



# Letterkenny University Hospital HAEMATOLOGY USER MANUAL

## Change Description:

### Reason for Change:

- Procedural and Document amendments:
  - (a) Updated information on Turnaround times of FBC
  - (b) Additional Information on outsourcing of GP samples to Eurofins for testing
  - (c) Updated information on Paediatric Blood Films referred to Children's Hospital Crumlin
  - (d) Updated information on referral of samples for Immunophenotyping and Cytogenetics to MLL Munich
- Effective Date: 02/05/2024
- Review Date: 02/05/2026

## **GUIDE TO USING THIS MANUAL**

This User Manual has been prepared in conjunction with The Pathology Department User Manual (MP-GEN-0064) to inform the users of the Saolta University Health Care Group, Letterkenny University Hospital, Pathology Department of which services are available within the Pathology Department and how to obtain the services required.

**PLEASE REFER TO DOCUMENT MP-GEN-0064, THE PATHOLOGY DEPARTMENT GENERAL USER MANUAL FOR GUIDANCE ON USING THESE DOCUMENTS.**

Documents are available on Q-Pulse and also on the HSE Website <http://www.hse.ie/luhPathology>



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## 1. General Information

This laboratory provides diagnostic investigations in general haematology, coagulation, and specialised areas. Approximately 175,000 FBC samples and 60,000 coagulation samples are processed in the lab each year. In addition the laboratory carries out daily ESRs, infectious mononucleosis screens, blood film reviews, warfarin monitoring tests, DDimers, malaria screening, sickle cell screening and Kleihauer studies. Some specialised investigations not performed at Letterkenny University Hospital are routed through the Haematology Lab to external laboratories

### 1.1 Haematology Staffing

The Haematology Laboratory is staffed by:

Consultant Haematologist

Laboratory Manager: overall scientific responsibility of Laboratory

1 x Chief Medical Scientist

2 x Senior Medical Scientists

4.5 x Staff Grade Medical Scientists

### 1.1 Medical Advisory Services

Clinical laboratory advice is provided by a Consultant Haematologist (with 24/7 telephone cover).

### 1.2 Turnaround Times

Expected turnaround times for Haematology assays are identified in Table 1 below.

Turnaround time is defined as the time from specimen receipt in the Pathology Department to the time results are available.

The times stated are deliverable in 90% of instances in normal circumstances. There are times, due to factors outside the laboratories control, that the stated turnaround times may be exceeded. These events are infrequent and will be explained to users at the time.

If the laboratory fails to meet expected turnaround times please contact Chief Medical Scientist or Laboratory Manager (see contact list).

**NB: Turnaround times for assays referred to external laboratories for testing are NOT exact and may alter dependent on batch referral from LUH, courier availability and receipt of reports by mail.**

### 1.3 Laboratory Accreditation

The Haematology Laboratory is currently accredited to ISO15189.

The scope of accreditation for the Pathology Laboratory at haematology Laboratory at Letterkenny University Hospital is controlled by the Irish National Accreditation Board (INAB) and detailed in Scope Registration Number 210MT on the INAB website [www.inab.ie](http://www.inab.ie).



## 2 Haematology Laboratory Tests

### 2.1 Laboratory Request Forms/ Specimen containers/ Sample Acceptance Policy

Please refer to the **General Information User Guide, MP-GEN-0064, Section 8** for sample and request form labeling requirements. This manual is available on Q-Pulse and the HSE website <http://www.hse.ie/ahPathology>

Haematology Tests, sample containers, and expected turnaround times

**2.2 Table 1: Haematology Tests, sample containers, and expected turnaround times**

| Test  | Container         | Routine                      | Urgent   | Note   |
|---|-------------------|------------------------------|--|--|
| FBC   | EDTA (purple top) | ≤ 2 days                     | 60 min   |  |
| Blood Film examination                                  | EDTA (purple top) | 1-2 days<br>(excl weekends ) | Urgent films requested by Consultant Haematologist/Clinician: same day | See section 2.6  |
| Blood Film referred for Consultant Haematologist review |                   | 5-7 days<br>(excl weekends)  | 8-24 hours for critical/urgent blood films                             | See section 2.6  |
| Rapid Diagnostic Malaria Screen                         | EDTA (purple top) | 1 day (excluding weekends)   | 2 hours  | Rapid Diagnostic Tests are screening assays and should be interpreted with caution pending Thick and Thin film examination reports |
| Malaria Thick + Thin Film                               | EDTA (purple top) | 1 day (excluding weekends)   | 4 hours  | Samples should preferably be received within 2 hours   |

