Food and Water Borne Diseases

CHOLERA

Internationally notifiable:	**Yes**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Report to the World Health Organization/Pan American Health Organization in accordance with the International Health Regulations.

Overview

Cholera continues to be a global public health threat, causing millions of infections and thousands of deaths annually. It is typically linked to poor sanitation and inadequate access to clean water. In the Caribbean region where cholera was not known to be endemic the most recent outbreak occurred in Haiti and spread to the Dominican Republic starting in October 2010.

Cholera is an acute bacterial enteric disease caused by infection with *Vibrio cholerae* of the serogroups O1 or O139. These pathogens are transmitted through the ingestion of water or food contaminated directly or indirectly with faeces or vomitus of infected persons.

The El Tor biotype of *Vibrio cholerae* serogroup O1 causes a high infection to case ratio and can survive for long periods as a free-living organism in the environment e.g. in fresh water, salt water, human waste and sewage. This ability to survive in the ecosystem after clinical cases have ceased occurring, constitute a potential for causing future outbreaks and has implications for surveillance activities.

Clinical presentation

The incubation period can range from 12 hours to 5 days. In its severe form the illness is characterized by the acute onset of copious watery, non-bloody diarrhoea with or without vomiting. Untreated, it results in rapid dehydration, metabolic disturbances and circulatory collapse leading to death.

Mild cases and asymptomatic infections are more common than the classical clinical illness, and this is an important consideration in the surveillance of travellers from infected areas. For unknown reasons persons with type O blood are at greatest risk of severe disease, whereas those with type AB are at least risk[(4)]. The bacteria are present in faeces for 1 – 10 days after infection.

Case Definition

a) **Suspected case**: In non-endemic areas - any case of acute, profuse, watery diarrhoea and vomiting resulting in dehydration or death in a person over the age of 5 years,

Or

Any case of acute watery diarrhoea and vomiting in a person with history of recent travel in an infected area within 5 days of the onset of illness.

Or

In areas where a cholera outbreak is declared - any patient 5 years or older that presents with or dies from acute watery diarrhoea.

b) Confirmed case

- Laboratory confirmed case: A suspected case with isolation of toxigenic *Vibrio cholerae* O1 or O139 from stool or vomitus
- Epidemiologically linked confirmed case

In epidemic situations, a case may be considered epidemiologically linked if the patient has had contact with one or more persons who have or had the disease, and at least one case in a chain of transmission has already been laboratory confirmed. Under these circumstances a suspected case may be considered to be "confirmed" for reporting purposes.

Laboratory diagnosis

Specimen Collection and Transport

a) Fresh stool: 10ml of stool should be collected in a clean dry container and must reach the laboratory within the hour.

b) Rectal swabs or stool in Cary-Blair medium: Organisms stored in Cary-Blair medium can remain viable for as long as 48 hours. Transport these specimens on wet ice (4°C)

c) Vomitus: This should be collected into a clean dry container and must reach the laboratory within the hour.

All these specimens should be securely enclosed in a plastic bag with a biohazard sticker, if available.

Laboratory Confirmation

Laboratory criteria for diagnosis:

- Isolation of toxigenic *Vibrio cholerae* O1 or O139 from stool or vomitus
  Or
  Identification of *V. cholerae* by PCR
  Or
- Significant rise in vibriocidal or antitoxin antibodies in acute and early convalescent sera
  Or
- Significant fall in vibriocidal antibodies in early and late convalescent sera

Syndromic Surveillance

Cholera is reported under the syndrome Acute Gastroenteritis.

Environmental Health

- Coastal salt water and brackish estuaries are reservoirs for cholera and seasonal increases in this pathogen may be observed in association with algal blooms. *V. cholerae* can also thrive in warm nutrient rich fresh water. The frequency of cholera increases in the summer months when the marine water temperature is above 20^{o}C [4]
- Humans become infected by consumption of contaminated food or water. The disease can then spread from person to person via the faecal-oral route.

- The spread if cholera is amplified in communities without access to portable water and with poor hygiene and sanitation practices.

Traveller's Health

- Travellers from endemic regions may carry cholera to countries where the disease is not present and cause localized outbreaks. Some individuals may carry and excrete V. cholerae asymptomatically for an extended period of time.
- Consumption of undercooked sea food is a common means of infection by V. cholerae.

Control and Prevention

Control and prevention measures are directed largely to ensuring food and water safety, the safe disposal of waste and advising travellers to endemic areas of appropriate precautions which should be taken. Water, sanitation and hygiene (WASH) interventions are key to prevent cholera and other gastrointestinal diseases. "WASH goals are achieved through a combination of safe water supply, improved sanitation services and awareness raising around the importance of hygiene practices to prevent diseases" (UNICEF, n.d.).

- Undertake surveillance of Diarrhoeal disease, especially among travellers to or from cholera endemic or epidemic areas. Travel agencies and airlines may be a useful source of information with particular reference to itinerary of tour groups.
- Oral cholera vaccine (OCV) should be use during cholera outbreaks in conjunction with other prevention and control measures (WHO, 2019).
- Isolation, with hospitalization in severe cases, with enteric precautions.
- Surveillance of persons who shared food and drink with the infected person within 5 days of last exposure.
- Where the likelihood of secondary transmission exists within households, chemoprophylaxis should be given to those "at risk" household contacts.
- Appropriate guidelines for safe eating and drinking practices should be made available, in writing to travellers whose itinerary may expose them to risk of infection.
- Provide guidelines for safety of water used for drinking or ice-making - chlorination or boiling.
- Intensify safe potable water supply programme — intersectoral co-operation.
- Emphasize the importance of hygiene and sanitation, especially in regard to the disposal of faeces.
- Ensure the ready availability of I.V. fluids and Oral Rehydration Salts as well as guidelines for their timely usage
- Ensure proper sewage disposal systems.

Technical Notes

The case definition used in this section is recommended by WHO for areas where cholera is not known to be present.

Cholera does occur in children under 5-years, however including these cases reduces the specificity of reporting.

Strains of Vibrio other than O1 and O139, and non-toxigenic *V. cholerae* O1 should not be reported as cholera.

FOODBORNE ILLNESS OUTBREAK

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Foodborne illnesses include, but are not limited to, foodborne intoxications and foodborne infections acquired by the consumption of bacteria in contaminated food, or drink. Other causes of foodborne illness which are not covered in this manual include chemical contaminants such as heavy metals, pesticides; organic poisons found for example in ackee, cassava, mushroom or fish – ciguatoxin mainly in large reef fish; viruses and parasitic or protozoal infections.

Epidemics of foodborne illness may be explosive or gradual depending on the causative agent, hygienic practices, and environmental factors. Minor epidemics are sometimes unrecognized depending on severity of illness, or surveillance sensitivity level (in which clusters of illness which may be related to a common source are unreported and therefore not epidemiologically linked). Signs and symptoms and the incubation period depend upon the aetiologic agent.

Case Definition

a) Probable case

An event in which two or more people experience a similar illness, after ingestion of a common food or drink and epidemiologic analysis implicates the food or drink as the source of the illness.

b) Confirmed case

A confirmed case is a probable case with laboratory confirmation. Criteria depend upon the aetiologic agent.

Note: One case of botulism or chemical poisoning linked to food constitutes an outbreak.

Table 7. Clinical Aspects of Some Foodborne Illnesses

Agent	Incubation period	Signs and Symptoms	Transmission	Disease confirmation
Entamoeba histolytica	24 – 72 hours up to 1 – 4 weeks	Lower abdominal pain, frequent diarrhoea that is often bloody. Duration: weeks to several months	Contaminated water, uncooked food or food contaminated by an ill food handler after cooking	Demonstration of cysts and parasites in stool; ideally 3 samples should be collected. Serology may be helpful in long-term infections.
Bacillus cereus	10 – 16 hours	Nausea, vomiting, diarrhoea, abdominal cramps. Duration: 24 to 48 hours.	Inadequately cooked or stored seafood, especially rice, meats stews,	Isolation of organism from stool OR Isolation of 10^5 organisms/g from

Agent	Incubation period	Signs and Symptoms	Transmission	Disease confirmation
			gravies and vanilla sauce.	epidemiologically implicated food, provided specimen is properly handled
Brucella	5 days to 6 months	Fever, headache, chills, joint pains, weakness, weight loss, enlarged spleen	Undercooked meats, dairy products	Isolation of organism in culture of blood or bone marrow. Greater than fourfold increase in standard agglutination titre (SAT) over several weeks, or single SAT 1:160 in person who has compatible clinical symptoms and history of exposure
Campylobacter jejuni	2 – 10 days but usually 2 – 5 days	Diarrhoea (may be bloody), abdominal cramps, nausea, vomiting, fever and malaise	Contaminated water, raw and undercooked poultry, unpasteurized milk	Isolation of organism from clinical specimens or from epidemiologically implicated food
Ciguatera toxin	2 – 6 hours	Nausea, vomiting, abdominal pain and diarrhoea Paraesthesia, pain, reversal of sensation of hot and cold, weakness and pain. 2 – 5 days later: Bradycardia, hypotension, T wave abnormalities. Duration: weeks to months	Reef fish such as barracuda, red snapper, grouper, etc.	A consistent clinical history, Identification of ciguatera toxin in fish by radioassay.
Clostridium botulinum	2 hours-8 days; usually 12-48 hours	Vomiting, diarrhoea, blurred vision, double vision, difficulty in swallowing, muscle weakness. Can result in respiratory failure and death	Improperly canned foods, especially home canned vegetables, fermented fish, baked potatoes in aluminium foil Grows in anaerobic	Detection of botulinum toxin in serum, stool, gastric contents, or implicated food OR Isolation of organism from stool or intestine

Agent	Incubation period	Signs and Symptoms	Transmission	Disease confirmation
			foods and produces toxin	
Clostridium perfringens	8 – 16 hours	Abrupt onset, intense abdominal cramps, nausea, vomiting, diarrhoea Duration: usually 24hrs	Inadequately cooked or stored foods. Meats, poultry, gravy, dried or precooked foods, time and/or temperature-abused foods	Isolation of 10^6 organisms/g from stool or demonstration of enterotoxin in the stool of ill persons, or isolation of 10^5 organisms/g from epidemiologically implicated food, provided specimen is properly handled
Cryptosporidium spp.	2-28 days; median: 7 days	Watery diarrhoea, abdominal cramps, nausea, vomiting, slight fever	Contaminated water, uncooked food or food contaminated by an ill food handler after cooking	Demonstration of oocysts in stool or in small-bowel biopsy of ill persons, or demonstration of organism in epidemiologically implicated food
i– Enterotoxigenic (ETEC) (common cause of "traveller's diarrhoea")	6 – 48 hours	Abdominal cramps, watery diarrhoea, nausea and vomiting Duration: 3 days to a week	Contaminated food and water	Isolation of organism of the same serotype, demonstrated to produce heat-stable (ST) and/or heat-labile (LT) enterotoxin, from stool of ill person
Escherichia coli Enterohemorrhagic (E. coli O157:H7 and others)	1-10 days; usually 3-4 days	Diarrhoea (often bloody), abdominal cramps, vomiting, Little or no fever. E. coli 0157: H7 produces toxin — may cause haemorrhagic colitis Duration: 5 – 10 days	Contaminated water, undercooked beef (especially hamburger), unpasteurized milk and juice, raw fruits and vegetables (e.g. sprouts)	Isolation of E. coli O157:H7 or other Shiga-like toxin-producing E. coli from clinical specimen from ill persons or from epidemiologically implicated food
Giardia intestinalis	3-25 days; median: 7 days	Diarrhoea, gas and bloating, abdominal cramps, nausea, fatigue	Contaminated food and water	Demonstration of the parasite in stool or small-bowel biopsy specimen of ill persons

Agent	Incubation period	Signs and Symptoms	Transmission	Disease confirmation
Hepatitis A	15-50 days; median: 28 days	Fever, anorexia, nausea, vomiting, diarrhoea, muscle aches, jaundice, dark urine, fatigue	Contaminated food (e.g. shellfish and salads) and water	Detection of immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV) in serum from persons who consumed epidemiologically implicated food
Listeria monocytogenes – Invasive disease	9-48 hours for GI symptoms, 2-6 weeks for invasive disease	Fever, muscle aches, nausea, diarrhoea, abdominal cramps. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immunocompromised patients may develop bacteraemia or meningitis	Dairy products such as unpasteurized milk, soft cheeses made with unpasteurized milk, also, ready-to-eat deli meats	Isolation of the organism from a normally sterile site, or from stool of ill persons exposed to food that is epidemiologically implicated or from which organism of the same serotype has been isolated
Norovirus	12 – 48 hours	Nausea, vomiting, diarrhoea, abdominal cramps, fever, headache. Diarrhoea is more prevalent in adults, vomiting more common in children Duration: 12 – 60 hrs.	Contaminated water, raw produce, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters	Detection of viral RNA in bulk stool or vomitus specimens by RT-PCR, or stools positive by commercial enzyme immunoassay (EIA)
Salmonella spp.	6 – 48 hours	Diarrhoea, low grade fever, vomiting, abdominal cramps Duration: 4 – 7 days	Contaminated water, eggs, poultry, meat, cheese, unpasteurized milk or juice, contaminated raw fruits and vegetables	Isolation of organism of the same serotype from clinical specimens from ill persons or from epidemiologically implicated food
Shigella spp.	12 hours to 6 days; usually 2-4 days	Diarrhoea (often bloody), nausea, vomiting, abdominal cramps, fever	Contaminated water, raw produce, uncooked foods and	Isolation of organism of the same serotype from clinical specimens from

Agent	Incubation period	Signs and Symptoms	Transmission	Disease confirmation
		Duration: 4 – 7 days	cooked foods that are not reheated after contact with an infected food handler	ill persons or from epidemiologically implicated food
Staphylococcus aureus	30 min-8 hrs; usually 2-4 hours	Abrupt onset of nausea, abdominal cramp, vomiting, diarrhoea. Fever may or may not be present Duration: 24 – 48 hrs.	Inadequately cooked or unrefrigerated or improperly refrigerated foods; pastries, cream, processed foods, meats, potato and egg salads,	Isolation of organism of the same phage type from stool or vomitus of ill persons, or detection of enterotoxin in epidemiologically implicated food, or Isolation of 10^5 organisms/g from epidemiologically implicated food, provided the specimen is properly handled.
Vibrio parahaemolyticus	6 – 96 hours	Watery diarrhoea (occasionally bloody), abdominal cramps, nausea, vomiting, fever Duration: 2 – 5 days	Inadequately cooked or raw seafood especially e.g. shellfish such as crabs, or food exposed to contaminated seawater	Isolation of Kanagawa-positive organism from stool of ill persons or Isolation of 10^5 Kanagawa-positive organisms/g from epidemiologically implicated food, provided the specimen is properly handled

Adapted from US "FDA Foodborne illness-causing organisms in the US" (FDA, n.d.) *and CDC "Guidelines for Confirming Cause of Foodborne Disease Outbreaks"* (CDC, 2015)

Laboratory diagnosis

Specimen Collection and Transport

a. **Stool and/or vomitus**: Collect in a clean, dry container and transport at 4°C within 24 hours.
b. **Rectal Swabs** (Only to be used if stool is not available): Place in Cary-Blair transport medium and transport at 4°C within 24 hours.
c. **Leftover foods or other foods**: Samples should be collected aseptically and put into sterile jars or plastic bags. Perishable food which are not frozen at the time of collection should be rapidly chilled to 4°C and kept at this temperature until examined. (Do not freeze these samples as certain bacteria such as C. perfringens die off rapidly during frozen storage. Keep frozen foods frozen until examined.

The laboratory should be alerted, and all samples should be received at the laboratory within the shortest possible time.

Laboratory confirmation
Isolation of the causative organism from clinical specimens and from food samples.

Syndromic Surveillance

- Foodborne diseases are reported under the Acute Gastroenteritis syndrome.
- Outbreaks of acute gastroenteritis are facilitated in congregate settings such as nursing homes, schools and day care centres, and in social events.

Environmental Health

- The training of food handlers and inspection of food establishments are important public health activities to prevent foodborne disease outbreaks. Lack of portable water and poor hygiene and sanitation standards favour the spread of foodborne diseases.
- See control and prevention
- Collect environmental samples for investigation as appropriate
    - Left over foods
    - Ice
    - Eggs
    - Other Raw ingredients

Traveller's Health

- The main cause of travel related illness is traveller's diarrhoea. It usually starts on average 3 days to 5 days into travel but can extend to 2 weeks. Traveller's diarrhoea is usually a self-limited illness, lasting between 1 – 5 days. The consumption of contaminated food or water is generally the cause [(4)]. Although many organisms may cause traveller's diarrhoea, enterotoxigenic E. coli is the most significant.
- Congregate facilities such as hotels and cruise ships are important settings for foodborne disease outbreaks.
- The food and beverage industry are central elements of tourism. Ensuring the safety of meals prepared is important to prevent guests from falling sick. However, the prevention of foodborne diseases is an effort that starts from the farm to the plate and controls at all stages are required for the process to be effective.

Control and Prevention
Food hygiene is defined as "all conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain." The microbiologic safety of foods is principally ensured by control at the source, product design, process control, and good hygienic practices during production, processing, handling, distribution, storage, sale, preparation and use. The application of the Hazard Analysis and Critical Control Points (HACCP) system is now an integral component of food hygiene programs. Hazard analysis is defined as "The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for food safety." This preventive system offers more control than end product testing because of the limited effectiveness of microbiologic examination to assess the safety of food. HACCP can be used as a corrective

risk management option: a risk is identified, and a management option is selected and implemented. HACCP is also used as a preventive risk management tool. In this case, hazard analysis identifies potential hazards in raw materials, production line, and line-environments to the consumer.
Control and prevention of food borne illnesses, regardless of the specific cause, are based on principles directed towards the avoidance of food contamination, destruction or denaturation of contaminants and the prevention of spread or multiplication of contaminants.

Basic food safety practices include the following:

- Choose foods processed to ensure safety.
- Cook food thoroughly.
- Eat cooked foods immediately.
- Store cooked foods carefully.
- Reheat cooked foods thoroughly.
- Avoid contact between raw and cooked foods.
- Wash hands repeatedly.
- Keep all kitchen surfaces meticulously clean
- Protect food from insects, rodents and other animals.
- Use safe water.

Some areas of specific action include the following:

- Educate food handlers in strict food hygiene, sanitation and cleanliness of kitchens, proper temperature control, handwashing, cleaning of fingernails; and to the danger of working with exposed skin, nose and eye infections and the need to cover wounds.
- Reduce food-handling time (preparation to service) to an absolute minimum, with no more than 4 hours at ambient temperatures.
- Keep hot foods hot (> 60°C) and cold foods cold (< 10°C).
- Temporarily exclude people with boils, abscesses and other purulent lesions of hands, face or nose from food handling.
- Seafood:
    - ensure that cooked seafood reaches a temperature of at least 70°C for at least 15 minutes.
    - handle cooked seafood in a manner that prevents contamination with raw seafood or contaminated sea water.
    - keep all seafood, raw and cooked, adequately refrigerated before eating.
    - avoid the use of sea water in food handling areas.
- Refrigerate leftover foods promptly and reheat rapidly and thoroughly before use.

SALMONELLOSIS (NONTYPHOIDAL)

Internationally notifiable:	**No**
Reporting interval:	**Weekly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Salmonellosis is an acute diarrhoeal disease caused by infection with Salmonellae bacteria. Globally over 90 million infections and over 150,000 deaths occur yearly; the incidence being highest in the rainy season in the tropics and in summer in temperate regions [(4)]. Asymptomatic infections may occur, and the organism can cause extra-intestinal infection.

Transmission occurs most frequently through the ingestion of salmonella in food derived from infected food-animals or contaminated by faeces of an infected person or animal. Common sources of infection include raw and undercooked eggs and egg products, raw milk and unpasteurized dairy products, meat and meat products, poultry being a common source. Processed meat products and contaminated water are common causes of epidemics.

Clinical presentation

The incubation period is 6 – 72 hours (usually 12 – 36 hours). The disease causes an acute enterocolitis of sudden onset with diarrhoea accompanied by headache, cramping abdominal pain, nausea and sometimes vomiting. Fever is almost always present. The disease is usually self-limited, with the diarrhoea lasting about 2 - 7 days. It may, however, develop into a septicaemia and localization in bones and joints may occur. Less frequently, other sites such as the pericardium, lungs, pleurae, kidneys and other organs may become involved. In the absence of fluid replacement, especially among the infants and the elderly, dehydration may be severe.

Case Definition

a) Suspected case

A person presenting with an acute illness characterized by diarrhoea with one or more of the following:

- Fever
- Abdominal pain
- Nausea and/or vomiting
- Headache

b) Probable case

- A suspected case that is epidemiologically linked to a confirmed case through ingestion of contaminated food.

c) Confirmed case

A confirmed case is a suspected or probable case or any other individual with laboratory confirmation — isolation of Salmonellae from stools or any other body site.

Laboratory Diagnosis

Laboratory Confirmation

Isolation of the causative Salmonella organism from clinical specimens and from food samples.

Phage typing confirms the food item(s) responsible for the outbreak.

Specimen Collection and Transport

1) Stool and/or vomitus
   Collect into a clean, dry container and transport at 4°C within 24 hours.
2) Rectal Swabs (to be used if stool is not available)
   Place in Cary Blair transport medium and transport at 4°C within 24 hours.
3) Leftover foods or other foods
   Samples should be collected aseptically and put into sterile jars or plastic bags. Perishable food which are not frozen at the time of collection should be rapidly chilled to 4°C and kept at this temperature until examined. (Do not freeze these samples as certain bacteria such as *C. perfringens* die off rapidly during frozen storage).

Note: Keep frozen foods frozen until examined. The laboratory should be alerted, and all samples should be received at the laboratory within the shortest possible time.

Syndromic Surveillance

This disease would have been reported as the syndrome Acute Gastroenteritis.

Environmental Health

- The Environmental Health Department or other relevant public health authority should be notified immediately when a food source is implicated so that an investigation and control measures can be initiated
- Every step of the food production process should be carefully monitored from the raw materials, to distribution and final preparation for consumption
- Public health officials should remember that although animal products are usual sources, the consumption of fruits and vegetables contamination by animal manure also cause outbreaks of non-typhoidal salmonella

Veterinary

Healthcare providers should bear the following in mind:

- In addition to farm animals, many individuals, especially children, become infected with salmonella species from pets such as turtles, lizards, snakes, iguanas, etc. Other pets such as birds, rodents, dogs, cats, etc. are sources of non-typhoidal salmonella
- The widespread use of antimicrobials in animals has resulted in the emergence of species of non-typhoidal salmonella that are resistant to conventional antibiotics

Traveller's Health

- Visitors should avoid consumption of uncooked or undercooked meat and poultry products.
- Fruits and vegetables should be properly washed before eating
- See foodborne diseases and control and prevention.

Control and Prevention

Case/outbreak investigation

- Interview the case to generate a hypothesis regarding the possible source
- Ascertain whether there was overseas travel during their exposure period
- Take a detailed food history
- Enquire about exposure to farm animals

Educate food handlers on the importance of safe food handling practices placing emphasis on:

- Handwashing before, during and after food preparation and especially after using the toilet.
- Refrigerating prepared foods in containers that would allow the stored food to reach the required temperatures.
- Thoroughly cooking all foodstuffs derived from animal sources, particularly poultry, egg products, pork and other meat dishes.
- Avoiding recontamination after cooking.
- Maintaining sanitary utensils and surfaces in the kitchen and other food preparation and serving areas.
- Staying away from work for up to 48 hours after diarrhoea has resolved.

Educate the public to:

- Avoid consuming raw or undercooked eggs and using dirty or cracked eggs in making eggnogs or ice-cream.
- Avoid the use of pooled eggs or egg products which have not been pasteurized or irradiated.
- Do not consume ice made with unsafe water.
- Boil or disinfect water for drinking when unsure about its safety.
- Wash raw fruits and vegetables before consumption.
- Exclude individuals with diarrhoea from food handling for up to two days after it has subsided, especially in institutions providing care for the ill, the elderly or children.
- Recognize the risk of Salmonella infections in pets such as chicks and turtles especially for small children.
- Monitor and advise on adequate sanitation in abattoirs, butcher shops and food processing plants.
- Assist in establishing Salmonella control programs in commercial food outlets.

SHIGELLOSIS

Internationally notifiable:	**No**
Reporting interval:	**Weekly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Shigellosis is an acute enteric bacterial disease caused by infection with Shigella species. Shigella are non-motile, Gram-negative bacilli belonging to the Enterobacteriacae family. The genus Shigella includes four species: *S. dysenteriae, S. flexneri, S. boydii and S. sonnei*; all

except the latter have multiple serotypes. *S. dysenteriae* (Shiga bacillus) differs from the other shigella in that it produces a potent cytotoxin (shiga toxin), causes a more severe and prolonged illness, causes large outbreaks and is more frequently resistant to antimicrobials (WHO, 2005).

Acute bloody diarrhoea can be caused by all species of Shigella due to their invasion of the epithelium of the colon causing patchy destruction leading to the formation of tiny ulcers and causing inflammatory cells (polymorphonuclear leucocytes) and blood to appear in stool.

Humans provide the only significant reservoir of infection. These organisms are transmitted either directly or indirectly via the faecal-oral route (direct contact with an infected person, or by eating contaminated food or drinking contaminated water). The incubation period is usually one to four days.

Clinical presentation

Patients classically present with diarrhoea characterized by the frequent passage of small liquid stools that contain visible blood, with or without mucus. Abdominal cramps, tenesmus (unproductive, painful straining), fever and anorexia are common. Some patients may however have only watery diarrhoea without visible blood.

Most patients recover uneventfully but complications can include sepsis, metabolic abnormalities, convulsions, toxic megacolon, intestinal perforation, rectal prolapse and haemolytic-uraemic syndrome. (WHO, 2005)

<u>Case Definition</u>

a) **Suspected case**
   An acute illness with diarrhoea with one or more of the following:
   - Fever
   - Nausea and/or vomiting
   - Tenesmus
   - Abdominal pain/cramps

b) **Probable case**
   - A suspected case that is epidemiologically linked to a confirmed case through ingestion of contaminated food, or
   - Detection of *Shigella spp.* or Shigella/enteroinvasive *E. coli* in a clinical specimen using a non-culture-based method (CDC, 2016)

c) **Confirmed case**
   Laboratory confirmed case: A suspected or probable case from whose clinical specimen Shigella has been isolated.

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

- Diagnosis is made based on isolation of *Shigella spp*. from a clinical specimen using selective media.

- Serotyping augments epidemiologic investigations in identifying the source(s) of infection.

Specimen Collection and Transport

- Stool samples
  Stool is the specimen of choice and should be placed in a clean container for transport to the laboratory.
- Rectal swabs
  Where stools are not practical, properly taken rectal swabs should be sent to the laboratory in Cary Blair Transport medium.

All specimens should be transported to the laboratory at 4°C within 2 hours of collection. Shigella species are fragile.

Alternatively, if a delay is anticipated place approximately 1 gram of stool specimen into Cary Blair transport medium and then send to the laboratory within 48 hours.

Syndromic Surveillance

This disease would be reported as Acute Gastroenteritis syndrome.

Environmental Health

- The Environmental Health Department or other relevant public health authority should be notified immediately when a food source is implicated so that an investigation and control measures can be initiated.
- Every step of the food production process should be carefully monitored from the raw materials, to distribution and final preparation for consumption.

Traveller's Health

- Visitors should avoid consumption of contaminated water, raw produce, uncooked foods and cooked foods that are not reheated properly.
- Fruits and vegetables should be properly washed before eating.
- See foodborne diseases and control and prevention.

Case/outbreak investigation

- Interview the case to generate a hypothesis regarding the possible source
- Ascertain whether there was overseas travel during their exposure period
- Find out whether the case was in close contact with other individuals with a similar illness
- Take a detailed food history over the previous days
- Follow up contacts of cases to ascertain whether they have symptoms and provide education

Control and Prevention

- Observe enteric precautions during acute illness, including disposal of faeces and terminal cleaning.

- Ensuring the availability of safe water for drinking
- Control vectors such as flies
- Administer adequate antimicrobial therapy in terms of choice of drug, dose and duration.
- Patients with known Shigella infections should be excluded from food handling and the employment in the provision of child or patient care until 2 successive faecal samples or rectal swabs (collected 24 hours apart, but not sooner than 48 hours following discontinuation of antimicrobials) are found to be free of Shigella.
- Ill contacts of shigellosis patients should be excluded from food handling and the care of children or patients until diarrhoea stops, and 2 successive negative stool cultures are obtained 1 month apart.
- Educate persons engaged in commercial food-handling as well as the general public in safe food-handling practices.
- Ensure that knowledge of safe food-handling procedures is part-requirement for the issue of food handlers' badges.

Technical Notes

Multidrug resistance is common, and the antibiogram of the isolated strain or local antimicrobial susceptibility patterns as provided by the laboratory will increase the efficacy of antimicrobial treatment.

TYPHOID FEVER

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Typhoid and paratyphoid fever are caused by Salmonella enterica serovar Typhi (*S. typhi*) and
Salmonella enterica serovar Paratyphi (*S. paratyphi*) respectively. *S. paratyphi* A and B (and, uncommonly, *S. paratyphi* C) cause a disease that is clinically indistinguishable from typhoid fever (WHO, 2018). The reservoir and only source of typhoid infection is human with transmission occurring by the faecal–oral route through contaminated food or water. Climate change, urbanization, poor sanitation and lack of access to clean water contribute to an increased burden of typhoid fever globally. The development of antibiotic resistance also favours the spread of this disease. Travelers may become infected when they are exposed to settings with substandard food and personal hygiene and poor water quality.

