

NICD-NHLS QUICK REFERENCE GUIDE FOR THE LABORATORY DIAGNOSIS OF PRIORITY COMMUNICABLE DISEASES

Developed by:

**The National Institute for Communicable Diseases (NICD)
A division of the National Health Laboratory Service (NHLS)**

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**NATIONAL HEALTH
LABORATORY SERVICE**

NATIONAL INSTITUTE FOR COMMUNICABLE DISEASES

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Prefix and Disclaimer

This material is intended for use by healthcare professionals. While the greatest care has been taken in the development of the document, the National Department of Health and the National Institute for Communicable Diseases, of the National Health Laboratory Service, do not accept responsibility for any errors or omissions. All healthcare professionals should exercise their own professional judgement in confirming and interpreting the findings presented in the guidelines.

1. Introduction

Using this guide: This guide serves as a reference for laboratory staff and healthcare workers regarding priority communicable diseases. We provide a basic guide regarding specimen requirements, transportation and storage requirements, and available tests for a series of priority communicable diseases. In the event of occurrence of a specific disease, a more comprehensive guide with specific information on that communicable disease should be consulted. These are commonly available on the NICD-NHLS website (www.nicd.ac.za/?page=guidelines&id=73) and/or the Department of Health website (www.doh.gov.za), and further advice should be obtained from specialists in the field and/or the NICD-NHLS via the doctor on call (NICD Hotline: 082-883-9920) if needed.

Case investigation forms: Disease-specific case investigation forms and test request forms mentioned in this document may be found on the NICD-NHLS website (www.nicd.ac.za/?page=guidelines&id=73).

Notifications: All priority conditions herein are additionally notifiable medical conditions as per the South African national health regulations. Healthcare workers must notify all suspected cases to the relevant local Department of Health authorities, prior to laboratory diagnosis, to ensure a timely and adequate public health response.

General points on laboratory investigations: You should also alert the testing laboratory about specimens they will receive or need to refer. All tests requested, and clinical information, should be clearly stated on request forms to prevent incorrect/unnecessary tests being performed. Finally, many of the priority conditions listed have specific specimen submission/case investigation forms that must be completed and accompany specimens. Nevertheless, all specimens should be accompanied by the following minimum set of legible information:

- Patient's full name, surname, age and gender;
- Name and contact numbers of the attending health worker, hospital name and ward;
- Name and contact numbers (incl. cell phone) of key investigators (to facilitate communication of results and response);
- Clinical features and relevant history (e.g. date of illness onset, travel, insect bites, etc.);
- Specimen type; and,
- A clear test request.

Some practical advice for specimens referred to the NICD-NHLS:

- The NICD does not have a specimen collection service, but serves as a referral laboratory.
- Inform the specific NICD laboratory if you are sending an urgent specimen for testing of a priority communicable disease.
- Use a reliable courier for urgent specimens. Record the waybill/tracking number and communicate this to the appropriate laboratory for tracking purposes (contact details supplied in this document).
- After-hours specimens must be left at gate security, NOT at any other location inside the complex. Couriers will not be permitted onto the campus before 7h30 and after 16h00 on weekdays, and all hours over weekends/public holidays. Procedures are in place to keep the cold chain and record the chain of custody of the specimens after receipt at the main gate.

2. Acute Flaccid Paralysis or Polio (ICD-10 A80)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Poliovirus – Acute flaccid paralysis (AFP) or suspected polio	Two stools collected 24-48 hours apart and within 14 days of onset of paralysis. Where stools cannot be obtained, a rectal swab must be submitted for testing. See Appendix 1 for further details.	AFP or Polio	NICD Receiving Office 1 Modderfontein Rd., Sandringham, Gauteng, 2192 Inform NICD Receiving Office prior to sending to ensure correct sample transport and tracking: 011 386 6404 /6314 /6466	AFP case investigation form

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Virus Isolation	Maintenance of cold chain is recommended from collection to receipt at NICD. See the case investigation form and specimen collection guide for further details .	14 days	Enterovirus Section, Viral Diagnostic Unit, NICD-NHLS 011 386 6421/2

3. Anthrax (ICD-10 A22)

Instructions for Healthcare Workers:

In the event of a suspected deliberate anthrax exposure (bioterrorism or 'white powder' incident):

- Move away and do not attempt to collect or send powder or other suspicious material to the laboratory.
- Immediately review the [NICD-NHLS Healthcare Workers Handbook on Bioterrorism](#) Section 5.1 for details on the required response.

In the case of suspected clinical anthrax infections: human specimens should be sent to the Special Bacterial Pathogens Reference Unit. Please note: SBPRU must be notified that specimens are being sent.

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Bacillus anthracis (anthrax)	Depending on site affected. Safety precautions should be taken when handling all samples.		Special Bacterial Pathogens Reference Unit (SBPRU), NICD-NHLS 1 Modderfontein Rd., Sandringham, Gauteng, 2192 **Label outside of box with "Do not open. Suspected Anthrax."	SBPRU must be notified that specimens are being sent Standard NHLS specimen submission form
1. Cutaneous anthrax	Vesicular fluid from previously unopened vesicle or skin fluid from under edge of eschar should be obtained; submit 2x swabs in bacterial transport medium e.g. Cary-Blair. Make smears on slides to submit at same time.	Anthrax: microscopy and culture		
2. Inhalational Anthrax	Sputum / gastric washings Blood for culture	Anthrax: microscopy and culture Anthrax		
3. Gastro-intestinal anthrax	Blood for serology (paired serum taken 2-3 weeks apart) Blood for culture Blood for serology (paired serum taken 2-3 weeks apart)	Anthrax serology Anthrax Anthrax serology		
4. Anthrax meningitis	Blood for culture Blood for serology (paired serum taken 2-3 weeks apart) CSF	Anthrax Anthrax serology Anthrax: microscopy and culture		

