NIGERIA CENTRE FOR DISEASE CONTROL

NATIONAL GUIDELINES FOR YELLOW FEVER PREPAREDNESS AND RESPONSE

NIGERIA CENTRE FOR DISEASE CONTROL: NATIONAL GUIDELINES FOR YELLOW FEVER PREPAREDNESS AND RESPONSE

National Guidelines for Yellow Fever Preparedness and Response

Cover Design and Layout by Boboye Onduku/Blo'comms, 2019

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NCDC

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About NCDC

Nigeria Centre for Disease Control (NCDC) is Nigeria's national public health institute with the mandate to protect Nigerians from the impact of communicable diseases of public health significance, amongst other responsibilities. It focuses on this through evidence-based prevention, integrated disease surveillance and response activities, using a One Health approach, guided by research and led by a skilled workforce.

NCDC operations and activities are guided by five key goals to:

- Accurately measure the burden of infectious diseases in Nigeria
- Ensure Nigeria is able to meet its international obligations as a member of the World Health Assembly
- Develop a Public Health laboratory service network to support the detection and prevention of, and response to critical infectious diseases
- Reduce the adverse impact of predictable and unpredicted public health emergencies
- Create an efficiently managed and evidence-based organisation with a clear focus of health promotion and disease prevention.

NCDC currently operates through five directorates: Surveillance and Epidemiology, Public Health Laboratory Services, Emergency Preparedness and Response, Prevention and Programmes Coordination and Administration.

Foreword

The Nigeria Centre for Disease Control is the agency of the Federal Ministry of Health with the mandate to coordinate the public health response to communicable diseases. NCDC leads the surveillance, diagnosis, preparedness and response for communicable disease outbreaks in Nigeria.

Yellow fever (YF) is endemic in sub-Saharan Africa and tropical South America. It is capable of causing sporadic small-scale outbreaks in rural settings and can cause large epidemics that are hard to control in urban settings. This vaccine preventable disease is targeted globally for elimination. The launch of the Eliminating Yellow Fever Epidemics (EYE) strategy in 2017 is a global and comprehensive long term (2017-2026) strategy targeting the most vulnerable countries to achieve the elimination goal. It also addresses global risk by building resilience in urban centres, and preparedness in areas with potential for outbreaks. Critically, the strategy highlights the need to ensure reliable vaccine supplies as well as a global coalition of partners to predict needs and shape vaccine production.

This guideline is designed to guide national and sub-national health authorities, all health institutions and key stakeholders involved in YF preparedness and response in Nigeria to prepare for, detect and respond to yellow fever epidemics. It covers the background of YF, an introduction of the EYE strategy, guidance on coordination, human and vector surveillance and control, case management, laboratory diagnosis. It also covers vaccines and logistics, incorporating preventive and reactive vaccination, action at point of entries, risk communication and social mobilisation as well as reporting.

This guideline has been jointly developed with stakeholders involved in outbreak preparedness and response. I encourage its use by all relevant stakeholders to improve our response capacity during outbreaks of YF in Nigeria and ultimately support our journey towards its elimination.

Chikwe Ihekweazu

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Acknowledgements

The Nigeria Centre for Disease Control (NCDC) wishes to express its immense gratitude to the leadership of the Federal Ministry of Health- the Honourable Minister, Dr Osagie Ehanire and Honourable Minister of State for Health, Dr. Olorunnimbe Adeleke Mamora.

We appreciate the efforts of members of the National Yellow fever Technical Working Group, our sister agencies- National Primary Healthcare Development Agency, the National Arbovirus and Vector Research Centre.

We thank our partners – World Health Organization, United Nations Children's Fund, United States Centers for Disease Control and Prevention, University of Maryland, Baltimore, Pro Health, International, eHealth, Public Health England, George Town University, Nigerian Red Cross, Resolve To Save Lives and GAVI, for their invaluable support during the development of this document.

We deeply appreciate the contributions of the consultant Dr. Theresa Madubuko, as well as Dr. Erin Staple and Stacey Martin of US CDC for their technical assistance.

Abbreviations

AFENET	African Field Epidemiology Network
CSOs	Civil Society Organizations
ELISA	Enzyme-Linked Immunosorbent Assay
EOC	Emergency Operations Centre
EPI	Expanded Programme on Immunization
EYE	Eliminate Yellow Fever Epidemics
DSNO	Disease Surveillance and Notification Officer
FBO	Faith Based Organisations
GAVI	GAVI, the Vaccine Alliance
GIZ	Deutsche Gesellschaftfür Internationale Zusammenarbeit
ICG	International Coordinating Group for vaccine provision
IgG	Immunoglobulin G
IgM	Immunoglobulin M
ICVP	International Certificate of Vaccination or Prophylaxis
IFRC	International Federation of Red Cross
IHC	Immunohistochemistry
IHR	International Health Regulations (2005)
IMS	Incident Management System
IM	Incident Manager
IPC	Infection Prevention and Control
MDA	Ministries Departments and Agencies
MoH	Ministry of Health
MSF	Medecins San Frontieres
NCDC	Nigeria Centre for Disease Control
NCH	National Council on Health

NFELTP	Nigeria Field Epidemiology and Laboratory Training Programme
NMEP	National Malaria Elimination Programme
NPHCDA	National Primary Healthcare Development Agency
PCR	Polymerase Chain Reaction
PHS	Port Health Services
PoE	Point/s of Entry
PI	Population Immunity
PMVC	Preventive Mass Vaccination Campaign
PPE	Personal Protective Equipment
PRNT	Plaque Reduction Neutralization Test
RT-PCR	Real Time Polymerase Chain Reaction
RI	Routine Immunization
RRT	Rapid Response Teams
SAGE	Strategic Advisory Group of Experts on Immunization
SMC	Social MobiliSation Committees
TWG	Technical Working Group
UNICEF	United Nations Children's Fund
WHO	World Health Organization
YF	Yellow Fever
WHOPES	World Health Organisation Pesticide Evaluation Scheme

Overview

Scope

This yellow fever (YF) guideline is designed to guide national and sub-national health authorities, all health institutions and stakeholders involved in YF preparedness and response, to prepare for, detect and respond to yellow fever epidemics. This guideline covers the following areas: background of YF, introduction of the Eliminating Yellow fever Epidemics (EYE) strategy, coordination, surveillance and epidemiology, vector surveillance and control, case management, laboratory diagnosis, vaccines and logistics also incorporating preventive and reactive vaccination, point of entries, risk communication and social mobilisation and reporting.

Aim and Objectives

Aim

1. To provide guidance to public health officials at the national, state, local government and health facility levels on the prevention, detection and response to YF outbreaks in Nigeria.

Specific Objectives

1. To guide the prevention, early detection and response to suspected YF cases and prompt reporting of such cases from health facilities to national level for public health action.
2. To guide the activation of the emergency operating centres at national and sub national levels during outbreaks.
3. To strengthen surveillance and laboratory confirmation at all levels for immediate public health control measures.
4. To guide preparedness and response plans for YF outbreaks.
5. To support adherence to IHR through strengthening of POEs activities relating to yellow fever.
6. To provide guidance on the reporting on yellow fever to Rapid Response Teams (RRT) in the field.

CHAPTER 1
Introduction

Yellow fever (YF) virus is a flavivirus that is primarily transmitted to humans by infected *Aedes* (*Stegomyia*) and *Haemagogus* species mosquitoes. It is endemic to sub-Saharan Africa and tropical South America. Its transmission in Africa is principally dependent upon vectors of the Aedes spp. This viral disease affects unvaccinated people living in and visiting tropical regions of Africa. In rural areas next to forests, the virus typically causes sporadic cases or small-scale outbreaks but, if it is introduced into urban areas, it can cause large explosive epidemics that are hard to control.

Most people infected with YF virus remain asymptomatic. Clinical disease ranges from a mild febrile illness to severe disease with jaundice and haemorrhage. The case fatality rate for severe YF is 30–60%[1].

Because no treatment exists for YF disease, prevention is critical to lower disease risk and mortality. YF is preventable by a safe and effective vaccine. Other preventive measures include mosquito control and behaviour modification to avoid mosquito bites.

Mosquitoes acquire the virus by feeding on infected primates (human or non-human) then transmit the virus to other primates. The virus can also be acquired by the offspring of the mosquito through trans-ovarian transmission (vertical transmission). People infected with YF virus are infectious to mosquitoes (referred to as being 'viraemic') shortly before the onset of fever and up to five days after onset.

Many infected patients do not present with symptoms, however, some have mild flu-like symptoms, which generally subsides after several days, while others can go on to develop high fever with associated jaundice from which the name 'yellow

1 CDC, 2019, Yellow Fever: Case Definition *https://wwwn.cdc.gov/nndss/conditions/yellow-fever/case-definition/2019/*

fever' is derived. Haemorrhage may develop from the mouth, nose, eyes, or stomach in some patients. Mortality rate in those who develop these severe symptoms is between 25% to 50%. WHO estimates that yellow fever causes about 84,000–170,000 severe cases with about 29,000 - 60,000 deaths annually in Africa[2].

1.1 Transmission Cycle for Yellow Fever Virus

Three transmission cycles for YF virus have been observed: Sylvatic (jungle), Savannah (intermediate), and Urban (Figure 1).

In the Sylvatic (jungle cycle), the virus is usually transmitted between non-human primates by tree-hole-breeding mosquito species (Ae. africanus and Ae. leutocephalus) found in the forest canopy. Humans working in or visiting forests can be infected when bitten by mosquitoes that had previously fed on infected monkeys (zoonotic transmission).

The Savannah (intermediate cycle) exists only in Africa and involves transmission of the YF virus from tree hole-breeding Aedes mosquito species breeding in the savannah area to humans living or working in jungle border areas. This can lead to an "Emergence Zone" in rural areas which can progress to large outbreaks if infected individuals travel to urban areas. In this cycle, the virus can be transmitted from non-human primate to humans or from human to human via these mosquitoes.

The Urban cycle involves transmission of the virus between humans and urban mosquitoes, primarily *Ae. aegypti.* and can be characterised by rapid amplification. Major specific risk factors for the occurrence of an urban outbreak are population density, crowding, low levels of population immunity, daily population movements and mosquito breeding sites leading to high mosquito vector density.

Upon infection, viraemia in humans peak shortly before the onset of fever and remains high for three to five days after. It is this period when humans can transmit the virus to mosquitoes. Viraemic humans travelling from one region to another can feed into and serve as a source of infection for mosquitoes in other transmission cycles (dotted line).

2 WHO, Africa, 2019/Health topics/ Yellow Fever: *https://www.afro.who.int/health-topics/yellow-fever*

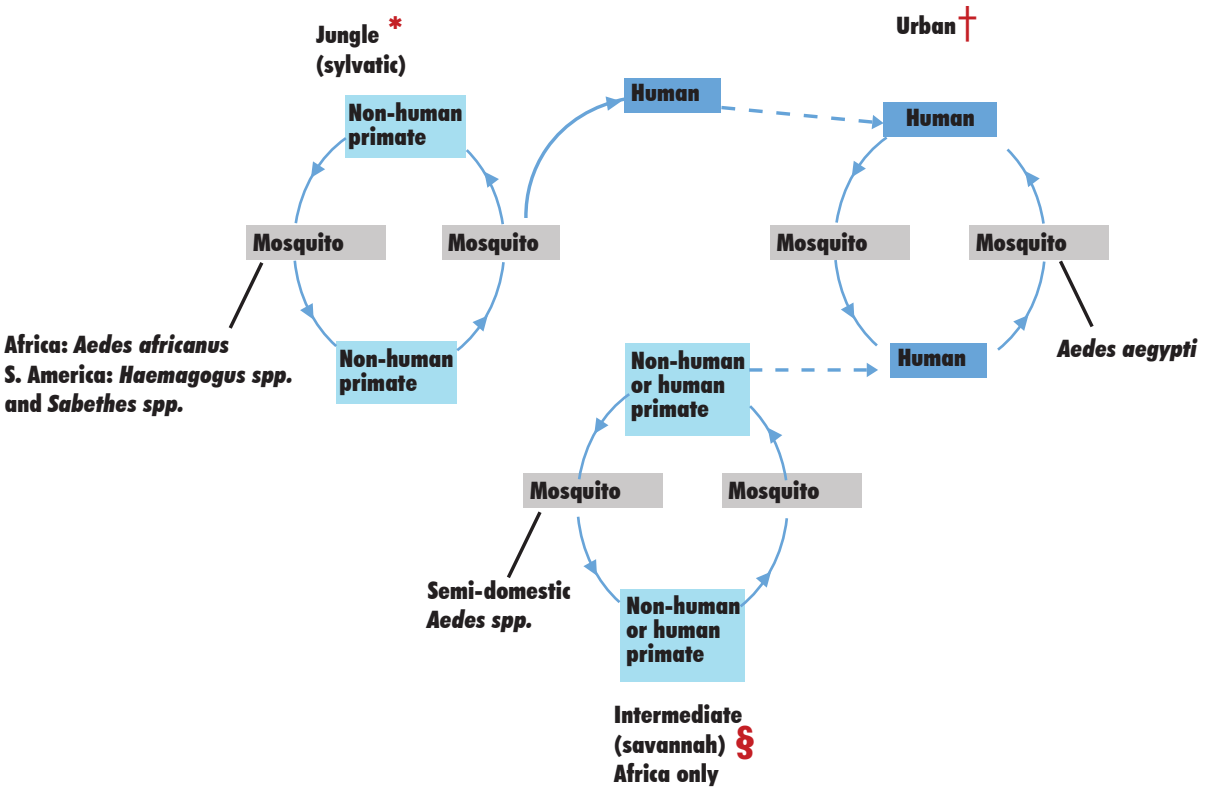


Figure 1: Yellow Fever Transmission Cycle[3]

* The jungle (sylvatic) transmission cycle involves transmission of the virus between nonhuman primates and mosquito species found in the forest canopy. The virus is transmitted via mosquitoes from non-human primates to human when the humans encroach into forest areas during occupational or recreational activities.

† The urban transmission cycle involves transmission of the virus between human and urban mosquitoes, primarily Ae. aegypti. Viraemic humans traveling from one region to another can feed into and serve as a source of infection for mosquitoes in other transmission cycles (dotted line).

§ In Africa, an intermediate (savannah) cycle involves transmission of YFV from tree hole-breeding *Aedes spp.* to humans living or working in forest border areas. In this cycle, the virus can be transmitted from non-human primates to humans or from human to human via these mosquitoes.

3 CDC, 2019, Yellow Fever: Transmission of Yellow Fever Virus h*ttps://www.cdc.gov/yellowfever/transmission/index.html* A Global Strategy to Eliminate Yellow fever Epidemics (EYE) 2017 – 2026. World Health Organization 2019

1.2 Situation Analysis of Yellow Fever in Nigeria

Nigeria is the largest populated country in Africa and is among the 47 countries (34 in Africa and 13 in Central and South America) at risk of yellow fever infection in the world. The yellow fever vaccine was introduced into the routine immunisation schedule in Nigeria in 2004. Since then, routine immunisation coverage for YF in the country has remained at low levels. Low coverage levels result in an ongoing accumulation of susceptible populations, which can trigger outbreaks.

1.3 Eliminating Yellow Fever Epidemics (EYE) Strategy

The Eliminating Yellow Fever Epidemics (EYE) strategy was developed in response to the re-emergence of YF in 2016 in Angola, DRC and Brazil. It is a global and comprehensive long term (2017–2026) strategy targeting countries and regions that are considered as most vulnerable to YF outbreaks. The strategy consists of three strategic objectives and is supported by five cross-cutting competencies to ensure its roll-out and success.

Vision - A world without yellow fever epidemics.

Mission - Coordinate international action and help at-risk countries to prevent YF outbreaks and to prepare for those which might still occur. We aim to minimise suffering, damage and spread by early and reliable detection and a rapid and appropriate response.

1.3.1 Strategic Objectives

a. Strategic Objective 1:

Protect at risk populations

- Where risk is high, vaccinate everyone- quickly raise population immunity levels through mass vaccination campaigns
- Reach every child – sustain high YF vaccine coverage in all districts through routine childhood immunisation
- Risk assessments – assess risk of YF epidemics in at-risk countries to set priority for interventions

b. Strategic Objective 2:

Prevent international spread

- Protect high risk workers- engage private sector to protect unimmunised workers with sylvatic exposure (e.g. oil and mining industry, agro business)

- Apply International Health Regulations IHR – Develop innovative approaches to strengthen IHR application in countries at risk or potential for YF
- Build resilient urban centres – develop and implement urban readiness plans to enable urban coping with epidemics

c. Strategic Objective3:

Contain outbreaks rapidly

- Detect early – strengthen surveillance and laboratory capacities
- Vaccine supply is ready at all times – ensure permanent availability of yellow fever vaccines worldwide for rapid intervention
- Respond immediately – launch coordinated control interventions including reactive immunisation, community mobilisation, vector control and case management

The EYE strategy ranks countries' risk for yellow fever outbreaks based on basic epidemiological and socio-economic dynamics like environmental factors, vector prevalence, and population density viz urbanisation and peri-urbanisation, ease and spread of population movements and changes in work, fast transportation enhancing international spread. Forty countries were considered to be at highest risk for yellow fever. For the success of the EYE strategy, activities to address different drivers of the infection beyond immunisation which include efficient surveillance system and the control of international dissemination are essential pillars complementing population protection were proposed[4].

4 World Health Organization 2018 A global strategy to Eliminate Yellow fever Epidemics 2017–2026 https://apps.who.int/iris/bitstream/handle/10665/272408/9789241513661-eng.pdf?ua=1

CHAPTER 2
Coordination

2.1 Coordination and Outbreak Preparedness Plan

A yellow fever (YF) outbreak is a public health emergency, which calls for an immediate response and requires the rapid mobilisation of public health resources. YF outbreak response should take place at the lowest administrative level of the affected areas. For example, an outbreak occurring at the LGA should lead to an immediate response by the LGA public health and immunisation teams. The response effort should include direct involvement, technical assistance or resource support from the state and/or national level.