Clinical presentation

The incubation period is usually 8 to 14 days. Typhoid is a systemic illness often characterized by insidious onset of sustained fever, (39 – 40^{o} C) headache, anorexia, nausea, abdominal pain, malaise, constipation or diarrhoea and non-productive cough. There is

relative bradycardia and a rash may occur. Many mild and atypical infections occur. Children are at greatest risk of acquiring infection. Carrier state may be prolonged (> 1 year), with healthy carriers being reservoirs of infection.

Case Definition (Who, 2018)

Suspected case of typhoid or paratyphoid fever

- A patient presenting with fever for at least three out of seven consecutive days in an endemic area or following travel from an endemic area

OR

- A patient presenting with fever for at least three out of seven consecutive days within 28 days of being in household contact with a confirmed case of typhoid or paratyphoid fever

Confirmed cases

- **Typhoid fever**: Laboratory confirmation by culture or molecular methods of S. Typhi or detection of S. Typhi DNA from a normally sterile site

- **Paratyphoid fever**: Laboratory confirmation by culture or molecular methods of *S. paratyphi* A, B, or C or detection of *S. paratyphi* A, B, or C DNA from a normally sterile site.

- **Invasive non-typhoidal salmonellosis (iNTS):** Laboratory confirmation by culture or molecular
- methods of non-typhoidal Salmonella or detection of non-typhoidal Salmonella DNA from a normally sterile site.
- **Relapse of typhoid or paratyphoid fever**: Laboratory confirmation of *S. typhi* or *S. paratyphi* from a normally sterile site within one month of completing an appropriate course of antimicrobial treatment and resolution of symptoms.

Chronic Carriers

- **Presumptive carrier**: Evidence of shedding of Salmonella spp. (positive stool culture or PCR) of an unknown duration.
- **Definitive carrier**
    - Evidence of shedding of Salmonella spp. (positive stool culture or PCR) at least 12 months after finishing an appropriate course of antimicrobial treatment and the resolution of symptoms following a laboratory-confirmed episode of acute disease

      OR
    - Two positive stool samples 12 months apart.
- **Convalescent carrier**: Evidence of shedding Salmonella spp. (positive stool culture or PCR) 1–12 months after finishing an appropriate course of antimicrobial treatment and the resolution of symptoms following a laboratory-confirmed episode of acute disease. (WHO, 2018)

Probable case

A suspected case which is epidemiologically linked to a confirmed case in an outbreak.

Laboratory Diagnosis

Laboratory Confirmation

Laboratory confirmation is made on the isolation of S. typhi from blood, or other clinical specimen.

Specimen Collection and Transport

a) Blood specimens should be collected as early possible after the onset of illness. For paediatric patients (40ml blood culture broth bottles) collect:
   - 1 – 2ml (3 months to < 2 years),
   - 2 – 3ml (2 - < 5 years) and
   - 5 – 10ml (5 - < 15 years).

   For >15 years - adults (80 ml blood culture broth bottles) collect:
   - 8 – 10ml of blood.

   Transport at room temperature to reach the laboratory within 4 hours.

b) Stool — collect and transport in a sterile screw cap container. Stool culture may be used for the detection of chronic carriers and to monitor faecal shedding. Faecal shedding may be sporadic. Generally, collect three stool samples taken 24 hours apart, or at least seven samples after completion of antimicrobial therapy (WHO, 2018).

c) Rectal swabs should be transported in Cary Blair medium.

d) Midstream specimen of urine — transport in a sterile Universal container.

Specimens of stool, urine and rectal swabs should be transported at 4°C and should be received at the laboratory within 24 hours of collection.

Syndromic Surveillance

This disease would be reported as Acute Gastroenteritis syndrome.

Environmental Health

- The Environmental Health Department or other relevant public health authority should be notified immediately when a food source is implicated so that an investigation and control measures can be initiated.
- An assessment should be carried out if a food handler is suspected to be a carrier and the source of contamination.

Traveller's Health

- Visitors should avoid consumption of contaminated water, raw produce, uncooked foods and cooked foods that are not reheated properly.
- Fruits and vegetables should be properly washed before eating.
- See foodborne diseases and control and prevention.

Case/outbreak investigation

- Interview the case to generate a hypothesis regarding the possible source
- Ascertain whether there was overseas travel during their exposure period

- Find out whether the case was in close contact with other individuals with a similar illness
- As much as possible, take a food history over the previous two months including the name of restaurants and other sites where the case consumed meals
- Follow up contacts of cases to ascertain whether they have symptoms and provide education

Control and Prevention

Routine Measures

- Observe enteric precautions while ill. Release from supervision by health authority should be based on no less than 3 consecutive negative stool cultures taken at least 24 hours apart and at least 48 hours after any antibiotic, and not earlier than 1 month following onset of illness.
- Carry out concurrent disinfection of faeces and urine and of articles soiled by these. Where adequate sewage systems exist, faeces and urine may be discharged directly into the system.
- Investigate contacts to uncover other infections and use epidemiologic approaches to determine the actual or likely source(s) of infection. These would include search for unreported cases, carriers, or contaminated food, water, milk or shellfish. Apply appropriate measures to deal with existing contaminations and to protect against recurrence of these.
- Exclude household and close contacts of cases from employment in sensitive occupations (e.g. food handlers) until at least 2 specimens of faeces and urine taken at least 24 hours apart are negative on culture for S. typhi.
- Maintain Typhoid Registers at Local and National levels and keep these regularly updated. (Their usefulness should be assessed in terms of their practical application as a surveillance tool; in the control of outbreaks; and the prevention of disease transmission related to high-risk occupations of carriers and excreters.)
- In 2018, WHO recommended the first prequalified typhoid conjugate vaccine for intramuscular administration of a single dose (0.5 ml) in children ≥ 6 months of age and in adults up to 45 years of age. The unconjugated Vi polysaccharide vaccine is recommended for intramuscular or subcutaneous administration in individuals 2 years of age and older. The live attenuated vaccine is available in enteric-coated capsules recommended for oral administration on alternate days in a three-dose regimen (or a four-dose regimen in Canada and the US) in persons above 6 years of age. Repeat vaccination is recommended for the unconjugated Vi polysaccharide vaccine every three years, and for the live attenuated vaccine every 3 - 7 years in most endemic settings or every 1 - 7 years for travellers from non-endemic to endemic areas, depending on national policies (WHO, 2018).
- Institute continuing surveillance of all known cases for at least 6 months and preferably for 12 months after initial treatment, as feasibility permits. The purpose is to ascertain their post-illness status, i.e. whether an excreter or carrier. A suggested protocol is as follows:

    (1) the collection of a stool sample once monthly for an initial period of 3 months.

(2) the collection of a stool specimen once every 3 months over the succeeding 9 months.

This procedure may facilitate the identification of excreters or carriers.

Epidemic measures:

- Search for the case or carrier who is the source of infection and for the vehicle (water or food) by which infection was transmitted.
- Selectively eliminate suspected contaminated food.
- Exclude milk supplies, unless pasteurized or boiled, as well as other foods suspected to be contaminated on epidemiologic evidence, until safety of supplies is ensured.
- Chlorinate suspected or incriminated water supplies adequately or avoid their use until safety is assured.
- Chlorinate or boil all water used for drinking or ice-making before use. (Note: Since boiled water has no residual chlorine protection, special care should be taken to avoid contamination of water supplies which are stored over a period of time.)

Technical Notes

Blood culture is usually positive in the first week of illness. The rate of positivity declines thereafter, but blood cultures may be positive up to the third week in patients who have not yet been placed on antimicrobial therapy.

Serologic tests are not acceptable as diagnostic criteria for the detection of a case or carrier of the disease. Phage typing however, can be a useful tool in tracing/confirming source(s) of infection and its application is intervention related.

Vi agglutination testing can be a useful tool for preliminary screening in outbreaks.

Excreter – an asymptomatic individual who continues to excrete pathogenic organisms in their faeces for less than 12 months. Such a person may be a “recovered case” (sometimes termed a “convalescent carrier”), or someone who has had a symptomless infection (sometimes termed a “temporary carrier”).

Carrier (sometimes termed “chronic carrier”) – a person without symptoms but excreting pathogenic organisms in faeces or urine, either continuously or intermittently for more than 12 months.

Disaster implications: With disruption of usual water supply and sewage disposal facilities, and of controls on food and water, transmission of typhoid fever may occur if active cases or carriers are among the displaced population. Of high priority should be measures taken to restore safe drinking water supplies and sewage disposal systems. Vaccine administration to selected population groups may be helpful.

Travel: Immunization is recommended for international travellers to endemic areas, especially if travel is likely to involve exposure to unsafe food and water, or close contact in rural areas and indigenous populations.

VIRAL HEPATITIS A

Internationally notifiable:	**No**
Reporting interval:	**Weekly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Viral Hepatitis A is an acute, self-limited inflammation of the liver caused by infection with the Hepatitis A virus (HAV). It is transmitted by the faecal oral route. Vehicles for the virus are water, food contaminated during preparation, and raw shellfish, including conch. Person-to-person spread is common among children who frequently have asymptomatic infections.

The period of maximum transmissibility is at the end of the incubation period which ranges from 15 to 50 days (average 28–30 days). The symptomatic period is one to two weeks, with rare instances of disease lasting more than one month. Young children usually have asymptomatic infection, but older children and adults commonly experience symptomatic disease.

Clinical presentation

The clinical manifestations of acute hepatitis A infection are malaise, fatigue, anorexia, vomiting, abdominal discomfort, diarrhoea and jaundice, and are indistinguishable from acute hepatitis caused by other viruses.

HAV resolves completely in most cases but relapses can occur. Rarely, acute liver failure occurs (WHO, 2018). Clinical diagnosis is unreliable, and laboratory tests are available to distinguish Hepatitis A from B, C, and E.

The main purpose of surveillance is the detection of outbreaks which may have a common source or may indicate a micro-environment of very poor hygiene, e.g. an institution or housing settlement.

Case Definition

Presumptive (suspected) case:

A person with either or both of the following:

- Discrete onset of an acute illness with fever, malaise, fatigue AND signs of liver damage (anorexia, nausea, jaundice, dark urine, right upper quadrant tenderness)
  OR
- Raised alanine aminotransferase (ALT) levels more than ten times the upper limit of normal (400 IU/L) (WHO, 2018).

Confirmed case:

- **Laboratory-confirmed case**: A person who meets the presumptive case definition and is positive for IgM anti-HAV.
- **Epidemiologically linked case**: A person who meets the presumptive case definition and is epidemiologically linked to a laboratory-confirmed case (contact with a person with hepatitis A confirmed by biomarker testing, 2 - 6 weeks before onset, or occurrence in the context of an outbreak confirmed by biomarker testing). Contact can be among household members, sexual contact or drug-sharing contact (WHO, 2018).

Laboratory Diagnosis

Laboratory Confirmation

- Demonstration of specific IgM antibody to Hepatitis A virus (anti - HAV IgM) is diagnostic. ELISA kits are commercially available and are most frequently used. In general IgM becomes detectable 5–10 days before the onset of symptoms and can persist for up to 6 months (WHO, 2018).
- Identification of hepatitis A virus RNA using PCR.

Specimen Collection and Transport
Blood sample.

a) As soon as the patient presents, collect 5 to 10ml of venous blood into a sterile tube. Forward to the laboratory on ice within 24 hours.
b) If immediate shipment is not possible, centrifuge the blood and transfer serum to a sterile tube with a secure cap. Store at –20°C and ship frozen.
c) Include patient, clinical and exposure data.

Syndromic Surveillance

This disease would be reported as the syndrome undifferentiated fever.

Environmental Health

- The Environmental Health Department or other relevant public health authority should be notified immediately when a food source is implicated so that an investigation and control measures can be initiated.
- An assessment should be carried out if a food handler is suspected to be the source of contamination.

Traveller's Health

- Visitors should avoid consumption of contaminated water, raw produce, uncooked foods and cooked foods that are not reheated properly.
- Fruits and vegetables should be properly washed before eating.
- See foodborne diseases and control and prevention.

Hepatitis A Control and Prevention

Hepatitis A outbreak investigation

- Interview the case to generate a hypothesis regarding the possible source

- Ascertain whether there was overseas travel during their exposure period
- Find out whether the case was in close contact with other individuals with a similar illness
- As much as possible, take a food history over the previous two months including the name of restaurants and other sites where the case consumed meals
- Follow up contacts of cases to ascertain whether they have symptoms and provide education
- Determine the common cause of the outbreak by epidemiological investigation and remove or correct.
- If the outbreak is traced to an individual (e.g. a food handler), counselling on personal hygiene (disposal of faeces and hand washing) should be given and enteric precautions advised for one week after the onset of jaundice.
- Post-exposure prophylaxis with inactivated HAV vaccine can be considered for close contacts
- Immune globulin should be offered to contacts within 3 days of exposure, or, in an outbreak situation, within 2 weeks of exposure.
- If a day care centre is involved, emphasis should be placed on hand washing after diaper change and supervision of the children's hygiene. Enteric precautions should be enforced for 2 to 3 weeks.

Increased incidence of Hepatitis A in a district

- Investigate and improve water supply and quality
- Correct environmental problems (sewage disposal, drainage)
- Educate the public on good sanitation and personal hygiene
- WHO recommends that vaccination against hepatitis A be integrated into the national immunization schedule for children aged ≥ 1 year if indicated based on incidence of hepatitis A. In low endemicity countries, such as in CARPHA Member States, vaccination is considered for high-risk groups (WHO, 2018).

Respiratory Diseases

CORONAVIRUS DISEASE

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division weekly**

Overview

Coronaviruses are a large family of viruses which cause illness in animals or humans. Seven (7) coronaviruses are known to cause disease in humans; four (229E, OC43, NL63 and HUK1) are associated with the common cold. The other three coronaviruses cause a more severe and sometimes fatal respiratory infection namely; the severe acute respiratory syndrome coronavirus (SARS-CoV) that appeared in China in 2002; Middle East respiratory syndrome coronavirus (MERS-CoV) that arose in 2012; and SARS-CoV-2, the cause of coronavirus disease 2019 (COVID-19) that was first identified in Wuhan China that same year.

COVID-19

Transmission occurs through contact with infected secretions especially respiratory droplets, contact with a surface contaminated by respiratory secretions or droplets and possibly by aerosols.

Clinical presentation

Incubation period is 2 to 14 days (average 5 days). Most COVID-19 infected persons are asymptomatic or have only mild disease. Severe disease is more common in people aged over 60 years and those with underlying conditions such as morbid obesity (BMI>40), immunosuppressing condition, diabetes, hypertension, chronic respiratory disease, cardiovascular disease, and cancer.

Symptoms include fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting and diarrhoea. In the severe form of the disease, pneumonia with dyspnoea and hypoxia can progress to respiratory failure, shock, multi organ compromise and death. Coagulation disorders and a rare postinfectious inflammatory syndrome termed multisystem inflammatory syndrome in children (MIS-C) has also been reported.

Case definition

Suspect case

- A patient with acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath), AND a history of travel to or residence in a location reporting community transmission of COVID-19 disease during the 14 days prior to symptom onset;
  OR
- A patient with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case in the last 14 days prior to symptom onset;
  OR

- A patient with severe acute respiratory illness (fever and at least one sign/symptom of respiratory disease, e.g., cough, shortness of breath; AND requiring hospitalization) AND in the absence of an alternative diagnosis that fully explains the clinical presentation.

Probable case

- A suspect case for whom testing for the COVID-19 virus is inconclusive.
  OR
- A suspect case for whom testing could not be performed for any reason.

Confirmed case

- A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.

<u>Laboratory Diagnosis</u>

Confirmatory laboratory evidence:

- Detection of severe acute respiratory syndrome coronavirus 2 ribonucleic acid (SARS-CoV-2 RNA) in a clinical specimen using a molecular amplification detection test

Presumptive laboratory evidence:

- Detection of specific antigen in a clinical specimen
- Detection of specific antibody in serum, plasma, or whole blood indicative of a new or recent infection

Specimen collection and transport

Table 8. WHO guidance on specimen collection [(2)]

Specimen type	**Collection materials**	**Transport to laboratory**	**Storage till testing**	**Comment**
Nasopharyngeal and oropharyngeal swab	Dacron or polyester flocked swabs in VTM	2-8 °C	≤5 days: 2-8 °C >5 days: -70 °C (dry ice)	The nasopharyngeal and oropharyngeal swabs should be placed in the same tube to increase the viral load
Bronchoalveolar lavage	sterile container with VTM	2-8 °C	≤48 hours: 2-8 °C >48 hours: –70 °C (dry ice)	There may be some dilution of pathogen, but still a worthwhile specimen
(Endo)tracheal aspirate, nasopharyngeal aspirate or nasal wash	sterile container with VTM	2-8 °C	≤48 hours: 2-8 °C >48 hours: –70 °C (dry ice)	
Sputum	sterile container	2-8 °C	≤48 hours: 2-8 °C >48 hours: –70 °C (dry ice)	Ensure the material is from the lower respiratory tract
Tissue from biopsy or autopsy including from lung	sterile container with saline or VTM	2-8 °C	≤24 hours: 2-8 °C >24 hours: –70 °C (dry ice)	
Serum (2 samples acute and convalescent possibly 2-4 weeks after acute phase)	Serum separator tubes (adults: collect 3-5ml whole blood)	2-8 °C	≤5 days: 2-8 °C >5 days: –70 °C (dry ice)	Collect paired samples: • acute – first week of illness • convalescent – 2 to 3 weeks later

Whole blood	collection tube	2-8 °C	≤5 days: 2-8 °C >5 days: –70 °C (dry ice)	For antigen detection particularly in the first week of illness
Urine	urine collection container	2-8 °C	≤5 days: 2-8 °C >5 days: –70 °C (dry ice)	

VTM = viral transport medium

Note: Appropriate infection prevention and control procedures should be used when collecting samples (a P2/N95 mask, disposable gown, gloves, and eye protection must be worn).

Oropharyngeal and nasopharyngeal swabs (Dacron): These are collected within the first 10 days of onset of illness, placed in viral transport medium, and shipped to the laboratory promptly on wet ice (2 – 8°C). For longer delays between collection and testing, specimens should be stored at –20°C or ideally -70°C and shipped on dry ice to the laboratory.

Note: The world is still in an early stage of the COVID-19 pandemic and the scientific information is still evolving. These guidelines may be updated as new evidence emerges of additional diagnostic tests that can be performed.

Control and prevention

Public education

To help prevent the spread of COVID-19, everyone should be advised to:

- Cover cough or sneeze with a tissue, then throw the tissue in the trash, or use the inside of your elbow and do not spit.
- Clean hands often, either with soap and water for 20 seconds or a hand sanitizer that contains at least 60% alcohol. Hand cleansing should be done after coughing or sneezing and after contact with public places.
- Avoid close contact with persons who are sick.
- Maintain physical distance from other people (at least 6 feet).
- Cover mouth and nose with a cloth face cover when around others, especially when other social distancing measures are difficult to maintain. Cloth face coverings may help prevent people who have COVID-19 from spreading the virus to others.
- Clean and disinfect frequently touched objects and surfaces daily.
- Monitor oneself daily and avoid school, work or social settings if symptoms develop. Ill persons should not leave home except to seek essential medical attention.

Health care setting

Every healthcare workers should adhere to the measures outlined above and in addition:

- All healthcare staff should receive appropriate training in infection prevention and control (IPC).
- Health care staff should be educated on the nature of COVID-19 and be made aware of the current epidemiological situation in their country and recommended IPC measures and resources available for diagnosing and managing the disease.
- Staff should be trained to correctly select and use personal protective equipment in a rational manner and evidence-based manner.
- Possible cases of COVID-19 should be quickly identified and isolated from the other patients. They should be given a medical mask to wear and dedicated facilities, such as toilets, should be assigned for their use.

- Appropriate PPE should be worn by staff conducting transfer of a suspected or confirmed COVID-19 patient via ambulance.
- Staff caring for COVID-19 patients, after removing PPE at the end of their shift, should undertake meticulous hand washing and consider showering and changing into new clothing before leaving the healthcare facility.
- All staff with symptoms suggestive of COVID-19 should not report to work and should be isolated until infectiousness has subsided.
- Electronic devices that are commonly used such as mobile phones, tablets, computers, etc. should be regularly cleaned and disinfected.
- Regular cleaning and disinfecting of surfaces, common areas and patient rooms is recommended and staff responsible for these tasks should be adequately trained and provided with appropriate PPE to safely do their work. The same applies to persons involved in the management of waste.
- Healthcare workers should adhere rigorously to standard precautions in order to prevent infection when collecting and handling clinical specimens for COVID-19.

Outbreak investigation steps in a high-risk setting

(Taken from the Coronavirus Disease 2019 (COVID-19), Communicable Diseases Network Australia (CDNA) National Guidelines for Public Health Units) [3]

1. Identify the setting. High-risk settings are defined as a setting where there is evidence of a risk for rapid spread and ongoing chains of infection.
2. Confirm and declare a COVID-19 outbreak with one confirmed case.
3. Identify those most at risk of severe disease.
4. Arrange diagnostic testing for COVID-19 for all members of the setting. If available, consider additional serological tests. If other members of the setting are symptomatic, test these individuals for other respiratory pathogens such as influenza as well as COVID-19.
5. Ensure that the facility managers have notified ALL staff, residents (where applicable) and visitors as relevant, that cases of COVID-19 have occurred in the setting.
6. Advise staff about enhanced implementation of infection control measures.
7. Collate information onto a line list that describes people infected in terms of time, place and person.
8. In a residential facility, ensure the staff form an outbreak management team that meets within hours of the identification of a case. The team should not be part of day-to-day facility management.
9. Identify and inform relevant internal and external stakeholders.
10. Isolate and treat individuals who test positive. Quarantine, as best as possible, those individuals who test negative and monitor for illness-persons in this group are considered to be susceptible or incubating.
11. Where feasible, commence a program of repeat tests for those (who may be) susceptible or incubating who are in quarantine. This will identify those who are pre-symptomatic to enable rapid removal from the environment.
12. Identify suitable sites where individuals may be co-hosted together into either: isolation of the sick OR quarantine the exposed.

CARPHA has developed technical guidance documents for COVID-19 which can be accessed at
https://www.carpha.org/What-We-Do/Public-Health/Novel-Coronavirus/Technical-Guidance

INFLUENZA

Internationally notifiable:	**Infection caused by a new subtype is reportable**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Influenza is an acute systemic febrile respiratory disease of world-wide distribution. It affects all age groups and can more severely affect certain age groups and persons with underlying conditions. The importance of the virus lies in its epidemic and pandemic potential, which has led to international surveillance of the disease coordinated by the WHO. The 2009 influenza pandemic was caused by serotype A H1N1 (H1N1pdm09) which now circulates as a seasonal serotype along with influenza A H3N2.

Due to increased inter-island travel for business and tourism, influenza can spread quickly between the islands. The most prevalent strains in the region have been influenza A (H1N1) and H3N2). Due to a high burden of chronic disease in the region influenza can potentially have a severe impact on the population. Additionally, the region is prone to increasing numbers of disasters such as hurricanes and earthquakes. Influenza like illness infection rates commonly increase in the conditions after disasters which may leave large numbers of people living in confined spaces or without enough shelter.

There are 3 types of influenza virus that cause illness in humans, A, B and C. Types A and B are associated with epidemics and type C with sporadic disease. Isolated strains can be typed (A, B) and subtyped (A / H3N2, A / H5N2). Influenza A viruses, which affect both humans and animals, contain 2 major antigens, haemagglutinin (H) and neuraminidase (N). These antigens are subject to frequent major and minor changes, resulting in new sub-types which are responsible for epidemics or pandemics, depending on their ability to spread.

Due to rapid antigenic variation, influenza vaccine formulation is changed each year to reflect the prevailing strains detected by a laboratory-based surveillance system. Trivalent vaccine is manufactured containing 2 influenza A and one B strain and is offered annually to persons in high-risk groups.

Mode of Transmission

Influenza is spread from person to person by respiratory droplets that are produced when an infected person coughs, sneezes and speaks. Transmission can also occur indirectly by contact with infectious secretions on objects (fomites). The incubation period is 2-3 days. Persons are infectious up to 1 day before and seven days after the onset of symptoms.

Clinical Presentation

The infection is characterized by fever, chills, headache, myalgia, malaise, mild sore throat, coryza and cough. Individuals may experience disease ranging from mild respiratory illness to fatal viral pneumonia.

It affects all age groups, however, the elderly, and those compromised by chronic pulmonary, cardiac or metabolic disease are more susceptible to severe disease and death.

Case Definitions

Key messages (WHO, 2013)

- Influenza infection causes a clinical syndrome not easily distinguished from other respiratory infections.
- The case definitions for Acute Respiratory Illness (ARI), influenza like illness (ILI), and severe acute respiratory infection (SARI) are not necessarily intended to capture all cases but to describe trends over time.
- Using one common case definition globally will allow national health authorities to interpret their data in an international context.

Suspected case

i) **ARI case definition**

An acute respiratory infection – (having at least one of the following: shortness of breath; cough, sore throat, coryza) with:

- reported fever of ≥ 38°C;
- and cough;
- with onset within the last 10 days

ii) ILI case definition

An acute respiratory infection with:

- measured fever of ≥ 38 C°;
- and cough;
- with onset within the last 10 days.

iii) SARI case definition

An acute respiratory infection with:

- history of fever or measured fever of ≥ 38 C°;
- and cough;
- with onset within the last 10 days;
- and requires hospitalization.

Confirmed case

i) Laboratory confirmed case: An ARI, ILI, or SARI case with positive RT-PCR for influenza.

ii) Epidemiologically confirmed case: an ARI, ILI, or SARI case linked to a laboratory confirmed case in an epidemic situation.

Laboratory Confirmation

Laboratory Diagnosis

For the purposes of surveillance, laboratory confirmation can be by any of the following, however RT-PCR is the most common diagnostic test:

- Conventional or real-time reverse transcriptase-polymerase chain reaction (RT-PCR) to identify influenza viral RNA.
- Viral antigen detection by immunofluorescence or enzyme immunoassay methods (including commercially available bedside tests).
- Viral culture with a second identification step to identify influenza viruses (immunofluorescence, haemagglutination–inhibition, or RT-PCR).
- Four-fold rise in antibody titre in paired acute and convalescent sera.

Specimen Collection and Transport

a. Oropharyngeal and nasopharyngeal swabs (Dacron)
   These are collected within the first 5 days of onset of illness, placed in viral transport medium, and shipped to the laboratory within 24 hours on wet ice. If this is not possible, specimens should be stored at –70°C and shipped on dry ice to the laboratory.
b. Nasopharyngeal washings
   These are collected within the first 5 days of onset into a sterile vial and transported immediately to the laboratory on wet ice.
c. Blood samples
   Acute and convalescent samples may be drawn from a number of suspected cases, the former within 3 days of onset and the latter 14 days later. The serum is separated by centrifugation and sent in sterile tubes to the laboratory for serological testing.

Note: Specimens **a** and **b** are preferred for Influenza diagnosis.

<u>Treatment and Prevention and Control</u>

- The current formulation of influenza vaccine should be administered before the season, or prior to an anticipated outbreak. Target groups are individuals at risk mentioned below. Healthcare workers and those in essential community services should also be protected by vaccination.

- The drugs currently recommended for the treatment of influenza A and B are the neuraminidase inhibitors (e.g. Oseltamivir, Zanamivir and peramivir). Each country should maintain a stock of these antivirals for the treatment of influenza especially ahead of the flu season.

- Appropriate antibiotics should be used if secondary bacterial pneumonia is suspected.

<u>Animal Health Surveillance</u>

Several animal species may act as a source of flu viruses. Flu viruses are known to cause disease and are transmitted among animals, such as domestic and wild birds, pigs, horses, dogs and cats. The 2009 H1N1 pandemic and others were caused by flu viruses in animals that acquired the ability to infect and spread easily in humans; because of this public health agencies such as the CDC and infectious disease experts around the world monitor flu viruses that circulate in animals.

CARPHA's Medical Microbiology Laboratory provides confirmation of influenza infection in humans using PCR. Nasopharyngeal or oropharyngeal swabs, aspirate or washes should be

collected within 1 to 7 days from the onset of symptoms and sent to the laboratory for testing according to the instructions above.

The following events should be monitored in the veterinary sector:

- Reports of respiratory syndromes in farm animals identified by veterinarians.
- Unexplained deaths of farm animals such as chickens and wild birds.
- Domestic animals with respiratory syndromes identified at veterinary clinics.
- History of contact with domesticated birds or visit to live bird markets in patients with ILI or SARI.

Environmental Health

Influenza like illnesses normally shows seasonal variation throughout the year. The flu season generally coincides with the dryer and cooler months of the year (November to March). There is also a suggested relation between the levels of Sahara dust in the atmosphere and respiratory disease in the Caribbean.

Increases in worker absenteeism can be a sign of increased morbidity due to influenza when outbreaks have occurred. Surveillance of reasons for medical leave can supply valuable information on flu related morbidity among workers. When analysed by sector, workers at increased risk may be identified.

The following parameters should be monitored:

- Seasonal variation in rainfall, humidity, temperature and corelate with the trends in influenza like illness, acute respiratory infection and severe acute respiratory infections.
- Air quality, including the seasonal variation in Sahara dust and its relation to respiratory diseases identified in humans.
- Worker absenteeism and medical leave claims during flu season.

Traveller's Health

Typical outbreaks of influenza in the Northern hemisphere begin in early winter. As such the flu season also coincides with the winter tourist season in the Caribbean which generally extends from November to March.

Surveillance at ports of entry is vital for the detection and control of outbreaks of respiratory diseases, paying special attention to the following:

- Ensure that all arriving ships have completely and accurately completed the maritime declaration of health, paying attention to the threshold of level of infection before pratique is granted.
- Ensure that the health declaration is accurately completed by the captain of all arriving aircraft before port health clearance is given.
- Syndromic surveillance at tourist accommodations should be maintained to allow for early detection of priority diseases and outbreaks.

