University Hospitals of Morecambe Bay NHS Foundation Trust

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Which Principles of the NHS Constitution Apply? **Please list from principles 1-7 which apply** 1-7 Principles	**Which Staff Pledges of the NHS Constitution Apply?** **Please list from staff pledges 1-7 which apply** 1, 2 Staff Pledges

Does this document meet the requirements of the Equality Act 2010 in relation to Race, Religion and Belief, Age, Disability, Gender, Sexual Orientation, Gender Identity, Pregnancy & Maternity, Marriage and Civil Partnership, Carers, Human Rights and Social Economic Deprivation discrimination? **Yes**

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BEHAVIOURAL STANDARDS FRAMEWORK

To help create a great place to work and a great place to be cared for, it is essential that our Trust policies, procedures and processes support our values and behaviours. This document, when used effectively, can help promote a workplace culture that values the contribution of everyone, shows support for staff as well as patients, recognises and celebrates the diversity of our staff, shows respect for everyone and ensures all our actions contribute to safe care and a safe working environment - all of which are principles of our Behavioural Standards Framework.

Behavioural Standards Framework – Expectations 'at a glance'

1. INTRODUCTION TO UHMBT BLOOD SCIENCES DEPARTMENT

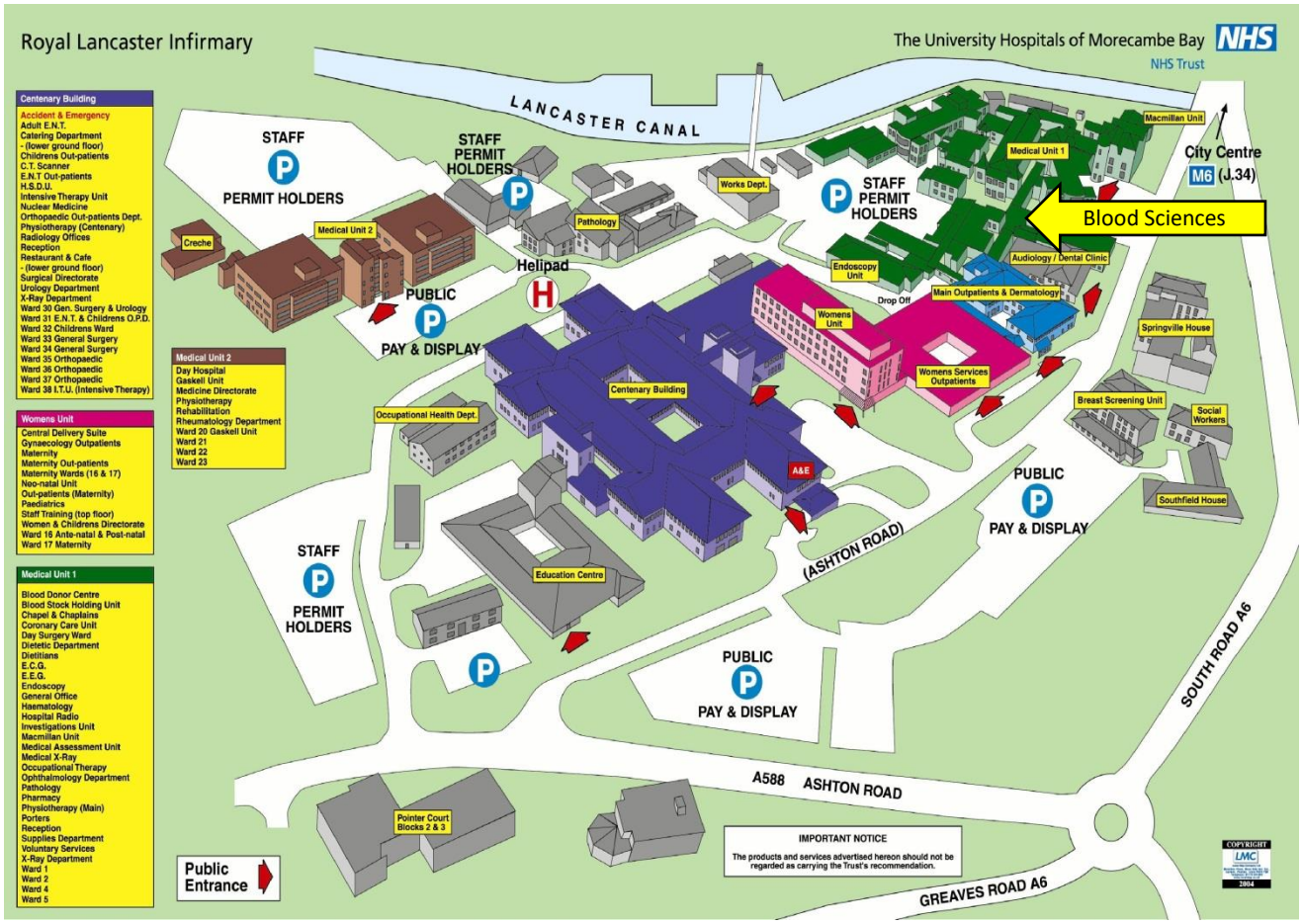
The Blood Sciences Department at the University Hospital of Morecambe Bay NHS Trust (UHMBT) is composed of Clinical Biochemistry, Haematology and Blood Transfusion.

Services are provided from Royal Lancaster Infirmary (RLI), Furness General Hospital (FGH) and Westmorland General Hospital (WGH). Each laboratory is covered by Medical and Scientific staff and specialist advice is available on the selection of tests and the interpretation of results.

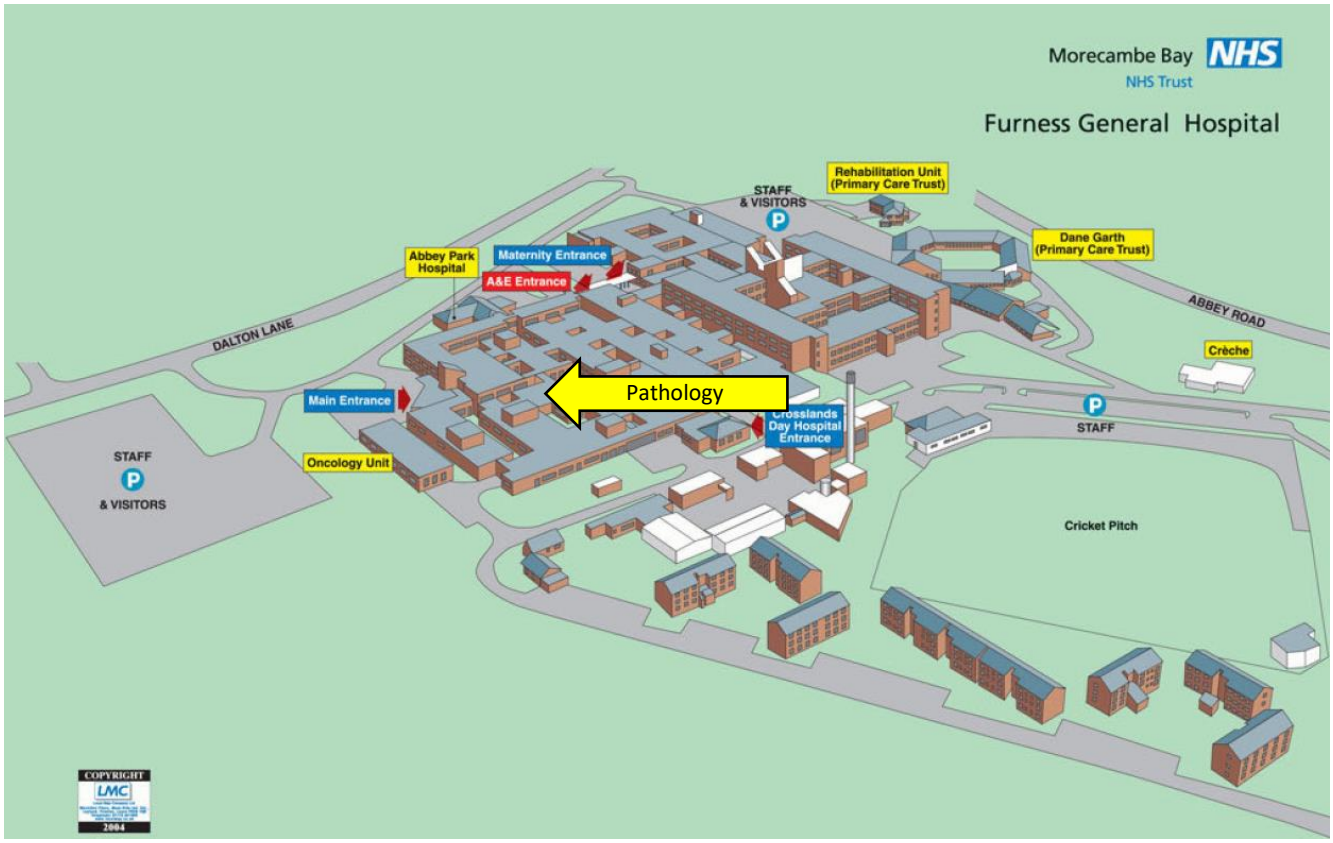
Each request for examination that is received by the laboratory is considered an agreement.

All laboratories undertake rigorous internal quality control procedures and participate in appropriate national external quality assurance schemes covering routine and specialist assays. There is an ongoing programme of departmental and regional audit of clinical and consultative services.