Preparedness activities include identifying treatment facilities and prepositioning of case management supplies in advance of any outbreak.

Advance planning and preparing for an outbreak response should take place at all administrative levels. Specifically, routine surveillance and risk assessment of YF outbreaks should take place at the local government, state and national levels.

During outbreak response, the appropriate administrative level – national or state level should adopt and implement the Incident Management System (IMS) to coordinate the much-needed multi-sectoral response as appropriate. The IMS is led by an assigned Incident Manager (IM) who oversees the preparation, planning, resource management, and overall operation of an emergency response (refer NCDC EOC Guidelines).

2.1.1 Pre-outbreak Response Activities

- The multi-agency and multi-sectoral National Yellow Fever Technical working group (YF TWG) hosted at NCDC, coordinates the response activities during pre-outbreak season.
- The YF TWG activities should be coordinated through the following pillars:
  - Coordination
  - Surveillance and Epidemiology
  - Laboratory
  - Case management

- Vaccines and logistics
- Risk communication
- Vector control including entomology

2.1.2 Roles and Responsibilities

2.1.2.1 National Level

a. NCDC

- Develop/review and provide YF specific guidelines/tools to states on surveillance and epidemic activities in accordance with the national IDSR guideline
- Coordinate activities on the National YF preparedness and response plan
- Prepare and implement simulation exercises to test the YF preparedness and response plan
- Support states in monitoring and evaluating preparedness and response activities, such as providing an external evaluation to determine any gaps in preparedness and response activities
- Conduct nationwide, response capacity and risk assessment in collaboration with 36 states and the Federal Capital Territory (FCT), share the findings and recommendations
- Assess resource availability (i.e. healthcare workers, laboratory supplies and equipment) based on the outcome of the risk assessment, and preposition to address gaps
- Map out resources on geographical basis and share information with states and partners
- Stockpile supplies of commodities and equipment necessary for management of YF cases
- Support states in planning, strengthening and coordinating activities of surveillance/epidemiology, laboratory diagnosis and case management pillars
- Collaborate with National Arbovirus and Vectors Research Centre (NAVRC) and the Federal Ministry of Environment

(FMEnv) to assist states to strengthen vector surveillance and control activities

- Develop a model incident action plan for activating EOC and the deployment of IMS team or Rapid Response Team (RRT) personnel
- Coordinate a consortium of external partners/NGOs that have the requisite resources and expertise in supporting YF outbreak preparedness and response activities
- Support States in identifying possible treatment centres for case management of YF
- Coordinate and strengthen the activities of laboratories in the network and provide quality control over other laboratories testing for YF that are not in the YF laboratory network to ensure timely and quality laboratory outputs
- Support the laboratory pillar in matters concerning laboratory accreditation process
- Seek advice from research and academic institutions on YF
- Develop multimedia communication outputs for public education campaigns with key messages for promoting YF vaccination campaigns and preventive behavioural measures
- Coordinate the development and review of guidelines, field investigation guides, standard operating procedures (SOPs), quick reference guides, toolkits, data tools and other such documents that will be relevant to YF control programmes.

b. NPHCDA

- Develop and submit a request for YF vaccines during an outbreak to the International Coordinating Group (ICG) working with NCDC and affected States
- Implement reactive vaccination campaigns during outbreaks
- Plan and lead the implementation of YF preventive mass vaccination campaigns.

c. NAVRC

- Strengthen vector surveillance and control activities in collaboration with the state teams
- Conduct vector control activities in collaboration with Federal Ministry of Environment and Malaria Control Programme
- Support outbreak investigation through vector surveillance

d. PHS

- Implement border surveillance at Points of Entry

2.1.2.2 State Level

- Ensure that YF data from the state are transmitted to NCDC regularly
- State epidemiology team to review, adopt, and regularly implement the YF-specific risk assessment tool to determine hotspots throughout the state
- Communicate the findings and recommendations of the risk assessment to the appropriate stakeholders
- Ensure the implementation of recommendations through a multi-disciplinary and multi-sectoral approach
- Identify and preposition resources (i.e., healthcare workers, lab supplies, and equipment) based on the capacity gaps and the outcome of the risk assessment
- Implement YF-specific guidance (e.g. case definition and reporting forms/methods) at the LGA and healthcare facility-levels on surveillance and epidemic activities in accordance with the national IDSR guideline
- Adapt, implement and monitor the YF preparedness and response plan
- Build the capacity of staff to respond to outbreaks and regular training for frontline healthcare workers on yellow fever epidemiology, early reporting and case management
- Identify and designate appropriate treatment centres with

capacities to improve YF case management

- Develop messages from YF guidelines targeting specific populations in collaboration with the national level
- Establish and strengthen cross border surveillance activities
- Review and adapt the national incident action plan during emergency to suit state peculiarities and regularly exercise the plan to identify areas for improvement or sustainment
- Collaborate with development partners/NGOs and other ministries, department and agencies to leverage on their resources and expertise to supplement LGA's response capacity

2.1.2.3 LGA Level

- Assign Epidemiological (Epid.) Number, collect specimens, investigate, analyse and promptly report all suspected cases of YF
- Implement YF-specific guidance (e.g. case definition and reporting forms/methods) at the LGA and healthcare facility-level on surveillance and epidemic activities in accordance with the national IDSR guidance
- Implement outbreak prevention and control activities with multi-sectoral partners
- Coordinate with the State Epidemiologist/DSNO on conducting risk assessment routinely and communicating the findings and recommendations to the appropriate state/LGA ministries
- Implement recommendations from the routine risk assessment with a multidisciplinary and multi-sectoral approach
- Identify and preposition resources (i.e. healthcare workers) to respond to a suspected case, as well as a confirmed outbreak
- Work with State Ministry of Health, Epidemiologist, DSNO and the State EOC in developing logistical plans such

as, dispatching pillar teams/personnel, vaccines, to reach affected/implementing communities as soon as possible upon notification

- Participate in joint exercises with state EOC to ensure timely sharing of information and executing of response activities
- Collaborate with external partners/NGOs in order to leverage on resources and expertise to supplement LGA capacity
- Conduct training regularly for frontline healthcare workers and laboratory technicians on identification sample collection and transportation and reporting of YF cases
- Promote and conduct risk communication and social mobilisation activities on YF

2.1.2.4 Healthcare Facility Level

- Detect and manage cases, report and collect specimens for diagnosis
- Implement YF-specific guidance (e.g., case definition and reporting forms/methods) at the healthcare facility on surveillance and epidemic activities in accordance with the national IDSR guidance
- Build the capacity of health care workers to have high index of suspicion of YF to detect and respond to outbreaks
- Identify and preposition resources (i.e. healthcare workers, case management commodities, laboratory supplies, and equipment) availability to respond to a suspected case(s)

2.1.3 Notification of Yellow Fever Positive Result

Two phases of testing are currently employed for the diagnosis of YF in Nigeria. The result from the laboratory network in Nigeria and the result from the regional reference laboratory. (See the laboratory testing algorithm on page 47)

2.1.3.1 *Presumptive positive result*

Upon notification of presumptive positive IgM result from any of the national testing laboratories, the national YF TWG team lead will send a notification of presumptive positive case of yellow fever to the state Epidemiologist and also recommend to the State to:

- Conduct case investigation
- Conduct active case search
- Case management
- Social mobilisation activities
- Entomological survey and vector control
- Environmental sanitation
- Ensure all clinical and epidemiological data is collected

2.1.3.2 *Confirmed positive result*

All IgM presumptive positive samples are tested at the regional reference laboratory. Upon receipt of a confirmed yellow fever positive result from the regional laboratory, the National YF TWG lead will send notification of confirmation of the confirmed positive case to the State Epidemiologist.

Similarly, a yellow fever PCR positive result from either a national or regional reference laboratory will be shared with the State epidemiologist.

2.2 Outbreak Response Activities

Upon notification of a confirmed case of yellow fever from the regional reference laboratory or national laboratory testing with real time – Polymerase chain reaction (RT-PCR) to the yellow fever laboratory focal person and the YF TWG Team Lead.

The following activities will be initiated:

2.2.1. National Level (Nigeria Centre for Disease Control)

The YF TWG Team lead will:

- Carry out a case summary and notify the Director General (DG) of the NCDC about the case(s)
- Notify the state(s) immediately of a confirmed case(s) of yellow fever through the State Epidemiologist with detailed information to enable the state identify the case(s)
- Notify WHO country office
- Develop strategy for response based on the following thematic areas
  - Strong coordination of national laboratories providing laboratory testing
  - Rapid investigation of confirmed cases and descriptive analysis of cases
  - Rapid mobilisation of entomology team for survey
  - Intensify risk communication
  - Rapid development of ICG request for reactive vaccination
  - Facilitate YF mass vaccination campaign
  - Activate the Incident Management System (IMS) as will be directed by the DG and appointment of the Incident Manager (IM)
  - When the IM is appointed, s/he coordinates the response activities

2.2.2. Guide for Activating IMS Structure

One confirmed case of yellow fever from the regional reference laboratory or RT-PCR positive result from any nationally approved laboratory testing with RT – PCR is declared an outbreak at the state level.

Activate national EOC when:

- There are more than several states with recent confirmed yellow fever cases

- There are two or more states reporting clusters of confirmed yellow fever cases

The national EOC will:

Coordinate activities and collaborate with Federal Ministry of Health, NAVRC, PHS, Ministry of Environment, relevant agencies and development partners to ensure a multi-sectoral response to outbreaks through the following:

- Support activation of state EOC in the affected state(s) with clear terms of reference
- Deploy rapid response teams to the state as appropriate
- Provide technical or/and other assistance to the affected states during an outbreak
- Support states/LGAs in strengthening surveillance and reporting from affected areas
- Analyse case information from states; distribute data and analysis and maintain information exchange with states and other stakeholders
- Support states/LGAs in monitoring and evaluating response activities, such as providing situation awareness assessment, or an after-action review
- Support states in coordinating with external partners for technical, resources or direct assistance
- Support states in improving linkage of laboratory data to epidemiologic data, as well as translating such data for decision making to support response activities
- The NCDC will regularly produce national surveillance updates and disseminate to stakeholders
    - o Provide feedback to state EOCs on progress
    - o Provide feedback on findings immediately to the State Epidemiologist
    - o Produce weekly situation reports and disseminate to the public and stakeholders

2.2.3. State Level

The State team led by the State Ministry of Health through the Department of Public Health will carry out the following:

- Activate State EOC by adopting the national structure with some modification based on state peculiarities and with clear terms of reference
- Appoint an Incident Manager (IM)
- Ensure a protocol is in place for immediate reporting to the national level i.e. the Nigeria Centre for Disease Control
- Activate State Rapid Response Team (RRT) to assist LGAs in conducting rapid assessment to verify reported cases or a suspected outbreak
- Utilise technical experts, including the RRT to assist the LGA in case investigation
- Map the pattern of the epidemic, with disaggregated data to capture geographic distribution of cases, at-risk population or high-risk areas, case fatality rate and/or weekly incident rate, demographic data, case dispersal pattern
- Collect case information from LGAs, report regularly to NCDC, and maintain information exchange with the NCDC and other stakeholders
- Collect data to be used for reactive vaccination campaign request by NPHCDA
- Support healthcare facilities and LGAs in sample collection, handling and transportation to a designated laboratory for confirmatory testing
- Collaborate with healthcare facilities and/or external partners/NGOs in establishing treatment centres
- Coordinate technical support and resources in key areas with external partners

2.2.4 LGA Level

- Conduct rapid investigation of cases and active case search and report findings immediately to the State Epidemiologist
- Collect case information from healthcare facilities and report immediately to the State Epidemiologist, and maintain information exchange with the State Epidemiologist and other stakeholders
- Assist healthcare facilities in accessing and transporting specimens to the network of laboratories with capacity for sample testing
- Engage affected communities, civil and religious organisations in vaccination awareness campaigns

2.2.5 Healthcare Facility Level

- Immediately activate case management protocol and utilise standardised case definition for identification, treatment and reporting
- Report suspected cases that meet the case definition to the LGA DSNOs and maintain information exchange with DSNOs
- Conduct active case monitoring to include taking blood samples from suspected cases
- Refer and transport samples to the nearest, designated laboratory for confirmation

2.2.6 Post Outbreak

Post outbreak response activities

- Deactivate/de-escalate incident management structure to technical working group
- Finalise detailed outbreak investigation and response report
- Institute enhanced surveillance
- Harmonise and update routine and outbreak data
- Develop post outbreak sustainability plan
- Plan and conduct after action review meeting
- Develop YF preparedness and action plan

CHAPTER 3
Surveillance

The Nigeria yellow fever surveillance system is designed to detect cases of yellow fever in a timely manner to enable prompt verification, investigation and response thereby minimising spread of the virus in the community.

3.1 Routine Surveillance for Yellow Fever in Nigeria

The primary purpose of surveillance for YF in Nigeria is to detect outbreaks early enough to allow timely and effective control measures to be put in place. The objectives of surveillance can differ depending on the phase of the response. The main objective of the preparedness phase is to determine if the YF virus is circulating and causing disease in an area. In the response phase, surveillance will help define the scope and size of local transmission and guide interventions.

3.2 Assessing the Potential for Local Transmission of Yellow Fever Virus

All states should be prepared to identify and assist in investigating potential YF outbreaks. Because clinicians are integral to the surveillance process, LGA and state public health officials should take steps to increase healthcare provider's awareness of YF and ensure testing of all suspected cases. Clinicians should consider YF in the differential diagnosis for individuals presenting with fever and /or jaundice or haemorrhage, not readily explained by aetiology.

3.3 Yellow Fever Case Definitions and Classifications

3.3.1 Suspected case

Any person with acute onset of fever or history of fever and/ or general body weakness, vomiting, bleeding from any part of the body, and jaundice appearing within 14 days of onset of the first symptom.

3.3.2 Probable case

A suspected case as defined above but who died without the collection of specimen for laboratory testing.

3.3.3 Presumptive Positive Case

- Presence of yellow fever IgM antibody in the absence of yellow fever immunisation within 30 days before onset of illness;
- positive post-mortem liver histopathology;
- epidemiological link to a confirmed case or an outbreak

3.3.4 Confirmed Case

A presumptive positive case AND one of the following;

- detection of yellow fever-specific* IgM;
- detection of fourfold increase in yellow-fever IgM, or IgG antibody titres between acute and convalescent serum samples, or both;
- detection of yellow fever-specific* neutralising antibodies

AND

- absence of yellow fever immunisation within 30 days before onset of illness

OR one of the following;

- detection of yellow fever virus genome in blood or other organs by PCR;
- detection of yellow fever antigen in blood, liver or other organs by immunoassay;
- isolation of yellow-fever virus

AND

- absence of yellow fever immunisation within 14 days before onset of illness

Yellow fever-specific means that the results of antibody tests (such as IgM or neutralising antibody) for other prevalent flaviviruses are negative or not significant. Testing should include at least IgM for dengue fever and West Nile virus but may include other flaviviruses according to local epidemiology (for example, Zika virus).

3.4 Yellow Fever Outbreak

3.4.1 YF Outbreak Alert

One presumptive positive case constitutes an outbreak alert. The state should conduct a detailed investigation of the case, initiate active case search, guide appropriate case management and preposition response commodities.

3.4.2 YF Alert Threshold

A single suspected case of YF

3.4.3 YF Outbreak Threshold

The outbreak threshold for yellow fever is a single confirmed case from a YF reference laboratory or national laboratory with demonstrated capacity reporting PCR positive.

3.5 Notification of Yellow Fever Occurrence

The response to a YF case requires an efficient and coordinated communication at all levels (LGA, States and National).

Reporting of YF cases should follow the IDSR reporting flow which is outlined below. See figure 2.

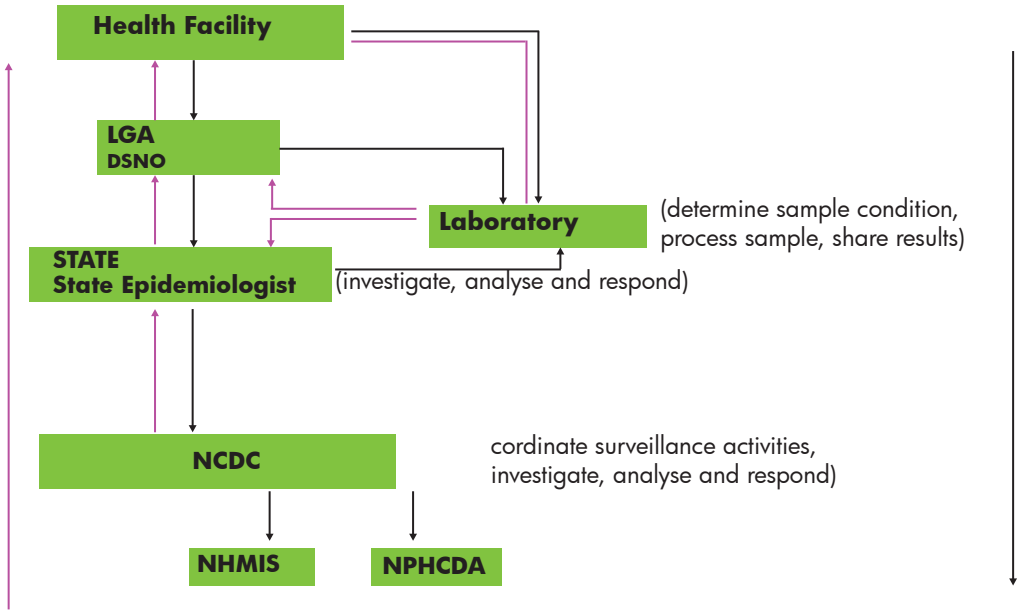


Figure 2: IDSR Surveillance flow chart

3.5.1 Reporting to the LGA DSNO

If the patient's illness is compatible with the case definition of YF, the attending clinician should inform the DSNO of the LGA where the health facility is located immediately. The LGA DSNO should then immediately notify the State Epidemiologist. The State/LGA surveillance team should visit the health facility and the community of residence of the patient for further investigations within 24 hours following notification. The LGA DSNO should conduct active case search in the community and health facilities and carry out a retrospective review of patient's records at other health facilities.