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Anthrax - ELISA	SBPRU must be notified that specimens are being sent.	5 days	Special Bacterial Pathogens Reference Unit, NICD 011 555 0306 011 555 0331
Anthrax culture and confirmation		3 days	
Anthrax PCR			

4. Botulism (ICD-10 A05.1 / A48.5)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<i>Clostridium botulinum</i> (botulism)	Clotted blood (20 to 30 ml)	Botulinum investigation: anti-toxin assay, culture and confirmation	Special Bacterial Pathogens Reference Unit (SBPRU), NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192	Contact SBPRU or NICD Hotline immediately for advice prior to submitting any specimens Standard NHLS specimen submission form
	Serum (10 to 15 ml)			
	Stool (25 to 50 g)			
	Gastric washing			
	Vomitus			
	Suspected food			

In the event of a suspected deliberate exposure (bioterrorist attack): Consult the [NICD-NHLS Healthcare Workers Handbook on Bioterrorism](#) for details on the required response.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Botulinum – Anti-toxin assay	SBPRU must be notified that specimens are being sent. Transport specimens at 2-8°C	Up to 4 weeks	Special Bacterial Pathogens Reference Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192 011 555 0306 011 555 0331
Botulinum – Culture and confirmation			
Botulinum – PCR			

5. Cholera (ICD-10 A05.8)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p><i>Vibrio cholerae</i> O1</p> <p>Acute watery diarrhoea, with or without signs of dehydration</p>	<p>Stool specimen, or rectal swab if stool cannot be obtained.</p> <p>If stool specimen cannot be processed within 2 hours: use a cotton-tipped swab to sample stool specimen. Place swab with sampled stool in Cary-Blair transport medium. Submit both the initial container with stool and swab in transport medium to the lab. Transport refrigerated, do NOT freeze.</p> <p>See specimen collection guide for suspected cholera cases (Appendix 2)</p>	MCS including cholera	Local NHLS laboratory	Contact NICD Hotline to facilitate laboratory testing. Standard NHLS specimen submission form

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Primary identification, serotyping and antimicrobial susceptibility	Contact NICD Hotline to facilitate laboratory testing.	Liaise with local NHLS	Specimens should be referred to local/regional NHLS laboratory for primary identification.
Further identification and tests offered at NICD: <ul style="list-style-type: none"> Extended serotyping Antimicrobial susceptibility testing Screening for extended spectrum beta-lactamase (ESBL) Cholera enterotoxin detection via PCR Biotyping via PCR DNA fingerprinting of strains via PFGE analyses 	Culture isolates sent from other laboratories: Isolates subcultured onto Dorset transport medium, incubated at 37 degrees overnight at laboratory of origin, prior to submission to EDRU. Dorset slope to be kept at room temperature upon receipt at NICD.	1-4 days	Isolates to be referred to Enteric Diseases Reference Unit (EDRU), NICD-NHLS. Enteric Diseases Reference Unit, NICD-NHLS 011 555 0333 011 555 0334

6. Diphtheria (ICD-10 A36)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p><i>Corynebacterium diphtheriae</i> and rarely <i>Corynebacterium ulcerans</i> (Diphtheria)</p> <p>Local symptoms as a result of a non-invasive respiratory tract infection: include: a tough grey to white adherent membrane (pseudomembrane) on the tonsils, pharynx, and/or nasal cavity sore throat, problems swallowing, bloody watery drainage from the nose, drooling, hoarseness, croup-like cough, stridor, difficulty breathing or tachypnoea, enlarged lymph nodes in the neck, "Bull neck" appearance due to severe cervical lymphadenopathy and oedema of the anterior cervical tissues.</p> <p>Systemic symptoms due to secondary dissemination of the toxin through the bloodstream to other organs such as the heart, kidneys, and nervous system. Myocarditis is the most common potentially life-threatening complication.</p>	<p>Throat swabs: Rub vigorously over any membrane, white spots, or inflamed areas; apply slight pressure with rotating movement. If membrane is present, lift the edge and swab beneath it.</p> <p>Nasopharyngeal specimens: gently introduce the swab along the floor of the nasal cavity, under the middle turbinate until the pharyngeal wall is reached.</p> <p>Skin lesions: clean lesions with sterile normal saline and remove crusted material; press the swab firmly into the lesion.</p>	<p>Culture for diphtheria</p> <p>Toxin testing</p>	<p>Local laboratory for culture</p> <p>NHLS Green Point may accept referred samples for toxin testing, depending on the availability of antitoxin. Contact the laboratory to make enquiries prior to sending any specimens.</p> <p>Old City Hospital Complex, Portwood Road, Greenpoint, 8000. 021-417-9328 021-417-9344</p>	<p>Contact NICD Hotline to facilitate laboratory testing.</p> <p>Standard NHLS specimen submission form.</p>

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Culture	<p>Throat swabs are not routinely cultured so it is important to inform the laboratory that diphtheria is suspected. Observe infection prevention and control protocols when collecting and handling specimens, and send to the laboratory immediately. If transportation is likely to be delayed, consider using an appropriate transport medium such as Amie's gel medium. If the transit time will exceed 24 hours, the swab should be preserved in a special pack containing a desiccant such as silica gel.</p>	<p>Consult testing laboratory</p>	Local
Toxin testing			<p>NHLS Green Point Old City Hospital Complex, Portwood Road, Greenpoint, 8000. 021-417-9328 021-417-9344</p>

