POLICIES

Laboratory Services Operating Hours

Clinical Chemistry CORE Laboratory	24 hours
Haematology CORE Laboratory	24 hours
Blood Transfusion Services	24 hours
Microbiology Laboratory	24 hours
Special Chemistry	Office hours
Immunoassay Laboratory	Office hours
Stem Cell Laboratory	Office hours
Flow Cytometry Laboratory	Office hours
Cytogenetics Laboratory	Office hours
Molecular Diagnosis Centre	Office hours
Medical Centre Laboratory	Office hours
Laboratory Administration	Office hours
Laboratory Information Services	Office hours
Point-of-Care Support Services	Office hours
NUH Referral Laboratory Services	Monday-Friday, 8.30am – 5.00pm Saturday, 8.30am – 12.00pm

Office hours: Monday to Friday, 8.30am – 5.30pm

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.

Turnaround Times

- Routine Tests
  These tests are performed in a batch mode or in a continuous flow on receipt. Most tests will be processed and results will be available within 24 hours upon receiving the specimen.
- Scheduled Tests
  These tests are performed on a fixed schedule basis with turnaround time ranging from a few days to a week. A few esoteric tests may take up to two weeks to result.
- Referred Tests
  These tests may take a few days to a few weeks. Both courier schedules and testing schedules of the referred laboratory must be taken into consideration when tracing for results.
- Urgent Tests
  An urgent test or sample will be processed for testing as soon as it is received in the laboratory. The results should be available within 2 hours, depending on the tests requested.

Tests available on an URGENT basis for inpatient wards:

- Chemistries: Sodium, Potassium, Chloride, Carbon Dioxide, Urea, Creatinine, Glucose, Calcium, total & ionized, AST, CK, LDH, CKMB, Troponin, Myoglobin, Amylase, Serum & Urine Osmolality, Magnesium, Ammonia, Lactate, Beta hydroxy butyrate, Neonatal Bilirubin, C-reactive protein
- Blood gases, carboxyhaemoglobin
- Therapeutic drugs: Acetaminophen, Salicylate, Digoxin, Theophylline, anti-epileptics, aminoglycosides

- Full blood count
- Coagulation studies: PT/INR
- ABO Rh Group and Type
- Crossmatch of Blood and Blood Products
- Type specific non-crossmatched blood
- Blood films for Malarial and Filarial parasites

Additional tests available on an URGENT basis for Outpatient Centres
These tests will be considered as urgent when the attending clinician requires the results for the same clinic session and orders them as urgent requests.

- Thyroid hormones: T3, free T3, T4, freeT4, TSH
- Reproductive hormones: LH, FSH, Estradiol, Testosterone, Progesterone, Prolactin
- Tumour markers: AFP, CEA, Total Beta HCG, PSA
- Lipids
- Troponin
- Iron panel: Iron, Ferritin, Transferrin
- Therapeutic drugs
- Urine formed elements
- Glycated Haemoglobin

All tests will be performed promptly on receipt in the laboratory. The actual time will vary depending on the required time on the analyser for each test.

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

Test Amendments

The cancellation or addition of tests must be submitted using the appropriate forms – Test Cancellation/Charge Waiver Form, DLM-FORM-GEN-081 and Add-on Test Request form, DLM-FORM-GEN-084 respectively.

- Cancellation of Tests

  For notice of cancellation of tests due to the incorrect identification on the samples: All results will be invalidated and the billing cancelled from the patients account. Billing will be posted to the ordering location. Requesting doctor/location is required to fill in Test Cancellation/Charge Waiver form and submit to the laboratory as soon as possible. The Head of Department of the requesting location is required to approve the charge waiver.

  For notice of cancellation of tests due to incorrect or double ordering: Test results will not be removed from the patient record as there is no error in the results. However, the billing will be cancelled from the patients account. Billing will be posted to the ordering location. Requesting doctor/location is required to fill in Test Cancellation/Charge Waiver form and submit to the laboratory as soon as possible.

  For notice of cancellation of tests prior to analysis of the sample: No patient billing will be incurred. Test cancellation form is still required and test billing will be cancelled.