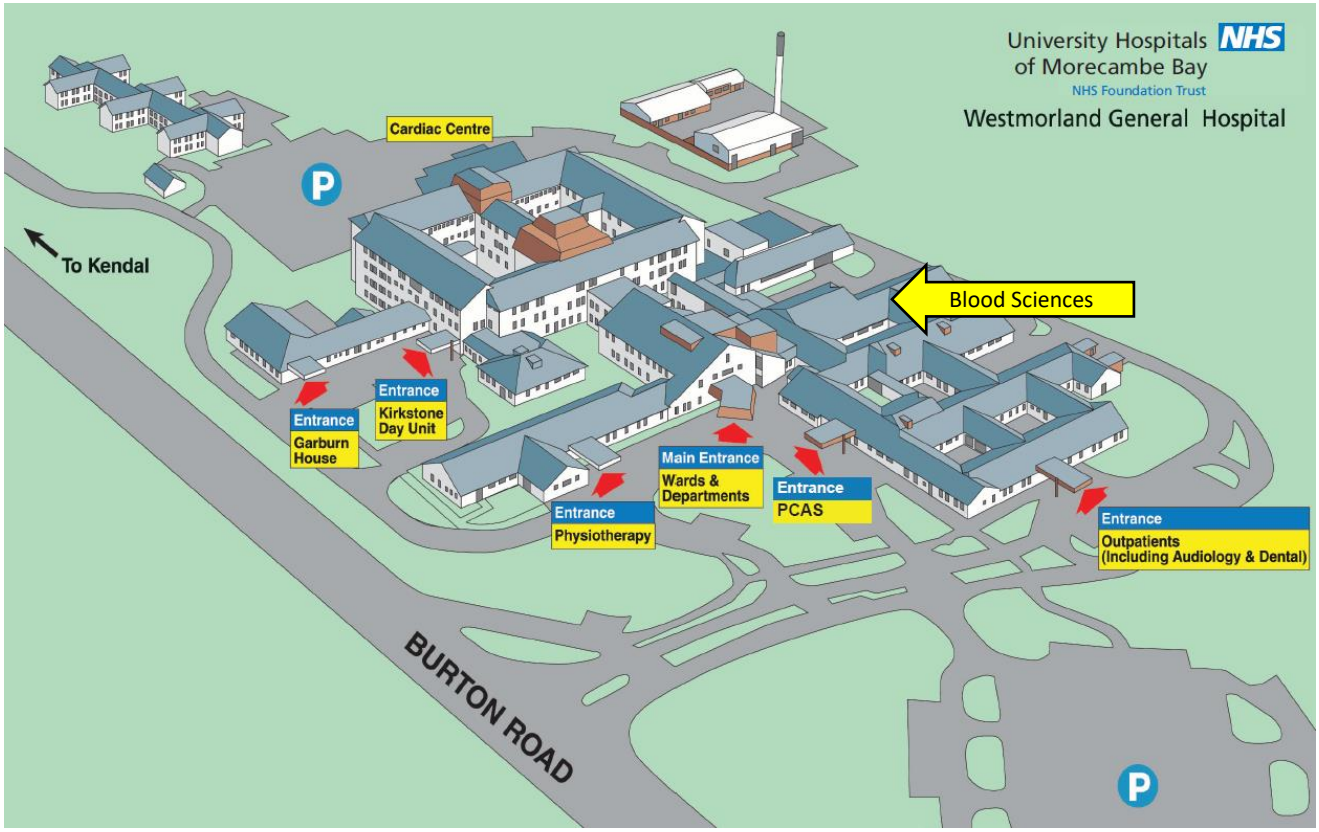
Royal Lancaster Infirmary – Blood Sciences
Medical Unit 1 Link Corridor



Furness General Hospital – Pathology, Level 4



Westmorland General Hospital – Pathology



Laboratory Telephone Numbers
These are for general enquiries NOT clinical advice and interpretation of test results.

RLI
Reception: 01524 583750
Biochemistry: 01524 583756
Haematology: 01524 583761

FGH
Reception: 01229 491050
Biochemistry: 01229 491333
Haematology: 01229 491064

WGH
Blood Sciences: 01539 795284

2. PURPOSE

This manual provides information about the services and tests provided by the Blood Science Department at UHMBT. These include: opening times, specimen collection and delivery, safe specimen transportation, completion of request forms, requesting and reporting policy and warning about hazards of clinical specimen.

3. SCOPE

This information is for all users of the laboratory services including hospital physicians, nurses and laboratory personnel.

4. BLOOD SCIENCE USER MANUAL

4.1. Senior Blood Sciences Staff Contact Details

Name	Title	Internal	External
Mr Nigel Nelson	Pathology Services Manager	49701	01524 519701
Mrs Janet Eglin	Technical Services Manager, Biochemistry	51279	01229 491279
Mrs Rachael Williams	Technical Services Manager, Haematology	49702	01524 519702
Dr David Howarth	Consultant Haematologist	53753	01524 519703
Dr Tony Macheta	Consultant Haematologist	51253	01229 491253
Dr Tina Kozlowski	Consultant Haematologist	53752	01524 583752
Dr EiEi Htwe	Consultant Haematologist	53752	01524 583752
Dr Thet Oo	Consultant Haematologist	53752	01524 583752
Dr Ravinder Sodi	Consultant Clinical Biochemist	49703 41266	07980 962 765
Dr Andrew Brown	Principal Clinical Biochemist	49703 41266	01524 519703 01229 491266

Emails: forename.surname@mbht.nhs.uk

For Haematology clinical advice please contact the relevant Clinical Consultant on-call via switchboard.

For Clinical Chemistry advice please contact the laboratory in the first instance. If the query requires clinical guidance, please contact one of the Clinical Biochemists using the contact details above or utilise the Advice and Guidance system provided for primary care support. If outside office hours please contact the laboratory who will be able to refer the query to the duty Biochemist.

For advice regarding referred tests and Immunology please contact the laboratory in the first instance. If the query requires clinical guidance, please contact one of the Clinical Biochemists or Immunology Department at Lancashire Teaching Hospitals Trust (LTHT) on 01772 52260. If not urgent, please utilise the Biochemistry Advice and Guidance system provided for primary care support. If outside office hours please contact the laboratory who will be able to refer the query to the duty Biochemist or Immunologist.

For advice regarding Virology/Serology tests please contact the Microbiology service.

For Blood Sciences Organisational Chart See Appendix 4

4.2. Laboratory Opening Times

RLI and FGH

Core working day: 8:45 am to 5.15 pm Monday-Friday.
A 24-hour Emergency Service is available, on a restricted range of tests (see section 7).

Urgent requests should be made only when the result will affect the immediate management of the patient.

WGH

Core working day: 9:00 am to 5.00 pm Monday-Friday

Services provided at WGH:
Haematology and Blood Transfusion.
Specimens must arrive before 5.00pm; all Blood Sciences specimens arriving out of core hours should be taken to Kendal Urgent Treatement Centre or Switchboard and transport arranged to be transferred to RLI.
Biochemistry:
Point of care equipment provided in the reception area; access during core hours can be requested from the Laboratory staff, out of core hours the bleep 10 holder can provide access.

The point of care analyser must be used prior to sending any samples for investigation.

Requests for urgent tests should be made to the appropriate extension.

4.3. Scope of Service and Tests Available Urgently

For specific details regarding sample type and collection procedures, reference intervals, turn-around times and other pertinent information, please consult the Laboratory Test Directory (A to Z) available on the intranet site – Share Point.

Available at all times

IF URGENT – TELEPHONE LAB TO WARN OF ARRIVAL
(Except ED sent via point to point pneumatic tube system).
All available within 60 minutes of receipt in lab if URGENT (any analytical problems causing delays will be advised by laboratory staff when telephoned).

ALP	Fibrinogen (Derived and Claus)
ALT	γGT
Albumin	Gentamicin*
Amylase	Glucose
APTT	Group and antibody screen
βHCG**	INR
Bicarbonate*	Iron*
Bilirubin (Direct) *	LDH*
Bilirubin (Total)	Lithium*
Blood film	Lactate*
Blood gases	Magnesium
Calcium	Malaria screen
Carboxyhaemoglobin	Methaemoglobin
CK*	Monospot (IM screen)
Clotting screen	Paracetamol
Creatinine (Serum& Urine)	Phosphate
Crossmatch	Potassium (Serum & Urine)
CRP	Protein (Total)
CSF Protein/Glucose	Reticulocytes
DCT	Salicylate
D-Dimer	Sickle screen
Digoxin*	Sodium (Serum & Urine)
Drain Protein/Glucose/LDH/pH	Troponin I
ESR	Urate
Full blood count	Urea (Serum & Urine)

* may not be immediately available due to maintenance procedures on single analysers
** available for urgent pregnancy testing when a urine sample is unobtainable

Limited urgent availability

ALL SAMPLES RECEIVED WILL BE CONSIDERED AS NON-URGENT unless a telephone request is received directly from a CONSULTANT.
Please note not all assays are available on both sites so delays are to be expected if specimens need to be transported.

Ammonia*	Thyroid function tests
Anti- Xa for LMWH (analysed on RLI site)	Osmolality (blood or urine)
Bile acids* (analysed on RLI site)	Phenytoin* (analysed on FGH site)
Carbamazepine* (analysed on FGH site)	PTH**
Cortisol	Theophylline* (analysed on FGH site)
Ethanol*	

* may not be immediately available due to maintenance procedures on analysers
****** PTH is available urgently for intraoperative use, if pre-arranged with the laboratory

Not available urgently
Tumour markers, genetic testing, specialist tests sent to a referral laboratory unless by prior arrangement.

Consultant only requests
The following requests must be discussed and agreed between the Consultant Clinical Biochemist at UHMB and the specialist referral lab before dispatch:

- Ethylene glycol, methanol or other suspected alcohols (referral laboratory telephone number: 0121 554 3801).
- Urgent Immunology requests including, ANCA and anti-GBM (referral laboratory telephone number: 01772 522607, Preston).
- Drugs of abuse screens.
- Thrombophilia screens
- Anti-Xa
- Investigations for Haematological Diseases e.g. Leukaemia

4.4. Request Forms – Minimum Data Set Policy

1. Requests should be made by utilising the electronic requesting system if available, on T Quest or Lorenzo, alternatively use the combined Biochemistry/Haematology Request Form.
2. Use the tick boxes provided, when appropriate, otherwise specify the test required legibly.
3. The following information is ESSENTIAL when requesting laboratory investigations:
    4.1. Hospital number and/or NHS number
    4.2. Patient's name - surname and forename(s)
    4.3. Patient's date of birth
    4.4. Investigation(s) requested.
    4.5. Patient's Consultant or GP.
    4.6. Location for report.
4. The following information is IMPORTANT in order to process a specimen in an appropriate and timely manner :
    4.1. Patient's address
    4.2. Nature of specimen, e.g. blood, urine, CSF etc.
    4.3. Date and time of sample.
    4.4. Relevant clinical details – including any special information or precautions relevant to specimen handling and any risk of infection.
5. Requesting Doctor's name in block capitals, signature and bleep number/extension

4.5. Blood Transfusion

A separate policy covers requests for cross matches, group and saves, and antenatal group and save screening. **Please see Transfusion of Blood and Blood Components from Sample to Administration CORP/POL/098**

Blood transfusion samples and forms **must be handwritten** in black ink and contain the following information:- (address if outpatient)

- RTX Number (must include RTX prefix) or NHS number.
- Forename and surname
- Date of birth
- Print and Sign Authorised requestor
- Print and Sign name of sample taker
- Date and time of sample
- Ward and gender
- Clinical details

NOTE: Blood Transfusion samples labelled with ADDRESSOGRAPH LABELS will be rejected.

The sample must only be taken by staff that have been assessed as competent in taking transfusion samples.
Please try to anticipate transfusion requirements & allow sufficient time for blood to be cross-matched.
Routine blood for theatre cover should be ordered at least 24 hrs in advance of surgery, where possible.

