Scottish Microbiology Reference Laboratories Glasgow

User manual

Version 1, February 2025

Amendment table

Current amendments are listed on this page. The amendment history is available from ggc.glasgowsmrl@nhs.scot

All amendments are controlled within the laboratory in accordance with the local quality management system. It is the responsibility of the copy holder to ensure that any hard copy or locally held copy reflects the most recent version. Refer to the following for the most recent version: Scottish Microbiology Reference Laboratories - NHSGGC

Amendment date	10/02/2025
Issue number discarded	1
Insert issue number	1
Anticipated next review date*	10/02/2026
Section(s) involved	Updates to personnel page 6

*Reviews can be extended up to five years subject to resources available.

Contents

Introduction

The Scottish Microbiology Reference Laboratories (SMiRL), Glasgow are part of the Acute Service Division of NHS Greater Glasgow and Clyde. Commissioning is through Public Health Scotland (PHS) which is part of NHS National Services Scotland. The services are combined within one site on Level 5 of the New Lister Building, Glasgow Royal Infirmary, SMiRL, Glasgow work closely with stakeholders to deliver key public health functions for epidemiology and surveillance, as well as outbreak and incident investigations. Expert advice and specialist diagnostic testing are offered for a broad range of pathogens and the diseases they cause. Investigations include serology, microscopy, and state-of-the-art molecular profiling to permit in-depth examination of respiratory and systemic bacteria, enteric bacteria and parasites, ocular and blood parasites, ecto-parasites and multiple-drug resistant bacteria. Active collaborations are encouraged to undertake relevant research projects with a focus on public health through networking with a variety of academic and commercial institutes. SMiRL, Glasgow participates in local, national and international surveillance programmes and operates a comprehensive quality management system. The Scottish Microbiology Reference Laboratories, Glasgow is a UKAS accredited medical laboratory. No. **8514.** The full scope of accredited tests offered is available on the UKAS website http://www.ukas.com

Postal address

Scottish Microbiology Reference Laboratories (SMiRL) Glasgow
Level 5, New Lister Building
Glasgow Royal Infirmary
10-16 Alexandra Parade
Glasgow
G31 2ER

DX Number: DX 6490200
DX Exchange: BISHOPBRIGGS 90GX

Normal laboratory working hours

Monday to Friday 08:45 to 17:00
Saturday mornings and Public Holidays: specimen reception only

Out of hour's requests

SMiRL Glasgow does not operate an out of hour's service. Only under exceptional circumstances and with approval from the laboratory director will tests be performed outside the normal laboratory hours.

Services for the public

SMiRL, Glasgow does not offer diagnostic services to members of the public except via a registered medical practitioner. Results can only be issued to the requesting physician or medical unit and will not be given to patients directly under any circumstances. We reserve the right to check the authenticity of callers in order to protect the confidentiality of patients' personal data. There are no clinical facilities at SMiRL, Glasgow and we are unable to see patients or give telephone medical advice directly to members of the public.

Contact details and key personnel

General enquiries: 0141 242 9633; internal: 29633

Email ggc.glasgowsmrl@nhs.scot

For urgent, clinical, or non-routine enquiries, please call the laboratory directly on one of the numbers below.

Key personnel

Professor Alistair Leanord (Director)	0141 242 9633
Professor Andrew Smith (Director, BRIS)	0141 956 0431
Pamela Saunders (Head of Technical Services)	0141 242 9647
Anne Hawthorn (Laboratory Manager)	
Michael Coyne (Operations Manager)	0141 242 9620
Julie Mallon (Quality Manager)	0141 242 9621
Dr. Diane Lindsay (Principal Clinical Scientist, BRIS)	0141 242 9627
Dr. Claire Alexander (Consultant Clinical Scientist, DRPS)	0141 242 9631
Derek Brown (Principal Clinical Scientist, EBIS)	0141 242 9626
Dr. Andrew Robb (Principal Clinical Scientist, MRSA Service)	0141 242 9629
Dr Kevin Scott (Principal Clinical Scientist)	0141 242 9622

Medical Microbiologists and Clinical Scientists are available to offer advice on diagnosis, clinical interpretation of results and management of infections. For emergency enquiries out with normal working hours please contact the duty microbiologist via switchboard on 0141 211 4000.

Test repertoire

The table below lists all current tests and the sample types required. Turnaround times (TRT) represent the number of working days from the time that we receive the sample until the result is authorised.

