VAIOLA HOSPITAL

Ministry of Health, Nukualofa, Tonga

LABORATORY SERVICES

HANDBOOK

2023-2026 EDITION

Reviewed by: Laboratory Services Management

Preface

This handbook serves as a guide for clinicians and health workers to the use of services available at the Vaiola Hospital Laboratory. It is hoped that it will be able to provide quick guide and easy reference to the services that are provided at Vaiola Hospital Laboratory. Information provided are on the laboratory tests, specimen requirements, specimen collection procedures, reference ranges for analytes, and some details on laboratory report management. Specialised tests that are not offered at Vaiola Hospital Laboratory are referred abroad to reference laboratories. LabPlus, Auckland is the main reference laboratory for Ministry of Health, Tonga. Detailed information on specimen requirements and transportation guideline for

referred specimens are available on LabPlus website www.labplus.co.nz.

The laboratory endeavours to produce high quality results in a timely manner. We welcome comments from users communicated in writing or email to the Pathologist, Medical Officer in charge of laboratory or Principal Medical Scientist that may lead to the future improvements of the service.

Laboratory Management.

CONTENTS

1.0 LABORATORY PERSONNEL

Dr Siale 'Aka'ola	Pathologist
Dr 'Ilaisaane Fohohema	Pathology Registrar
Dr Patrick Penitani	Pathology Registrar
Mr Semisi Lenati	Procurement/Stock Manager
Mrs Senisaleti Pasikala	Quality/HR Manager
Miss Vaohoi Moala	Head Scientist, Molecular Lab Unit.
Mrs Melevea Fonua	Head Scientist,Hematology
Mr Sione 'Isoa units.	Head Technician,Histology/Cytology
Mrs Fele'unga Vaka'uta Blood Collection units.	Head Technician,Lab Reception and
Mrs Mele Mo'ungaevalu	Head Scientist,Microbiology Unit.
Mrs.Lu'isa Vailanu Blood Transfusion.	Head Scientist,Blood bank and

2.0. GENERAL INFORMATION

Vaiola Hospital Laboratory Contact Details

Vaiola Hospital Switchboard operator	Tel:23200
Pathologist and MO	Ext 1397/7400161
Laboratory Services Manager	Ext 1515/7400470
General Enquiries	Ext 1612/7400493
Haematology/Biochemistry	Ext 1403/7400218
Blood Transfusion/Serology	Ext 1402/7400443
Blood Bank Services	Ext 1363/7400442
Microbiology	Ext 1618/1617
Molecular Biology Unit	Ext 1547/7400861
Histology/Cytology Unit	Ext 1616/7400480
Laboratory Administration	Ext 1323/7400162

2.1 Laboratory Hours of Operations

Laboratory service is provided 24 hours/7days a week.

Normal Hours of Service

Monday –Friday 8.30am-4.30pm

During these hours, all routine and emergency samples are processed. Clinicians are urged to send routine samples to the laboratory not later than 3.00pm

After hours' services

Monday-Friday 4:30pm -8:30am

Weekends and Public Holidays 24hours.

During these hours, only urgent services provided. This include

- Urgent blood transfusion and haematology service.
- Urgent biochemistry and CSF analysis.
- CSU analysis
- COVID tests.

Results for these urgent tests are released by phone to the requesting clinicians/ward staff. Results are also available on hospital information system

Staff Working After Hours

- There is only **LIMITED** number of technical staff on duty after hour. All samples are given high priorities, frequent phone calls to the laboratory would disturb workflow and delay testing.
- Limit of phone calls to the laboratory is requested.
- Patient laboratory results will be available on the hospital patient information system
- A standby technical staff will be on called to assist the technicians on duty if need arises.

*The pathologist and registrars are also available afterhours for consultation.

Laboratory Routine Tests Schedule

Days	Tests
Mondays	INR from clinics
Tuesdays	First Visit Samples.
Weds-Fridays (normal working hours	All other requests including requests from clinics.

Note:

Any routine requests received from clinics outside this scheduled time will not be processed.

2.2 Specimen Collection and management:

Requests and Collection

- The pathology laboratory provides and interprets analytical and morphological information that assist in the diagnosis of problem, management of treatment and monitoring of progress.
- The provision of legible and appropriate clinical information on the request form together with a proper sample collection allows the laboratory to provide relevant and accurate results.
- Pathologist and technicians should be consulted where uncertainty exists whether about the availability, appropriateness or selection of request, specimen required or result interpretations.

Requesting laboratory tests

Correct labelling of all samples and checking of patient identify is essential. Request forms and samples should have these minimal identification requirements;

- ✓ **Patient's full name (surname and first name)**
- ✓ **Hospital PR number**
- ✓ **Date of birth**
- ✓ **Date and Time of collection**
- ✓ **Nature of specimens.**

The following information are also required on all request slip for patient identification and sample processing;

- ✓ Tests requested
- ✓ Relevant clinical information
- ✓ Signature and name of doctor requesting the test.
- ✓ Patient sex and Age
- ✓ Patient Address.

Samples may be rejected if incomplete patient identification is provided.

Labelling Specimens

All specimen containers/tubes must have the following, clearly written on the label:

- ✓ Patient's full name
- ✓ Hospital PR number
- ✓ Date of birth
- ✓ Date and time of specimen collection.
- ✓ Nature of specimen.

(DO NOT WRITE OR APPLY LABEL ON THE LID OF THE SPECIMEN CONTAINER. "WRITE and LABEL ON THE SIDE of the tube or container").

Problem samples will be communicated to the requesting medical officer or ward sisters and/or specimen will be discarded if responsible officers fail to rectify the problem.

Blood specimen

It's very important that a proper specimen is submitted for testing.

Be sure that the correct amount of is drawn into each vacuum tube.

Blood tests are performed on either;

-serum

-plasma

-whole blood.

Serum

- Serum is the liquid portion of the blood obtained after the sample is clot and centrifuged.
- Serum tube may or may not contain a gel separator.
- Tests requiring serum use a tube with no anticoagulant.
- Invert the tube 5-6times after collection to hasten the clotting process. Do not shake the tube as this may cause haemolysis and sample rejection.

Plasma

- Liquid portion of the blood sample obtained after centrifuging specimens collected in anticoagulated tube.
- Determine the appropriate plasma tube for use.