Outbreak Investigation and control

- The detection of a new subtype of influenza should be reported to the WHO via the regional IHR focal point.

- Detection of levels of influenza above seasonal baselines should trigger the activation of the country's influenza plan and the necessary control measures.

- Once an outbreak is confirmed, efforts should be made to obtain information on travel, exposure to animals, occupation, vaccination, comorbidities, etc.

- Follow up all contacts with possible exposure and educate them on the need to monitor for development of symptoms and how to seek health care should symptoms develop.
- Quarantine individuals with likely exposure for the standard incubation period to watch for development of symptoms. Testing should be done according to international protocols for the current strain.

- The public should be educated about appropriate hand hygiene and about exercising proper cough and sneeze etiquette. They should also be advised to avoid unnecessary contact persons who are sick.

- Crowding of large numbers of people in enclosed places should be avoided.

- During an influenza epidemic, attempts should be made to prevent severe disease in persons at high risk (the elderly; cardiac patients; those with chronic health conditions such as bronchitis, emphysema, asthma; those with renal disease or diabetes; persons with immunosuppression; children under 5 years; and pregnant women).

- In addition to using standard Infection Prevention and Control measures at health care facilities the following steps should be taken [(1)]:
    - Health care workers should routinely wear PPE consisting of a surgical mask, protective eyewear and disposable gloves if they are undertaking an examination that may lead to coughing in an individual with an acute respiratory illness (e.g., collecting nose/throat swabs)
    - Infectious patients should wear a surgical mask when not in isolation.
    - Erect signage at the entrance to general practice, emergency departments and outpatient settings requesting that patients with ILI should inform reception staff immediately on arrival, should don a surgical mask, and perform hand hygiene.
    - Highlight the importance of hand hygiene and respiratory hygiene/cough etiquette amongst patients and staff.
    - Residential or long-term care facilities and hospital wards will need to take additional precautions to limit exposures to infected persons and to stop the spread of the virus.

LEGIONNAIRE'S DISEASE

Internationally notifiable:	**No**
Reporting interval:	**Immediately**

Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Legionnaire's disease is a bacterial illness caused by *Legionella* species (*L. pneumophilla* being the most common cause) that can range from mild febrile illness (Pontiac disease) to progressively severe and fatal pneumonia (Legionnaires' disease). Transmission is by contaminated aerosols from air conditioning cooling towers, hot and cold-water systems, whirlpool spas and humidifiers. Aspiration of contaminated ice or water by susceptible hospital patients also results in infection.

Persons at higher risk of legionnaires include the immunocompromised, those with chronic comorbidities (diabetes, chronic obstructive pulmonary disease (COPD), congestive heart failure, chronic liver and kidney disease), smokers and those over 50 years old. Additionally, hospitalized patients who are intubated and those fed by nasogastric tubes are also at increased risk of the infection.

The incubation period ranges from a few up to 48 hours for the mild form, and from 2 to 10 (sometimes up to 16) days for the severe form.

Clinical presentation

Legionnaire's disease has two presentations:

- Pontiac disease is a self-limited influenza-like illness that lasts 2 – 5 days and resolves without treatment.

- Symptoms of Legionnaire's disease include fever, anorexia, headache, malaise, myalgia, lethargy and diarrhoea. There is usually a cough productive of phlegm that is sometimes blood streaked. The pneumonia can rapidly progress resulting in respiratory failure, shock, multiorgan failure and death if untreated. The overall death rate is usually 5 – 10% but it can be as high as 40–80% in untreated immuno-suppressed patients (WHO, 2018).

Case Definition

a) Suspected case

An illness that meets the clinical description for Legionnaires' disease, characterized by fever, headaches and myalgia, followed by signs and symptoms or radiological evidence of pneumonia.

b) Probable

A clinically compatible case with an epidemiologic link to a setting with a confirmed source of or confirmed case(s) of *Legionella* during the 14 days before onset of symptoms.

c) Confirmed case

Clinical or radiological evidence of pneumonia with laboratory isolation of *L. pneumophila* or serological findings as listed at consistent with the disease.

Laboratory Diagnosis

Laboratory Confirmation

Laboratory criteria for diagnosis are:

- Detection of *Legionella* from lung tissue, respiratory secretions, pleural fluid, blood, or other normally sterile sites by PCR, or
- Demonstration of a fourfold or greater rise in the reciprocal IF (immunofluorescence) antibody titre or an acute titre ≥1:128 against Legionella pneumophila serogroup 1, or
- Demonstration of *L. pneumophila* serogroup 1 in lung tissue, respiratory secretions, or pleural fluid by direct fluorescence antibody testing, or
- Demonstration of *L. pneumophila* serogroup 1 antigen in urine by radioimmunoassay.
- Culture of *Legionella* from respiratory secretions is the gold standard but requires special medium (buffered charcoal yeast extract agar (BCYE).

Specimen Collection and Transport

Blood, respiratory secretions, pleural fluid and urine:

- These are collected as early as possible in the illness. If submitted for isolation of bacteria, they should be transported immediately at room temperature (CSF should reach the laboratory within one hour).

Blood for Serology:

- Paired sera are required for antibody titres. The first specimen should be collected as early as possible in the illness, and the second one week later.
- Specimens of blood for serology are transported to the laboratory on wet ice (4°C). They should not be frozen and should be received at the laboratory within 24 hours of collection.

Syndromic Surveillance

- Legionnaires disease should be reported as a syndrome under ILI/SARI.

Environmental surveillance

Legionella can survive under a wide range of environmental conditions such as in refrigerated water, air conditioning cooling systems, drinking water systems and, pressurized water systems, and to a lesser extent in natural bodies of water. Legionella form microcolonies within biofilm and warm temperatures (25-42^{o}C) and the presence of sediments enhance colonization. The presence of ciliated protozoa, algae and amoeba in water promotes the growth of *Legionella*.

Water distribution systems can become contaminated with legionella by runoff after heavy rainfall. Colonization of water systems located in office buildings, malls, hotels, motor vehicle washing facilities and factories are common sources of legionnaires' disease acquired in the community. Cooling towers have been labelled as the major source of legionella outbreaks but drinking water systems may be a more common source.

The follow should be considered for environmental surveillance:

- Monitor water quality, including residual chlorine levels (note however CFU/ml have proven unreliable and inconsistent in predicting disease).

- Environmental culture of hospital water supplies for Legionella should be done routinely to prevent hospital-acquired Legionnaires' disease.
- Conduct sampling and culture of water from cooling towers, air conditioning systems, whirlpools, spas and other aerosol generating machinery in public settings (such as car washers) as part of an outbreak investigation.

Traveller's health

- Syndromic surveillance at tourist accommodations should be maintained to allow for early detection of priority diseases and outbreaks.
- Conduct sampling and culture of water from cooling towers, air conditioning systems, whirlpools as indicated above.

Case/cluster investigation

- Interview the case(s) to confirm the date of onset, signs and symptoms of the illness
- Obtain a detailed exposure history; identify all activities and places visited (including malls, hospitals, water fountains, car washes, etc.) during the exposure period (2-14 days).
- Confirm results of laboratory tests, or recommend the tests be done.
- Identify likely source(s) of a cluster or outbreak, including mapping of cases, and initiate control measures.
- If the infection was hospital acquired or associated, initiate an intensive environmental investigation for a source in the health care setting.
- Actively search for additional cases with hospital acquired infection, workplace exposure and community clusters.
- Notify the public of common exposure and the need to seek medical attention if there are suggestive symptoms.

Control and Prevention

- Investigate cases and contacts early with a view to identifying and decontaminating source of infection.
- The antibiotic treatment of choice for *Legionella* are the macrolides (especially azithromycin) and the quinolones (especially levofloxacin).
- Carry out preventive maintenance of air-conditioning and ventilation systems in accordance with manufacturer's instructions/guidelines. Routine decontamination is recommended.
- Install appropriate devices to reduce dissemination of aerosols from cooling towers;
- Maintain an adequate level of a disinfectant such as chlorine in a spa pool and completely drain and clean the whole system at least weekly;
- Keep hot and cold water systems clean and at adequate temperatures (>50 ^{o}C and <25 ^{o}C respectively), and treat them with a suitable disinfectant to limit growth, especially in hospitals and other health care settings, and aged-care facilities (WHO, 2018);
- Flush unused taps in buildings on a weekly basis to reduce stagnation of water.
- Implement special surveillance of illness among workers whose occupations are considered high-risk for exposure to infection. Such surveillance should be qualified, as it does not refer to ongoing routine surveillance related to all potential sources of

infection, but is activated on epidemiologic considerations in the event of disease occurrence.

- Routine environmental sampling is not recommended, except for cooling towers implicated during an investigation.
- If a single confirmed nosocomial case is detected, initiate investigation for a hospital source, and other possible infected persons. If L*egionella* is detected in > 30% of hospital sites, increase index of suspicion and consider empiric therapy for hospital acquired legionnaires' disease.

Technical Notes

Clinical symptoms of pneumonia can vary but must include acute onset of lower respiratory infection with fever and/or cough. Other symptoms could include shortness of breath, headache, myalgia, malaise, chest discomfort, confusion, nausea, abdominal pain, or diarrhoea (CDC, 2020).

TUBERCULOSIS

Internationally notifiable:	**No**
Reporting interval:	**Monthly/Quarterly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Tuberculosis (TB) is a chronic bacterial disease due to infection with Mycobacterium species and characterized pathologically by the formation of granulomas. The lungs are most commonly affected, but lesions may also occur in the kidneys, bones, lymph nodes, or meninges or be disseminated throughout the body. The infection may cause disease either shortly after inoculation or after a period of months or decades of dormancy.

Transmission occurs through exposure to tubercle bacilli in airborne droplet nuclei produced by persons with pulmonary or laryngeal tuberculosis. Prolonged close exposure to an infectious case may lead to infection of contacts. Except for rare situations where there is a draining sinus, extrapulmonary tuberculosis (other than laryngeal) is generally not communicable.

There are an estimated 1.7 billion people infected with TB worldwide and each year around 10 million fall ill with the disease (the majority in developing countries). Globally, the TB mortality rate fell by 42% between 2000 and 2018 (WHO, 2019). After a progressive decline of TB among CARPHA member countries during the first half of the 1980's, a tendency to plateau was observed during the period 1988/89. Since then, there has been a gradual but distinctly notable increase in some member countries. Upward trend in HIV infections/AIDS is among the factors contributing to this rising pattern in some member countries.

The control of TB continues to be a major public health challenge. With the overall goal to end the global TB epidemic, the End TB Strategy, which covers the period 2016 – 2035, was adopted by all WHO Member States at the World Health Assembly in 2014 (WHO, 2019).

Clinical presentation

Initial infection often produces no significant clinical illness. With progressive disease (pulmonary or extra-pulmonary) the general symptoms are weight loss, malaise, fatigue, fever and night sweats. Pulmonary tuberculosis also includes persistent productive cough over long periods (3 weeks or more) with or without blood-stained sputum. The symptoms of extra-pulmonary disease depend on the part of the body that is affected.

Persons infected with the Human Immunodeficiency Virus (HIV), with or without AIDS are at increased risk of developing TB.

<u>Case Definition (WHO)</u>

Based on diagnostic criteria, TB can be defined as:

1. **Presumptive TB** (formerly known as suspected TB): anyone with symptoms or signs that suggest tuberculosis.
2. **Bacteriologically confirmed TB:** anyone with a positive sputum smear, culture, or rapid test (Xpert MTB/RIF and other molecular assays, or immunochromatography).
3. **Clinically diagnosed TB**: anyone who does not meet the criteria for bacteriological confirmation but has been diagnosed with active TB and a decision made to administer a full course of TB treatment to the patient. Clinical diagnosis can be based on anomalous x-ray findings or suggestive histology and extrapulmonary cases without laboratory confirmation. With subsequent positive bacteriology, these cases should be reclassified as bacteriologically confirmed TB.

WHO further classifies bacteriologically confirmed or clinically diagnosed cases of TB as follows:

Based on the anatomical site of TB disease

- **Pulmonary TB (PTB)** refers to TB involving the lung parenchyma or the tracheobronchial tree. Miliary tuberculosis is classified as pulmonary TB because there are lesions in the lungs. Tuberculous intrathoracic lymphadenopathy (mediastinal and/or hilar) or tuberculous pleural effusion, without radiographic abnormalities in the lungs, constitutes a case of extrapulmonary TB (EPTB). A patient with both PTB and EPTB should be classified as a case of pulmonary TB.
- **Extrapulmonary TB** refers to TB involving organs other than the lungs, e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints, bones and meninges. Diagnosis of EPTB is made only with a positive TB culture.

Based on the bacteriological results for PTB cases

- **Smear positive**: One or more sputum smear specimens at the start of treatment are positive for Acid Fast Bacilli (AFB).
- **Smear negative**: Sputum is smear-negative but culture-positive for M. tuberculosis **OR** smear negative with radiographic abnormalities consistent with active PTB and clinician to treat with a full course of anti-TB.

Based on the history of previous treatment

- **New patients** – never had treatment for TB or have taken anti-TB drugs for less than one month.

- **Previously treated patients** - have received one month or more of anti-TB drugs in the past. These cases can be further categorized based on the treatment outcomes as follows:
    a) **Relapse:** Patients who have previously been treated for TB, were declared cured or treatment completed at the end of their most recent course of treatment and are newly diagnosed with TB (reactivation or a new infection).
    b) **Treatment after failure patients**: Patients who have previously been treated for TB but whose treatment failed (positive sputum smear or culture at month five or subsequently during treatment).
    c) **Treatment after loss to follow-up patients**: Patients who have previously been treated for TB and were declared lost to follow-up at the end of their most recent course of treatment (persons diagnosed with TB who did not begin treatment or whose treatment was interrupted for a month or more). These were previously known as treatment after default patients.
    d) **Other previously treated cases**: Patients who have previously been treated for TB but whose outcome after their most recent course of treatment is unknown or undocumented.
- **Patients with unknown previous TB treatment history**: Patients who do fit into any of categories listed.

Based on the effectiveness of TB treatment determined by DST

- **Drug susceptible TB** - no drug resistance to TB medications
- **Drug Resistant TB** - depending on the resistance profile, this is further categorized as follows:
    - **Monoresistance**: resistance to only one first-line TB drug.
    - **Polydrug resistance**: resistance to more than one first-line TB drug (other than both isoniazid (INH) and rifampicin)
    - **Multidrug resistance (MDR-TB):** resistance to at least both INH and rifampicin
    - **Extensive drug resistance (XDR-TB):** resistance to any fluoroquinolone and to at least one of the three second-line injectable drugs (capreomycin, kanamycin, and amikacin), in addition to multidrug resistance
    - **Rifampicin resistance (RR**): resistance to rifampicin detected using phenotypic or genotypic methods, with or without resistance to other TB drugs. It includes any resistance to rifampicin, whether monoresistance, multidrug resistance, polydrug resistance, or extensive drug resistance.

Serological HIV test result:

Diagnosing TB/HIV coinfection is critical in managing the patient.

- **HIV-positive TB patient** refers to any bacteriologically confirmed or clinically diagnosed case of TB who has a positive HIV test.
- **HIV-negative TB patient** refers to any bacteriologically confirmed or clinically diagnosed case of TB who has a negative HIV test.
- **HIV status unknown TB patient** refers to any bacteriologically confirmed or clinically diagnosed case of TB who has no result of HIV testing.

Outcomes of TB treatment

- **Cure**: A TB patient whose sputum smear or culture was positive at the beginning of the treatment but who was smear- or culture-negative in the last month of treatment and on at least one previous occasion.
- **Treatment Completed:** A TB patient who completed treatment but who does not have a negative sputum smear or culture result in the last month of treatment and on at least one previous occasion.
- **Treatment Failure**: A TB patient whose sputum smear or culture is positive at five months or later during treatment. Also included in this definition are patients found to have a MDR strain at any point of time during the treatment, whether they are smear-negative or –positive. (The sputum examination may not have been done or the results may not be available.)
- **Died**: A TB patient who dies for any reason before starting or during the course of treatment.
- **Default**: A TB patient whose treatment was interrupted for two consecutive months or more.
- **Transfer Out:** A TB patient who has been transferred to another recording and reporting unit and whose treatment outcome is unknown.
- **Treatment Success:** The sum of cured and completed treatment (for smear- or culture-positive patients only).

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

- Isolation of *M. tuberculosis* from a clinical specimen, OR
- Demonstration of *M. tuberculosis* complex from a clinical specimen by nucleic acid amplification test, OR
- Demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated. (CDC, 2009)

Specimen Collection and Transport

b) Three (3) sputum specimens are collected (within 24 hours where possible).
c) Explain to the patient that spit or saliva is not suitable. Patients should be requested to rinse their mouths out first with water, if they have been chewing food immediately before sputum collection.
d) Ask the patient to cough deeply, clear the back of the throat and produce about 5 –10ml of sputum in the container. Repeat the process until a sufficient amount of sputum is obtained.
e) After collecting the sputum, place the lid on the container and close firmly. Use a clean, leakproof, screw-capped plastic or glass container (do not use wax container).
    - Sputum for isolation should be stored and transported to the laboratory within 24 hours.
    - Sputum for smear microscopy may be transported at room temperature.
f) Sputum should be transported in sealable plastic bags with a separate pouch for completed request forms.

<u>Syndromic Surveillance</u>

Cases of TB may be captured in the acute respiratory infection (ARI) surveillance system. Patients presenting with typical symptoms and signs of TB may be identified at the first level of care and confirmed via laboratory testing.

Environmental Health

The persistence and spread of TB are facilitated in areas of poverty, overcrowding and poor sanitation. The surveillance of environmental determinants that favour the spread of TB and other communicable diseases and the application of measures to mitigate or eliminate these hazards should be a priority of public health systems.

Traveller's Health

Global travel provides an avenue for the spread of TB worldwide. The influx of travellers from countries with a high incidence of TB continues to be a challenge for countries pursuing TB elimination. In 2016, seven countries accounted for 64% of the estimated 10.4 million new cases of TB worldwide: India, China, Indonesia, the Philippines, Pakistan, Nigeria and South Africa. CARPHA Member States are dependent on tourism and receive millions of visitors annually. This along with the relatively high incidence of HIV makes the region vulnerable to outbreaks of TB. As such, countries must have local capacity to rapidly detect and control occurrences of this disease.

Animal health surveillance

The *Mycobacterium tuberculosis* complex consists of eight subgroups of organisms of which M. Tuberculosis is the most important. Some members of this complex are capable of causing zoonotic diseases. These include *M. bovis* (the bovine tubercle bacillus, a cause of TB transmitted by unpasteurized milk, especially in Africa) and *M. caprae* (related to *M. bovis*). Other rare causes of TB include *M. pinnipedii* (which infects seals and sea lions in the Southern Hemisphere and also have been isolated from humans), *M. mungi* (from banded mongooses in southern Africa), M*. orygs* (seen in antelopes and other Bovidae in Africa and Asia and a potential cause of infection in humans), and *M. microti* (in voles) [(4)].

Control and Prevention

- Control and prevention depend upon early case finding and administration of adequate treatment to achieve cure.
- Establish case-finding and treatment facilities for infectious cases to reduce transmission.
- Make available medical, laboratory and x-ray facilities for prompt examination of patients, contacts and suspects; facilities for early treatment of cases and people at high risk of infection; and beds for those needing hospitalization.
- Educate the public in mode of spread and methods of control and the importance of early diagnosis and treatment. Education should include the risk associated with overcrowding.
- TB prevention and control programmes should be established in all institutional settings at which health care is provided and/or HIV-infected persons may be congregated.
- Initiate early and appropriate treatment utilizing multi-drug regime (isoniazid, rifampicin, pyrazinamide and ethambutol) and take steps to avoid the development of drug resistance, usually caused by using inadequate/ inappropriate drug regimes.

- Implement the Directly Observed Therapy Short-course (DOTS) approach to treatment, especially in the initial phase.
- Provide outreach services where possible for direct supervision of patient therapy to ensure drug compliance. Innovative methods should be pursued towards this end as supervision by formally trained health staff is impractical to cover all cases where this is required.
- BCG vaccine is recommended for all infants preferably at birth (with the exception of those with HIV/AIDS or who are otherwise immuno-compromised) in populations with a high prevalence of TB.
- Use the Mantoux tuberculin skin testing for the identification of latent TB infection and chemoprophylaxis where indicated.
- Maintain evaluation of programmes to ensure maximum effectiveness possible.

Note: Active case-finding is used to follow-up of close contacts of smear positive patients and for high risk groups such as health care workers, prison inmates, elderly in long stay institutions, migrants, etc.

Passive case-finding is based on self-referral of symptomatic individuals who seek medical attention at a health care facility in the public or private sector.

Reporting and Investigative Procedures

There will be variations in the details of reporting and investigative procedures depending on the type of TB control programme in place.

Basic needs are:

- A designated programme manager (or national coordinator) at central level with responsibility for planning, coordinating and evaluating activities of the programme. This should be a Senior Medical Officer, preferably with specialization in infectious diseases, epidemiology or public health. The programme manager works in close liaison with the National Epidemiologist and reports directly to the Chief Medical Officer of the Ministry of Health.
- Field coordinator at regional, parish, county or district level, depending upon the administrative structure for the delivery of community health services at the peripheral level. This is necessary to facilitate the integration of the national programme into the existing health services as opposed to a vertical programme. This establishes a continuum of linkage to the national level of coordination.
- Laboratory services to provide a minimum of microscopic examination for acid fast bacilli (AFB), and where possible for the culture and identification of *M. tuberculosis*.
- Regular and adequate drug supplies required for use in multi-drug regimen of treatment to effect cure and prevent the development of drug resistance.
- A standardized system for recording, reporting and maintaining tuberculosis registers.
- The provision of suitable training for health workers. The extent and level of this training would vary with the level of available staff, which can extend from medical officers, through trained nurses, nursing aides, low level health aides which may exist in remote rural areas, whose role may be no more than to recognize suspicious cases of illness or at risk persons and arrange for referral to the appropriate level.

- Referral facility/facilities to which suspected cases can be referred by health care providers in the public or private sector for investigation, treatment and other relevant follow-up action.

Vaccine Preventable Diseases

CHICKENPOX (VARICELLA)

Internationally notifiable:	**No**
Reporting interval:	**Within 48 hours**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

The varicella-zoster virus (VZV) causes varicella (chickenpox) with acute primary infection and herpes zoster (shingles) by endogenous reactivation from latency. In temperate countries acquisition of infection tends to be at a younger age with greater than 90% infected by adolescence in absence of vaccination programme. In tropical regions however, an older age distribution is observed. Large outbreaks of varicella can occur every 2 – 5 years and there is a predominance of occurrence of cases in the winter/spring or cool/dry months. Because VZV is highly contagious secondary attack rates from varicella cases can ranging from 61–100%. The virus is transmitted from person-to-person primarily by inhalation of aerosols from vesicular fluid of skin lesions, by direct contact with rash and possibly by infected respiratory tract secretions. The incubation period, from time of contact to rash onset, is generally 14–16 days, with a range of 10–21 days.

Clinical presentation

The prodrome consists of fever, malaise and anorexia and can precede the rash by several days. The rash consists of new crops of skin lesions which progress over five to seven days from macules to papules, to pruritic vesicles and then scabs, with unvaccinated individuals often typically having approximately 300 lesions. Crops of rash on affected regions in various stages of development is a typical feature of this disease. VZV can be transmitted one to two days before rash onset and until the lesions have crusted.

Varicella is usually mild and self-limited. Rare severe complications include pneumonia, cerebellar ataxia, encephalitis, haemorrhagic conditions and bacterial superinfection of skin lesions. Serious disease with visceral organ involvement can occur in immunocompromised persons.

Groups at high risk for more serious disease and complications of primary VZV infection include infants < 1-year old, pregnant women, adults and immunocompromised persons.

Herpes Zoster (shingles) occurs as a result of reactivation later in life of latent VZV. It is characterized by a vesicular rash usually in a single dermatome accompanied by radicular pain, which can last from two to four weeks. Active Herpes Zoster can transmit VZV to susceptible people, causing varicella (chickenpox). Post herpetic neuralgia is a common and often debilitating complication of herpes zoster and can cause persistent pain for months to years after the rash resolves.

Case Definitions (WHO, 2018)

Suspected Case Definition for Case Finding

Acute onset of a generalized maculopapulovesicular rash with concomitant presence of papules, blisters, pustules or crusts appearing on trunk and face and spreading to extremities, without other apparent cause.

Final Case Classification

Laboratory-confirmed: A suspected case with laboratory evidence of acute VZV infection by one of the following methods:

- Detection of VZV DNA (using PCR)
- Direct antigen detection of VZV from an appropriate clinical specimen (for example, direct fluorescent antibody (DFA) testing)
- Isolation using viral culture
- Seroconversion or a significant rise (fourfold or greater) in varicella-zoster IgG titre between acute and convalescent sera by any validated serologic assay.

Epidemiologically linked confirmed case: A suspected case that is epidemiologically linked to a laboratory confirmed case, another case confirmed by epidemiologic linkage, or another clinically compatible case of VZV.

Epidemiologic linkage requires contact between two people involving a plausible mode of transmission at a time when:

- One of them is likely to be infectious (one to two days before rash onset until lesions have crusted)
  AND
- The other has illness 10–21 days after contact (the incubation period).

Clinically compatible case. A case that meets the suspected case definition, is not laboratory-confirmed and is not epidemiologically linked to another clinically compatible or confirmed case.

Other Definitions

Vaccine associated varicella: A varicella-like rash in a person vaccinated 5–42 days prior to rash onset, or isolation of vaccine-type virus from rash that occurs during that interval after vaccination.

Modified varicella in a vaccinated person *(also known as breakthrough varicella):* is varicella due to wild-type virus that occurs in vaccinated people (> 42 days after vaccination). Modified varicella is usually mild, with < 50 lesions, low or no fever, and shorter duration of rash. The rash may be atypical in appearance with predominance of maculopapular lesions and fewer vesicles.

Specimen Collection

The diagnosis of varicella is usually made clinically by the characteristic clinical presentation of the rash with fever.

If a country chooses to conduct laboratory testing, several types of specimens can be collected.

- Skin lesions are the preferred specimen, which is collected by unroofing a vesicle (preferably a fresh fluid-filled vesicle) with a sterile needle and swabbing the base of the lesion with a sterile polyester swab with enough vigour to ensure epithelial cells are collected. Do not use cotton swabs.
- If the rash comprises only macules or papules, scrape the lesion (with the edge of a glass microscope slide, for example), swab the abraded lesion with a polyester swab,

and then use the same swab to collect any material that was accumulated on the object that was used to scrape the lesion (avoid contaminating the sample with blood if direct fluorescent antibody test (DFA) is to be used). Swabs can be used for PCR, DFA or viral culture. Swabs for PCR should be transported dry or in universal transport media for culture.

- Crusts or scabs from skin lesions are excellent specimens for PCR testing but not for DFA or culture. To collect these, crusts should be lifted off the skin, placed into an empty tube and transported dry.
  The swabs and crusts should be transported at ambient temperature and arrive at the laboratory as soon as possible.
- For paired IgG antibody testing a venepuncture blood specimen can be collected and sent to the laboratory for testing. Blood collection tubes can be those for serum or plasma. Serum and plasma samples may be stored for up to five days at 2–8 °C or four weeks at -20 °C. An acute specimen should be taken within the first few days of illness, and the convalescent specimen should be taken at least three weeks later. For acute varicella, cheek and throat swabs and oral fluid are nearly as reliable as skin lesion samples and scabs.

Outbreak Response

An outbreak is an increase in varicella cases over baseline, tightly clustered in place and time. Because varicella outbreaks are so widespread in the absence of a vaccine programme, investigations should be prioritized among potentially high-risk individuals in well circumscribed settings such as hospitals, jails and day care facilities with infants.

Public health response measures:

- Once an outbreak is confirmed, enhanced surveillance with line listing should be conducted to keep track of cases and document outcomes, particularly complications. If not already established, surveillance should continue through two full incubation periods (42 days) after the rash onset of the last identified case to ensure that the outbreak has ended.
- Vaccination is recommended to control the outbreak and prevent spread. Single-dose varicella vaccine administered within three to five days of exposure has proved to be highly effective for prevention of disease (> 70%), the earlier after exposure the higher the efficacy
- If vaccination is contraindicated or refused the person should be excluded from school or work for up to 21 days after the last case is identified to prevent infection.
- VZV immune globulin can be effective for post-exposure prophylaxis if given soon after exposure, to reduce disease severity in persons at high risk for severe varicella such as pregnant women, immunocompromised persons and neonates.
- Post-exposure prophylaxis with antiviral medications has been shown to prevent clinical disease in immunocompromised children.

DIPHTHERIA

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly**
	PAHO EPI Advisor weekly

Overview

Diphtheria is an acute bacterial disease of the upper respiratory tract and occasionally of the skin, conjunctivae or genitalia. It is caused by toxigenic strains of *Corynebacterium diphtheriae.* Infection may be clinically inapparent or may result in a mild nasal discharge in adults or severe laryngeal disease in children.

characterized by a greyish membrane caused by the bacterial cytotoxin.

Humans are the reservoir for *C. diphtheria* and transmission is by respiratory droplets, contact with nasopharyngeal secretions, infected skin lesions and rarely fomites. Persons may become asymptomatic carriers and can spread the disease to others. The disease can occur in epidemic proportions in any community with low immunization coverage. The incubation period is 2 to 5 days. The case fatality rate in recent outbreaks has been 5 to 10%.

Clinical presentation

There is usually an insidious onset of pharyngitis and/or laryngitis with a distinctive thick, adherent, greyish white membrane on the pharynx caused by the bacterial cytotoxin. Other mucous membranes may be affected. Patients may have enlarged anterior cervical lymph nodes, and oedematous surrounding tissue.