SERVICES	TEST(S) PERFORMED	SAMPLE REQUIRED	TRTs	REQUEST FORM
Acanthamoeba	PCR assay [a]	The optimal sample type is corneal tissue (corneal "scrape"). If it is not possible to collect corneal tissue, then contact lens, and / or contact lens fluid will be accepted.	3 days	RF-3
Amoebiasis (see also *Entamoeba histolytica*)	Serology – LATEX agglutination	Clotted blood/serum [b]	10 days	RF-3
Anisakiasis	No test available within the UK	-	-	-
Babesiosis	Microscopy and PCR	EDTA whole blood	10 days	RF-3
Bordetella pertussis	*B. pertussis* toxin antibody (IgG) detection	Serum [b]	9 days	RF-4
Carbapenemase producing organisms	Carbapenemase gene detection (RT-PCR)	Pure culture on Nutrient Agar Slope	1 day	RF-6
	Broth microdilution (BMD)	Pure culture on Nutrient Agar Slope	15 days	RF-6
Clostridium difficile	*C. difficile* PCR ribotyping	Pure culture in Robertson's Cooked Meat broth	7 days	RF-5
	C. difficile antibiotic susceptibility testing	Pure culture in Robertson's Cooked Meat broth	7 days	RF-5
Cryptosporidium	Molecular assays for a) surveillance, b) outbreaks, c) confirmatory testing [d]	Faeces [c] DNA [c] Environmental samples (on request by PHS for outbreaks)	10 days	RF-3
Cysticercosis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
Echinococcus granulosus (see also Hydatid Disease)	Microscopy for confirmatory testing [d]	Cyst fluid	3 days	RF-3

Ecto-parasite identification	Microscopy for confirmatory testing [d]	Larvae, insects, worms	10 days	RF-3
Enteric parasites (see Intestinal Helminths and Intestinal Protozoa)	-	-	-	-
Entamoeba histolytica/ dispar (see also amoebiasis)	PCR assay to differentiate between the species	Faeces [c]	3 days	RF-3
Enterobius vermicularis	Microscopy for confirmatory testing [d]	Sellotape smear or perianal swab	10 days	RF-3
Fascioliasis	Microscopy for confirmatory testing [d]	Faeces	10 days	RF-3
	Serology - ELISA	Clotted blood / serum [b]	10 days	RF-3
Filariasis (main species *Wuchereria bancrofti, Onchocerca volvulus*, *Brugia malayi* and *Loa loa*)	Serology - ELISA	Clotted blood / serum [b]	10 days	RF-3
	Microscopy	EDTA whole blood collected between 1000h-1400h (day blood) or 2200h-0200h (night blood) N.B. EDTA sample MUST be taken and examined within 72hrs of collection *Onchocerca volvulus* is diagnosed by skin snip microscopy – please contact the laboratory prior to sampling on 0141 242 9631. N.B. Samples should NOT be refrigerated following collection	3 days	RF-3
Giardiasis (see also Intestinal protozoa)	PCR assay	Faeces [c]	10 days	RF-3
Hydatid Disease (see also *Echinococcus granulosus*)	Serology – ELISA and IHA	Clotted blood/serum [b]	10 days	RF-3
Haemophilus influenzae (refer to appendix 1 for isolate submission criteria)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Serotyping	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	MLST	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4

	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid (500µl minimum volume)	3 days	RF-4
Insects (see Ectoparasites)	Microscopy for confirmatory testing [d]		10 days	RF-3
Intestinal Helminths	Microscopy for confirmatory testing [d]	Faeces	10 days	RF-3
Intestinal Protozoa (see also *Entamoeba histolytica, Giardia* & *Cryptosporidium outbreak service)*	Microscopy for confirmatory testing [d]	Faeces Duodenal/jejunal juices for *Giardia duodenalis* (examined within 4 hours)	10 days	RF-3
Legionella spp. (refer to appendix 1 for isolate submission criteria)	*L. pneumophila* urinary antigen	Urine (plain universal or in boric acid) – diagnostic testing is available for NHSGG&C only. All urinary antigen positives from non GGC HB should be sent to BRIS for confirmation	2 days	RF-4
	Legionella RT-PCR on respiratory samples	Sputum, tracheal aspirates, bronchoalveolar lavage, PM lung	5 days	RF-4
	Legionella sequence based typing on PCR positive samples and isolates	DNA extracts, Pure culture on BCYE agar	12 days	RF-4
	Legionella culture	Sputum, tracheal aspirates, bronchoalveolar lavage, PM lung. Environmental samples – please contact the lab prior to sending	10 days	RF-4
	Legionella ID, mip genotyping and sequence based typing	Pure culture on BCYE agar	12 days	RF-4
Leishmaniasis (visceral and mucocutaneous)	Molecular assays	Bone marrow AND EDTA whole blood	3 days	RF-3
	Serology – immunodiffusion assay	Clotted blood/serum [b]	10 days	RF-3
Leishmaniasis (cutaneous)	Molecular assays	Skin biopsy, skin swab		
Malaria (see *Plasmodium* species)	----	----	----	----