- Tubes should be filled completely and gently inverted at least 10times immediately after collection to assure proper mixing.
- DO NOT shake the tube, this may cause haemolysis and sample rejection.

Whole Blood

- Obtained when blood is collected into an anticoagulated tube.
- Determine the appropriate tube to use.
- Tube must be filled completely and gently inverted at least 10times immediately after drawing.
- DO NOT shake, this may cause haemolysis and rejection of sample.

2.3 Blood Collection and Blood Donor Services

Normal blood collection Service Hours
Monday – Friday :8.30am-3.30pm

There is no blood collection service after hours and public holidays.

Infants and newborn blood collection should be collected by Paediatric doctors not by the laboratory technicians.

Blood Donor Collection Services

Normal Hours of Service

Monday-Friday:9.00am-3.30pm

Special Call-back Service

Monday -Friday: 6pm-10pm

Weekends and Public Holidays:10am-2pm and 6pm-10pm

For emergency need of Fresh Whole Blood and Platelets outside these hours, the Laboratory should be notified in advance to allow timely arrangement.

Blood Collection

Staff responsible for collection of blood samples will not collect from:

- Arms or hands receiving intravenous fluids. Fluids can dilute the samples.
- Bruised or thrombosed veins as venepuncture can cause a blood clot to dislodge causing embolism.
- Legs as complications may arise in diabetic patients.

Blood Collection using evacuated tubes

1. Prepare venepuncture equipment and selecting tubes next to patient.
2. Perform hand hygiene before touching the patient.
3. Ensure patient identification, requests and test conditions had been checked and the patient is position appropriately.
4. Apply tourniquet 12cm above venepuncture site.
5. Palpate for vein position.
6. Perform hand hygiene and don gloves before touching the patient and perform procedures.
7. Using sterile alcohol swab, in one outward motion, wipe the site and allow to air dry.
8. Remove the needle cover and anchor vein and ensure bevel is uppermost and keeping the needle at a 15 to 30° angle to the skin. Insert needle over and in line with vein
9. Tubes must be collected in the correct order.
10. Once the tube is fully drawn, remove from the needle.
11. Invert tubes at least six times to ensure mixing of contents on tubes with blood.
12. Repeat steps 9-12 until all tubes have been collected.

13. Release tourniquet and place gauze on site and safe motion remove the needle. Apply pressure to the dressing once the needle has been removed.
14. Immediately dispose of needle and holder appropriately.
15. Label each tube as described in procedures.
16. Label also the Date, time and sign the request form.
17. Show the patient all samples and request form and ask to identify that all labels are correct.
18. Place all samples and request form into biohazard bag.
19. Remove gloves and perform hand hygiene.
20. Check the patient's venepuncture site for any sign of bleeding. Apply clean swab and tape on site once bleeding stopped.
21. Explain to patient how to monitor the site for further 15minutes and provide after care advice.
22. Perform hand hygiene after touching the patient.
23. Transport specimens to laboratory for testing.

2.4 Sample Collection Charts: Order of Draw.

1. Blood Culture, Sterile tubes
2. Citrate Tube (light blue top)

3. SST (serum separator tube) gel separator tube (red or gold top) or serum tube.
4. Heparinised tube (green top)
5. EDTA tube (lavender)
6. Fluoride tube (grey)

Collection tubes

Stopper Colour	Tube Description	Use	Important Instructions
Blood Culture	First in the order of draw to prevent needle contaminations.		
	3.2% Sodium Citrate	Coagulation studies,	1.8mls or 2.7mls only(adult) Mix gently 8-10 times
	plain tube (no additive)	Chemistry Tests,G&H,Serology.	
	Serum Gel SST	For routine Biochemistry tests (UEC, Lipids/LFTs	Mix 8-10 times and leave to settle

		Cardiac enzymes, tumor markers	before centrifuging. 5.0mls and 1.0ml for paed.
	Heparin Tube	Cytogenetics, Chromosome Studies	. Mix sample gently 8-10times.
	EDTA tube	Hematology Tests (Hb, WCC, Platelets ,HbA1C Malaria,Blood Film,retics,ESR	. Mix sample gently 8-10times
	EDTA tube	For Cross Matching	Mix sample gently 8-10times
	Sodium fluoride	Blood glucose test(FBS,OGTT)	Mix well 8-10 times and indicate if fasting or random

Specimen Containers

Specimen containers and blood tubes are available from the Laboratory specimen reception area.

Histology specimen containers are only available in limited stock. Larger specimen containers may be obtained from the operating theatre nurses.

Formalin for tissue preservation is available in the Laboratory reception.

Factors Affecting Laboratory Test Results

Pre-analytical Factors

- Physiological factors, patient preparation, specimen collection and transport.

Analytical Factors

- Lipemia, in-vitro haemolysis and medications.

Post Analytical Factors

- Data entry, calculations by lab staff, result validation, interpretation of results, data transfer and report of results.

2.5 Specimen reception

All sampled are to drop off at the reception window # 2 during working hours and window # 1 during afterhours.

Rejected specimens

Specimens will be rejected due to the following reasons.

- Poorly labelled, un-labelled or wrongly labelled specimens
- Specimens without matching request form
- Gross haemolysis
- Specimen collected in wrong additives or preservatives that adversely affect test results
- Delayed specimens that are received in decomposed status
- Highly infectious material in which the laboratory does not have appropriate biohazard provisions.
- Spilled/soiled infectious specimens that are considered hazardous to the laboratory staff

Exceptions

- **Freshly collected samples, sterile sites samples, histology samples will not be rejected but held in**

the laboratory for further necessary corrective actions.

- **These sterile samples include; CSF, tissues, Body Fluids and CSU.**
- **Samples marked 'URGENT' will be processed while awaiting verification by requesting officer.**
- **Requesting officers are expected to complete these requirements with in 30minutes of notification.**

NOTE: Results of the tests that are performed on these specimens will not be released until the identity of the specimen and the request form are verified by the requesting officer.

Sample Retention Period.

Disposal of specimens after completion of testing are as follows:

Specimen type	Retention Period/Stability
Haematology	FBC 24 hrs Stability for 12hours at 4°C

	7days at -20°C for plasma for coagulation tests **Blood Films** 1.Significant findings-1year 2.Non-significant findings-1month Bone Marrow Slides and Report 10years for adult and 7years from the age of majority for minor.
Biochemistry	4 weeks at -20°C
Serology Syphilis Serology HCV/HIV	 1 week at 2-8°C Positive RPR and TPPHA,6months at -20°C. 1 week at 2-8°C and 6years at -80°C.