7. Legionellosis (ICD-10 A48.1)

Instructions for health care workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<i>Legionella pneumophila</i> (Legionellosis / Legionnaires' Disease) Flu-like illness, followed by a dry cough and frequently progresses to pneumonia	Urine	Legionella urinary antigen test (recommended)	<ul style="list-style-type: none"> NHLS Infection Control Services Laboratory NHLS Groote Schuur or <ul style="list-style-type: none"> NHLS Public Health Laboratory KZN 	Standard NHLS specimen submission form Contact testing laboratory prior to sending specimens. NHLS-ICSL Specimen submission form
	Blood	Blood culture for <i>Legionella</i> spp.		
Water testing for Legionella (to be done by Environmental Health Practitioners only)	Water as per EHP guidelines	Legionella	NHLS Infection Control Services Laboratory	

Laboratory test information:

Available tests	Special instructions	Turn-around time	Testing laboratory
Legionella urinary antigen	This is a rapid test that detects Legionella antigens in urine, and has very good sensitivity and specificity. This is the recommended diagnostic test.	Within a few hours	NHLS Infection Control Services Laboratory Wits Medical School, Level 3, Room 3T09 7 York Road, Parktown Johannesburg, 2193 Tel: 011-489-8579/80
Culture	Collect sputum, or lower respiratory tract secretions or blood or pleural fluid	10-14 days	NHLS Microbiology Laboratory (C18) Groote Schuur Hospital Main Road, Observatory, Cape Town, 7925 Tel: 021-404-4129 / 5137 NHLS Public Health Laboratory KZN 3rd Floor, 149 Prince Street, Durban, 4001. Tel: 021-417-9354 / 9355
Water testing / environmental studies	Vol: 1000ml, container: clean/new/sterile, transport temp: RT (if delivered the same day), rejected after: >72 hrs at RT	Liaise with testing laboratory	NHLS Infection Control Services Laboratory

Note: Other tests such as serology (IFA) and PCR are NOT recommended as first-line diagnostics tests for Legionellosis. A single positive serology result does NOT confirm active Legionella infection.

8. Measles (ICD-10 B05)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Measles	<p>Blood (5ml clotted or in EDTA tube)</p> <p>PLUS one of the following:</p> <ul style="list-style-type: none"> Nasopharyngeal/ throat swab in viral transport medium (VTM~3ml), OR Urine <p>Recommended swabs: Dacron tip and aluminium or plastic shaft or Virocult flocced swabs.</p> <p>Unsuitable swabs: wooden, cotton, calcium alginate swabs</p> <p>Samples should reach the laboratory within 3 days of collection</p>	Measles	Viral Diagnostics Unit (VDU), NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192	Measles Case Investigation Form

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Measles IgM and IgG EIA	Transport at 2-8°C. Maintenance of cold chain is recommended from collection to receipt at NICD.	7 days	Serology, VDU, NICD-NHLS 011 386 6398/6435
Measles PCR and sequencing to determine genotype (surveillance)	Transport at 2-8°C	14 days	Specialized Molecular Diagnostics Unit: Measles, NICD-NHLS 011 386 6343
Cell culture (surveillance)	Transport at 4°C. Sample should reach laboratory within 72hrs.	1 month	Virus Isolation, VDU-NHLS 011 386 6373

9. Pertussis (ICD-10 A37)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p><i>Bordetella pertussis</i> or <i>B. papapertussis</i> (pertussis)</p> <p>Disease typically manifests in 3 stages: a catarrhal stage with signs and symptoms of an URTI, the classical paroxysmal stage with a cough lasting >2 weeks, and a convalescent stage. In the paroxysmal stage, children may present with paroxysms of severe coughing, inspiratory whooping, and posttussive vomiting. Infants below 6 months-old, among whom severe morbidity & mortality risks are highest, present atypically with episodes of apnoea, cyanosis and gagging. Adults and adolescents, who constitute an important source of infection for non-immune infants, also present with atypical clinical manifestations such as mild LRTI with prolonged paroxysmal coughing. Additionally, pertussis should be considered in persons of all ages who are in contact with a known pertussis case.</p>	<p>Duplicate posterior nasopharyngeal swabs or aspirates</p>	Culture for <i>B. pertussis</i>	Local NHLS laboratory	Standard NHLS specimen submission form
		PCR for <i>B. pertussis</i>	NHLS Infection Control Services Laboratory or NHLS Groote Schuur	

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Culture PCR	<ul style="list-style-type: none"> Use Dacron or Rayon swab. Do not use calcium alginate swabs or cotton swabs as these inhibit PCR reactions and growth of <i>B. pertussis</i> for culture. The mode and timing of specimen collection, as well as rapid transport to the laboratory, are important for optimal yield of culture. Gently pass the swab through the nostril to the posterior nasopharynx. Do not force the swab; resistance will be felt when the posterior nasopharynx is reached. Rotate the swab and leave in place for 30 seconds or until the patient coughs. Inoculate the first swab immediately onto the surface of Regan-Lowe charcoal agar (obtain from local laboratory) at patients bedside. Repeat the procedure through the second nostril. Send swab in universal container for PCR. 	Liaise with testing laboratory	<p>Local NHLS Laboratory</p> <p>NHLS Infection Control Services Lab Wits Medical School, Level 3, Room 3T09 7 York Road, Parktown Johannesburg, 2193 Tel: 011-489-8579/80</p> <p>NHLS Microbiology Laboratory (C18) Groote Schuur Hospital, Main Road, Observatory, Cape Town, 7925 Tel: 021-404-4129 / 5137</p>

Notes:

- **PCR** is the most sensitive and, therefore, recommended for routine clinical diagnosis. PCR may remain positive in late disease and after receipt of antibiotic treatment. Results must be interpreted in conjunction with clinical features of disease.
- **Culture** is the gold standard, however sensitivity is variable – highest in the first 2 weeks (catarrhal phase) and is reduced in later stages and following antibiotic treatment.
- **Serology and direct fluorescent antibody tests** are not recommended for routine diagnosis. These tests have poor sensitivity and specificity (giving false negatives and false positives) and no local cut-offs are available to interpret serology results.