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| Test  | Container                               | Routine  | Urgent   | Note  |
|---|---|--|--|---|
| Confirmatory Malaria Screen, (Malaria Reference Laboratory) | As per lab                              | 1-2 working days for diagnosis by blood film and/or immunochromatographic technique. 1-4 days for PCR confirmation | Urgent telephoned requests can be available within 2 hours of sample receipt at reference laboratory |   |
| Reticulocyte  | EDTA (purple top)                       | 48 hours   | 60 min   |   |
| Infectious Mononucleosis Screen                             | EDTA (purple top) or clotted (gold top) | 2 day  | Not applicable. For 'urgent' requests Clinician must contact Laboratory                              | Infectious Mononucleosis screen results should be interpreted in conjunction with clinical information. A negative result does not preclude the possibility of IM infection.                                  |
| ESR   | EDTA (purple top)                       | ≤ 2 days   | Not applicable. For 'urgent' requests Clinician must contact Laboratory                              |   |
| Sickle cell screen  | EDTA (purple top)                       | 1 day  | Not applicable. For 'urgent' requests Clinician must contact Laboratory.                             | Sickledex is a qualitative screening procedure and does not differentiate between Sickle Cell Disease (S/S) and Sickle Cell Trait (A/S). All samples are sent to referral laboratory for confirmatory testing |



| Test                 | Container         | Routine | Urgent   | Note   |
|----------------------|-------------------|---------|----------|--|
| Kleihauer Test (FMH) | EDTA (purple top) | 1 day   | 4 hours  |  |
| Urinary Haemosiderin | Urine vacutainer  | 1 day   | Not done | This test is outside the scope of accreditation of this laboratory. This does not affect the validity of the result. |

### Blood Coagulation

| Test                 | Container          | Routine                               | Urgent   | Note  |
|----------------------|--------------------|---------------------------------------|----------|---|
| Coagulation screen   | Citrate (blue top) | 4 hours                               | 90 min   | Samples for APTT testing have a limited stability period. For optimum testing samples must be received and reported within 4-5 hours of collect time. |
| D-Dimer              | Citrate (blue top) | 4 hours                               | 90 min   | Samples for this assay have a limited stability period. For optimum testing samples must be received and reported within 4-5 hours of collect time    |
| INR                  | Citrate (blue top) | 1 day                                 | 90 min   | see section 2.9 for dosing information  |
| Fibrinogen           | Citrate (blue top) | 4 hours                               | 90 min   |   |
| 50:50 Mixing studies | Citrate (blue top) | 4-24 hrs, dependant on assay testing. | Not done | 50:50 Mixing assays carried out only if PT >2 seconds and/or APTT >5 seconds above reference range  |

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|                                  |                        |                |           |  |
|----------------------------------|------------------------|----------------|-----------|--|
| Factor Assays<br>FVIII, FIX, FX, | 2 x Citrate (blue top) | 2 working days | 4 hours   | Samples for Factor assays have a limited stability period. For optimum testing samples must be received and reported within 4-5 hours of collect time  |
| Anti F10a Assay                  | 2 x Citrate (blue top) | 2 working days | 2-4 Hours | Samples for Anti Xa assay MUST be collected 4 hours post administration of Low Molecular Weight Heparin (LMWH) as per British Society for Haematology Guidelines (Guidelines on the Use and Monitoring of Heparin, 2006 BSH, 133, 19-34) |



### 2.3 Referred Tests to External Laboratories

**NB: Turnaround times for assays referred to external laboratories for testing are NOT exact and may alter dependent on batch referral from LUH, courier availability and receipt of reports by mail.**

Contact the Haematology Laboratory to request any further information on the following tests.

| Test                                  | Container  | Routine   | Urgent  | Note   |
|---------------------------------------|--|-----------|---|--|
| Paediatric Factor Assays              | 2-4 Green capped paediatric coagulation  | 2-4 weeks | Contact Laboratory/Referral Laboratory (CHI Crumlin)  |  |
| Paediatric Von Willebrand screen      | 4 Green capped paediatric coagulation  | 8 weeks   | Not Done  |  |
| EMA (Hereditary Spherocytosis) Screen | 2 x EDTA (purple top) must be FRESH and in Lab by 10.30am. Do not send Fridays. Do not refrigerate | 2-4weeks  | Not Done  |  |
| PNH Screen                            | 2 x EDTA (purple top) must be FRESH and in Lab by 10.30am. Do not send Fridays                     | 2-4weeks  | Not Done  |  |
| Immuno-phenotyping                    | EDTA, Bone marrow, CSF. Contact Laboratory   | 2-4weeks  | 1-2 days, must be pre arranged with Laboratory at LUH | Currently, requests for Immuno-phenotyping are sent to MLL at Munich testing <a href="https://www.mll.com/en.html">https://www.mll.com/en.html</a> |





