Medical Microbiology

Laboratory User Handbook

Version number 10

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Issued on 04/10/2022

Version Number	Change Details	Date
9.2	Updated references to Viapath	04/10/2022
9.2	Indicated Amphotericin B TDM monitoring is not performed	04/10/2022
9.2	Indicated that Teicoplanin & azoles are processed by Toxicology not sent to Southmead	04/10/2022
9.2	Updated Infection Sciences Laboratory Director Details	04/10/2022
9.2	Updated Service Delivery Manager Details	04/10/2022

Contents

1. General Information

This user manual outlines the Medical Microbiology service provided by Synnovis Analytics LLP at the Denmark Hill site of the King's College Hospital NHS Foundation Trust. The Infection Sciences department includes the Medical Microbiology service and Virology service. The information provided in this user manual includes specimen requirements, instructions for collection of specimens, and reference values or interpretative data where relevant for Microbiology. Please refer to the Virology User Manual for information relating to Virology. The Microbiology department provides an extensive consultant-led, customer focussed clinical microbiology service and specialist advice in microbiology, virology, parasitology and mycology to hospitals and General Practitioners.

Synnovis Group LLP is a joint venture between Guy's and St. Thomas' NHS Foundation Trust, Kings College Hospital NHS Foundation Trust and SYNLAB. Synnovis Group LLP is a provider of Pathology services. Synnovis Analytics and Synnovis Services sit within the Synnovis Group: The Department of infection sciences sits within Synnovis Analytics LLP. Please see for further information http://www.Synnovis.co.uk

Commitment to Quality

The Synnovis management system supports the business vision to be the leading Pathology provider of high quality, cost effective pathology services. The Infection Sciences, Microbiology Department, is a UKAS accredited medical laboratory No. 9863. The Microbiology test repertoire No. 9863 is stated on the Schedule of Accreditation, please see https://www.ukas.com/find-an-organisation/ and enter 9863 in the Search accreditation organisation field to retrieve the department's schedule of accreditation

A statement of Purpose constitutes the Quality policy for Synnovis Group LLP and is applicable to both Synnovis Analytics and Synnovis Services. Synnovis is an independent pathology provider registered with the Care Quality omission. The quality policy can be found at http://www.Synnovis.co.uk

Synnovis continually monitors it activity (Microbiology receives approximately 350,000 samples annually), annually reviews this policy. Services complete an Annual Management Review (AMR) to ensure quality objectives are monitored locally and changes or new systems are implemented effectively. Satisfaction of service users is seen as a key indicator of success in improvement of services.

Key performance and quality indicators are used to enhance operational performance and remove variation from laboratory processes. Internal quality control (IQC) and assurance with External Quality Assurance (EQA) is used as part of the overall assurance mechanism along with clinical and internal audit to monitor adequacy of operating procedures and effectiveness of the quality systems. We recognise the confidentiality of information we hold on patients, donors and clients and allow

accreditation and regulatory bodies appropriate access to knowledge systems maintained to provide third party assurance to Synnovis and our stakeholders.

Data Protection

The laboratory complies with the requirements of the General Data Protection Regulation (GDPR) 2018, the Data Protection Act 1998, the Caldicott principles on safeguarding patient confidentiality and patient information, and with guidance from the Royal College of Pathologists. All patient identifiable information is regarded as confidential and is passed on only for official purposes e.g. to professionals with responsibility for patient care or public health. Confidential data is held only as long as necessary for operational purposes, and is stored securely.

1.1 Location

The Medical Microbiology laboratory covering bacteriology, mycology and parasitology is located on the third floor of the Cheyne (Synnovis Pathology) wing at King's College Hospital. The laboratory can only be accessed via security swipe cards, but during core hours, personnel can access Microbiology on the 3rd floor Cheyne wing by pressing a buzzer directly reporting to laboratory staff. Microbiology specimen reception is located on the 2nd floor of the Cheyne (Synnovis Pathology) wing at King's College Hospital.

King's College Hospital Map

Postal address

Synnovis Analytics LLP Department of Medical Microbiology King's College Hospital NHS Foundation Trust Cheyne Wing, 3rd Floor Denmark Hill London SE5 9RS	Hays DX address: South London (PHL) Kings DX 6570200 Peckham 90SE

1.2 Key Personnel and Contact Details

Hospital switchboard: 020 3299 9000

Results enquiries: 0203 299 3567 / 4354 General enquiries: 0203 299 3565

Telephone Number 020 3299 + extension		
Designation	**Name**	**Extension**
Clinical Lead for Infection Sciences and Consultant Microbiologist	Dr Carmel Curtis	32709
Consultant Microbiologist and SYNLAB Strategic Clinical Lead	Dr Silke Schelenz	34361
Consultant Microbiologist (Bacteriology and ICU Lead)	Dr Carmel Curtis	32709
Consultant Microbiologist	Dr Hector Maxwell Scott	35826
Consultant Microbiologist (Hepatology)	Dr Anita Verma	34364
Consultant Microbiologist (TB Lead)	Dr Mauricio Arias	33766
Consultant Microbiologist (PRUH)	Dr Mustafa Atta	64280
Consultant Microbiologist (PRUH)	Dr Sumati Srivastava	64325
Consultant Microbiologist (PRUH)	Glynis Double	64323
Service Delivery Manager	Diana Bate	37777
Infection Sciences Quality Manager	Lucy Chiri	36140
Microbiology Operations Manager	Katy Stocker	33442
Director of Infection Prevention & Control across all Kings sites	Ashley Flores	38173
Microbiology Clinical Advice	**Specialist Registrar (SpR)**	**34360**

2. Use of the Laboratory

2.1 Core Laboratory Opening Times

Routine specimens are accepted in the Microbiology laboratory during the following hours:

Mon-Fri	Saturday
09:00 – 17:00	09:00 – 12:00 09:00 – 10:30 (specimens)

Saturdays, the Microbiology laboratory is open in the morning for essential work only with limited staff. Please be patient when contacting the laboratory as staff may be busy dealing with emergencies or liaising with clinical teams. All specimens should reach the laboratory by 10.30am. Sunday and Bank Holidays are classed as out of hours. An on-call out of hours system is in operation at all other times (see section 2.2).

Urgent specimens during normal laboratory hours please telephone urgent requests direct to the laboratory to ensure priority processing. Either bring the specimen to the Microbiology laboratory specimen reception yourself, or arrange urgent transport via porters. Staff delivering critical or unrepeatable specimens to the laboratory will be asked to sign them in. All preliminary or final results deemed clinically significant are phoned to the requesting clinician; completed results, once authorised, are available on the EPR system. Please ensure you provide a contact number to Microbiology staff when delivering urgent samples.

2.2 Out of hours On-call Service

The on-call Biomedical Scientist (BMS) is available on bleep 272 through the hospital switchboard during the times below:

Mon-Fri	Sat - Sun	Sun - Mon	Bank Holidays
17:00 – 09:00	12:00 – 09:00	09:00 – 09:00	09:00 – 09:00

Specimens will only be processed outside normal laboratory hours if agreed criteria are satisfied and the on-call BMS has been consulted. Out-of-hours specimens should be left at the entrance to the Microbiology laboratory in the fridge except for blood cultures; these should be placed in the red box on top of the fridge. **It is essential to contact on-call BMS to inform them of the urgent specimen once they have been delivered to the department**. The on-call BMS may not be on-site and MUST always be contacted before urgent work is sent to the laboratory. Out of hours blood cultures must be brought up to the 3rd floor Cheyne wing and dropped off in the basket on top of the specimen fridge outside of Microbiology to ensure prompt loading onto the analyser. Urgent Gram stains are not performed on blood cultures (until growth is detected automatically); therefore there is no need to alert the on-call BMS.

Appropriate specimens for urgent examination on-call include:

- Cerebrospinal fluid (CSF)
- Aspirates and fluids from normally sterile sites
- Peri-operative specimens such as biopsies or pus including drainage of empyema

- Urine microscopy in children where it may influence the decision for acute abdominal surgery

All preliminary or final urgent results deemed clinically significant are phoned by the medical team to the requesting clinician; completed results, once authorised, are available on the EPR system. Specialist registrars on-call may be contacted via switchboard if clinical advice is required.

2.4 Requesting Investigations

All hospital requests should be made electronically using the EPR system. However, if a request is made manually then the following should be adhered to as detailed below.

2.4.1 Request Form

A request form MUST accompany all specimens sent to the laboratory for a manual request. If a pre-printed label, please ensure that a label is also placed on all copies of the request form. It is essential that specimens are correctly identified otherwise:

- A patient may receive the wrong treatment
- A patient may not receive the treatment that they require.