10. Meningococcal Disease (ICD-10 A39)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<i>Neisseria meningitidis</i>	Dependent on clinical presentation:		Local NHLS laboratory. Specimens may be referred to a regional NHLS laboratory depending on capacity at the local level.	Standard NHLS specimen submission form
1. Meningitis	CSF	MCS, Latex agglutination (where indicated)		
	Blood	Blood culture		
2. Septicaemia	Blood	Blood culture		
3. Focal infections (e.g. septic arthritis, pneumonia)	Blood	Blood culture		
	Other specimens (e.g. synovial fluid, peritoneal / pericardial fluid, sputum)	MCS		
4. Conjunctivitis	Blood	Blood culture		
	Conjunctival swab	MCS for suspected meningococcus		
5. Petechial rash	Blood	Blood culture		
	Skin lesion biopsy (Note: this is not a sensitive test but may be helpful if positive)	Gram stain and culture		

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Primary identification of <i>Neisseria meningitidis</i> , latex agglutination, susceptibility testing	Refrigeration preferred but not essential.	Liaise with local lab	Local NHLS laboratory
Further identification of <i>Neisseria meningitidis</i> - isolates submitted to NICD for national surveillance (GERMS-SA):	Isolates on Dorset transport medium inoculated as per NIC0184. No refrigeration required. Do not batch, as isolates will lose viability.	2 days	RMPRU, NICD-NHLS
Antimicrobial susceptibility testing (disc and minimum inhibitory concentration - MIC) - as part of surveillance or to confirm results		2 days	011 555 0315
Pulsed-field gel electrophoresis (PFGE) - Outbreak investigation/ molecular epidemiology		1 week	011 555 0317
Multilocus sequence typing (MLST) - Molecular characterization		3 days	
Serotyping/serogrouping (slide agglutination) - routine surveillance, or to assess vaccine response, or guide meningococcal vaccine use		2 days	
Polymerase chain reaction (PCR) for identification - culture-negative specimens	Whole blood, clotted blood (serum), unclotted EDTA blood, CSF. Refrigeration preferred but not essential	1 day	
PCR for serotyping/serogrouping - culture-negative specimens		1 day	

11. Plague (ICD-10 A20)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request		Send to	Forms to complete
		Sample collection	Tests to request		
1. Bubonic plague <i>Yersinia pestis</i> (plague)	Dependent on clinical presentation. Safety precautions should be taken when handling samples.			Special Bacterial Pathogens Reference Unit (SPBRU), NICD-NHLS, 1 Modderfontein Rd, Sandringham, Johannesburg, 2192 * Label outside of box with "Do not open. Suspected Plague"	Contact SBPRU or NICD Hotline immediately for advice prior to submitting any specimens. Standard NHLS specimen submission form.
	Bubo aspirate plus 2x swabs in bacterial transport media (e.g. Cary-Blair). Absorb a few drops of sample on a sterile swab.	Plague investigation (microscopy, culture and confirmation)			
	Blood for serology (paired serum taken 2-3 weeks apart)	Plague serology			
2. Septicaemic plague	Blood culture bottle	Plague investigation (microscopy, culture and confirmation)			
	Blood for serology (paired serum taken 2-3 weeks apart)	Plague serology			
3. Pneumonic plague	Sputum plus 2x swabs in bacterial transport media (e.g. Cary-Blair)	Plague investigation (microscopy, culture and confirmation)			
	Blood culture bottle	Plague investigation (microscopy, culture and confirmation)			
	Blood for serology (paired serum taken 2-3 weeks apart)	Plague serology			
4. Other manifestations (e.g. meningitis, pharyngitis)	Blood for culture	Culture for plague			
	Blood for serology	Plague serology			
	CSF, pharyngeal swab, etc.	Plague investigation (microscopy, culture and confirmation)			

In the event of a suspected deliberate exposure (bioterrorist attack): Consult the [NICD-NHLS Healthcare Workers Handbook on Bioterrorism](#) for details on the required response.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Plague - ELISA	SBPRU must be notified that specimens are being sent.	2 days	Special Bacterial Pathogens Reference Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192 011 555 0306 011 555 0331
Plague - culture and confirmation		5 days	
Plague - DFA		2 days	
Surveillance plague - ELISA		21 days	

12. Rabies disease in humans (ICD-10 A82)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Rabies <ul style="list-style-type: none"> Furious rabies: hallucinations, agitation, hydrophobia, bizarre behaviour, encephalitis Paralytic rabies: ascending flaccid paralysis <p>A history of animal exposure may provide insight. Accurate dates of exposure, onset and progression of disease are vital in our investigation.</p> <p>Post-vaccination antibody titre measurement</p>	Saliva (ante-mortem, most sensitive)	Rabies	Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd, Sandringham, Gauteng, 2192	Contact NICD Hotline immediately for advice prior to submitting specimens. Refer to the Rabies Specimen Collection Guide for information and complete the NICD Suspect Rabies Case History Form.
	CSF (not preferred but co-submit with other specimens if available)			
	Nuchal biopsy (ante- or post-mortem)			
	Brain specimen (post-mortem)			
	Blood/serum for serology (not sensitive but may co-submit with other specimens)			
	Blood/serum for serology	Rabies antibody		Standard NHLS specimen submission form for clinical specimens.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Serology: fluorescent antibody test, post-vaccination antibody titre determination	Blood tubes sealed in plastic bags, and labelled biohazardous. Store and transport at 4 °C (or on ice packs).	24-48 hours	Special Pathogens Unit, NICD-NHLS 011 386 6339/6376
Serology: fluorescent antibody test, clinical cases		24-48 hours	
Virus isolation: ante-mortem	At least 200 ul in plastic screw top containers, packaged in secondary container; label as biohazardous and for rabies investigation. Address to Special Pathogens Laboratory; contact laboratory, and store and transport at 4 °C (or on ice packs).	3 weeks	
PCR: ante-mortem		24-48 hours	
Virus isolation: post-mortem	Whole, half or cubes of representative regions of brain submitted in 50 % glycerol-saline in plastic screw top containers. Label as biohazardous, store and transport at 4 °C (or on ice packs).	3 weeks	
PCR: post-mortem (only performed if antigen detection is not conclusive)		24-48 hours	
Antigen detection (fluorescent antibody test): post-mortem		24-48 hours	