| Test   | Container  | Routine   | Urgent  | Note  |
|--|--|---|---|---|
| Cytogenetic analysis                                     | Contact Haematology team or laboratory<br>Do not refrigerate         | Dependant on assay required                           | Not Done  | Currently, requests for Cytogenetics sent to MLL at Munich testing, <a href="https://www.mll.com/en.html">https://www.mll.com/en.html</a> |
| Cancer Molecular Diagnostic Tests (BCRABL,MPN Panel etc) | Bone marrow, EDTA (x 2) or Lithium Heparin                           | 3-4 weeks   | Not Done  |   |
| Inherited Bone Marrow Failure Syndrome                   | 10mls EDTA<br>Contact Haematology Team to arrange                    | 12+ months  | Not Done  |   |
| Soluble CD25   | 1 x clotted (gold top)   | 8 weeks   | Not Done  |   |
| Thrombophilia screen                                     | 6 x Citrate (blue top) + 1 x clotted (gold top)+ 1 EDTA (purple top) | 8 weeks   | Not Done  | See section 2.10  |
| Lupus anticoagulant                                      | 4 x Citrate (blue top)   | 4weeks  | Not Done  | See section 2.10  |
| von Willebrand Factor                                    | 4 x Citrate (blue top)   | 8 weeks   | Not Done  |   |
| Heparin induced thrombocytopenia (HIT)                   | 2 x clotted (gold top)   | 2- 5 working days post receipt at referral laboratory | 48 hours post receipt in referral laboratory(SJH)     | See section 2.11  |
| Factor Assays (Adult)                                    | 2 x Citrate (blue top)   | 2-4 weeks   | Contact Laboratory/Referral Laboratory (NCC St James) |   |
| Factor V Leiden  | 1 x EDTA (purple top)  | 8 weeks   | Not Done  |   |

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| Test                        | Container             | Routine | Urgent   | Note  |
|-----------------------------|-----------------------|---------|----------|---|
| Prothrombin Gene Mutation   | 1 x EDTA (purple top) | 8 weeks | Not Done |   |
| Lymphocyte Subsets          | 1 x EDTA (purple top) | 2 weeks | Not Done | Samples must be FRESH and received in Lab by 10.30am. Do not send Fridays. Do not refrigerate |
| Haemoglobin Electrophoresis | 2 x EDTA (purple top) | 4 weeks | Not Done | Ferritin assay should be performed prior to testing for Haemoglobinopathy.                    |

## 2.4 Sample Requirements

Please refer to the **General Information User Guide, MP-GEN-0064, Section 8 for sample** and request form labeling requirements. This manual is available on Q-Pulse and the HSE website <http://www.hse.ie/tubPathology>

### Adult Sample

Sample requirements for EDTA (purple top) samples are 3ml

Sample requirements for Citrate (blue top) samples are 2.7ml

Sample requirements for clotted (gold top) samples are 3 ml

### Paediatric Specimens

FBC – 0.5ml in purple EDTA Paediatric container

ESR – 0.5ml in purple EDTA Paediatric container x3 (Minimum 1.5 mL required)

Coagulation screen - minimum volume 1.3ml in green Sodium Citrate paediatric container

Specialist Coagulation testing: Contact Haematology Laboratory for instructions.

## 2.5 Blood Films

If abnormalities are detected in the full blood count profile, laboratory staff will examine a blood film. The protocol as to which an abnormal FBC receives blood film examination, and the frequency, is decided by the Consultant Haematologist. If required, a blood film examination may be requested on a FBC sample, by requesting Physician. **NB: Please indicate on the request form the clinical reason for the blood film or contact the Haematology Laboratory.** Requests outside this criteria will not be accepted.

Blood films that are notified to the laboratory as urgent by Clinical team/Consultant Haematologist will be reviewed and reported immediately, during routine working hours. Outside routine hours, the timing of blood film review will be at discretion of Laboratory staff and/or Consultant Haematologist.

A blood film and differential white cell count may be analysed by digital morphology methods. This will be indicated on the final report with a relevant comment.

## 2.6 Blood Film for Urgent Review by Consultant Haematologist

The following categories of Blood film and findings are referred for Urgent attention to the Consultant Haematologist

- Newly presented indications of Haemolytic Uraemic Syndrome (HUS) or Thrombotic Thrombocytopenia (TTP), (features of Microangiopathic haemolytic anaemia on blood film, ie red cell fragments (schistocytes), polychromasia and platelet consumption).
- Newly presented /transformed Leukaemias
- New /Unexpected presentation of Neutropenia  $<0.5 \times 10^9/L$
- New/Unexpected presentation of Blast cells on blood film.
- New /Unexpected presentation of Platelet count  $<20 \times 10^9/L$  or  $>1000 \times 10^9/L$
- Newborn + platelet count  $<50 \times 10^9/L$



### **Paediatric Blood Film for Review by Consultant Haematologist**

Paediatric blood films for review by Consultant Haematologist are referred to the Children's Hospital Crumlin (CHI).

Blood films may be referred to CHI at the request of Consultant Haematologist (LUH), Consultant Paediatrician (LUH) or Consultant at CHI.

### **2.7 Platelet Clumping**

Occasionally platelet clumping occurs in EDTA samples for FBC testing. In this case it is difficult to provide an accurate platelet count with the FBC. Platelet testing on a Sodium Citrate sample (blue top) may help alleviate the problem. If a patient persistently presents with platelet clumps send Sodium citrate sample with FBC REQUESTS. Request form must be clearly marked that 'Sodium Citrate is for Platelet testing'.

### **2.8 Coagulation Testing**

It is essential that all tubes be filled accurately to the marked line on the bottle. They should not be taken from heparin containing IV lines

Samples for special coagulation are separated, frozen, and done in batch analysis.

If required urgently in a particular clinical case please discuss with the laboratory..