On the skin lesions usually arise on exposed areas, especially on the legs. They appear as vesicles and quickly progress to small, sometimes multiple, well delineated, ulcers. Generally, disease of the skin is not accompanied by systemic symptoms.

Diphtheria vaccine is included in the childhood immunization schedule as part of the triple vaccine DTP - Diphtheria, Tetanus and Pertussis. Four doses constitute the primary series; the first at 6 - 8 weeks, the second and third at intervals of 4 - 8 weeks thereafter, and a booster at 18 months. The toxoid contained in this vaccine induces a long-lasting immunity.

The purpose of surveillance is to predict epidemics by early detection of cases so that control measures can be instituted, and to monitor the effectiveness of vaccination.

Case Definition

Probable Case

An illness characterized by tonsillitis **or** pharyngitis **or** laryngitis, **and** an adherent greyish membrane on the tonsils, pharynx and/or nose.

Confirmed case

Laboratory confirmed case
A probable case from which toxin-producing *C. diphtheriae* has been cultured, or a four-fold or greater rise in serum antibody (only if both serum samples are taken before the administration of diphtheria toxoid or antitoxin).

Epidemiologically confirmed case
A probable case that is linked epidemiologically to a laboratory confirmed case

Laboratory Diagnosis

Laboratory Confirmation
Organisms are cultured and identified as *C. diphtheriae* toxigenic (which is diagnostic) or non-toxigenic.
Laboratory investigation of sporadic cases is necessary to rule out viral or streptococcal pharyngitis, Vincent's angina, infectious mononucleosis, oral candidiasis or oral syphilis.

Specimen Collection and Transport
Throat, nose and/or nasopharyngeal swabs: These are collected from probable cases and placed in Amies transport medium. Nasopharyngeal and throat swabs are collected from healthy persons who are potential carriers.

Specimens are transported at ambient temperature accompanied by a request form stating the site of the swab, age of the patient and clinical information.

Control and Prevention

Investigation

- Identify close contacts (household members, kissing, mouth-to-mouth resuscitation, health care worker providing care, child care centre, school setting). Persons at risk are those with close contact with a case within the previous 7 days.
- Identify the risk of exposure to potential sources of infection.
- Obtain a travel history.
- Contacts of laboratory confirmed cases (regardless of their immunisation status) should have the following done:
    - Nose and throat cultures
    - Wounds swabbed,
    - Promptly receive antimicrobial prophylaxis.
- Contacts should be monitored daily for 7 days for evidence of disease.

A threatened outbreak can be controlled by the following measures:

- Isolate pharyngeal patients and prevent contact with cutaneous cases.
- Treat promptly with antibiotics (penicillin or erythromycin).
- Culture contacts and administer chemoprophylaxis if found to be carriers.
- Conduct mass immunization in high risk populations, especially children**.**

Long term measures include:

- Education of parents on the necessity for completing the full schedule of infant immunization.

- Filling in of immunity gaps in any age group using DT or Td vaccine.
- Immunization of those at special risk, e.g. health care workers, and administration of 10-year booster doses. (Note: HIV positive children may be immunized

Technical Notes

- It should also be noted that vaccination does not eliminate the carriage of *C. diphtheriae* in the pharynx, nose, or on the skin.
- Asymptomatic carriers should not be reported as probable or confirmed cases.
- Cases of cutaneous diphtheria should not be reported.

MEASLES

Internationally notifiable:	**Yes**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

Measles is a highly contagious systemic viral disease characterized by fever and a generalized maculopapular rash. It is distributed globally and can occur in all age groups but is particularly severe in malnourished young children among whom the case fatality rate can be as high as 30%.

The disease is transmitted through the air by coughing and sneezing and by direct contact with infected respirator secretions. The virus can remain active in the air for up to two hours and can cause infection. The incubation period is usually 10 – 14 days (range 7 – 23 days) from infection to the onset of symptoms. Patients are usually contagious from four days before the rash to four days after its appearance (WHO, 2018).

Clinical presentation

The early stage is characterized by high fever, conjunctivitis, coryza, cough and koplik spots (small white spots inside the cheeks) on the buccal mucosa. This is followed by a non-itchy maculopapular rash that starts on the face and neck then spreads to the rest of the body including the hands and feet that lasts 5 to 6 days. Following the appearance of the rash, infectivity declines and uncomplicated recovery takes place in 2 to 3 weeks.

Complications of measles include pneumonia, diarrhoea and encephalitis which can occur in up to 30% of persons with risk factors such as malnutrition, immunocompromised state and young children (<5 years). Other complications include otitis media, blindness (associated with vitamin A deficiency) and deafness. Pneumonia, diarrhoea and croup are the three major causes of high mortality.

Measles may resemble clinical infections with Rubella, Dengue fever, Zika, Chikungunya, Coxsackie, Parvovirus B19 and Herpesvirus 6 viruses, as well as some bacterial and rickettsial diseases.

In 2016 the region of the Americas was the first in the world to be declared free of endemic measles after many years of determined effort including mass vaccination against the disease. However, in mid-2018 endemic transmission of measles was once again re-established in the South American country of Venezuela (PAHO, 2018).

The purpose of measles surveillance in the Caribbean is the rapid detection of measles virus importation and circulation through identification of every case and to respond to, control and report on the occurrence. Surveillance for two of the febrile rash diseases, Measles and Rubella, has been integrated and a case investigation form and flow chart developed.

Case Definitions

a) **Suspected measles case**

A person with:

- Fever, and
- Maculopapular rash (non-itchy), and
- At least one of the following; cough, coryza (runny nose), or conjunctivitis

Or

- Any person in whom a health worker suspects measles infection.

b) **Confirmed measles case**

i) **Laboratory confirmed:** A suspected case that meets one of the laboratory criteria for diagnosis, which are:

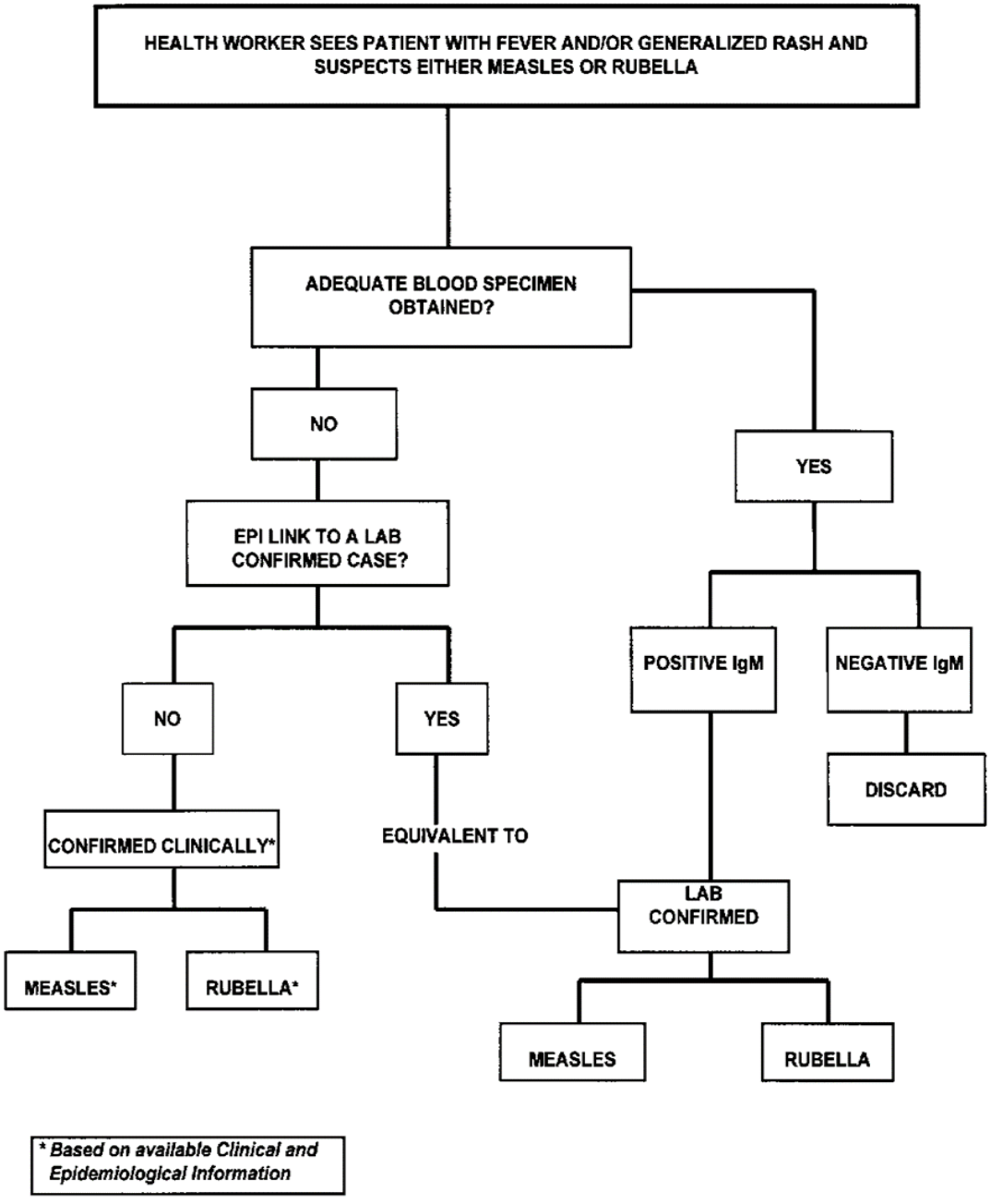
1. Presence of measles-specific IgM antibodies
2. A four-fold increase in measles antibody (IgG) between acute and convalescent stages
3. Isolation of measles virus
4. Detection of measles virus RNA by PCR

ii) **Epidemiologically confirmed**: Any suspected case linked epidemiologically to a laboratory confirmed case.

iii) **Clinically confirmed**: A suspected case where no blood sample is taken or where the patient cannot be assessed. (This category denotes a weakness in the surveillance system)

Measles case classification scheme (see flowchart)

Figure 4. Flowchart for measles/rubella surveillance



Laboratory Diagnosis

Table 9. Measles Specimen Collection and Transport (Who, 2018)

Type of sample	**Purpose**	**Timing of collection of specimens**	**Procedure**
Whole Blood/serum	Detection of IgM antibodies Documentation of IgG seroconversion in paired sera	At the first contact with the suspected case up to 30 days from the start of the rash. Pared sera are usually collected 10 – 20 days apart.	5ml to 8ml of blood in adults and older children, 1ml from younger children and 0.5ml from infants. In well-labelled tube, without anticoagulant, centrifuge and separate serum, maintain cold chain (4 to 8°C),
Nasopharyngeal / Pharyngeal swab	Virus isolation by culture, Detection of viral RNA by Rt PCR	Ideally collected within 5 days (up to 14 days) after the start of the rash.	In viral transport medium (VTM), well labelled, keep cold chain (4 to 8°C)
Urine	Virus isolation by culture, Detection of viral RNA by Rt PCR	Ideally collected within 5 days (up to 14 days) after the start of the rash.	10ml (preferably first void in the morning). Sterile bottle, well labelled, keep cold chain (4 to 8°C)

Laboratory Diagnosis

- A positive serologic test for measles IgM antibody; or
- Detection of measles-virus specific nucleic acid from a clinical specimen using PCR; or
- Isolation of measles virus from a clinical specimen; or
- IgG seroconversion or a significant rise in measles IgG antibody; or
- Direct epidemiologic linkage to a case confirmed by one of the methods above.

Case and Contact Investigation

Each country should create rapid response teams (RRT) to deal with events or diseases that require rapid control to prevent epidemics or high case-fatality [(9)].

Case/contact investigation should begin in the first 48 hours after the case is reported:

- Conduct a well-structured interview appropriate to the patient's age, with questions in a logical sequence, using appropriate language. Standardized epidemiological forms for case investigation should be used to guide the interview and record data.
- Start contact tracing with strict observation of symptoms for 30 days.
- Collect specimens (serum, urine, nasopharyngeal or throat swab) of other suspected measles cases in contact with the confirmed case, and ship to the laboratory.
- Describe the outbreak in terms of person, place, and time.
- Analyse the potential risks of virus spread based on:

    - Risk factors in the locality
    - Identification of the population exposed to risk
    - Likely routes for movement of the virus.
    - Vaccination coverage in recent years.
    - Analysis of the susceptible population.
    - Analysis of circulation of arboviruses, which can mask circulation of measles.
- Create a final case classification based on corresponding criteria (laboratory confirmed; epidemiological or clinical link).
- Determine the source of the infection (imported, import-related, autochthonous, or unknown).
- Formulation of hypotheses on case importation [(9)].

It is essential for rapid response teams (RRT) investigating a measles (or rubella) outbreak to have the following instruments and information available for the field work:

- Epidemiological forms for case investigation.
- Register of contacts with addresses and landmarks for monitoring.
- Register of places visited by suspected/confirmed cases.
- Forms for active institutional and community case-finding.
- Forms for rapid coverage monitoring.
- Analysis of vaccination coverage for MMR1 and MMR2 by municipalities.
- Analysis of susceptible population aged <5 years at national and subnational levels.
- Laboratory protocols for serum, urine, and nasopharyngeal swab sampling in the general population and sampling of infants in congenital rubella syndrome (CRS) cases.
- Protocols for special situations that warrant a second serum specimen for IgM or IgG PCR or avidity testing [(9)].

Control and Prevention

- Prevention of measles at the community level requires the simultaneous vaccination of a large proportion of children (95%) in an epidemiologically determined age range. A live attenuated vaccine is available and is given starting at age 12 to 15 months, with a second dose at 4 to 6 years.
- Vitamin A treatment is recommended for children with measles.
- Standard contact and airborne precautions should be used when interacting with measles cases.
- Measles immunoglobulin should be given to non-immunized infants, immunosuppressed individuals and susceptible pregnant women who were exposed to positive cases.

Technical Notes

Imported measles: An individual exposed to measles outside the country during the 7–23 days prior to rash onset and supported by epidemiological or virological evidence.

Importation-related measles case: A locally acquired infection that occurs as part of a chain of
transmission originating from an imported case as supported by epidemiological or virological evidence.

Endemic measles case: A confirmed case of measles resulting from endemic transmission of measles. When a chain of measles virus transmission is continuous for ≥ 12 months within a country, this is defined endemic transmission (WHO, 2018).

The CARPHA Medical Microbiological Laboratory is a member of the regional measles laboratory network which uses approved kits and participates in assessment and confirmatory testing of results.

Blood samples collected within the first 72 hours after rash onset may yield false negative IgM results. Tests on such patients should be repeated using a blood sample collected more than 72 hours after rash onset.

Specimens negative for measles IgM should be tested for rubella, dengue, Zika and chikungunya which are diseases detected in the Caribbean. A positive result indicating recent infection with any of these viruses will strengthen the decision to discard the case as measles.

MENINGITIS (DUE TO HAEMOPHILUS INFLUENZAE)

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

Haemophilus influenzae can be capsulated (types a – f) or non-capsulated. Capsular type b is responsible for 95% of severe disease. The spectrum of disorder ranges from asymptomatic colonization of the human nasopharynx to symptomatic invasive disease such as otitis media, sinusitis, pneumonia, epiglottitis meningitis and septic arthritis among others. Most invasive diseases occur in children <5 years. (WHO, 2018). Before the introduction of a vaccine, *Haemophilus influenzae* type b (Hib) was the leading cause of bacterial meningitis.

The mode of transmission is by droplet infection and discharges from nose and throat during the infectious period which lasts as long as organisms are present. The incubation period is thought to be 2 to 4 days. With effective antibiotic therapy the disease becomes non-communicable within 48 to 72 hours after the start of treatment.
The portal of entry is most commonly the nasopharynx.

Clinical presentation

The onset may be subacute or more usually sudden. Symptoms include fever, vomiting, lethargy and meningeal irritation with bulging fontanelle in infants or stiffness of neck or back in older children. Progressive stupor or coma is common. Occasionally there may be a low-grade fever lasting several days, with less severe CNS symptoms. *H. influenzae* serotype b strains are a common cause of meningitis in childhood, but adults may also be affected.

Case Definition

Suspected case

A person presenting with sudden onset fever (> 38 °C) and one of the following signs: headache, neck stiffness, altered consciousness, bulging fontanelles in babies (commonly preceded by an upper or lower respiratory tract infection).

Probable bacterial meningitis

A suspected meningitis case with cerebrospinal fluid (CSF) examination showing at least one of the following:

- Turbid appearance
- Leucocytosis (> 100 cells/mm^3)
- Leucocytosis (10–100 cells/mm^3)

  AND
- Either an elevated protein (> 100 mg/dL) or decreased glucose (< 40 mg/dL).

Confirmed case

A suspected or probable case of meningitis that is laboratory-confirmed by culture or identification of *H. influenzae* (by polymerase chain reaction (PCR), antigen detection, immunochromotography or other methods) in the CSF or blood from a patient with a clinical syndrome consistent with meningitis. (WHO, 2018)

Laboratory Diagnosis

Laboratory Confirmation

Laboratory confirmation is made by:

- Bacterial culture (CSF, Blood, etc),
- PCR (CSF) or
- Antigen detection: Rapid Diagnostic Kits are available (CSF). (WHO, 2018)

Specimen Collection and Transport

a) **Cerebrospinal fluid**

   Collect up to 3ml if possible (1ml in each of 3 tubes for chemistry, appearance and WBC and microbiological tests). This should be collected before the start of antibiotic therapy and sent to the laboratory for detection of H. influenzae type b antigen or bacterial isolation. The specimen of CSF must be transported at room temperature to reach the laboratory within one hour.

b) **Blood**

   Collect 1–3ml from a child, and 5–10ml for an adult. This should be collected before the start of antibiotic therapy for bacterial isolation. Specimens should be transported at room temperature and be should be received at the laboratory within 1 hour of collection.

Control and Prevention

- Caregivers, patients and contacts should be educated about the disease and how it is transmitted.

- Respiratory precautions should be observed during the nursing care of patients until at least 48 hours from the start of antibiotic treatment.
- Chemoprophylaxis measures should be applied to household and other close contacts of a known case, especially where these include children and infants unprotected by immunization.
- Chemoprophylaxis of staff and children in day care centres should be considered when one (1) case has occurred and is recommended when two (2) or more cases have occurred among the children. It is also recommended when children under 12 months of age or 12 – 24 months of age who are inadequately immunized have been exposed.

Technical Notes

A protein polysaccharide conjugate vaccine effective in children >6 weeks is available in monovalent formulations or combined with other antigens: diphtheria-tetanus-pertussis (DTP) vaccine, hepatitis B vaccine and inactivated polio vaccine (IPV). (WHO, 2018)

MENINGOCOCCAL INFECTION (DUE TO NEISSERIA MENINGITIDIS)

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

Meningococcal meningitis is an acute bacterial disease caused by *Neisseria meningitidis* of which one of several serogroups (A, B, C, W, X and Y) may be implicated. These serogroups can cause both endemic disease and outbreaks. The reservoir is human, and transmission is from person to person in direct contact, through respiratory droplets from nose and throat of infected persons. The incubation period ranges from 2 – 10 days. Untreated, many of those who acquire infection will progress to invasive disease characterized by one or more clinical syndromes, including fulminant septicaemia (meningococcaemia), pneumonia or meningitis.

Clinical presentation

The onset of meningitis is usually sudden with high fever, stiff neck, headache, photophobia, nausea often with vomiting and a petechial rash may appear. Meningococcal septicaemia often initially presents with systemic symptoms and signs of meningitis and progresses to often include a non-blanching haemorrhagic (petechial or purpuric) rash (WHO, 2018). Pockets of asymptomatic carriers are usually present in communities.

Polysaccharide and protein-polysaccharide conjugate vaccines are available against meningococci of serogroups A, C, W and Y. Protein-polysaccharide conjugate vaccines are

more immunogenic, elicit immunologic memory and are effective in infants as young as 2 months of age. (WHO, 2018).

Case Definition

Suspected case

An individual presenting with sudden onset of fever > 38.5°C and one of the following:

- Neck stiffness
- Altered consciousness
- Other meningeal signs
- A petechial or purpural rash
- A bulging fontanelle and ragdoll appearance in children < 1 year

Probable case

Clinical diagnosis of meningitis or septicaemia and at least one of the following:

- Purpuric rash where invasive meningococcal disease is considered the most likely cause (epidemiologically linked to confirmed cases with other causes of haemorrhagic rash excluded or considered less likely)
- Identification of Gram-negative diplococci from any normally sterile site (blood, CSF) or from a purpuric skin lesion.
- Detection of antigen of *N. meningitidis* (e.g., by latex agglutination testing) from any normally sterile site or from a purpuric skin lesion. (WHO, 2018)

Confirmed case

Identification of *N. meningitidis* via culture or polymerase chain reaction (PCR) from a purpuric skin lesion or any normally sterile site (blood, cerebrospinal fluid [CSF] or other fluids such as synovial fluid). (WHO, 2018)

Laboratory Diagnosis

Laboratory Confirmation

- Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g., blood or CSF)
- Detection of *N. meningitidis* antigen in formulin-fixed tissue by immunohistochemistry (IHC); or in CSF by latex agglutination.
- Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a validated polymerase chain reaction (PCR) assay; or
- Isolation of *N. meningitidis* from a normally sterile body site (e.g., blood or CSF, or less commonly, synovial, pleural, or pericardial fluid); or from purpuric lesions. (CDC, 2015)

Specimen Collection and Transport

a) Blood (5 – 10ml from adults, 1 – 3ml from child) and CSF (3ml in total is ideal: 1ml in each of 3 tubes) specimens are collected from a probable case and transported at room temperature and should be received at the laboratory within 1 hour of collection. Blood and CSF should be collected early in the illness (before antibiotic treatment is started).
b) Nasopharyngeal swabs (for carriers) should be transported in Stuarts or Amies transport media at room temperature to reach the laboratory within 24 hours of collection.

Control and Prevention

- Patients should be placed under respiratory isolation until 24 hours after the start of antibiotic therapy. Items soiled with nasal and throat secretions should be disinfected.

- Household and other intimate contacts should be monitored for early signs of illness and chemoprophylaxis be administered where indicated. High risk contacts include household members, kissing, children and staff in child care settings, passengers seated together on long distance journeys and healthcare workers exposed to respiratory droplets).

- Contacts should be provided with information about meningococcal infection and their level of risk.

- Chemoprophylaxis should be limited to intimate contacts (household contacts and people socially close enough to have shared eating utensils, e.g., close friends at school but not the whole class).

- Even healthcare personnel are rarely at risk when caring for patients and only intimate exposure to nasopharyngeal secretions (e.g., as in mouth to mouth resuscitation) warrants prophylaxis.

- In epidemic situations, major emphasis should be placed on careful surveillance, early diagnosis and immediate treatment.

- Separate individuals and ventilate living and sleeping quarters of all persons who are exposed to infection because of crowding or congested living conditions e.g., soldiers, prisoners, worksite campers, etc.

- Vaccine use is subject to the consideration of individual countries and is not routinely recommended in our region. Polysaccharide vaccines are used during a response to outbreaks, mainly in Africa. Conjugate vaccines are used in prevention (into routine immunization schedules and preventive campaigns) and outbreak response. (WHO, 2018)

MUMPS

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

Mumps is an acute disease caused by a paramyxovirus. The virus is spread by respiratory droplets and has an incubation period of 2 to 3 weeks. Asymptomatic infections are common and such persons are infectious. Symptomatic cases are infectious several days before the swelling of the salivary glands and for as long as 9 days after.

Clinical presentation

The most characteristic sign of mumps is swelling and tenderness of the salivary glands, usually the parotid and sometimes the sub-lingual and sub- maxillary. It is accompanied by fever, anorexia, headache, and frequently in children by invasion of the central nervous system causing aseptic meningitis or meningoencephalitis. Orchitis occurs in 15–25% of males, and mastitis and oophoritis occurs in females. Mumps is a leading cause of acquired sensorineural deafness among children (WHO, 2018).

Mumps virus may be isolated from saliva, urine and cerebrospinal fluid.

Mumps is preventable by vaccination with live attenuated virus, usually administered as a component of the triple Mumps/Measles/Rubella (MMR) vaccine.

<u>Case Definition</u>

Suspected case:

- A person with acute onset of unilateral or bilateral tender, swelling of the parotid or other salivary gland that lasts two or more days and without other apparent cause,
  or
- Clinical suspicion of mumps because of other mumps-associated symptoms (e.g. aseptic meningitis, encephalitis, hearing loss, orchitis, oophoritis, mastitis, pancreatitis) unexplained by another more likely diagnosis. (WHO, 2018)

Probable case:

- Meets the suspected case definition AND has a positive test for serum anti-mumps IgM antibody
  OR
- Meets the suspected case definition AND has epidemiologic linkage to another probable or confirmed case or linkage to a group/community during an outbreak of mumps. (WHO, 2018)

Confirmed cases:

- Isolation of mumps virus by culture or reverse transcription-polymerase chain reaction (RTPCR) from an appropriate clinical specimen (buccal swab, throat swab, urine, and cerebrospinal fluid) from person meeting the suspected case definition.
- Seroconversion from IgG negative to IgG positive in the absence of mumps immunization in the preceding six weeks.
- In unvaccinated individuals, significant (≥ fourfold) rise in serum mumps IgG titre. (WHO, 2018)

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

Laboratory confirmation of mumps virus infection rests upon:

- Isolation of the virus from saliva, CSF or urine.
- Detection of viral antigen by direct or indirect immunofluorescence on epithelial cells in urine sediment.
- Demonstration of a four-fold or greater increase in specific antibody between the acute and convalescent stages of the disease.

Specimen Collection and Transport

a) Saliva: Collect in the acute stage of the illness by aspiration from the buccal cavity, or using a polyester fibre swab. Place in viral transport medium, store at 4°C, and send to the laboratory within 24 hours.
b) CSF: If cerebrospinal fluid is being collected, an aliquot may be placed in a sterile vial and sent immediately to the laboratory at 4°C.
c) Urine: Collect 10ml urine up to 7 days after onset of illness. Place in a sterile screw-capped container and send immediately to the laboratory at 4°C.
d) Blood samples: Collect an acute sample within one week of onset, and a convalescent sample 2 weeks later. Following clot retraction, the serum is transferred to a sterile vial. Serum may be stored at 4°C for 48 hours, or at –20°C if immediate shipment to the laboratory is not possible.

Control and Prevention

The spread of a mumps epidemic may be controlled by isolation of suspect cases for 9 days from the onset of parotid swelling. However, transmission will still occur from asymptomatic cases. Standard contact and droplet precautions should be put in place. Contacts should be educated about signs and symptoms of mumps. (WHO, 2018)

In response to an outbreak the population at risk and transmission setting should be defined, and persons without evidence of immunity should be rapidly identified and vaccinated to prevent
exposure and infection. (WHO, 2018)

The inclusion of MMR vaccine in the routine infant immunization programme is recommended for prevention of disease. Males with no history of mumps disease or immunization may be vaccinated with the single vaccine as they approach maturity.

PERTUSSIS

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly** **PAHO EPI Advisor weekly**

Overview

Pertussis, (whooping cough), is an acute bacterial infection of the respiratory tract caused by *Bordetella pertussis*. Its distribution is worldwide, and it is seen most frequently in children under 5 years.

Transmission is by airborne droplets and contact with secretions from the respiratory tract and the patient is most infectious in the catarrhal stage. The incubation period is 6 to 20 days.
Pertussis is one component of the triple vaccine Tdap which is included in the routine schedule of vaccination (EPI). Waning immunity may permit cases in adolescents and young adults. Second attacks sometimes occur in persons who were infected with the wild organism.

Clinical presentation
The onset of symptoms is insidious with a catarrhal stage leading to a cough which becomes paroxysmal and which may last for up to 2 months. The main symptom is easily recognizable - a series of rapid coughs ending in inhalation which produces the characteristic “whoop”. This is followed by vomiting. Mortality is high in malnourished infants with other respiratory and enteric infections or those who succumb to the complications of broncho-pneumonia or encephalopathy.

The purpose of surveillance is to detect cases early enough to prevent community outbreaks, to monitor the impact of vaccination and to identify high risk areas. All suspected cases should be investigated immediately and confirmed by the laboratory.

<u>Case Definition</u>
Suspected case
Anyone presenting with a cough lasting at least 2 weeks, or of any duration in an infant or any person in an outbreak setting; and with at least one of the following:
- Paroxysms (fits) of coughing
- Inspiratory “whoop” at the end of the coughing fit
- Vomiting after coughing
- Apnoea (only in < 1 year of age)

OR
- A Clinician suspects of pertussis.

Confirmed case
I. Laboratory confirmed case: A case that is a suspected case with positive laboratory findings.
II. Epidemiologically confirmed case: A suspected case that is linked epidemiologically to a laboratory confirmed case.

<u>Laboratory Diagnosis</u>

Laboratory Confirmation
Laboratory confirmation of a suspected case of pertussis rests on one of the following:
- Bacterial culture of *Bordetella pertussis* from nasopharyngeal secretions confirms the diagnosis of pertussis.