Microsporidia species	Samples will be referred by SMiRL, Glasgow to the Hospital for Tropical Diseases, London for molecular testing.	Faeces [c]	-	RF-3
Neisseria meningitidis (Meningococcus) (refer to appendix 1 for isolate submission criteria)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Capsular serogrouping	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Whole Genome Sequencing	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid (500µl minimum volume)	3 days	RF-4
	Capsular serogrouping, MLST and PorA typing from PCR positive samples and fast tracking outbreak isolates	DNA extracts Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
Plasmodium species	Speciation PCR assays [e]	EDTA whole blood	3 days	RF-3
Salmonella species	Identification of genus and species by whole genome sequencing	Pure culture on Nutrient Agar Slope	14 days	RF-2
	Confirmation of Hazard Group 3 pathogens	Pure culture on Nutrient Agar Slope	4 days	RF-2
Schistosomiasis	Serology - ELISA	Clotted blood / serum taken at least 8 weeks after last exposure [b]	10 days	RF-3
	Microscopy for confirmatory testing [d]	Stools / urine [d]	10 days	RF-3
Shigella species	Identification of genus and species by whole genome sequencing	Pure culture on Nutrient Agar Slope	14 days	RF-2
	Confirmation of Identification by Microbact		4 days	
Staphylococcus spp.	PCR confirmation of MRSA status	Pure culture on an agar slope OR swab in transport medium	5 days	RF-1

	PCR detection of mupirocin resistance gene	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
	Toxin testing (PVL by real-time PCR; TSST, eta/b and enterotoxin genes upon request by PCR)	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
Staphylococcus spp. (continued)	Epidemiological typing: Spa-typing – MSSA and MRSA(in outbreak situations and upon request) PFGE – *S.aureus,* CNS. (must be agreed with laboratory prior to sending isolate)	Pure culture on an agar slope OR swab in transport medium	7-8 days	RF-1
Streptococcus pneumoniae (Pneumococcus) (Refer to appendix 1 for isolate submission criteria)	Antimicrobial susceptibility testing	Pure culture on an agar slope OR swab in transport medium	4 days	RF-4
	Capsular typing & MLST (Whole genome sequencing)	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
	Multiplex PCR for meningococcal, pneumococcal and *H. influenzae* DNA	CSF, serum, EDTA blood, Blood culture fluid (500µl minimum volume)	3 days	RF-4
	MLST on PCR positive samples	DNA extracts	10 days	RF-4
Streptococcus pyogenes (Group A streptococcus) (refer to appendix 1 for isolate submission criteria)	*emm* (M) typing and MLST	Pure culture on an agar slope OR swab in transport medium	10 days	RF-4
Strongyloidiasis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3

	PCR (under validation) and culture	Faeces, duodenal / jejunal aspirates N.B. Samples should NOT be refrigerated following collection	10 days	RF-3
Toxocariasis	Serology - ELISA	Clotted blood/serum [b]	10 days	RF-3
Toxoplasmosis	Users are requested to send samples **directly** to the Scottish Toxoplasma Reference Laboratory, Microbiology Department Zone 3, Raigmore Hospital Old Perth Road, Inverness, IV2 3UJ	Seek advice on sample types from the Scottish Toxoplasma Reference Laboratory Tel 01463 705882		
Trichinellosis	Samples will be referred by SMiRL, Glasgow to the Hospital for Tropical Diseases, London.	Clotted blood/serum [b]	-	RF-3
Trichomonas vaginalis (TV)	PCR – for challenging cases only where confirmatory testing is required.	Swab		RF-3
Trypanosomiasis	Microscopy	EDTA whole blood / CSF [f]	-	RF-3
	Samples will be referred by SMiRL, Glasgow to the Hospital for Tropical Diseases, London for serology testing.	Clotted blood/serum [b]	-	RF-3
Vancomycin-Resistant Enterococci (VRE)	Epidemiological typing – PFGE (must be agreed with laboratory prior to sending isolate)	Pure culture on an agar slope OR swab in transport medium	No TRT defined	RF-1

[a] Corneal scrapes should be sent in sample tubes containing specialised transportation buffer that are provided by the SMiRL, Glasgow. **Please phone 0141 242 9631 at least one week in advance of sampling if you require these tubes.**
[b] For serology testing, 5-10mls clotted blood is required (minimum 1ml clotted blood).
[c] For Giardia PCR testing, approximately 5ml liquid faeces or 5g semi-solid / solid faecal material should be forwarded **WITHOUT** any additives / fixatives.
[d] Only if confirmatory testing is required as SMiRL, Glasgow are not funded for first-line diagnostic parasite microscopy.
[e] For speciation only – first line diagnostic testing for malaria is performed by the local haematology laboratory.
[F] Samples must be examined within 24hrs (20mins for CSF).