Please contact the laboratory for advice if any other clotting assay is required which is not listed.

Samples for APTT and DDimer assays have a limited stability period. For optimum testing samples must be received and reported within 4-5 hours of collect time.

### **2.9 Warfarin /INR dosing**

For information and guidance on INR dosing refer to BCSH 1998,101,374-387 Guidelines on oral anticoagulation



## 2.10 Thrombophilia Testing

Requests for Thrombophilia Testing and/or Lupus Anticoagulant screen are sent for testing at the National Coagulation Centre, St James Hospital.

Requests must meet 'Thrombophilia Testing Guidelines', see:

<http://www.stjames.ie/GPsHealthcareProfessionals/LaboratoryPolicesGuidelines/Thrombophilia%20Testing%20Guidelines%20October%202016.pdf>

Requests for these assays must be accompanied by dedicated St James request form, plus indication MUST be confirmed on the request form that patient consent has been agreed. A copy of the patient consent form must be stored in patient chart.

Copies of request form, consent forms and Patient information leaflets are available by contacting the Haematology laboratory or at the following link:

<http://www.stjames.ie/GPsHealthcareProfessionals/Referral/ReferralForms/>

## 2.11 Heparin Induced Thrombocytopenia (HIT) Screen

Requests for HIT screen are sent for testing at the National Coagulation Centre, St James Hospital.

Requests for this assay must be accompanied by dedicated St James request form.

Copies of request form are available by contacting the Haematology laboratory or at the following link:

[https://www.stjames.ie/media/HIT%20request%20form%20\(1\).pdf](https://www.stjames.ie/media/HIT%20request%20form%20(1).pdf)



## 2.12 Foetal Maternal Haemorrhage (FMH) by Kleihauer Test

- Kleihauer testing is NOT indicated in Rhesus Positive antenatal patients <20 weeks gestation.
- In pregnancies <12 weeks gestation, a test for foetomaternal haemorrhage (FMH) is not required.
- For potentially sensitising events between 12 and 20 weeks in **Rhesus negative** patients, a dose of anti D should be administered within 72 h of the event. A test for FMH is **NOT** required.
- For potentially sensitising events after 20 weeks gestation, in **Rhesus negative** patients, anti-D should be administered within 72 h of the event. A test for FMH **IS** required.
- It may be helpful to estimate FMH in **Rhesus positive** women who have had an intrauterine death or stillbirth particularly if the cause of death is unknown or foetal haemorrhage is suspected. Severe anaemia at birth may also warrant FMH if the anaemia is otherwise unexplained.

If the FMH is less than or equal to 12ml it is covered by the standard anti-D Ig dose given (1500 IU covers a 12mls bleed), additional Anti-D Ig is not required. However, an FMH of greater than or equal to 12mls is considered to be “significant” and there should be a follow-up maternal sample to check for clearance of foetal cells.

If the FMH volume exceeds 12mls an appropriate supplementary dose of Anti-D Immunoglobulin will be required and, follow up- maternal samples for Kleihauer are required to check for clearance of foetal cells, 48 hours following administration of anti-D.

## 2.13 Urgent Samples

If urgent analysis is required, please contact the Laboratory on 5033 during routine hours. Outside of routine hours contact the Medical Scientist on call.



## 2.14 On Call Tests

During 'on call' periods the following tests are routinely available:

- FBC
- Coagulation Screen/ INR
- Fibrinogen Assay
- DDimers

The following tests can be performed on-call under predefined circumstances. Please contact the Medical Scientist on call if requesting any of these tests:

- Malarial Parasites
- Sickle Test
- ESR (Specifically for Temporal Arteritis and Osteomyelitis only)
- Infectious Mononucleosis Screen
- Thrombin Time

Requests for 'on call' tests are carried out at 40 minute intervals between 5pm and 12 midnight. Outside these hours the Medical Scientist must be contacted prior to sending samples. To arrange tests outside this profile contact the laboratory or medical scientist on call for further information.

## 2.15 Outsourcing of requests from General Practice (GP)

Currently, a proportion of Haematology requests for FBC and ESR from GPs are being referred to an external laboratory for testing. Samples are sent to Eurofins Biomnis.

Results from Eurofins are available to Users via Healthlink.

Eurofins sample turnaround times are comparable to those analysed at Letterkenny University Hospital.

Any queries can be directed to the Client Services Department, Eurofins Biomnis through the freephone number (1800 252 966) or via email ([client.services@eurofins-biomnis.ie](mailto:client.services@eurofins-biomnis.ie))

**NB:** Samples that are deemed urgent or require testing at Letterkenny Hospital Pathology Department may be sent to the LUH in a separate envelope marked "Urgent" to allow easier identification of the sample.



## 2.16 Reference Ranges

For samples processed at the Haematology Lab, LUH, all age and sex related ranges are available on LIS and are also printed on all hard copy and electronic reports issued from the Laboratory.

The reference ranges for all tests referral to external laboratories are printed on reports. All original reports issued from referral laboratories are returned to ordering Physician by the Pathology reception at LGH.