If request forms are being hand written please ensure that they are legible. At least three patient identifiers are required on both sample and request form for sample acceptance. A correctly completed request form MUST state to unequivocal identification of the patient and specimen:

- **Patient name (surname and forename)**
- **Date of Birth**
- **Hospital number or NHS number (if known)**
- **Specimen type** – e.g. specify anatomical site which a 'wound' specimen was taken
- **Date and time the sample was collected** (this is essential as processing delayed specimens can yield unhelpful or frankly misleading results and they may be discarded such as a urine sample dated 2 days prior to day of receipt). When patients are given a request form and asked to provide a specimen, they should be asked to ensure that the date on which the specimen was collected is given on the container and the form
- **Name of Consultant or GP caring for the patient with bleep or contact number** (important for on-call requests)
- **Location of patient to send the reports**
- **Examination/tests required** (specify 'TB' if appropriate)
- **All relevant clinical details/symptoms** (including date of onset if known)
- **History of foreign travel** (including return dates)
- **Any antimicrobial treatment** (recent, current or intended, date and time of last dose)
- **Risk status if applicable - if the clinical presentation or travel history suggest that a specimen may pose a potential risk to ward staff or**

laboratory staff – e.g. brucellosis, typhoid, viral haemorrhagic fever - then discuss the patient with the on-call Microbiologist or Virologist

- **The identity of the individual collecting the sample**

If uncertain about the exact test and terminology, please give a detailed clinical history as this can help the medical staff to decide the most appropriate investigations or alternatively contact the Microbiology laboratory for advice. If request forms are not correctly and legibly completed then the laboratory reserves the right to cancel requests for the safety of patients.

2.4.2 Specimen Labelling

The person collecting the specimen is responsible for positively identifying the patient and obtaining consent. Specimen tubes must be labelled as soon as the samples are collected and before leaving the patient. The specimen must be labelled with the patient details as on the request form and hazard label if appropriate. Labelling must be clear and legible. The specimen must be labelled with the date of collection. Unlabelled or mis-labelled specimens cannot be accepted, for the safety of patients and for the medico-legal protection of hospital staff.

If EPR barcode stickers are used, please try to ensure that the sticker is placed on the specimen container in such an orientation that it can be read by a bar code reader. i.e. not wrapped around a specimen tube vertically. It is recommended that one specimen is submitted for one EPR request for Microbiology. However, if this is not possible and one specimen is submitted with more than one EPR request, we ask the requestor to mention this in the clinical details which will highlight this on specimen receipt and booking.

2.4.3 Requesting Additional Tests

The microbiological value of specimens - especially those from non-sterile sites - usually deteriorates with time as significant bacteria may die-off, or be overgrown by clinically insignificant contaminants. Generally, requests for additional tests on a specimen should be made to the laboratory on the day the specimen is submitted. Although most specimens are kept for approximately 48 hours, for easily collected material (e.g. urine, superficial swab) it is better to send a fresh specimen and request the additional investigation(s). However, sterile fluids and tissues are kept for longer. Additional investigations on these specimens (if sufficient volume) may be warranted and clinically helpful: additional tests should be discussed with the Microbiology SpR or Consultant Microbiologist.

2.4.4 Specimen Collection

The best results are obtained when an appropriate, well-taken specimen in the proper container, is delivered to the laboratory promptly and relevant clinical information provided on the request form. Waste generated as a result of sample collection must be disposed of in accordance with local waste management policies.

General guidelines on specimen collection are:

- Do not send specimens in non-sterile containers. A leak proof CE marked specimen container should be used. Lids must be firmly affixed to prevent leakage
- Collect specimens from the actual site of suspected infection. Please do not send blood samples with very general requests such as ‘viral serology’ when the best sample may be vesicular fluid, throat swab or CSF

- The specimen taken should be representative of the disease process. For example, material swabbed from the opening of a sinus tract is more likely to yield commensal skin micro-organisms than would material obtained by curettage or biopsy of the base of the tract
- Specimens should be obtained before antimicrobial agents have been administered wherever possible
- An adequate quantity of material should be obtained for complete examination. Always send pus rather than a swab of pus, and if possible, a minimum volume of 1mL
- Swabs should always be in transport medium rather than dry
- Care must be taken to avoid contamination of the specimen by micro-organisms normally found on the skin and mucus membranes. Sterile equipment and aseptic technique must be used for collecting specimens, particularly for those from normally sterile sites
- Material must be transported promptly to the laboratory. Fastidious organisms may not survive prolonged storage or may be overgrown by less fastidious organisms before culturing
- Other factors affecting results (bacterial serology and PCR)
    - inherent (age, gender, nutritional status, pregnancy, congenital immunological defects)
    - acquired (passively acquired antibody, immune response to immunisation, immunosuppression)
    - biological (lipaemic, haemolysed, high bilirubin content e.g. Liver ITU patients)
    - collection (use of correct blood collection tubes – e.g. serum from clotted blood may underestimate HIV-1 RNA load when compared to EDTA plasma)
    - Sample volume, collection and transportation

Please contact the laboratory if there is any doubt about the best specimen to take or if you have questions about the availability of a test.

2.4.5 Specimen Containers

Leaking specimens, or those received in inappropriate containers, may not be processed (although the laboratory will try to recover leaking unrepeatable samples).

The following are the usual containers used to collect specimens. These are ordered by clinical areas:

- BacT/ALERT Blood culture bottles: keep bottles of a set together and return any unused bottles. Ensure the stock is used in turn and always within its expiry date. Please do not detach the barcode labels on the bottles or cover the barcodes with the EPR sticker.
- Dermapaks for superficial fungal specimens (skin scrapings, hair *etc*)
- Faeces pots
- Sputum pots - 60ml wide mouth plastic container
- Swabs with bacteriological Amies transport medium with/without charcoal
- Dry swabs are not recommended for bacterial recovery, a transport medium is optimal
- Universal containers (sterile and empty); these must be Sterilin containers.

- Gold topped serum separator blood tubes, red top blood tubes and green topped lithium heparin blood tubes.

The laboratory holds a small stock of pernasal swabs for whooping cough.

2.4.6 High Risk Specimens

Separate procedures are used in the laboratory for the safe handling and examination of samples from patients **known, or suspected** to have infection caused by high risk pathogens that pose a risk to laboratory workers and others if handed incorrectly. It is the responsibility of the person taking such a specimen to ensure request forms and specimens are labelled to indicated danger of infection. The request form must give sufficient clinical information to enable experienced laboratory staff to know what special precautions are necessary. These specimens must be placed in a Biohazard specimen bag. The requestor must alert a Specialist Registrar in Microbiology they are sending a high risk specimen to including the following pathogens (please note this list is not exhaustive):

- *Brucella* species
- *Salmonella typhi* and *paratyphi*
- *Mycobacterium tuberculosis*
- Creutzfeldt-Jakob disease (CJD)
- Causative agents of Anthrax, Rabies, Yellow fever, plague.

For pyrexial patients presenting within 3 weeks of arriving from a viral haemorrhagic fever endemic region, malaria should be excluded as *per* policy and then the case discussed with a Consultant Virologist (*via* King's switchboard out-of-hours) before submitting any further samples to any laboratory or admitting the patient.

Samples known or suspected to contain biological agents in Hazard Group 4 **MUST NOT** be sent to the laboratory without discussion with, and the permission of the Consultant Microbiologist. These include the causative agents of Viral Haemorrhagic Fevers (Lassa fever, Ebola, Marburg).

2.5 Transport to the Laboratory

2.5.1 General Health & Safety Requirements

Please note:

- Specimens must only be submitted to the laboratory in approved containers
- Needles and other sharps must never be sent to the laboratory
- The outside of containers must be free from contamination by potentially infectious material

Each specimen container should be sent in a sealed plastic specimen bag

- Each specimen container should be sent in a sealed plastic specimen bag
- If a request form is sent with the specimen, it should be kept in a separate from the specimen within the specimen bag
- See section 2.5.2 for details of the air tube system at King's

2.5.2 Pneumatic Air Tube Transport System (PATTS)

The King's NHS Trust policy for use of the PATTS can be viewed on the Kings Intranet [available at http://kweb/kwiki/Air_tube_system]; instructions are available at each station.

The following 'microbiology' specimens must **not** be sent via the air tube:

- any respiratory tract specimen (sputum, pleural fluid, bronchoalveolar lavage, aspirates *etc*)
- any specimen sent for mycobacterial (TB) culture
- any specimen from patients know to have, or thought to have:
  - transmissible spongiform encephalopathy (CJD, GSS *etc*)
  - a viral haemorrhagic fever (eg Lassa, Ebola *etc*)
  - typhoid
- any unrepeatable specimen of any type
- blood culture sets

2.5.3 Receipt of Specimens

During normal working hours, specimens are to be delivered to Synnovis Pathology Central Specimen Reception on the ground floor of Bessemer Wing or Microbiology specimen reception on the 2nd floor of Cheyne Wing. Staff delivering critical / unrepeatable specimens directly to the Microbiology laboratory will be asked to sign them in: the date and time will be recorded and the entry countersigned. Specimens that require urgent processing should be discussed with the duty Specialist Registrar. Most specimens for bacterial culture must be processed within 48 hours of being taken. However, urgent or critical samples must be processed without delay.

2.5.4 Courier and Postal Deliveries

When sending samples from an external laboratory, it is the responsibility of the requesting laboratory to ensure that the samples are packed in accordance with the current postal regulations, contain appropriate paperwork and are labelled correctly (sender and recipient). Samples transported by road are classified as dangerous good and must be packaged and labelled in accordance with the Health & Safety Executive guidance - Carriage of Dangerous Good regulations.