- Add-On Tests

  We discourage additional tests being requested on samples drawn earlier due to sample degradation and evaporation after testing. A form is available for a limited menu of tests in the event that the test orders cannot wait till the next blood draw. This form DLM-FORM-GEN-084 needs the MCR of the ordering doctor to be filled before the form will be accepted. Due to small sample volumes and high levels of evaporation in paediatric samples from microtainer collections we do not accept Add-On Test for paediatric samples. For Outpatient requests please call the testing laboratory in advance to ensure a suitable and adequate sample before performing Add-On Test. Outpatient Clinic staff are required to manually post the bill into the patients account.

  In the event there is insufficient sample to Add-On Test, the order will appear in the patient's records and tagged as insufficient.

Specimen Rejection

Specimens may be rejected by the laboratory for a wide variety of reasons:

- Incorrect transit temperature (e.g. not received in ice). Please refer to individual test requirements for preferred temperatures.
- Incorrect specimen type, for example plasma instead of whole blood.
- Inadequate specimen volume. Please refer to individual test requirements for minimum volume.
- Inadequate preservation of 24-hour urine collection. Obtain collection bottle with appropriate preservatives from the laboratory prior to collection. Not all tests can be collected during a single collection due to differences in preservation requirements.
- Expired transport medium.
- Incorrect specimen container, e.g. a sterile container or a trace-metal free blood tube.
- Unlabelled specimens cannot be labelled in the laboratory. The samples will be archived.
- A specimen is received with a request form and the identifiers are mismatched.
- For unlabelled "precious" samples, e.g., cerebrospinal fluid (CSF) or extracted fluids that cannot be recollected, the person responsible for collecting the sample would be required to personally verify the correct patient identification at the laboratory prior to analysis. An incident report will be raised and the notice of verification will be appended to the patient report.

Handling of Results

- All laboratory results are treated with the strictest confidentiality. We comply with the Personal Data Protection Act 2012 (PDPA) in all result handling and correspondence. All results conveyed verbally to the ordering clinician or designee are documented for audit purposes. All patient results may be viewed in CPSS_2. For HIV, only the ordering clinician or a clinician of consultant level or above may access the results. It requires a double log in to access these results.
- A patient's laboratory results are released into CPSS_2 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 CPSS_2.
- 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 the Specialist Results System (SRS), an integrated component of CPSS_2 for clinicians to review and verify.
- SRS will also 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 CPSS_2.
- 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 CPSS_2. The name of the person receiving the amended results, and the date and time of amendment communication, are 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
Calcium, corrected	< 1.75 or > 3.00 mmol/L
Glucose, serum	< 2.5 or > 25.0 mmol/L
Sodium, serum	< 120 or >160 mmol/L
Potassium, serum	< 2.5 or >6.0 mmol/L
Lactate	> 5.0 mmol/L
Troponin I	$\geq$ 17.5 ng/L on first presentation per admission (NUH only)
Ammonia	> 100 umol/L (NUH only)
Bilirubin, paediatric	> 300 umol/L (NUH only)
APTT	> 100 seconds
INR	$\geq$ 5.0
Haemoglobin	$\leq$ 5g/dL
White Blood Count	$\leq 1x10^9$/L or $\geq 50x10^9$/L on first presentation per admission
Malaria/Filaria Parasite	Malarial/Filarial Parasite present on first presentation per admission
AFB Smear	Positive
Blood Culture	Positive
CSF Gram Stain	Positive

Table 3: Alert Values

Acetaminophen	> 200 mg/L
Amikacin	> 26.0 mg/L
Digoxin	> 2.4 ug/L
Gentamicin	> 13.0 mg/L
Lithium	> 2.0 mmol/L
Phenobarbital	> 40 mg/L
Phenytoin	> 20 mg/L
Salicylate	> 300 mg/L
Theophylline	> 20 mg/L
Valproate	> 200 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 the 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 selected, the HMS will escalate to the next Clinician on the specific Department roster and he or she is required to reply within 10 minutes.
- If there is no response, or option 3 is used, the call will be intervened manually by the Call Centre staff.
- Call Centre staff will source for the next most suitable Clinician and connect them 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 notifications are documented to indicate the recipient, time (for both electronic and manual notification) and the laboratory staff reporting the result (for manual reporting).