Sample submission and transport

Sample labelling

Samples MUST be labelled with the following information:

Essential Information	Desirable Information
1. Patient's full name or unique coded identifier 2. DOB or CHI/Hospital unit number 3. Sender's Laboratory number (if appropriate)	1. Date & Time of sampling

Request form completion

SMiRL, Glasgow request forms are available to download from our website. A separate request form must be completed for EACH sample. Please use the latest version of the form and complete the forms in black or blue ink with the following information:

Essential Information	Desirable Information
1. Patient's full name or unique coded identifier 2. DOB 3. CHI/Hospital unit number 4. Investigation(s) required 5. Sender's address 6. Sender's laboratory number (if appropriate) 7. Clinical details including (where relevant) travel history, vaccination history and current antibiotic therapy 8. ACDP hazard group if known or suspected HG3	1. Date & Time of sampling 2. Patient's address 3. Practitioner's contact number especially if expecting an urgent result

It is the responsibility of the requester to ensure that samples are correctly labelled and forms completed to the standards detailed above. Failure to provide essential information may result in the specimen being discarded or a delay in receiving results.

Taking specimens in clinical areas

These are generic instructions for all samples:

- Confirm the identity of the patient
- Explain the procedure to the patient and obtain consent (as appropriate)
- Consent to treatment is the principle that a person must give permission before they

receive any type of medical treatment, test or examination. The principle of consent is an important part of medical ethics and international human right law. For full details refer to the NHS consent to Treatment webpage.

- Check that the specimen container is appropriate for the test
- Perform hand hygiene
- Take all required equipment to the patient
- After taking the sample ensure the sample container is sealed/secure
- Complete documentation near the patient
- Ensure the outside of the container is not contaminated (If so, either repeat the sample or clean the container with an alcohol wipe)
- Place the specimen in a sealed specimen bag for transport to the lab

Specimens for other laboratories

For samples / requests not listed in the test repertoire table above, please submit directly to the desired laboratory using individual request form for each test, according to the receiving laboratory website. Request forms are unique to each receiving laboratory and normally available from their website. NB samples for a limited number of parasite investigations (microsporidiosis, trichinellosis and trypanosomiasis) should be sent to SMiRL, Glasgow who will refer on to Hospital for Tropical Diseases, London, as outlined in the table.

Patient collected samples

Where patients are required to take their own samples they can be referred to the NHS website that provides advice on how samples should be taken: how should I collect and store urine & faecal samples.

Transport of Specimens

All samples must be appropriately packaged and transported in accordance with UN 3373 postal regulations. Please ensure samples are sent to SMiRL Glasgow without delay. For clinical samples, if unable to submit sample on day taken, please contact SMiRL Glasgow to discuss sample storage prior to submission. NB some samples e.g. whole blood for Filariasis and some samples for strongyloidiasis investigation should not be refrigerated following collection – refer to test repertoire table for more details.

Hazard Group 3 pathogens

To comply with UN 3373 regulations, SMiRL Glasgow must be NOTIFIED IN ADVANCE by telephone prior to the dispatch of any Hazard Group 3 (confirmed or suspected) organisms. Classification of organisms is available on HSE website. To ensure the safety of our staff request forms for work on isolates that presumptively fall into ACDP (Advisory Committee on

Dangerous Pathogens) Hazard Group 3 must be clearly marked to show the findings of the sending laboratory.

Urgent samples & outbreak investigations

Please contact the laboratory by telephone in advance with regards to urgent samples or samples that are part of an outbreak investigation.

Specimen Acceptance and Rejection Criteria

In order for the laboratory to deliver accurate and reliable results we require good quality samples. Upon receipt of each sample, the laboratory will assess its suitability with regards to the requested test. Samples will be discarded in all but exceptional circumstances if any of the following criteria are not met:

- The sample/form lacks essential information as detailed in the sample submission guidelines
- They have been stored or transported incorrectly
- An inappropriate sample type, sample container or preservative has been used
- They have leaked or become damaged or cross contaminated in transit
- An insufficient quantity has been supplied
- Mixed cultures detected upon subculture

Exceptions may be made for clinically critical or irreplaceable samples i.e. those which are difficult to repeat or produce e.g. CSF, BAL, aspirates, parasite/worm samples, theatre samples and post mortem samples. However, in this instance the requesting laboratory will assume full responsibility for any data derived from such specimens.

Requests for additional tests: time limits and specimen reception

If any additional requests are required on samples already submitted, please contact SMiRL, Glasgow to discuss. Original samples are normally retained for at least one month, and up to several years for certain specimens, though further testing may not be possible due to a number of factors, including volume constraints and sample deterioration. Where additional testing is possible, turnaround times will be according to those listed in the test repertoire table below and SMiRL,Glasgow will be able to advise on the feasibility of using the original sample or whether a new sample is required.