2.6 Reporting of Results

2.6.1 Telephoned Results

Results of urgent requests - and results where the clinical information suggests that they may immediately impact on patient management - will be telephoned to the requesting doctor or, in some cases, to the senior ward or clinic nurse. Results of public health epidemiological importance are telephoned whenever possible

Significant results include:

- Positive blood cultures
- All sterile fluids / tissues if cell count raised (for fluids) and/or organisms seen on Gram stain
- All significant growth from sterile fluids / tissues / deep abscesses

- All growth from sterile products e.g. stem cell harvests; islet cells, hepatocytes or explanted prosthetic material; also positive Gram stain of islet cell or hepatocyte preparations
- Any positive corneal scrape or vitreous Gram
- Group A streptococci from sites other than throats
- Group B streptococci in pregnant women or neonates
- *N. gonorrhoeae* except those from GUM, RSH, Caldecott Clinic *etc*
- First isolates of Infection Control 'alert organisms'
    - MRSA
    - Glycopeptide-resistant enterococci (GRE)
    - Potential or proven carbapenemase-producing Gram-negatives
    - ESBLs / Gentamicin-resistant *Klebsiella* species / Meropenem-resistant *Acinetobacter* species
    - Group A streptococci from sites other than throats
    - *Listeria* species
    - New *C. difficile* toxin positives
    - All new Zn or culture positive specimens for *Mycobacterium* species
    - New *Salmonella* species (NB: *S. typhi** and *S. paratyphi* *)
    - New *Shigella* species (NB: *S. dysenteriae**)
    - New *Campylobacter* species
    - New *E. coli* 0157*
    - *Vibrio* species*/*Plesiomonas* species / *Aeromonas* species
    - *Neisseria meningitidis** / *Haemophilus influenzae* type b*
    - *Brucella* species
    - *Legionella* species* (including urinary antigen positive)
    - New presumptive *B. cepacia* in CF patients
    - *Cryptosporidium* species
    - New positive cryptococcal antigen from serum or CSF
    - Dimorphic fungi
    - Rarities: *B. anthracis* / *C. diphtheriae* / *Burkholderia pseudomallei etc**

***Notifiable: inform PHE Health Protection Unit as well**

2.6.2 Printed Reports

All significant results are authorised by the Microbiology clinical team and then released for printing. Reports for Primary Care are printed and dispatched every working day, Monday to Friday. Written reports are not produced for specimen requests made through the King's EPR system. Apart from negative urines, which can be reported after one working day, most Microbiology culture results are reported after 2-5 days, depending on the investigation. Copies of printed reports can be obtained upon request. Reports are never faxed.

2.6.3 Electronic Reports

Access to completed Microbiology results are available via the EPR system. Please look on the EPR system before telephoning the department for results.

3. Clinical Advice

A Medical Microbiologist is available from 9:00 to 17:00, Monday to Friday on extension 34360. Advice on prophylaxis, treatment of infections and therapeutic monitoring of antimicrobials - is available on KingsWeb Intranet, the Antimicrobial Pocket Guide and the British National Formulary.

Demand for advice is very high, so please ensure that calls are clinically necessary, that the case/query has been discussed with a senior medical team member (preferably the Consultant in charge), and that all relevant clinical information is to hand before calling the SpR or Consultant Microbiologist. During the day, infection control advice can be obtained from the Infection Control Nurses.

Out of hours (17.00 – 09.00 weekdays and at weekends), a duty Specialist Registrar in Microbiology and duty Consultant Medical Microbiologist are available *via* KCH switchboard to discuss clinical, diagnostic and therapeutic problems with doctors at any time. Out-of-hours calls should be made to the on-call SpR, where there is a pressing need for urgent clinical advice, we would expect these calls to be made by a doctor of seniority (StR and above).

Trust clinical guidelines for Denmark Hill and Orpington can be found on the King's Intranet [available from http://kweb/kwiki/King%27s_Local_Clinical_Guidelines]

Infection resources such as Antibiotic guidelines and stewardship can be found on the King's Intranet [available from http://kweb/kwiki/Infection_Resources]

The free antimicrobial App called 'Infections' available for Apple and Android devices from www.ubqo.com/infections (password for contacts is 'infection').

4. Tests Offered by Microbiology

The Medical Microbiology service offers an extensive range of tests. If tests are required that do not appear on the following list, please contact the laboratory.

- Antibiotics assays
- Blood culture
- Beta-D-glucan serology
- CSF examination
- Cryptococcal antigen detection
- Samples from normally sterile sites

- Eye, ear, throat and oral infections
- Fungal infections
- Lower respiratory tract infections
- Mycobacterial investigation
- Genital tract infections
- Faeces culture
- *C. difficile* detection in faeces
- Investigation of ova, cysts and parasites in faeces
- Helicobacter pylori stool antigen testing
- Urine microscopy and culture
- Wound infections
- Screening samples (MRSA, VRE, CPE, *Candida auris*)
- Antimicrobial susceptibility testing

5. Specimen Collection Methods

5.1 Antimicrobial Assays

Under certain circumstances it may be desirable to measure the levels of other antimicrobial agents such as streptomycin (e.g. TB), trimethoprim (e.g. renal failure), chloramphenicol (neonates), teicoplanin (prolonged therapy of serious, deep or complicated infections), Daptomycin, colistin, and certain antifungals (eg flucytosine, itraconazole, voriconazole, posaconazole and Isavuconazole).

Antimicrobial assays for aminoglycosides and vancomycin are performed in the Blood Sciences Laboratory, (BSL) at King's College Hospital not in Microbiology. Itraconazole, voriconazole , posaconazole and Teicoplanin are performed in Toxicology Laboratory at King's College Hospital.

Antimicrobial assays are run on 5mL-10mL clotted blood samples – red or yellow top. Please ensure that the dosage, frequency and timing of samples are stated on the request form. These samples are referred to Antimicrobial Reference Laboratory, Southmead Hospital for testing.

Antibiotic	Timing of Samples	Expected Levels (mg/L)	Re-Assay Interval
Colistin	Approx. 1-2mL of separated serum (the minimum acceptable is 100µL) We recommend a pre dose sample only, taken up to an hour before dosing. Post dose samples will not be processed due to interpretation of the result potentially being misleading.	Pre dose: 2 – 4 mg/L	Day 2-3 (if patient received a loading dose) 5-7 days
Chloramphenicol	Approx. 1-2mL of separated serum (the minimum acceptable is 100µL). We recommend a pre dose sample and a post dose sample, taken 2 hours after the end of either IV administration or	Pre dose <10 mg/L Post dose (2h) 10-25 mg/L	5-7 days – assuming initial results are within

	oral administration. Chloramphenicol is degraded by light; please ensure the samples are protected from direct sunlight.		expected range
Daptomycin	Approx. 1-2mL of separated serum (the minimum acceptable is 100µL). We recommend a pre dose samples and a post dose sample, taken 1 hour after the end of the IV administration.	Pre dose 5-20 mg/L or in severe sepsis 10-20 mg/L Pre dose levels >20 mg/L are associated with increased risk of toxicity	6-8 days – assuming initial results are within expected range
Rifampicin	We recommend a pre dose sample and a post dose sample taken 1 hour after iv administration or three post dose samples, taken 1 hour, 2 hours and 4 hours after oral administration.	Pre <0.5 mg/L Post <4 mg/L sub-therapeutic Post 4-8 mg/L usually adequate Post 8-24 mg/L ideal	Depending on levels and patient progression
Streptomycin	We recommend a pre dose sample and a post dose sample, taken 1 hour after the end of IV/IM administration.	7.5 mg/kg BD Pre dose <3.0 mg/L Post dose 10-25 mg/L	7–28 days
Trimethoprim in Co-trimoxazole	We recommend a pre dose sample and a post dose sample, taken either 1 hour after the end of iv administration or 2 hours after oral administration.	Pre dose 5-7 mg/L Post dose 5-10 but <20 mg/L	6-8 days
Flucytosine*	We recommend pre dose sample and a post dose sample, taken 1 hour after the end of IV administration.	Pre dose 20-50 mg/L Post dose 50-100mg/L Pre dose concentrations <20 mg/L have been associated with treatment failure and emergence of resistance Post dose concentrations >100 mg/L have been associated with toxicity	4-8 days

Voriconazole*	We recommend a pre dose sample taken immediately before administration	Prophylaxis and therapy – Pre dose 1.0-5.5mg/L or 2.0-5.5 mg/L for bulky or disseminated infections.	4-8 days
Itraconazole*	We recommend a pre dose sample only, taken up to an hour before dosing.	By Chromatographic assay. Prophylaxis:Pre 0.5-4.0mg/L. Therapy: Pre 1.0-4.0mg/L. All pre dose levels to be kept below 4.0mg/L.	4-8 days

*for therapeutic drug monitoring of other anti-fungals please discuss with mycologist. Amphotericin B TDM monitoring not performed.

5.2 Blood Cultures

An adult blood culture set consists of two BacT/ALERT SA & SN bottles and a paediatric blood culture consists of one BacT/ALERT PF bottle. . Trust guidelines for collection of blood cultures is available on the King's intranet [available from http://kweb/kwiki/Infection_Control_Policies,_Protocols_and_Guidance].