Note: Testing of a full repertoire of specimens (i.e. saliva, CSF, nuchal biopsy, post-mortem brain biopsy, blood/serum) is recommended to conclusively confirm or rule out rabies. Testing of repeat saliva specimens is also required as virus is shed intermittently in this body fluid. Serology is generally not very sensitive for diagnostic use.

13. Rift Valley fever (ICD-10 A92.4)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p>Rift Valley fever (RVF) virus</p> <p>Fever with flu-like symptoms (including myalgia, arthralgia or headache), neck stiffness, sensitivity to light (photophobia), pain behind the eyes, loss of appetite and vomiting. Complications may include ocular (retinal) disease, meningoencephalitis, hepatitis, or haemorrhagic fever. Direct contact with tissues/fluids of sick/dead ruminant animals is considered a major risk factor.</p> <p>Accurate dates of exposure, onset and progression of disease is vital in our investigation.</p>	Blood: Clotted blood or serum (red/yellow top tube)	RVF	Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192	<p>NICD RVF suspected case investigation form</p> <p>Refer to the Healthcare Workers Handbook on RVF for further information.</p> <p>Contact NICD hotline for suspected RVF cases with haemorrhage/encephalitis.</p>

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Serology HAI	Package as biohazardous material, stored and transported at 4°C.	5 days	Special Pathogens Unit, NICD-NHLS 011 386 6376 011 386 6339
IgM ELISA		2-4 days	
PCR		24-48 hours	
Virus isolation		18 days	

Note: Conducting a full repertoire of serological and virological tests is strongly recommended. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, testing of acute and convalescent specimens are strongly recommended to confirm/exclude RVF diagnosis.

Similar laboratory procedure for other arboviruses, including: chikungunya, dengue, West Nile, yellow fever and Sindbis

14. SARS (Provisional ICD-10 U04.9)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p>SARS coronavirus High fever (temp > 38°C) with other symptoms that may include headache, an overall feeling of discomfort and body aches. Some people also have mild respiratory symptoms at the outset. 10-20% of patients have diarrhoea. After 2-7 days, SARS patients may develop a dry cough. Most patients develop pneumonia.</p>	Nasopharyngeal/ oropharyngeal swabs	SARS	Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192.	Contact NICD Hotline for advice and to facilitate laboratory testing.
	Recommended swabs: Swabs with Dacron tip and an aluminium or plastic shaft OR Virocult flocced swabs			
	All swabs must be placed into VTM (viral transport medium) to preserve the virus particles			
	Stool			
	Clotted blood for serology			

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
PCR	Observe appropriate infection prevention and control protocols when collecting and handling specimens.	Liaise with Special Pathogens Unit	Special Pathogens Unit, NICD-NHLS 011 386 6339/6376
ELISA IgM and IgG	Package as biohazardous material, and store and transport at 4°C.		

15. Smallpox (ICD-10 B03)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Smallpox virus Fever, malaise, head and body aches, vomiting, pustular rash.	Cutaneous lesion scabs OR pustule fluid	Smallpox	Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192 Specimens referred to US CDC for further testing.	Contact NICD Hotline for advice and to facilitate laboratory testing.

Note: Smallpox was declared eradicated in 1980 (i.e. the virus does not circulate anymore); however, it is considered a risk for use as a biological warfare agent. In the event of a suspected deliberate exposure (bioterrorist attack): Consult the [NICD-NHLS Healthcare Workers Handbook on Bioterrorism](#) for details on the required response.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
PCR	Observe appropriate infection prevention and control protocols when collecting and handling specimens.	Liaise with Special Pathogens Unit	Special Pathogens Unit, NICD-NHLS 011 386 6339/6376

16. Typhoid Fever (ICD-10 A01.0)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Salmonella Typhi 1. Enteric fever	Dependent on case presentation and history	Culture for typhoid	Local NHLS laboratory. Specimens may be referred to a regional NHLS laboratory depending on capacity at the local level. NICD-NHLS, Enteric Diseases Reference Unit (EDRU), will verify the isolate where possible, and can perform molecular tests (PCR) when urgent confirmation/diagnosis is required.	Standard NHLS specimen submission form for clinical specimens. For case investigations, complete NICD typhoid fever case investigation form .
	Blood for culture* Bone marrow aspirate Stool (or rectal swab if stool cannot be obtained)			
2. Extraintestinal complications (e.g. endocarditis, pneumonia, meningitis, arthritis, focal abscesses)	Blood			
	Focal infections: submit appropriate specimen (e.g. sputum, CSF, synovial fluid, pus)			

*Blood culture is the diagnostic test of choice for acute cases of typhoid fever.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Primary identification, serotyping and antimicrobial susceptibility	If stool specimen cannot be processed within 2 hours: use a cotton-tipped swab to sample stool specimen. Place swab with sampled stool in Cary-Blair transport medium. Submit both the initial container with stool and swab in transport medium to the lab. Transport refrigerated, do NOT freeze.	Liaise with local lab	Local NHLS laboratory
Further identification	For stool / rectal swab specimens: see note above. Culture isolates sent from other laboratories: Isolates subcultured onto Dorset transport medium incubated at 37 degrees overnight at source laboratory, prior to submission to EDRU. Dorset slope to be kept at room temperature upon receipt at NICD	2-3 days	Enteric Diseases Reference Unit (EDRU), NICD-NHLS 011 555 0333 011 555 0334
Extended serotyping		5-7 days	
Antimicrobial susceptibility testing		2-3 days	
PCR		1 day	
DNA fingerprinting of strains via PFGE analyses		4 days	
DNA finger printing of strains via MLVA		2 days	

Note: Serological testing (the Widal test) is NOT recommended due to the low sensitivity and specificity of this test. Suspected typhoid fever cases should have appropriate specimens submitted for culture as detailed above.