Laboratory expectations and requirements of service users

Service users are responsible for ensuring that all of the following points are met and they must:

- Provide a specimen/sample that is valid and of acceptable quality for testing
- The sample must be fully and correctly labelled before sending this to the laboratory.
- The sample container must be sealed in order to prevent spillage. Failure to do so may result in loss of sample.
- Use the correct containers. Specimens may be discarded if the wrong container is used, or if the specimen is leaking.
- Specimens/samples must be taken into the correct containers and be filled to the correct levels. The laboratory must be contacted if this cannot be done and they will advise as to whether alternatives would be acceptable.
- Specimens must be correctly packaged, preserved and transported in a timely manner to the laboratory for testing.
- Request forms must be completed correctly and include both patient and clinical details and any other information that will ensure that the correct tests are performed as required.
- If a specimen is urgent please telephone us in advance and arrange what tests are required, where and to whom the results have to be telephoned and to find out when to expect the results.
- Users should ensure the purity of isolates prior to sending.

Communication of results

All results are reported through the Telepath system, with paper reports posted to the sending laboratories. Reports are printed and dispatched every working day, Monday to Friday. Results of urgent samples or samples with diagnostic or epidemiological significance will also be telephoned as soon as they are verified.

Data protection

The laboratory adheres to Data Protection Law and holds all patient information in a secure manner. Staff complete Learnpro modules that cover all statutory and mandatory requirements relating to data protection.

SMiRL complies with the NHS Scotland information security policy when handling and processing personal data. The six Caldicott Principles apply to the use of confidential patient information within NHSGGC and when such information is shared with other organisations and between individuals, both for individual care and for other purposes. A list of the Caldicott Principles and more information on Caldicott Guidelines are available at:
https://www.informationgovernance.scot.nhs.uk/wp-content/uploads/2016/03/CaldicottGuardianManualScotland-June2012v2.pdf
Additional details on NHS GGC Data Protection are available at:
https://www.nhsggc.scot/patient-visitor-faqs/data-protection-privacy/

Laboratory statement to users:

Our duty to safeguard patient data has not changed and continues to be our priority. We have worked to make sure that these rights are properly implemented, however release of any data is through consent. Additionally any freedom of information requests are handled by the Microbiology & Virology Clinical Service Manager, the process is managed by the NHS GGC Central Legal teams which ensures that the request is appropriate and that all requests are dealt with confidentially.

The receipt of the sample to the laboratory infers that consent has been discussed with the patient.

Problems, complaints and service improvements

If any problems are encountered with the service or any matter for complaint arises, please contact a member of the laboratory management team by phone or by using the generic email provided (refer to Page 6 for contact details). All complaints will be recorded in Q-pulse and a full investigation carried out by an independent member of staff, and all complaints will receive a response from management. We encourage all forms of feedback, positive and negative, and use it to continuously improve our services.

Appendix 1 – Bacterial Respiratory Infections Service (BRIS)

Enhanced surveillance

BRIS typing and antimicrobial susceptibility data is important with regards to enhanced surveillance schemes such as MIDAS (Meningococcal Invasive Disease Augmented Surveillance) and SPIDER (Scottish Pneumococcal Invasive Disease Enhanced Reporting). Data from these schemes is used in epidemiological surveillance, vaccine policy development and evaluation of policy implementation. Further information can be found on the PHS website.

Streptococcus pneumoniae

All invasive isolates of *S. pneumoniae* should be submitted to BRIS, this is especially important from the under 5's as it provides intelligence data on pneumococcal vaccine effectiveness.

Pneumococcal isolates from respiratory samples will not be processed unless one of the following phenotypes:

a) Penicillin MIC ≥ 2mg/L
b) 3rd generation cephalosporin resistance MIC > 2mg/L
c) Resistance to vancomycin, teicoplanin, linezolid, levofloxacin or rifampicin

i.e. any respiratory isolates of pneumococci submitted and not meeting the above criteria will be rejected.

Haemophilus influenzae

Only invasive isolates of *H. influenzae* should be submitted. In addition, any isolates resistant to 3rd/4th/5th generation cephalosporins or any carbapenem **should also** be submitted. At present, BRIS is not characterising any fluoroquinolone resistant isolates so these **should not** be submitted.

Neisseria meningitidis

All invasive isolates of *N. meningitidis* should be submitted. BRIS will not routinely process non-invasive mucosal isolates; however throat swabs from patients where meningococcal infection is clinically suspected or confirmed will be accepted.