Wherever possible, blood for planned transfusions should be ordered at least 24 hours in advance.
Blood products and components will normally be reserved for 48 hours only

Blood Transfusion Turnaround Times

Product	Urgency	Turnaround Time
Red blood cells	Major Haemorrhage Uncross matched	15 mins
Red blood cells	Crossmatched urgent	45 mins
Red blood cells	Non-urgent	2 hours
Red blood cells	Phenotypes / Special requirements	48 hours
Fresh frozen plasma (FFP) / Octaplas	-	30 mins
Cryoprecipitate	-	30 mins RLI / 2 hours FGH
Platelets	Urgent	2 hours
Platelets	Non-urgent	24 hours
Prothrombin Combined Concentrate (Octaplex)	Urgent	15 mins
Prophylactic Anti-D	Urgent	1 hour
Prophylactic Anti-D	Non-urgent	24 hours

Batched Products: use of these must be discussed with a the Consultant Haematologist prior to issue		
Combined Human Coagulation Factor VII and Von Willebrands Factor	RLI and FGH	15 mins
Recombinant Factor VIII	RLI and FGH	15 mins
Recombinant Factor IX	RLI and FGH	15 mins

In case of Transfusion Reaction - Stop the Transfusion immediately and inform the Transfusion laboratory. **Please see Transfusion of Blood and Blood Components from Sample to Administration CORP/POL/098**

Transport times from NHS Blood and Transplant Stock Holding Unit Lancaster:

Hospital Site	**Non-urgent**	**Urgent (Blue Light)**
RLI	60 mins	15 mins
FGH	4 hours	110 mins
WGH	4 hours	90 mins

Please note:
These are transport times only. Some of the products listed above may need to be processed upon demand and some may need further work once received in the Laboratory, leading to further delay.

4.6. Specimen Collection and Delivery

In patient / out patients specimens for routine analysis should **preferably** arrive in the laboratories before 18:00 hours on weekdays and 11:00 hours on Saturday, Sunday and Bank Holidays to enable timely processing as only few staff are available over these periods.

Regular collections are made from GP Surgeries and outlying Hospitals (see table below).

At RLI and FGH, there is a pneumatic tube delivery system from the wards. At RLI there is a designated system for the Emergency Department.

At WGH, wards are responsible for arranging delivery of specimens to the laboratory during core hours or if urgent via Switchboard outside of the core hours.

Specimens should be kept at room temperature until despatch unless otherwise stated.

Specimen Collection Trunking Route Times

Please note these delivery/collection routes on run on weekdays	**Departs RLI**	**WGH**	**FGH**	**WGH**	**Returns to RLI**
	08:30	09:15	10:30	11:30	12:45
	10:30	11:45	12:30	14.30	15:30
	16:00	17:45	18:30	20.00	21:00

GP Sample Delivery Arrival Times

FGH		**RLI**		
Local Barrow GPs	12:30	13:30	Dalton Square King Street Rosebank University	Galgate Queen Square Scale Hall Meadowside
Coniston & Hawkshead	12:30			
Millom	13:00			
Ulverston & Dalton	13:30	14:00	Heysham Morecambe Health Centre West End	Owen Road Strawberry Gardens West Gate York Bridge
Outlying GPs	14:30	14:30	Ash Trees Carnforth Outpatient Bentham Arnside Park View - Milnthorpe	Lunesdale – Kirkby Lonsdale Stoneleigh – Milnthorpe
Ulverston & Barrow	15:30			
Local Barrow GPs	16:00			
WGH				
Lakes and Kendal GPs	12:15 sent onto FGH	15:00	Sedbergh	
Sedbergh GPs	14:00 sent onto RLI	18:00	2nd run from all GP surgery's above and BMI	
Lakes and Kendal GPs	16:25 sent onto FGH	20:30	Station House James Cochrane Practice	

4.7. Despatch of Reports

All samples received within pathology will have a report produced. There are several methods of distributing and receiving reports.

Reports are available electronically in two information systems; Lorenzo for hospital sites, released immediately after reporting from the laboratory; Indigo Review for GPs, released every 15minutes after reporting from the laboratory.

Email reporting is also available for those locations not on the N3 network or unable to access Indigo.

Paper copies are sent upon request only. Original paper reports from referral laboratories are sent to requestor and results are either transcribed onto the laboratory information management system or scanned directly onto Lorenzo.

4.8. Telephone Enquiries

Before ringing the laboratory for a result please check the Indigo Review system or Lorenzo for the results.

Telephone enquiries for results can cause delays to laboratory activities resulting in delays in reporting samples.

Please keep enquiries for essential routine results to a minimum and before phoning please check that the results have not already been phoned, faxed, or the reports delivered.

Please have the following information to hand:-
The patient's RTX / NHS number
Date of birth
Ward
Date and time of specimen request
Tests result required.

If the office staff are not able to deal with a telephone enquiry, calls will be transferred to the appropriate laboratory.

Abnormal results that fall out of the telephone action limits will be telephoned. See section 4.11

4.9. Tests Offered and Reference Ranges

Reference ranges are supplied strictly for guidance only, and should be used over those quoted in textbooks or other sources. This is because methods and units can vary and all are subject to regular review.

The current reference/ therapeutic range are included with the final report. 5% of the healthy population will have results marginally outside the quoted reference range. Ranges may be affected by age, gender, ethnic group, pregnancy, time of sampling and many other factors.

Detailed information or advice on interpretation is always available from the laboratory.

For a full list of tests offered, their reference ranges, units reported, turnaround times (TAT) and special collection requirements please see the Laboratory Test Directory (A to Z) on the UHMBT intranet site (SharePoint) at:
http://uhmb/clinicalservices/pathology/testdir/Pages/default.aspx

Therapeutic drug monitoring target ranges and Haematology reference ranges.

Drug	Therapeutic Range	Half-life	Sampling Time	Time to Steady State
Carbamazepine	4-10 mg/L	8-24 hrs	Pre-dose	3 days
Cyclosporine	80 - 280 µg/l	6 hrs	Pre-dose	2 – 3 days
Digoxin	1.0 - 2.0 ug/L	38 hrs	At least 6 hrs post-dose	8 days
Gentamicin	<2 mg/L	3h then 7d	Pre-dose	Pre 2nd to 3rd dose
Lamotrigine	3-15 mg/L	24 hrs	Pre-dose	
Lithium	0.4 - 0.8 mmol/L	18 – 30 hrs	12 hrs post-dose	3 – 10 days
Phenytoin	5-20 mg/L	24 hrs	Pre-dose	5 – 10 days
Tacrolimus	5-10 mg/L	4 – 33 hrs	Pre-dose	3 days
Theophylline	10-20 mg/L	3 - 13 hrs	Pre-dose	48 hrs

Coagulation		**Adults**	**Units**
Coagulation Screen	INR	0.8 - 1.2	Ratio
	APTT ratio	0.8 - 1.2	Ratio
	Claus Fibrinogen	1.5 - 4.5	g / L
	Derived Fibrinogen	1.5 – 4.5	g / L
D Dimer		0 - 278	ng/mL
Anti-Xa for LMWH	Prophylaxis	0.1 - 0.2	IU/mL
	Therapy	0.3 - 0.6	IU/mL
Factor Assays		**Adults**	**Units**
Factor II		50- 150	%
Factor V		50- 150	%
Factor VII		50 - 150	%
Factor VIII		50 - 200	%
Factor VIII RaG		50 - 200	iu/dL
Factor IX		50 - 150	%
Factor X		50 - 150	%
Factor XI		50 - 150	%
Thrombophilia Screen		**Adults**	**Units**
Antithrombin III*		83-128	%
Free Protein S		50-150	%
Protein C*		70-140	%
Lupus Anticoagulant		**Adults**	**Units**
dRVVT		≤1.2	ratio

*Antithrombin levels are reduced in neonates but increase to adult levels by age 1. Between the ages of 1 - 16 years Antithrombin levels are slightly higher than adult levels.
*Protein C levels are low in neonates and infants but increase to normal adult levels through adolescence upto age of 16 years.

Full Blood Count Reference Ranges

FBC parameter	Units	M/F/AGE	VALUE	
			LOW	HIGH
Haemoglobin	g/L	Male	125	180
		Female	115	165
		Neonate	140	220
		> 3 days	150	210
		>1 month	115	165
		>2 months	94	130
		3 – 24 months	111	141
		2 – 6 years	110	140
		6 -12 years	115	150
		12-18 years M	121	166
		12-18 years F	121	151
Red blood cells (RBC)	$x10^{12}$/L	Male	4.5	6.5
		Female	3.8	5.8
		Neonate	5.0	7.0
		> 3 days	4.0	6.6
		>1 month	3.0	5.4
		>2 months	3.1	4.3
		3 – 6 months	4.1	5.3

		6 – 24 months	3.9	5.1
		2 – 12 years	4.0	5.2
		12-18 years M	4.2	5.6
		12-18 years F	4.1	5.1
Haematocrit (HCT)	%	Male	40	50
		Female	36	46
		Neonate	45	75
		> 3 days	45	75
		>1 month	33	53
		>2 months	28	42
		3 – 6 months	30	40
		6 – 12 months	30	38
		2 – 6 years	34	40
		6 -12 years	35	45
		12-18 years M	40	50
		12-18 years F	36	46
Mean cell volume (MCV)	fL	Male	77	100
		Female	77	100
		Neonate	100	120
		> 3 days	92	118
		>1 month	92	116
		>2 months	87	103
		3 – 6 months	68	84
		6 – 24 months	72	84
		2 – 6 years	75	87
		6 -12 years	77	95
		12-18 years M	77	92
		12-18 years F	77	94
Mean cell haemoglobin (MCH)	pg	Male	27	32
		Female	27	32
		Neonate	31	37
		> 3 days	31	37
		>1 month	30	36
		>2 months	27	33
		3 – 6 months	24	30
		6 – 24 months	25	29
		2 – 6 years	31	37
		6 – 12 years	23	33
		12–14 years M	26.9	31.8
		12–14 years F	27.3	32.2
		14-18 years M	26.7	32.8
		14-18 years F	26.9	31.9
Mean cell haemoglobin concentration (MCHC)	g/L	Male	315	345
		Female	315	345
		Neonate	300	360
		> 3 days	290	370
		>1 month	290	370
		>2 months	285	355
		3 – 6 months	300	360
		6 – 24 months	320	360
		2 – 6 years	310	370