Transfusion	1 week
Microbiology	Wet Preparation-discard. Slides Gram stain-2 weeks ZN stain slides-6weeks Other stained slides-2weeks. **Isolates** Clinical Significant-5days Non-clinical significant-discard. **Urine Samples** 3days from date of issue of reports. **Seminal Fluid** 24hrs

Histology	2 weeks after the results are released to clinician.
Cytology	Specimens are usually processed in total. If preserved, retain for 1month.
Molecular Samples	1 week at 2-8°C Respiratory Samples at -80°C for 2years.
Rejected specimens	**Leaking sample will be discarded immediately.** **Histology and sterile samples will be kept until patient identification is verified.**

2.6 Specimen referral from outer stations

Samples must be packed properly in biohazard bag and in accordance to IATA standard if using air or ferry transportation.

It is advised that samples are to be packed in a cool well insulated container.

The Laboratory Quality Manager or Technician in-charge at Vaiola Hospital Laboratory should be notified in time to arrange for specimen Pick-up.

2.7 Overseas Referral tests:

SPECIALISED tests that are not available locally are referred to reference laboratories overseas.
Most of these specimens are referred to Lab Plus, Auckland Hospital, New Zealand. For COVID whole genome sequencing, samples are referred to ESR, Wellington New Zealand.
Most viral samples are referred to VIDRL, Melbourne Australia.

Schedule for parcel send-off depends on courier's schedule. **Some of the tests require very short transit**

time and special preparation. Please contact the biochemistry unit for details.

Requests for overseas tests are limited to Specialists only. This is to ensure rational approach to this expensive service.

Detailed information of overseas specimen requirements are available on LabPlus, website www.labplus.co.nz "laboratory services" and "clinical resources" webpages.
For VIDRL and ESR information contact the laboratory for guidance.

2.8 Additional Test Requested (Add-On Tests)

Additional tests can be done on the same samples and must be communicated via phone to laboratory staff for processing before sample is discarded.
Refer to retention period for sample stability

3.0 Laboratory Test Results.

3.1 Marked Abnormal and Urgent Results

Immediately communicated to clinicians or ward nurses directly by phone.
Results will also available on hospital information system.

3.2 All Other Results

All results will be available on hospital information system once validated.

Results with hard copies will be placed for collection by private clinics at the laboratory.

3.3 Turn Around Time (TAT)

Tests	TAT
All urgent haematology, biochemistry , Micro ,Immunohematology	2-3hrs from time the samples received
Routine Requests; Haematology (including blood film), Biochemistry, Immunohematology	8-24hours
Tb Microscopy	8hrs
Urgent Cytology	8hrs
COVID Test	same day
Histology	3-5days

Referral Tests	1-2weeks(refer to website)

4.0 Customer Feedback and Complaints

- The laboratory service welcomes customer feedback, complaints and criticism.
- Feedback forms are available at the laboratory reception.
- Please fill the first section of the form with details of your complaints.
- The Laboratory administration will see that measures are put in place to ensure that incidences do not re-occur.

5.0 Laboratory Units Information

5.1 Biochemistry Unit

- Routine and urgent tests are carried out during normal working hours.
- There are times when tests are conducted in batches to minimise wastage of reagents. In this

situation results will be delayed and not released within 24 hours.

Biochemistry Tests Available after hours and during normal hours

- ✓ Urea
- ✓ Electrolytes
- ✓ Blood glucose
- ✓ C.S.F. protein, glucose
- ✓ Serum bilirubin for neonates only
- ✓ Creatinine
- ✓ Creatinine Kinase, CK
- ✓ LFTs
- ✓ Cardiac Enzymes
- ✓ Troponin
- ✓ Beta-HCG

Special arrangements are required for other Biochemistry tests apart from those in the list above to be carried out after-hours such as CSF and so on.

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Reference ranges and Sample Requirements

Please note reference ranges listed are based on analysers publication which were not based on Tongan reference values.

Reference ranges is subjected to changes from time to time due to changes of methods and techniques.

Tests	**Collection Requirements**	**Ref.Ranges/Comments**
ALT	5mls blood in SST tube	F:10-35 U/L M:10-50 U/L
ALB	5mls blood in SST tube	A:35-52g/l NB:28-44g/l Children 4d-14yrs:35-54g/l Teenages:32-45g/l
ALP	5mls blood in SST tube	A:40-120U/L F:35-105U/L Children :110-390U/L (ALP also is produced in bones and placenta hence serum value increases in pregnancy and children)
Amylase	5mls of blood in SST tube	28-100U/L
AST	5.0 mls of blood in SST tube	F:10-35U/L M:10-50U/L (**haemolysis can cause false elevated results)**

Direct Bilirubin	5mls in SST tube	Preterm infants 1-5days <10umol/l Infants >1month and adults 0-3.4umol/l (Infant range may vary in some population)
Total Bilirubin	5.0mls in SST tube. 2.0mls of blood for newborn in Paed SST tube.	A: up to 21umol/L Children >month –up to 17umol/L Newborn 95th percentile values: 24hours -137umol/L 48hrs – 222umol/L 84hrs – 290umol/L (Newborn level above 95th percentile requires close supervision, further evaluation and sometimes intervention. It is recommended to use clinic/ward SBR chart if it differs from the values indicated above)
Calcium	5.0mls blood in SST tube	2.15-2.55mmol/l (Serum Ca is slightly higher in children with

		upper limits of 2.70mmol/l in the active growth phase(2-12yrs)
CSF	At least 1ml in plain tube.	Protein:150-450mg/l Sugar :2.4 – 4.4 mmol/l (CSF glucose should be ≥2/3 of blood glucose level)
Total Cholesterol	5mls blood in SST tube (Fasting specimen is recommended)	Tot.Chol:3.8-5.2mmol/l HDL: F:1.15-1.68mmol/l M:0.90-1.45mmol/l LDL:<2.6mmol/L (Chronic liver disorder affects protein synthesis, hence falsely low lipoprotein level. LDL can be calculated form Friedwald formula: LDL chol=total Chol – (Triglyceride/5).
CK	5mls blood in SST tube	M:<190U/L F:< 167 U/L