- Detection of genomic sequences of *B. pertussis* by means of polymerase chain reaction (PCR) assay
- Detection of elevated IgG antibodies to pertussis toxin in an individual ≥ 11 years of age, a year or longer after last vaccine dose. (WHO, 2018)

Specimen Collection and Transport

Cases found within 4 weeks of cough onset:

a) Collect two nasopharyngeal swabs using sterile polyester, rayon or nylon flocked swabs (NOT cotton swabs): one for culture and one for PCR. Do NOT collect throat and anterior nasal swabs.
b) Specimens for culture should be plated directly onto selective culture medium or placed in half-strength Regan-Lowe transport medium.
c) Specimens solely for PCR testing should be placed in a sterile tube or universal transport media for transport to the laboratory.
d) Saline nasopharyngeal aspirate may be collected from suspected cases. (WHO, 2018)

Cases found 4 – 12 weeks after cough onset:

a) Serum sample can be collected for IgG anti-pertussis toxin antibody testing.
b) In an outbreak situation blood samples may be drawn from a number of suspected cases. The serum is separated by centrifugation and sent in sterile tubes to CARPHA for serology.
c) Serology is mostly beneficial for diagnosing individuals > 10 years of age with at least two weeks of cough. (WHO, 2018)

<u>Control and Prevention</u>

Some measure of control of transmission may be achieved by:

- Treatment of cases and immediate close contacts with appropriate antibiotics should be done, which reduces communicability but may not stop the cough.
- Isolate the affected child in the early stages; but unfortunately, pertussis may not be suspected.
- Patients who are hospitalized should be placed under respiratory isolation. Contact and respiratory droplet precautions (such as wearing a mask when around other patients) should be applied when caring for patients. (WHO, 2018)
- Exclusion of incompletely immunized household contacts younger than 7 years from school for 14 days is recommended.
- During outbreaks, protect health care workers in close contact with cases with a 14-day course of erythromycin.
- Long term prevention rests on the maintenance of high vaccination coverage in the population.
- The immunization status of each suspected case should be specifically assessed, and the schedule completed if found to be incomplete.
- Children less than 7 years with the last dose more than 3 years ago should be given boosters.
- The public should be educated about the disease and encouraged to bring children for the full immunization series.

PNEUMOCOCCAL INFECTION (INVASIVE)

Internationally notifiable:	**No**
Reporting interval:	**Within 24 hours**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Streptococcus pneumoniae (pneumococcus) are common bacterial inhabitants of the human nasopharynx especially in children. The normal human respiratory tract has a variety of mechanisms which guard the lungs against infection. Any anatomical or physiological derangement of these built-in defences lead to susceptibility to infection. The reservoir for pneumococcus is human, and transmission occurs by droplet spread, by direct oral contact, or indirectly through contact with articles freshly soiled with respiratory discharges.

The bacteria may cause upper or lower respiratory infections including otitis media, mastoiditis and sinusitis. The lung is the most common site of infection leading to the development of pneumococcal pneumonia especially in the very young and in the elderly, and those with certain chronic conditions.

Failure of local defence mechanisms in the lungs results in spread of pneumococci to the hilar lymph nodes, and if unchecked via the thoracic duct into the circulation. Through the resulting bacteraemia, extrapulmonary infections can also occur. Invasive pneumococcal disease can have high case fatality rates ranging up to 20% for sepsis and 50% for meningitis in developing countries.

Prior to the introduction of pneumococcal conjugate vaccines, 6 –11 out of the over 90 capsular serotypes accounted for ≥ 70% of all invasive pneumococcal disease occurring in children worldwide. Two types of pneumococcal vaccines are currently available. (WHO, 2018)

Case Definition

a) Clinical case

The signs and symptoms of pulmonary infection are those of a pneumonia. Other presentations depend upon the organ / tissue affected.

i) Pulmonary (pneumococcal pneumonia)

An illness characterised by the sudden onset of fever with 2 or more of the following:

- Productive cough
- Rigors
- Dyspnoea
- Early pleuritic chest pain
- Clinical or x-ray evidence of pneumonia

i) Extra-pulmonary
Extra-pulmonary presentations are preceded by a pneumonia and require laboratory confirmation. They may include:
- Upper respiratory tract infection
- Meningitis
- Pericarditis
- Endocarditis
- Arthritis

b) Confirmed case

A clinically compatible case that is laboratory confirmed by isolation of pneumococci from a normally sterile body site, and respiratory tract secretions.

Laboratory Diagnosis

Laboratory Confirmation

- Generally, laboratory confirmation is based on a positive pneumococcal culture.
- Cerebrospinal fluid (CSF): Laboratory confirmation of pneumococcal meningitis is done by culture, PCR or antigen detection.
- Blood: Culture can be used to diagnosis pneumococcal meningitis, pneumonia and sepsis.

Collection and Transport of Specimen

a) Specimen of blood collected for culture. The specimen should be collected before the start of antibiotic treatment and transported at room temperature to reach the laboratory within 1 hour.
b) CSF should be collected as soon as possible and preferably before antibiotic therapy is started.
c) Pleural fluid can be collected for biochemistry, microbiology, cytology and PCR.
d) Specimens of sputum and respiratory secretions should be sent to the laboratory in sterile containers for culture and Gram stain microscopy. These specimens should be transported at room temperature and should be received at the laboratory within 24 hours of collection

Control and Prevention

- In hospitals, respiratory isolation may be warranted for patients with antibiotic-resistant infection to curtail the risk of transmission to other patients whose resistance to infection may be compromised or who are otherwise at high risk.
- Ensure concurrent disinfection of discharges from nose and throat of patient.
- Where diagnostic facilities are limited and a delay in treatment could prove fatal, antibiotic treatment of infants and young children should be started based on history and clinical findings.
- While vaccination is beneficial to prevent disease in the long term, it is not useful for controlling acute situations. Prioritise vaccines for older adults, immune compromised persons, and those who’ve had their spleen removed

Technical Notes

Because of the increasing resistance to commonly used first- line antibiotics, sensitivity testing would provide useful information for case management as well as for inclusion in the laboratory's antibiogram databank.

Investigation of contacts and source of infection are of no practical value.

Polysaccharide vaccines including 23 serotypes are currently available. These vaccines are recommended in some developed countries to prevent pneumonia in older persons and persons with underlying medical conditions. However, they are not immunogenic in children < 2 years of age.

Two available pneumococcal conjugate vaccines (PCVs), containing 10 or 13 serotypes are available, which are effective in preventing pneumococcal disease in children caused by the vaccine serotypes. Their worldwide use in infants is recommended by WHO.

POLIOMYELITIS

Internationally notifiable:	**Yes**
Reporting interval:	**Within 24 hours**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division weekly** **PAHO EPI Regional Advisor weekly**

Overview

Poliomyelitis is a permanent flaccid paralysis of the muscles without sensory loss, which frequently but not exclusively affects the lower limbs. It follows acute infection with the poliovirus types 1,2 or 3, which are enteric viruses that are transmitted by the faecal-oral route. The incubation period is usually 7–10 days (range 4–35 days). Most people infected with poliovirus do not have symptoms, though they can still excrete virus in faeces.

Clinical presentation

About a quarter of those infected develop minor, transient symptoms including fever, headache, malaise, nausea, vomiting and sore throat. Some individuals (approximately 4%) develop a self-limited illness with signs of meningeal irritation (neck stiffness, severe headache). Paralytic poliomyelitis is rare and occurs when poliovirus enters the central nervous system and replicates in anterior horn cells (motor neurons) of the spinal cord or brainstem. In children < 5 years of age, it is observed in < 1% of poliovirus infections.

Inactivated poliovirus vaccine (IPV) is an injectable vaccine consisting of all three poliovirus serotypes. Oral poliovirus vaccines (OPV) are composed of live attenuated polioviruses, and can be monovalent (mOPV, type-specific) or bivalent (bOPV, types 1 and 3). Trivalent OPV (tOPV, all serotypes), which has been used in many countries for decades, has been

unavailable since May 2016 when its use was discontinued as part of the global removal of type 2 from OPVs in immunization programmes following the declared eradication of wild poliovirus (WPV) type 2 in 2015.

In rare instances the attenuated viruses in OPV (Sabin strains) may re-acquire neurovirulence leading to vaccine-associated paralytic poliovirus (VAPP) in the vaccine recipient or close contact. Vaccine-derived polioviruses (VDPVs) are Sabin strains that re-acquire neurovirulence and efficient transmissibility as a result of prolonged replication in an immunodeficient individual (immunodeficiency associated VDPV or iVDPV), or in a community with low population immunity to polio (circulating VDPV or cVDPV)

Poliomyelitis caused by WPV is targeted for eradication; however, the ultimate goal is a polio-free world, including poliomyelitis caused by VDPVs and VAPP. Highly sensitive surveillance for acute flaccid paralysis (AFP), including immediate case investigation and specimen collection for standardized testing, is critical for the detection of the circulation of poliovirus.

AFP surveillance is also critical for documenting the absence of poliovirus circulation for certification of eradication. (WHO, 2018)

<u>Case Definition</u>

a) **Suspected case**: Any person with acute flaccid paralysis (AFP) (including Guillain-Barré Syndrome and transverse myelitis) or any person with paralytic illness at any age when polio is suspected.

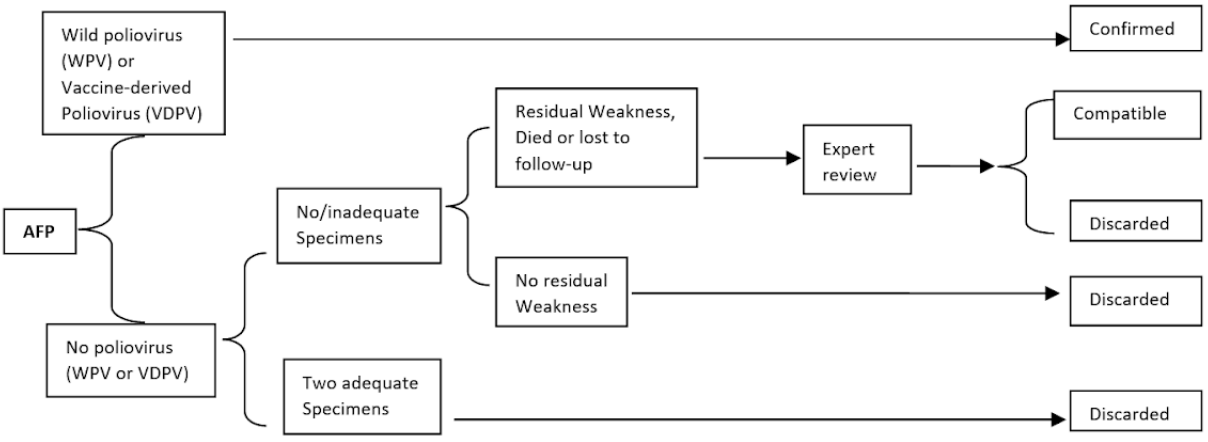
   An AFP case is defined as a child < 15 years of age presenting with recent or sudden onset of floppy paralysis or muscle weakness due to any cause, or any person of any age with paralytic illness if poliomyelitis is suspected by a clinician. (WHO, 2018)

b) **Confirmed**: A suspected case with isolation of WPV or VDPV in stool specimens collected from the suspected case or from a close contact. (WHO, 2018)

c) **Compatible**: A suspected case with no adequate specimens; no isolation of WPV or VDPV from the case or close contacts; and residual paralysis after 60 days follow up that is deemed by the national expert review committee to be clinically and epidemiologically compatible with poliomyelitis. (WHO, 2018)

d) **Discarded cases**: A suspected case that was adequately investigated (including collection of adequate stool specimens) and resulted in any of the following:
   - No laboratory evidence of WPV or VDPV infection
   - Inadequate specimens collected and resolution of weakness within 60 days of paralysis onset
   - Deemed by the national expert review committee to not be compatible with poliomyelitis. (WHO, 2018)

Figure 5. Final classification of acute flaccid paralysis (AFP) cases (WHO, 2018)



Laboratory Diagnosis

Laboratory Confirmation

- A case of Acute Flaccid Paralysis is confirmed as Poliomyelitis if wild polio virus is isolated from the stool.
    - Laboratory confirmation is based on isolation of poliovirus on monolayers of tissue culture cells (RD and L20B). As part of testing for poliovirus, isolation of non-polio enterovirus (NPEV) is possible and is reported as a separate result.
    - Intratypic differentiation is conducted by reverse transcriptase polymerase chain reaction (RT-PCR) to identify the virus as WPV, VDPV or Sabin, as well as serotype (1, 2, 3).
    - Genetic sequencing results help monitor pathways of poliovirus transmission by comparing the nucleotide sequence of the VP1-coding region of poliovirus isolates. (WHO, 2018)
- Stool specimens must be tested in a WHO accredited laboratory which will be using standard methods and approved reagents, and which will have passed a recent proficiency test.
- The laboratory is required to report on the presence or absence of polio virus within 28 days of receipt of the specimen. A further 2 weeks may be required to determine whether the polio virus is wild, or vaccine derived.

Specimen Collection and Transport

Stool specimen

a) Procedure:

- A stool sample of approximately 8 gms (2 adult thumbnails) should be collected as soon as possible, and in any event within 14 days of onset of paralysis.
- This is placed in a clean, dry, screw-capped container and labelled with patient name, EPID number (if available) and date of collection.
- Stool samples are placed immediately in a cold box or refrigerator at 4°C and shipped to the laboratory within 48 hours in a cold box.
- If immediate shipment is impossible, the specimen must be stored in a freezer at –20°C and shipped on frozen icepacks.

b) Adequacy of stool sample
   The laboratory will record and report on the adequacy of the specimen based on the following:
   - Interval between onset of paralysis and stool collection (<14 days)
   - Volume of specimen (approximately 8 grams)
   - Absence of leakage or desiccation
   - Presence of ice or temperature indicator showing maintenance of cold chain
   - Completed request form

c) Laboratory request form
   - The accompanying request form must include the following:
   - Patient information including unique identification number (EPID number)
   - Date of onset of paralysis
   - Date of collection and shipment of specimen
   - Immunization history, especially date of last OPV
   - Name and address of person to whom laboratory results should be sent.

d) Contact sampling
   - If an adequate sample is not taken from the case, stool samples are collected from three close contacts, preferably less than 5 years of age.
   - Contact sampling may also be done if the case is highly suspicious

Control and Prevention

In the Americas, given the absence of wild poliovirus since 1991, detection of a single case of wild polio virus in the community represents a public health emergency. This should be immediately followed by investigation of contacts and source of infection, and a search for additional cases complete with immunization history. Concurrently, there should be a "mop-up" immunization campaign which may be district or country wide and may involve house-to-house delivery. The targeted age group is usually less than 5 years but may be varied. The objective is immediate interruption of virus circulation.

Genomic analysis of a wild polio virus can provide important information on its source. Its sequences may show a close relationship with currently circulating strains from another country, or they may indicate re-appearance of an indigenous virus.

If importation is suspected special surveillance should be put in place to detect recurrence and to monitor arrivals.

If an indigenous virus has reappeared an investigation should be launched to identify risk factors and to protect high-risk populations.

The community should be advised to observe enteric precautions.

Performance Indicators of Surveillance Quality

The sensitivity of the surveillance system must be maintained by close attention to the surveillance indicators. A decline in any of the following criteria should lead to corrective action:

- AFP detection rate (Target 1/100,000)
- Completeness of monthly reporting (Target ≥ 80%)
- Timeliness of monthly reporting (Target ≥ 80%)
- AFP cases investigated in < 48 hours (Target ≥ 80%)
- AFP cases with adequate specimens (Target ≥ 80%)
- AFP cases receiving 60-day follow-up examination (Target ≥ 80%)
- Specimens arriving at the laboratory in "good" condition. (Target ≥ 80%)
- Specimens with turn-around time of < 28 days (Target ≥ 80%)
- Stool specimens from which a non-polio enterovirus was isolated (Target ≥ 1)

RUBELLA AND CONGENITAL RUBELLA SYNDROME

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**
	PAHO EPI Regional Advisor

Overview

Rubella is an acute febrile rash disease that is distributed worldwide and endemic in most countries. It is spread by contact with nasopharyngeal secretions, by droplet or direct contact, and is highly infectious in closed populations such as day care centres and summer camps.

The incubation period is 16–18 days and the outcome of exposure can range from asymptomatic infection with the development of antibody, to a disease characterized by fever, lymphadenopathy, maculopapular rash, arthritis and arthralgia.

The importance of rubella derives from the effect that it may have on the foetus if the mother is infected during the first trimester of pregnancy. The risk of Congenital Rubella Syndrome (CRS) is lower in the second and third trimester. CRS may occur after asymptomatic infection. The baby may be born with two or more of the symptoms of CRS and may develop others during the first year. Affected babies may excrete rubella virus for as long as one year and are highly infectious to susceptible contacts.

Rubella and CRS can be prevented through immunization. The live attenuated vaccine is given either as a single antigen or in combination with measles and mumps.

Surveillance for rubella seeks to document the pattern of circulation of the virus in the community and to guide immunization strategy towards the prevention of CRS.

Case Definition for Rubella

Special attention should be paid to the diagnosis of rubella in pregnancy in view of the mild and non-specific nature of many of the symptoms, and the grave consequences to the child.

a) **Suspected rubella case**:
A patient in whom a health care worker suspects rubella.
A patient with fever, maculopapular rash, adenopathy (cervical, postauricular or suboccipital) or arthritis/arthralgia.

b) Probable rubella case
A person experiencing an acute illness with low grade fever, and a diffuse, punctate, maculopapular rash, and two or more of the following:
- Post auricular, occipital or posterior cervical lymphadenopathy
- Arthralgia or arthritis
- Lack of epidemiological linkage or laboratory confirmation.

c) Confirmed rubella case
(i) Laboratory confirmed case
- A probable case with a positive laboratory test result (e.g. positive rubella IgM).

(ii) Epidemiologically confirmed case
- A probable case who had been in contact with a laboratory confirmed case within the past 18 days.

Case Definition for Congenital Rubella Syndrome (CRS)

a) Suspected CRS case
An infant less than one year of age presenting with one or more of the following: Patent Ductus Arteriosus, hearing impairment, cataracts, nystagmus, microphthalmos, congenital glaucoma, hepatosplenomegaly, purpura; OR whose mother had suspected or laboratory confirmed rubella infection during pregnancy even when there are no signs; AND/OR there is a clinical suspicion of CRS in that infant.

b) Clinically confirmed CRS case
An infant in whom an experienced physician detects at least two of the complications listed in group A below, or one in group A and one in group B:

Group A symptoms
- Cataract and/or congenital glaucoma
- Congenital heart disease
- Loss of hearing
- Pigmentary retinopathy

Group B symptoms.
- Purpura
- Splenomegaly

- Hepatomegaly/jaundice
- Microcephaly
- Mental retardation
- Meningoencephalitis
- Radiolucent bone disease
- Intrauterine growth retardation

c) **Laboratory confirmed CRS case**
A suspected case of CRS with supportive laboratory evidence (positive rubella specific IgM in blood)

d) **Congenital rubella infection (CRI):** an infant who has a positive rubella specific IgM test but has no clinical sign of CRS. (WHO, 2020)

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

Laboratory testing is necessary to distinguish acute rubella from mild measles, scarlet fever, chikungunya, dengue, zika, infectious mononucleosis and enterovirus infections.

Criteria for laboratory diagnosis of rubella are:

- Presence of rubella specific IgM antibody in serum by ELISA
- Demonstration of a four-fold increase in antibody titre between acute and convalescent sera measured by Haemagglutination inhibition (HI), or latex agglutination (LA).
- Isolation of rubella virus from throat swab, urine or blood

Laboratory confirmation of CRS depends upon:

- Presence of rubella specific IgM in serum within the first week of life
- Isolation of rubella virus from urine, throat swab or blood
- Maintenance of IgG antibody level during the first 6 months of life, shown by an HI titre that fails to decrease at the expected rate of a twofold dilution per month
- Detection of rubella virus in tissues by PCR

Specimen Collection and Transport

a) **Acute blood sample**
A blood specimen should be drawn on first contact with the patient, although rubella IgM is most reliably detected after 7 days of onset. The blood should be kept cool and shipped to arrive at the laboratory within 24 hours or the serum should be separated and frozen at –20°C for later shipment with cold packs. This acute sample should be sent to the laboratory as soon as possible to facilitate IgM testing or virus isolation if this is to be attempted.

b) **Convalescent blood sample**
This will be requested if needed by the laboratory.

c) **Urine**
This is collected into a clean, preferably sterile container and shipped immediately to the laboratory on ice.

d) **Throat swab or nasopharyngeal washing**

To be collected in the acute stage of the disease and transported in viral transport medium.

Note that from a suspected or probable CRS cases collect:

- A blood sample as soon as possible after birth
- Further blood samples at 2,4 and 6 months
- Throat swabs and urine specimens

Prevention and Control of Rubella And CRS

- Case investigation is like that of measles (see measles above).
- Control of rubella transmission is often not very effective due to the mild nature of the illness.
- The prevention of rubella and CRS relies on immunization of various population groups. Infants, as part of the EPI schedule, are given MMR (measles, mumps and rubella) or MR (measles and rubella).
- Rubella vaccine should be given to pre-pubertal girls in a school-based programme. The vaccine should be offered to pre-marital and post-partum women.
- Especially at-risk groups such as child-care workers, nurses and teachers should be routinely covered.
- Cases and/or caregiver should be educated about the nature of the infection and the mode of transmission.
- The public in general should be educated about rubella, CRS and the recommended immunization schedule.

Technical Notes

False positive rubella IgM test results have been reported in persons with other viral infections (EBV, infectious mononucleosis, CMV, and parvovirus), or in the presence of rheumatoid factor.
Theoretically, live rubella vaccine should not be given to pregnant women, or to women likely to become pregnant within 2 months of vaccination. However, no defects attributable to vaccine virus have been detected in the babies of women given the vaccine during pregnancy. If the vaccine is inadvertently given to a pregnant patient, she should be counselled, and the theoretical risks explained. After birth the child should be monitored as a suspect case of CRS.

TETANUS (NON-NEONATAL AND NEONATAL)

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division** **PAHO EPI Advisor**

Overview

Tetanus in adults and new-borns is caused by infection of wounds with spores of the Gram-positive bacterium *Clostridium tetani*. Its spores are widely distributed in nature and will grow anaerobically at the site of an injury, producing a toxin whose action on the central nervous system results in painful muscle spasms and rigidity.

The injury in adults may be a deep wound contaminated with soil containing the bacterial spores or intramuscular use of unsterile needles. New-borns are infected by cutting of the umbilical cord with unsterile instruments or dressing with spore containing materials.

Clinical features

The incubation period is 3 to 28 days (average 7 days) and the case fatality can be as high as 100% in neonates and non-neonates without treatment. Distinctive features of tetanus are trismus (lockjaw, or inability to open the mouth), risus sardonicus (forced grin and raised eyebrows) and opisthotonus (backward arching of the spine). Seizure like muscle spasms occur frequently in response to stimuli such as light and sound. Autonomic nervous system dysfunction (hypertension, abnormal pulse) and spasm of respiratory muscles and larynx can lead to respiratory failure (WHO, 2018).

Full immunization with tetanus toxoid lasts for 10 years and a fully immunized mother confers protection on her baby against neonatal tetanus.

Maternal and neonatal tetanus are targeted by WHO for elimination and the focus of surveillance is the identification of high-risk areas and population groups where unsafe delivery practices and low maternal immunization coverage result in a high incidence of disease.

Case Definition

Non-neonatal tetanus

- **Suspected case:** Any person > 28 days of age with acute onset of at least one of the following: trismus (lockjaw), risus sardonicus (sustained spasm of the facial muscles) or generalized muscle spasms (contractions).

- **Confirmed**: A case meeting the suspect definition and clinically confirmed as tetanus by a physician/trained clinician.

- **Probable**: A case meeting the suspect case definition without clinical confirmation by a physician/trained clinician.

- **Discarded**: A case that has been investigated and does not satisfy the clinical criteria for confirmation or has an alternate diagnosis (WHO, 2018).

Neonatal tetanus

Any neonatal death between 3 and 28 days of age should be investigated.
Suspected case: A case that meets either of these two criteria:

- Any neonate who could suck and cry normally during the first two days of life and developed tetanus-like illness or died between 3 and 28 days of age
  OR
- Any neonate who died of an unknown cause during the first month of life.

Confirmed case: Any suspected Neonatal Tetanus case found during case investigation to have all three of the following:

- Normal ability to suck and cry during the first two days of life

AND

- Could not suck normally between 3 and 28 days of age

AND

- Developed muscle stiffness and/or spasms (jerking).

Discarded case: A case that has been investigated and does not satisfy the clinical criteria for confirmation or has an alternate diagnosis.

Not investigated: Any suspected case not investigated, or without information available on age and symptoms to confirm the case (WHO, 2018).

<u>Laboratory Diagnosis</u>

Laboratory Confirmation
Clinical criteria are used for case confirmation

Specimen Collection and Transportation
Bacteriological culture is not necessary for the diagnosis of Tetanus

<u>Tetanus Control and Prevention</u>

The public should be educated about the nature of the disease, how it is transmitted and the recommended immunization.

Persons with puncture wounds, animal bites and other injuries contaminated with soil should be advised to seek medical attention. Wounds should be managed appropriately (cleaning, debridement, disinfection and sutured, etc. as appropriate.

a) **NON-NEOTAL TETANUS**

- Clean wounds thoroughly with soap and water, followed by appropriate medical wound management
- Give tetanus immune globulin intramuscularly 3,000-6,000 IU
- Educate the public on the hazards of punctate wounds.
- Immunize the population with adsorbed tetanus toxoid, paying special attention to high risk groups such as the military, farm workers and veterinarians.

- Offer dT boosters after 10 years.

b) **NEONATAL TETANUS**

- Immunize all women of child-bearing age and ensure that pregnant women are fully immunized (Dose 1 on contact; Dose 2, 2-4 weeks later; Dose 3, 6-12 months later plus 2 annual boosters).
- Investigate every suspected case to identify and correct risk behaviours
- Institute clean delivery programmes in hospitals and in communities

Investigation

- Identify the source of infection. Puncture wounds and injuries contaminated by soil, body piercings, dental infection, animal bites, injection drug use, burns and abortions are examples of entry points for tetanus.
- Ascertain the patient's tetanus immunization history

Vector Borne Diseases

CHAGAS DISEASE

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Chagas Disease is a parasitic disease resulting from infection with *Trypanosoma spp*. (*e.g. Tyrpanosoma cruzi*). The *Trypanosoma* parasites are transmitted through the bite of an infected triatomine bug also known as a "kissing bug". About 6 to 7 million persons worldwide are estimated to be infected with Chagas disease although most cases occur in Latin America. The region of the Americas is also at risk. Additional routes of transmission include food-borne, blood transfusions or congenital (mother-to-child).

Clinical presentation

There are two phases of the infection: acute and chronic. In most cases the acute phase presents with symptoms are mild, unspecific, or asymptomatic. However, in some cases, this can progress to a skin lesion or swelling of the lids of one eye with additional symptoms of fever, headache, muscle pain and chest pain with difficulty in breathing.

During the chronic phase, also known as the "chronic indeterminate," the parasites would have mostly cleared the blood circulation and entered the heart and digestive system. This causes a range of digestive and cardiac disorders in some patients. It is theorized that infection of the heart muscles with *Trypanosoma* parasites can lead to progressive heart failure.

Laboratory Criteria for Diagnosis (Ref: ADHS Communicable Disease Case Definitions 2020)

Confirmatory Testing

• Isolation of *T. cruzi* by microscopy (microscopic examination, wet mount, thick and thin smears Giemsa stain), OR
• Isolation of *T. cruzi* by culture, OR
• Detection of *T. cruzi* DNA by polymerase chain reaction (PCR), OR
• Detection of antibody specific to *T. cruzi* by two distinct diagnostic assays (can only be performed at CDC)

Presumptive Testing

• Evidence of *T. cruzi* antibodies on a single serologic diagnostic assay (IgG positive; not blood
screening); OR

• Reactive blood donor screen AND a secondary positive diagnostic assay (IgG positive). (Note
that 'additional' or 'confirmatory' antibody tests performed by a blood screening agency do not
count as diagnostic tests. See Comments.)

Case Classification

Confirmed
A case that meets the confirmatory laboratory criteria.

Probable
A case that meets the presumptive laboratory criteria.

Type Classification

Acute phase
Asymptomatic or symptomatic within 8 weeks of documented exposure or symptom onset/diagnosis

Chronic, intermediate phase
Asymptomatic case > 9 months of age and > 8 weeks since documented exposure

Chronic, symptomatic phase
Symptomatic case > 9 months of age and > 8 weeks since documented exposure

Control

Control of Chagas disease is through control of the vector. Entomological investigations around the localities (residences) of infected individuals are recommended for detection and identification of the vector. Further to confirmation of the vector, the appropriate vector control measures should be used.
Once the vector is confirmed to be present in a region, health education should focus on personal protective measures to prevent infestation e.g. use of bed nets and insect-proofing of windows and doors.

CHIKUNGUNYA FEVER (CHIK)

Internationally notifiable:	**No**
Reporting interval:	**Within 48 hours**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview
Chikungunya fever (CHIK) is an emerging, mosquito-borne disease caused by an alphavirus; Chikungunya virus (CHIKV). The disease was first identified during an epidemic of fever, rash and arthritis in Tanzania in 1952 – 1953. Subsequently there have been sporadic outbreaks

in regions of Africa, Asia and Europe (Italy). In December 2013, confirmation of the first cases of autochthonous transmission of chikungunya in the Americas (Caribbean) was made.

Chikungunya is transmitted predominantly by the bites of infected *Aedes aegypti* and *Ae. albopictus* mosquitoes, the same species involved in the transmission of dengue. The onset of illness usually occurs between 3 and 7 days after infection but the incubation period can range from 2 to 12 days.

Clinical presentation
The disease is characterized by an abrupt onset of fever and joint pain. Other symptoms include muscle pain, headache, nausea, and rash. Following acute infection, chronic joint pains may persist for months or years along with fatigue and depression.
There is no specific treatment or vaccine available for Chikungunya. Most patients recover fully. Serious complications are not common, but older people, children and pregnant women may be more severely affected by the disease.