Complete documentation should be made on the appropriate IDSR forms (IDSR 001A, 001B and 001C) and Case Investigation Form. Documentation should follow the sequence below:

Case Investigation Form

IDSR 001A - Case-based surveillance reporting form

IDSR 001B - Case-based Laboratory reporting form

IDSR 001C - Line list for reporting case-based information when several cases occur during a short period

3.5.2 Reporting to the State Epidemiologist and NCDC

Following notification from the LGA DSNO to the State Epidemiologist, the State Epidemiologist should immediately notify NCDC. The State Epidemiology team will collaborate with the LGA DSNO, managing health facility, laboratory and NCDC to initiate response activities.

3.5.3 Notification to WHO

Due to the potential risk of international spread of YF, under the International Health Regulations (IHR) 2005, countries are required to carry out an assessment of public health events arising in their territories utilising the IHR decision instrument, and subsequently notify WHO of all qualifying events within 24 hours of such an assessment.[5]

5 International Health Regulations (2005). Geneva: World Health Organization https://apps.who.int/iris/bitstream/handle/10665/246107/9789241580496-eng.pdf?sequence=1

3.6 Case Investigation

Case investigation is an important component of outbreak response carried out for all cases meeting the standard/surveillance case definitions of YF. These cases are classified as suspected, presumptive positive, confirmed or probable.

For every suspected case, the State surveillance team should:

a. Administer Case Investigation Form
b. Collect and transport blood samples (serum) to the designated YF laboratory in the network
c. Initiate case management

For any presumptive positive case reported, the State surveillance team should:

a. Update the Case Investigation Form with test result and outcome
b. Conduct entomological survey
c. Continue case management
d. Update the Case Investigation Form with final outcome

For any confirmed case reported, the national Yellow Fever Technical Working Group supports the State. This includes:

a. Deploy a Rapid Response Team (RRT) to support the state in the investigation process
b. Facilitate ICG request as appropriate (see page 57)

In addition, epidemiologic investigation is conducted for all deaths, either in the community or health facility, attributable to YF.

The tool for conducting epidemiologic investigation is the Case Investigation Form; this should be completed for all yellow fever cases and deaths meeting the standard case definitions. The verbal autopsy tool is used to estimate the burden of the disease, mortality and under reporting of YF.

The LGA and state surveillance team should conduct active case search in all communities with presumptive positive and confirmed cases in line with the YF response and preparedness guidelines.

YF cases detected via active case search should be reported using the notification channel. Information should be collected on each case using the IDSR 001 A, B & C.

The purpose of epidemiological surveillance is to:

a. Confirm the outbreak
b. Identify all cases
c. Determine the pattern of spread
d. Estimate the potential for further spread of the disease
e. Determine whether prevention and control measures are working effectively

3.6.1 Active Case Search

Active case search is a form of community-based surveillance, targeting all communities with presumptive and confirmed cases. It enables the early identification of individuals in the community who have developed symptoms compatible with YF. Active case search should include other wards in the LGA and the contiguous LGAs to the index LGA.

3.6.2 Active Case Search in Communities

Active case search is the process of identifying unreported symptomatic individuals, who may fulfil the alert or suspected case definition of YF by actively searching for the cases household-to-household within communities. The communities of interest will be determined based on confirmation of a case. If a suspect is identified during active case search, the LGA DSNO administers the Case Investigation Form and refers them to a healthcare facility for laboratory investigation. Detailed report of the case should be submitted for documentation and followed up.

3.6.3 Active Case Search in Health Facilities

The primary objective of conducting active case search in healthcare facilities is to identify and investigate cases among out-patients, those on admission, and those discharged. In addition, the capacity of the facility to identify and report suspected cases could be assessed. Healthcare facilities should be prioritised based on risk category (High, Medium, Low). The risk classification should be based on where the case was identified or has visited in the last 21 days, proximity to identification site, volume of patients attending the facility, and other factors as the situation might dictate. The methods used to obtain data/information during active case search include records review and interviews with relevant health care workers.

3.7 Event-based Surveillance

The NCDC Connect Centre receives calls directly from the public as well as scans media outlets for reports on YF. All rumours of potential YF cases are recorded in the rumour log and the State surveillance team is contacted to investigate and report back within 48 hours. See event-based information flow chart below.

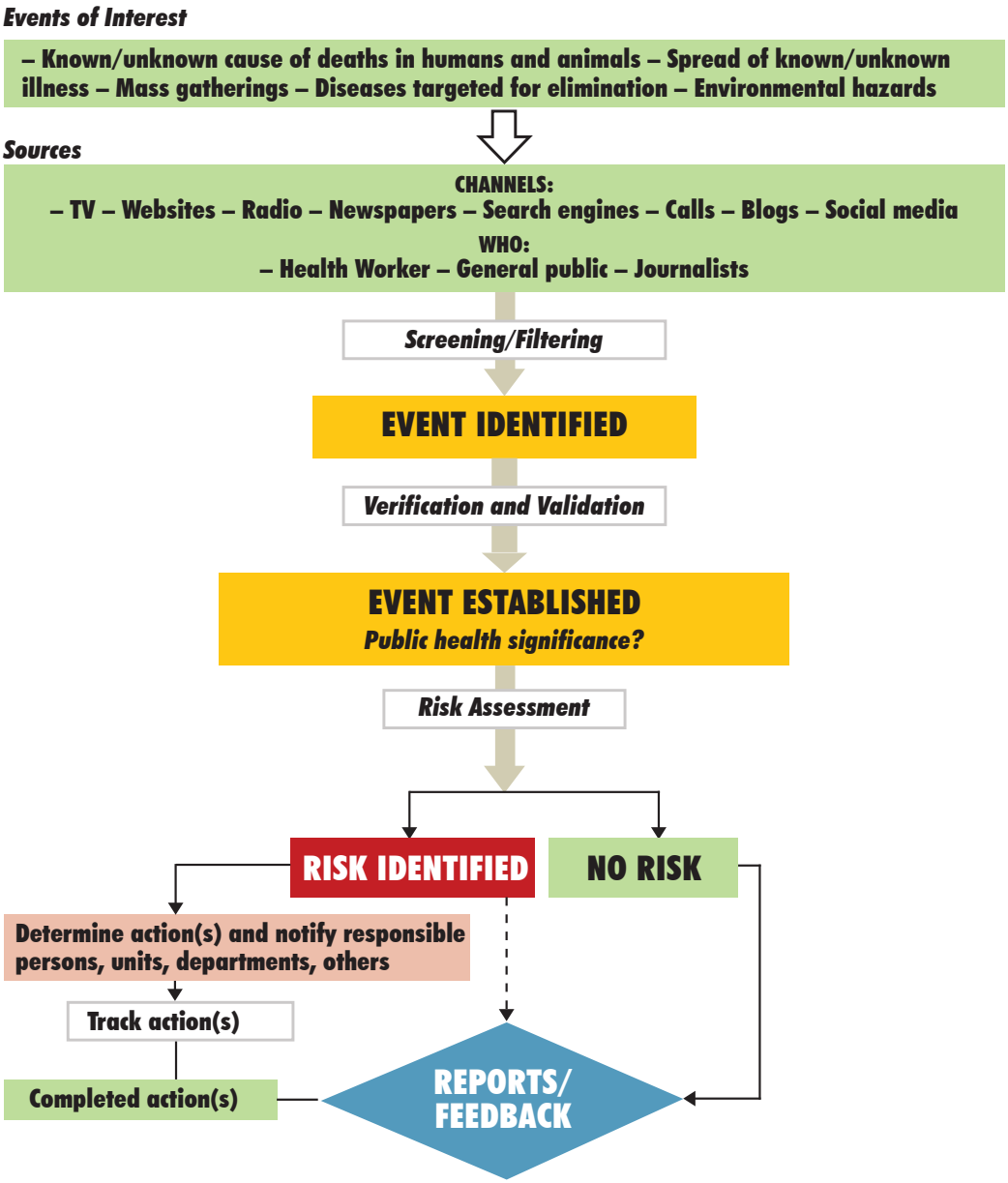


Figure 3: Event-based information flow chart

All inquiries related to potential cases and information on YF should be addressed to the state public health authorities or NCDC through the -

- *Toll-free contact* – **0800 9700 0010**
- *SMS* – **0809 955 5577**
- *Twitter handle* - **@NCDCgov**
- *Facebook page* - **@NCDCgov**
- *WhatsApp contact* – **0708 711 0839**

3.8 Investigation of Yellow Fever Cases

3.8.1 Investigation of Suspect Case

A suspect case is defined as a person with symptoms compatible with YF virus infection. In response to a suspect case, healthcare facilities and public health officials should notify the LGA DSNO who should fill out the YF case investigation form. If clustered cases are found, initiate epidemiological investigation.

3.8.2 Investigation of Unusual Clusters Of Febrile Illness With Jaundice Or Haemorrhage

Outreach to healthcare providers should be carried out to increase awareness and recognition of unusual clusters of febrile illness with jaundice or haemorrhage in areas with *Aedes aegypti* mosquito activity. In such situations, if there is no identified cause, testing for YF virus should be considered.

3.8.3 Investigation of a Probable Case

Investigation can be carried out by verbal autopsy (VA). VA is a tool developed to estimate the burden of disease, mortality and under-reporting of yellow fever. A case for VA is defined as "any death of a family member(s) in a community / health facility who prior to death, developed acute onset of fever and jaundice appearing within 14 days in a person residing in a particular place and at a point in time".

3.8.4 Investigation of a Presumptive Positive YF Case

Typically, a suspect case will be considered a Presumptive Positive YF Case case if the blood sample obtained from the patient tests positive for YF IgM only and the patient does not have a recent history of vaccination. If there is an IgM positive test result from the YF laboratory network, the following response activities should be undertaken:

- Define geographic areas with YF virus transmission risk and the need to implement control measures
- Obtain further information on the case if information is missing or incomplete from forms already submitted
- Conduct active case finding in suspected area(s) of local transmission to identify additional cases, including:
- Assess other household members for symptoms of YF virus disease and collect serum to test for recent YF virus infection
- Liaise with community informants to determine if other persons are ill in the community with symptoms of YF and obtain specimens to test for recent YF virus infection from symptomatic individuals
- Consider conducting verbal autopsy if deaths occurred in area where confirmed case was likely infected
- Determine vaccination coverage in the community
- Assess community and healthcare awareness about YF and sensitise the public
- Augment clinician outreach and communication activities to healthcare providers through existing local channels

3.8.5 Investigation of a Confirmed Yellow Fever Case

A single confirmed case of yellow fever is sufficient to identify a potential outbreak and justify planning for early investigation and intervention. In addition to the response activities outlined above in investigation of suspect and probable cases, the following steps should also be taken:

- Obtain any additional information needed about the confirmed case
- Continue epidemiological investigation
- Determine vaccination coverage in the affected area (coverage of

routine Expanded Programme on Immunisation, recent outbreak response activities and preventive vaccination campaigns)

- Determine the extent and characteristics of unvaccinated populations in the area. This information is essential to determining an intervention strategy including possible vaccination campaigns
- Initiate entomological investigation and, as feasible and necessary, vector control measures
  - Environmental vector control measures are not recommended for sporadic cases in rural areas
  - Effectiveness of vector control as an emergency measure during urban outbreaks should be reviewed and implemented if appropriate
- Assess laboratory surge capacity for anticipated increased testing volume
- Report all cases through the IDSR structure, using the YF case report form
- Conduct risk analysis
- Notify WHO using International Health Regulations (2005) decision instrument

3.9 Activities to be Undertaken by RRT During Deployment

- Active case search in communities and health care facilities
- YF sample collection from patients that meet the YF standard case definition
- Risk analysis of the affected area to determine the level of risk of further transmission
- Rapid YF vaccination coverage assessment
  - A rapid yellow fever vaccination coverage (RVC) assessment for the affected community, LGA and surrounding LGAs should be carried out by the RRT. Yellow fever routine immunisation (RI) coverage for children between 1 – 10 years should be assessed to determine the YF vaccination status in the area. Sighting of the RI cards will be evidence of receiving RI vaccination.
- Verbal autopsy
- Rapid entomological survey

- Knowledge, attitude and practices of YF in the communities and health facilities
- YF Investigation should extend to the contiguous LGAs

3.10 Situation Reports

NCDC will establish situational reporting with feedback from affected states. The types and number of situation reports will likely evolve during the course of the outbreak to reflect the types of surveillance that are performed in an area. Following the introduction of YF virus into an area, a line list of suspect and laboratory-confirmed cases should be maintained.

3.11 Vector Surveillance and Response

The main objectives of vector surveillance are to identify Aedes mosquitoes species present in each locality, detect the presence of virus in the vectors, determine the density of the mosquitoes to measure the risk of an epidemic, assess, and support the selection of the most appropriate control methods to interrupt the transmission. Furthermore, data from the entomology assessment are needed to complete an ICG request to receive YF vaccine doses for a reactive vaccination campaign.

Specimens are collected according to the various stages of the vectors development and can include the collection of active adult vectors, collection of immature forms (eggs, larvae and pupae forms) and the calculation of larval indices for density/ risk assessment (Breteau, House and Container indices). The National Arbovirus and Vectors Research Centre conducts entomological investigations which can reveal the identity of the vectors, their density, the epidemic risk indices, as well as environmental factors from the affected areas. Entomological investigation can also help vaccination planning by identifying hot spots and periods of potential outbreaks.

The objectives of the entomological investigations are to identify the species of the vectors, delimiting their areas of activity, their abundance in the area, estimating the current risk for and risk of spread of the epidemic into other geographical zones, assisting the authorities to make decisions for better control and for training the local personnel. The choice of places to be investigated should be based on epidemiological and laboratory documentation of clinical cases of YF and must therefore be done in collaboration with teams in these disciplines.

For YF, the commonly used vector indices for estimating disease outbreak risk are the Breteau, Container and House indices. Breteau Index (BI) is defined as the number of containers found positive for larvae and/or pupae per 100 houses surveyed. The Container Index (CI) is the percentage of water-holding containers that were found positive for larvae and /or pupae. The House Index (HI) is the percentage of houses found positive for larvae and/or pupae. According to the World Health Organization, there is an epidemic risk when these indices are more than the thresholds of 5% for the Breteau, 3% for container and 4% for the house index.[6]

The typology of breeding sites can also be determined, and a curve of their abundance can be drawn. This abundance curve can be used to determine which specific types of containers are mostly preferred by the vector in a given area. This can be done by estimating the abundance of the breeding sites containing water and then determining the number of breeding sites which are found to be positive with the YF vector.

3.11.1 Distribution of *Aedes* Vectors in Nigeria

The distribution of *Aedes* mosquitoes in Nigeria based on the entomological surveys conducted from 2007 to 2014 following outbreak investigations and recent publication from the National Arbovirus and Vectors Research Centre (NAVRC) are as follows; nine different species (*Aedes aegypti, Aedes albopictus, Aedes africanus, Aedes luteocephalus, Aedes cumminsi, Aedes taylori, Aedes vittatus, Aedes simpsoni*, and *Aedes circumluteolus*) were found across the six geopolitical zones of the country These were collected from 19 states (Kwara, Kogi, Benue, Edo, Cross River, Rivers, Akwa Ibom, Delta, Anambra, Imo, Enugu, Abia, Ebonyi, Ondo, Kaduna, Kebbi, Katsina, Zamfara, and Taraba states) and the Federal Capital Territory (FCT).[7]

6 WHO 2009, Dengue: guidelines for diagnosis, treatment, prevention and control. World Health Organization, Geneva, Switzerland. *http://www.who.int/tdr/publications/documents/dengue -diagnosis.pdf.*

7 Okechukwu Chimaeze, C., Aldophus Chukwuemeka, N., Nwangwu, U., Onwude, O., Nneka Obiageli, A., Anumba, J., & Chukwuebuka, O. (2018). Diversity and distribution of Aedes mosquitoes in Nigeria. *https://doi.org/10.7537/marsnys110218.07*

3.11.2 Vector Control

In responding to local transmission, vector control should be considered for three reasons even though a vaccination campaign will be done: 1) a vector suppression programme often can be implemented over a large area quicker than immunisation; 2) since many cases of YF virus infection are subclinical or mildly symptomatic, vector control can be extended beyond evident clusters; and 3) infected mosquitoes remain infected for the rest of their lives, which may be for several weeks, allowing for the possibility of transmission during and after limited vaccination.

Some of the vector control measures include;

a. Reducing mosquito breeding sites around households, health facilities and worksites

b. Covering water storage containers with lids and emptying water containers with no lid

c. Proper and regular disposal of solid waste. Discarded tyres should be collected, recycled or disposed of by proper incineration or storing them under a roof

d. Plants such as banana and cocoyam with leaf axils that can retain water should be planted far away from human dwellings.

e. In an expanding outbreak, residual and peri-focal treatment should be employed. Hand-operated compression sprayers should be used to treat large accumulations of discarded containers. Ordinarily, use of biological or chemical larvicides (such as Temephos or Bacillus thuringensis) that are non-toxic for consumption at recommended doses can be employed, otherwise susceptibility of the vectors to the WHO Pesticide Evaluation Scheme (WHOPES) approved pesticide should be determined to ascertain the most effective chemical for the locality.

f. Individual protection measures against mosquito bites such as repellents, wearing clothes that cover arms and legs can be used.