		(Normal CKMB activity accounts for 6-25% of total CK activity)
CKMB(CM isoenzyme)	5mls blood in SST tube	0-24U/L
Creatinine (serum)	5mls of blood in SST tube	Adult: F: 0.05-0-08mmol/l M:0.06-0.12mmol/l Neonates: 0.02-0.08mmol/l Infants 2-12months:0.02-0.02mmol/l 1-5yr: 0.02-0.02mmol/l 5-11yrs; 0.05-0.08mmol/l (some analysers provide results in umol/L,convert mmo/l to umol/l by multiplying by 10^3
Creatinine (urine)	24hrs urine (no preservative)	F:7-14mmol/24hr M:9-21mmol/24hr

Creatinine clearance	24hrs urine + blood sample taken within 24hr)	1.5-2.0ml/sec
Electrolytes	5mls blood in SST tube	Sodium: 135-150mmol/l Potassium: 3.4-5.0mmol/l
Glucose	3mls in fluoride tube or plain tube	FBS:4.11-6.05mmol/l RBS:4.11-7.8mmol/l (Specimen in plain tube should be sent immediately to the lab to be analyse with in 24hrs.Glucose range varies with methods used.Refer to package inserts)
GGT	5mls in SST tube	F:5-36U/L M:8-61U/L
Hemoglobin A1C	4mls blood in EDTA tube	4.8-5.9% or 20-42mmol/mol (HbA1C level below the reference range indicate periodic hypoglycaemia)

LDH	5ml blood in SST tube	135-225mmol/l
Lipids	A cluster of tests include total Chol, LDL, HDL and Trigy. See table for more information. Falsely elevated lipids would be seen in postprandial samples especially after consumption of fatty meal.) Fasting specimen is recommended to maximise quality of information obtained from lipid test.	
LFTs	Include a cluster of 7 tests. Vaiola Hospital laboratory found this too expensive and its now following a more rational approach by offering only two enzymes' tests; ALP and ALT as the primary test for liver function. Abnormality in any of these two enzymes then warrants further investigation into either hepatocellular damage or biliary disorder.	
Phosphate	5mls blood in SST tube	A:0.87-1.45mmol/L Neonates: 1.6-3.1mmol/l 2-12mo:1.3-3.5mmol/l >1yr 1.1-2.0mmol/l

Potassium (serum)	Refer to electrolytes)	
Potassium (urine)	24hrs urine or random, no preservative	25-100mmol/24hrs
Pregnancy Test(urine)	Early morning urine	Negative-non-pregnant Positive: pregnancy , gestational trophoblastic disease and germ cell tumours (sensitivity of method is 20units HCG.Lower level is not detected in this method.
Protein(total)	5mls blood in SST tube	A:66-87mg/dl Newborn:47-70mg/dl 7months-1yr: 51-73mg/dl 1-2yrs-56-75mg/dl >3yrs – 60-80mg/dl
TFTs (TSH, Free T3, Free T4)	5mls blood in SST tube.	**TSH:** Neonates; 0.4 – 16 pmol/L 1m – 12m; 0.6 – 8.0 pmol/L 1yr – 18yr;

		0.5 – 4.5 pmol/L > 18 yr 0.27 – 4.2 pmol/L **Free T3**: < 7 yrs ; 3 – 10 pmol/L < 19 yrs 3.5 – 8.0 pmol/L > 19 yrs – Adult; 3.9 – 6.8 pmol/L **Free T4**: Neonate ; 10 – 40 pmol/L 1m – 12m ; 10 – 30 pmol/L 1yr – 12yr; 11 – 22 pmol/L >12yr – adults; 12 – 22 pmol/
Triglycerides	5mls blood in SST tube	**<2.3mmol/l (Fasting specimen is recommended)**
Troponin	5ml blood in SST tube	**<14pg/ml**
Tumor Markers	5mls blood in SST tube	**BHcG** males: 0 - 2 IU/L

		Females: <5 non-pregnant, pre-menopausal <14 post-menopausal 5 – 25 equivocal, repeat in 48 hrs >25 consistent with conception. **PSA** 0 – 50 yrs :0 – 2.5 ng/mL >50 – 60 yrs: 0 – 3.5 ng/mL >60 – 70 yrs :0 – 4.5 ng/mL > 70 yrs :0 – 6.5 ng/mL **AFP** **Units:ug/l** **See table below**

Age	**Term Baby (37 week +)**	**Prem Baby (<37 week)**

0 days	9,100-190,000	31,000-80,0000
1 day	8,000-166,000	280,000-710,000
2 days	7,000-145,000	25,000-630,000
3 days	6,000-126,000	22,000-560,000
4 days	5,300-110,000	19,500-500,000
5 days	4,600-96,500	17,400-445,000
6 days	4,000-84,500	15,300-393,000
7 days	3,500-73,500	12,600-350,000
8-14 days	1,500-59,000	6,000-312,000
15-21 days	575-23,000	2,700-151,000
22-28 days	300-6,300	1,200-120,000
29-45 days	30-5,700	400-80,000
46-60 days	16-2,000	90-39,000
61-90 days	6-1,000	20-22,000
91-120 days	3-420	10-18,500
121-150 days	2-220	4-8,300
151-150 days	1-130	3-4,350
181-270 days	0-87	3-2,600

271-365 days	0-87	3-830
1 to 2 years	0-87	0-370
2y - Adult (non-pregnant):		< 10
Pregnancy		
14 weeks (median)		23
22 weeks (median)		60
30 weeks (median)		180

Other Tumor markers analysis e.g., CA125, CA19-9, CEA, Prolactin, PLAP, Immunoglobulins etc. are referred to Labplus.

Urea	5ml blood in SST tube	1.7-8.3mmol/l
Uric Acid	5ml blood in SST tube	F:0.14-0.34mmol/l M:0.20-0.42mmol/l

Other biochemistry tests:

Other tests that are not stated in this handbook are referred to reference laboratories overseas, contact

Vaiola laboratory for information on specimen preparation and transportation and refer to LabPlus website www.labplus.co.nz for further information.

5.2 Blood Bank, Immuno-haematology and Serology Units

Essentials

- Is the blood transfusion necessary in this patient?
- If so, ensure;
  -right blood
  -right patient
  -right time
  -right place

Major Activities:

1.Work in conjunction with the Tonga Red Cross to oversee recruitment of voluntary blood donors.
2.Perform serological test markers of infectious diseases.