17. Viral Haemorrhagic Fevers (ICD-10 A96)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p>Viral haemorrhagic fevers</p> <p>Fever, headache, arthralgia, myalgia, rash, haemorrhagic manifestations, gastrointestinal symptoms, pathology lab indicators (including thrombocytopenia, raised liver transaminases). Recent travel and exposure events (e.g. contact with animals, bats, tick bites, sick patients) may provide insight.</p> <p>Accurate dates of exposure, onset and progression of disease are vital in our investigation.</p>	<p>Blood: Clotted blood (red/yellow top tube) and EDTA blood (purple top tube)</p> <p>Other specimens where indicated e.g. CS, liver biopsies in post mortem cases.</p>	VHF	<p>Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192</p>	<p>All cases to be notified to the NICD Hotline. Cases will be referred accordingly.</p> <p>Complete the NICD VHF Test Request Form</p>

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Serology: fluorescent antibody test, IgG and IgM	Institute immediate infection prevention and control measures.	24-48 hrs	<p>Special Pathogens Unit, NICD-NHLS 011 386 6339/6376</p>
Serology: ELISA, IgG and IgM	Package as biohazardous material, and store and transport at 4°C.	3-5 days	
PCR		24-48 hrs	
Virus isolation		3 weeks	

Note: Conducting a full repertoire of serological and virological tests is mandatory. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, multiple specimens are required to confirm/exclude diagnosis.

Infection prevention and control for viral haemorrhagic fevers:

Comprehensive documents detailing the necessary precautions and appropriate infection control practice can be accessed as follows:

- Reference guide for healthcare workers: WHO Infection Control for viral haemorrhagic fevers in the African health care setting: <http://www.who.int/csr/resources/publications/ebola/WHO EMC ESR 98.2 EN/en/>
- Reference guide for laboratory staff: Q-Pulse, document number GPL 0890 (Infection Control Services Laboratory, Johannesburg) and GPL 0947 (Virology Laboratory, Groote Schuur Hospital).

18. Viral Hepatitis (ICD-10 B15-19)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Hepatitis A virus	Blood: Plasma in EDTA tube or ACD tube, and/or serum (SST tube)	HAV IgM	Local NHLS laboratory	Standard NHLS specimen submission form
Hepatitis B virus		sAg, sAb, cIgM, total core Ab, eAg, eAb		
Hepatitis C virus		HCV Antibody		

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory		
HAV IgM	4°C to room temperature, minimum 1500µl plasma	Performed at all regional and provincial laboratories: liaise with individual laboratory	Local NHLS laboratory		
sAg, sAb, cIgM, total core Ab, eAg, eAb					
HCV Antibody					
HBV PCR					
HBV viral load					
HBV genotyping					
HCV PCR				10 days	Specialized Molecular Diagnostics Unit, NICD-NHLS 011 386 6439
HCV genotyping				15 days	
HCV viral load				10 days	

19. Yellow Fever (ICD-10 A95)

Instructions for Healthcare Workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
<p>Yellow fever virus (an arbovirus)</p> <p>Rash, arthralgia, myalgia, fever, encephalitis, travel history/insect bites Travel to yellow fever areas without pre-travel vaccination. Patients are exposed through mosquito bites.</p>	<p>Clotted blood and serum</p> <p>Other specimens where indicated: CSF, liver biopsies in post-mortem cases.</p>	Yellow fever	Special Pathogens Unit, NICD-NHLS, 1 Modderfontein Rd., Sandringham, Gauteng, 2192.	Standard NHLS specimen submission form.
Post-vaccination yellow fever antibodies	Clotted blood and serum	Yellow fever antibodies		

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Serology: HAI	Observe appropriate infection prevention and control protocols when collecting and handling specimens. Package as biohazardous material, and store and transport at 4 °C (or on ice packs).	5 days	Special Pathogens Unit, NICD-NHLS 011 386 6339/6376
IgM Elisa/IgA		2-4 days	
PCR		24-48 hours	
Virus isolation		18 days	

Note: Conducting a full repertoire of serological and virological tests is strongly recommended. Test results are highly dependent on timing of specimen collection in relation to disease onset; therefore, testing of acute and convalescent specimens is strongly recommended to confirm/exclude yellow fever diagnosis.

Testing of post-vaccination antibodies is usually not indicate but is often requested for travel clearance purposes. Vaccinated patients may not necessarily develop detectable antibody response and there are not standard antibody cut-offs that indicate immunity. Yellow fever vaccination should be repeated in travellers to endemic countries every 10 years and recorded on vaccination cards.

20. Clusters (outbreaks) of Gastrointestinal Disease/Foodborne Disease

Investigations should be initiated in the event of 2 or more linked cases of gastroenteritis or foodborne illness. Department of Health or NICD foodborne illness [case investigation forms](#) should be completed. A [line list](#) should additionally be completed for all investigations. Refer to the NICD-NHLS [Handbook for Diagnosis of Foodborne Illness Outbreaks](#) and the NICD [Quick Reference Guide for Investigation of Foodborne Disease Outbreaks](#) for further information. Samples of the implicated food/beverage AND clinical human samples (i.e. stool, rectal swabs and/or vomitus) should be collected for all outbreaks when possible, and ALL samples collected should be referred to the [designated NHLS Public Health Laboratory](#).