Bottle Type			**Blood Volume**
Adult Blood Culture	BacT/ALERT SA 	Part of adult blood culture set for standard aerobic culture. This can be used for sterile fluids such as ascitic fluid. Blue top	Maximum volume of 10mL
	BacT/ALERT SN 	Part of adult blood culture set for standard anaerobic culture. This can be used for sterile fluids such as ascitic fluid. Red top	Maximum volume of 10mL
Paediatric Blood Culture	BacT/ALERT PF 	Paediatric blood culture bottle Yellow top	Maximum volume of 4mL

Ensure bottles are used within expiry dates and ensure no obvious signs of damage or contamination (bottom of bottle would appear yellow). Flip the plastic caps and disinfect the top of the bottles. See Appendix 1 for the recommendations for blood culture collection. For adult bottles inoculate with up to 10mLs of blood per bottle; smaller volumes may reduce sensitivity. Inoculate paediatric bottles with up to 4mLs of blood per bottle. Dispose of any sharps in a sharp's container through the correct waste stream. Ensure additional labels DO NOT cover the bottle barcodes and ensure that the tear-off barcode labels are not removed as these are scanned in the laboratory.

During normal laboratory opening hours, bottles should be transported to the laboratory for incubation as soon as possible. Out of normal hours, the bottles should be placed in the red box on top of the fridge located outside the Microbiology laboratory. It is not necessary to contact the on-call BMS for blood cultures taken out-of-hours.

5.3 Cerebro-spinal fluid (CSF)

CSF is always treated as an urgent sample; the laboratory must always be informed when a CSF samples is being sent out-of-hours.

Transfer 1mL of CSF into each three sequentially numbered, sterile universal containers labelled '1', '2' and '3' (1mL is about 20 drops) and approximately 0.2mL into a fluoride oxolate bottle for glucose estimation. Smaller volumes will be accepted however it may not be possible to perform additional tests e.g. viral PCR. The minimum for protein estimation (tube 2 is used) is 0.2mL approximately4 drops). For investigation of tuberculous meningitis, a large volume (>6mL) should be collected as small numbers of organisms may be present.

CSF samples should be sent to Blood sciences Laboratory:

- Universal no. 2 for xanthochromia
- Fluoride oxalate bottle for glucose and protein estimation.

Any positive results of microscopy, Gram stain and any positive cultures are always telephoned but should be available on EPR.

In suspected meningitis please send in addition:

- Whole blood in an EDTA for meningococcus and pneumococcus PCR
- Blood culture set
- Urine for pneumococcal antigen test
- Throat swab culture and sensitivity

If suspected viral meningitis/encephalitis send CSF for Varicella zoster virus (VZV), Herpes simplex virus (HSV) and Enteroviruses (at least 1 mL).

If suspected subarachnoid haemorrhage (SAH) and the specimen is blood stained, the 1st and 3rd samples. Always inform the laboratory that SAH is a possibility by providing the differential diagnoses in the clinical information.

CSFs from patients thought to have an non-infective aetiology (e.g. degenerative diseases) are not processed out-of-hours from the Programmed Investigation Unit.

5.4 Cryptococcal Antigen Detection

CSF

A minimum of 0.5mL is required in a sterile universal.

Serum

Collect 5-10mL of blood in a blood collection tube usually red topped or yellow topped (serum separator) tubes.

Aspirates and Fluids from Sterile Sites

Fluids from normally sterile sites such as ascitic fluid, peritoneal fluid or joint fluids require a minimum volume of 1mL. Collect the specimen with a sterile syringe. Large volumes specimens such as peritoneal fluid may contain very low numbers of organisms which require concentration in order to increase the likelihood of successful culture. Transfer a maximum of 20mL into a sterile container. Ensure the cap is tightly screwed on. Ascitic fluids may also be inoculated in to a blood culture set (but a sample in a sterile container is required for microscopy). Small volume fluids such as synovial fluids may be received in insufficient volumes. This may impede the recovery of organisms.

Peritoneal dialysis fluid

Using a fine needle and syringe, aspirate fluid from the peritoneal dialysis bag. Transfer 20mL into a sterile universal container. A blood culture set may also be inoculated but a sterile container is required for microscopy.

5.5 Eye, Ear, Throat and Oral Infections

Eye Swabs

A swab should be gently rotated against the conjunctiva in the lower eye lid and placed in Amies transport medium. Any visible pus should be sampled. Swabs should be placed in the plastic transport sheath containing Amies transport medium.. Examination for Chlamydia trachomatis and viruses is carried out by Virology; please see Virology Laboratory User's Manual.

Corneal Scrapes

These samples should be collected by an Ophthalmic surgeon. Agar plates (chocolate, blood agar, fastidious anaerobic and Sabouraud) and a microscope slide are supplied by the Microbiology laboratory when required to inoculate at the patient's side. The agar plates should be inoculated first; if there is sufficient material then prepare slides. A separate set of plates should be used for each eye. Material should be spread from the scalpel blade directly onto the surface of the plates using short streaks. Spread material directly onto the surface of the labelled glass slide. Culture plates and microscope slides should be sent back to the laboratory promptly. All plates and slides should be labelled with patient details and the date. The slide should be labelled on the side it is inoculated.

Acanthamoeba Culture

Corneal scrapings should be collected into a small volume (1-2mL) of sterile water or saline. These vials should be labelled with the patients details and transported promptly to the laboratory. Contact lens washing fluid or lenses in contact lens fluid sent in sterile containers will also be accepted.

Ear Swabs

A swab or fine wire swab with a small bud may be used. Insert the swab into the outer ear and gently rotate. Place the swab in the plastic transport sheath containing Amies transport medium.

Nasal Swab – Anterior Nares
Nasal swabs are usually taken to detect staphylococcal or meningococcal carriage. Moisten the swab before swabbing with sterile saline. Swab the anterior nares by gently rotating the swab in each nostril. Place the swab in the plastic transport sheath containing Amies transport medium.

Pernasal Swabs
Pernasal swabs should be used for the investigation of whooping cough (*Bordetella pertussis*). Pass the swab along the floor of the nasal cavity to the posterior wall of the nasopharynx and gently rotate the swab. Taking these samples in patients with whooping cough may precipitate a paroxysm of coughing and cause obstruction of the airways. Resuscitation equipment must be available if whooping cough is suspected. The specimen collector should avoid direct coughs from the patient.
Note a rapid diagnostic test (Biofire Film Array) is available for the rapid diagnosis of whooping cough in neonates in whom there is a strong suspicion. This test can only be requested by contacting the Consultant Microbiologist. A naso-pharyngeal swab should be taken using universal viral transport medium after consultation.

Throat Swabs
Throat swabs are cultured for Haemolytic Streptococci and *Corynebacterium diphtheriae* (if clinically indicated). The patient's tongue should be depressed using a spatula, before quickly and gently rubbing the swab over the tonsillar fossa and/or posterior pharynx or any region with a lesion of visible exudates. Touching other areas of the mouth such as the tongue and uvula should be avoided. Throat swabs should not be taken if the epiglottis is inflamed as sampling may cause serious respiratory obstruction. Swabs should be placed in the plastic transport sheath containing Amies transport medium.

Mouth Swabs
Sample pus if present otherwise sample any lesions or inflamed areas. A tongue depressor or spatula may be helpful to aid vision and avoid contamination from other parts of the mouth. Place the swab in the plastic transport sheath containing Amies transport medium.

5.6 Fungal Infections

Skin Scrapings
Patients' skin and nails can be swabbed with 70% alcohol prior to collection of the specimen, this is especially important if creams, lotions or powders have been applied. The edges of skin lesions yield the greatest quantities of viable fungus. Lesions should be scraped with a blunt scalpel blade. Send material to the laboratory in a Dermapak, if these are unavailable, place sample into a sterile universal. At least 5mm^2 of skin scrapings are required.

Nail clippings
Material should be taken from any discoloured, dystrophic or brittle parts of the nail. The affected nail should be cut as far back as possible through the entire thickness and should include any crumbly material. Nail drills, scalpels and nail elevators may be helpful but must be sterilized between patients. It should be specified whether the sample is from the fingernails or toenails.

When there is superficial involvement (as in white superficial onychomycosis), nail scrapings may be taken with a curette. If associated skin lesions are present samples from

these are likely to be infected with the same organism and are more likely to give a positive culture. Sample from associated sites should be sent in separate Dermapaks.

Hairs
Hairs should be plucked never cut from affected areas to include scalp scales and hair stumps. Skin scrapings from associated scalp lesions should also be sent with the hairs in a Dermapak.

Please do not refrigerate the above samples for mycological investigation.

Laboratory tests for the diagnosis of invasive fungal infections can be discussed with the consultant microbiologist lead for mycology.

5.7 Lower Respiratory Tract Infections

Antral Washings
Ideally an ENT surgeon should collect the specimen. Transfer to a sterile universal container. Ensure the cap is tightly screwed on.

Broncho-Alveolar Lavage (BAL) Samples
A segment of lung should be 'washed' with sterile saline after insertion of a flexible bronchoscope. As large a volume as possible should be collected. After collection remove the cap and the tubing of the sterile suction container and apply the screw cap to the container. BAL samples will be cultured for routine pathogens, *Mycobacterium tuberculosis* and fungi.

Sputum
Sputum samples should contain material from the lower respiratory tract, expectorated by deep coughing. When the cough is dry, physiotherapy, postural drainage or inhalation of an aerosol before expectoration may be helpful. Saliva and pernasal secretions are not suitable and will not be processed. A minimum of 1mL should be collected into a sterile universal container. Do not collect shortly after the patient has been eating, drinking or cleaning their teeth.