Blood Transfusion service including;

- Blood donated screening for transfusion transmissible infections (TTI),
- grouped
- fractionated
- cross matched.

Errors in these processes is fatal to the patients therefore ensuring that right specimen and complete patient information is vital.

Transfusion Therapy and risks

Transfusion of whole blood should only be given when there is no other alternative. There is always a higher risk of transmitting infection in larger volume of plasma than in Packed Red cells. Commercial intravenous volume expanders should be used to replace plasma volume rather than whole blood.
(Please refer to the booklet for Clinicians of the Ministry of Health, titled: *"The Clinical use of Blood/Blood Products"*)

Sources of Errors in blood transfusion

Clerical errors are the most common cause of major haemolytic transfusion reaction. This is due to the following reasons;

(i) Wrongly labelled sample from wards.

(ii) second person involvement in labelling of sample and not the person obtaining the sample.

(iii) Failure to correctly identify patient in the ward before administering unit of blood/blood product.

(iv) Transcription and checking errors within the Laboratory.

Wrongly labelled specimen

- It is strongly advised to put in measures that will ensure your patients' identity, request form and samples are correctly identified before sending specimen to the Laboratory.
- All specimens **should be labelled and checked by the same person who perform the venepuncture.**
- **Any discrepancies in the specimen and/or request form for Blood Transfusion will be rejected.**

Blood Products

Four blood products available:

1.Whole blood

2.Packed Red Cells

3.Fresh Frozen Plasma

4.Platelets

Blood Products	Volume	Indication
Whole blood/Fresh Whole blood	400-450mls	For emergency transfusion in major blood loss to increase red cell mass as well as blood volume
Packed Red blood cells	250-300mls	Increase red cell mass without significantly expanding blood volume Most transfusion requires PRC only.
Plasma(Fresh Frozen plasma)	200-250ml	For treatment of coagulation disorders, warfarin overdose, DIC and certain plasma protein abnormalities. Plasma should not be used as a plasma volume expander.
Platelet concentrate	$>4.5x10^{10}$ platelets /unit	Bleeding due to thrombocytopenia and some intrinsic

	Volume 50-60ml	platelets disorders .Usually 6units for adults and 1unit per 10 to 12kg.One unit should increase platelet count by 5-10^9/L

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Request for Cross-Match

Specimen: - 5mL fresh blood in pink top or 4-5mls EDTA or yellow top tube.

To be submitted together with a complete blood transfusion request form (pink form)

- Samples will only use with in 72hrs.Fresh samples are requested if previous samples had been stored for more than 72hours.
- Cross matched units are only kept in the bank for 72 hours. New request should be accompanied with new samples if need after 72hours.

Request for release of cross-matched blood/blood products.

- All request must be made on blood transfusion request form.

- Complete request form is required and must match the units to be issued.
- No blood unit will be released from blood transfusion unit if request is incomplete.

Setting up blood transfusion

The following procedures should be followed while setting up blood transfusion

(i) Check and match patient details and unit tag/label for compatibility.

(ii) check that the blood group on the tag is the same as those that had been transfused.

(iii) Sign transfusion record, indicating that rechecking has been done

(iv) Using aseptic technique transfuse blood using blood giving set that has filter for blood clots.

(v) Closely observe patient by taking blood pressure, pulse and temperature in the first 15minutes and every 30 minutes thereafter.

(vi) Record patient observations and sign on the record.

Note:

- The blood giving set should be changed regularly at the most after 8 hours or 3 units transfused.
- Do not introduce any other fluid or intravenous antibiotic into blood giving set during

transfusion, this will cause haemolysis and introduce infection.

Timing of transfusion

- Units should be transfused within 30minutes of issue.
- Any delay in transfusion, the unit must be returned to the blood bank with in 2hours of issue.
- Units that are not refrigerated after 2hours should be discarded.
- In exceptional circumstances, blood unit will be allowed by the laboratory to store in the ward or theatre refrigerators.
- Discuss with head of transfusion unit when this is required.

Care during Transfusion and detecting transfusion reaction

- Major transfusion reaction occurs within the first five minutes of transfusion.
- It is therefore crucial that patients receiving blood are closely monitors within the first 5-15minutes of transfusion.

(Please see the booklet on *"The Clinical Use of Blood/Blood Products"*, for further details).

Investigating Transfusion reactions

In the event, that a transfusion reaction occurs, you are required to do the following:

a) Discontinue transfusion by removing the unit of blood together with Blood giving set but keep IV access patent with either HepLock or IV normal saline.
b) Obtain blood for culture inoculated directly into blood culture bottle, 3mls of blood in EDTA tube and 5 mls of blood in plain tube for further investigation.
c) fill an adverse transfusion reaction form with all required details.
d) Return adverse reaction form with unit of blood and giving set, specimen for blood culture, EDTA sample and blood in plain tube to the Laboratory for investigation.

Note:

Adverse transfusion reaction forms should be available in the wards and can also be obtained from the Laboratory.

Post Transfusion Care

Observation of transfused patients should continue even after the transfusion process, in-order to identify possible delayed transfusion reactions that need to be investigated properly.

Immuno-haematology tests

Tests	Volume	Remarks
Antibody Screening	5mls blood in pink stopper tube.	Provide clinical diagnosis and details of previous transfusion
Blood Grouping (ABO/Rh)	3mls blood in pink stopper tube or 3mls in yellow top together with 4ml blood in purple top tube.	
Cross Match	❖ See blood grouping	

DCT	4mls blood in EDTA tube	
Group and Hold(G&H)	❖ See blood grouping.	G&H serum only suitable for cross-match 72hours.

Serology Tests

Tests	**Volume**	**Remarks**
HBsAg	3ml blood in SST tube or EDTA tube	Results are reported as either negative/nonreactive or positive/reactive.
HCV	3ml blood in SST tube or EDTA tube	
RPR(Syphilis)	3ml blood in SST tube or EDTA tube.	VDRL with positive results are given in titres.
HIV Viral Load	4ml EDTA tube	Dedicated EDTA tube for viral load only, no other tests.
HIV DNA PCR	Refer to LabPlus website for more information.	