Sex related Reference Ranges are not provided on reports issued for patients who are registered as Gender 'Unknown'.

**Appendix 1** details the reference ranges for commonly ordered assays, contact the Haematology laboratory for any further details on reference ranges or in the event of LIS being unavailable.

Note 1: Coagulation Assays: Normal Ranges for these assays are dependent on patient anticoagulant status. Ranges may change with variations in reagents in use, but will appear as part of the hardcopy or electronically available report.

Please contact the Haematology department for details of current ranges if required.

Note 2: DDimer: Quoted reference ranges do not apply during pregnancy.

### 2.15.1 Source of Reference Ranges

1. International Consensus Group for Hematology Review: Suggested Criteria for Action following Automated CBC and WBC Differential Analysis. *International Society for Laboratory Hematology 2005*.

2. Lewis, Bain & Bates 'Practical Haematology' (9<sup>th</sup> ed.) 2001. Churchill Livingstone

3. Bain, B.J. 'Blood Cells-A practical Guide' (5th ed.) Blackwell Science

4. Our Lady's Hospital for Sick Children, Crumlin

5. Guidelines on the laboratory aspects of assays used in haemostasis and thrombosis:

BJH <https://onlinelibrary.wiley.com/toc/13652141/2020/191/3>

<https://b-s-h.org.uk/guidelines/guidelines/guideline-on-laboratory-aspects-of-assays-used-in-haemostasis-and-thrombosis/>

**NOTE: In the event of changes to the reference range a message shall be displayed to all reports to highlight these changes to users, for a minimum period of 4 weeks.**





### **2.17 Measurement of Uncertainty**

Measurement of Uncertainty has been estimated for all in house investigations where a numerical result is reported. The estimate of measurement uncertainty provides a quantitative indication of the quality of a measurement result and the dispersion of values in which the true result could reasonably be expected to lie.

Measurement of Uncertainty calculations are annually based on precision and bias data from the analysis of quality control and internal quality assurance data over a period of time where available. Estimates for measurement uncertainty for each investigation are available on request. For further information please contact the Chief/deputy Medical scientist at the Haematology Laboratory.

Please note: Requests for information on Uncertainty of Measurement data should take account of other sources of uncertainty that may exist, for example biological or diurnal variations.

## **3. Delivery, packaging and transport requirements**

Specimens should be transported to the laboratory without delay to ensure optimal results. Please see Policy on Transport of Specimens to the Laboratory MP-GEN-0060  
Please refer to Pathology Department User Manual MP-GEN-0064.



## 4. Storage of Samples

Sample are retained post Analysis as per Table 4

**Table 4:**

| Specimen Description  | Storage Requirement       | Storage Location          | Retention Period |
|---|---------------------------|---------------------------|------------------|
| EDTA Samples:<br>Including<br>FBC/Reticulocyte<br>counts/ESR/Infectious<br>Mononucleosis screen | Room Temp/2-8°C           | Haematology<br>Laboratory | 24-48 hours      |
| Sodium Citrate:<br>Coagulation Samples  | Room Temp                 | Haematology<br>Laboratory | 24 hours         |
| Plasma/Serum<br>(Excluding Coagulation<br>Samples)  | Room<br>Temperature/2-8°C | Haematology<br>Laboratory | 48 hours         |
| Routine Blood Films   | Room Temp                 | Haematology<br>Laboratory | 3 months         |
| Stained smears for<br>Kleihauer Screens   | Room Temp                 | Haematology<br>Laboratory | 3 months         |
| Stained Thick and Thin<br>films for Malaria and or<br>Parasite identification                   | Room Temp                 | Haematology<br>Laboratory | 3 months         |
| Blood Films Referred<br>to Consultant<br>Haematologist  | Room Temp                 | Haematology<br>Laboratory | Permanently      |
| Bone marrow Smears  | Room Temperature          | Haematology<br>Laboratory | Permanently      |
| Urine Samples   | Room<br>Temperature/2-8°C | Haematology<br>Laboratory | 48 hours         |



## 5. Appendices

### Appendix 1: Haematology (LUH) Reference Ranges

NB: See section 2.15 for additional information on reference ranges (including the source of ranges)

(D =days,M=months,Y=years)

| Test | Sex (Male/Female) | Age      | Lower Normal Range | Upper Normal Range | Units               |
|------|-------------------|----------|--------------------|--------------------|---------------------|
| WBC  | M+F               | 0-7D     | 10                 | 26                 | 10 <sup>9</sup> /L  |
|      | M+F               | 7D-1Y    | 6                  | 18                 |                     |
|      | M+F               | 1Y-8Y    | 5                  | 15                 |                     |
|      | M+F               | 8Y-13Y   | 4.5                | 13.5               |                     |
|      | M+F               | 13Y-150Y | 4                  | 11                 |                     |
| RBC  | M+F               | 0-1D     | 3.9                | 5.3                | 10 <sup>12</sup> /L |
|      | M+F               | 1-3D     | 4                  | 6.6                |                     |
|      | M+F               | 3D-7D    | 3.9                | 6.3                |                     |
|      | M+F               | 7D-14D   | 3.6                | 6.2                |                     |
|      | M+F               | 14D-28D  | 3                  | 5.4                |                     |
|      | M+F               | 28D-56D  | 2.7                | 4.9                |                     |
|      | M+F               | 56D-91D  | 3.1                | 4.5                |                     |
|      | M+F               | 91D-2Y   | 3.7                | 5.3                |                     |
|      | M+F               | 2Y-6Y    | 3.9                | 5.3                |                     |
|      | M+F               | 6Y-12Y   | 4                  | 5.2                |                     |
|      | M                 | 12Y-18Y  | 4.5                | 5.3                |                     |
|      | F                 | 12Y-18Y  | 4.1                | 5.1                |                     |
|      | M                 | 18Y-150Y | 4.5                | 5.9                |                     |
|      | F                 | 18Y-150Y | 4                  | 5.2                |                     |