In addition, contact national authorities such as the National Arbovirus Research Centre and the Ministry of Environment for expert advice about chemical and other methods of mosquito reduction.

CHAPTER 4

Laboratory Investigation

4.1 Yellow Fever Laboratory Network

The national surveillance for yellow fever in Nigeria currently operates within a network of national and regional reference laboratories. At the national level, six laboratories currently use serology-based tests to detect the presence of IgM in suspected samples collected through routine surveillance. An additional four laboratories from the Lassa fever/VHF network have the capacity to perform YF RT PCR as a differential test which is currently performed on severely ill patients whose clinical signs and symptoms remain unchanged or deteriorate after treatment and who may also develop jaundice.

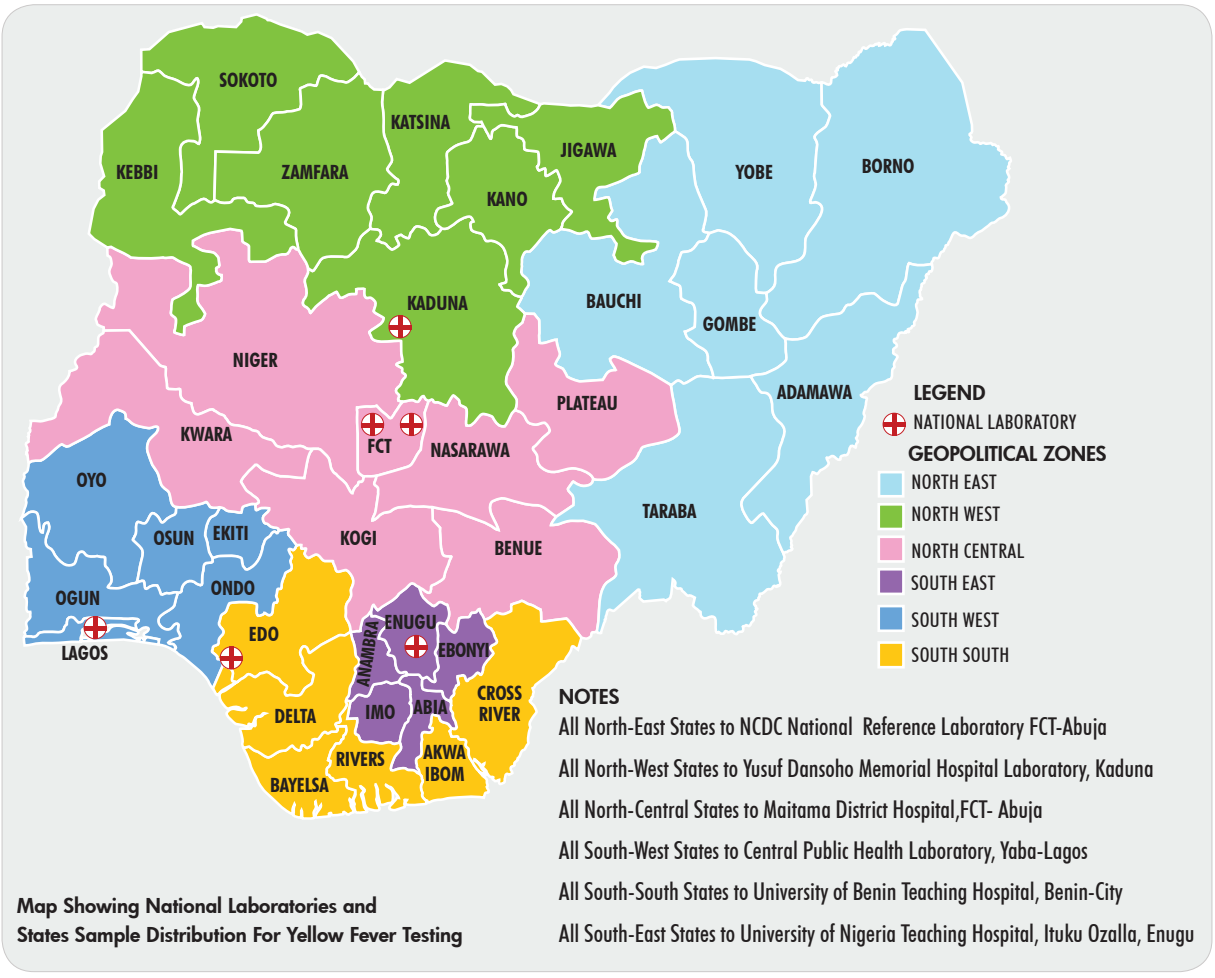


Figure 4: YF laboratory network as at October 2019

4.2 Laboratory Diagnosis of Yellow fever

Diagnosis for YF virus infection can be accomplished using both molecular and serologic methods. Immunohistochemical staining of formalin-fixed tissues can also be used to detect YF virus antigen in histopathologic specimens. During the acute disease, reverse transcriptase-polymerase chain reaction (RT-PCR) can be used to detect YF viral RNA in serum up to 10 days after illness onset and is the preferred diagnostic test. However, because viremia decreases over time, a negative RT-PCR does not exclude YF virus infection, and antibody testing should be performed. YF virus-specific IgM antibodies usually are detectable several days after onset of illness and likely persist for months after onset of illness. Serum samples obtained within 10 days of illness onset and negative by RT-PCR, and all specimens collected >10 days after symptom onset, should be tested for IgM antibodies.

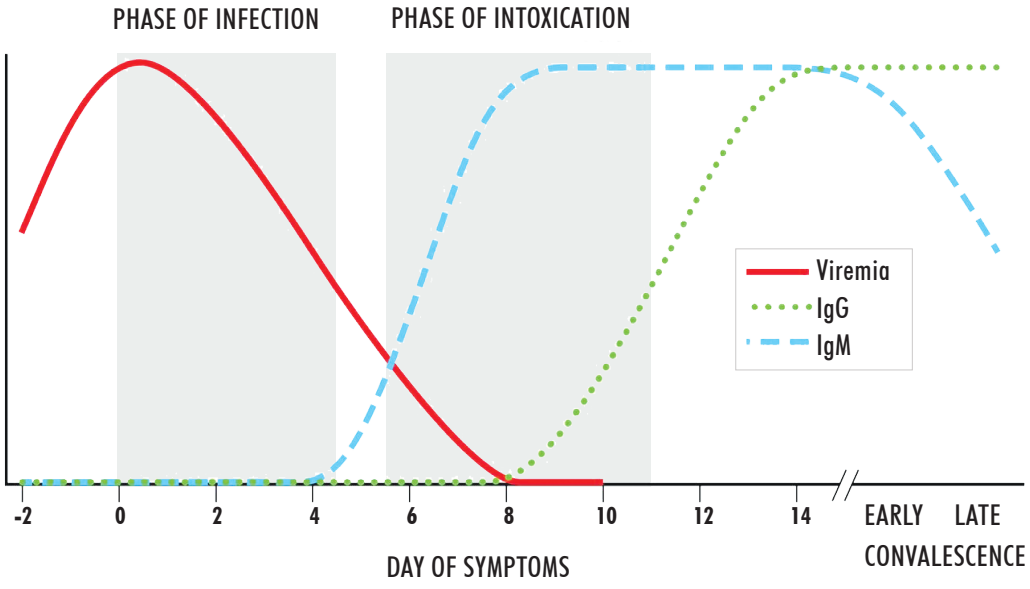


Figure 5: Yellow Fever Disease Progression[8]

8 Waggoner, J.J.; Rojas, A.; Pinsky, B.A. 2018, Yellow fever virus: Diagnostics for a persistent arboviral threat. J. Clin. Microbiol. https://jcm.asm.org/content/56/10/e00827-18

4.2.1 Clinical Laboratory Findings

Laboratory abnormalities can vary based on the severity and stage of illness. In the first week of the illness, there may be leukopenia, but leukocytosis can occur during the second week. Bleeding dyscrasias with elevated prothrombin, partial thromboplastin times, decreased platelet count, and presence of fibrin-split products may be found. Hyperbilirubinemia may be present as early as the third day but usually peaks toward the end of the first week of illness. Elevation of serum transaminase levels occur in severe disease and may remain elevated for up to 2 months after onset.

4.3 Sample Management (Health Facility Laboratory)

4.3.1 Sample Collection

Collect at least 5ml of blood sample from a yellow fever suspected case(s). Transfer the sample into a sterile plain tube. Immediately label the tube or vacutainer with the patient information. Spin the sample at 3000rpm in an ordinary or refrigerated centrifuge to obtain the serum/plasma (at least 3 ml). If a centrifuge is not available, allow the blood sample to stand at room temperature until clot retraction has occurred. Remove the serum from above the clot.

4.3.2 Sample Storage and Transport

If samples are being transported from the field to the laboratory within a few hours, refrigerate at +2 to +8 degrees Celsius but do not freeze. If the samples must be stored for more than 24 hours, freeze at -20 degrees Celsius. Transport samples to testing laboratory in cold chain on frozen ice packs using triple package system.

4.4 Differential Diagnosis

Preliminary diagnosis is based on the patient's clinical features, YF vaccination status, and travel history, including destination, time of year, and activities. Mild YF cannot be clinically distinguished from a wide array of other infections. Cases of YF with jaundice must be differentiated from viral hepatitis, malaria, Dengue haemorrhagic fever, Zika, West Nile, Leptospirosis, Crimean-Congo haemorrhagic fever, Rift Valley fever, Typhoid, Q fever, and Typhus, as well as surgical, drug-induced, and toxic causes of jaundice.

4.5 Laboratory Testing

There are two major ways for laboratories to determine a positive or negative YF infection for samples that are received in the laboratory

a. Detection of virus particles, viral RNA or antigen in blood or tissue samples. Three types of tests are available to detect virus, viral RNA or antigen.

   i. *Reverse Transcriptase Polymerase Chain Reaction (RT-PCR)* for YF viral RNA Performed on samples collected ≤ 10 days after onset of symptoms

   ii. *Viral culture* for YF virus. Performed on acute samples obtained within first few days after illness onset

   iii. *Immunohistochemical (IHC)* staining for YF viral antigen. Performed on tissue samples; usually post-mortem samples

b. Detection of YF – specific antibodies in serum samples. Most common diagnostic test for antibody detection include Enzyme-linked Immunosorbent Assay (ELISA) and Plaque Reduction Neutralization Test (PRNT).

   i. *Enzyme-linked ImmunosorbentAassay (ELISA)* measure YF IgM and IgG antibodies that have been produced by the body in response to YF virus infection. This test is performed on samples collected ≥ 3 days after illness onset.

ii. Plaque Reduction Neutralization Test (PRNT) detects neutralizing antibodies to the YF virus. Neutralizing antibodies develop shortly after IgM antibodies.

4.6 Nigeria (In-Country) Testing Algorithm

Initial testing for YF can be carried out either by serological or molecular methods in selected laboratories respectively.

a. Serology (ELISA) - serological testing, through ELISA, detects the presence of IgM in serum samples collected from suspected cases. The laboratories test for the presence of Yellow Fever antibodies using the CDC MAC ELISA protocols. Positive cases are recorded as '**Presumptive Positive**'; indeterminate, equivocal or inconclusive results are recorded '**Inconclusive**' while negative results are recorded '**Negative**'. All presumptive positive and inconclusive cases are sent to the Regional Reference Laboratory for confirmation within three days of in-country testing.

b. Molecular (RT-PCR) – samples are tested within the Lassa fever/VHF laboratories as part of a differential panel for samples that are negative for Lassa fever. Due to the short viraemic phase, samples should be collected within 10 days of disease onset to detect viral genome in the blood. After 10 days, virus may no longer be detectable in the blood and the likelihood of false negative results may be higher. All YF PCR negative samples therefore should be sent to a YF serology laboratory for further testing using IgM ELISA. All YF PCR positive results can be reported as 'confirmed' at the national level, and a subset of samples should be sent to the regional reference laboratory for quality control when a new outbreak is detected.

All PCR negative samples also have to be tested by serology to rule out 'false negatives'

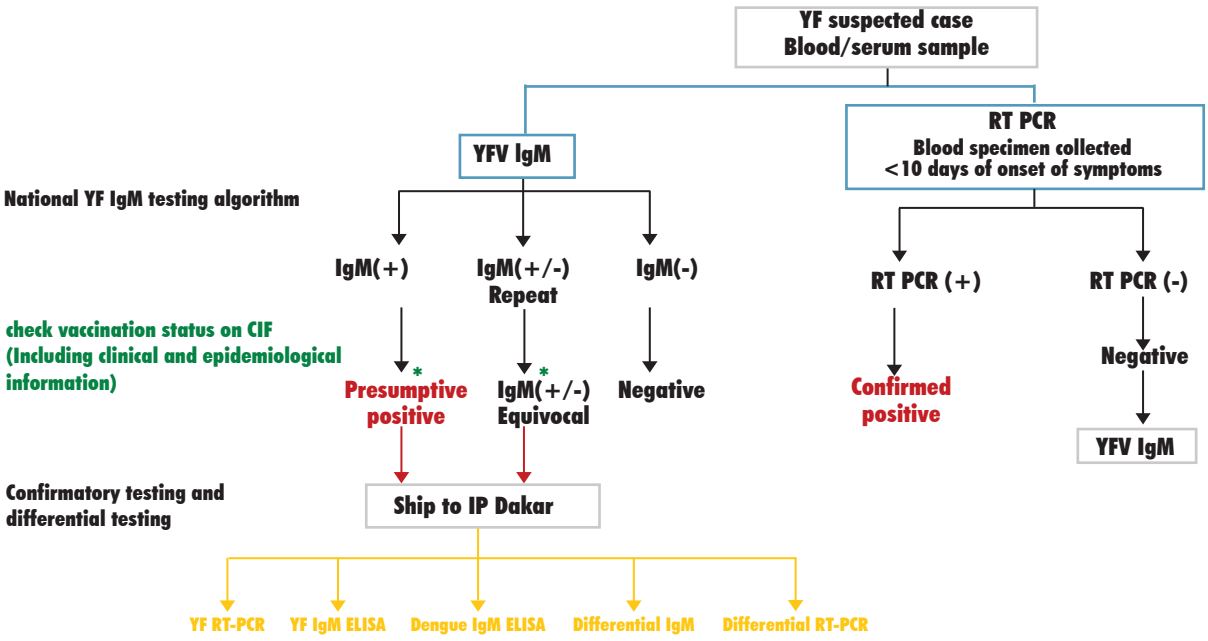


Figure 6: National YF IgM testing algorithm

NOTE: for samples tested by PCR, care has to be taken in interpreting results – due to the high possibility of false negative PCR tests from samples collected post-viremic phase, it is required that samples negative by PCR as the first test, be retested by ELISA for confirmation. IF positive for IgM, PRNT and other differential tests should also be carried out for a final confirmation.

4.7 Regional Reference Laboratory (RRL) Testing

Presumptive positive and inconclusive samples sent to RRL for confirmation are tested as follows:

a. YFV IgM ELISA detection: YFV specific antibody detection to determine the presence of IgM in the serum.
b. Plaque Reduction Neutralization Test (PRNT): this has greater specificity than ELISA to determine presence of YF antibodies in serum samples and rules out the possibility of antibodies due to a past infection or recent vaccination.
c. RT-PCR: Reverse Transcriptase Polymerase Chain Reactions are used to detect YF virus specific genomic RNA in the sample.
d. Flavi-group and other jaundice presenting illnesses differential: due to the cross reactivity between antibodies in the flaviviridae family such as Dengue,

Zika and West Nile, Chikungunya viruses etc., differential tests for specific antibodies to any of these viruses are carried out to rule out infection with any of these flaviviruses. Reverse Transcriptase-PCR differential is also carried out for Hepatitis E due to its associated symptom of jaundice and faeco-oral route of transmission from infected food and water sources.

A suspected case of yellow fever is laboratory-confirmed if any of the following criteria are met:

a. Presence of yellow fever virus RNA in blood from a person with no history of recent yellow fever vaccination or
a. Presence of yellow fever virus specific IgM antibody, absence of other relevant flaviviruses (dengue virus, West Nile virus, Zika virus) and no history of recent yellow fever vaccination

Current laboratory serological tests cannot differentiate between yellow fever virus IgM stimulated by vaccination and that stimulated by infection with yellow fever wild-type virus. Therefore, the **laboratory results in people who have received a yellow fever vaccine within 30 days must be interpreted with care** and assessed on a case by case basis, considering the clinical presentation and epidemiological context along with the laboratory results.

Table 1: Laboratory Results Interpretation for Yellow Fever Testing

NIGERIA LAB		**IP DAKAR**				**VACCINATION** *within the last 30 days	**FINAL RESULT/ CLASSIFICATION**
IgM	**PCR**	**IgM**	**PRNT**	**PCR**	**DIFFERENTIALS**		
NEG						Y or N	NEGATIVE
POS						N	PRESUMPTIVE POSITIVE
POS		POS	POS	POS	NEG		CONFIRMED POSITIVE
	POS					N	CONFIRMED POSITIVE
POS		POS			NEG	N or U	PRESUMPTIVE POSITIVE
POS		POS	POS	POS	POS	N or U	CONFIRMED POSITIVE *co-infection with other Flaviviruses (report specifics)
POS	NEG	NEG	NEG	NEG	NEG	Y or N or U	NEGATIVE
POS	NEG	POS	POS		NEG	Y or N or U	CONFIRMED POSITIVE

Y = Yes; N = No; U = Unknown

4.8 Interpretation of Results

Results from laboratory investigations need to be interpreted with care and all results from the various tests including the differential tests and vaccination status of the individual need to be taken into consideration. Due to the cross reactivity between antibodies of the Flavivirus group, the differential testing for Dengue and Zika viruses are particularly important as well as testing for Hepatitis E virus, which shares similar clinical presentation to Yellow Fever. In addition, for patients who have been vaccinated within 30 days of disease onset, results have to be interpreted with care and sometimes, specific tests need to be carried out to detect vaccine-specific yellow fever virus strains. For all PCR positive cases, clinical and epidemiological information needs to be collected and shared during the ICG request process, in addition to all other information provided during this process.