Viral and toxoplasma serology IgG and IgM	

5.3 Haematology

Haematology Tests

Tests	Volume	Comments/Reference Range.
APTT	**1.8ml or 2.7mls blood only** in citrate tube (blue top) for adult. For PAed,1ml micro citrate – blood.	The test requires fresh specimen that must arrive in the laboratory with in 60mins.
Blood Film	4mls EDTA blood tube	This is not routinely done unless specifically requested. The laboratory however also offers blood film report when there are abnormalities

		detected in the full blood count.
<u>Bone Marrow Aspiration and Trephine Biopsy</u> • Pre-booking is required if pathology medical officers are to provide this service. • It is also encouraged that clinicians train junior medical officers to do bone marrow biopsy, so they would be able to provide the service in outer island clinics where there are no pathologist or pathology medical officers. • Bone Marrow aspirates from outer islands should be referred on air- dried slides and trephine biopsies in formalin fixative for processing at Vaiola Hospital.		
Coagulation Profile	**1.8mls or 2.7mls blood** only in citrate tube (blue top)	All sample should be in the lab with in 60minutes of collection.

Note: Citrated coagulation tubes are only available in the Laboratory. You must notify the laboratory of your plan to do INR test before the tubes can be released for use. The Lab should be notified of the clinic schedule where INR test results will be required for patient management Reference range - see INR, PT, APTT		
CD4 Count	10ml blood in citrate CPD tube	**Preferred tube due to longer 48hrs preservation.**
	Or 5mls blood In heparin or EDTA tube.	**Reference Range:** Adult: 500-1650 cells/uL. Neonatal- 400-3500cells/ul 1 wk-2months; 1700-5300cells/ul 3-9months: 1400-5000cells/ul. 10-24months: 900-5000cells/ul. 2-5yrs; 500-2400cells/ul

ESR	2mls blood in EDTA tube.	**M=0-15mm/hr** **F=0-20mm/hr**
Note: A larger volume of blood is required i.e 4mls if ESR is requested together with full blood count.		
FDP **(**Fibrin Degra-Dation Product)	2.7ml blood in Citrate (blue top) Tube.	Report as negative Or positive.
FBC **(Full Blood Count)**	4ml blood in EDTA Tube	**Ref.Ranges** **Hemoglobin;** M=13-18g/dl F=11.5-16.5g/dl **White Cell Count;** 4-11x10^9/L. **Red Blood Cell;** M=4.5-6.5x10^{12}/L F=3.8-5.8x10^{12}/L **Hct;** M=0.40-0.54 F=0.37-0.47 **MCV;** 76-96 fl **MCH;** 27-32pg **MCHC;** 31-35g/dl **Platelets;**

		150-400x10^9/L **Differential Count** Neutrophils=40-75% Lymphocytes:20-45% Monocytes=2-10% Eosinophils=1-6% Basophils=0-1%
INR(PT International Normalised Ratio)	1.8mls or 2.7mls blood **ONLY** in citrate tube(adult) For Paed-1ml microcitrate tube.	Normal Range in the absence of anticoagulation: 0.8-1.2. Therapeutic Range; 2.0-3.0. **Note:** INR is used for monitoring warfarin therapy.
Prothrombin Time(PT)	1.8ml or 2.7mls blood **ONLY** in citrate tube	10-15seconds PT is prolonged in factor V11, X and V deficiency, liver disease and anticoagulation therapy.

LE cells	1ml blood in EDTA tube	Notify laboratory first about this test before sample is collected.
Malaria Parasites	1ml blood in EDTA tube	
Microfilarial Parasites	1ml blood in EDTA tube	
Reticulocyte Count	4ml blood in EDTA tube	Adult=0.2-2.0% Infant=2.0-6.0% Note: No additional volume is required if requested together with FBC.

Haematology reports

Delay in releasing hardcopy of the report is usually due to delay in uploading results into THIS. You are therefore advised to check results on THIS. Results for blood film would take longer 4-24 hours depending on the availability of expertise in the field.

Results of specimens without UR number will not be uploaded into THIS.

5.4 Histopathology and Cytology Units

Working Hours

Normal Working Hours:

8:30am – 4:30pm Mondays to Fridays.

This service is not provided afterhours or on public holidays, however it can be provided in case of emergency or urgent need. Please contact the pathologist or pathology registrars through the hospital switchboard if you require this service after-hours. Histology and cytology reports are available in the Hospital Information system THIS.

Anatomical Pathology

- Correct handling of samples submitted for morphological assessment is critical. Pathologist can be consulted for assistance ahead of collection.
- Complete patient information and clinical information must be provided on the request forms.
- For non-gynecological or tissue cytology, aspirated fluid should be placed in cytology liquid transport media.
- Gynecological samples can be fluid or conventional samples.
- If other tests are required such as microbiological or immunological, send a separate sample and request forms.

Laboratory Procedures

Labelling.

- ✓ All specimens should be labelled according to the labelling requirements stated above and must be accompanied by proper request form.
- ✓ All specimens should be sent to the Lab during normal working hours.

Specimens for Histopathology

Small biopsies:
Immerse immediately in at least ten-fold volume of formalin in an adequately sized container.

Large specimens:

- ✓ These specimens should be sent in formalin, and delivered to the laboratory as soon as possible for processing, sectioning and proper fixation.
- ✓ Large specimens that cannot be delivered immediately to the Laboratory should be completely immersed in formalin such as uterus and breasts.
- ✓ All efforts should be made to ensure **IMMEDIATE** transfer of large specimen to the Laboratory, where tissues could be sectioned and fixed

properly to prevent tissue autolysis that will preclude proper histological assessment.

Cytology Procedures and specimens

Fine Needle Aspiration

- ✓ Prior arrangement should to be done with Pathology medical officers and cytology staff for FNA to be done. You can also send your patients with request form for FNA to be done in the Laboratory.
  *(*when onsite Pathologist is available*).
- ✓ Medical officers obtaining FNA should provide a minimum of 4 smears for one FNA preferably from 2 passes. 2 slides with adequate material should be fixed immediately in alcohol for 5minutes, the remaining slides to be air dried.
- ✓ Air dried slides should be provided whenever there is FNA for suspected Lymphoma cases.
- ✓ Slides should be properly labelled with a pencil and accompany with a properly filled Histopathology/Cytology form to the Laboratory.