Case Definition
Suspect case: a patient with acute onset of fever >38.5ºC (101.3ºF) and severe arthralgia or arthritis not explained by other medical conditions, and who resides or has visited epidemic or endemic areas within two weeks prior to the onset of symptoms.

Confirmed case: a suspect case with any of the following CHIK specific tests:
- Viral isolation. Detection of viral RNA by RT-PCR.
- Detection of IgM in a single serum sample (collected during acute or convalescent phase).
- Four-fold increase in CHIKV-specific antibody titres (samples collected at least two to three weeks apart)[(5)]
- Viral isolation.

Laboratory diagnosis
Laboratory Confirmation
Three main types of laboratory tests are used for diagnosing CHIKV:
- Reverse transcriptase-polymerase chain reaction (RT-PCR) for the detection of CHIKV RNA from serum obtained from whole blood.

- Serology (immunoglobulin M [IgM] and G [IgG] ELISA) and plaque reduction neutralization testing (PRNT) in serum obtained from whole blood. The serum (or blood) specimen should be transported at 2°−8°C and should not be frozen. Serologic diagnosis can be made by demonstration of IgM antibodies specific for CHIKV or by a four-fold rise in PRNT titre in acute and convalescent specimens.

- Virus isolation from acute serum specimens (≤5 days).

Table 10. Typical results of samples tested at various time points post-infection.

Days post illness onset	**Virus testing**	**Antibody testing**
Day 1-3	RT-PCR = Positive Isolation = Positive	IgM = Negative PRNT = Negative

Day 4-8	RT-PCR = Positive Isolation = Negative	IgM = Positive PRNT = Negative
>Day 8	RT-PCR = Negative Isolation = Negative	IgM = Positive PRNT = Positive

Collection, Storage, and Transportation of Samples

Collection of samples for serology, isolation and molecular diagnosis:

Sample: Serum

Time of collection: Acute, within the first eight days of illness; convalescent, 10−14 days after acute specimen collection.

To collect serum:

- Aseptically collect 4−5 ml of venous blood in a tube or a vial.
- Allow blood to clot at room temperature, centrifuge at 2,000 rpm to separate serum. Collect the serum in a clean dry vial.
- All clinical samples should be accompanied by their clinical and epidemiological information.

Other types of specimens for laboratory investigation:

Specimens:

- CSF in meningoencephalitis cases.
- Synovial fluid in arthritis with effusion.
- Autopsy material – serum or available tissues.

[Note: Mosquitoes collected in the field will also be handled using the same techniques described here]

Transportation of Samples:

- Transport specimens to the laboratory at 2°−8°C (icebox) as soon as possible.
- Do not freeze whole blood, as haemolysis may interfere with serology test results.
- If a delay greater than 24 hours is expected before specimens can be submitted to the laboratory, the serum should be separated and stored at refrigerated temperature.
- Serum samples for virus isolation and molecular diagnosis should be stored frozen (at −20°C for short-term storage or at −70°C for long-term storage) [(6)].

Patient Isolation Recommendations

To prevent the infection of others in the household, the community, or the hospital, a patient with acute CHIKV should avoid being bitten by *Ae. aegypti* or *Ae. albopictus* mosquitoes during the viraemic phase, which is usually the first week of illness.

DENGUE FEVER

Internationally notifiable:	**No**
Reporting interval:	**Weekly (outbreaks only)**
Report to (country level):	**National Epidemiologist (collective data)**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Dengue is an acute febrile illness caused by one of the four types of dengue virus (DEN-1, DEN-2, DEN-3 and DEN-4). The four serotypes circulate in the Caribbean region; however, DEN-1 and DEN-2 predominate. Viral transmission is through the bite of an infective *Aedes aegypti* mosquito. The disease occurs in all countries infested with the vector and is prevalent in the Caribbean. Dengue is usually seasonal, with an increase in cases occurring after the onset of the rainy season.

The incubation period of dengue is usually 4 to 10 days with a range of 3 to 15 days. Patients are infectious for mosquitoes during the period of viraemia which lasts for 5 days from the day before onset of fever.

Clinical presentation

The illness is characterized by an abrupt onset of fever accompanied by headache, myalgia, arthralgia, retro-orbital pain and rash. In its early stages it may resemble influenza, rubella or measles.

Antibody to the dengue viruses is protective and long lasting but is type specific so that an individual can be infected with each of the 4 types. Reinfection of an individual with a different type may result in the severe forms of the disease.

The objective of surveillance for dengue fever is to anticipate large outbreaks of disease in order to reduce virus circulation through vector control and to avoid the high morbidity associated with epidemics. A second objective is to track the circulation of the four serotypes, particularly the introduction of a new serotype into a country and the consequent risk of Severe Dengue.

Case Classification

2. **Suspected dengue case**

   Dengue without warning signs (DNWS):

   A person who lives in a dengue endemic region or has travelled to areas with dengue transmission in the last 14 days and presents with fever, usually of 2 to 7 days duration, and two (2) or more of the following features:

   1. Nausea/ vomiting
   2. Exanthema (rash)
   3. Headache/ retro-orbital pain
   4. Myalgia and arthralgia
   5. Petechiae or positive tourniquet test
   6. Leukopenia

   A case also includes any child coming from or living in an area with dengue transmission, with acute febrile illness, usually of 2 to 7 days and no apparent cause.

   Dengue with warning signs (DWWS):

   A dengue case that, near or preferably at defervescence, presents one or more of the following signs:

1. Intense abdominal pain or tenderness
2. Persistent vomiting
3. Fluid accumulation (ascites, pleural effusion, pericardial effusion)
4. Mucosal bleed
5. Lethargy/restlessness
6. Postural hypotension (lipothymia)
7. Liver enlargement >2 cm
8. Progressive increase in hematocrit

Severe Dengue (SD)

A dengue case that has one or more of the following manifestations:

1. Shock or respiratory distress due to severe plasma leakage.
   Shock evidenced by tachycardia, weak or undetectable pulse, cold extremities, and capillary refill time >2 seconds, pulse pressure ≤ 20 mmHg: hypotension in late phase.
2. Severe bleeding: based on evaluation by the attending physician (e.g. hematemesis, melena, ample metrorrhagia, central nervous system bleeding).
3. Severe organ involvement, such as liver impairment (AST or ALT ≥1000 IU), central nervous system (impaired mental state), heart (myocarditis), or other organs [7].

Note:

- All severe cases of dengue should be confirmed by laboratory tests specific for dengue.
- Dengue with warning signs and Severe Dengue require strict observation and medical intervention.

3. Probable dengue case

Any suspected dengue case that has a positive IgM or non-structural protein (NS1) result, or clinical-epidemiological link.

Note: During outbreaks, reported cases that could not be investigated are also considered probable dengue cases, since it is considered that all have a clinical-epidemiological link.

4. Confirmed dengue case

Any dengue case that is laboratory-confirmed (by molecular techniques, such as conventional RT-PCR, real-time RT-PCR, or others; IgM or IgG seroconversion in paired sera or a fourfold IgG titre increase; viral isolation).

Note: During an epidemic it is unnecessary to continue laboratory investigation of all suspected cases after the diagnosis of dengue has been established and the virus type identified. The great majority of cases will be epidemiologically linked.

Laboratory surveillance should be restricted to the collection of specimens from a limited number of probable cases in order to:

- Identify the introduction of any new serotypes into already infected areas
- Identify spread of the epidemic into new areas
- Monitor severe, complicated and fatal cases attributed to dengue fever

5. Death from dengue

- Every patient who meets the definition for suspected, probable, or confirmed case who dies as a consequence of dengue.

6. Ruled out case

Any suspected case of dengue that meets one or more of the following criteria:

- Negative laboratory diagnosis. (Ensure that samples were obtained within the adequate time frame)
- No clinical-epidemiological link
- Has laboratory diagnosis of another clinical disorder
- A case without laboratory testing whose clinical and epidemiological investigations are compatible with suspicion of other disorders

Laboratory confirmation of any dengue type not previously identified in a country or not detected in the country for several years should be immediately reported.

<u>Laboratory diagnosis</u>

<u>Specimen Collection and Transport</u>

Acute blood sample

It is preferable to collect this within 3 days of onset to increase the probability of virus identification. However, if the patient presents at a later date a sample should still be collected and forwarded to the laboratory.

- Draw a 5 to 10ml blood sample from each suspected case and place in a sterile tube.
- Send to the laboratory immediately in a cold box at 4–8°C.
- If shipment is to be made outside of the country and shipment is not possible within 48 hours, centrifuge the blood and transfer the serum to a sterile vial.
- Store at –20°C and ship with frozen icepacks (This sample will be used for serology only).
- Label all tubes and vials with patient name, specimen and date of collection.
- Complete a laboratory request form including date of onset of illness, symptoms and date of specimen collection.

Convalescent blood sample

Only if requested by the laboratory, draw a 5ml convalescent blood sample 2 to 3 weeks after the first. Store and ship as above.

<u>Laboratory Confirmation</u>

A laboratory confirmed case of dengue is a probable case with one or more of the following:

- Detection of IgM antibodies to one or more of the dengue virus antigens by capture ELISA (this test is most reliable on blood taken more than 5 days after onset).
- Isolation and identification of dengue virus from acute serum (collected within 3 days of onset) and shipped immediately to the laboratory at 4–8°C.
- Demonstration of dengue virus antigen in autopsy tissue, serum or cerebrospinal fluid samples by immunohistochemistry, immunofluorescence or ELISA
- Demonstration of dengue virus genomic sequences in autopsy tissue, serum or cerebrospinal fluid samples by polymerase chain reaction (PCR).
- Demonstration of a fourfold or greater rise in flavivirus antibody (IgM/IgG) titres between acute and convalescent phase serum specimens [7].

MALARIA

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Malaria is a parasitic disease resulting from infection with the *Plasmodium spp*. (*P. falciparum, P. vivax, P. ovale,* and *P. malariae*). The *Plasmodium spp*. parasites are transmitted through the bite of the infected female Anopheles mosquito. About half of the world's population are at risk of being infected with malaria although most cases occur in sub-Saharan Africa. The region of the Americas is also at risk. Children under 5 years are the most vulnerable group affected and account for a large percentage of deaths annually.

Clinical presentation

Table 11. Incubation period for plasmodium species

Plasmodium species	Incubation period
P. falciparum	9 to 14 days
P. vivax	12 to 18 days
P. ovale	16 to 18 days or longer
P. malariae	18 to 40 days or longer (years)

Most cases will experience fever and rigors which is usually cyclical in occurrence (malaria paroxysms). The cycle of abrupt chills, fever (39 – 41^{o} C) and sweating is repeated either daily, every other day, or every third day depending on the infecting species of Plasmodium. Other commonly associated symptoms include malaise, headache, myalgia, nausea and vomiting. Splenomegaly and hepatomegaly also occur.

Plasmodium falciparum generally causes the most severe disease with cerebral-related findings (confusion, coma, neurologic signs and convulsions), respiratory difficulties (pulmonary oedema), haemolytic anaemia, dark urine, anuria and diarrhoea.

Case Definition

1. **Suspected case**

   A person with chills followed by fever and sweating and/or rapid diagnostic test (RDT) detection of plasmodium species.

2. **Confirmed case**

   A suspected case with laboratory confirmation – identification of Plasmodium species on peripheral blood smear or using PCR.

Confirmed cases are classified as follows:

- **Imported**: Malaria acquired outside the country.
- **Autochthonous**
  - **Indigenous**: Malaria acquired by mosquito transmission in an area where malaria is a regular occurrence.
  - **Introduced**: Malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence
- **Induced**: Malaria acquired through artificial means (e.g. blood transfusion, sharing of syringes or needles)
- **Congenital**: Malaria acquired through transplacental transmission
- **Cryptic**: An isolated case of malaria not associated with secondary cases, as determined by appropriate epidemiologic investigations.
- **Relapsing**: Recurrence of disease after it has been apparently cured. Relapses are caused by reactivation of dormant liver-stage parasites (hypnozoites) of P. vivax and P. ovale. (CDC, 2014)

Laboratory diagnosis

Laboratory confirmation

- Detection of specific antigens (proteins) produced by malaria parasites in the blood of infected individuals using malaria rapid diagnostic tests (RDTs).
- The identification of the Plasmodium parasite in thick or thin peripheral blood film. The species of *Plasmodium* should also be reported — *P. vivax, P. malariae, P. ovale, P. falciparum* or mixed.
- Detection of DNA of specific species of plasmodium in a sample of peripheral blood using Polymerase Chain Reaction (PCR).
- Immunofluorescent Antibody Test (IFAT) – a blood drop from a finger prick is collected on a strip of special filter paper and examined for antibody. This serological test is a useful tool when a large number of persons are being screened.

Specimen Collection and Transport

a) **Thick and thin blood smears**

   These are taken from the peripheral blood stream and remain the mainstay of diagnosis.

   Because the level of parasitaemia varies from hour to hour, especially for P. falciparum

infections in which parasite may be difficult to find, blood should be examined at 8-hour intervals ideally, for 3 days, during and between febrile spikes. Infection is more readily detected on a thick film and the less sensitive thin film is used primarily for species identification.

Ensure that slides with the blood films are properly labelled. Dates are important since serial specimens are taken from each case and the results are important to case management.

b) Blood for serology

Serologic tests are not used in diagnosis of acute attacks since they do not distinguish between antibody from present and past infections which may persist for 10 years or more.

However, the Immunofluorescent Antibody Test (IFAT) provides a useful tool for screening in epidemics or where large numbers of cases are involved, so that the taking of blood smears may be prioritized.

Control and Prevention of Malaria

- Prompt investigation of suspected cases and close surveillance of those at high risk.
- Immediate commencement of treatment of confirmed cases (results of sequential blood smears should give an indication of drug resistance and the need for modification of chemotherapeutic regime). Artemisinin-based combination therapy such as artemether/lumefantrine is usually the drug of choice.
- Nurse patient in mosquito-proof area, especially from dusk to dawn.
- Investigate contacts and try to identify the source of infection. The latter may provide a lead to other cases with inapparent infection.
- Undertake “Active Fever Surveillance” – examine smears from febrile persons presenting to health facilities in case vicinity.
- Undertake “Active Geographical Surveillance” – examine smears from persons living in surrounding households – with or without fever. A one-mile radius around a positive household is a commonly used guide.
- In epidemics, plot epidemic curve utilizing line listing data, and use spot maps to monitor distribution of cases and direct vector control activity.
- Maintain updated information on endemic countries and those in which epidemics are occurring as an item of surveillance data.
- Put in place systems to facilitate access to information on countries visited by travellers, e.g., collaboration with Immigration Department, links with travel agencies, regular tour organizers and airlines may provide information useful for traveller surveillance.
- Provide appropriate chemoprophylaxis for persons travelling to endemic areas.
- Maintain the use of Health Alert Cards for arriving passengers at Ports of arrival.
- In endemic areas, examine blood for parasites as part of routine screening at blood banks.
- Educate the public on the mode of transmission and of precautions which can help to prevent contracting malaria.

- Institute measures to reduce the Anopheles population in endemic areas, in areas surrounding locations where cases have been identified, and around the premises where the patient has been 30 days prior to the onset of illness (aim at covering a radius of 1 mile around these areas).
- Maintain rigid anti-mosquito control for 400 meters around the perimeter of airports and seaports.

Technical Notes

The first attack in a country regardless of whether the person has had previous attacks in other countries should be counted as a new case in that country. A subsequent attack in the same person in the same country caused by a different Plasmodium species should be counted as another case.

A subsequent attack in the same person in the same country caused by the same *Plasmodium* spp. may indicate relapsing infection, or treatment failure due to drug resistance.

In areas where other diseases with similar symptomatology are prevalent, especially other diseases spread by vectors (e.g. yellow fever and dengue), co-infection should be considered even with the demonstration of malarial parasites.

Syndromic Surveillance of Select Vector Borne Diseases

Chikungunya, dengue, Zika, Yellow fever and Malaria will be reported under undifferentiated fever. Dengue and Yellow fever may also present with bleeding and be reported as fever and haemorrhagic syndrome.

Environmental Health

The mosquito vectors (Aedes) that transmits these diseases breeds in domestic and peri-domestic such as in water storage containers, flower vases, vehicle tyres, coconut shells and other discarded items. Public health authorities should:

- Conduct surveillance of Aedes mosquito species to determine density and distribution of the population and to identify the communities at risk for disease transmission.
- Monitor the seasonality of the trends in vector borne diseases so that interventions can be intensified in anticipation of the usual increases in incidence.
- Conduct larval survey measurements such as the house index, container index and Breteau index to monitor the mosquito population in different areas.
- Conduct sampling of adult mosquito to obtain information on disease transmission risk and the effectiveness of control interventions.

Traveller's Health

Visitors to the Caribbean from non-endemic regions may become infected while on vacation and fall ill on return to their homelands. This can lead to negative publicity, travel advisories, a reduction in visitor arrivals and economic loss to the sector.

Public health authorities should:

- Monitor areas with high levels of vectors and target them for control interventions.

- Maintain control of mosquito vectors around tourist accommodations to limit the impact of arboviral diseases on this sector.
- Educate travellers of the need to use personal prevention measures.
-

Control and Prevention of Mosquito Borne Diseases

Prevention is reliant on upon the measures taken to avoid mosquito bites and on the elimination of mosquito breeding sites. It is important to strengthen disease surveillance systems to detect and respond to outbreaks of vector borne diseases.

To avoid mosquito bites individuals are advised to:

- Wear long-sleeved shirts and long trousers; especially at dawn and dusk when Aedes mosquitoes are most active.
- Use mosquito repellents on parts of the body that are exposed.
- Use repellents such as mosquito coils, electric vapour mats during the daytime to prevent mosquito bites.
- Use mosquito bed nets to protect individuals who may sleep during the day (insecticide treated nets are effective at preventing mosquito bites during sleep). Nurse febrile patients in screened rooms or use insecticide-impregnated bed nets.
- Use screens on windows and doors to keep mosquitoes out of dwellings.

Vector control measures include

- Use of chemical insecticides in the recommended dose to kill adult mosquitoes (through fogging or ultra-low volume (ULV) application of insecticide especially in a one-mile radius surrounding confirmed cases).
- Elimination of breathing sites of mosquitoes by removing containers that can hold water such as flower vases, tyres, cans, jars, coconut shells, etc.
- Treating water containers with larvicide to destroy the larval stage of Aedes mosquitoes and prevent the emergence of adult mosquitoes.

Integrated vector management (IVM)

Integrated vector management is a framework for managing vector populations in such a way as to reduce or interrupt transmission of disease. Components of IVM include:

- A strengthened public health regulatory and legislative framework that facilitates the inclusion of vector control in the policies of all relevant agencies, organizations and among civil society.
- Evidence-based decision making – the methods employed are based on knowledge of factors influencing local vector ecology, epidemiology, surveillance and resources.
- biology, disease transmission and morbidity;
- Use of a range of interventions, often in combination and synergistically;
- Collaboration within the health sector and with other public and private sectors that impact on vectors;
- Engagement with and empowerment of local communities and other stakeholders to facilitate the adoption of measures that limits the proliferation of vectors and the transmission of diseases.[(6)]

YELLOW FEVER

Internationally notifiable:	**Yes**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Report to World Health Organization/Pan American Health Organization in accordance with the International Health Regulations

Overview

Yellow Fever is an acute viral haemorrhagic fever transmitted to man by mosquitoes infected with the yellow fever virus. It is endemic in parts of Africa, South America and occasionally enzootic in Trinidad.

The virus exists in three transmission cycles: (1) Jungle yellow fever transmitted between monkeys and forest-dwelling mosquito species such as *Haemagogus sp.* in South America and *Aedes africanus* in Africa., (2) Intermediate transmission occurs in semiarid regions of Africa where mosquitoes feed both on primates (monkeys) and humans, given the opportunity, and (3) Urban yellow fever transmitted between man and the *Aedes aegypti* mosquito. Susceptible humans can become infected if they enter the forest when the virus is active and are bitten by infected forest mosquitoes.

Clinical presentation

The incubation period of yellow fever is 3 to 7 days and the illness is characterized by an acute phase lasting 4 to 5 days with fever, chills, headache, dizziness, malaise, nausea and lower back pain. Relative bradycardia, conjunctival injection, and facial flushing may be found on physical examination. A short period of remission lasting about 24 hours follows. About 15 – 25% of cases experience a toxic phase of 3 to 5 days duration with a very high fatality rate. The toxic phase is marked by fever, abdominal pain, vomiting, renal failure, and haemorrhagic manifestations such as petechiae, ecchymoses, epistaxis, bleeding from gums and venepuncture sites, melena, hematemesis, and metrorrhagia. Jaundice and elevated liver enzymes (AST > ALT) are also prominent (Blyth, 2019).

Confirmation of yellow fever rests on laboratory diagnosis since the disease, in its wide range of clinical severity, can resemble many others. The differential diagnoses include influenza, dengue fever, malaria, hepatitis, leptospirosis and other viral haemorrhagic fevers.

Surveillance for yellow fever permits rapid identification and laboratory confirmation of cases leading to prompt outbreak control through immunization and vector reduction.

Case Definition

Suspected case

A suspected case of yellow fever is a person with an illness characterized by:

- Acute onset of fever followed by two or more of the following symptoms:
    - Headaches or backaches

- Muscle pain
- Nausea and/or vomiting
- Fatigue/lethargy

AND at least one of the following:

- Jaundice (within two weeks of the onset of fever)
- Reduced amounts of urine production
- Bleeding from nose, gums or skin
- Blood in vomit, stool or urine

Probable case

A probable case of yellow fever is a suspected case fulfilling one or more of the following criteria:

- Living/working in an area where yellow fever is enzootic or endemic
- Presence in the neighbourhood or village, within the last two weeks, of a person ill with fever and jaundice

Confirmed case

A confirmed case of yellow fever is a suspected case with positive laboratory test results or is epidemiologically linked to a laboratory confirmed case.

<u>Laboratory diagnosis</u>

Specimen Collection and Transport

a) Acute blood sample

- Draw a 5 to 10ml blood sample from each suspected case and place in a sterile tube.
- Send to the laboratory immediately in a cold box.
- If shipment is not possible within 24 hours, centrifuge the blood and transfer the serum to a sterile vial.
- Store at –20°C and ship with frozen icepacks.
- Label all tubes and vials with patient name, specimen and date of collection.

b) Convalescent blood sample

- If requested by the laboratory draw a 5ml convalescent blood sample 2 to 3 weeks after the first.
- Store and ship as above.

c) Autopsy specimens

- Blood: Place a 10ml sample of heart blood into a sterile vial, label and ship to the laboratory within 24 hours. If prompt shipment is not possible store and ship as in (a) above.
- Liver: Place a section of liver, at least one cm^3, into a sterile jar with viral transport medium or buffered saline. Store and ship at 4°C

  OR

  Place liver specimen in normal saline and ship at ambient temperature.

All specimens must be accompanied by patient identification, clinical data and recent yellow fever immunization history.

Laboratory confirmation

a) Criteria for case confirmation.

A case is laboratory confirmed as yellow fever if one of the following criteria are met.

- Yellow fever-specific IgM antibodies are detected in the serum and there is no history of recent immunization.
- Yellow fever virus is isolated from blood or liver by culture.
- Paired sera show a four-fold or greater increase in yellow fever specific antibody level in the absence of recent vaccination.
- Yellow fever viral antigen or genome is detected in blood or tissue by RT-PCR.
- Characteristic liver histopathology is seen at autopsy.

b) Other laboratory examinations

Laboratory tests for some of the other possible aetiologic agents should be conducted if the capability exists. These might include Malaria blood film, Hepatitis A and B serology, Dengue IgM or virus isolation, Leptospirosis agglutination test, and immunofluorescence for selected viral haemorrhagic fevers.

<u>Yellow Fever Control and Prevention</u>

a) Outbreak control

Upon confirmation of a case of yellow fever, action can be initiated at the district level which will reduce the severity of, or even abort, the threatened epidemic.

Appropriate measures are:

- Conduct emergency immunization in the district. (More extensive immunization must be planned at the national level.)
- Intensify surveillance to identify additional cases
- Alert nearby districts or counties to the possibility of yellow fever virus circulation
- Coordinate with vector control authorities to reduce Aedes density within a six-mile radius of the case and around hospitals.
- Inform and involve the community in elimination of mosquito breeding sites
- Set up a mapping system for suspected and confirmed cases
- Strengthen clinical management of yellow fever in health facilities

b) Outbreak prevention

Having brought the outbreak under control attention can be focused on long-term activities which will prevent the recurrence of epidemic yellow fever.

The following are appropriate activities:

- Conduct a thorough epidemiological analysis of the recent outbreak
- Immunize populations identified by this analysis to be at risk e.g. newly developed peri-sylvatic communities whose residents may not have been immunized, or urban communities potentially exposed.
- Improve yellow fever vaccine coverage in the EPI. This is a long-term strategy to ensure protection of each birth cohort
- Reinforce routine surveillance. Identify areas of weakness in awareness, training, designation of responsibility

- Collaborate with vector control to set up a mosquito monitoring and control programme
- Strengthen the early warning system for epizootic yellow fever.

Technical Notes

- Serologic cross-reactions occur with other flaviviruses (i.e. dengue), in the HI test.
- Yellow fever vaccine must be approved by WHO and administered by approved persons. An international certificate of vaccination should be filled out, dated, signed and validated. Vaccination is valid for life.

ZIKA

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA Epidemiology Division**

Overview

Zika virus (ZIKV) is an RNA virus that gets its name from the forest in Uganda where it was discovered in 1947. It is an arbovirus of the genus Flavivirus (family Flaviviridae) that is closely related to other viruses such as dengue, yellow fever, West Nile and Japanese encephalitis viruses. It is mainly transmitted by mosquitoes of the genus *Aedes*, but sexual and vertical (mother-to-child) transmission have been reported. Additionally, a limited number of cases of transmission via blood transfusion have been documented.

Clinical presentation

The incubation period is about 3 to 12 days. Most (1 in 5) cases are asymptomatic. Symptoms of zika infection include rash, fever, conjunctivitis, myalgia, arthralgia, malaise and headache and may last from 4 to 7 days.

An increase in prevalence of neurological complications, most notably Guillain-Barre Syndrome (GBS) has been observed to coincide with an outbreak of zika infection. Also, birth defects such as microcephaly, placental insufficiency, intrauterine growth retardation and foetal demise have been linked to zika infection in pregnancy.

Surveillance objectives (PAHO, 2016)

- *Enable early detection of imported cases in areas/territories where the mosquito vector is absent;*
- *Permit early detection of the introduction or presence of clusters of ZIKV infection in an area/territory where the mosquito vector is present, but vector borne transmission has not been previously documented;*
- *Characterize the epidemiological situation and follow up the outbreak on the basis of the detection of local transmission and monitor the circulation of the virus, taking into account other endemic arboviral diseases;*
- *Detect unusual events, for example, atypical clinical descriptions of ZIKV infection or a new mode of transmission;*
- *Detect the occurrence and temporal evolution of neurological manifestations;*

- *Determine the prevalence of congenital abnormalities at birth, especially those affecting the central nervous system (CNS), such as microcephaly; investigate the birth defects affecting CNS and the potential relation with prior ZIKV infection of the mother;*
- *Contribute to the knowledge of the disease, its complications, and its sequelae, so as to support the implementation of primary, secondary, and tertiary prevention measures, since it is an emerging disease and its natural history and disease burden are still only partially understood* [8].

Case Definitions (PAHO, 2016)

Suspected case of Zika virus disease:

A patient with rash (usually maculopapular and pruritic) with **at least two or more** of the following signs or symptoms:

- fever, usually < 38.5 °C
- conjunctivitis (non-purulent/hyperaemic)
- arthralgia
- myalgia
- peri-articular oedema

Probable case of Zika virus disease:

A patient who meets the criteria of a suspected case AND also has anti-ZIKV IgM antibodies, without laboratory results indicating infection by other flaviviruses.

Confirmed case of Zika virus disease:

A patient who meets the criteria for a suspected case AND has laboratory confirmation of recent ZIKV infection, with presence of:

- RNA or ZIKV antigen in any serum sample or other type (for example, urine, saliva, tissue or whole blood) by RT-PCR; OR
- Positive anti-ZIKV IgM antibodies AND Plaque reduction neutralization plate (PRNT90) for ZIKV titres ≥ 20 and four or more times higher than for other flaviviruses; and exclusion of other flavivirus; OR
- In deceased individuals, molecular detection of the viral genome in autopsy tissue (fresh or in paraffin), or specific viral antigen detection by immuno-histochemistry testing.

Sample selection and storage

- Samples that will be processed (or sent to a reference laboratory) within 48 hours should be kept refrigerated at 4 °C to 8 °C.
- Samples that will be tested after the first 48 hours but no later than 7 days should be kept frozen at -10 °C to -20 °C.
- Samples that will be processed after a week should be kept frozen at -20 °C to -70 °C. Such samples will keep for prolonged periods.

Sexually Transmitted Infections

HUMAN IMMUNODEFICIENCY VIRUS (HIV) INFECTION AND ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS). CLASS 3

Internationally notifiable:	**Yes**
Reporting interval:	**Monthly to National Authorities** **Annually to CARPHA**
Report to (country level):	**National Epidemiologist or National AIDS Programme Coordinator as is relevant**
Report to (regional level):	**CARPHA's Epidemiology Division (HCE)**

Overview

A case of HIV infection is defined as an individual with HIV infection confirmed by laboratory criteria, irrespective of clinical stage (including severe or stage 4 clinical disease, which is also known as AIDS).

AIDS is a constellation of symptoms, signs and illnesses resulting from a compromised immune system following infection with human immunodeficiency virus (HIV) in the absence of other known causes of immunosuppression.

HIV is found in blood, semen, vaginal and rectal secretions or breast milk of an infected person. For infection to occur the virus must be introduced through broken skin including via injection, via the placenta or come in contact with mucous membranes.