5.8 Mycobacterial Investigations

Sputum
Early morning freshly expectorated sputum is recommended for *Mycobacterium* species. Sputum specimens should be relatively fresh (less than 1 day old) to minimise contamination. Purulent specimens are best. When the cough is dry, physiotherapy, postural drainage or inhalation of an aerosol before expectoration may be helpful. Three samples of ≥ 5mL should be collected on at least 3 consecutive days approximately 8-24 hours apart. Samples should be sent to the laboratory with 48 hours. Urgent Auramine Phenol for Acid Fast Bacilli (AFB) is available during normal working hours.

BAL Samples
These may be sent if spontaneous or induced sputum is unavailable or if such specimens are AFB smear negative. Note: Contamination of the bronchoscope with tap water, which

may contain environmental *Mycobacterium* species, should be avoided. A minimum sample size is preferably 5mL.

Urine
When sterile pyuria is noted, three early morning urines (EMU) should be collected in 24hr urine large containers (that does not contain boric acid) taken on different days. The entire voided urine should be collected as soon as possible after waking and at the same tie each morning if more than one specimen is being collected. Samples should be sent to the laboratory on a daily basis.

Sterile Body Fluids (CSF, pleural fluids, pericardial fluid)
These samples should be sent in a sterile universal container with a minimum of 1mL, ideally >6mL of fluid is required. Pleural or pericardial fluids are not very sensitive samples for the detection of *M. tuberculosis*, and that a concurrent pleural or pericardial biopsy taken with the fluid is more useful. A negative result on these fluids does not rule out the diagnosis.

Tissues and Biopsies
Specimens should be collected aseptically and placed in a sterile universal container without preservatives and sterile distilled water added to prevent desiccation. Tissues biopsy specimens received in formalin are unacceptable and will not be processed.

Blood
Blood should be collected in lithium heparin tubes and should be transported to the laboratory as soon as possible. EDTA tubes will be rejected as this inhibits the growth of mycobacteria.

5.9 Genital Tract Infections

High/Low Vaginal Swabs
The swab should be used to obtain a sample from the mucosal membrane of the vaginal vault after removal of secretions or discharge. It is important to avoid vulval contamination. Samples can be taken with the aid of a speculum. If there are obvious candida plaques, swab the lesions. Place the swab in the plastic transport sheath containing Amies transport medium with/without charcoal. Vaginal swabs are routinely examined for the presence of Candida species, Beta Haemolytic Streptococci and Bacterial Vaginosis. For *Trichomonas vaginalis*, swab the posterior fornix. Please indicate on the request form is investigation for *T. vaginalis* is required. Vaginal swabs will not be tested for *Neisseria gonorrhoeae* culture unless chain of evidence case. An endocervical or urethral swab is preferred for GC culture.

Cervical Swabs
After introduction of the speculum to the vagina, the swab should be rotated inside the endocervix. The swab should then be placed in Amies transport medium with charcoal.

If pelvic infection disease (PID) is suspected, please send an APTIMA cervical swab for gonorrhoea and Chlamydia testing.

Urethral Swabs

Avoid contamination with micro-organisms from the vulva or the foreskin. Small swabs are available for this purpose. The patient should not have passed urine for at least 1 hour. For males, if discharge is not apparent attempt to "milk" it out of the penis. Pass the swab gently through the urethral meatus and roll around. Place the swab in the plastic transport sheath containing Amies medium with charcoal.

Penile Swabs

After retracting the prepuce, the swab should be gently rotated to collect any secretions in the urethral meatus. Place the swab in the plastic transport sheath containing Amies medium with charcoal.

For *Chlamydia trachomatis* investigation a self-taken vaginal swab, cervical swab, male urethral swab or mid-stream urine specimen should be sent for Nucleic Acid Amplification Test (NAAT) testing using the appropriate transport medium (refer to Virology User Manual).

Semen for Culture

Specimens should be collected by masturbation directly into the sterile container. Fasten lid securely.

Intra-Uterine Contraceptive Device (IUCD)
Send the entire device in a sterile container.

5.10 Faeces Culture

Send 5-10mL if liquid or an equivalent sized portion in a sterile container. A minimum of 1-2g or a 'pea sized' portion is required for culture alone. Ask the patient to defecate into a clean bedpan or other convenient container if at home. Use the plastic spoon to transfer a portion of faeces into the pot. For liquid faeces use a plastic medicine spoon. Take care not to contaminate the outside of the faeces pot. Select a representative portion of the specimen.

Please provide relevant clinical details as these affect processing and test selection of the sample. Please state if :

- The patient has returned from abroad and the date of return
- Food poisioning is suspected
- The patient is on antibiotics or has been on antibiotics in the last four weeks

All faeces samples are investigated routinely for :

- *Salmonella* species
- *Shigella* species
- *Campylobacter* species
- Verotoxic *Escherichia coli* 0157

Additional investigations for other enteric pathogens are performed based on age, clinical picture and travel history.

5.11 *Clostridioides difficile* Detection in Faeces

C.diificile will be tested on LIQUID stool only if the following criteria are met:

- All samples from in-patients over 1 year old.
- All other patients with liquid stools that have requested CDT testing or with clinical details stating recent antibiotics/recent hospital admission.
- All other patients over 65 years old with clinical details of diarrhoea and/or colitis.
- A previous positive result reported in the last 2 weeks of the new request.

These samples will be tested once daily.

5.12 Investigation of Ova, Cysts and Parasites in Faeces

If parasites are of particular concern, send three separate samples in sterile universal containers collected over no more than a 10-day period. It is usually recommended that specimens are collected every other day and sent to the laboratory (as parasites may be intermittently excreted). Faeces samples should be ideally collected between 10pm and midnight, or early morning before defecation or bathing. Faeces may be passed directly into a sterile wide mouthed container or passed into a clean, dry bedpan or similar container and transferred into a sterile container. Tapeworm ova are rarely found in faeces, please send a segment or suspected parasite whenever possible.

Fresh faeces specimens are essential for the examination of Protozoan trophozoites. For examination of amoebic trophozoites, the specimen must reach the laboratory within 30 minutes of its production. It is advisable to arrange this examination with the laboratory in advance.

Sellotape Slide

For investigation of *Enterobius vermicularis* (threadworm), a Sellotape slide is the most appropriate sample. For a Sellotape slide, cut a 4 inch strip of clear Sellotape and apply to the perianal region, pressing the adhesive side of the tape firmly against the left and right perianal fold several times. Smooth the tape back on the slide, adhesive side down. Ensure the slide is labelled with the patient details and placed within a slide container.

Urine

For investigation of *Schistosoma haematobium*, 10mL of terminal urine (including the last few drops) should be collected between 10am and 2pm when ova numbers are highest in the urine. Alternatively, a 24-hour collection of terminal urine samples may be obtained. Samples should be collected into sterile containers with no preservatives such as boric acid. Patients with haematuria, ova may be found trapped in the blood and mucus in the terminal portion of the urine specimen.

A minimum volume of 1mL of CSF, pus or aspirates should be collected.

5.13 *Helicobacter pylori* Stool Antigen Testing

Faeces should be passed into a clean, dry sterile disposable bedpan or similar alternative before being transferred into a leak proof universal container. Antibiotics, proton pump inhibitors and bismuth preparations are known to suppress growth of *H. pylori*. Stool sampling must be performed not earlier than after 2 weeks of termination of ingestion proton pump inhibitors and bismuth preparations and 4 weeks after termination of ingestion of antibiotics. It should be noted that there is insufficient evidence at present to recommend the use of the stool antigen test as a test-of-cure.

5.14 Urine Microscopy and Culture

Urine

If transport of urine specimens to the laboratory is delayed, they should be refrigerated. A routine automated microscopy detects white blood cells, red blood cells, bacteria, yeasts and epithelial cells. If casts are required please specify on the request.

Midstream Urine (MSU)

The first part of voided urine is discarded and, without interrupting the flow, approximately 10mL is collected into a sterile universal container. A minimum of 5mL is required for automated microscopy and culture. Clean voided MSU is the preferred specimen for microscopy and culture. It is recommended that in females the hands and the perineal area

are washed with soap and water prior to specimen collection. Part the labia and clean the area around the urethral meatus from front to back. Spread the labia with the fingers of one hand. In males retract the foreskin, if present, and clean the skin surrounding the urethral meatus. To avoid urethral contamination, the patient must be instructed of these specimen collection procedures. The reliability of microscopy and culture results depends on the avoidance of contamination and prompt transportation.

Clean Catch Urine (CCU)

In young children, clean catch urines are preferable to bag urines which are almost always contaminated by perineal flora. Peri-urethral cleaning is recommended before sample collection. A minimum of 5mL is required for automated microscopy and culture.

Catheter Specimen Urine (CSU)

Samples should only be sent if infection is suspected as colonisation of catheters is common and does not usually require treatment. The sample may be obtained either from a transient catherization or from an indwelling catheter. Samples should be obtained aseptically from a sample port in the catheter tubing using a sterile syringe and needle following disinfection of the catheter port with alcohol or by aseptic aspiration of the tubing of indwelling catheters and transferred into sterile container. The specimen should not be obtained from the collection bag. Inappropriate use of antibiotics in asymptomatic patients with urinary catheters may result in the selection of resistant bacteria.