		2 – 12 years	310	370
		12–14 years M	334	354
		12–14 years F	332	352
		14-18 years M	335	352
		14-18 years F	330	355
Red cell distribution width (RDW)	SD	Male	11.6	14.0
		Female	11.6	14.0
White blood count (WBC)	$x10^9/L$	Male	6.0	10.0
		Female	4.0	10.0
		Neonate	10.0	26.0
		> 3 days	7.0	23.0
		>1 month	5.0	19.0
		>2 months	5.0	15.0
		3 - 6months	6.0	18.0
		6 – 24 months	6.0	16.0
		2 – 6 years	5.0	15.0
		6 -12 years	5.0	13.0
		12-18 years	4.5	13.0
Neutrophils	$x10^9/L$	Male / Female	2.0	7.5
		Neonate	4.0	14.0
		> 3 days	3.0	5.0
		>1 month	3.0	9.0
		>2 months	1.0	5.0
		3 – 6 months	1.0	6.0
		6 – 24 months	1.0	7.0
		2 – 6 years	1.5	8.0
		6 -12 years	2.0	8.0
		12 -18 years	1.5	6.0
Lymphocytes	$x10^9/L$	Male	1.0	3.0
		Female	1.0	3.0
		Neonate	3.0	8.0
		> 3 days	2.0	8.0
		>1 month	3.0	16.0
		>2 months	4.0	10.0
		3 - 6months	4.0	12.0
		6 – 24 months	3.5	11.0
		2 – 6 years	6.0	9.0
		6 -12 years	1.0	5.0
		12 – 18 years	1.5	4.5
Monocytes	$x10^9/L$	Male	0.2	1.0
		Female	0.2	1.0
		Neonate	0.5	2.0
		> 3 days	0.5	1.0
		>1 month	0.3	1.0
		>2 months	0.4	1.2
		3 - 6months	0.2	1.2
		6 – 24 months	0.2	1.0
		2 – 6 years	0.2	1.0
		6 -12 years	0.2	1.0
		12 – 18 years	0.15	1.3
Eosinophils	$x10^9/L$	Male	0.02	0.50

		Female	0.02	0.50
		Neonate	0.10	1.00
		> 3 days	0.10	2.00
		>1 month	0.20	1.00
		2 months – 12 years	0.10	1.00
		12 – 18 years	0.05	0.80
Basophils	$x10^9$/L	Male	0.00	0.10
		Female	0.00	0.10
Platelets	$x10^9$/L	Male	150	400
		Female	150	400
		Neonate	150	400
		> 3 days	210	500
		>1 month	210	575
		>2 months	210	650
		3 - 6months	200	550
		6 – 24 months	200	550
		2 – 6 years	200	450
		6 -12 years	180	400
		12 – 18 years	180	430
Reticulocytes	$x10^{12}$/L	Male	0.05	0.10
		Female	0.05	0.10
		Neonate	0.12	0.40
		> 3 days	0.05	0.35
		>1 month	0.03	0.05
		>2 months	0.04	0.10
		3 - 6months	0.04	0.10
		1 – 18 years	0.05	0.10

ESR	Males	Females	Units
0 - 7 yrs	< 55	< 55	mm / hr
7 - 16 yrs	< 62	< 62	
16 - 50 yrs	< 11	< 13	
50 - 60yrs	< 13	< 20	
60 - 70yrs	< 15	< 21	
70 -110yrs	< 31	<36	

4.10. Typical Turnaround Times

Typical turnaround times can be found in the Laboratory Test Directory (A to Z) on the UHMBT intranet site at: http://uhmb/clinicalservices/pathology/testdir/Pages/default.aspx. Wherever possible we have consulted with referral laboratories to estimate turnaround times for analyses sent to specialist laboratories but delays in transit and postal disruption cannot be accounted for.

4.11. Telephone Action Limits

Results are automatically authorised if they are within pre-set ranges and have no analytical flags. Results outside these ranges are scrutinised and authorised by qualified staff or authorised by the Consultant. Comments may be appended and additional analyses undertaken based on the clinical details provided and on previous results.

Whilst internal and external quality assurance programmes are in operation to ensure accuracy and precision of results, occasionally random errors may occur and escape detection. The clinician is often best placed to detect such errors. Therefore if you doubt the validity of a result, it is vital that you contact the relevant laboratory extension at once so that we can investigate and re-test samples whenever possible.

Please remember that certain factors may affect and possibly invalidate some test results, causing potential biological and analytical interference or misleading results. For example, blood transfusion and other intravenous fluids, antibiotics, anticoagulants, drugs, timing of specimen in relation to drug dose, type of tube, incorrect order of draw. Please remember to give details of recent or current treatment on the request forms.

Test	Lower phone limit	Upper phone limit	Source
Sodium (mmol/L)	120 (130 if <16y) (note b)	160	RCPath
Potassium (mmol/L)	2.5	6.5 (note a, b)	RCPath
Bicarbonate (mmol/L)	10	-	RCPath
Urea (mmol/L)	-	30 (10 if <16y) (note b)	RCPath
Creatinine (µmol/L)	-	354 (200 if <16y) (note b)	RCPath
AKI 1 and potassium is >6.0	Phone all new AKI 1 if potassium >6.0 mmol/L except dialysis or renal wards		RCPath
AKI 2 and 3 (note b, c)	All new occurrences except dialysis or renal wards		RCPath
Glucose (mmol/L)	2.5	25; If known diabetic - 30 (15 if <16y)	RCPath
Adjusted calcium (mmol/L)	1.8	3.5	RCPath
Magnesium (mmol/L)	0.40	-	RCPath
Phosphate (mmol/L)	0.35	4.0	Local consensus
ALT or AST (U/L)	-	1000 (note c)	Local consensus
Total Bilirubin (µmol/L)	-	200 in neonates (note d)	Local consensus
Direct Bilirubin (µmol/L)	-	25	RCPath
CK (U/L)	-	5000 (note c)	RCPath
Amylase (U/L)		500 (note c)	Local consensus
Ammonia (µmol/L)	-	100	RCPath
Lactate (mmol/L)	-	4.0	Local consensus
Iron (µmol/L)	-	55	Local consensus
CRP (mg/L)	-	300 (note c)	RCPath

Troponin I (ng/L)	-	>12 in females,>20 in males(GPs only)	Local consensus
Cortisol (nmol/L)	50 (note e)	-	RCPath
Ethanol (mg/L)	-	4000	RCPath
Osmolar gap (mmol/L)	-	>10 (advise alcohol screen to follow)	Local consensus
Urate (µmol/L)	-	340 (note f)	RCPath
Digoxin (µg/L)	-	2.5 (note g)	RCPath
Gentamicin pre-dose (mg/L)	-	>3.0	Local consensus
Theophylline (mg/L)	-	25	RCPath
Carbamazepine (mg/L)	-	25	Local consensus
Phenytoin (mg/L)	-	25	RCPath
Lithium (mmol/L)	-	1.5	RCPath
Paracetamol (mg/L)	-	Detectable (note c)	RCPath
Salicylate (mg/L)	-	300	RCPath
Paraprotein identification	Newly diagnosed cases phoned by Clinical Biochemist		Local consensus
Sweat Chloride	Abnormal results phoned by Clinical Biochemist		Local consensus
CSF Xanthochromia	Abnormal results phoned by Clinical Biochemist		Local consensus
Haemoglobin (g/L)	80		Local consensus
Platelets ($x10^9$/L)	50	-	Local consensus
Neutrophils ($x10^9$/L)	1.0	-	Local consensus
INR	-	5.0 (note h)	Local consensus

a. Exclude artefactual causes: haemolysis (usually apparent from haem index); K-EDTA contamination (check adjusted calcium); delayed analysis (check sample date/time); raised platelets or white cell count (check FBC results if available). If creatinine is not raised do not phone but liaise with Clinical Biochemist the following morning.
b. Do not phone if known CKD or if on dialysis or there is an improvement (decrease in concentration).
c. Only communicate on the first occurrence but check previous results were telephoned.
d. During routine hours phone results to ANC or contact the RLI community midwife on 53867, FGH community midwife on 43802 or 43803. During out of hours, phone results to Delivery Suite and ask them to contact the on-call midwife.
e. Do not phone if you are sure it is part of an overnight dexamethasone suppression test (ONDXMT).
f. Only communicate if woman in ante-natal clinics or if known to be pregnant.
g. Check timing >6 h from last dose. More urgent, if potassium <3.0 mmol/L or magnesium <0.7 mmol/L.
h. After checking GP referrals with anticoagulation therapists.

4.12. Hazards of Clinical Specimen

IMPORTANT REMINDER TO ALL HEALTH CARE WORKERS involved in the collection, packing, storage or transport of CLINICAL SPECIMENS

All specimens should be regarded as being potentially infective.

You have a personal and statutory duty of care to protect the Health and Safety both of yourself and of others who deal directly or indirectly with patient specimens and/or associated clinical waste.

Failure to comply with Trust infection prevention policies is notifiable under the Trust's Incident Reporting Scheme, whether or not an accident, injury or infection has resulted: the Trust does not indemnify its staff in cases where there has been a clear breach of its own policy.

The following Infection Prevention Policy applies to any clinical material taken from a patient and sent to a diagnostic laboratory:

• The specimen must be placed in a suitable container and the lid or cap tightly secured to prevent leakage.

• Needles MUST be removed from specimens for blood gases and the specimen sealed.

• The container must be sealed in a leak-proof bag, which will contain any spillage accidentally occurring during transit.

• Laboratory staff have are within their discretionary right to discard any sample that is received in a state which renders it hazardous for them to handle. Where there is perceived to be a lack of duty of care, this will be reported via the Trust Incident reporting system.

• Clinical samples must not be sent to outside agencies other than via the Trust's own transport systems; if to be posted, the sender is directly responsible for complying with current postal regulations.

It is essential that ALL the RELEVANT CLINICAL DETAILS are supplied on the Request Form:

Specimens from High Risk patients known or suspected to be carrying airborne or blood borne viruses or other infectious agents must be labelled as High Risk in accordance with the Trust's Infection Prevention Policy. A yellow 'Danger of Infection' label must be affixed to the Request Form and the specimen container. Please ensure that a clear view of the length of any sample tube is not obscured.
If in doubt, please contact the Microbiology Department

4.13. Frequently Encountered Unexpected Effects on Selected Analytes

The table below, though by no means exhaustive, represents some of the common effects and interferences encountered in tests in the department. In some cases, assay manufacturers inform the laboratory of specific interferences caused by drugs - these are listed here. In general, correlate all biochemical and haematological parameters with the clinical picture and contact the relevant laboratory if there is any doubt regarding the results.