4.8.1 Interpretation of Results Reported (*See table 2*):

a. Negative: Any test that is reported as negative by Enzyme Linked Immunosorbent Assay (ELISA) from national testing laboratory or Plaque Reduction Neutralization Test (PRNT)
b. Presumptive positive: Any test that is reported as IgM positive from national testing laboratory
c. Confirmed positive: Any test that is reported as positive EITHER by PRNT or PCR (or both)
d. Equivocal/Inconclusive: Any test that is reported as IgM equivocal or inconclusive by the national testing laboratory

4.9 Reporting of Results

Two levels of reporting occur within the national context. Presumptive positive results are reported from a designated YF serology laboratory to NCDC and then to the State Epidemiologist. This triggers a number of actions such as further investigations at the field level and follow up with clinicians and hospitals. Samples are also shipped to the regional reference laboratory for further testing and confirmation. Secondly, PCR laboratories can also report a confirmed YF result, the same reporting lines are followed as for IgM results

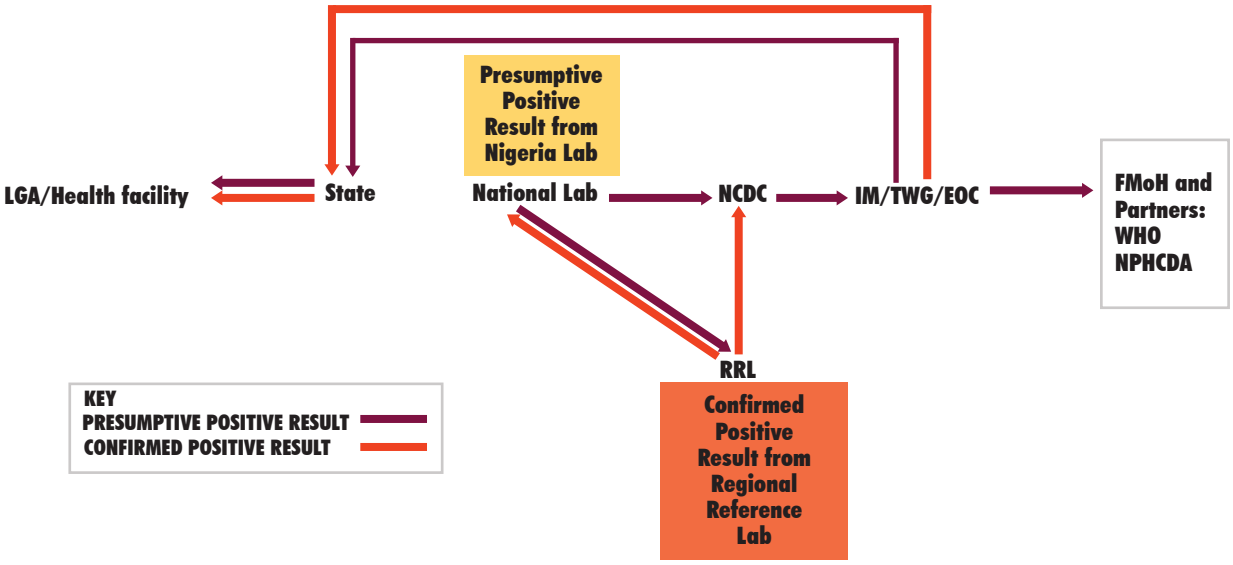


Figure 7: Flow of Results Information

4.10 Roles and Responsibilities for Sample Collection, Testing and Reporting

4.10.1 LGA

- DSNO /Lab focal person/Clinician collects adequate specimen from health facility
- DSNO to complete the lab form and line list template as required
- Assign Epidemiology Number and send both the specimen and lab form to the testing labs
- S/He makes arrangement for replacement where necessary

4.10.2 Network of Testing Labs

- When a presumptive positive ELISA IgM result is recorded, the national testing laboratory should do the following:
- Inform NCDC (through the National Reference Laboratory) and National Laboratory Focal Point (NLFP) of the presumptive result (send email containing name, state, epid. number to NCDC and NLFP)
- Initiate a shipment to CPHL or NRL, based on proximity and timeline

of next shipment from either laboratory, for an international shipment to the Regional Reference Laboratory
- CPHL or NRL to initiate a shipment with DHL or any other courier service in place for international shipment.
- CPHL or NRL to inform Regional Reference Laboratory of pending shipment with presumptive positives
- Report the presumptive positive as part of the weekly reporting

When a PCR positive result is recorded, the laboratory should do the following:
- Inform NCDC (through the National Reference Laboratory), data focal person and National Laboratory Focal Point (NLFP) of the result (send email containing name, state, epid. number to NCDC and NLFP).
- Initiate a shipment to Gaduwa for a quality control test, completion of necessary documentation and reporting through the WHO AFRO reporting system
- Send the result line list, including CIFs to the NCDC NRL and data focal person

4.10.2.1 NCDC/ National Laboratory Focal Person/Surveillance Focal Person

When the NCDC/ NLFP is notified of a presumptive IgM positive from the network lab:
- Notify the IM/TWG Lead of the presumptive positive
- Collect the CIF and laboratory data and generate a line list
- Send line list to IM/TWG lead as well as surveillance focal person
- Ensure international shipments have been initiated either through CPHL via DHL or through Abuja via WHO agreement to Regional Reference Laboratory and follow up on shipment to ensure pick up within 48 hours of notification
- Maintain contact with Regional Reference Laboratory to ensure shipment is received
- Ensure all relevant information on samples shipped have been

shared with the regional reference laboratory for interpretation of results
- Communicate directly with the IM/ TWG Lead and gives feedback to the testing labs by communicating on status of the sample from time to time either by SMS, phone calls or emails

Once a result is received from Regional Reference Laboratory,
- Update line list with results of tests from the RRL and immediately communicate confirmed results to the IM/TWG lead and the surveillance focal person

***The national IM has full communication benefits.*

4.10.2.2 Regional Reference Laboratory (RRL):

Estimated time for diagnosis for yellow fever sample is <21 days.

Once presumptive positive samples are received at the RRL:
- informs the network lab, NCDC/NLFP and WHO of the reception of samples

Upon confirmation of results, the RRL:
- Shares results of the various tests with the NCDC/NLFP immediately

The minimum variables to be shared in the result from RRL are
- Epidemiological number
- Laboratory assigned number
- Age
- Sex
- State
- LGA
- Specimen ID
- Vaccination status
- Serological test (PRNT) result
- Differentials test result
- RT PCR test result
- HEV test result (if done)

4.10.2.3 IM/TWG Lead

Once the IM/TWG lead receives a confirmed positive result from the NCDC/NLFP, (confirmed by RRL) the following activities are implemented;

- Receives updated line list from NCDC/NLFP
- Inform the surveillance focal person and concerned states of confirmed cases
- Assemble a Rapid Response Team for investigation
- Work with NPHCDA to initiate an ICG request

4.10.2.4 State

Receives status of test result directly from the IM and/or NLFP. The State Epidemiologist shares test result (s) with the concerned
LGA(s) in the state.
Pillar heads/NPHCDA/WHO: Monitors status of outbreak and sample shipment and provide response as appropriate

CHAPTER 5

Case Management Guidelines for Yellow Fever

5.1. Introduction

Yellow fever (YF) affects all ages but is associated with higher morbidity and severity among younger children and older adults with an incubation period of three to six days following the bite of an infected female mosquito. The variety of ways that YF occurs includes:

- Subclinical infection
- Abortive, nonspecific febrile illness without jaundice
- Life-threatening disease with fever, jaundice, renal failure, and haemorrhage

There are several approaches to managing cases of YF, which is usually dependent on the phase of the illness. The severity of YF infection varies, as there are different phases of the disease. These phases and diagnostic criteria are described in the table below.

Table 2: Phases of Yellow Fever Infection and Diagnostic Criteria

PHASE	DESCRIPTION
Infective	• Experienced in about 10% of infected persons • Characterised by non-specific symptoms such as fever, muscle pain with prominent back pain, headache, loss of appetite, nausea and/or vomiting • Most people recover after 3-4 days
Remission	• Infected persons recover from symptoms. • Period lasts for about 24-48 hours
Toxic	• About 15% of infected persons go into this phase • Characterised by high grade fever, jaundice (yellowing of the eyes and skin), dark urine and abdominal pain with vomiting • Bleeding can occur from the nose, mouth, eyes or stomach • Multiple organ failure can also occur

5.2. Complications of Yellow Fever

These include bacterial super-infections, such as pneumonia, parotitis, and sepsis. Late deaths during convalescence rarely occur and have been attributed to myocarditis, arrhythmia, or heart failure.

5.3. Diagnosis of Yellow Fever

Presumptive diagnosis can be made using the history (travel from non-endemic region to endemic region, history of recent outbreaks) and clinical features. Definitive diagnosis is however based on detection of virus specific immunoglobulin M (IgM) and immunoglobulin G (IgG) on serology; or detection of viral genome by polymerase chain reaction (PCR) if a blood sample is taken early enough in the course of the infection as described above.

5.4. Differential Diagnosis of Yellow Fever

The differential diagnosis of yellow fever includes: Malaria, Influenza, Dengue fever (Non-haemorrhagic), Typhoid fever, Rickettsial infections, other arboviral fevers, Viral hepatitis, other Viral Haemorrhagic Fevers (Lassa, Marburg, Ebola, Crimean-Congo and Hantaan) Leptospirosis, surgical or toxic causes of jaundice.

5.5. Management of Yellow Fever

5.5.1 Treatment of Yellow Fever

There is no specific treatment for YF. Management of cases is usually symptomatic with supportive management provided. This includes:

- Hospitalisation of patients for supportive care and close observation. Severely ill patients may be treated in an intensive care setting, if available or referred to one if possible
- Rehydration
- Use of pain relievers and medications to reduce fever and relieve aching symptoms. Certain medications should be avoided such as aspirin and non-steroidal anti-inflammatory drugs e.g. Ibuprofen, naproxen as they may increase the risk of bleeding
- Respiratory failure may require use of a ventilator
- Dialysis is indicated in cases of renal failure

- In severe case of bleeding, transfusion with fresh frozen plasma or use of heparin is indicated.

It is important to also protect the infected patient from further exposure to mosquitoes. This can be done by staying indoors and/or under a mosquito net, for up to five days after the onset of fever. This will make them unavailable to infected mosquitoes thereby stopping the transmission cycle and further help reduce risk of transmission to persons around them.

5.5.2 Infection and Prevention Control

In endemic areas, because viraemic patients bitten by mosquitoes can transmit the virus to other patients, the patient should be isolated with mosquito netting in areas with potential vector mosquitoes; this is vital in situations where vaccination coverage is low, or the vaccine is not readily available.

Mosquito control includes eliminating sites where mosquitoes can breed and killing adult mosquitoes and larvae by using insecticides in areas with high mosquito density. Community involvement through activities such as cleaning household drains and covering water containers where mosquitoes can breed is a very important and effective way to control mosquitoes.

Yellow fever virus is not transmitted person to person, but other infections in the differential diagnoses can be transmitted; thus, the patient should be isolated until a definitive diagnosis is made. Adherence to universal precautions is mandatory to prevent transmission to health care workers.

Following the introduction and local transmission of YF virus into an area, healthcare facilities should

- Ensure rapid and frequent communication with LGA Health Department
- Implement surge-capacity plans that address staffing, bed capacity, consumables and durable supplies, and continuation of essential medical services
- Institute appropriate control measures (e.g. vaccination among healthcare workers and vector control personnel)
- Ensure patients are protected from further mosquito exposure (staying

indoors under a mosquito net) during the first few days of illness so they do not contribute to the transmission cycle

Care for patients with YF using standard precautions. The use of special Personnel Protective Equipment (PPE) or other transmission precautions (e.g., droplet or aerosol) are usually not necessary since the mode of transmission is mainly via the vector does not involve human-to-human transmission.

5.5.3 Burial Procedures

Patients who die from YF can be buried using standard burial procedures as the body is not contagious.

5.5.4 Intervention for Local Transmission: Use of Yellow Fever Vaccine

The most effective measure to decrease the risk and spread of YF virus is vaccination. Vaccination of persons in areas with active ongoing YF virus transmission should be prioritised to help limit the magnitude of the outbreak.

The specific boundaries for the vaccination campaign should be determined by NCDC and NPHCDA in consultation with the affected state(s) and LGA(s). Once the specific boundaries are defined, the doses of vaccine that will be needed should be determined based on the target population of 9 months to 44 years multiplied by a wastage factor usually estimated to be 1.11 (See ICG request guidance on page 46).

All eligible persons irrespective of their vaccination status in the risk area who do not have a contraindication to vaccination should be vaccinated. People who routinely travel to the risk area (e.g., work in the area) and those who might be considered to be at higher risk for YF virus infection based on their profession (e.g., vector control personnel or healthcare personnel who are likely to provide service to persons in an active transmission area and miners) should be considered for vaccination as long as they do not have a contraindication to vaccination. The vaccine is contraindicated for infants aged less than 6

months. In addition, the YF vaccine should not be administered to the following:

- People with acute febrile diseases, whose general health status is compromised
- People with a history of hypersensitivity to chicken eggs and their derivatives
- Pregnant women, except in an epidemiological emergency and at the express recommendation of health authorities
- People with disease-related (for example, cancer, leukaemia, AIDS etc.) or drug-related immunosuppression
- People of any age with a disease involving the thymus[9]

5.5.5. Completing ICG Request for Reactive Campaign

The International Coordinating Group (ICG) comprises of UNICEF, MSF, IFRC and WHO. The ICG manages the YF vaccine stockpile of six million doses and approves deployment of vaccines to affected areas. Vaccine security stocks can be accessed by any country facing an epidemic anywhere in the world, as long as the country's request fulfils ICG's criteria for release of vaccine stocks. As a first step, a country must complete and submit a request to the ICG Secretariat using the standard application form.

The decision to release vaccine stocks is grounded in evidence-based criteria which includes; epidemiological evidence of an outbreak, entomological findings, laboratory confirmation of pathogen, history of previous outbreaks, RI coverage for 10 years and an accompanying operational plan of action for mass vaccination. A country must submit this information in full, in order for its request for emergency vaccine supplies to be accepted within 48 hours.

Once the request for vaccine supplies has been accepted, a process is put in place to ship the vaccines and supplies. Prior to shipment, the recipient country must demonstrate that there is enough cold chain capacity to receive and store the vaccines and supplies. The recipient

9 Pan American Health Organization (2005) Control of Yellow Fever: Field Guide. Washington, D.C.: PAHO *http://www.paho.org/immunization/toolkit/resources/paho-publication/field-guides/Control-of-Yellow-Fever.pdf?ua=1*

country must either ensure that funds are fully available for operational costs of the immunisation campaign or request for operational funds support. Additionally, customs and regulatory approvals must be granted and provided to the ICG prior to the shipment of the vaccines and supplies. More information can be obtained from the WHO website below on International Coordinating Group (ICG) on Vaccine Provision.[10]

10 International Coordinating Group (ICG) on Vaccine Provision *https://www.who.int/csr/disease/icg/qa/en/*

CHAPTER 6

Vaccines and Logistics

There is a safe and effective vaccine for YF and a single injection is all that is required for life-long protection.

6.1. Routine Immunisation

The routine immunisation programme is responsible for service delivery, cold chain and vaccines management, monitoring and evaluation and advocacy, communication and social mobilisation for effective implementation of the routine immunisation programme. The National Primary Health Care Development Agency (NPHCDA) is responsible for vaccination, supportive supervision and use vaccine coverage data for action.

The routine immunisation schedule has evolved over the years with the introduction of eight antigens (BCG, HBV, OPV, Penta, PCV, IPV, Measles and Yellow Fever). The YF vaccine was included in the schedule in 2004 and is given to children at 9 months of age. High population immunity is required to prevent YF epidemics.

6.2. Supplemental Immunisation Activities

Supplemental Immunisation Activities (SIAs) are immunisation strategies that are used to deliver vaccines including YF vaccine to individuals who have otherwise been missed by routine services. These SIAs could either be preventive or reactive and are used to rapidly "catch up" susceptible individuals on their immunisations in order for the population to achieve "herd" immunity" to break disease transmission. However, an optimal Routine Immunisation programme is critical to sustaining the gains made through SIAs.

6.2.1 Preventive Mass Vaccination Campaign (PMVC)

Preventive Mass Vaccination Campaigns (PMVCs) are the most efficient approach to rapidly increase population immunity in high risk areas and eliminate the risk of epidemics on a short-term basis. It is a key strategy for YF control which aims to interrupt local transmission of the YF virus. In Nigeria, PMVC targets individuals aged 9 months to 44 years (85% of total population). The strategy for implementation is by fixed and temporary fixed vaccine posts (temporarily selected for the

period) and lasts for a period of 10 days.
A successful mass vaccination campaign is hinged on the following areas:

- Early planning and effective coordination
- Advocacy, communication and social mobilisation activities
- Cold chain and logistics management
- Appropriate waste management
- Monitoring and evaluation (monitoring of adverse events following immunization, assessment of vaccine coverage, vaccine accountability etc.)
- Post vaccination coverage

6.2.2 Reactive Mass Vaccination Campaigns

Reactive Mass Vaccination Campaigns (RMVCs) are used after a case or outbreak of YF has been confirmed and other criteria met to rapidly increase population immunity and eliminate the risk of further transmission on a short-term basis. The response targets LGAs with confirmed case(s) and/or other LGAs contiguous to the LGA with the confirmed case(s).
All LGAs that conducted reactive vaccination are excluded from subsequent preventive campaigns. The optimal time for conduct of a reactive campaign is four weeks from the date of laboratory confirmation.
Reactive campaign targets individuals aged 9 months to 44 years (85% of total population). The strategy for implementation of the vaccination campaigns is fixed and temporary fixed posts and lasts for a recommended duration of 10 days.