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| Test        | Sex (Male/Female) | Age      | Lower Normal Range | Upper Normal Range | Units |
|-------------|-------------------|----------|--------------------|--------------------|-------|
| Haemoglobin | M+F               | 0-2D     | 13.5               | 19.5               | g/dL  |
|             | M+F               | 2D-4D    | 14.5               | 22.5               |       |
|             | M+F               | 4D-8D    | 13.5               | 21.5               |       |
|             | M+F               | 8D-21D   | 12.5               | 20.5               |       |
|             | M+F               | 21D-35D  | 10                 | 18                 |       |
|             | M+F               | 35D-63D  | 9                  | 14                 |       |
|             | M+F               | 63D-18M  | 10.5               | 13.5               |       |
|             | M+F               | 18M-3Y   | 10.5               | 13.5               |       |
|             | M+F               | 3Y-7Y    | 11.5               | 14.5               |       |
|             | M+F               | 7Y-13Y   | 11.5               | 15.5               |       |
|             | M                 | 13Y-19Y  | 13                 | 16                 |       |
|             | F                 | 13Y-19Y  | 12                 | 16                 |       |
|             | M                 | 19Y-150Y | 13.5               | 16.5               |       |
|             | F                 | 19Y-150Y | 12                 | 16                 |       |
| HCT         | M+F               | 0-2D     | 0.42               | 0.6                | ratio |
|             | M+F               | 2D-4D    | 0.45               | 0.67               |       |
|             | M+F               | 4D-8D    | 0.42               | 0.66               |       |
|             | M+F               | 8D-21D   | 0.39               | 0.63               |       |
|             | M+F               | 21D-35D  | 0.31               | 0.55               |       |
|             | M+F               | 35D-49D  | 0.34               | 0.4                |       |
|             | M+F               | 49D-63D  | 0.28               | 0.42               |       |
|             | M+F               | 63D-98D  | 0.29               | 0.41               |       |
|             | M+F               | 98D-3Y   | 0.33               | 0.39               |       |
|             | M+F               | 3Y-13Y   | 0.35               | 0.45               |       |
|             | M                 | 13Y-19Y  | 0.37               | 0.49               |       |
|             | F                 | 13Y-19Y  | 0.36               | 0.46               |       |
|             | M                 | 19Y-150Y | 0.36               | 0.46               |       |
|             | F                 | 19Y-150Y | 0.36               | 0.46               |       |
| MCV         | M+F               | 0-2D     | 98                 | 118                | fL    |

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| Test      | Sex (Male/Female) | Age       | Lower Normal Range | Upper Normal Range | Units              |
|-----------|-------------------|-----------|--------------------|--------------------|--------------------|
|           | M+F               | 2D-4D     | 95                 | 121                |                    |
|           | M+F               | 4D-8D     | 88                 | 126                |                    |
|           | M+F               | 8D-21D    | 86                 | 124                |                    |
|           | M+F               | 21D-35D   | 85                 | 123                |                    |
|           | M+F               | 35D-63D   | 77                 | 115                |                    |
|           | M+F               | 63D-98D   | 74                 | 118                |                    |
|           | M+F               | 98D-3Y    | 70                 | 86                 |                    |
|           | M+F               | 3Y-6Y     | 75                 | 87                 |                    |
|           | M+F               | 6YRS-13Y  | 77                 | 96                 |                    |
|           | M+F               | 13Y-19Y   | 78                 | 97                 |                    |
|           | M+F               | 19Y-150Y  | 78                 | 97                 |                    |
| MCH       | M+F               | 0-4D      | 31                 | 37                 | pg                 |
|           | M+F               | 4D-35D    | 28                 | 40                 |                    |
|           | M+F               | 35D-63D   | 26                 | 34                 |                    |
|           | M+F               | 63D-98D   | 25                 | 35                 |                    |
|           | M+F               | 98D-3Y    | 23                 | 31                 |                    |
|           | M+F               | 3Y-7Y     | 24                 | 30                 |                    |
|           | M+F               | 7Y-13Y    | 25                 | 33                 |                    |
|           | M+F               | 13Y-19Y   | 25                 | 35                 |                    |
|           | M+F               | 19Y-150Y  | 26                 | 34                 |                    |
| MCHC      | M+F               | 0-1D      | 30                 | 33                 | g/dL               |
|           | M+F               | 1D-2D     | 29                 | 34                 |                    |
|           | M+F               | 2D-14D    | 28                 | 35                 |                    |
|           | M+F               | 14D-56D   | 29                 | 34                 |                    |
|           | M+F               | 56D-2Y    | 30                 | 33                 |                    |
|           | M+F               | 2YRS-150Y | 31.5               | 37                 |                    |
| RDW       | M+F               | 0-10Y     | 11.5               | 15                 | %                  |
|           | M+F               | 10-150Y   | 11.5               | 14.5               |                    |
| Platelets | M+F               | 0-150Y    | 140                | 450                | 10 <sup>9</sup> /L |