Na	low	Lipaemia; hyperglycaemia; raised protein e.g. myeloma; drip arm infusion with dextrose resulting in dilution
K	high	Storage in cold (including fridge) unseparated; infusion with potassium; K-EDTA contamination (purple bottle) usually as a result of incorrect venepuncture order; use of narrow-bore syringes resulting in haemolysis; prolonged venous stasis during venepuncture; storage in cold (including fridge) unseparated; infusion with potassium; K-EDTA contamination (purple bottle) usually as a result of incorrect venepuncture order; use of narrow-bore syringes resulting in haemolysis; prolonged venous stasis during venepuncture; haemolysis; storage unseparated for >24h; pseudohyperkalaemia: high white blood cell and/or platelet counts
K	low	Storage of whole blood in warm environment
Ca	High	Venous stasis at venepuncture / haemolysis
Ca	low	K-EDTA (purple bottle) or citrate (blue 'clotting studies' bottle) contamination
Mg	low	EDTA contamination (purple bottle)
Zn	low	EDTA contamination (purple bottle)
Creatinine	low	Metamizole (dipyrone) has been identified as an interferent which may cause false low results
Glucose	High	Drip arm infusion with dextrose
Phosphate	High	Prolonged storage unseparated; intravenous supplementation
TG	High	Postprandial sampling; metamizole (dipyrone) has been identified as an interferent which may cause false low results
CK	High	Muscle clenching at venepuncture; vigorous exercise 24h prior to sample collection
Lactate	low	Patients treated with N-Acetyl Cysteine (NAC) for a paracetamol overdose may generate a false low result; metamizole (dipyrone) has been identified as an interferent which may cause false low results
Uric Acid	low	Patients treated with rasburicase (sample must be collected on ice and sent to lab asap); N-Acetyl Cysteine (NAC) for a paracetamol overdose may generate a false low result; metamizole (dipyrone) has been identified as an interferent which may cause false low results
Cholesterol	low	Patients treated with N-Acetyl Cysteine (NAC) for a paracetamol overdose may generate a false low result; metamizole (dipyrone) has been identified as an interferent which may cause false low results
HDL-cholesterol	low	metamizole (dipyrone) has been identified as an interferent which may cause false low results
fT4 and fT3	high	Biotin (vitamin B7 or H) found in vitamin and food preparations falsely elevate fT4 and fT3 and can give the false impression of Graves disease. Please ask the patient if they are on any over-the-counter medications.

Special note on Immunoassays

Immunoassays for various laboratory tests such as cardiac troponin I, LH, FSH, oestradiol, growth hormone, IGF-1, thyroid function tests, tumour markers, free light chains (FLCs), proteins and many others are known to be prone to both positive and negative interferences from a number of substances. In general, when the result does not corroborate the clinical picture please contact the laboratory for further advice.

4.14. Spurious Results due to Inappropriate Collection /Storage

Problem	**Common Causes**	**Consequences**
Delay in separation of plasma	overnight storage delay in transit	Increased K, PO4, ALT, LDH, Mg (Na occasionally)
Storage	storing at 4^{o}C	Increased K
Haemolysis	expelling blood through needle into tube over vigorous mixing of specimen storing specimen in freezer (-20^{o}C) excessive delay in transit leaving specimen in hot environment	Increased K, PO4, Bilirubin, LDH, Mg, AST Decreased Na, Cl, Glu, Iron, TIBC Decreased Hb Inaccurate D-Dimer No reportable result on group and save.
Inappropriate sampling site	specimen taken from drip arm	Increased drip analyte, e.g. glucose, K, Mg Dilutional effect on FBC
Incorrect container or anticoagulant	no enzyme inhibitor EDTA tube (purple or grey) or transferring blood from one tube to another	Low glucose Increase K, Decreased Ca, ALP, Mg
Lipaemia	specimen taken after fatty meal	Low Na
Venous stasis	prolonged use of tourniquet	Increased calcium, protein, CK

4.15. Routine Analyte Stability Data

Add on tests may be undertaken as per the table below. **H – haemolysis; L – lipaemia; I – Icterus.**

Analyte	STABILITY		RESULTS AFFECTED BY			Add on request time limit from venepuncture/collection
	room temp	2°C to 8°C	H	L	I	
ACE	2 hours	4 weeks		yes		4 weeks
AFP	8 hours	48 hours			yes	48 hours
Albumin	7 days	30 days				7 days
ALP	7 days					7 days
ALT	3 days	7 days				7 days
Amylase	7 days					7 days
APTT	24 hours	24 hours				24 hours
AST	4 days	7 days	yes			7 days
B12	8 hours	24 hours	yes		yes	24 hours
Bicarbonate (TCO2)	NIL	4 hours (CLOSED TUBE)				N/A
Bile acids	Not available	5 days	yes	yes	yes	5 days
BNP		4 days	yes	yes	yes	4 days (recommended not to use visually haemolysed, lipaemic or icteric samples)
C125	8 hours	48 hours			yes	48 hours
C199	8 hours	48 hours	yes			48 hours
Caeruloplasmin		3 days		yes		3 days
Calcium	7 days	21 days				7 days
Carbamazepine		7 days				7 days
CEA	8 hours	48 hours				48 hours
Cholesterol		7 days	yes		yes	7 days
CK	4 hours	8 hours	yes			8 hours
Cortisol	8 hours	48 hours			yes	48 hours
Creatinine (Serum)	7 days					7 days
Creatinine (Urine)		7 days				7 days
CRP	11 days	2 months				7 days
D-Dimer	4 hours	4 hours	yes	yes	yes	4 hours
DHEA	8 hours	48 hours			yes	48 hours
Digoxin	2 weeks	3 months				7 days
Direct Bilirubin	3 days PROTECT FROM LIGHT		yes			3 days PROTECTED FROM LIGHT

E2	8 hours	48 hours			yes	48 hours
ESR	4 hours	4 hours				4 hours
FBC	24 hours	24 hours				24 hours
Ferritin	8 hours	48 hours	yes		yes	48 hours
Folate	Ni-refrigerate if not assayed within 2 hours of centrifugation	8 hours	yes		yes	8 hours if stored in stored in fridge
Fibrinogen	24 hours	24 hours				24 hours
FSH	8 hours	48 hours			yes	48 hours
FT3	8 hours	48 hours			yes	48 hours
FT4	8 hours	48 hours			yes	48 hours
Gentamicin		7 days				7 days
GGT	7 days					7 days
Glandular Fever Screen	24 hours	2 days				EDTA 2 days Serum 3 days
Glucose	2 days	7 days				7 days
Group and Save	3 days	7 days				
Growth hormone	8 hours	48 hours				48 hours
HbA1c	7 days					7 days
HCG	8 hours	48 hours				48 hours
HDL Cholesterol	2 days	7 days				7 days
IGA	8 months					7 days
IGE (Total)	8 hours	48 hours				As of 06/02/17, done at RPH
IGG	4 months	8 months				7 days
IGM	2 months	4 months				7 days
INR	24 hours	24 hours				24 hours
Iron	7 days	21 days	yes	yes		7 days
Lactate	8 hours	14 days				7 days
LDH	4 days	7 days	yes			7 days
LH	8 hours	48 hours				48 hours
Magnesium	7 days		yes			7 days
Microalbumin (urine)	7 days	1 month				1 month NB samples not retained for this length of time
Paracetamol		14 days			yes	7 days
Phenytoin		7 days				7 days
Phosphate	1 day	4 days	yes			4 days
Progesterone	8 hours	48 hours		yes	yes	48 hours
Prolactin	Not available	48 hours			yes	48 hours
PSA	3 hours	24 hours			yes	24 hours
PTH (PLASMA)	8 hours	48 hours			yes	48 hours
PTH (SERUM)	4 hours	8 hours			yes	8 hours
Rheumatoid	24 hours	8 days				7 days

Factor						
SHBG	8 hours	7 days			yes	7 days
Testosterone	8 hours	48 hours			yes	48 hours
Theophylline		7 days				7 days
Thyroid Peroxidase Ab	8 hours	48 hours				48 hours
Total Bilirubin	1 day	7 days (IF PROTECTED FROM LIGHT)				7 days (IF PROTECTED FROM LIGHT)
Total Protein	6 days	28 days	yes			7 days
Triglyceride	2 days	7 days			yes	7 days
Troponin I	2 hours (must be separated within 2 hrs of venepuncture)	24 hours				24 hours
TSH	8 hours	48 hours			yes	48 hours
UIBC	7 days	21 days	yes			7 days
Urate	3 days	7 days				7 days
Urea	2 days	7 days			yes	7 days
Urine Protein		48 hours				48 hours
Vitamin D	72 hours	7 days	yes		yes	7 days

4.16. Biochemistry Common Blood Test Acceptance Policy on Delayed/Old samples

This assumes unseparated whole blood samples NOT to be confused with separated samples as listed in section 4.15. All samples refer to the gold top serum SST tubes unless otherwise stated. If these times are exceeded or where a test is not listed, the report issued will state 'delayed analyses, please repeat'.

Up to 6 hours	**Up to 24 hours**	**Up to 48 hours**
Sodium	Cardiac Troponin I	Lipids
Potassium	Cortisol	TFTs
Chloride	PTH	LH/FSH/Prolactin
Glucose	Urea & Creatinine	Oestrogen
Lactate (acceptable up to 8h)	Liver profile (excluding Bilirubin)	Testosterone
Phosphate	Bone Profile	Progesterone
LDH	Amylase	Tumour Markers
Bicarbonate	Urate	HbA1C
Total & direct bilirubin	Magnesium	

4.17. Data Protection Act and Patient Confidentiality

For details regarding the Trust data protection policy please refer to Data Protection and Confidentiality Policy CORP/POL/015.

Important points to remember at all times when viewing patient results

- A patient's right to confidentiality is protected by the law.
- You are expected to abide by the Data Protection Act at all times; it is in your contract of

employment.

- All employees of the Trust are responsible for maintaining confidentiality. This duty of confidentiality is written into your employment contract. Breach of confidentiality of information gained, either directly or indirectly in the course of duty, is a disciplinary offence that could result in dismissal.
- You are only authorised to access the personal information you need to know in order for you to perform your duties. Gaining access or attempting to gain access to information that you do not need to know to carry out your work is a breach of confidentiality. So is passing information on to someone who is not authorised to receive it. Any personal information given for one purpose must not be used for another purpose without the consent of the individual concerned because that use may breach confidentiality.
- All personal information must be treated as confidential, not just clinical information.
- You should understand your responsibilities to protect the confidential information you collect and use, by following the rules and guidance in the Trust's Policy for Confidentiality.

Protecting Confidentiality

- Never attempt to access information on patients whose care you are not directly involved in, e.g. family members. This is a breach of confidentiality and will be treated as such.
- Smartcards – You must never share smartcard access. Don't leave your card in the PC when you are not using it or share your card and PIN details.
- Security - Always log off your computer or lock the screen using CTRL-ALT-DEL and 'Lock Computer' when not in use.
- Confidentiality Policy - staff are not permitted to take confidential information off site without specific authorisation. This can be enforced via the Disciplinary Policy. You should be particularly careful with small paper items e.g. handover sheets, letters. If items are inadvertently removed to home there are 2 courses of action – secure disposal at home by shredding / burning or return document to work for secure disposal in confidential waste. No confidential waste should EVER be disposed of in general waste.

If in doubt about anything above, please ask your line manager or log a call via Service Desk to Information Governance or email information.governance@mbhci.nhs.uk

4.18. Complaints Procedure

Patient complaints must be directed through the Patient Advice and Liason Service (PALS)

The PALS Offices are located on each site and are open Monday to Friday, 10am - 4pm (excluding bank holidays).