There is no risk of transmission during routine social contact with an HIV infected person.

Established modes of transmission include:

- Unprotected sexual contact (heterosexual or homosexual); in rare cases oral sex with an HIV infected person.
- Perinatal transmission from an HIV infected mother to a foetus or new-born
- HIV infected mother breastfeeding
- Transfusion of HIV infected blood or blood products
- Sharing HIV-contaminated needles
- Needle stick injuries especially in healthcare settings

Antiretroviral therapy (ART) effectively suppresses HIV in the body and reduces the chance of a person living with HIV transmitting the disease to another.

Case definition (WHO, 2007)

HIV infection:

Adults and children 18 months or older

The diagnosis of **HIV infection** is based on: A positive HIV antibody test (rapid or laboratory-based enzyme immunoassay) that is confirmed by a second HIV antibody test (rapid or laboratory-based enzyme immunoassay) relying on different antigens or on different operating characteristics;

and/or;

A positive virological test for HIV or its components (HIV-RNA or HIV-DNA or HIV p24 antigen), that is confirmed by a second virological test obtained from a separate sample.

Children younger than 18 months:

A diagnosis of **HIV infection** is based on: A positive virological test for HIV or its components (HIV-RNA or HIV-DNA or HIV p24 antigen), that is confirmed by a second virological test obtained from a separate sample taken more than four weeks after birth.

Note: Because of the possible presence of the mother's antibodies circulating in the infant's blood, HIV antibody testing is not recommended for definitive or confirmatory diagnosis of HIV infection in children until 18 months of age.

Advanced HIV infection (including AIDS):

Clinical criteria for diagnosis of advanced HIV in adults and children with confirmed HIV infection:

Diagnosis (whether presumptive or definitive) of any stage 3 or stage 4 condition (Tables 12 and 13).

AND/OR;

Immunological criteria for diagnosing advanced HIV in adults and children five years or older with confirmed HIV infection:

A CD4 count less than 350 per mm^3 of blood in an HIV-infected adult or child (Table 3).

AND/OR;

Immunological criteria for diagnosing advanced HIV in a child younger than five years of age with confirmed HIV infection (Table 14):

- Children younger than 12 months; % CD4+ < 30
- Children aged 12–35 months; % CD4+ < 25
- Children aged 36–59 months; % CD4+ < 20

AIDS:

AIDS in adults and children is defined as:

- A presumptive or definitive clinical diagnosis of any stage 4 condition (Table 1) with confirmed HIV infection, OR
- An immunological diagnosis in adults and children with confirmed HIV infection and > 5 years of age; first ever documented CD4 count less than 200 per mm^3 or % CD4+ < 15, OR
- Among children aged 12–35 months with confirmed HIV infection; first ever documented % CD4 < 20, OR
- Among children less than 12 months of age and with confirmed HIV infection; first ever documented % CD4 < 25.

Note: In cases where laboratory confirmation of HIV infection cannot be obtained, a case of AIDS may be reported on its clinical presentation.

Clinical criteria for presumptive diagnosis of severe HIV disease among infants and children aged less than 18 months in situations where virological testing is not available (WHO)

A presumptive diagnosis of severe HIV disease should be made if:

- the infant is confirmed as HIV antibody-positive;
  AND
- diagnosis of any AIDS-indicator condition(s) can be made;
  OR
- the infant is symptomatic with two or more of the following;
  - oral thrush
  - severe pneumonia
  - severe sepsis

Other factors that support the diagnosis of severe HIV disease in an HIV seropositive infant include:

- recent HIV related maternal death or advanced HIV disease in the mother;
- CD4 < 20%.

Confirmation of the diagnosis of HIV infection should be sought as soon as possible.

Table 12. WHO clinical staging of HIV/AIDS for adults and adolescents with confirmed HIV infection

Clinical stage	**Condition**
1	Asymptomatic Persistent generalized lymphadenopathy
2	Moderate unexplained weight loss (<10% of presumed or measured body weight) Recurrent respiratory tract infections sinusitis, tonsillitis, otitis media and pharyngitis) Herpes zoster Angular cheilitis Recurrent oral ulceration Papular pruritic eruptions Seborrhoeic dermatitis Fungal nail infections
3	Unexplained severe weight loss (>10% of presumed or measured body weight) Unexplained chronic diarrhoea for longer than one month Unexplained persistent fever (above 37.6°C intermittent or constant, for longer than one month) Persistent oral candidiasis Oral hairy leukoplakia Pulmonary tuberculosis (current) Severe bacterial infections (such as pneumonia, empyema, pyomyositis, bone or joint infection, meningitis or bacteraemia) Acute necrotizing ulcerative stomatitis, gingivitis or periodontitis

	Unexplained anaemia (<8 g/dl), neutropoenia (<0.5 × 109 per litre) or chronic thrombocytopaenia (<50 × 109 per litre)
4	HIV wasting syndrome Pneumocystis pneumonia Recurrent severe bacterial pneumonia Chronic herpes simplex infection (orolabial, genital or anorectal of more than one month's duration or visceral at any site) Oesophageal candidiasis (or candidiasis of trachea, bronchi or lungs) Extrapulmonary tuberculosis Kaposi's sarcoma Cytomegalovirus infection (retinitis or infection of other organs) Central nervous system toxoplasmosis HIV encephalopathy Extrapulmonary cryptococcosis including meningitis Disseminated non-tuberculous mycobacterial infection Progressive multifocal leukoencephalopathy Chronic cryptosporidiosis (with diarrhoea) Chronic isosporiasis Disseminated mycosis (coccidiomycosis or histoplasmosis) Recurrent non-typhoidal Salmonella bacteraemia Lymphoma (cerebral or B-cell non-Hodgkin) or other solid HIV-associated tumours Invasive cervical carcinoma Atypical disseminated leishmaniasis Symptomatic HIV-associated nephropathy or symptomatic HIV-associated cardiomyopathy

Table 13. WHO clinical staging of HIV/AIDS for children with confirmed HIV infection

Clinical stage	**Condition**
1	Asymptomatic Persistent generalized lymphadenopathy
2	Unexplained persistent hepatosplenomegaly Papular pruritic eruptions Fungal nail infection Angular cheilitis Lineal gingival erythema Extensive wart virus infection Extensive molluscum contagiosum Recurrent oral ulcerations Unexplained persistent parotid enlargement Herpes zoster Recurrent or chronic upper respiratory tract infections (otitis media, otorrhoea, sinusitis or tonsillitis)

3	Unexplained moderate malnutrition or wasting not adequately responding to standard therapy Unexplained persistent diarrhoea (14 days or more) Unexplained persistent fever (above 37.5°C intermittent or constant, for longer than one month) Persistent oral candidiasis (after first 6–8 weeks of life) Oral hairy leukoplakia Acute necrotizing ulcerative gingivitis or periodontitis Lymph node tuberculosis Pulmonary tuberculosis Severe recurrent bacterial pneumonia Symptomatic lymphoid interstitial pneumonitis Chronic HIV-associated lung disease including bronchiectasis Unexplained anaemia (<8 g/dl), neutropoenia (<0.5 × 109 per litre) and or chronic thrombocytopaenia (<50 × 109 per litre)
4	Unexplained severe wasting, stunting or severe malnutrition not responding to standard therapy Pneumocystis pneumonia Recurrent severe bacterial infections (such as empyema, pyomyositis, bone or joint infection or meningitis but excluding pneumonia) Chronic herpes simplex infection (orolabial or cutaneous of more than one month's duration or visceral at any site) Oesophageal candidiasis (or candidiasis of trachea, bronchi or lungs) Extrapulmonary tuberculosis Kaposi sarcoma Cytomegalovirus infection: retinitis or cytomegalovirus infection affecting another organ, with onset at age older than one month Central nervous system toxoplasmosis (after one month of life) Extrapulmonary cryptococcosis (including meningitis) HIV encephalopathy Disseminated endemic mycosis (coccidiomycosis or histoplasmosis) Disseminated non-tuberculous mycobacterial infection Chronic cryptosporidiosis (with diarrhoea) Chronic isosporiasis Cerebral or B-cell non-Hodgkin lymphoma Progressive multifocal leukoencephalopathy Symptomatic HIV-associated nephropathy or HIV-associated cardiomyopathy

Table 14. WHO immunological classification for established HIV infection

HIV-associated immunodeficiency	**Age-related CD4 values**			
	<11 months (% CD4+)	**12–35 months (% CD4+)**	**36 –59 months (% CD4+)**	**>5 years (absolute number per mm3 or % CD4+)**

None or not significant	> 35	> 30	> 25	> 500
Mild	30 – 35	25 – 30	20 – 25	350 – 499
Advanced	25 – 29	20 – 24	15 – 19	200 – 349
Severe	< 25	< 20	< 15	< 200 or <15%

Control and prevention

- The public should be educated about HIV and AIDS and on the modes of transmission.
- Individuals should be encouraged to know their HIV status and less risky sexual behaviours should be promoted.
- The use of male and/or female condoms consistently and correctly should be promoted
- HIV-negative people in serodiscordant relationships and those who engage in risky sexual practices should be placed on pre-exposure prophylaxis for HIV (PrEP) to prevent HIV transmission.
- People living with HIV should be placed on ART to reduce viral load to undetectable levels

SEXUALLY TRANSMITTED INFECTIONS

Internationally notifiable:	**No**
Reporting interval:	**Weekly to National Authorities**
Report to (country level):	**Annually to CARPHA**
Report to (regional level):	**CARPHA's Epidemiology Division 4 weekly**

Overview

Sexually transmitted infections (STIs) are a cause of considerable morbidity and have a huge impact on sexual and reproductive health worldwide. If HIV / AIDS is included, this group of diseases ranks among the five most important causes of healthy years of life lost in developing countries.

Several viruses, bacteria and parasites are transmitted through sexual contact; however, eight in particular are responsible for the greatest incidence of STIs. Of these eight pathogens, four are curable: gonorrhoea, chlamydia, syphilis and trichomoniasis. The other four are viral pathogens which are incurable: HIV, hepatitis B, herpes simplex virus and human papillomavirus (HPV). Treatment of the viral infections is intended to either alleviate symptoms or modify the disease.

STIs are transmitted mainly by sexual contact, including vaginal, anal and oral sex. Some STIs are also spread through non-sexual means such as by blood or blood products. Several STIs can also be transmitted from mother to child during pregnancy and childbirth (e.g. HIV, hepatitis B, herpes, HPV, syphilis, chlamydia and gonorrhoea. STIs may be asymptomatic in some individuals.

CHLAMYDIA

Chlamydia trachomatis infection can cause cervicitis, acute salpingitis, urethritis, epididymitis, or other diseases; however, the infection may be asymptomatic in women. Inclusion conjunctivitis and pneumonia in newborns can occur when the infection is acquired perinatally. *C. trachomatis* also causes trachoma and lymphogranuloma venereum.

The incubation period after sexual exposure is 5–7 days following which there may be a urethral discharge in males, and inapparent infection in females leading to cervicitis and salpingitis. Infection does not confer protection and re-infection is possible.

Case definition

Suspected case: Chlamydia may be suspected if one of the following is present:

a) **In males**
- Opaque urethral discharge
- Urethral itching
- Burning on urination

b) **In females**
- Genital discharge
- Cervicitis
- Salpingitis

c) **In babies 5–12 days old**
- Acute papillary conjunctivitis
- Mucopurulent discharge from the eyes

Confirmed Case: A case that is laboratory confirmed (isolation of *C. trachomatis* by culture, OR
demonstration of *C. trachomatis* in a clinical specimen by detection of antigen or nucleic acid).

Laboratory Diagnosis

Laboratory Confirmation

- Nucleic Acid Amplification tests (NAATs) in first catch urine, endocervical or vaginal swab in women or first catch urine and urethral swab in men (by PCR).
- Demonstration by Giemsa staining of intracytoplasmic inclusions in epithelial cells from the genital tract, eye or respiratory tract is highly suggestive of Chlamydial infection.
- Demonstration of specific Chlamydial antigen by immunofluorescence is a definitive diagnosis.
- Isolation of Chlamydia in cell culture demands special techniques and may not be readily available in the region.
- ELISA for Chlamydial antigen detection.

Specimen Collection and Transport

a) From adults
- Urethral or endocervical swabs in transport medium placed at 4–8°C and transported in a cold box
- Genital scrapings spread on a microscope slide, air dried and transported rapidly at room temperature

b) From babies with conjunctivitis
- Eye swab in transport medium or conjunctival scrapings on a microscope slide transported as above

c) From babies with pneumonia
Tracheal aspirate in a sterile tube transported at 4–8°C.

GONORRHOEA

Gonorrhoea is caused by the gram-negative diplococcal bacteria, *Neisseria gonorrhoeae*, which is almost always transmitted by sexual contact. It typically infects epithelia of the cervix, urethra, rectum, pharynx, or conjunctivae, causing inflammation and purulent discharge. Gonorrhoea is a worldwide genital disease and the appearance of antibiotic resistant strains is an increasing concern. The incubation period is typically 2 – 7 days. Males present with a purulent urethral discharge and dysuria which may progress to epididymitis, while females have mild urethritis or cervicitis which may develop into endometritis or pelvic inflammatory disease.

Pharyngeal and anal infections occur in both sexes and rare complications include septicaemia, arthritis, skin lesions, endocarditis and meningitis.

Symptoms of urethral infection in men usually cause them to seek treatment early enough before sequelae develop. However, in women, gonococcal infections are frequently asymptomatic or might not produce identifiable symptoms until complications (e.g., pelvic inflammatory disease [PID]) have arisen. Pelvic inflammatory disease can lead to scaring of the fallopian tubes which results in ectopic pregnancy and infertility. (CDC, 2015)

Chronic maternal infection of the endocervix, often asymptomatic, may result in infection of the newborn and development of gonococcal conjunctivitis 1–5 days after birth. If untreated, this may lead to corneal ulcer perforation and blindness.

<u>Case Definition</u>

Suspected case

a) Gonorrhoea is suspected in adults presenting with
- Purulent discharge from the urethra
- Dysuria
- Vaginal discharge
- Anal discharge

b) In newborns, gonorrhoea is suspected if, 1–5 days after birth, the baby develops
- Redness and swelling of the conjunctivae

- Mucopurulent or purulent discharge from the eyes

Probable case

- Identification of gram-negative intracellular diplococci in a male urethral smear or a female endocervical smear. (CDC, 2013)

Confirmed case

- Isolation of typical gram-negative, oxidase-positive diplococcic by culture (presumptive Neisseria gonorrhoeae) from a clinical specimen, or
- Demonstration of *N. gonorrhoeae* in a clinical specimen by detection of antigen or detection of nucleic acid via nucleic acid amplification (e.g., Polymerase Chain Reaction [PCR]) or hybridization with a nucleic acid probe. (CDC, 2013)

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

Infection with the gonococcus is confirmed by

- Demonstration of gram-negative intracellular diplococci in a urethral smear obtained from a male or a female endocervical smear, or
- Identification of typical gram-negative, oxidase-positive diplococci by culture (presumptive Neisseria gonorrhoeae) from a clinical specimen, or
- Demonstration of N. gonorrhoeae in a clinical specimen by detection of antigen or nucleic acid (CDC, 2013)

Specimen Collection and Transport

From Adults:

- Collect male urethral or female endocervical swabs, place immediately into pre-packaged bacterial transport medium or plate onto Thayer-Martin medium
- Prepare smears of male urethral exudates on microscope slides and air dry
- Collect scrapings from the endocervix and spread onto microscope slides
- All specimens should be rapidly transported to the laboratory at room temperature to preserve bacterial viability or cellular integrity

From babies:

- Prepare conjunctival swabs and scrapings on microscope slides or place in transport medium and transport rapidly to the laboratory

SYPHILIS

Syphilis is a sexually transmitted infection caused by the bacteria *Treponema pallidum*; a spirochete, which is transmitted by contact with body fluids – semen, vaginal secretions, saliva, and blood – during the early stages of the disease (primary, secondary and early latent stages). During acute maternal infection the organism can cross the placenta causing congenital syphilis in the newborn. Untreated primary, secondary and latent syphilis infections in pregnancy typically result in several adverse pregnancy outcomes, including

early foetal deaths/stillbirths, neonatal deaths, preterm/low-birth-weight babies and infected infants.

If untreated, the disease progresses through 3 stages: 1) **Primary syphilis** appearing 3 weeks (range 9 – 90 days) after exposure as a solitary, painless chancre at the site of infection, usually in the vagina, penis or anus (the primary lesion begins as a raised papule and ulcerates before healing within 3 to 10 weeks). 2) **Secondary syphilis**, appearing 4 - 8 weeks later as generalized eruptions of the skin and mucous membranes, which characteristically affects the palms and soles. Large white or grey raised lesions develop in warm and moist areas of the body, such as the anus and labia called condyloma lata. Signs and symptoms of secondary syphilis resolve even without treatment. 3) In **latent syphilis** serology is positive but there are no clinical symptoms or signs. Latent syphilis is often divided in two phases: early latent syphilis (infection for less than two years) and late latent syphilis (infection for two years or more). 4) Around 25% of untreated patients will develop **tertiary syphilis**, which can affect any organ system up to 30 years or more after infection. The main clinical manifestations of tertiary syphilis are neurological disease (neurosyphilis), cardiovascular disease (cardio-syphilis) and gummatous lesions (gumma). (WHO, 2016)

Primary syphilis, secondary syphilis and early latent syphilis are labelled early syphilis; while late latent syphilis and tertiary syphilis is called late syphilis.

Surveillance of symptomatic sexually active persons permits early treatment and contact tracing. Serological screening of pregnant women provides information about latent and asymptomatic infection in this group and can be considered an approximation of syphilis prevalence in the general population.

Case Definition

Primary and secondary Syphilis

Probable case

An illness with ulcers (primary) or mucocutaneous lesions (secondary) and a reactive serological test (non-treponemal or treponemal). Primary syphilis lesions may occur on sites other than in the anogenital area (WHO, 2015).

Confirmed case

Demonstration of *Treponema pallidum* in clinical specimens by dark-field microscopy, direct fluorescent antibody *Treponema pallidum* test (DFA-TP), nucleic acid test or equivalent methods (WHO, 2015).

Latent Syphilis

No clinical signs or symptoms of syphilis and

1) A reactive non-treponemal and treponemal test in a patient with no prior diagnosis of syphilis; or
2) A non-treponemal test titre demonstrating fourfold or higher increase from the last nontreponemal test titre in a patient with a prior diagnosis of syphilis (WHO, 2015)

Congenital syphilis

The global surveillance case definition for congenital syphilis is as follows:

- A stillbirth, live birth or foetal loss at >20 weeks of gestation or weighing >500 g to a syphilis-seropositive mother without adequate syphilis treatment;
  OR
- A stillbirth, live birth or child aged <2 years with microbiological evidence of syphilis infection (WHO, 2015)

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

Infection with Treponema pallidum is confirmed by:

- Demonstration of the organism by dark-field or phase-contrast microscopy on exudates.
- Positive VDRL test confirmed by *Treponema pallidum* haemagglutination (TPHA) or fluorescent antibody (FTA).
- Rapid Plasma Reagin test, similarly confirmed.

Specimen Collection and Transport

a) Collect exudates from lesions and prepare smears on microscope slides. Send to the laboratory at ambient temperature.
b) Draw 5–10ml of blood into a sterile tube. Hold at room temperature for clot retraction. Remove serum and either transport immediately at 4–8°C or freeze for later shipment to the laboratory.

GENITAL DISCHARGE SYNDROME

Infections with several sexually transmitted agents result in a urethral or vaginal discharge. The syndrome of genital discharge is the most frequently seen at health facilities and the use of a syndromic definition will, in many instances, simplify the reporting of sexually transmitted disease.

Common causes of vaginal discharge syndrome include trichomoniasis, bacterial vaginosis and vulvovaginal candidiasis; gonococcal or chlamydial cervical infection are less frequent causes. Common causes of urethral discharge (UD) syndrome include Neisseria gonorrhoeae or *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Ureaplasma urealyticum* and *Trichomonas vaginalis*. (WHO, 2015)

<u>Case Definition</u>

- **Vaginal discharge:** An abnormal vaginal discharge with change in the quantity, consistency, colour or odour (with or without vulval itching or burning) (WHO, 2015)

- **Urethral discharge:** A discharge in men (with or without dysuria), seen at the urethral meatus, with or without milking/expressing the urethra (WHO, 2015)

Laboratory Diagnosis

Laboratory Confirmation

- This is not essential to syndromic STI surveillance.
- If possible, a gram stain can be done to detect gram negative diplococci.
- If more sophisticated laboratory facilities are available, follow procedures listed under the individual diseases above.

Specimen Collection and Transport

- Prepare smears of urethral or genital discharges on microscope slides if a basic laboratory is available.

GENITAL ULCER SYNDROME

Sexually transmitted infections such as Herpes simplex, chancroid, lymphogranuloma venereum and syphilis may all present as an ulcerative condition of the genitalia, difficult to diagnose without sophisticated laboratory facilities. Surveillance of the genital ulcer syndrome will enable health authorities to monitor changes in incidence and plan appropriate interventions.

Case Definition

Genital ulcer disease: An ulcer (a visible break in the skin), with or without pain, on the penis, scrotum or rectum in men, and on the labia, vagina, cervix or rectum in women (WHO, 2015).

Laboratory Diagnosis

Laboratory Confirmation

- This is not essential to syndromic STI surveillance.
- If laboratory facilities exist, consultation should be held with the microbiologist concerning available tests and appropriate specimens.

Specimen Collection and Transport

- Vesicle fluid or material from the base of a recent ulcer can be collected by swab into viral transport medium if virology laboratories exist

Prevention and Control of Sexually Transmitted Diseases

- Community health and sex education should be ongoing and particularly directed towards pre-pubertal and adolescent age groups.

- Services should be provided for early diagnosis and treatment of STD.
- Special attention should be given to ensuring that marginalized populations (such as men who have sex with men, sex workers, people who inject drugs, prison inmates, migrant populations and adolescents) have access to adequate health services.
- Infected persons should be counselled on measures of avoiding transmission.
- Sexual contacts of infected adults should be contacted for treatment and counselling
- Condom use for extra-marital sex should be promoted.

VIRAL HEPATITIS B

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist** **CARPHA's Epidemiology Division 4 weekly**
Report to (regional level):	**PAHO EPI Advisor weekly**

Overview

Viral Hepatitis B is a disease of insidious onset caused by the Hepatitis B virus. It is distributed worldwide and of moderate prevalence in the Caribbean. Infection in early childhood is usually asymptomatic but results in a high rate of development of the permanent carrier state. A high percentage of adult infections are symptomatic, but the rate of resolution and antibody development are also high.

The incubation period is usually 30 to 180 days, with an average of 60–90 days. The multiple outcomes of viral Hepatitis B include acute hepatitis, and in the long term, chronic liver disease, cirrhosis and hepatocellular carcinoma. Acute infection and chronic infections are frequently asymptomatic in children.

Hepatitis is transmitted by parenteral exposure to infected blood or blood products, by sexual contact and by infected mother to child in utero or perinatally. Donors of blood for transfusion are screened by interview and all blood and blood products are tested for the virus. Those at special risk are health care workers, dialysis patients and those requiring blood products, patients in mental institutions and drug users who share needles. These are also at special risk for Hepatitis C.

The objectives of surveillance for hepatitis B are to: 1) detect outbreaks of viral hepatitis; 2) monitor trends in incidence and identify risk factors for new infections; 3) estimate the prevalence of chronic infections; 4) estimate the burden of sequelae and mortality of chronic hepatitis, including cirrhosis, liver failure and carcinoma; and 4) provide data to inform the national vaccination programs. 5)

Another important overall objective is to assess the impact of this disease on the population and to select and implement the most appropriate control strategies.

Case Definition

A presumptive (suspected) case of acute hepatitis B:

A person with either or both of the following:

- Discrete onset of an acute illness with fever, malaise, fatigue AND signs of liver damage (anorexia, nausea, jaundice, dark urine, right upper quadrant tenderness)
  OR
- Raised alanine aminotransferase (ALT) levels more than ten times the upper limit of normal (400 IU/L) (WHO, 2020).

Laboratory confirmed acute hepatitis B:

A laboratory-confirmed case meets the prospective case definition and is IgM anti-HBc positive (WHO, 2020).

Laboratory Diagnosis

Laboratory Confirmation

- Acute: IgM anti-HBc (IgM antibody to the core antigen of the Hepatitis B virus). The presence of IgM specific for the Hepatitis B virus is diagnostic.
- Chronic: HBsAg (Hepatitis B surface Antigen) is present in high titre in the serum during acute disease, and in the carrier state. If symptoms are present, a positive HBsAg test is accepted as diagnostic.
- HBeAg - The presence of Hepatitis 'e' antigen in an infected person indicates a high level of infectivity and is important in the management of pregnant women whose babies are at risk of contracting hepatitis and becoming permanent carriers.

Specimen Collection and Transport

Blood sample.

- As soon as the patient presents, collect 5 to 10ml of venous blood into a sterile tube. Forward to the laboratory on ice within 24 hours, accompanied by whatever patient data are then available.
- If immediate shipment is not possible, centrifuge the blood and transfer serum to a sterile tube with a secure cap. Store at –20°C and ship frozen.
- Include patient, clinical and exposure data

Control and Prevention

- Enforce strict discipline in blood banks, rejecting high risk donors
- Offer personal counselling to patients on behaviours likely to transmit the virus.
- Attempt to trace sexual contacts and counsel. Hepatitis B immune globulin may be offered.
- Maintain confidentiality of all collected data regarding risk behaviour.
- Determine, by analysis of surveillance data, the incidence of acute disease in the population and the prevalence of the chronic sequalae
- Improve vaccine coverage of high-risk groups e.g. health care workers
- Implement a programme of infant vaccination, to prevent development of the carrier state
- Launch a public awareness programme aimed at reducing high-risk behaviour

Note: Hepatitis B vaccine is recommended for children as a 3 or 4 dose regimen, including a birth dose to protect against perinatal transmission (WHO, 2020).

Zoonotic Diseases

BRUCELLOSIS (IN HUMANS)

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Brucellosis is a zoonotic illness characterized by an acute or insidious onset of fever, night sweats, easy fatigability, anorexia, weight loss, headache, arthritis/spondylitis, meningitis, or focal organ involvement (endocarditis, orchitis/epididymitis, hepatomegaly, splenomegaly). The fever is usually intermittent, especially at night, and may become chronic and undulant. It is predominantly an occupational disease in persons working with animals and may occur in persons who consume raw dairy products from infected animals. Following exposure, the incubation period ranges from 5 days to 6 months (average 2 – 4 weeks) (CDC, 2017). Immunity after infection in humans lasts about 2 years. The disorder may become chronic.

Case Definition

a) Probable case

A clinically compatible case that is

- Epidemiologically linked to a confirmed case
- Epidemiologically linked to a confirmed infected source

  AND/OR
- Has supportive serology (rising serologic titres, or an absolute agglutination titre of ≥ 1:160 in one or more serum specimens collected after the onset of symptoms).

b) Confirmed case

A clinically compatible case that is laboratory confirmed using the following criteria:

- Isolation of *Brucella sp.* from a clinical specimen, or
- Fourfold or greater rise in Brucella agglutination titre between acute and convalescent serum specimens obtained at least 2 weeks apart and studied at the same laboratory, or
- Demonstration of *Brucella sp.* in a clinical specimen by immunofluorescence

Laboratory Diagnosis

Laboratory Confirmation

Criteria for laboratory diagnosis are:

- Isolation of Brucella sp. from a clinical specimen

  OR
- A four-fold or greater rise in Brucella agglutination test on paired sera.

Specimen Collection and Transport

a) **Acute blood sample**

The first blood sample should be collected as early as possible after the onset of illness. If laboratory capability exists for isolation of *Brucella sp.*, this sample must be transported at room temperature to reach the laboratory within one hour.

b) **Convalescent blood sample**

A second blood sample should be collected two weeks after the first. The paired sera will be used in the Brucella agglutination test. These must be transported to the laboratory within 24 hours at 4°C.

<u>Control and Prevention</u>

- Administer appropriate multiple-drug regime to patient (doxycycline or trimethoprim/sulfamethoxazole plus gentamicin, streptomycin, or rifampin). Relapses with single drug regime may be as high as 50%. Treat relapsed cases promptly and adequately.
- Implement concurrent disinfection of purulent discharges in cases where such complications exist.
- Carry out epidemiologic investigation to identify other cases.
- Liaise with veterinary public health or other suitable personnel from animal health discipline to trace infection to common or individual source.
- Veterinary personnel to implement appropriate control measures in respect of animals.
- In the case of an outbreak, search for a common vehicle of infection, e.g., milk or milk products from an infected herd; recall incriminated products and ensure the institution of corrective measures (e.g. pasteurization) before production and release to the public are restarted.

Long term measures:

- Educate the public to use only pasteurized milk and milk products.
- Educate workers in farms, abattoirs, butchers' shops, meat processing plants etc, as to the nature of the disease and precautions to be taken in day to day activities. These workers should wear goggles and rubber gloves and protect areas with broken skin from exposure.
- Provide post exposure antimicrobial prophylaxis in cases of high-risk exposures.
- Maintain surveillance of livestock through relevant persons to discover early possible warnings such as abortion in animals.
- Ultimate control of human brucellosis depends upon the elimination of the disease in the animal reservoir provided primarily by domestic animals. A live attenuated vaccine for use in animals is available.