Streptococcus pyogenes (Group A Strep)

All group A streptococcal isolates from sterile sites should be submitted to BRIS for typing. Isolates from non-sterile sites may also be submitted if they are associated with a severe clinical presentation, such as streptococcal toxic shock syndrome (STSS) or necrotising fasciitis. In addition, the laboratory should be contacted with regards to all suspected or confirmed GAS outbreaks in acute health care or maternity settings and the isolates submitted for typing.

Detection of *N. meningitidis*, *S. pneumoniae* and *H. influenzae* DNA from clinical samples

A multiplex RT-PCR is available for the detection of *N. meningitidis*, *S. pneumoniae* and *H. influenzae DNA* from CSF, serum or whole blood (EDTA or other un-clotted sample). It is therefore very important that whole blood samples are sent to BRIS for PCR testing as such testing can provide diagnostic and additional typing information in the absence of a culture isolate.

Legionella referrals - Isolates of *Legionella spp.*

The laboratory welcomes submission of all suspected *Legionella* isolates from clinical and environmental sources for confirmation and surveillance purposes. Confirmation of species and serogrouping is performed by latex agglutination. Molecular techniques available include *mip* gene speciation and Sequence Based Typing (SBT).

Legionella urinary antigen testing

This test detects the presence of *Legionella pneumophila* Sg 1 antigen in the acute phase of Legionnaires' disease. Specimens should be collected as soon as possible after onset of symptoms, excretion of antigen usually continues for up to 2 weeks after onset. It should be noted that a negative result does not exclude infection with a *Legionella sp*. other than *L. pneumophila* serogroup 1. N.B. First line (diagnostic) samples will only be accepted from NHSGG&C. Samples from other health boards should be known positives requiring confirmation by BRIS.

Detection of Legionellae in clinical material

A RT-PCR assay screens for *Legionella* species and *Legionella pneumophila* in respiratory samples and has been adopted as definitive of a LD case in the UK. All samples submitted will be cultured to attempt isolation of *Legionella spp*.

Detection of Legionellae in environmental material

Please contact the laboratory to discuss testing requirements prior to sending any samples.

Enhanced surveillance of travel associated Legionnaires' disease

BRIS in association with PHS submits travel associated Legionnaires' disease cases to the International Health Regulations (IHR) National Focal Point (NFP) at the UK Health Security Agency (UKHSA). The UKHSA disseminates clinical and epidemiological information to IHR NFP colleagues & throughout the World Health Organisation (WHO) member states. Action is then taken by that member state which has been identified as the country of travel.

Bordetella pertussis referrals

As of June 2015, BRIS became the referring lab in Scotland for IgG pertussis toxin antibody detection in human serum by ELISA. A clotted blood or serum sample is preferred. Vaccination history should be known when interpreting results as the test cannot discriminate between antibodies produced by disease and those produced post vaccination.

Appendix 2 – MRSA Service (including Vancomycin Resistant Enterococci)

Gene detection (qRT-PCR)

Confirmation of methicillin and mupirocin resistance and detection of the *PVL* gene is performed using quadraplex real-time PCR (qRT-PCR). The genes detected are:

- *mecA*
- *mupA*
- Panton Valentine Leucocidin (*PVL*)
- *S. aureus* species specific *nuc*

Strain typing

1. **Spa typing** (***S****. aureus* **P**rotein **A**) is a single-locus sequence typing method, sequencing the polymorphic region X, used in the characterisation of *Staphylococcus aureus*. Isolates typed by this method include all European Antimicrobial Resistance Surveillance Survey (EARSS) blood isolates and those from suspected outbreaks or transmission events.

   Key factors affecting test performance

- <1% of isolates are non-typable, using the standard primer set, due to deletion of the entire protein A gene or genetic rearrangements with its IgG binding domain.

2. **Pulsed Field Gel Electrophoresis (PFGE)**

   PFGE analysis is available for the inter-strain comparison of, *S. aureus*, coagulase negative staphylococci (CNS) and enterococci, from suspected transmission events or outbreak situations. The laboratory must be consulted prior to sending isolates.

   Key factors affecting test performance

- Strains belonging to CC398 (Livestock associated lineage) are non-typable using *smaI* endonuclease due to DNA-methylation
- Single isolate with no suitable comparator
- DNA degradation
- Presence of autolytic enzymes

Additional tests on request

- ***mecC*** **PCR** for the detection of the *mecC* gene is available if suspected. This gene is closely linked to the Livestock associated lineage CC130 which accounts for 0.2% of annual submissions
- **BORSA** can be confirmed on isolates that are negative for the *mecA/C* genes and a raised oxacillin MIC.
- **Exfoliative toxins a and b** (eta/etb). Only tested if clinically suspected.
- **Toxic Shock Syndrome Toxin gene-1** (*tsst*). Only tested if clinically suspected

- **Enterotoxins** - *S. aureus* isolates from suspected cases of food poisoning can be screened for nine enterotoxin genes (A-E and G-J) and available upon request.
- ***Staphylococcus intermedius* group (SIG)** – Differentiation to species level by PCR

Appendix 3 – Enteric Bacterial Infections Service (EBIS)

Clostridium difficile Reference Service

DNA-based typing

All *C. difficile* isolates will be tested by PCR Ribotyping according to the methods developed by Dr. Jon Brazier at the Anaerobic Reference Laboratory in Cardiff.