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| Test                      | Sex (Male/Female) | Age        | Lower Normal Range | Upper Normal Range | Units               |
|---------------------------|-------------------|------------|--------------------|--------------------|---------------------|
| Absolute Neutrophil Count | M+F               | 0-1D       | 5                  | 13                 | 10 <sup>9</sup> /L  |
|                           | M+F               | 1D-3D      | 1.5                | 7                  |                     |
|                           | M+F               | 3D-2YRS    | 1                  | 8.5                |                     |
|                           | M+F               | 2YRS-6YRS  | 1.5                | 8.5                |                     |
|                           | M+F               | 6YRS-12YRS | 1.5                | 8                  |                     |
|                           | M+F               | 12Y-16Y    | 1.8                | 8                  |                     |
|                           | M+F               | 16Y-150Y   | 2                  | 7                  |                     |
| Abs Lymphocyte Count      | M+F               | 0-1D       | 3.5                | 8.5                | 10 <sup>9</sup> /L  |
|                           | M+F               | 1D-3D      | 2                  | 5                  |                     |
|                           | M+F               | 3D-2Y      | 3                  | 13.5               |                     |
|                           | M+F               | 2Y-6Y      | 2                  | 9.5                |                     |
|                           | M+F               | 6Y-12Y     | 1.5                | 7                  |                     |
|                           | M+F               | 12Y-16Y    | 1.2                | 5                  |                     |
|                           | M+F               | 16-150Y    | 1                  | 3                  |                     |
| Abs Monocyte Count        | M+F               | 0-1D       | 0.5                | 1.5                | 10 <sup>9</sup> /L  |
|                           | M+F               | 1D-3D      | 0.3                | 1.1                |                     |
|                           | M+F               | 3D-6YRS    | 0.3                | 1.5                |                     |
|                           | M+F               | 6Y-16Y     | 0.1                | 0.8                |                     |
|                           | M+F               | 16Y-150Y   | 0.2                | 1                  |                     |
| Absolute Eosinophil Count | M+F               | 0-1D       | 0.1                | 2.5                | 10 <sup>9</sup> /L  |
|                           | M+F               | 1D-3D      | 0.2                | 2                  |                     |
|                           | M+F               | 3D-2YRS    | 0.1                | 0.3                |                     |
|                           | M+F               | 2Y-6Y      | 0.3                | 0.8                |                     |
|                           | M+F               | 6Y-16Y     | 0.1                | 0.8                |                     |
|                           | M+F               | 16Y-150Y   | 0.02               | 0.5                |                     |
| Absolute Basophil Count   | M+F               | 0-150Y     | 0                  | 0.1                | 10 <sup>9</sup> /L  |
| Absolute                  | M+F               | 0-1D       | 324                | 617                | 10 <sup>12</sup> /L |

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| Test               | Sex (Male/Female) | Age      | Lower Normal Range | Upper Normal Range | Units       |
|--------------------|-------------------|----------|--------------------|--------------------|-------------|
| Reticulocyte Count |                   |          |                    |                    |             |
|                    | M+F               | 1d-5d    | 85                 | 400                |             |
|                    | M+F               | 5D-30D   | 34.2               | 724                |             |
|                    | M+F               | 1M-3M    | 21                 | 205                |             |
|                    | M+F               | 3M-12M   | 8                  | 171                |             |
|                    | M+F               | 1Y-3Y    | 56                 | 120                |             |
|                    | M+F               | 3Y-7Y    | 16                 | 121                |             |
|                    | M+F               | 7Y-150Y  | 35                 | 123                |             |
| ESR                | M                 | 0-51Y    | 0                  | 12                 | mm/hr       |
|                    |                   | 51Y-61Y  | 0                  | 14                 |             |
|                    |                   | 61Y-70Y  | 0                  | 17                 |             |
|                    |                   | 70Y-150Y | 0                  | 30                 |             |
|                    | F                 | 0-51Y    | 0                  | 14                 |             |
|                    |                   | 51Y-61Y  | 0                  | 22                 |             |
|                    |                   | 61Y-70Y  | 0                  | 22                 |             |
|                    |                   | 70Y-150Y | 0                  | 35                 |             |
| DDIMER             | M+F               | All      | 0                  | 0.55               | mg/L<br>FEU |
| Fibrinogen         | M+F               | All      | 1.5                | 3.5                | g/L         |
| Factor VIII assay  | M+F               | 0-1D     | 0.22               | 1.78               | iu/mL       |
|                    |                   | 1D-5D    | 0.22               | 1.54               |             |
|                    |                   | 5D-1M    | 0.25               | 1.57               |             |
|                    |                   | 1M-6M    | 0.33               | 1.25               |             |
|                    |                   | 6M-150Y  | 0.50               | 1.50               |             |
| Factor IX assay    | M+F               | 0-5D     | 0.15               | 0.91               | iu/mL       |
|                    |                   | 5D-1M    | 0.21               | 0.81               |             |
|                    |                   | 1M-3M    | 0.21               | 1.13               |             |
|                    |                   | 3M-150Y  | 0.40               | 1.60               |             |
| Factor X assay     | M+F               | 0-1D     | 0.12               | 0.68               | iu/mL       |