6.3. At Risk Populations

6.3.1 Vulnerable Populations

Special efforts and plans are needed to identify and reach vulnerable populations and hard-to-reach communities (migrants, displaced persons, street children, nomads and their families etc.), as they represent potential sources of amplification and/or spread of YF if they are unprotected.

6.3.2 High Risk Workers

Workers such as those that work in the mining industry, construction workers and farmers in forest areas need to be identified and protected by vaccination.

6.4 Vaccine Supply

Currently, vaccine supply is prioritised to ensure there are doses for reactive vaccination campaigns, routine immunisation, and preventive campaigns. The preventive mass vaccination plan for the country should be flexible to evolving epidemiology that could change the original plan. In Nigeria, a 10-year preventive mass vaccination plan (2017– 2026) to protect at risk populations has been developed and has undergone several reviews following the occurrence of outbreaks.

6.5. Vaccine Immunogenicity

Following YF vaccine administration, primary vaccine recipients often develop a low-level viraemia with the vaccine virus. The viraemia usually occurs within 3–7 days following the YF vaccine administration and can last for 1–3 days, abating as IgM antibodies are developed. IgM antibodies that develop following YF vaccination can be detected for years afterward. Healthy persons rarely fail to develop neutralizing antibodies following YF vaccination; in controlled clinical trials, the primary failure rate is generally about 1%. Persons who fail to develop neutralising antibodies after their first vaccination can develop antibodies upon revaccination. Studies have demonstrated that 80%–100% of vaccinated persons develop neutralizing antibodies by 10 days after vaccination[11]. Studies also indicate that >99% of those vaccinated developed YF virus neutralizing antibodies by 28 days after vaccination. Overall, vaccine-induced antibodies take longer to develop and reach lower titres than those developed in response to natural YF virus infection.

In 2013, the WHO Strategic Advisory Group of Experts on Immunization (SAGE) concluded that a single primary dose of YF vaccine is sufficient to confer lifelong protection against YF disease and that a booster dose is not needed. This conclusion was based on a systematic review of published studies on the duration of immunity after a single dose of YF vaccine, and on data indicating vaccine failures are extremely rare and do not increase in frequency with time since vaccination.

11 Staples JE, Gershman M, Fischer M. 2010,Yellow fever vaccine: recommendations of the advisory committee on immunization practices (ACIP). MMWR Recomm Rep 2010; 59: 1–27: *https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5907a1.htm*

6.6 Dose and Administration of Yellow Fever Vaccine

YF vaccines are recommended to be given as a single dose (0.5 ml) injected subcutaneously (SC) and site of administration is the left upper arm. The YF vaccines are of 17D strain, live attenuated and confer lifelong immunity.

6.7 Fractional Dose of Yellow Fever Vaccine

Fractional dosing for YF vaccine is recommended only during outbreak situations when vaccine supplies are limited. The minimum recommended effective dose is one fifth of normal dose and it is estimated to confer at least eight years of protection. Children < 2 years, pregnant women and HIV infected individuals should still be vaccinated using the standard dose due to lack of evidence on immunogenicity and reactogenicity. It is not recommended for YF vaccination of travellers going to endemic countries.

6.8 Vaccine Safety and Adverse Reactions

Reactions to YF vaccine are generally mild; 10%–30% of recipients report mild systemic adverse events. Reported events typically include low-grade fever, headache, and myalgia that begin within days after vaccination and last 5–10 days. Approximately 1% of recipients temporarily curtail their regular activities because of these reactions. Symptoms that signify a serious AEFI include amongst others, an altered mental state, focal weakness, limb weakness, bleeding, dyspnoea.[12,13] ,

6.9 Yellow Fever Vaccine Coverage Assessment During Outbreak

A rapid yellow fever vaccination coverage (RVC) assessment for the affected community, LGA and surrounding LGAs should be carried out by the rapid response team during an outbreak. Yellow fever routine immunisation (RI) coverage for children between 1 – 10 years will be assessed to determine the yellow fever vaccination status in the area. Sighting of the RI cards will be evident of receiving RI vaccination.

For a State that has implemented the yellow fever preventive mass vaccination campaign

12 WHO 2008, Detection and Investigation of Serious Adverse Events Following Yellow Fever Vaccination. Guidance from an Informal Consultation of Experts. Geneva, Switzerland: WHO; *https://apps.who.int/iris/bitstream/handle/10665/70251/WHO_HSE_GAR_ERI_2010.2_eng.pdf?sequence=1*

13 World Health Organization. (2014). Global manual on surveillance of adverse events following immunization, 2016 update. World Health Organization. *https://apps.who.int/iris/handle/10665/206144*

(PMVC), the YF coverage assessment should be extended to adult less than 45 years as at the implementing year. Sighting of either RI card or YF supplemental immunisation activities (SIA) card for children between 1 – 10 years and SIA card for adult will be evidence of receiving YF vaccination. Also, provision of International Certificate of Vaccination or Prophylaxis (ICVP), otherwise called 'Yellow Card' for sighting will be evident of receiving YF vaccination.

CHAPTER 7

Technical Guidelines for Yellow Fever Response at Points of Entry

Points of Entry (PoE) play a major role in preventing the importation and exportation of infectious diseases. Port Health Services (PHS), the competent public health authority at PoE leads multi-sectoral stakeholders in prevention, detection and response to public health events at PoEs.

The following are considerations and guidelines for response to a national or regional yellow fever outbreak.

7.1 Exit/Entry Screening

Following the declaration of a yellow fever outbreak/activation of national EOC, routine screening of travellers – visual surveillance, temperature screening, checking for International Certificate of Vaccination or prophylaxis and risk assessment – are scaled up.

7.1.1 Primary Screening

a. *Visual surveillance* – Port Health Services at PoE actively look out for symptoms/signs of yellow fever as defined in the case definition (to include yellowness of the eyes, fever, vomiting, etc.), including screening of travellers for valid International Certificate of Vaccination or Prophylaxis (ICVP). Upon identification of a suspect/ill traveller and risk assessment carried out, PHS will contact the State Epidemiologist/State DSNO for the transfer of suspect/ill persons to designated referral facilities for further care and report through the Integrated Disease Surveillance and Response (IDSR) framework. Frontline agencies at the PoE are also trained by PHS to identify and report YF suspect travellers to PHS.

b. *Temperature screening* – temperature checks are carried out for all travellers, using walk-through thermal scanners and/or non-contact thermometers and further evaluation done for suspect/ill persons with temperature readings greater than 38°C.

c. *ICVP Screening* – All travellers entering the country will be required to provide proof of vaccination against YF in the form of a valid International Certificate of Vaccination and Prophylaxis (ICVP) before they are granted entry into the country. Intending travellers without proof of vaccination should be vaccinated and issued ICVP at the point of entry at least 10 days prior to their travel. Travellers, who present proof of vaccination in form of vaccination cards during YF mass reactive vaccination campaigns, should be issued ICVP.

7.1.2 Secondary Assessment/Screening

In the event of a traveller appearing obviously unwell/with temperature above 38 degrees Celsius, PHS shall carry out a risk assessment using a risk assessment form. Components of a risk assessment include biodata, medical history, vaccination history and travel history. This assessment is done by a medical or public health personnel. Results of the risk assessment will determine whether the suspect/ill person is transferred to a referral facility for further care or allowed to continue travelling.

It is recommended that clinicians or public health personnel conducting risk assessments at PoE operate with a high index of suspicion. In the event that an identified ill traveller is deemed, after further assessment, to be a suspect case, he/she/they will not be allowed to travel. Nigerian Immigration Services (in collaboration with other security agencies) will help to enforce **exit/entry** control decision made by PHS.

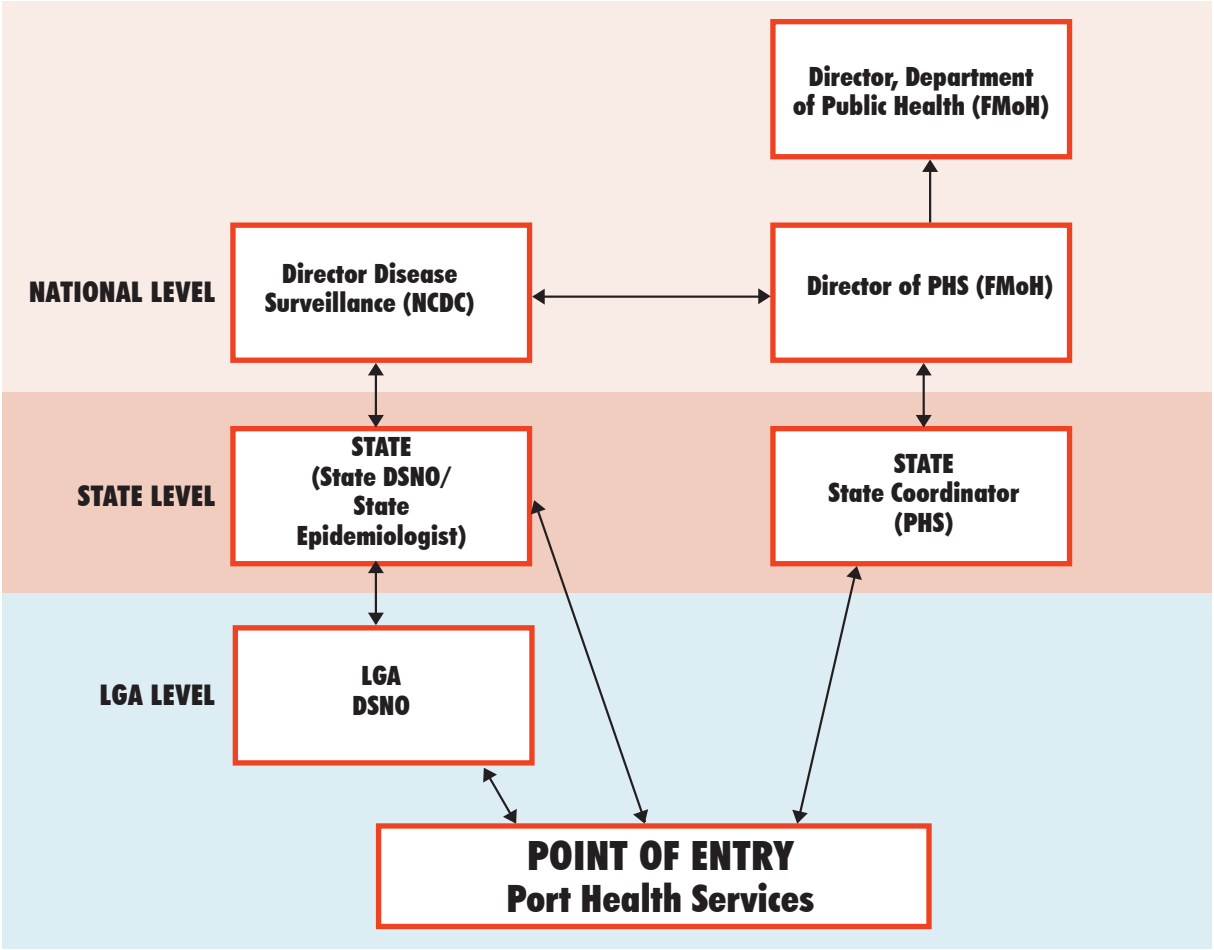


Figure 8: Port Health Services & Point of Entry Information Coordination/Reporting at Various Levels

7.2 Linking Cases to Travel Retrospectively

Where there are cases diagnosed after disembarkation away from the PoE and linked to recent international travel, the State Ministry of Health (SMoH), shall communicate this to PHS.

In order to identify such events, SMoH staff should be advised to include travel information in their reports since this will allow:

- The surveillance authority receiving the report to link the case with travel and consequently inform PHS, who may then implement the necessary health measures, obtaining necessary clinical information
- NCDC (and the National EOC response team) to identify all the travel-related cases

7.3 Communication at PoEs

PHS will lead the dissemination of public health information in the event of a yellow fever outbreak to PoE users and communities within a 400m radius of the PoE. PHS shall collaborate with the PoE management to disseminate the appropriate health messages via appropriate channels (e.g.; Public Address Systems, Banners, Seminars, Flight Information Display Systems, Flyers and Health Alert Notices etc.)

The appropriate public health messages for PoE and the nearby communities shall be developed in collaboration with NCDC including health education and promotion messages on Infection Prevention and Control and identification/ reporting of suspect/ill cases.

7.4 Hygiene and Sanitation/Vector Control

PHS officers are tasked with the responsibility of ensuring a sanitary PoE (a clean and safe environment for travellers). For YF response, PHS in collaboration with PoE management will scale up vector control measures to eliminate mosquito breeding sites and prevent other transmission risks. PHS will lead the staff at the PoE on routine surveillance of the PoE and within the 400m radius mark and will supervise supplementary fumigation/disinfection where necessary.

7.5 Point Of Entry Policy on the Prevention and Control of Cross Border Transmission of Yellow Fever

7.5.1 Objectives

The objectives of the National Point of Entry Policy on Prevention & Control of Cross Border Transmission of Yellow Fever:

- To prevent cross-border transmission of yellow fever
- To ensure protection of at-risk population of travelers entering Nigeria as part of the global strategy to Eliminate Yellow Fever Epidemics (EYE) by 2026

7.5.2 Guiding Principles

The resolutions of the 58th regular session of the National Council of Health (Nigeria's highest advisory and policy-making body on matters relating to health), in March 2016 reads thus:

"Screening of International Certificate of Vaccination and Prophylaxis (Yellow Card) for travelers arriving from countries at risk of yellow fever transmission be re-strengthened and a user fee of $50 or equivalent be charged to travelers without valid evidence of vaccination against Yellow fever. A certificate of vaccination against Yellow fever is valid for the life of the person vaccinated."

This policy reviews the National Council on Health (NCH) Resolution to provide for the implementation of additional measures at points of entry as a response to yellow fever outbreaks in several states in Nigeria as follows:

- Screening of International Certificate of Vaccination or Prophylaxis (Yellow Card) for all travelers arriving in Nigeria.
- Travelers arriving without proof of yellow fever vaccination will be vaccinated with the yellow fever vaccine and issued the yellow card once payment protocols are concluded.

The International Health Regulations (IHR 2005) require countries to

- Obtain vaccination certificates from travelers from areas determined by the World Health Organization (WHO) to be at risk of yellow fever transmission.
- Disinfect aircraft, ships and other modes of transportation coming from yellow fever risk countries.

7.5.3 Policy

- Consequently, the following measures are adopted at Nigeria's Points of Entry to control international transmission of Yellow Fever:
- As of July 1, 2019, all international travelers to and from Nigeria will be required to show proof of Yellow Fever vaccination (unless in possession of a valid waiver certificate, which is a Medical

Contraindication to Vaccination certificate). Proof of Yellow Fever vaccination is a valid International Certificate of Vaccination or Prophylaxis (also known as a Yellow Card) from all citizens and non-citizens over one year of age.

- The validity of the vaccination against Yellow Fever begins 10 days after vaccination and is for life
- The validity of the e-Yellow Card will be for the period of the validity of the holder's international passport.
- No traveler will be allowed into the country without a valid Yellow Fever vaccination certificate.
- Travelers who are unable to produce a valid Yellow Card at the Point of Entry will either be:
  - Refused entry into the country

  OR
  - Vaccinated upon arrival in the country and issued a certificate of vaccination against Yellow Fever
  - Pay a fine of $50 or the equivalent in Naira
  - Quarantined for a period of not more than six days or until their certificate becomes valid
  - Travelers with an exemption certificate due to medical reasons will be allowed entry but will be: required to report any fever or other symptoms to the health authorities or placed under surveillance.

(N.B. A valid yellow fever vaccination certificate is the International Certificate of Vaccine or Prophylaxis (Yellow Card) issued upon vaccination with a WHO-approved vaccine at least 10 days before traveling.)

- If the Yellow Fever vaccine is administered less than 10 days before departure, measures for refusal of entry, surveillance or quarantine may be applied.
- Where a traveler is suspected to have yellow fever, the appropriate protocols will be activated. The State Epidemiologist will be notified and the suspect case transferred to the designated facility in the State where the point of entry is located. The State Epidemiologist is expected to manage the case in collaboration with NCDC.

CHAPTER 8
Risk Communication

The main components in communicating public health risks are the message, the platform, the audience and feedback, which all form part of a risk communication strategy. Key messages targeted at specific audiences emphasise that the risk of YF virus infection can be reduced, through vaccination, personal protection against mosquito bites and vector control measures.

There is a national risk communication technical working group led by NCDC in collaboration with relevant stakeholders and partners who should liaise with the national yellow fever technical working group to implement the risk communication activities. Similarly, social mobilisation committees at subnational levels are to work with the relevant coordinating centre to implement the outlined activities.

The risk communications strategy must capture the following;

- Strategic objectives to address identified issues affecting prevention and control of yellow fever
- Situation analysis: this contains data on the community's knowledge and perception of the current risk.

Management and Delivery Strategies: this gives a description of specific mechanisms and required tools for implementing the risk communication strategy

Responses can be managed at the community level; therefore, mechanisms to coordinate with and strengthen capacities at the state and local government levels must be outlined in this strategy (leveraging on existing structures as need be). It should also contain pre, during and post outbreak risk communication activities.

At the national level, NCDC will coordinate communications activities through the National Risk Communication Technical Working Group in collaboration with stakeholders and partners (NPHCDA, Ports Health Service, NOA, FMOI, WHO, PHI etc.); whereas subnational activities will be coordinated by social mobilisation committees (SMC).