Sometimes it may not be possible to speak to a PALS Officer immediately, so you may prefer to contact them on 01539 795497 or email pals@mbht.nhs.uk

Complaints from service users must initially be discussed with a senior member of staff and will be logged to be resolved informally. Formal complaints can be directed through to PALS (as above) or emailed to commentsandcomplaints@mbht.nhs.uk

Departmental issues will be recorded as a CAPA, organizational and or clinical issues will be logged in the Ulysses system.

For further details please refer to Management Procedure for the Investigation and Resolution of Complaints CORP/PROC/004.

4.19. Informed Consent

Patients have a fundamental legal right to determine what happens to them. Informed consent to treatment and care is therefore absolutely necessary and also a matter of common courtesy between health professionals and patients.

The Department of Health has issued a range of guidance documents on consent and these should be consulted for details of the law and good practice requirements on consent. This procedure sets out the standards and procedures in the University Hospitals of Morecambe Bay NHS Trust which aim to ensure that health professionals are able to comply with the guidance.

In the Clinical Laboratory setting tests are undertaken on the understanding that they were ethically obtained after the patient was informed on the nature of the test usually by the requesting doctor.

No samples are stored for any purpose other than to undertake tests requested and for a period of time to confirm results should the need arise. If samples are stored for research purposes, ethical approval must have been sought and documentations are available on file.

For consent for blood transfusion please refer to **Transfusion of Blood and Blood Components from Sample to Administration CORP/POL/098**

5. Attachments

Number	Title
Appendix 1	Collection of 24h Urine Specimen
Appendix 2	Lumbar Puncture and CSF Sample Collection
Appendix 3	Special Tests and Dynamic Function Tests
Appendix 4	Equality & Diversity Impact Assessment Tool

6. Other relevant / associated documents

Unique Identifier	Title and web links from the document library
CORP/POL/098	Transfusion of Blood and Blood Components from Sample to Administration
CORP/PROC/004	Management Procedure for the Investigation and Resolution of Complaints
CORP/POL/015	Data Protection and Confidentiality Policy v6
Blood Sciences Laboratories Test Directory (A to Z)	http://uhmb/clinicalservices/pathology/testdir/Pages/default.aspx

7. Supporting references / evidence based documents

Number	References
1	ISO 15189:2012 Medical Laboratories – Requirements for quality and competence.

8. Definitions/glossary of terms

Abbreviation or Term	Definition
N/A	

9. Consultation with staff and patients

Enter the names and job titles of staff and stakeholders that have contributed to the document

Name	**Job Title**	**Date Consulted**
Ms Rachel Banks	Quality Manager	09/09/2019
Mrs Rachael Williams	Technical Services Manager, Haematology	28/10/2019
Dr Ravinder Sodi	Consultant Clinical Scientist	19/07/2019

10. Distribution plan

Dissemination lead:	Pathology Quality Manager Technical Services Manager
Previous document already being used?	Yes
If yes, in what format and where?	N/A
Proposed action to retrieve out-of-date copies of the document:	N/A
To be disseminated to:	
Document Library	New documents are uploaded to the Document Library & Blood Sciences intranet page
Proposed actions to communicate the document contents to staff:	Departmental Meetings and Q-Pulse

11. Training

Is training required to be given due to the introduction of this policy? No

Action by	Action required	Implementation Date
N/A		

12. Amendment history

Version No.	Date of Issue	Page/Selection Changed	Description of Change	Review Date
1	12/01/2012	All	Telephone numbers, reference ranges and other pertinent details updated.	12/01/2014
2	20/01/2012	All	Telephone numbers, reference ranges and other pertinent details updated.	20/01/2014
3	22/10/2012	All	CR2778 and CR3202 (haematology reference ranges did not match those on INTERNET, adjusted, now the same: no training required.	22/10/2014
4	10/12/2012	All	Dr Taylor removed, Stability data added, telephone number changed for Haem RLI, Osm changed to urgent only with consultant approval, statement regarding phoning requesters back with results not yet available removed.	04/10/2017
5	17/04/2018	All	Following on from UKAS inspections: added information on lipids, diabetes, state cortisol now available on both sites. Removed test directory and mentioned A to Z laboratory test directory available on intranet.Updated Telephone Action Limits now included.	17/04/2021

6	17/07/2019	All	Amended minor typographical errors, updated contact details and included information on acceptance of blood test results on old/delayed samples. Also, responded to UKAS finding: 224663-00-E01815-012 ‘section 4.3 User manual contains incorrect information. It indicates that there are stated Turn Around Times in appendix one however, Appendix one is for 24hr urines. Turn Around Times, are not stated in User Manual for Clinical Biochemistry.’	20/07/2022

Appendix 1: Collection of 24h Urine Specimen

What is a 24 hour urine collection?

A 24 hour urine collection is all of your urine passed over a 24 hour period. The time you start the collection is not important; however, it is very important that you complete the 24 hour period and collect all urine passed during this time. Recording the start and end times may help in obtaining a full collection.

What is the test for?

The body produces many waste products some of which are secreted into the urine. In certain conditions the amount of these products may be increased or decreased. Dependent on what your doctor is investigating, they may wish to measure one of these products. This will help your doctor decide on the correct diagnosis or treatment.

If the collection is for a Creatinine Clearance test you will also need to have a blood sample taken, ideally this should be within the urine collection period but should still be acceptable 1 - 2 days either side of it.

If the collection is for 5HIAA test please note that foods such as vanilla-based products, avocados, bananas, pineapples, plums, walnuts, tomatoes, kiwi fruit, sweetcorn, broccoli, spinach and aubergine and over-the-counter medications should be avoided for 48hr prior to and during urine collection

If the collection is for Urine Catecholamines /Metadrenalines please note that certain medications including paracetamol and stimulants such as nicotine and caffeine may affect the result. Please avoid this for 24hr prior to and during urine collection. If you are on prescribed medications, please inform your doctor before you start collecting urine as some medications can affect the results. Do NOT stop any medications without your doctor's permission.

When will I get the result?

The result will be sent to the doctor who asked for you to be tested. We are not allowed to give the results directly to you.

When to collect the urine?

First decide which is the most convenient day to take your urine collection to the hospital or your GP surgery, you must start the collection 24 hours before this date.

What if I forget to collect some of my urine in the 24 hour period?

If you do not collect all the urine, the results may be misleading
If the collection is incomplete, please return it and collect a fresh container. Please ensure that you complete the label details on the container as the sample will be rejected if not labelled.

What to do?

1. On a convenient day, empty your bladder into the toilet at 8am. From this point onwards, collect all the urine you produce in the next 24 hours into the large container(s) provided.
2. Use a funnel or other clean container if filling is a problem or if the bottle contains a preservative (see below).
3. In warm weather, please try to keep the sample cool.
4. Empty your bladder at 8am the following day and add this to the large container. After

this point cease any further collection.

5. Make sure the large bottle has your full name plus the times and dates of the start and end of the collection written on its label. Please also write your date of birth on the label.
6. Take the urine and request form in the bag provided, ensuring the absorbent material supplied is kept within the bag with the sample to absorb any leakages, to the laboratory at the hospital or your GP surgery if more convenient.

For some 24 hour urine collections the laboratory may add an acid preservative to the container. These bottles can be identified by the warning labels attached. Goggles, gloves and absorbent material will have also been provided in the transport bag.

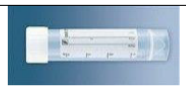
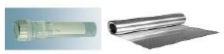
- Do not discard the preservative or the absorbent material (in case of leakage)
- The preservative is toxic and corrosive –avoid contact with eyes and skin. DO NOT collect the urine directly into the container – please use a clean container such as a jug
- Please use the gloves and goggles provided whenever the collection bottle is opened
- Keep out of reach of children
- Any spillage must be mopped up and rinsed with plenty of water
- If contact with skin or eyes occurs rinse with copious amounts of water. Seek medical advice if problems arise, stating that you have had contact with 25% Hydrochloric Acid

Appendix 2: Lumbar Puncture and CSF Sample Collection

Ensure you enter the full clinical details for the patient and your suspected diagnosis on the request form.
Requests for viral/extended bacterial investigations must be request specific: use of “PCR” is not appropriate.
Subarachnoid Haemorrhage investigations should be performed at least 12 hours after onset of headache in patients with a normal CT.

Central Nervous system (CNS) investigations for suspect infection: samples as indicated below plus Blood Cultures **The following tubes are NOT required:** **5 and 8 (recycle- use for other tests)** **Fill other tubes as indicated** **Suspected meningococcal/pneumococcal investigation can be alternatively performed using Blood cultures and an EDTA (tube 9) blood sample only**	**Subarachnoid haemorrhage including Xanthochromia investigation** **The following tubes are NOT required:** **6, 7, 9 (recycle- use for other tests)** **Fill other tubes as indicated** **CNS investigations for Multiple Sclerosis:** **Fill tubes 1, 2, 3, 4, 8 and 10**

Do not transfer CSF between containers.
The draw order is specific to avoid contamination.
When in doubt please seek advice from the Microbiologists and Clinical Biochemists.
For further information please see the Blood Science home page:
http://uhmb/clinicalservices/pathology/bloodsciences/Pages/Investigation-of-suspected-SAH.aspx

Order of draw	Sample	Container	Volume	Request	Send to
1	CSF		2.5mL Label (1)	Depending on condition under investigation this sample is for: Microbiology or Oligoclonal bands: include Serum Gel-Tube 8	Microbiology Please use an Immunology request form for Oligoclonal bands
2	CSF	 Fluoride Oxalate	0.5mL	Glucose	Biochemistry
3	CSF		2.5mL Label (3)	Microbiology for cell count & culture	Microbiology
4	CSF		1.0mL	Protein	Biochemistry Fully label/Do not use an addressograph
5	CSF		**Minimum 1.0mL**	Xanthochromia	Biochemistry **Foil wrap** **Hand deliver** Fully label/Do not use an addressograph
6	CSF		2.0mL	Microbiology for viral investigations: please specify requirements	Microbiology
7	Blood	 Serum Gel	Fill to line	Microbiology	Microbiology
8	Blood	 Serum Gel	Fill to line	Depending on condition under investigation this sample is for: Liver Profile or Oligoclonal bands	Biochemistry (Renal Profile) Blood for oligoclonal bands please pack with CSF(1)
9	Blood	 EDTA	Fill to line	Microbiology	Microbiology
10	Blood	 Fluoride Oxalate	Fill to line	Glucose	Biochemistry

Appendix 3: Special Tests and Dynamic Function Tests

For further information on other specialist Dynamic Function Tests (DFTs) please see the Blood Sciences intranet site and laboratory test directory at http://uhmb/clinicalservices/pathology/bloodsciences/Pages/default.aspx and http://uhmb/clinicalservices/pathology/testdir/Pages/default.aspx

Guidance on Lipids

For details regarding guidance on lipid disorders and their management refer to NICE CG181 - Cardiovascular disease (CVD): risk assessment and reduction, including lipid modification (July 2014) and European Guidelines on cardiovascular disease prevention in clinical practice (European Heart Journal 2016; 37:2315–2381).