Supra-Pubic Aspirates (SPA)

Samples should be collected aseptically, directly from the bladder by aspiration with a needle and syringe and transferred into a sterile universal container. Ultrasound guidance should be used to show the presence of urine in the bladder before carrying out SPA collection. The use of this invasive procedure is usually reserved for clarification of equivocal results from voided urines in infants and small children.

Bag and Pad Urines

Bag and pad urine Bag urine is commonly collected from infants and young children, although it should be discouraged as pads are a more comfortable and easier method of collection.

Ileal Conduit Urine

Open the dressing pack and remove the stoma appliance. Clean the area around the stoma. Dry thoroughly. Gently insert a urinary catheter into the stoma to a depth of 2.5-5cm. Drain sufficient urine into a receiver. Remove the catheter and pour urine into a sterile universal container. Attend to the stoma.

Other Urine Specimens

Other specimens obtained during or as a result of surgery include those from cystoscopy, nephrostomy and urostomy, prostatic massage/secretions. Specimens may also be taken after bladder washout.

For investigation of mycobacterial infection please see section 5.8.

5.15 Wound Infections

Surface swabs and skin swabs

Rotate the swab on or in the required site. Sample a representative part of the lesion. Swabbing dry crusted areas is likely to yield the causative pathogen. The swab should then be placed in Amies transport medium. Samples of pus/exudates, if present, are preferred to swabs. If copious pus or exudate is present, aspirate with a sterile syringe and transfer to a sterile universal container. If insufficient to aspirate rotate a swab in the centre of the infected area and place the swab in the plastic transport sheath containing Amies transport medium.

If specimens are taken from ulcers, the debris on the ulcer should be removed and the ulcer should be cleaned with saline. A biopsy or, preferably, a needle aspiration of the edge of the wound should be taken. A less invasive irrigation-aspiration method may be preferred. Place the tip of a small needleless syringe under the ulcer margin and irrigate gently with at least 1mL sterile 0.85% saline without preservative. After massaging the ulcer margin, repeat the irrigation with a further 1mL sterile saline. Massage the ulcer margin again, aspirate approximately 0.25mL of the fluid and place in a sterile universal.

Always state the site and nature of the wound. This is essential, as the laboratory may need to interpret findings against a background of normal flora present in a given part of the body.

Pus

A minimum volume of 1mL of pus should be collected in a sterile universal.

Tissues and biopsies

Under aseptic conditions transfer material to a sterile universal container that does not contain formalin as this inactivates pathogens very rapidly. If the specimen is small, place it in 0.5mL of sterile water to prevent desiccation. If viral aetiology is suspected, please specify which virus.

Investigation of orthopaedic implant infections

If possible stop antibiotics 2 weeks prior to sampling and consider not giving routine surgical prophylaxis until after sampling. In theatres, multiple (3-5) samples should be taken using separate instruments for each sample. Aspirates should be >1 mL, smaller volumes may impede the recovery of organisms. Swabs are not the preferred sample. Prosthetic joint apirates, per-prosthetic biopsies, intra-operative specimens, and prostheses can be sent in a sterile universal container.

Intravascular devices

Line infection is confirmed by semi-quantitative culture of a removed line. After removing a possibly infected line from a patient, cut off the intravascular portion using sterile scissors and place it in a sterile universal container. If infection is suspected in a long line send the intravascular portion immediately adjacent to the exit site and the tip in separate sterile universal containers.

Animal bite or scratch acquired outside the UK

Please discuss with the SpRs.

5.16 Screening Samples

MRSA

Nose, throat and groin (or perineum) swabs are required for a screen. Other sites such as wounds or line swabs can also be requested. If the patient has a long-term catheter, please send a CSU for MRSA.

CRE

A rectal swab is required for a CRE screen. A swab should be inserted into the anal canal and rotated ensuring visible faecal material is present on the swab. The swab should then be placed in Amies transport medium. A faecal sample can also be sent.

VRE

A rectal swab is required for a VRE screen. The swab should be inserted into the anal canal and rotated ensuring visible faecal material is present on the swab. The swab should then be placed in Amies transport medium.

Candida auris

Nose, throat, groin (or perineum) and axillae swabs are required for a screen. If the patient has an in-dweeling catheter, please send a CSU sample. Swabs must be collected using liquid Amies transport medium.

5.17 Serology

Serology (e.g. Beta-D-glucan)

Collect 5-10mL of blood in a blood collection tube usually red topped or yellow topped (serum separator) tubes.

6. Quick Guide Table to Specimen Collection

Specimens should be transported and processed as soon as possible

Specimen / investigation	Container and comments
Antral washings	Sterile universal container
Antimicrobial assays	Collect 10mL of blood using the red topped or yellow topped tubes
Aspirates and fluids from normally sterile sites (joint, ascites, peritoneal and pleural fluids)	Sterile universal container
AFB investigations in blood	Collect 10mL of blood using the green topped (lithium heparin) blood tubes
Beta-D-glucan (pan-fungal marker)	Collect 10mL of blood using the red topped or yellow topped tubes
Blood cultures	Take before antimicrobials are given if possible Disinfect skin with 70% isopropyl alcohol for 30 seconds. Place up to 10mL in each blood culture bottle for adults, 4mL in one paediatric bottle for paediatric patients. Ensure prompt transport to the Microbiology laboratory.
Bronchial washings	Sterile container; e.g. 20mL sterile container or sterile universal container

Specimen / investigation	Container and comments
Bronchoalveolar lavage	Sterile container; e.g. 20mL sterile container or sterile universal container
Cervical swab	For the investigation of gonorrhoea use a Microbiology swab in Amies transport medium with charcoal, and transport to the laboratory immediately. Urethral, rectal and throat swabs may also be collected and sent. For the investigation of *Chlamydia* in females a self-taken vaginal or cervical swab should be sent for NAAT testing using the appropriate APTIMA transport medium. This test is performed in Virology.
Cerebrospinal fluid (CSF)	For cell count, Gram staining and culture send at least 2-3mL of CSF in 3 separate sterile universal containers. If meningitis is suspected contact the laboratory and send the specimens immediately. Send separate specimens for glucose and protein analysis to the Biochemistry department.
Cryptococcal antigen detection	A minimum of 0.5mL of CSF is required in a sterile universal. Collect 5-10mL of blood in a blood collection tube usually red topped or yellow topped (serum separator) tubes.
Clostridium difficile stool testing	Send a faecal specimen in sterile container. NB: Only very loose or liquid stools (eg those that adopt the shape of the container) need be sent for testing
Culture for bacterial infections	Pus is the ideal specimen or a biopsy of the infected tissue. Send in a sterile universal container. If only a small sample of tissue is available, add a few drops of sterile water to prevent drying. If swabs are taken, send in Amies transport medium with charcoal.
Ear swab	Send a swab in Amies transport medium with charcoal
Eye swab	For investigation of *Chlamydia trachomatis* infection, send a swab in NAAT transport medium.
Faeces	Send 5-10mL if liquid or an equivalent sized portion in a sterile container
Galactomannan (aspergillus marker)	Collect 10mL of blood using the red topped or yellow topped tubes
Helicobacter pylori stool antigen testing	With the spatula provided transfer a plum-sized portion of faeces, or equivalent volume of fluid, into a sterile universal container
High vaginal swab (HVS)	Use Amies transport medium with charcoal for investigation of *Candida*, *Trichomonas vaginalis* and vaginosis. For PID, gonorrhoea and *Chlamydia* investigations send specimens for Chlamydia and gonococcus NAAT.
Intrauterine contraceptive device – IUCD	Send the device in a sterile universal container
Mouth swab	Send a swab in Amies transport medium with charcoal for Microbiology. For virology send the swab in virus transport medium.

Specimen / investigation	Container and comments
Nasal swab	Send a swab in Amies transport medium with charcoal for Microbiology. For virology, send the swab in virus transport medium.
Nasopharyngeal aspirate	Traps containing a specimen should be sealed using lid.
Pernasal swab	Use a pernasal swab and transport immediately to the laboratory
Post nasal swab	Send a swab in Amies transport medium with charcoal
Pus	Transfer into a sterile universal container. Only use Microbiology swabs in Amies transport medium with charcoal if pus cannot be obtained
Seminal fluid	Sterile universal container
Skin, nail and hair for mycology	For skin, nail and hair clippings use black card, Dermapaks or sterile universal. Routine Microbiology swabs in Amies transport medium with charcoal are used for the investigation of *Candida* infections
Sputum	Sputum from deep expectoration and not saliva is required. Send specimen in a 30ml sputum container or universal
Throat swab	For Microbiology investigations send a swab in Amies transport medium with charcoal. For virology send the swab in virus transport medium.
Tissues and biopsies	Sterile universal container. If biopsy is small add 0.5ml of sterile saline to prevent it from drying out. Ensure there is NO formalin or other preservative
Tuberculosis	Best specimens are early morning sputum, urine, pus or tissue. For sputum and urine send 3 early morning specimens taken on consecutive days
Sellotape slide	Press Sellotape around the perianal region and transfer to a clean microscope slide. Place this in a slide box
Urine	Collect urine in a sterile universal container. For *Chlamydia trachomatis*. Send a first-catch specimen.
Catheter specimen of urine (CSU)	Transfer urine to a sterile universal container (containing boric acid). If less than 15ml do not use boric acid
Clean-voided midstream specimen of urine	Collect in sterile container and transfer to a sterile universal container (containing boric acid). If less than 15ml do not use boric acid
Early morning urine for tuberculosis	Sterile large volume container
All other urine specimens	Sterile universal container
Urethral swab	For the investigation of gonorrhoea by culture use a Microbiology swab in charcoal-containing Amies transport medium transport to the laboratory immediately. If there is likely to be a delay, keep at 4°C if possible.
Vesicles, ulcers and genital lesions	Send a swab in virus transport medium. Vesical fluid or pus is preferred over a swab.