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| Test                  | Sex (Male/Female) | Age   | Lower Normal Range | Upper Normal Range | Units |
|-----------------------|-------------------|---|--------------------|--------------------|-------|
|                       |                   | <i>1D-5D</i>  | <b>0.19</b>        | <b>0.79</b>        |       |
|                       |                   | <i>5D -3M</i>   | <b>0.31</b>        | <b>0.87</b>        |       |
|                       |                   | <i>3M -6M</i>   | <b>0.38</b>        | <b>1.18</b>        |       |
|                       |                   | <i>6M-5Y</i>  | <b>0.58</b>        | <b>1.16</b>        |       |
|                       |                   | <i>5Y-150Y</i>  | <b>0.50</b>        | <b>1.50</b>        |       |
| Anti Factor 10a assay | <i>M+F</i>        | Clinical implications of results are dependent on individual patient circumstances. Contact Haematology team for advice on therapeutic ranges |                    |                    | iu/mL |

#### Prothrombin Time/ APTT

Normal Ranges for these assays are dependent on patient anticoagulant status. Ranges may change with variations in reagents in use. Please contact the Haematology laboratory for details of current reference ranges if required.

#### DDimer

Please note quoted reference ranges are not applicable during pregnancy.

Guidelines on the laboratory aspects of assays used in haemostasis and thrombosis:

BJH <https://onlinelibrary.wiley.com/toc/13652141/2020/191/3>

<https://b-s-h.org.uk/guidelines/guidelines/guideline-on-laboratory-aspects-of-assays-used-in-haemostasis-and-thrombosis/>





## Appendix 2: Pregnancy Related Reference Ranges

| Parameter                         | First Trimester  | Second Trimester | Third Trimester* |
|-----------------------------------|------------------|------------------|------------------|
| RBC (x10 <sup>12</sup> /l)        | <b>3.52-4.52</b> | <b>3.20-4.41</b> | <b>3.10-4.44</b> |
| Hb (g/dl)                         | <b>11.0-14.3</b> | <b>10.0-13.7</b> | <b>9.8-13.7</b>  |
| HCT (l/l)                         | <b>0.31-0.41</b> | <b>0.30-0.38</b> | <b>0.28-0.39</b> |
| MCV (fl)                          | <b>81-96</b>     | <b>82-97</b>     | <b>91-99</b>     |
| WBC (x10 <sup>9</sup> /l)         | <b>5.7-13.6</b>  | <b>6.2-14.8</b>  | <b>5.9-16.9</b>  |
| Neutrophils (x10 <sup>9</sup> /l) | <b>3.6-10.1</b>  | <b>3.8-12.3</b>  | <b>3.9-13.1</b>  |
| Lymphocytes (x10 <sup>9</sup> /l) | <b>1.1-3.5</b>   | <b>0.9-3.9</b>   | <b>1.0-3.6</b>   |
| Monocytes (x10 <sup>9</sup> /l)   | <b>0.0-1.0</b>   | <b>0.1-1.1</b>   | <b>0.1-1.1</b>   |
| Eosinophils (x10 <sup>9</sup> /l) | <b>0.0-0.6</b>   | <b>0.0-0.6</b>   | <b>0.0-0.6</b>   |
| Basophils (x10 <sup>9</sup> /l)   | <b>0.0-0.1</b>   | <b>0.0-0.1</b>   | <b>0.0-0.1</b>   |
| Platelets (x10 <sup>9</sup> /l)   | <b>174-391</b>   | <b>171-409</b>   | <b>155-429</b>   |

\* Third trimester reference range is applicable for 6 weeks post delivery

Source of Ranges: Blood Cells. A Practical Guide. Barbara J. Bain; 4th Edition

## Appendix 3: WBC in Africans and Caribbeans of African Lineage

| Origin    | Male    |         | Female   |         |
|-----------|---------|---------|----------|---------|
|           | WBC     | Neut    | WBC      | Neut    |
| African   | 2.8-7.2 | 0.9-4.2 | 3.0-7.4  | 1.3-3.7 |
| Caribbean | 3.1-9.4 | 1.2-5.6 | 3.2-10.6 | 1.3-7.1 |

Source of Ranges: Blood Cells. A Practical Guide. Barbara J. Bain; 4th Edition