20.1. Bacterial identification (human specimens)

Instructions for healthcare workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Bacterial pathogens	<u>Vomiting</u> : vomitus / gastric contents	Foodborne illness investigation	Specimens must be referred to the designated Public Health Laboratory for specialised testing (see contact details below)	Clinical specimens: standard NHLS specimen submission form, clearly stating 'foodborne illness investigation'.
	<u>Diarrhoea</u> : stool specimen, or rectal swab if stool cannot be obtained. If stool specimen cannot be processed within 2 hours: use a cotton-tipped swab to sample stool specimen. Place swab with sampled stool in Cary-Blair transport medium. Submit both the initial container with stool and swab in transport medium to the lab. Transport refrigerated, do NOT freeze.			
	<u>Fever</u> : blood culture and serum			
	<u>Environmental isolates</u> in water/food-borne disease outbreaks only.			
	<u>Neurological features</u> : serum, stool and vomitus/gastric contents			
		Botulism		

When enteric pathogens (such as *Salmonella* spp.) are cultured, we request that isolates are referred to the Enteric Diseases Centre, NICD for further characterisation. This will enable the detection of widespread foodborne illness outbreaks, in addition to fully characterising local outbreaks.

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Microscopy, culture and antimicrobial susceptibility (MC&S)	Transport refrigerated, do NOT freeze.	Liaise with lab	Designated NHLS Public Health Laboratory
Bacterial toxin detection			
Diarrhoeagenic <i>E. coli</i> : Identification	Isolates sub-cultured onto Dorset transport medium incubated at 37°C overnight at source laboratory, prior to submission to EDRU	2-3 days	Enteric Diseases Reference Unit (EDRU), NICD-NHLS 011-555-0333/4
Diarrhoeagenic <i>E. coli</i> : Extended serotyping		5-7 days	
Diarrhoeagenic <i>E. coli</i> : Virulence gene identification via multiplex PCR		2 days	
Diarrhoeagenic <i>E. coli</i> : DNA fingerprinting of strains via PFGE analyses		4 days	
<i>Salmonella</i> and <i>Shigella</i> : Identification		2-3 days	
<i>Salmonella</i> and <i>Shigella</i> : Extended serotyping		5-7 days	
<i>Salmonella</i> and <i>Shigella</i> : DNA fingerprinting of strains via PFGE analyses and MLVA.		4 days	
Botulism testing	Transport refrigerated, do NOT freeze.	Liaise with lab	Special Bacterial Pathogens Reference Unit, NICD-NHLS, 011-555-0306/31

20.2. Viral identification

Tests for viral pathogens that may be the cause of foodborne illness incidents are not routinely performed, and these need to be requested specifically through liaison and discussion with the Viral Gastroenteritis Unit and the Outbreak Response Unit, NHLS-NICD.

Instructions for healthcare workers:

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Adenovirus type 40/41, astrovirus, enteric adenovirus, norovirus, rotavirus: Diarrhoea, vomiting, fever	Stool (note, rectal swabs are unsuitable specimens)	Viral gastroenteritis	Viral Gastroenteritis Unit, NICD-NHLS.	NICD Viral Gastroenteritis Unit Specimen form.
	Throat swab (in viral transport medium)	Adenovirus	Virus Isolation, NICD-NHLS	Standard NHLS specimen submission form for clinical specimens.
	Urine			
	Stool			
Adenovirus: RTI, haemorrhagic cystitis, gastroenteritis	Conjunctival swab (in viral transport medium),			
	Respiratory specimens: tracheal aspirate, nasopharyngeal aspirate, broncho-alveolar lavage, etc.			
	Stool specimen (or rectal swab in viral transport medium if stool cannot be obtained)	Enterovirus	Specialised Molecular Diagnostics Unit (SMDU), NICD-NHLS.	
Echovirus: 1. Diarrhoea, vomiting, fever	CSF in case of meningitis/ encephalitis	Enterovirus/ encephalitis		
	Stool specimen (or rectal swab in viral transport medium if stool cannot be obtained)			
	Throat swab (in viral transport medium)			
Adenoviridae, Astroviridae, Birnaviridae, Caliciviridae, Coronoviridae, Picornaviridae, Reoviridae: Gastroenteritis, AFP	Stool	Viral gastroenteritis	Electron Microscopy Unit, NICD-NHLS	

Laboratory test information:

Available tests	Special Instructions	Turn-around time	Testing laboratory
Shell vial culture	Transport at 4°C. Sample should reach laboratory within 72hrs	5 days	Virus Isolation, NICD-NHLS 011-386-6420/22
Adenovirus type 40/41 detection – ELISA	Store and transport at 4°C. Maintenance of cold chain is recommended from collection to receipt at NICD	Liaise with lab	Viral Gastroenteritis Unit, NICD-NHLS. 011-555-0370
Astrovirus, enteric adenovirus, norovirus – real-time PCR			
Rotavirus detection – ELISA/dipstick, real-time PCR		21 days	
Virus Isolation		5 days	Specialised Molecular Diagnostics Unit, 011 386 6330 or 011 386 6439
Enterovirus detection – real-time PCR			Electron Microscopy Unit, NICD-NHLS. 011-386-6318
Viral screening (negative staining with 2% PTA).	Refrigerated transport. May be dried smear on slide. Tests can't be used for initial diagnosis.	3.5hrs	

20.3. Environmental Sampling: Food, Milk and Water Testing

Contact the Public Health Laboratory for instructions on specimen collection and submission. Sampling should be systematic, and should cover as wide a range as possible. Where possible, different types of foods must be placed in separate containers. The quantity of food taken must be sufficient. An environmental health practitioner must notify the owner/manager at the food production/catering facility that samples need to be taken (provide a reason). Samples for microbiological analysis must be collected with decontaminated equipment (immerse equipment in 70% alcohol and flame using a portable spirit burner until alcohol evaporates, allow cooling before using).