Targets for the General population (based on Heart UK)

- Total cholesterol (TC) – ideally should be <5 mmol/L
- Non HDL-Cholesterol (non-HDL-C) - ideally it should be <4 mmol/L.
- LDL-Cholesterol (LDL-C) - ideally it should be <3 mmol/L.
- HDL-Cholesterol (HDL-C) - ideally it should be >1 mmol/L (men) and >1.2 mmol/L (women).
- TC:HDL ratio – a ratio >6 is considered high risk - the lower this figure, the better.
- Triglyceride (TG) - ideally it should be <1.7 mmol/L on a fasting sample or <2.3 mmol/L on a non-fasting sample.

Primary prevention

- Use the QRISK2 risk assessment tool to assess CVD risk for the primary prevention of CVD in people up to and including age 84 years.
- Do not use QRISK2 assessment tool to assess CVD risk in people older than 85 years, people with an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73m^2 and/or albuminuria or those with familial hypercholesterolaemia (FH) or type 1 diabetes mellitus. These people are already at increased risk of CVD. You may use the QRISK2 risk assessment tool to assess CVD risk in people with type 2 diabetes.
- Recognise that standard CVD risk scores will underestimate risk in people who have additional risk because of underlying medical conditions or treatments. These groups include: people treated for HIV; people with serious mental health problems; people taking medicines that can cause dyslipidaemia such as antipsychotic medication, corticosteroids or immunosuppressant drugs; people on antihypertensives or lipid-lowering medications, people with autoimmune disorders such as systemic lupus erythematosus, and other systemic inflammatory disorders.
- Before starting lipid modification therapy for the primary prevention of CVD, take at least one lipid sample to measure a full lipid profile. This should include measurement of total cholesterol, HDL-C, non-HDL-C (Total cholesterol minus HDL-C), calculated LDL-C and triglyceride concentrations. **A fasting sample is not needed.**
- Offer atorvastatin 20 mg for the primary prevention of CVD to people who have a 10% or greater 10-year risk of developing CVD. If CVD is already present, start with atorvastatin 80 mg.

- LDL-C is the primary target - for those deemed very high-risk: <1.8 mmol/L, or a reduction of at least 50% if the baseline is between 1.8 and 3.5 mmol/L. If high-risk: <2.6 mmol/L, or a reduction of at least 50% if the baseline is between 2.6 and 5.1 mmol/L. For those deemed low to moderate risk: <3.0 mmol/L. Non-HDL-C is a reasonable and practical alternative target because it does not require fasting (European Guidelines on CVD prevention, 2016). NICE CG181 recommends measure total cholesterol, HDL cholesterol and non-HDL cholesterol in all people who have been started on statin treatment at 3 months of treatment and aim for a greater than 40% reduction in non-HDL cholesterol.

Familial hypercholesterolaemia (FH)

- If cholesterol >7.5 mmol/L or there is a family history of premature coronary heart disease consider diagnosis of FH – liaise with the Clinical Biochemists regarding genetic testing. A special form needs to be completed and patient consent is required. Cascade testing of close relatives may be necessary.
- Diagnosis of FH is based on the Simon Broome criteria;
  Definite FH:
  a) Total cholesterol > 6.7 mmol/L or LDL-C >4.0 mmol/L in a child <16 years or Total cholesterol >7.5mmol/L or LDL-C > 4.9 mmol/L in an adult (levels either pre-treatment or highest on treatment).
  PLUS
  b) Tendon xanthomas in patient, or in 1st degree relative (parent, sibling, child), or in 2nd degree relative (grandparent, uncle, aunt)
  OR
  c) DNA-based evidence of an LDL receptor, apo B-100 or PCSK-9 mutation.

  Possible FH:
  a) Total cholesterol or LDL-C as above
  PLUS
  b) Family history of myocardial infarction below age of 50 in 2nd degree relative or below age 60 in 1st degree relative
  OR
  c) Family history of raised cholesterols: >7.5 mmol/L in adult 1st or 2nd degree relative or > 6.7 mmol/L in child or sibling under 16.
- For FH the target is 50% reduction of original LDL-C using high-intensity statins.
- If statins alone are not effective, people with FH should be considered for ezetimibe.
- PCSK-9 inhibitors such as Praluent (alirocumab) injections may be indicated but are strictly by specialist prescription.

When to refer to a specialist (currently undertaken by the Endocrinology Team of the Trust)

- Exclude possible common secondary causes of dyslipidaemia (such as excess alcohol, uncontrolled diabetes, hypothyroidism, liver disease and nephrotic syndrome) before referring for specialist review.
- Arrange for specialist assessment of people with a total cholesterol concentration of more than 9.0 mmol/L or a non-HDL cholesterol concentration of more than 7.5 mmol/L even in the absence of a first-degree family history of premature coronary heart disease.
- Refer for urgent specialist review if a person has a triglyceride concentration of more than 20 mmol/L that is not a result of excess alcohol or poor glycaemic control.

Primary prevention for people with diabetes mellitus

- Offer statin treatment for the primary prevention of CVD to adults with type 1 diabetes who: are older than 40 years or have had diabetes for more than 10 years or have established nephropathy or have other CVD risk factors.
- Start treatment for adults with type 1 diabetes with atorvastatin 20 mg.
- Offer atorvastatin 20 mg for the primary prevention of CVD to people with type 2 diabetes who have a 10% or greater 10-year risk of developing CVD. Estimate the level of risk using the QRISK2 assessment tool.

Primary prevention for people with chronic kidney disease (CKD)

- Offer atorvastatin 20 mg for the primary or secondary prevention of CVD to people with CKD.
- Increase the dose if a greater than 40% reduction in non-HDL-C is not achieved and eGFR is >30 ml/min/1.73m^2. Agree the use of higher doses with a renal specialist if eGFR is < 30 ml/min/1.73m^2.

Secondary prevention

- Start statin treatment in people with CVD with atorvastatin 80 mg.
- Target: TC <4 mmol/L or LDL-C <2 mmol/L.
- Non HDL-C secondary targets of 2.6, 3.3 and 3.8 mmol/L are recommended for very high, high and low to moderate risk subjects, respectively (European Guidelines on CVD prevention, 2016).

Monitoring patients on statins

- Before offering a statin, ask the person if they have had persistent generalised unexplained muscle pain, whether associated or not with previous lipid-lowering therapy. If they have, measure creatine kinase (CK) levels. If CK levels are more than 5 times the upper limit of normal, re-measure CK after 7 days. If CK levels are still 5 times the upper limit of normal, do not start statin treatment. If CK levels are raised but less than 5 times the upper limit of normal, start statin treatment at a lower dose.
- If people report muscle pain or weakness while taking a statin, explore other possible causes of muscle pain or weakness and raised CK if they have previously tolerated statin therapy for more than 3 months.
- Do not measure CK levels in asymptomatic people who are being treated with a statin.
- Measure baseline liver transaminase enzymes (ALT) before starting a statin. Measure liver transaminase within 3 months of starting treatment and at 12 months, but not again unless clinically indicated.
- Do not routinely exclude statin therapy in people who have liver transaminase levels that are raised but are less than 3 times the upper limit of normal.

Common causes of secondary hyperlipidaemia

Hypercholesterolaemia: hypothyroidism; anorexia nervosa, drugs e.g. cyclosporines
Low HDL-C: smoking, obesity, insulin resistant conditions (type 2 DM, metabolic syndrome), and specific genetic mutations such as Tangier disease. Medications which can reduce HDL levels include beta blockers, thiazide diuretics, androgens, progestogens and anabolic steroids.
High HDL-C: can be due to secondary causes such as excessive alcohol intake, exercise and medication such as oral oestrogen replacement. Those with a Japanese ancestry are found to have high HDL levels due to a genetic deficiency of a protein, the cholesterol ester

transfer protein (CETP). Very high levels of HDL have been reported to promote the development of atherosclerosis in some cases, and the mechanism of this affect is not clear.
Hypertriglyceridaemia: liver disease; diabetes mellitus; alcohol abuse; calorie excess/ obesity; chronic kidney disease; autoimmune conditions; pregnancy especially in third trimester; rarely hypothyroidism.
Mixed hyperlipidaemia: nephrotic syndrome; cholestatic jaundice; obesity; drugs e.g. corticosteroids, high dose thiazides, atypical anti-psychotics, cyclosporine, tacrolimus.

Lipid screening in children and adolescents

The U.S. Preventive Services Task Force concludes that the current evidence is insufficient and that the balance of benefits and harms of screening for lipid disorders in asymptomatic children and adolescents 20 years or younger cannot be determined (JAMA 2016).

Paediatrics reference intervals for lipids: age-specific and sex-specific (where applicable) paediatric reference intervals measured with Beckman Coulter assays[1] or Roche Cobas assays[2]. These are only meant to be a guide.

Lipid	Age and Sex	Reference interval	Source
Triglycerides[1] (mmol/L)	0 – 14 days	0.97-3.39	CALIPER
	15 days – <1 yr	0.57-3.38	
	1 – <19 yrs	0.45-2.54	
HDL Cholesterol[1] (mmol/L)	0 – 14 days	0.41-1.11	
	15 days – <1 yr	0.30-1.91	
	1 – <4 yrs	0.86-1.68	
	4 – <13 yrs	0.95-1.94	
	13 – <19 yrs	0.85-1.92	
Total cholesterol[2] (mmol/L)	0 – 14 days female	1.25-3.24	
	0 – 14 days male	1.15-2.83	
	15 days – <1yr female	1.70-6.07	
	15 days – <1 yr male	1.70-6.07	
	1 – <19 yrs female	2.91-5.36	
	1 – <19 yrs male	2.91-5.36	
LDL-cholesterol (mmol/L)	Not available at present		

<u>Guidance on Diabetes Mellitus</u>
For further details regarding management see:

- NICE NG17 (2016) - Type 1 diabetes in adults: diagnosis and management;
- NICE NG28 (2017) - Type 2 diabetes in adults: management;
- NICE NG18 (2016) - Diabetes (type 1 and type 2) in children and young people: diagnosis and management.

The NICE recommended target blood glucose levels are stated below for adults with type 1 diabetes, type 2 diabetes and children with type 1 diabetes. The table provides general guidance. An individual's target is set in conjunction with their healthcare team.

Target Levels (all in mmol/L)	Upon waking	Before meals (pre prandial) glucose	At least 90 minutes after meals (post prandial) glucose	HbA1c
Non-diabetic		4.1 to 5.6*	under 7.8	<42 mmol/mol; 6.0%
Type 2 diabetes		4.0 to 7.0	under 8.5	48 mmol/mol; 6.5%
Type 1 diabetes	5.0 to 7.0	4.0 to 7.0	5.0 to 9.0	48 mmol/mol; 6.5%
Children with type 1 diabetes	4.0 to 7.0	4.0 to 7.0	5.0 to 9.0	48 mmol/mol; 6.5%

*Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 2018.