Pap Smear (Cervical Smear)

- ✓ Properly labeled slides with pencil.
- ✓ Smeared slides must be immersed immediately (within seconds) in a fixative like 95% ethanol (wet fixation) or an alternative fixative such as Cytofix or Sprayfix.
- ✓ Delay in fixation will result in air-drying artifact which may hamper or prevent proper cytological assessment.
- ✓ Slides of cervical smears may be removed from the alcohol fixatives after 30 minutes of fixation and dispatched in a slide container accompanied by a completed cytology laboratory request form.

Slides labelled with ink, instead of lead pencil will be returned to the ward.

Sputum

- ✓ An early morning, deep cough specimen in a clean container is preferred. Saliva is unsuitable for assessment.
- ✓ Chest physiotherapy may assist production of specimen
- ✓ Sensitivity is increased if 3 specimens are collected on three different days.

Bronchial brushings or washings.

- ✓ Bronchial washings should be sent in normal saline directly without delay to the laboratory.
- ✓ Brushings should be rinsed in 50% alcohol and the final brushing smeared directly onto glass slides and fixed in alcohol.
- ✓ In the absence of alcohol fixatives, brushings could also be rinsed in normal saline and sent directly to the laboratory for processing.
- ✓ Contact cytology technician if you anticipate delay in transferring specimen to the laboratory.

Urine

- ✓ 20-30ml fresh clean-catch mid-stream urine, catheter- stream or cystoscopy specimen is recommended for urine cytology. Early morning urine should be avoided due to overnight cellular degeneration.
- ✓ Specimen should be sent directly, within 2 hours to the laboratory for processing. If you anticipate delay in sending specimen to the laboratory then an equal volume of 50% alcohol should be added to the specimen, store in refrigerator(2-8°C) and to be sent to the laboratory within 24-48 hours.

- ✓ Contact cytology technician if you anticipate further delay in sending specimen.

Pleural, pericardial or ascitic fluids.

- ✓ 20-30ml freshly tapped pleural, pericardial and peritoneal fluids is recommended and can be collected in tubes or syringes that may be either plain(sterile) or pre- heparinised, to prevent coagulation.
- ✓ Cells in heparinised fluids do not deteriorate rapidly and there are some advantages in the processing of these fluids like layering of many malignant cells in the buffy-coat of the centrifuged sample.
- ✓ If immediate processing is not possible, specimen can be preserved in the refrigerator(2-8°C) for up to 24-48 hours.
- ✓ Preservation of cells by adding equal volume of 50% ethanol is recommended when anticipating delay in transfer of specimen.

Smears from ulcerated lesions.

-Use a spatula or scalpel blade to scrape material from the surface of the ulcer, and smear on 2 – 4 slides. Fix

the first 1 or 2 smear by immediate immersion in 95% alcohol or spray fixation. The remaining smears to be air-dried.

Reports

- ✓ Histopathology and Cytology are reported by the Pathologist and senior medical Officer in charge of the Laboratory Services.
- ✓ Diffquick-stained cytology reports can be made available within 15 minutes to I hour when expertise is available.
- ✓ Routine smear and small biopsy slides are reported on the same day they are received from histology technicians.
- ✓ Larger specimens and complicated smaller biopsies would take on 2-5days to report.
- ✓ Specimens that are referred overseas for immunostains and second opinion would take an average 1-2months. This service could be fastened by direct communication with Pathologist abroad.

**This expected Turn-around time for Histology/Cytology reports apply when a Pathologist is permanently stationed at the Laboratory.*

Specimens' referral for further immunostains and second opinion

This is an expensive service, therefore should not be used just for the sake of getting a confirmed diagnosis, considering the cost. Specimen should only be referred abroad and for immunostains if there is plan for further patient management and treatment that is likely to change patient's clinical outcome.

5.5 Microbiology

Hours of Duty

Normal working hours:

8: 30am – 4:30pm, Mondays to Fridays

After-Hours: Weekends and Public Holidays.

- ✓ Microbiology section offers very limited-service afterhours i.e., processing of urgent samples such as CSF, CSU, and positive blood culture samples.
- ✓ Prior arrangement is made with the head technician of the microbiology section or the microbiology technician on-call.
- ✓ Culture reading and sensitivity testing of incubated cultures are carried out in the morning hours of the weekends and public holidays.

Laboratory Requests:

If you suspect odd or highly contagious infection, please notify pathology medical officers and microbiology staff for proper handling of specimen. Specimens that are not accompanied by request form will be rejected.

Microbiology Specimens

Blood Culture Samples

Tests	Samples	Comments
Blood Culture	Adult=5mls of blood ,1 aerobic and 1 anaerobic. Paed=2mls blood on paed blood culture bottle.	**In bacterial endocarditis,3 lots of blood culture specimen taken over 24hrs would ensure a 97% isolation rate.**
Note: Venepuncture and inoculation of blood culture bottles should be done in the strictest aseptic condition. Inoculated blood culture bottles should be transported in room temperature.		

Venepuncture technique to minimise contamination of blood culture.

- ✓ Cleanse skin with an iodine preparation (or 70% alcohol if allergic to iodine) and allow to dry.
- ✓ Collect 5mls blood into syringe
- ✓ Change and use fresh needle
- ✓ Commercially prepared BACTEC bottles have sterile caps therefore flip off the plastic cap and inoculate directly through the rubber lid.
- ✓ Inoculate required amount of blood into the blood culture bottle and remove the needle
- ✓ Properly label specimen and complete request form before forwarding to the laboratory.

CSF Samples

Test	Sample	Comment
CSF(cerebrospinal fluid)	3 lots of 1ml CSF in sterile (red top) tube. 1 for culture and cell count. 1 for chemistry 1 for cytology.	2 lot would be sufficed if inadequate CSF is collected.1 for MCS and 1 for chemistry.

Faeces/Stool Samples

- ✓ A small portion of faeces (teaspoon size) is adequate for bacteriological, parasitic cyst examination, and occult blood testing. Please use a stool collection container. Send specimen to the laboratory as soon as possible after collection.
- ✓ For protozoan trophozoite examination, (giardia and Entamoeba histolytica) send fresh faeces, to be received in the laboratory within 30 minutes of collection. Select blood stained or mucoid portion of stool.
- ✓ If delayed is anticipated, refrigerate samples in 2-8°C before deliver to the laboratory with in 24hours.