The EYE strategy outlines three central objectives for YF outbreak prevention and control which highlights the need for effective communications coordination across multi-agency and multi-level actors. The objectives are as follows:

8.1 To Protect At-risk Populations

The focus here is to increase vaccine coverage through public awareness and stakeholder engagement.

Pre-Outbreak Activities

- Develop a public health advisory for the general public on YF signs, symptoms and preventive measures to be published on various media channels such as – website, social media (WhatsApp, Twitter etc.), radio, television and prints
- Develop Information, Education and Communication (IEC) materials, such as fact sheets, frequently asked questions (FAQs), posters and jingles to ensure dissemination of accurate and uniform messages across all levels
- Develop advocacy kits for policy makers and administrators
- Promote positive behavioural practices for YF prevention through the following activities:
  - Advocacy to policy makers and key administrators to initiate measures to improve vaccine coverage
  - Dialogue with community leaders, influencers etc. to address factors responsible for low immunisation coverage
  - Convening town hall meetings with stakeholders; relevant MDAs, civil society and faith-based organisations (CSOs and FBOs), media and partners to align strategies to improve immunisation uptake.
- Institute vector control measures to reduce exposure to mosquitoes –
  - Conduct high level advocacy to relevant stakeholders and corresponding administrators to ensure alignment of vector control efforts at all levels.
  - Inform the public on evidence-based approaches to prevent exposure to mosquitoes (environmental sanitation etc.)
  - Stakeholders and administrators include; National Arbovirus and Vector Research Centre (entomologists), Ministry of Environment (Environmental Health Officers)

Messages regarding vector control measures should be developed in collaboration with vector control personnel (National Arbovirus and Vector Research Centre) and should emphasise specific measures that households must consider in optimising potential control measures.

8.2 Prevent International Spread

Key activities include:

- Identify and map appropriate platforms for information sharing with relevant travel and health authorities (e.g - PHS, SMoH)
- Utilise appropriate event-based surveillance systems to monitor local and international media stories related to YF
- Disseminate advisories on vaccination targeted at travellers through appropriate channels
- Develop capacity of communications personnel at potential information sources (e.g- borders, tourist sites)

8.3 Contain Outbreaks Rapidly

Outbreak Phase

During a YF outbreak, the communication plan is put into action; in particular communication coordination across stakeholders, key audiences and the media are intensified to reinforce preventive measures. Risk communications personnel are also required to be part of Rapid Response Teams deployed to support state level outbreak investigation and response activities.

8.3.1 Public Communication

Effective communication through mass and social media can help maintain clear understanding regarding the outbreak and the public health response. The media, public, health workers and relevant authorities should be educated about yellow fever, the mode of transmission, prevention, treatment and control measures, with emphasis on the availability of a safe and effective vaccine.

For effective engagement with the general public, the following activities should be considered:

- Design and implement a media engagement plan on YF
  - o Develop press releases at the national and subnational levels
  - o Organise media appearances with trained media spokes persons
- Collaborate with personnel at key information points; (e.g - points of entry and public facilities such as healthcare facilities, educational centres, workplaces etc) are intensified for the rapid dissemination of uniform advisories
- Air jingles on radio and television across all levels
- Utilise social media for awareness campaigns
- Disseminate IEC materials to key target groups health care workers, Community Informants, Patent Medicine Vendors, schools etc.)
- Create awareness on the available call centres for managing public enquiries

8.3.2 Healthcare Provider Communication

Mechanisms for rapid communication with health care providers should be established, such as health alert network notices, engagement via professional associations and engagement with community informants (patent medicine vendors, traditional healers and traditional birth attendants). Ideally, basic information, education and communication materials (IECs) and advocacy kits should be made available in advance of an outbreak.

8.4 Post Outbreak Phase

During the recovery phase, the main activities include guiding the general population on the sustainment of appropriate public health measures and informing the public when the risk of disease transmission has been reduced. Emphasis should be provided to inform the at-risk population on the need to sustain vector control measures through personal and environmental sanitation. An evaluation of the communication interventions at the end of the outbreak should be conducted to provide valuable insight for future response activities.

CHAPTER 9

Report Writing

9.1 Outbreak Report Writing

Report should be prepared during and after an outbreak of YF by the outbreak investigation team.

The purpose of the report is to document the phases of the outbreak investigation process. This report highlights how the outbreak was identified, investigated, public health interventions (response activities carried out, outcome, decisions taken), lessons learnt, best practices, challenges and recommendations made. Report should be made available timely to the relevant stakeholders in order to inform public health actions. Report of an outbreak comes in four stages which are:

9.1.1 Phase One: Preliminary Report (Initial Background Report)

This is the initial report written by the outbreak investigation team during the outbreak. It provides the situation analysis of the outbreak and it should be available within 24-48 hours to the next level of health authority (in accordance with IHR rules as adapted by NCDC). The following information is provided in the preliminary report:

- Source of information of the outbreak
- Brief initial descriptive epidemiology of the outbreak
- Initial response
- Number of cases
- Number of deaths
- Initial line list of cases
- Initial investigations conducted

9.1.2 Phase Two: Daily Situation Report (SitRep)

This is a daily situation and activity report of the outbreak. This should be shared with authorities at various levels and stakeholders. The information contained in the SitRep includes:

- Highlight of key response activities
- Epi summary e.g.:
  - Number of new cases on daily basis
  - Number of deaths
  - Attack rate and case fatality rate
  - Epicurve and map showing distribution of cases in area affected
- Public health actions taken on a daily basis
- Daily work-plan
- Challenges and recommendations

9.1.3 Phase Three: Debriefing Report

This is a meeting between the response team and the stakeholders at intermittent intervals based on the scale of the outbreak and information need of stakeholders. There should also be a final debriefing at the end of the outbreak investigation and response. It is an opportunity to pass information to the stakeholders about: the cause of the outbreak, how resources were mobilised, interventions, key findings, challenges and recommendations. It also provides the opportunity to communicate strengths and weaknesses during the outbreak investigation.

In addition to the daily situation report from the locality of response, NCDC should also develop and publish a national SitRep to be shared with relevant stakeholders, and a redacted version to be shared with the public.

9.1.4 Phase Four: Final Report

The final report is an important document that summaries the outbreak investigation. Reliable, complete information about outbreaks contributes

to understanding the trends and causal factors in disease incidence, and to detecting and evaluating new diseases and risks. The outbreak report of YF should contain the following components:

- Executive Summary (similar to an abstract)
- Introduction
- Background information
- Objective
- Methods
- Public health actions
- Results
- Discussion
- Conclusions
- Recommendations
- Acknowledgments
- References

The final outbreak report should also be used to justify resources that were expended and/or to identify a need for additional resources needed such as an International Coordinating Group (ICG) request for future incidents. The final report is a public document and may serve as evidence in legal proceedings. When the final report is completed and submitted, interim documents, working notes and other materials that are not specifically medical records can be discarded. Outbreak reports must be submitted to the Disease Surveillance Department of the Nigeria Centre for Disease Control by the affected State Ministry of Health within two weeks of the end of the outbreak.

Figure 9: Reporting Phases during Yellow Fever Outbreak

Annexes

Annex 1: World Health Organization Operational Framework to Guide Case Investigation and Outbreak Response for Yellow Fever

CASE CLASSIFICATION AND RECOMMENDED RESPONSE	INVESTIGATION AND RESPONSE
Suspected case – Implement surveillance protocol	• Notify health authorities- complete all details on notification form, including clinical information, vaccination status and travel history • Take blood specimen for laboratory confirmation • Treat Case(s) • If clustered cases- initiate epidemiological investigation • Consider other possible causes of fertile jaundice • Strengthen routine yellow fever immunization to improve coverage in target age groups
Probable case – issue a public health alert	*In addition to above; -* • Determine probable location of infection (local or district area) • Obtain convalescent specimen from patient(s) • Conduct active case-finding • Apply community case definition (fever and Jaundice) • Initiate epidemiological investigation • Determine vaccination coverage in the community • IF clustered cases – start planning for vaccination • Conduct public education to reduce risk • Activate the local epidemic-management committee
Confirm case – respond to outbreak according to local context	*In addition to all of the above; -* • Continue epidemiological investigation • Determine vaccination coverage in the affected area (coverage of routine Expanded programme on Immunization, recent outbreak responses, preventive campaigns) • Determine the extent and characteristics of unvaccinated populations in the area • Identify specific strategies to strengthen routine Immunization in areas where coverage is < 80% - consider catch-up strategies • Initiate entomological Investigation if indicated • Initiate vector control as informed by the results of the entomological assessment • Continue risk communication and management • Initiate social mobilization for selected response • Issue advice for travelers into the area • Notify WHO using *International Health Regulations (2005)*

Annex 2: Case Report Form for Yellow Fever Suspect

YELLOW FEVER CASE INVESTIGATION FORM

State:_____ LGA:_____ Community _____ Health Facilty_____

Name of Reporting Officer _____ Position _____ Tel:_____

<table>
<tr><td colspan="3">1. General Information about the Patient:</td><td>Date of Report:</td></tr>
<tr><td colspan="3">Patient's Name:_____
_____
Patient's Epid. Number:_____
Patient's Phone Number:_____
Caregiver's/Relation's Phone Number:_____</td><td>Sex: Male [ ] Female [ ]
Age _____
D.O.B.(DD-MM YYYY):_____

Occupation:_____
Educational Status:_____</td></tr>
<tr><td colspan="3">Residential Address:</td><td>Residential Settlement:</td></tr>
<tr><td>Res. Ward:</td><td>Res. LGA:</td><td>Res.State:</td><td rowspan="2">Name of Head of Patient's Household or Village Chief:</td></tr>
<tr><td colspan="3">GPS Latitude/Longitude: _____
____/_____</td></tr>
</table>

Annex 2: Case Report Form for Yellow Fever Suspect

2. Does Suspected Case have:				**Date of Onset**			**3. Record Travel and Yellow fever Vaccination History:**			
Fever (>38^{0}C or >101^{0}F) that did not respond to antimalarial treatment	Y	N	U	dd	mm	yy	List names of other villages, towns or LGAs that patient visited in the last 3 weeks:			
Jaundice	Y	N	U	dd	mm	yy				
Generalized body weakness/pains	Y	N	U	dd	mm	yy	Have cases of fever and jaundice been seen or reported in villages, towns or LGAs visited by the patient in the last 2 weeks before onset of symptoms?	Y	N	U
Bleeding from the nose, gums or skin or gastrointestinal tract	Y	N	U	dd	mm	yy	Has the patient ever received at least one dose of Yellow fever vaccine?	Y	N	U
Headache	Y	N	U	dd	mm	yy	Date or year patient last received vaccine: (dd)_____/ (mm)_____/ (yy)_____	Card seen	Verbal only	
Vomiting	Y	N	U	dd	mm	yy				
Others	Y	N	U	dd	mm	yy				

Annex 2: Case Report Form for Yellow Fever Suspect

<table>
<tr><th colspan="9">Laboratory Investigation and Final Classification of the Case</th></tr>
<tr><td colspan="9">Name and address of laboratory</td></tr>
<tr><td rowspan="2">Specimen(s) collected (tick one)</td><td rowspan="2">Date specimen(s) collected (dd/mm/yy)</td><td rowspan="2">Date received in the Laboratory (dd/mm/yy)</td><td rowspan="2">Type of Test</td><td colspan="4">Results</td><td rowspan="2">Date results sent to NCDC/MOH (dd/mm/yy)</td><td rowspan="2">Date results received at NCDC/MOH (dd/mm/yy)</td></tr>
<tr><td>Pos</td><td>Neg</td><td>Not processed</td><td>Unknown</td></tr>
<tr><td rowspan="2">Blood</td><td rowspan="2"></td><td rowspan="2"></td><td>IgM</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PCR</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="4">1. Specimens or isolate sent to another laboratory.
Yes [ ] No [ ] Unknown [ ]</td><td colspan="5">2. If YES, record laboratory's name, address and telephone number:</td></tr>
<tr><td colspan="9">3. What is the final classification of the case? (tick one):
Confirmed [ ] Not a Case [ ] Indeterminate [ ]</td></tr>
<tr><td colspan="4">4. If 'Not a Case', record diagnosis:</td><td colspan="5">5. What is the outcome for the patient? (tick one)
Alive [ ] Dead [ ] Unknown [ ]</td></tr>
<tr><td colspan="4">Signature:</td><td colspan="3">Date of Submission:</td><td colspan="2">Tel:</td></tr>
<tr><td colspan="3">Endorsed by:</td><td>Position:</td><td colspan="3">Signature:</td><td colspan="2">Date:</td></tr>
</table>

Annex 3: Yellow Fever Case Management Form

I. Case Identification/ Demographic Details

Patient Name:	Hospital Name:	Local government area (LGA):
EPI ID:		
☐Male ☐Female	Patient occupation ☐ Healthcare worker: _____ (please specify) ☐ Non-Healthcare worker: _____ (please specify)	
Date of birth (dd/ mm/ yyyy) ____ /____/___	If date of birth unavailable, please indicate age in month or years (*mark an X by one*): Age: _____ ☐ Years ☐ Months	
Date of admission: (dd/mm/yyyy) ___ /__ /___	Was the patient transferred from another facility? ☐ Yes ☐ No ☐ Unknown. If yes, name of facility _____	
YF Vaccination History ☐ Yes ☐ No ☐ Unknown. If yes, Date of vaccination: (dd/mm/yyyy) ___ /__ /___ Card seen ----- Yes /No	Travel History:	
Working diagnosis _____ _____		

Annex 3: Yellow Fever Case Management Form

II. Vitals at Triage

Heart rate (bpm):	Respiratory Rate (brpm):	Temperature(°C):
BP (mmHg): _____ (systolic) _____ (diastolic)		Mental status: GCS_____
	Weight (kg): _____ Self-reported height (cm): _____	Mid-upper arm circumference (MUAC) (cm) _____

III. Clinical Details (On Admission)

Date onset first symptoms(dd/mm/yyyy): ____/___/___	If female patient, is she pregnant? ☐ Yes ☐ No ☐ND
Post-partum (up to 6 weeks)? ☐ Yes ☐ No If yes, delivery date(dd/mm/yyyy): ____ /____/_____	
	Admitted to what type of bed? ☐ Ward ☐ ICU

Symptoms (on presentation) **Fever** ☐ Yes ☐ No ☐ Unknown **Weakness** ☐ Yes ☐ No ☐ Unknown **Malaise** ☐ Yes ☐ No ☐ Unknown **Myalgia** ☐ Yes ☐ No ☐ Unknown **Joint Pain** ☐ Yes ☐ No ☐ Unknown **Anorexia (i.e. loss of appetite)** ☐ Yes ☐ No ☐ Unknown **Yellowness of the Eyes/skin** ☐ Yes ☐ No ☐Unknown **Dark urine** ☐ Yes ☐No ☐ Unknown	**Sore throat** ☐ Yes ☐ No ☐ Unknown **Headache** ☐ Yes ☐ No ☐ Unknown **Chest pain** ☐ Yes ☐ No ☐ Unknown **Cough** ☐ Yes ☐ No ☐ Unknown **If cough, productive of sputum?** ☐ Yes ☐ No ☐ Unknown **Diarrhoea** ☐ Yes ☐ No ☐ Unknown	**Nausea** ☐ Yes ☐ No ☐ Unknown **Vomiting** ☐ Yes ☐ No ☐Unknown **Irritability/ Confsion** ☐ Yes ☐ No ☐ Unknown **Abdominal pain** ☐ Yes ☐No ☐ Unknown

Annex 3: Yellow Fever Case Management Form

III. Clinical Details (On Admission)

Signs (on presentation)	
Jaundice ☐ Yes ☐No ☐ Unknown **Pharyngeal erythema** ☐ Yes ☐No ☐ Unknown **Pharyngeal exudate** ☐ Yes ☐No ☐ Unknown **Conjunctival injection/bleeding** ☐ Yes ☐No ☐ Unknown **Oedema of face/neck** ☐ Yes ☐No ☐ Unknown **Tender abdomen** ☐ Yes ☐No ☐ Unknown **Sunken eyes or fontanelle** ☐ Yes ☐No ☐ Unknown **Tenting on skin pinch** ☐ Yes ☐No ☐ Unknown **Palpable liver** ☐ Yes ☐No ☐ Unknown **Palpable spleen** ☐ Yes ☐No ☐ Unknown **Rash** ☐ Yes ☐No ☐ Unknown	**Enlarged lymph nodes** ☐ Yes ☐No ☐Unknown *If yes,* distribution_____ **Lower extremity oedema** ☐ Yes ☐ No ☐Unknown **Bleeding** ☐ Yes ☐No ☐Unknown *If yes,* site of bleeding: **Nose** ☐ Yes ☐ No **Mouth** ☐ Yes ☐ No **Vagina** ☐ Yes ☐ No **Rectum** ☐ Yes ☐ No **Sputum** ☐ Yes ☐ No **Urine** ☐ Yes ☐ No Other, specify _____

Comorbid conditions	
Tuberculosis ☐ Yes ☐ No ☐U nknown **Asplenia** ☐ Yes ☐ No ☐ Unknown **Hepatitis** ☐ Yes ☐ No ☐ Unknown **Diabetes** ☐ Yes ☐ No ☐ Unknown **HIV** ☐ Yes ☐ No ☐ Unknown *If yes,* on ART? ☐ Yes ☐ No ☐ Unknown **Chronic liver disease** ☐ Yes ☐ No ☐ Unknown	**Malignancy/Chemotherapy** ☐ Yes ☐ No ☐ Unknown **Chronic heart failure including congenital disease** ☐ Yes ☐ No ☐ Unknown **Chronic pulmonary disease** ☐ Yes ☐ No ☐ Unknown **Chronic kidney disease** ☐ Yes ☐ No ☐ Unknown **Chronic neurologic condition** ☐ Yes ☐ No ☐ Unknown Other, specify _____

Annex 3: Yellow Fever Case Management Form

IV. Specimen Collection and Results

Specimen collection done? ☐ Yes ☐ No. If yes, what samples? ☐ Blood ☐ Urine ☐ Buccal swab Other_____Date

Yellow fever testing	**Collection date** (dd/mm/yyyy)	**Result/date**
Yellow fever PCR (admission)	_____/_____/_____ _____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
Yellow fever IgM serology	_____/_____/_____ _____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
Serology test (ELISA)	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
PRNT	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
YF Differentials	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
Other YF test	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate. Cycle time_____
Malaria RDT	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate
Blood culture	_____/_____/_____	☐ Pos ☐ Neg ☐ indeterminate

Annex 3: Yellow Fever Case Management Form

IV. Specimen Collection and Results

Did patient test positive for any other infection?