Glycated haemoglobin
This measures the average blood glucose over the last 90-120 days.
It is affected by biological variation and age variation. It can be affected significantly by conditions that alter red cell survival e.g. anaemias and polycythaemia. Current methods separate out abnormal haemoglobins and values in such patients are therefore more likely to be valid or at least not grossly inaccurate.

DCCT-adjusted % of total Hb	IFCC mmol/mol Hb	
>6.5	>48	Diabetes
6.0-6.4	42-47	Pre-diabetes
<6.0	<42	Normal

IFCC value = [DCCT value -2.15] X 10.9

Diagnostic use: used for the diagnosis and monitoring of diabetes mellitus.

The reference range in healthy adults is 4.0 - 5.9 %. This reflects the biological variation and this coupled with changes with age and laboratory test variability can confound its use as a diagnostic test for diabetes.

If HbA1c monitoring is invalid because of disturbed erythrocyte turnover or abnormal haemoglobin type, estimate trends in blood glucose control using one of the following:

- fructosamine estimation
- quality-controlled blood glucose profiles
- total glycated haemoglobin estimation (boronate-affinity chromatography).

Oral Glucose Tolerance Test (GTT)
The OGTT is recommended for screening of gestational diabetes in women at 24-28 weeks gestation and in individuals with fasting plasma glucose 6.1–6.9 mmol/L (impaired fasting glycaemia) to determine glucose tolerance status. It is NOT otherwise required for the diagnosis of diabetes mellitus.

The patient should fast overnight (10hr) and a fasting blood glucose specimen is taken at 0 minutes into a fluoride oxalate tube (grey). This is immediately followed by an oral 75g dose of anhydrous glucose in 300ml water (or equivalent), taken over 5 minutes. A further blood

glucose specimen should be taken at 120 minutes following the glucose drink. Both specimens should be clearly identified with time of specimen and patient name should be sent together to the laboratory.

Interpretation	**Venous Plasma Glucose (mmol/L)**
Diabetes Mellitus (WHO criteria) : Fasting 2 hrs after glucose-load	 > 7.0 > 11.1
Impaired Fasting Glucose (WHO criteria): Fasting 2 hrs after glucose-load	 6.1-6.9 <7.8
Impaired Glucose Tolerance (WHO criteria): Fasting 2 hrs after glucose-load	 < 7.0 7.8 - 11.1
Gestational Diabetes (NICE guidance NG3, 2015 criteria at 24–28 weeks of Gestation using 75 g OGTT): Fasting 2 hrs after glucose-load	 > 5.6 > 7.8

Short Synacthen Test (SST)

Take a blood specimen for cortisol at 0 minutes followed by 250ug Synacthen iv between 08.00 and 10.00hrs. Take further serum cortisol specimens 30 and 60 minutes after the Synacthen administration. All three blood specimens clearly identified with time of specimen and patient name should be sent together to the laboratory.

Interpretation
Serum cortisol increase to > 450 nmol/l at 30 minutes indicates adequate adrenal reserve (allowing for bias on current cortisol assay, February 2014).

Dexamethasone Suppression Test (DXST)

Patient is given a 1mg tablet of Dexamethasone between 22.00 and 24.00 hrs.

A blood specimen is taken at 09.00 hrs for cortisol.

Interpretation:
Cortisol suppressed to <50nmol/l excludes Cushing's Syndrome.

Requests for investigation of male infertility (Furness general Hospital only)

In addition to the patient information required the following details are required to be completed prior to submission of the sample to the laboratory

- The date and time that the sample was produced, the time must indicate whether am or pm
- The number of days of sexual abstinence prior to the production of the sample

It must be noted that samples received in the laboratory greater than one hour after production will rejected.

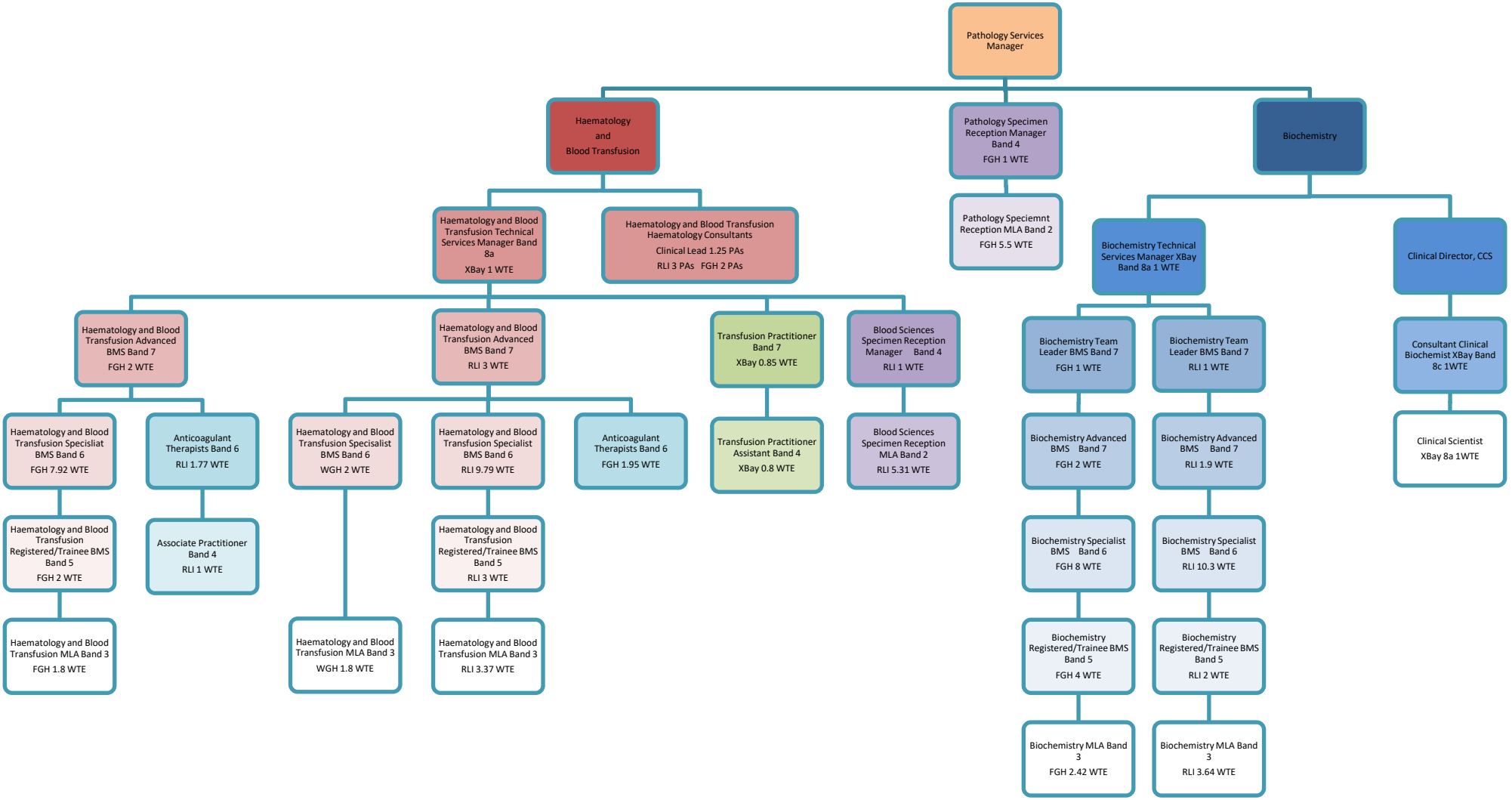
Samples should be protected from extremes of temperature (< 20°C and greater than 40°C) the best way to do this is to inform the patient that on transporting the samples they should keep it in an inside pocket near to the body.

There are a number of factors that can affect the results of semen sample

1. Collection into a condom or other contraceptive device, causing reduction in the numbers of motile spermatozoa
2. Variation in temperature during either transport or storage may cause a reduction in numbers of motile spermatozoa
3. Abstinence less than 48 hours may cause a reduced sperm count

Additional investigations are not carried out on semen samples. Any additional investigations required e.g. culture for potential infections must be carried out on an additional sample.

Appendix 4: Blood Sciences Organisational Chart



Appendix 5: Equality & Diversity Impact Assessment Tool

University Hospitals of Morecambe Bay NHS Foundation Trust

Equality Impact Assessment Form

Department/Function	Department of Blood Sciences	
Lead Assessor	Dr R Sodi	
What is being assessed?	Blood Science User manual	
Date of assessment	09/06/2019	
What groups have you consulted with? Include details of involvement in the Equality Impact Assessment process.	Equality of Access to Health Network	○ Yes ○ No
	Staff Side Colleague	○ Yes ○ No
	Service Users	○ Yes ○ No
	Staff Inclusion Network(s)	○ Yes ○ No
	Personal Fair Diverse Champions	○ Yes ○ No
	Other (including external organisations) Please give details: Senior Blood Sciences Team and Consultants	◉ Yes ○ No

1) What is the impact on the following equality groups?		
Positive: ➢ Advance Equality of opportunity ➢ Foster good relations between different groups ➢ Address explicit needs of Equality target groups	**Negative:** ➢ Unlawful discrimination, harassment and victimisation ➢ Failure to address explicit needs of Equality target groups	**Neutral:** ➢ It is quite acceptable for the assessment to come out as Neutral Impact. ➢ Be sure you can justify this decision with clear reasons and evidence if you are challenged

Equality Groups	**Impact (Positive / Negative / Neutral)**	**Comments** ➢ Provide brief description of the positive / negative impact identified benefits to the equality group. ➢ Is any impact identified intended or legal?
Race (All ethnic groups)	Neutral	None
Disability (Including physical and mental impairments)	Neutral	None
Sex	Neutral	None

Gender reassignment	Neutral	None
Religion or Belief	Neutral	None
Sexual orientation	Neutral	None
Age	Neutral	None
Marriage and Civil Partnership	Neutral	None
Pregnancy and maternity	Neutral	None
Other (e.g. caring, human rights)	Neutral	None

2) In what ways does any impact identified contribute to or hinder promoting equality and diversity across the organisation?	No impact

3) If your assessment identifies a negative impact on Equality Groups you must develop an action plan **to avoid discrimination and ensure opportunities for promoting equality diversity and inclusion are maximised.**

- This should include where it has been identified that further work will be undertaken to further explore the impact on equality groups
- This should be reviewed annually.

Action Plan Summary

Action	**Lead**	**Timescale**

This form will be automatically submitted for review for Policies and Procedures once approved by Policy Group. For all other assessments, please return an electronic copy to EIA.forms@mbht.nhs.uk once completed.