Antibiotic susceptibility testing

All isolates are screened for resistance to a wide range of clinically relevant and epidemiologically important antimicrobials by E-Test. The results of metronidazole and vancomycin sensitivities will be included in the final report to the sending laboratory.

Isolate submission criteria

Isolates of *C. difficile* should be submitted to the Scottish *Clostridium difficile* Reference Service in the case of the following: -

1) Severe cases

- Admission to a healthcare facility for treatment of community associated CDI.
- Admission to ITU for treatment of CDI or its complications.
- Endoscopic diagnosis of pseudomembranous colitis (with or without toxin confirmation).
- Surgery for the complications of CDI (toxic megacolon, perforation or refractory colitis).
- Death within 30 days following a diagnosis of CDI where it is either the primary or a major contributory factor.
- Persisting CDI where the patient has remained symptomatic and toxin positive despite 2 courses of appropriate therapy.

2) Suspected outbreaks

When an outbreak is suspected and stools are positive for *Clostridium difficile* toxin. An outbreak of CDAD occurs when more cases of CDAD than would normally be expected occur in a clinical unit, ward or hospital.

3) Representative Surveillance – "*Clostridium difficile* Snapshot Programme"

The "*Clostridium difficile* Snapshot Programme" looks at less severe hospital cases and isolates that are possibly community acquired. The protocol for the programme is available at: https://www.nss.nhs.scot/publications/protocol-for-the-clostridioides-difficile-snapshot-programme/

Salmonella & Shigella

Whole Genome Sequencing

Serotype and MLST are derived using WGS data and will be included in the final report. Detailed strain comparison and cluster analysis is performed using core genome multilocus sequence typing (cgMLST) and single nucleotide polymorphism (SNP) analysis which is communicated with epidemiologists at Public Health Scotland and/or Scottish Rural Colleges and Animal and Plant Health Agency and can be readily compared with other national and international centres for the purposes of outbreak investigation.

Antibiotic resistance testing

All *Shigella spp.* and HG3/invasive *Salmonella spp.* isolates are tested for minimum inhibitory concentration (MIC) to ciprofloxacin and azithromycin using E-test. An inferred antimicrobial resistance profile is extracted from WGS data by interrogation against curated databases (ResFinder/GastroresistanceFinder) of known resistance genes. This information is used by Public Health Scotland for epidemiological purposes.

Shigella Identification

Rapid confirmation of *Shigella spp.* using Microbact, which may be useful as there are exclusion policies in place in schools/childcare/food producing establishments with regard to Shigella. Result can be reported back as an interim report or as a telephone report.

Appendix 4 – Diagnostic and Reference Parasitology Service (DRPS)

Acanthamoeba

Corneal tissue (scrapings) should be placed in the transport buffer supplied on request by SMiRL, Glasgow. There is no requirement to place contact lens or the contact lens solution into buffer prior to transportation – only corneal scrapes should be placed into buffer. For the safety of laboratory staff, please refrain from sending needles or scalpel blades.

Amoebiasis (see also *Entamoeba histolytica* / *dispar*)

Amoebic serology should be performed when invasive disease is suspected.

Cryptosporidium

All *Cryptosporidium*-positive faeces from the following three healthboards should be sent for surveillance purposes; NHS GGC, Borders and Grampian.

Laboratories within all other healthboards should only send faeces or DNA for molecular investigations a) if confirmatory testing is required, or b) from cases suspected to be part of an outbreak. If an outbreak is suspected, please notify the laboratory in advance of sending a sample(s) (Tel 0141 201 8667). All samples will be speciated. Only *Cryptosporidium parvum* samples will be fully sub-typed. *Cryptosporidium hominis* samples will only be sub-typed if requested by local Outbreak Control Teams / Public Health Scotland.

Faeces and urine for intestinal helminth and protozoa investigations

Primary testing of faeces and urines for parasites is performed by the local diagnostic microbiology laboratories. A minimum of three faeces should be examined (taken on day 1, 3 and 5 preferably). Only if a “parasite-like” object has been identified and confirmatory testing is required, should a sample be referred to SMiRL, Glasgow for examination.