Instructions for Environmental Health Practitioners (and other health authorities):

Pathogen, clinical symptoms & comments	Sample collection	Tests to request	Send to	Forms to complete
Food- and water-borne pathogens	Food: Vol: 100g (container full), Container: sterile, transport temp: 2 - 8 deg C, rejected after: >48 hours at room temperature (RT)	Liaise with testing laboratory	Designated NHLS Public Health Laboratory	See Section 20.4 for the designated Public Health Laboratory Submission Forms.
	Milk: Vol: 100ml, container: original/ sterile, transport temp: 2 - 8 deg C, rejected after: >24 hrs at RT			
	Water (potability): Vol: 120ml, container: sterile, transport temp: 2 - 8 deg C, rejected after: >24hrs at RT			
	Water (Salmonella spp., V. cholerae, etc.): Vol: 1000ml for each test, container: clean /new / sterile, transport temp: RT (if delivered the same day), rejected after: >48hrs at RT			

Table: Testing of clinical and environmental specimens by specialised laboratories for food- and waterborne outbreaks

Laboratory	NHLS-ICSL		NHLS Port Elizabeth		NHLS Public Health, KZN		NHLS Green Point	
	Clinical ¹	Env ²	Clinical ¹	Env ²	Clinical ¹	Env ²	Clinical ¹	Env ²
<i>Salmonella</i> spp.	✓	✓	✓	✓	✓	✓	✓	✓
<i>Shigella</i> spp.	✓	✓	✓	✓	✓	✓	✓	✓
<i>E. coli</i> O157	✓	✓	✗	✓	✓	✓	✗	✗
<i>Bacillus cereus</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Clostridium perfringens</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Campylobacter</i> spp.	✓	✓	✗	✓	✓	✓	✗	✗
<i>Listeria monocytogenes</i>	✓	✓	✗	✓	✓	✓	✗	✗
<i>Staphylococcus aureus</i>	✓	✓	✓	✓	✓	✓	✓	✓
<i>Vibrio</i> spp.	✓	✓	✓	✓	✓	✓	✓	✓
Bacterial toxins ³	✓	✓	✗	✓	✓	✓	✗	✗

¹ Clinical specimens: stool, vomitus. ² Environmental specimens: food, water, milk. ³ *S. aureus* and *B. cereus* enterotoxin tests from isolates. *C. perfringens* enterotoxin from stools and isolates

20.4. Contact details for gastrointestinal disease outbreaks

It is essential for public health officials / healthcare workers investigating foodborne illness outbreaks to notify the NHLS staff when specimens are collected as part of an outbreak. ALL specimens collected should be referred to one of the designated public health laboratories:

Table: Designated NHLS Public Health Laboratories contact details and tests offered

* Provinces referring to designated public health laboratory	Laboratory	Address	Contact Person	Tests offered
1 Gauteng Limpopo Mpumalanga Northern Cape Free State	NHLS Infection Control Service Laboratory (ICSL), Johannesburg Public Health Sample Submission Form	Wits Medical School, Room 3T09, 7 York Rd, Parktown, Johannesburg, 2193.	Mr. Rob Stewart Tel. 011-489-8578/9 or 011-717-2496	Full range of foodborne pathogen tests offered
2 KwaZulu Natal	NHLS Public Health Laboratory KZN Public Health Sample Submission Form	3rd Floor, 149 Prince Street, Durban, 4001.	Mr. Leon Taylor / Ms Indrani Chetty Tel: 031-327-6743 / 6752	** Foodborne pathogens: Testing for <i>E. coli</i> O157, <i>Campylobacter</i> spp., <i>Listeria monocytogenes</i> , & Bacterial toxins is referred to NHLS-ICSL.
3 Western Cape	NHLS Public Health Laboratory, Green Point Public Health Sample Submission Form	Old City Hospital Complex, Portwood Road, Greenpoint, 8000.	Mr. Johann Steyl / Ms Annette Heydenrych Tel: 021-417-9354 / 9355	
4 Eastern Cape	NHLS Public Health Laboratory, Port Elizabeth Public Health Sample Submission Form	Corner of Buckingham and Eastborne Road, Mount Croix, Port Elizabeth, 6000.	Ms Vanessa Pearce Tel: 041-395-6174	

* Samples / specimens may also be transported directly to the NHLS-ICSL for testing; ** Public Health Laboratories to refer to NHLS-ICSL, Johannesburg

Healthcare workers and laboratory staff may additionally utilise the following contact points for discussion of cases/outbreaks if needed:

- **NICD Hotline:** 082-883-9920 (for use by healthcare professionals only)
- **NICD Division of Surveillance, Outbreak Response and Travel Health:** Ms Charlene Jacobs: 011-555 0541, charlenej@nicd.ac.za; Dr. Ayanda Cengimbo: 011-555-0541, ayandac@nicd.ac.za; Mr. Brett Archer: 011-386-6354, bretta@nicd.ac.za;
- **NHLS Infection Control Services Laboratory (ICSL):** Mr. Rob Stewart: 011-489-8578/9 or 011-717-2496, rob.stewart@nhls.ac.za
- **NHLS Public Health Laboratory KZN :** Mr. Leon Taylor: 031-327-6743, leon.taylor@nhls.ac.za
- **NHLS Public Health Laboratory Green Point:** Mr. Johann Steyl: 021-4179354, johan.steyl@nhls.ac.za
- **NHLS Public Health Laboratory Port Elizabeth:** Ms Vanessa Pearce: 041-395-6174, vanessa.pearce@nhls.ac.za