1.5 mmol/L
Phenobarbital	>40 mg/L
Phenytoin	>20 mg/L
Salicylate	>300 mg/L
Theophylline	>20 mg/L
Valproate	>120 mg/L
Vancomycin	>30 mg/L

NUH Patients

- Our Healthcare Messaging System (HMS) is utilised for the reporting of critical values to the Ordering Clinician via SMS.
- Once a critical result has been validated in LIS it will flow to an interface engine. Here the result is matched with the most up to date location for the patient, the Ordering Clinician and the critical result.
- The consolidated information creates and sends a SMS to the Ordering Clinician with details of the patient name, identity number, location, critical result, and reference range.
- The Clinician is required to reply within 10 minutes of receiving the message with one of three options (they respond by replying 1,2 or 3)
    1. Correct doctor and acting on it.
    2. Wrong doctor but acting on it.
    3. Wrong doctor and not acting on it.
- When options 1 or 2 are selected, no further action is required.
- When option 3 is selection, the HMS will escalate to the next Clinician on the specific Department roster and cycle the process to start the clock at 10 minutes again.
- If no response, or option 3, the call will be intervened manually by the Call Centre staff.
- Call Centre staff will source for the next most suitable Clinician and retrigger the sms. The second message sent still needs to be acknowledged to close the case.
- Any cases that are unable to receive an sms the Call Centre staff will connect a doctor to the laboratory staff for the reporting of the results. A result read back is required to ensure the results are documented correctly by the recipient. All critical result notification is documented to indicate the recipient, time (for both electronic and manual notification) and the lab staff reporting the result (for manual reporting).