Specimen / investigation	Container and comments
Wound and ulcer swabs	Send a swab in Amies transport medium with/without charcoal

7. Typical Turn-around Times for Common Specimens

Sample Type	Typical Turn-around Times
Urine	Negative 1 day Positive 2-3 days
High vaginal swab	3 days
Eye swab	3 days
Wound swab	3 days
Throat swab	3 days
Faeces	4 days
Sputum	4 days
Helicobacter pylori stool antigen testing	5 days (batched twice / week)
Beta-D-glucan serology	3 days
MRSA / CRE / VRE screen	Negative 1 day Positive 4 days
Mycology routine cultures	3 weeks
TB	6 weeks

Blood cultures are monitored continuously and all positives telephoned to the requesting clinician as soon as they are available. If there is no growth after 48 hours (of processing, not 48 hours after collection), a report to that effect is sent out automatically, but specimen processing continues for a total of five days. Blood cultures with appropriate clinical details (e.g. endocarditis) are monitored for 14 days.

8. Complaints

Complaints may be made directly to the department, via PALS, NHS South East London CCG Quality Team (mailto:kch-tr.GPLiaison@nhs.net) or via Synnovis Customer Support. Complaints are handled according to the Synnovis Complaints Policy and Procedure located at http://www.synnovis.co.uk/customer-service.

9. Specialist Laboratory Services Used

The PHE provides a comprehensive range of microbiological tests and services as indicated below.
The request form you should use is provided as a link against each test/service.
Further information regarding these or other tests can be obtained from the laboratory's user handbooks or direct from the laboratory. Links to both the relevant user manual and laboratory webpage (where you will find contact details) are provided against each test/service.

Services	Test type	Unit

Achromobacter	Species identification, molecular typing and antimicrobial resistance	AMRHAI
Acinetobacter	Species identification, molecular typing and antimicrobial resistance	AMRHAI
Actinomycetes (Aerobic)	Antimicrobial susceptibility	AMRHAI
Actinomycetes (Aerobic)	Identification and confirmation	AMRHAI
Amoebae	Detection, identification and confirmation, serodiagnosis	NPRL
Anaerobes (*Bacteroides*, *Clostridia*, *Fusobacteria*, *Actinomyces* spp., other closely related genera)	Identification	ARU
Anthrax	See *Bacillus anthracis*	
Antibiotic resistance surveys	European antibiotic resistance surveillance scheme (EARSS) and surveillance of resistance	AMRHAI
Antibiotic susceptibility testing	New antimicrobials, susceptibility testing service, beta-lactamases, endocarditis	AMRHAI
Bacillus anthracis	Identification and confirmation, PCR, serology, characterisation (phage, penicillin sensitivity)	RIPL
Bacillus (other than *B.anthracis*)	Identification, Molecular typing, Detection of emetic toxin gene by PCR	GBRU
Bacillus (other than *B.anthracis*)	Antimicrobial susceptibility	AMRHAI
Bacterial Identification Service (BIDS) - isolates	Isolate identification (unknown, atypical, fastidious, emerging bacteria)	AMRHAI
Bacterial Identification Service (BIDS) - clinical samples	Bacterial detection and species identification for culture-negative, unknown clinical samples from normally sterile sites	AMRHAI
Blastomyces dermatidis	Serology, identification and confirmation	MRL
Bordetella spp.	Identification	RVPBRU
Bordetella spp.	Antimicrobial susceptibility	AMRHAI
Bordetella pertussis	Serology: anti-PT IgG antibodies. Not suitable for immune status	RVPBRU
Bordetella pertussis	Oral fluid: anti-PT IgG antibodies. NOT suitable for immune status qPCR	RVPBRU
Brucella spp.	Serodiagnosis, Speciation and characterisation	BRU
Burkholderia spp.	Species identification, molecular typing and antimicrobial resistance	AMRHAI
Burkholderia pseudomallei	Identification and antimicrobial resistance	AMRHAI
Candida spp.	Identification and confirmation	Mycology RL
Campylobacter	Antibiotic susceptibility testing for gram negative GI pathogens	GBRU

Campylobacter	Identification	GBRU
Chlamydia (respiratory)	Only available after discussion and prior agreement with RVPBRU C. pneumoniae, *C. psittacci*, *C. abortus*: PCR assay	RVPBRU
Chlamydia trachomatis	*C. trachomatis*: LGV multiplex PCR	STBRU
Clostridium difficile	16S/23S PCR ribotyping, antibiotic susceptibility testing and toxin A and B assay on isolates	ARU
Clostridium botulinum	Detection and identification of *C. botulinum* from clinical, food or environmental samples by PCR and culture	GBRU
Clostridium botulinum	Detection of botulinum neurotoxins in clinical specimens or food	GBRU
Clostridium perfringens	Identification of enterotoxigenic *C. perfringens* by PCR, molecular typing, detection of *C. perfringens* enterotoxin in faeces by ELISA, *C. perfringens* Toxin (lethal toxins) typing by PCR	GBRU
Clostridium tetani	Detection and identification of *C. tetani* by PCR and culture, Detection of *C. tetani* neurotoxin in serum (note: serum will be first tested for tetanus antibody levels by RVPBRU)	GBRU
Clostridium tetani	Tetanus immunity: serum antibodies	RVPBRU
Coccidioides immitis	Serology, identification and confirmation	Mycology RL
Corynebacterium	Molecular typing and antimicrobial resistance	AMRHAI
Corynebacterium diphtheriae	*C. diphtheriae* and other potentially toxigenic Corynebacteria: identification and toxin testing by PCR and Elek, Diphtheria immunity: serum antibodies	RVPBRU
Corynebacterium jeikeium	*C. jeikeium* antimicrobial sensitivity	AMRHAI
Cronobacter	*C. sakazakii*: confirmation of identification, molecular typing and antimicrobial resistance	AMRHAI
Cystic Fibrosis (CF) pathogens	Identification and molecular typing, Antimicrobial susceptibility	AMRHAI
Cryptococcus spp.	Identification and confirmation	Mycology RL
Cryptosporidium spp.	Detection, identification and confirmation, typing	CRU
Dermatophytes	Identification, confirmation	Mycology RL
Diphtheria (see *Corynebacterium diphtheriae*)		

Ebola virus	Serology, PCR. Please contact lab before sending samples.	RIPL
Elizabethkingia.spp	Identification, molecular typing and antimicrobial resistance	AMRHAI
Enterobacter spp.	Molecular typing and antimicrobial resistance, Species identification, molecular typing and antimicrobial resistance	AMRHAI
Escherichia	Antibiotic susceptibility testing for gram negative GI pathogens, identification and typing, detection and isolation from faeces, E.coli 0157 serodiagnostic service	GBRU
Escherichia	*E. coli* (ACDP HG 2 only): molecular typing and antimicrobial resistance	AMRHAI
Francisella spp., including tularensis	PCR, serology, isolation	RIPL
Gram-negative bacteria non fermenter and fastidious organisms	Molecular typing and antimicrobial resistance	AMRHAI
Gram-positive bacteria (except *C. diphtheriae*)	Molecular typing and antimicrobial resistance	AMRHAI
Haemophilus	*Haemophilus* spp. (excluding *H. ducreyi*): identification, *H. influenzae*: sero typing and capsular genotyping of *H.influenzae*	RVPBRU
Haemophilus spp. and *Aggregatibacter* spp.	Antimicrobial susceptibility	AMRHAI
Helicobacter	Antibiotic susceptibility testing for gram negative GI pathogens, *H. pylori* identification and antibiotic susceptibility	GBRU
Histoplasma capsulatum	Serology, identification and confirmation	Mycology RL
Histology slides	Examination for the presence of fungi	Mycology RL
Hydatid disease or Echinococcosis	Serology	NPRL
Identification of bacterial isolates with no national reference facility (unknowns, atypical, fastidious, emerging	MALDI-TOF-MS, 16s ribosomal sequence analysis	AMRHAI
Klebsiella spp.	Molecular typing and antimicrobial resistance	AMRHAI
Legionella	*L.pneumophila*: in-house urinary antigen EIA assay (confirmation of sending lab testing results only), *L pneumophila* PCR (from urinary antigen positive patients only), Identification and epidemiological typing of clinical or outbreak associated isolates	RVPBRU
Leuconostoc spp.	Antimicrobial susceptibility	AMRHAI