HANTAVIRUS PULMONARY SYNDROME

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA Epidemiology Division**

Since this disease has not been identified in the Caribbean, suspected cases should be reported immediately to the National and Regional levels

Overview

Hantavirus Pulmonary Syndrome (HPS) is a fatal viral zoonotic disease transmitted to man through contact with rodents. Transmission occurs when the virus, which is excreted in the saliva, urine or faeces of mice, is aerosolized in the wind and inhaled. Infection may also occur directly through breaks in the skin, in the conjunctivae, or possibly through rodent bites. Infection may also be possible following the ingestion of contaminated food or water. Person to person spread is rare. The disease occurs wherever wild or domestic rodents are infected and the prevalence fluctuates with variations in the rodent population and opportunities for human contact with rodents.

Clinical presentation

The incubation period is between 1 to 6 weeks. The disease is characterized by a prodrome (3 to 5 days) consisting of fever, chills, myalgia, headache and gastrointestinal symptoms, followed by non-cardiogenic pulmonary oedema with bilateral interstitial pulmonary infiltrates and cardio-respiratory compromise resembling acute respiratory distress syndrome.

Case Definition

Clinical Hantavirus Pulmonary Syndrome (HPS) case

A person with an acute febrile illness (i.e., temperature greater than 38.3 C) with a prodrome consisting of fever, chills, myalgia, headache, and gastrointestinal symptoms, and one or more of the following clinical features:

- Bilateral diffuse interstitial oedema, **OR**
- Clinical diagnosis of acute respiratory distress syndrome (ARDS), **OR**
- Radiographic evidence of non-cardiogenic pulmonary oedema, **OR**
- An unexplained respiratory illness resulting in death, and includes an autopsy examination demonstrating non-cardiogenic pulmonary oedema without an identifiable cause, **OR**
- Healthcare record with a diagnosis of hantavirus pulmonary syndrome, **OR**
- Death certificate lists hantavirus pulmonary syndrome as a cause of death or a significant condition contributing to death [(10)]

Laboratory confirmed Hantavirus Pulmonary Syndrome (HPS) case

A person with a clinically compatible illness that meets one of the laboratory criteria for diagnosis.

Laboratory Diagnosis

Laboratory Criteria for Diagnosis:

1. Detection of hantavirus-specific immunoglobulin M (IgM), **or**
2. Detection of rising titers of hantavirus-specific immunoglobulin G (IgG), **or**
3. Detection of hantavirus-specific ribonucleic acid (RNA) by PCR in clinical specimens (lung tissue, blood clots, or nucleated blood cells), **or**
4. Detection of hantavirus antigen by immunohistochemistry (IHC) in lung biopsy or autopsy tissue.

Note: Laboratory test results must be confirmed at a reference laboratory.

Specimen Collection and Transport:

Acute blood sample

A blood specimen, (minimum 5ml), should be drawn as soon as possible after admission of the case. Hold at room temperature or at 4°C until clot retraction. Carefully remove the serum to a sterile tube and retain the clot. Label both tubes with patient name, specimen type and date of collection.

Blood and clot should be shipped immediately to the laboratory with cold packs, accompanied by a completed specimen referral form.

Convalescent blood sample

This should be collected approximately 21 days after the first specimen. The serum should be separated and shipped to the laboratory with cold packs.

Tissues

If an autopsy is being performed, lung, kidney, spleen and heart blood should be collected. The tissues should be at least 1 cm3. Fresh tissues must be shipped on dry ice, but if formalin fixed or paraffin blocks are available they should be sent at ambient temperature.

Immunohistochemistry can be done on formalin fixed tissues for all viral haemorrhagic diseases i.e. DHF and yellow fever and for rabies. If formalin fixed tissue is received in the laboratory, it should be immediately placed in 70% alcohol to preserve the antigen.

Prevention and Control of Hantavirus Pulmonary Syndrome

- Contact with rodents and their droppings should be avoided. Precautions should be taken when rodent-infested areas are identified, especially during cleaning.
- When cleaning up rodent infested areas, protective measures should be taken; wear latex, vinyl or nitrile gloves, do not stir up dust, and wet contaminated areas with a bleach solution or household disinfectant. After clean-up, wash hands with soap and water or use an alcohol-based hand sanitizer.
- Cracks and gaps in buildings should be seal up to prevent rodent entry and food sources for rodent should be removed.

LEPTOSPIROSIS

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Leptospirosis is an acute and often severe zoonotic bacterial disease, that is found worldwide. The infection is caused by several serotypes of the spirochete *Leptospira spp.*. Many animals, such as rats, dogs, sheep, goats, cattle, horses, and pigs can carry and shed leptospires in their urine for years and are common sources of human infection. Infection in humans occur directly by contact with infected urine or tissue or indirectly by contact with contaminated water or soil. Skin abrasions and exposed mucous membranes (oral, nasal, conjunctival) are the usual points of entry into the body. Cases can follow swimming in contaminated water and after exposure to floods. Certain occupations may be at high risk for infection (e.g. agriculture workers, abattoir workers, veterinary and sewer workers).

Clinical Presentation

The incubation period is about 7 - 14 days (range 2 – 30 days).

The disease is usually biphasic with an acute leptospiraemic phase characterized by fever that lasts 3 – 10 days and an immune phase that coincides with appearance of antibodies and resolution or deterioration of symptoms.

Mild leptospirosis:
Sudden onset of a flu-like illness with fever, chills, headache, abdominal pain, nausea, vomiting, conjunctival injection, intense muscle pains that especially affects the calves, back and abdomen. Additionally, headache occur sometimes with photophobia, and occasionally there are meningeal signs.

Severe leptospirosis:
Often rapidly progressive. This presentation of the disease has classically been referred to as Weils syndrome which is characterized by haemorrhage (pulmonary, gastrointestinal tract, urogenital tract and skin), jaundice and acute kidney failure. Meningitis may be present and cause altered mental status. Myocarditis, pancreatitis and cholecystitis may also occur.

Case Definition

Clinical description: An acute febrile illness with headache, myalgia (especially of calf muscle) and weakness associated with any of the following symptoms/signs:

- Conjunctival suffusion
- Anuria or oliguria
- Jaundice
- Cough, haemoptysis and shortness of breath
- Haemorrhages (gastrointestinal bleeding, lung bleeding)

- Meningeal irritation
- Skin rash.
- Cardiac arrhythmia or failure (WHO, n.d.)

<u>Laboratory diagnosis</u>

Presumptive diagnosis:

- A positive result of a rapid screening test such as IgM ELISA, latex agglutination test, lateral flow, dipstick etc.

Confirmatory diagnosis:

- Isolation from clinical specimen (blood, urine, CSF or tissue) through culture of pathogenic leptospires.
- A positive PCR result using a validated method (primarily for blood and serum in the early stages of infection).
- Fourfold or greater rise in titre or seroconversion in microscopic agglutination test (MAT) on paired samples obtained at least 2 weeks apart. A battery of Leptospira reference strains representative of local strains should be used as antigens in MAT. (WHO, n.d.)

Case classification

a) **Suspected case**: A case that is compatible with the clinical description **and** a presumptive laboratory diagnosis.
b) **Confirmed case**: A suspect case with a confirmatory laboratory diagnosis. (WHO, n.d.)

Specimen Collection and Transport

a) Acute blood, urine, CSF or tissue

   Specimens for isolation of Leptospira should be transported to the laboratory at ambient temperature within 24 hours.

   Urine specimens may be taken 10 days after the onset of illness for Leptospira isolation. Other specimens should be taken as soon as the patient is seen.

b) Blood for ELISA IgM

   This should be collected when the patient is seen and transported to the laboratory at 4°C within 24 hours. Only one specimen is need for ELISA IgM titre. If the result falls in the doubtful category, then a second sample is requested.

c) Convalescent blood specimen

   A second blood sample should be collected at least 2 weeks after the first and transported to the laboratory at 4°C within 24 hours.

Note: In order to make a serological diagnosis of Leptospirosis, both acute and convalescent sera are needed.

Only one specimen is needed for ELISA IgM titre. If the result falls in the doubtful category, then a second sample is requested.

Specimens must be properly sealed and labelled and accompanied by the following minimum information: Name of patient, address, date of onset, date of specimen, occupation of patient and history of animal contact.

Environmental Health

- To limit occupational exposure to leptospires measures to prevent contact with urine and tissues from infected animals through proper eyewear, footwear, and other protective equipment should be employed.
- Strategies for the control of rodent populations should be deployed.

Traveller's Health

- Travelers should be informed of the risk of leptospirosis before engaging in recreational activities that can result in infection such as swimming in freshwater bodies, canoeing, hiking, etc.
- Swimming on beaches after torrential rainfall should be discouraged.
- Travelers should be advised to inform their healthcare provider of their travel history when being investigated for acute febrile disease.

Outbreak response

- Upon receipt of a notification the case should be interviewed to verify the date of onset of the illness and to identify possible exposure scenarios.
- A careful history of possible exposures should be taken.
- Local public health laboratory should be contacted to confirm the results of testing.
- A site visit should be conducted to identify the likely source of infection.
- Other individuals at risk of infection should be identified.
- Interview individuals on sites to identify other clinically compatible cases for follow up.
- Implement control measures outlined below.

Control and Prevention

- Observe blood and body fluid precautions during patient care.
- Disinfect articles soiled with urine from infected animals.
- Prompt specific antimicrobial treatment is essential. Start as early in the illness as possible.
- Educate the public on the nature of the disease, modes of transmission and relevant recommended precautions.
- Provide workers in high-risk occupations with suitable personal protective gear.
- Recognize potentially contaminated waters including recreational pools and institute appropriate control measures.
- Control rodents in human habitations. Take special precautions in mass evacuation and temporary accommodation of disaster victims.
- Isolate infected domestic animals to prevent contamination of the living, utility and recreational environment of human populations.
- Maintain liaison with veterinary, rodent control, public health and other relevant personnel to facilitate co-ordination of prevention measures.

Technical Notes

Clinical diagnosis in the Caribbean region is difficult because other diseases with similar symptoms to those of leptospirosis frequently occur. (WHO, n.d.)

PLAGUE

Internationally notifiable:	**Yes**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division** **PAHO/IHR**

Overview

Plague is a zoonotic disease caused by the bacterium *Yersinia pestis*. It exists in enzootic cycles involving rodents and their fleas which transfer infection to various animals. It is transmitted among rodents and to man by bites of the fleas or from contact with infected animals. Plague may also be transmitted by direct exposure to infected tissues or respiratory droplets from a person with secondary pneumonic plague. Primary pneumonic plague may then lead to localized or widespread epidemics. The disease is endemic in South America and in the Western U.S.A.

Bubonic plague

Most common form, the incubation period is usually 2 to 5 days but can be up to 12 days. There is abrupt onset of fever (39.5 to 41° C) with chills, rapid pulse and sometimes hypotension. The patient may become restless, delirious, confused, and uncoordinated. Swollen and tender lymph nodes (bubos) appear in the region of inoculation (femoral and inguinal nodes most common) and may suppurate a few days later. At the site of the flea bite a papule, pustule or ulcer may form. Hepatosplenomegaly may also occur.

The bacteria can spread via the bloodstream to other organs and bubonic plague may lead to hematogenous (secondary) pneumonic plague.

Pneumonic plague

Without treatment most patients with pneumonic plague will die within 48 hours of the onset of symptoms.

In primary pneumonic plague the incubation period is 2 to 3 days. There is rapid onset of high fever, chills, tachycardia, chest pain, and severe headache. A cough develops within 24 hours productive of mucoid sputum initially. Streaks of blood then appear in the sputum which later becomes pink or bright red (resembling raspberry syrup) and foamy. Dyspnoea and tachypnoea are present but pleuritic chest pain is uncommon.

Secondary pneumonic plague is the result of hematogenous dissemination of bubonic plague.

Septicaemic plague

An acute, fulminant illness with abdominal pain, disseminated intravascular coagulation, gangrene of the extremities and multiorgan failure that rapidly lead to death. Septicaemic plague occurs as a result of hematogenous spread of plague bacteria and may appear before the manifestations of bubonic or pneumonic plague are evident.

Pharyngeal plague

Manifestations include pharyngitis with cervical lymphadenitis, fever, headache, and malaise which subside within a week. Usually only occurs in endemic areas.

Case Definition

Clinical criteria:

A person presenting with fever and one or more of the following:

- Regional lymphadenitis (bubonic or pharyngeal plague)
- Septicaemia without an evident bubo (septicaemic plague)
- Pneumonia (pneumonic plague)
  - Primary pneumonic plague (inhalation of infectious droplets)
  - Secondary pneumonic plague (haematogenous spread in a bubonic or septicaemic case)

a) Suspected case

A case that meets the clinical criteria, with epidemiological linkage and without laboratory evidence, or with laboratory evidence but no clinical information.

b) Probable case

A case that meets the clinical criteria, is without epidemiological linkage, and with supportive laboratory results:

- Demonstration of *Yersinia pestis* antigen or DNA in appropriate clinical specimens by PCR, immunohistochemistry of direct fluorescent antibody assay.
  OR
- Single or high antibody titre to Yersinia pestis in the absence of a history of immunization

c) Confirmed case

A case that meets the clinical criteria with laboratory confirmation:

- Isolation of *Yersinia pestis* from a clinical specimen
  OR
- Demonstration of a fourfold or greater rise in reciprocal serum IgG antibody titres to Yersinia pestis
  OR

A case that meets the clinical criteria, with presumptive laboratory evidence AND epidemiologic linkage. (CDC, 2019)

Laboratory Diagnosis

Laboratory Confirmation

- Isolation of Yersinia pestis from a clinical specimen with culture.
  OR
- Fourfold or greater increase in serum antibody titres to Yersinia pestis F1 antigen.

Specimen Collection and Transport

a) Blood specimen for isolation of *Yersinia pestis*.
b) Acute and convalescent blood specimens collected 1 week apart for serum antibody titres.
c) Blood, bubo exudates or aspirates and sputum smears sent for microscopic examination. Transport within 24 hours at 4°C.

Control and Prevention

- Use appropriate isolation practices in nursing cases of plague. Strict respiratory isolation with droplet precaution should be employed for pneumonic plague.
- Avoid direct contact with infected body fluids and tissues. Standard precautions should apply when handling potentially infected patients and collecting specimens.
- Investigate contacts and source of infection. Contacts should be monitored and placed on prophylactic medication.
- Administer specific treatment as early as possible (Streptomycin or gentamicin; alternatives include doxycycline, ciprofloxacin, levofloxacin, or chloramphenicol).
- Educate the public in enzootic areas on modes of human and domestic transmission, importance of rat-proofing buildings, preventing access to food and shelter by peri-domestic rodents through appropriate storage and disposal of food, garbage and refuse and the importance of avoiding flea bites by use of insecticides and repellents.
- Rat suppression should always be preceded by measures to control fleas.
- Survey rodent population periodically and implement rat suppression measures.
- Control rats on ships and docks, in warehouses and cargoes, especially containerized cargoes, before shipment and on arrival from plague-endemic locations.

RABIES

Internationally notifiable:	**No**
Reporting interval:	**Immediately**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division** **PAHO EPI Regional Advisor**

Overview

Rabies is a fatal zoonotic disease transmitted to humans through contact with infected animals, both wild and domestic. Surveillance is recommended since rabies is present in the Caribbean in livestock, wild and domestic animals, and bats.

Rabies virus is transmitted to man through entry of virus-laden animal saliva via the skin (bites, scratches), or rarely via mucous membranes (contact with the eyes). Other forms of contact such as petting, or contact with blood, urine or faeces of a rabid animal do not constitute exposure and are not indications for prophylaxis.

Clinical presentation

The incubation period may vary from days to years but is usually in the range 30 to 90 days. Initial symptoms include fever, malaise, and headache. Within days any of the following two manifestations may develop:

- Encephalitis (furious rabies; in 80%) with confusion, agitation, unusual behaviour, insomnia and hallucinations, excessive salivation, and painful spasms of the laryngeal and pharyngeal muscles (hydrophobia) on attempts to drink.
- Paralysis (dumb rabies; in 20%) with ascending paralysis and quadriplegia without hydrophobia and delirium.

Following exposure to a rabid animal, avoidance of disease is possible through rapid post-exposure prophylaxis (PEP). Surveillance therefore encompasses rabies exposure as well as clinical cases.

Case Definition

a) Suspected rabies case

Rabies may be suspected in a person with any of the following clinical signs:

- Acute encephalomyelitis preceded by fever, headache, malaise, anxiety or apprehension
- Spasm of the muscles on attempt to swallow
- Delirium and convulsions
- Hyperactivity or paralysis
- Coma and death usually by respiratory failure within 7 to 10 days of onset

b) Probable rabies case

- A case that meets the clinical case definition above and who has been exposed to a suspected rabid animal within the past 3 months
- Any person who has had abrasive contact with a confirmed rabid animal

c) Rabies exposure

- History of abrasive contact (bite or scratch) with an animal suspected of being rabid
- History of contact with livestock suspected of being rabid
- History of contact with bats

d) Laboratory confirmed rabies case

- Any suspected or probable case with a positive diagnostic laboratory result

Laboratory Diagnosis

Tests for rabies virus are available at veterinary diagnostic laboratories. If one is not available in country, CARPHA can facilitate referral of specimens to the appropriate laboratory. One or more of the following tests may be done. Each report must be accompanied by interpretation and comment and should be sent to the national level as well as to the referring centre.

- Fluorescent antibody test for rabies antigen on corneal or skin scrapings
- Fluorescent antibody on brain tissue for antigen detection
- Virus isolation from brain, saliva or CSF in cell culture or suckling mice
- RT-PCR for antigen detection from fresh or preserved brain, saliva or skin scrapings
- Rabies neutralizing antibody in the CSF of an unvaccinated person

Specimen Collection and Transport

Specimen collection from a suspected rabies case will be done in a hospital ward under appropriate medical supervision, or at autopsy. Specimens must be accompanied by patient, clinical and epidemiological data. A copy of the case investigation form may be used, even if incomplete.

a) Ante-mortem specimens:

- Corneal smear: spread on a glass slide, air dry and ship immediately.
- Scrapings of the buccal mucosa
- Saliva - Collect in a sterile vial, store and ship on ice
- CSF
- Nuchal sample

b) Post-mortem specimens:

- Brain tissue. Sections of the cerebellum, pons, brain stem and upper spinal cord. Place cm^2 blocks of tissue into sterile jars of viral transport medium or saline. Ship on ice.

[If a suspected animal is to be tested, the head should be surrounded with ice and shipped immediately to the laboratory].

<u>Rabies Control and Prevention</u>

a) Pre-exposure

Rabies vaccination is recommended for high-risk individuals such as veterinary workers, abattoir staff and laboratory technologists. This is also recommended for travellers to endemic areas. A three-dose schedule with tissue culture derived vaccine is usually adequate.

b) Post-exposure

Rapid action may prevent disease in an individual exposed to a rabid animal. The extent of the response will depend on the animal's behaviour, circumstances of the injury, presence of rabies in the area, or confirmation of rabies in the animal by Immunofluorescence.

Emergency actions

- Allow the wound to bleed, wash thoroughly with soap and water
- Do not suture unless absolutely necessary
- Administer Rabies Immune Globulin by infiltration around and into the wound.
- Rabies immune globulin (20 IU/kg body) should be infiltrated around the wound; if the injection volume is too large for distal areas (e.g. fingers, nose), some of the rabies immune globulin may be given by intramuscular injection.
- Give the first of a 5-dose series of vaccine as soon as possible
- Give subsequent doses on days 3, 7, 14, 28 after the first.

Rabies prevention and control demand close collaboration between Public Health and Veterinary Public Health departments at district and national levels.

Other Diseases

MENINGITIS/ENCEPHALITIS (VIRAL)

Internationally notifiable:	**No**
Reporting interval:	**Weekly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Viruses which may be cause infection of the central nervous system include:

- The enteroviruses: Coxsackie B, Echovirus, Enterovirus 71, and occasionally poliovirus and Coxsackie A
- Arboviruses: Eastern and Venezuelan Equine Encephalitis, St Louis Encephalitis, Japanese encephalitis virus and West Nile Virus
- Mumps, measles, herpes simplex, cytomegalovirus and varicella

Viral infection of the central nervous system (CNS) occurs either as the primary pathologic event in the infection or as a rare complication. Clinical expression ranges from mild aseptic meningitis to severe life-threatening encephalitis. Symptoms of acute infection include fever, headache, neck stiffness, vomiting and altered mental status. Seizures and neurologic deficits may also occur.

For many of these viruses there are no vaccines and, although antibody protects against re-infection with a specific agent, the multiple aetiology makes repeated occurrences possible. Treatment options are limited to a few antivirals and supportive management.

Laboratory diagnosis is possible, but the resources needed to investigate sporadic cases are considerable and results may be delayed. Priority should be given to clusters of cases or patients with severe disease or special risk factors.

Case Definition

a) **Viral meningitis suspected case**
   Fever of sudden onset, followed by two or more of the following:
   - Headache
   - Nausea
   - Vomiting
   - Stiffness and pain in the neck
   - Maculopapular, vesicular or petechial rash and two of the following
   - Pleocytosis of the spinal fluid
   - Elevated protein
   - Negative for bacteria

b) Viral encephalitis, suspected case

Fever of sudden onset, followed by three or more of the following:

- Headache
- Meningeal signs
- Drowsiness, stupor
- Confusion, disorientation
- Tremors, convulsions
- Coma
- Spasticity, spastic paralysis

c) Probable viral meningitis/encephalitis

- A suspected case with concurrent or recent symptoms of a disease which is known to be associated with CNS infection, e.g. herpes, mumps, measles.
- A suspected case with laboratory detection of an enterovirus in a site other than the CNS, e.g. faeces.

d) Laboratory confirmed viral meningitis/encephalitis

A suspected or probable case with:

- Detection of a virus or viral protein in the central nervous system.
- Specific viral antibody for herpes, mumps, or measles in the CSF.
- Positive serology for an arbovirus known to be associated with CNS infection.
- Positive enterovirus serology and epidemiological linkage to a case with enterovirus in the CNS.

<u>Laboratory Diagnosis</u>

Laboratory tests are selected based on the clinical and epidemiological information provided and on the date of specimen collection relative to the date of onset of illness.

The specific infecting virus may be determined by:

- Demonstration of viral antigen in tissues and cells by immunofluorescence (FA) or PCR.
- A four-fold or greater increase in antibody level between acute and convalescent blood samples.
- Isolation in cell culture or suckling mice.

Specimen Collection and Transport

a. Acute blood sample
    - Draw a 5 to 10 ml blood sample from each suspected case and place in a sterile tube.
    - Send to the laboratory immediately in a cold box at 4–8°C.
    - If shipment is not possible within 24 hours, centrifuge the blood and transfer the serum to a sterile vial. Store at –20°C and ship with frozen icepacks.
    - Complete a laboratory request form with clinical information and date of onset of illness.

b. Convalescent blood sample

- Draw a 5ml convalescent blood sample 2 to 3 weeks after the first.
- Store and ship as above.

c. Throat and vesicle swabs
    - Collect early in the course of the illness and place in viral transport medium.
    - Send immediately to the laboratory in a cold box.

d. Cerebrospinal fluid, brain biopsy or autopsy specimens
    - These are collected under sterile conditions by trained personnel and forwarded immediately to the laboratory in a cold box.

Control and Prevention of Viral Meningitis/Encephalitis

- If an arbovirus is responsible, intensify mosquito control measures.
- If mumps or measles are involved, improve vaccine coverage of the population.
- Control of herpes requires health education on recognition of the disease and prevention of transmission.
- Enterovirus circulation can be reduced by education on personal hygiene and care of infants in day care centres.

Technical Notes

Viral meningitis and encephalitis are grouped for routine surveillance purposes because of their clinical similarity in the early stages. Similar specimens are collected for referral to the laboratory where an in-house testing algorithm is used based on clinical data and the availability of diagnostic reagents.

Should a cluster of suspected cases be reported, investigations will be focused on determining if there is a common aetiology. For this purpose, specimens may be forwarded to other reference laboratories.

LEPROSY (HANSEN'S DISEASE)

Internationally notifiable:	**No**
Reporting interval:	**Monthly**
Report to (country level):	**National Epidemiologist**
Report to (regional level):	**CARPHA's Epidemiology Division**

Overview

Leprosy (Hansen's disease) is a disease caused by infection with the acid-fast, rod-shaped bacillus, *Mycobacterium leprae*. It affects the skin, peripheral nerves, eyes and the mucosa of the upper respiratory tract. Transmission of leprosy is believed to occur via inhalation of infectious respiratory droplets among persons who are in close contact. Although leprosy primarily is a human disease, infection in animals also occur; 15% of nine-banded armadillos in Louisiana and Texas in the USA are infected and contact with these animals occasionally result in human infection. Transmission via soil and insect vectors such as bedbugs and mosquitoes in endemic areas is also suggested (4). The incubation period ranges from 2 – 20

years or more. The spectrum of clinical presentations is based on the level of immune response to *M. leprae* and includes pale, anaesthetic, macular or erythematous skin lesions; superficial nerve-thickening with associated anaesthesia. History of childhood residence in an endemic area is common.

The elimination of leprosy as a public health problem (<prevalence of < 1 case per 10,000 population) was achieved globally in 2000. However, significant number of new cases continue to be diagnosed each year. In 2016 the Global Leprosy Strategy 2016-2020 "Accelerating towards a leprosy-free world" was launched by WHO to bolster the efforts to control leprosy. In 2017 the following case definitions were revised:

- **Paucibacillary (PB):** a case of leprosy with 1 to 5 skin lesions, without demonstrated presence of bacilli in a skin smear;
- **Multibacillary (MB)**: a case of leprosy with more than five skin lesions; or with nerve involvement (pure neuritis, or any number of skin lesions and neuritis); or with the demonstrated presence of bacilli in a slit-skin smear, irrespective of the number of skin lesions (WHO, 2018).

Clinical Presentation:

Hansen's disease manifests itself in different clinical types depending on the immunological status of the individual, and the presentation varies in a continuous spectrum between 2 polar forms, tuberculoid and lepromatous leprosy.

Table 15. Clinical variants of leprosy

FEATURE	TUBERCULOID (TT, BT) LEPROSY	BORDERLINE (BB, BL) LEPROSY	LEPROMATOUS (LL) LEPROSY
Skin	One or more sharply defined annular asymmetric macules or plaques with central clearing and elevated borders Skin lesions are anaesthetic	Intermediate between BT- and LL-type lesions; few or many ill-defined plaques with occasional sharp margin Skin lesions are hypoesthetic or anaesthetic	Multiple symmetric infiltrated nodules and plaques with poor margins or diffuse infiltration; xanthoma-like or dermatofibroma papules; leonine facies and eyebrow alopecia Hypoaesthesia is a late sign
Nerves	Nerve near lesions sometimes enlarged; nerve abscesses most common in BT	Nerve trunk palsies, at times symmetric	Nerve palsies variable; acral, distal, symmetric anaesthesia common
Acid-fast bacilli (AFB) BI	0–1+	3–5+	4–6+

Abbreviations: BB - mid-borderline; BL - borderline lepromatous; BT - borderline tuberculoid; TT - polar tuberculoid; LL - polar lepromatous; BI - bacteriologic index;
Source: Harrison's Principles of Internal Medicine, 20th Edition

<u>Case Definition</u>

Clinical classification

- **Lepromatous leprosy (multibacillary)**: erythematous nodules, papules, macules and diffuse infiltrations of the hands, feet and face that are bilateral, symmetrical and usually numerous and extensive; involvement of the nasal mucosa may lead to crusting, obstructed breathing and epistaxis; ocular involvement leads to iritis and keratitis.
- **Tuberculoid leprosy (paucibacillary):** skin lesions are single or few, sharply demarcated, anaesthetic or hypoaesthetic, and asymmetrical; peripheral nerve involvement tends to be severe.
- **Borderline leprosy:** has features of both polar forms and is more labile.
- **Indeterminate leprosy:** manifested by hypopigmented maculae with ill-defined borders, and if untreated, may progress to tuberculoid, borderline or lepromatous disease. Most indeterminate lesions selfheal.

A case of leprosy is a patient having one or more of the following (WHO, 2017):

(1) Hypo-pigmented skin lesions with loss of sensation;
(2) Impairment or involvement of the peripheral nerves as demonstrated by;
    - definite loss of sensation or
    - weakness of hands/feet or face or
    - autonomic function disorders such as anhidrosis (dry skin)
(3) Presence of visible deformities
(4) Signs of the disease with demonstrated presence of bacilli in skin smear or histopathological confirmation

AND

in need of leprosy treatment as decided by a clinician.

<u>Laboratory Diagnosis</u>

Laboratory Confirmation

Demonstration of acid-fast bacilli on microscopy in skin or dermal nerve from a biopsy of a skin lesion (ear lobe or another relevant site).

OR

Identification of noncaseating granulomas with peripheral nerve involvement in a biopsy specimen (skin or nerve).

Specimen Collection and Transport

a) Skin smear slide
   This is placed on a slide, dried and sent to laboratory for histology.
b) Biopsy of skin lesion or of thickened nerve
   This is transported to the laboratory in normal saline.

Specimens should be accompanied by request form with clinical findings and other relevant information.

Control and Prevention

- Detect cases early before visible deformities occur (particularly infectious multi-bacillary cases) and administer appropriate multi-drug therapy on a regular out-patient basis whenever possible.
- Investigate contacts and source of infection, with early diagnosis and treatment to render the patient non-infectious.
- Drug regimens used to treat leprosy include dapsone (50–100 mg/d), clofazimine (50–100 mg/d, 100 mg three times weekly, or 300 mg monthly), and rifampin (600 mg daily or monthly) [(4)]. Treatment duration may be six months (paucibacillary leprosy) up to 12-24 months (multibacillary leprosy).
- Periodically examine household and other close contacts at 12-month intervals for at least 5 years after last contact with an infectious case.
- Carry out health education programmes, especially in rural settings, to encourage the seeking of early medical attention. Give information on early signs and symptoms, the availability of the effective multi-drug therapy, the absence of infectivity of patients under continuous treatment and the prevention of physical and social disabilities.