Fungal scraping (skin) (Mycology)

- ✓ Fungal scrapings can be done in the ward/clinic by clinicians or in the laboratory outpatient by microbiology technicians.
- ✓ Specimen should be taken using aseptic techniques and collected into a dry wide mouth specimen container.
- ✓ Send patient, together with laboratory request form to the laboratory for scrapings to be taken by microbiology technicians.

Gastric washing

- ✓ At least 1 ml of gastric washing, collected in the morning on fasting stomach, hence proper patient preparation is important.
- ✓ Specimen should be sent immediately to the laboratory.

Pleural and other body fluids.

Collect at least 10mls of fluid in a sterile container and send to the laboratory immediately.

Sputum

For Culture

Ensure that sputum, not saliva is collected. Only one sputum specimen per patient, per day will be cultured if suitable.

Sputum and Tuberculosis Specimen

Specimens that are sent to the laboratory for Tb investigation should be packed properly to prevent spills and exposure of staff in contact with the specimen.

Dry sputum slides should be inactivated with heat prior to transportation to the laboratory.

The request form should be clearly labelled and please write in BOLD on top of the form **"SPECIMEN FOR TB TEST".**

Sputum for TB Microscopy and culture:

- ✓ 3mls of expectorant sputum, preferably early morning sputum should be collected in sterile plastic sputum container. A series of at least 3 samples on 3 successive days is recommended to exclude Tb on microscopy.
- ✓ Please note that TB culture is not available in Vaiola Hospital Laboratory. Specimens for culture and sensitivity testing from suspected multi-resistant infection will be received and packed at Vaiola Hospital Laboratory to be sent to Lab Plus Auckland.

Sputum for TB GeneXpert Tests

- ✓ Collect minimum of 2mls in sterile transparent container. Secure the lid before transport to laboratory.
- ✓ Transport to the laboratory as soon as it collected in biohazard bag.
- ✓ Samples will be rejected if contains food and other solids particles
- ✓ If delay is anticipated, store samples at 2-8°C.

Note

- ✓ TB requests for culture are sent to Lab Plus, Auckland.
- ✓ A separate form and sputum specimen must be provided for cytology if patient also requires sputum cytology investigation.

Swabs

- ✓ Sterile cotton swab with enriched transport media is to be used for ordinary tissue swab.
- ✓ Charcoal swab is recommended for suspected Gonococcal infection. Both charcoal and ordinary cotton swabs are available and can be obtained from the laboratory.
- ✓ Swabs should be inoculated directly into transport media and sent to the laboratory at room temperature.

Note:

Swabs should only be used when tissue, pus or other material cannot be collected in a syringe or a sterile container.

Wound should be cleaned with normal saline before swab is obtained to avoid contamination with normal tissue flora

Urine

- ✓ 5mls urine in urine bottle, this can be clean catch mid-stream, catheter stream or cystoscopy urine specimen. Early morning urine with higher bacterial load is ideal for culture and sensitivity.
- ✓ -Specimen should be received in the laboratory within 2 hours. Store specimen in 2-4°C if you anticipate 12–24-hour delay in transportation.
- ✓ Specimens that are stored for more than 24 hours are generally not suitable for microbiological investigation.

Urine Microbiology Tests

- ✓ Direct microscopy and urinalysis
- ✓ urine bacterial culture
- ✓ urine chlamydia testing

Tissues and Biopsies

All tissues and biopsies for microbiology should be sent in sterile jar; fresh and unfixed. Do not add formalin.

Public Health infectious disease outbreak screening

- Refer to specific specimen requirements above.
- This service is not budgeted for in the Laboratory annual budget proposal due to the unpredictability of outbreak occurrence. Early notification of

suspected outbreak to Laboratory management team is therefore crucial and you are required to communicate with Laboratory management first before sending in large amount of specimen for this purpose.

- Laboratory management will collaborate with hospital administration and other partners for extra supplies of laboratory consumables and reagents to cater for outbreak investigations.
- Vaiola hospital laboratory will follow the low resource country approach to confirm and monitor outbreak, therefore not all specimens that are sent for screening will be tested in-order to minimise cost.

Other Gene Xpert Tests (PCR)

Chlamydia/Gonorrhoea testing (CTNG Assay)

- 5mls urine in sterile urine bottle or endocervical swab collected only with swab kit available in the laboratory.

Note:

This is a molecular test that run-in batches. Results should be released in one week except in urgent cases.

HIV Viral Load

- 4ml blood sample in EDTA collection tube

Microbiology Reports

Microbiology test is a multistep process hence some of the culture reports will be available in provisional status pending further testing.

A final report is only provided when the whole testing process is completed.

All urgent requests, CSF, positive blood culture and unusual results will be communicated to the ward or clinician concerned as the results are available.

Routine results will be uploaded into THESE once results are available. Hardcopy of the reports are posted in the ward and clinic result files located at the laboratory reception area.

5.6 Molecular Biology Laboratory Unit

Normal Working Hours = 8:30am to 4:30pm Mondays to Fridays.

After Hours =4:30 to 12:30am on calls only.

Weekends and Public Holidays=8:30am to 12:30am (on call only)

Tests Provided

- COVID-19 PCR Test
- Respiratory Viral Panel Tests

Samples Requirements and Delivery

- Nasopharyngeal swab (NPS) collected from suspected COVID-19 patients and other viral infections.
- Swabs are available from the laboratory.
- Transport in biohazard bags as soon as it collected.

Sample Reception

- All samples are to deliver directly to Molecular biology laboratory unit both during and after hours.

Issuing of Results

- All results are issued by phone to requesting clinicians/wards.
- Hard copies of the results will be available at the main laboratory reception wards' files.
- Electronic copies will also available on THIS.

5.7 Immigration and Renumerated Tests

- All immigration, insurance, employment and non-citizen laboratory tests requests are required to pay at the hospital account department prior to deliver to the laboratory.

- Fail to provide receipts will result in samples rejected and delayed processing.

5.8 Post Mortem and Forensic Pathology Service

- Due to the Hospital Mortuary, rather limited facilities; Full Post Mortem examination will be restricted only to Police cases, suspected of homicide only.
- This decision is based mainly on fundamental safety issues, that must be resolved first before any routine post mortem can be performed.
- Any enquiries regarding the post mortem service should be directed to the Pathologist and Medical Officer, in charge of the Laboratory Services.

6.0 INDEX

Section

Urine samples	5.5
Whole blood	5.2

ENDS