Entamoeba histolytica / *Entamoeba dispar*

Only faeces reported by the diagnostic microbiology laboratory as being microscopy-positive for *Entamoeba histolytica* / *Entamoeba dispar* cysts should be referred to SMiRL, Glasgow where a molecular assay is used to differentiate *Entamoeba histolytica* (pathogenic) from *Entamoeba dispar* (non-pathogenic).

Enterobiasis

All samples requesting enterobiasis testing should be examined by the local diagnostic microbiology laboratory. Only if confirmatory testing is required, should samples be referred to SMiRL, Glasgow. A sellotape smear taken in the morning from the perianal skin and attached with the adhesive side facing downwards on a microscope slide is the optimum specimen for detecting *Enterobius vermicularis* ova. The tape must be clear, and the slide should be sent to

the laboratory in a suitable container. Alternatively, a swab may be taken from the perianal region, preferably before the individual showers in the morning, using a dry swab, or a swab in clear transport media (not charcoal).

Filariasis

A negative serology result does not exclude the diagnosis, particularly with onchocerciasis.

Giardiasis

A minimum of three stools (taken day 1, 3 and 5 if possible) should be examined by the diagnostic microbiology laboratory, and only forwarded to SMiRL, Glasgow if there is a high index of suspicion of giardiasis despite a negative microscopy. A Giardia PCR assay is available at SMIRL, Glasgow. Please note: Antibody detection for giardiasis is not deemed to be suitable and is therefore not available at SMiRL, Glasgow.

Hydatid disease

Positive serology results should be confirmed by non-serological means *e.g*. radiology, ultrasound, and microscopy.

Intestinal helminth and protozoa (excluding *Enterobius* spp.)

A minimum of three separate samples should be examined (taken on day 1, 3 and 5 preferably) by the local diagnostic microbiology laboratory, and only forwarded to SMiRL, Glasgow if confirmatory testing is required.

Leishmaniasis

Please inform the laboratory on 0141 242 9631 in advance if testing for leishmaniasis is required.

In suspected cutaneous leishmaniasis, please avoid the use of iodine when taking a skin biopsy as this can inhibit downstream PCR reactions.

Malaria (*Plasmodium* spp.)

If referring samples to SMiRL, Glasgow for confirmatory testing, please ensure a completed enhanced surveillance form is sent with the sample.

Schistosomiasis

Definitive diagnosis is by demonstrating the characteristic ova in clinical material. Only where a patient's serum is **positive** for schistosome antibodies, will three stools (taken day 1, 3 and 5) and the terminal portion of the first morning urine (approximately 20mls) be requested by the local infectious diseases specialists. Microscopy detection of ova in stool and urine samples is performed by the local microbiology laboratory whilst serology (antibody) testing is performed by SMiRL, Glasgow. The detection of ova from biopsy material (unfixed) *e.g*. rectum, sigmoid or bladder is also possible.

Appendix 5 – Satellite Antimicrobial Resistance Service

The Satellite Antimicrobial Resistance Service investigates resistance in healthcare associated bacterial pathogens, including confirmatory and reference testing for carbapenem resistant organisms and isolates with exceptional organism/antimicrobial resistance profiles.

RT-PCR for acquired carbapenemase genes

Real-time PCR is available for the detection of five acquired carbapenemase genes in Enterobacterales and non-fermenters (KPC, OXA-48, NDM, VIM and IMP). PCR for the detection of an additional four carbapenemase genes is performed on isolates of *Acinetobacter spp*. (OXA-23, OXA-24/40, OXA-51 and OXA-58). All isolates should be submitted on agar slopes.

modified Carbapenemase Inactivation Method (mCIM)

Performed on all Enterobacterales which are PCR negative for the 5 acquired carbapenemase genes listed above.

Broth Microdilution (BMD)

Performed on submitted isolates of Enterobacterales and non-fermenters. 32 agents are tested, and those with EUCAST interpretations are reported.

Colistin resistance

Any non-intrinsic Colistin resistance is investigated by whole genome sequencing. If any *mcr* genes, or other relevant genes are detected, this will be detailed on the reference laboratory report.

Referral criteria - as detailed on request form RF-6

Organism	Referral Criteria
Enterobacterales	Meropenem MIC >0.125 mg/L (carbapenemase confirmation)
	Temocillin MIC ≥64mg/L
	Ceftazidime-avibactam resistance
	Colistin resistance by commercial broth microdilution (excluding organisms with intrinsic resistance mechanisms
	Cefiderocol resistance
Acinetobacter spp.	Meropenem or Imipenem resistance
	Colistin resistance by commercial broth microdilution
Pseudomonas aeruginosa	Ceftolozane-tazobactam resistance MIC ≥4mg/L
	Colistin resistance by commercial broth microdilution
	Meropenem/imipenem AND ceftazidime AND piperacillin/tazobactam resistance