Leptospira spp	Isolation and confirmation, identification, serology	NLS
Listeria spp.	Identification, serotyping and molecular typing of *L.monocytogenes,* Species identification of Listeria	GBRU
Listeria spp.	Antimicrobial susceptibility	AMRHAI
Lyme disease	Serology, PCR	RIPL
Malaria	Blood film diagnosis, antigen detection, PCR, drug resistance markers	Malaria RL
Molluscum contagiosum	Electron microscopy	HPHCU
Moulds	Identification and confirmation, susceptibility testing	Mycology RL
Meticillin-resistant *S. aureus* (MRSA) (see Staphylococcus)		
Mycobacterium spp.	Identification, genotyping, drug susceptibility, molecular diagnosis (e.g. PCR for rapid species identification and detection of resistance genes), molecular epidemiological studies, QuantiFERON®-TB Gold test	NMRS-South
Mycoplasma	*M.hominis* and *Ureaplasma* spp.: PCR and/or culture, Mycoplasma and ureaplasma: biochemical characterisation and molecular methods, *M. pneumoniae*: PCR, Other species: culture, PCR and sequencing when relevant	RVPBRU
Mycoplasma	*M. genitalium*: molecular detection of the adhesion MgPa gene	AMRHAI
Neisseria spp.	*N.gonorrhoeae*: confirmation of identification by phenotypic and molecular methods, Susceptibility testing for third-generation cephalosporin and azithromycin antibiotics, Programme: Gonococcal resistance to antimicrobials surveillance programme (GRASP)	AMRHAI
Neisseria spp.	Molecular confirmation of GC NAAT result	STBRU
Neisseria meningitidis	Culture identification, molecular epidemiological studies, PCR, serology	MRU
Nocardia spp.	Antimicrobial susceptibility	AMRHAI
Opportunistic Pathogens	Molecular typing and antimicrobial resistance	AMRHAI
Pandoraea spp.	Molecular typing and antimicrobial resistance	AMRHAI
Parasites, intestinal protozoa and helminths,		NPRL

blood and tissue protozoa and helminths		
Penicillium marneffei (now known as Talaromyces marneffei)		Mycology RL
Plasmodium spp.		NPRL
Pseudomonas spp.	*P. aeruginosa* antibodies (serodiagnosis), Molecular typing and antimicrobial susceptibility	AMRHAI
PVL (see Staphylococcus)		
Q fever (*Coxiella burnetii*)		RIPL
Ralstonia spp.	Molecular typing and antimicrobial resistance	AMRHAI
Resistance mechanisms	Molecular detection and confirmation	AMRHAI
Salmonella	Antibiotic susceptibility testing for gram negative GI pathogens	GBRU
Salmonella	Identification and typing	GBRU
Serratia	Molecular typing and antimicrobial resistance	AMRHAI
Shigella	Antibiotic susceptibility testing for gram negative GI pathogens, Identification and typing	GBRU
Staphylococcus	*S.aureus*: molecular typing, Staphylococcus, coagulase negative: species identification and molecular typing, Antimicrobial susceptibility testing, Resistance gene detection, Toxin gene detection (including PVL)	AMRHAI
Staphylococcus	Detection of staphylococcal enterotoxins A, B, C, D or E in foods or beverages.	GBRU
Stenotrophomonas	S.maltophilia: molecular typing and antimicrobial resistance	AMRHAI
Streptococcus	Streptococcus spp. and related genera or Gram positive cocci: identification, *S.pyogenes* (Lancefield Group A) typing, *S.agalactiae* (Lancefield Group B) typing, Lancefield Group C and G typing, *S. pneumoniae*: serological typing	RVPBRU
Streptococcus	Antimicrobial susceptibility	AMRHAI
Tetanus	Tetanus immunity: serum antibodies	RVPBRU
Toxoplasma gondii	Isolation, identification, culture collection, serology (for active infection) molecular diagnostics by PCR	TRL
Treponema	*T. pallidum* (syphilis): serological, *T.pallidum*, *Haemophilus ducreyi*, Herpes Simplex Virus (HSV) complex (Genital ulcer disease): PCR	STBRU
Ureaplasma	Refer to mycoplasma	RVPBRU

Vibrio (including *Plesiomonas shigelloides*)	Antibiotic susceptibility testing for gram negative GI pathogens	GBRU
Vibrio (including *Plesiomonas shigelloides*)	Identification and typing	GBRU
VTEC O157 (See *Escherichia coli*)		
Yeasts	Serodiagnosis	Mycology RL
Yersinia	Antibiotic susceptibility testing for gram negative GI pathogens	GBRU
Yersinia	Identification	GBRU

Bacteriology reference department (BRD) Public Health England, 61 Colindale Avenue London NW9 5EQ. Comprising of: **AMRHAI, GBRU, RVPBRU**

BRU Brucella reference unit, Liverpool Clinical Laboratories, Virology Department, Royal Liverpool
and Broadgreen University Hospital NHS Trust, Prescott Street Liverpool L9 8XP

CDRN Clostridium difficile ribotyping network (CDRN) service, Leeds Reference Laboratory, Leeds General Infirmary, Great George St, Leeds, West Yorkshire LS1 3EX

MRL Mycology reference laboratory (Mycology RL) Bristol, Public Health England, South West
Laboratory, Myrtle Road, Kingsdown Bristol BS2 8EL

NMR-S National mycobacterium reference service-South (NMRS-South), National Infection Service
61 Colindale Avenue London NW9 5EQ

ARU Anaerobe reference unit (ARU) Cardiff, Public Health Wales Microbiology Cardiff, University
Hospital of Wales, Heath Park Cardiff CF14 4XW

MRU Meningococcal reference unit (Men RU) Manchester, Clinical Sciences Building 2,
Manchester Royal Infirmary, Oxford Road Manchester M13 9WL

NPRL National Parasitology Reference Laboratory, Faculty of Infectious and Tropical Diseases,
London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT

10. Notification of Infectious Diseases

The following infections are notifiable and should be reported to:

South London Health Protection Team
Public Health England,
Floor 3C, Skipton House,
80 London Road,
London SE1 6LH
Tel: 0344 326 2052 (Daytime and Out of Hours)
Fax: 0344 326 7255

E-Mail: slhpt.oncall@phe.gov.uk
phe.slhpt@nhs.net (secure e-mail if sending from an nhs.net)

The King's Infection Control Team must be notified of inpatients with these infections:

- Acute encephalitis
- Acute poliomyelitis
- Acute infectious hepatitis
- Acute meningitis
- Anthrax
- Botulism
- Brucellosis
- Cholera
- COVID-19
- Diphtheria
- Enteric fever (typhoid/paratyphoid)
- Food poisoning
- Haemolytic ureamic syndrome (HUS)
- Infectious bloody diarrhoea
- Malaria
- Mumps
- Meningococcal septicaemia
- Measles
- Plague
- Rabies
- Rubella
- Severe Acute Respiratory Syndrome (SARS)
- Smallpox
- Scarlet fever
- Tuberculosis
- Tetanus
- Typhus
- Viral haemorrhagic fever

- Invasive Group A streptococcal disease
- Legionnaire's disease
- Leprosy
- Whooping cough
- Yellow fever

11. Appendix 1. Recommended Blood Culture Collection

Recommendations for blood culture collection

a summary of good practice

Using winged blood collection set

1> Prepare blood collection kit

Gather all materials before beginning the procedure. Ensure the blood culture bottles are within date. Do not use bottles which show any signs of damage, deterioration or contamination.

2> Prepare bottles for inoculation

Wash hands with soap and water then dry, or apply an alcohol hand rub. Remove the plastic "flip-cap" from the blood culture bottles and disinfect the septum using an appropriate disinfectant, such as 2% chlorhexidine in 70% isopropyl alcohol, 70% isopropyl alcohol, or iodine in swab or applicator form. Use a fresh swab/applicator for each bottle. Allow bottle tops to dry in order to fully disinfect.

3> Prepare venipuncture site

Confirm the patient's identity. If skin is visibly soiled, clean with soap and water. Apply a disposable tourniquet. Palpate to identify the vein and cleanse using an appropriate disinfectant, such as 2% chlorhexidine in 70% isopropyl alcohol, 70% isopropyl alcohol, or iodine in swab or applicator form. The venipuncture site is not fully clean until the disinfectant and has fully evaporated.

4> Wash hands. Wear gloves.

Wash hands again or use an alcohol hand-rub and apply clean examination gloves. Sterile gloves are not necessary.

5> Venipuncture

Attach a winged blood collection set to a collection adapter cap. To prevent contaminating the puncture site, do not re-palpate the prepared vein before inserting the needle. Insert the needle into the prepared site.

6> Culture bottle inoculation

Place the adapter cap over the aerobic bottle and press down to pierce the septum. Hold the bottle upright and use the graduation lines to accurately gauge sample volume. Add up to 10 ml of blood per adult bottle and up to 4 ml per pediatric bottle. Once the aerobic bottle has been inoculated, remove the adapter cap and repeat the procedure for the anaerobic bottle.

The use of blood collection adapters without blood collection sets is not recommended.

7> Other blood tests

If blood is being collected for other tests, place an insert into the adapter cap. The insert is used to guide blood collection tubes onto the needle. If other blood tests are required, always collect the blood culture first.

8> Finish the procedure

Discard the winged collection set into a sharps container and cover the puncture site with an appropriate dressing. Remove gloves and wash hands before recording the procedure, including indication for culture, time, site of venipuncture, and any complications. Ensure additional labels do not cover the bottle barcodes and that the tear-off barcode labels are not removed.