☐ Yes ☐ No If Yes, specify_____

Other clinical laboratory tests done on admission (ND = not done)

Heamatological profile

FBC with differentials

Haemoglobin (g/L) _____ Total white cell count (10^9cells/L) _____

Neutropils (%) _____ Lymphocytes (%) _____

Moncytes (%) _____ Eosinophils (%)_____

Basophils (%) _____ Platelet count (10^9cells/L) _____

Red cell count (10^{12} cells/L) _____ Haematocrit (%) _____

Mean Cell Volume (fL) _____ Mean Cell Haemoglobin (pg) _____

Reticulocyte Count (%) _____

Haemoglobinuria ☐ Pos ☐ Neg ☐ ND

Proteinuria ☐ Pos ☐ Neg ☐ ND Hematuria ☐ Pos ☐ Neg☐ ND

Laboratory tests from admission or HD 1. (ND = not done). If repeat test done, then add yes or now.

HD1	**Admission**	Repeated		HD1	Repeated
ALT/SGPT (U/L)	☐ ND _____	☐ Yes ☐ No	Haemo-globin (g/L)	☐ ND _____	☐ Yes ☐ No
AST/SGOT (U/L)	☐ ND _____	☐ Yes ☐ No	Total bilirubin (umol/L)	☐ ND _____	☐ Yes ☐ No
Creatinine (umol/L)	☐ ND _____	☐ Yes ☐ No	Total bilirubin (umol/L)	☐ ND _____	☐ Yes ☐ No

Annex 3: Yellow Fever Case Management Form

IV. Specimen Collection and Results

Potassium (mmol/L)	☐ ND _____	☐ Yes ☐ No	WBC count (x10^9/L)	☐ ND _____	☐ Yes ☐ No
Urea (mmol/L)	☐ ND _____	☐ Yes ☐ No	Platelets (x 10^9/L)	☐ ND _____	☐ Yes ☐ No
Creatinine kinase (U/L)	☐ ND _____	☐ Yes ☐ No	PT	☐ ND _____	☐ Yes ☐ No
Calcium (mmol/L)	☐ ND _____	☐ Yes ☐ No	aPTT (seconds)	☐ ND _____	☐ Yes ☐ No
Lactate (mmol/L)	☐ ND _____	☐ Yes ☐ NO	Lactate (mmol/L)	☐ ND _____	☐ Yes ☐ NO
Clotting profile					
Radiological investigations					

Annex 3: Yellow Fever Case Management Form

V. Complications at Any Time (OD= onset date, format dd/mm/yyyy)

Bleeding ☐ Yes ☐ No ☐ Unknown OD___/____/_____	**Coma** (GCS < 8) ☐ Yes ☐ No ☐ Unknown OD ___/___ /__
Shock ☐ Yes ☐ No ☐ Unknown OD___/____/_____	**Bacteraemia** ☐ Yes ☐ No ☐ Unknown OD___/___/___
Meningitis* ☐ Yes ☐ No ☐ Unknown OD___/____/_____	**Hyperglycemia** ☐ Yes ☐ No ☐ Unknown OD ___/___ /___
Confusion ☐ Yes ☐ No ☐ Unknown OD___/____/_____	**Hypoglycemia** ☐ Yes ☐ No ☐ Unknown OD ___/___ /___
Seizure ☐ Yes ☐ No ☐ Unknown OD___/____/____	Other, specify _____ OD___/___/____
Kidney failure ☐ Yes ☐ No ☐ Unknown OD___/____/_____	
Liver failure ☐ Yes ☐ No ☐ Unknown OD___/____/_____	

**meningitis defined either clinically or with lumbar puncture*

Annex 3: Yellow Fever Case Management Form

VI. Treatment Information:

(please include loading dose, maintenance and switch to oral therapy)

Did patient receive ANY antimicrobial? ☐ Yes ☐ No

Type	**Dose**	**Route**	**Frequency**	**Start date (dd/mm/yyyy)**	**End date (dd/mm/yyyy)**
Antibacterial, specify_____		☐ **IV** ☐ **Oral**			
Antimalarial, spciefy_____		☐ **IV** ☐ **Oral**			
Others, specify _____		☐ **IV** ☐ **Oral**			

At any time during the hospitalization, did the patient receive any of the following?

Oral rehydration salts ☐ Yes ☐ No	IV fluid therapy ☐ Yes ☐ No	Access type: ☐ Intra-osseous ☐ PIV ☐ CVC
Blood transfusion. ☐ Yes ☐ No	Oxygen therapy ☐ Yes ☐ No	Invasive mechanical ventilation ☐ Yes ☐ No
Renal replacement therapy ☐ Yes ☐ No	Vasopressors/inotropes. ☐ Yes ☐ No	

Annex 3: Yellow Fever Case Management Form

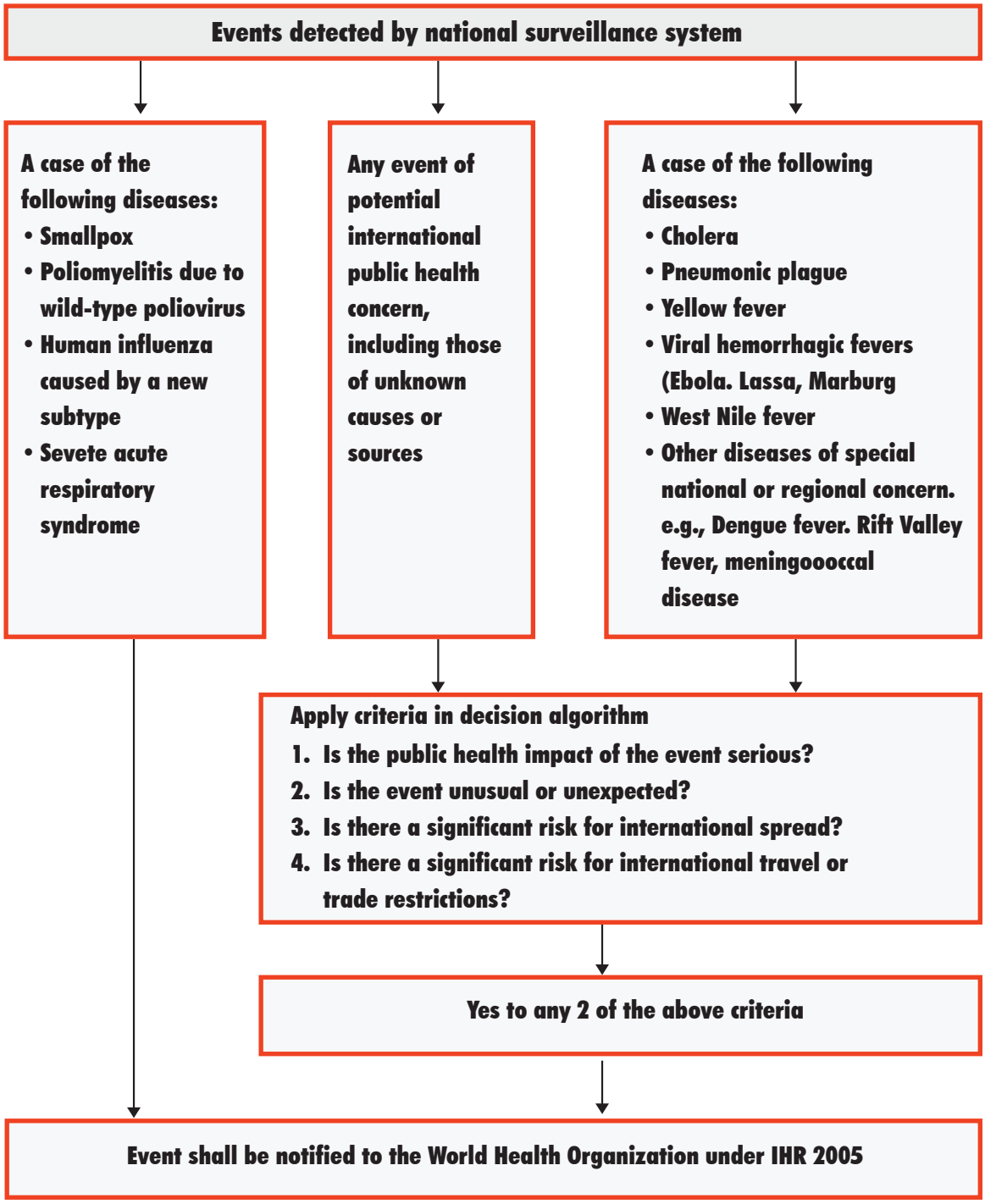
VII. Discharge Details

Date of Discharge/transfer from health facility/death	____ /_____/_____ **(dd/mm/yyyy)**
Final Diagnosis: □ Yellow fever □ Other (specify) Outcome at discharge □ Full recovery without sequelae at time of discharge □ Full recovery with sequelae If yes, □ hearing loss □ if pregnant, spontaneous abortion □ Other: _____ □ Patient died □ Referred to another facility. If yes, which facility: _____ □ Left against medical advice	

Form completed by: _____

*Date of Completion*_____

Annex 4: International Health Regulations (IHR) 2005 Decision Instrument (Simplified from Annex 2 of IHR)



Annex 5: Line Listing Form

s/n	QUESTIONS/VARIABLES	ANSWERS
1	Epid Number	
2	State	
3	LGA	
4	Ward	
5	Settlement	
6	Surname	
7	First Name	
8	Date of Birth	
9	AgeInYears	
10	Age Group	
11	Sex	
12	Date of Onset	
13	Year	
14	Month	
15	Week	
16	Case Detected Where? (Community/Health Facility)	
17	Case Seen at Health Facility (Yes/No)	
18	Name of Treatment Facility	
19	Date Seen at Health Facility	
20	Fever	
21	Jaundice	
22	Other symptoms (List all other symptoms presented)	
23	Received YF Vaccine (Yes/No)	
24	Vaccine Card Seen (Yes/No)	

Annex 5: Line Listing Form

s/n	QUESTIONS/VARIABLES	ANSWERS
25	Last date YF Vaccination	
26	Year of last YF Vaccination (Verbal report only)	
27	Number of YF Vaccine received	
28	Sample Taken (Yes/No)	
29	Date Lab Specimen Collected	
30	Date Blood sample sent to the Lab	
31	Date Lab received the sample	
32	Name of Lab in Nigeria	
33	Condition of specimen (Adequate/ Inadequate)	
34	Nigerian lab YF IgM	
35	Nigerian lab RT-PCR results	
36	Nigerian Lab results date	
37	Date sent to IP-Dakar	
38	Date received at IP-Dakar	
39	Condition of specimen received at IP-Dakar	
40	RT-PCR results (IP-Dakar)	
41	HEV	
42	IgM results (IP-Dakar)	
43	PRNT results (IP-Dakar)	
44	Result date (IP-Dakar)	
45	Final Classification	
46	Inpatient (Yes/No)	
47	Outcome (Alive/Dead)	
48	Remarks	

Annex 6: Checklist for Yellow Fever Verbal Autopsy

YELLOW FEVER VERBAL AUTOPSY CHECKLIST

Name of settlement: ..... Ward:.....

LGA: .....

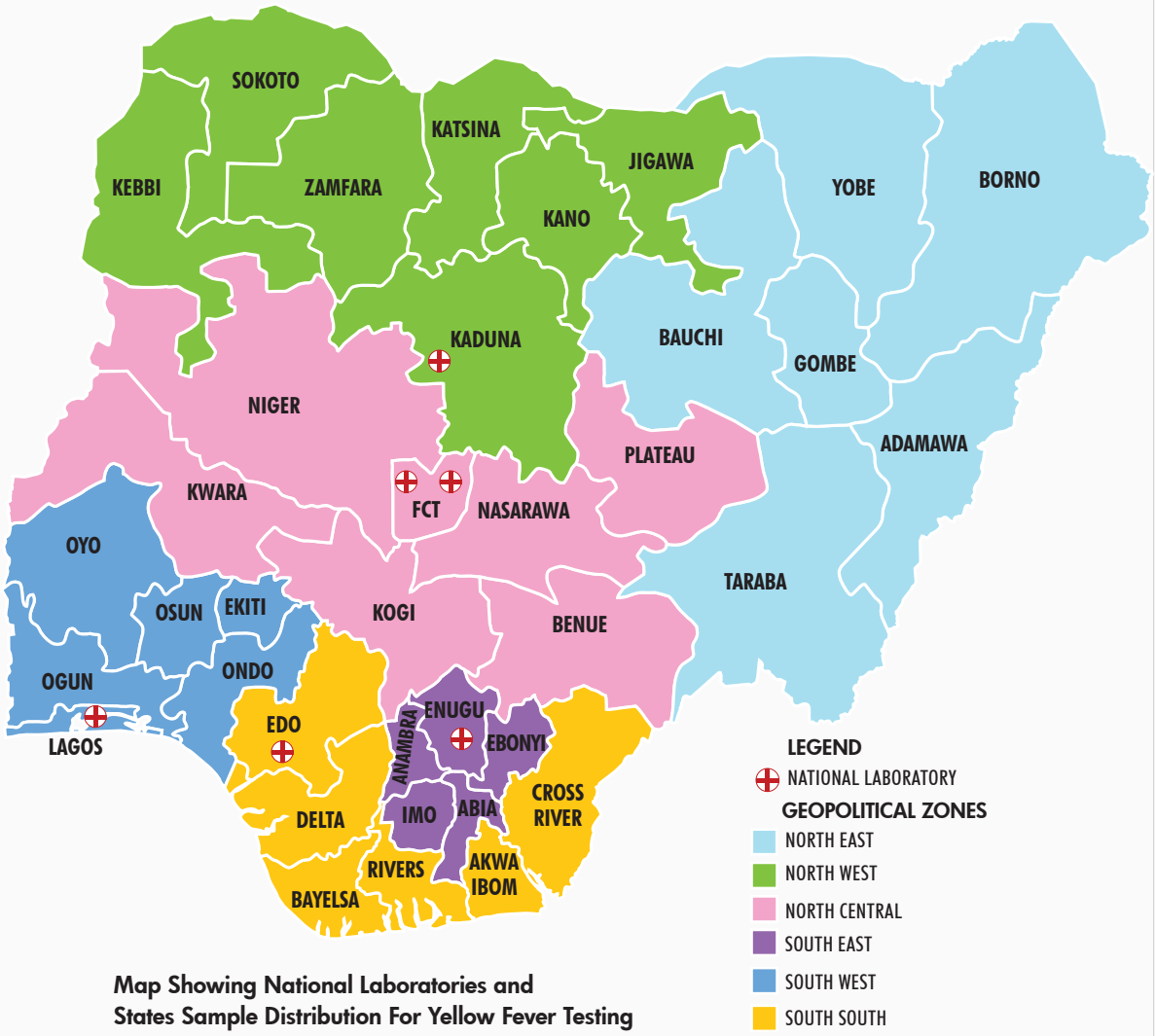
Informant: .....

Relationship to Case/Suspect: .....

Case/Suspect

1. Name: .....
2. Sex: Male [ ] Female [ ]
3. Age in years: .....
4. Marital Status: Single [ ] Married [ ] Widow/Widower [ ] Separated [ ] Divorced [ ]
5. Educational Level: No formal education [ ] Primary [ ] Secondary [ ] Tertiary [ ] Postgraduate [ ] Others (Specify)_____
6. Occupation: .....
7. Symptoms: Fever [ ] Jaundice [ ] Headache [ ] Catarrh [ ] Cough [ ] Vomiting [ ] Diarrhea [ ] Bleeding from orifices [ ] Others (Pls specify)..... .....
8. Date of onset of symptoms: .....
9. Treatment received (tick as many as applies): Self medication [ ] Herbs [ ] Hospital [ ] Others (Please specify) .....
10. Date of death: .....
11. Place of death: Hospital [ ] Home [ ] Traditional healer's house [ ] Others (pls specify) ....
12. Vaccination status before death: Yes [ ] No [ ] Don't Know [ ]
13. Any use of traditional medicine: Yes [ ] No [ ] Don't Know [ ]
14. Any history of chronic illness: Hypertensive [ ] Diabetic [ ] Cancer [ ] Others (Please specify) .....
15. Any history of travel in the last 14 days prior to onset of illness: Yes [ ] No [ ] Don't know [ ]
16. If yes to question 15, where did he/she traveled to: .....

Annex 7: List of Yellow Fever Testing Laboratories in Nigeria with the States Covered



Map Showing National Laboratories and States Sample Distribution For Yellow Fever Testing

NCDC NATIONAL REFERENCE LABORATORY, ABUJA	MAITAMA DISTRICT HOSPITAL, ABUJA	YUSUF DANSOHO MEMORIAL HOSPITAL LABORATORY, KADUNA	UNIVERSITY OF NIGERIA TEACHING HOSPITAL, ITUKU OZALLA	UNIVERSITY OF BENIN TEACHING HOSPITAL, BENIN-CITY	CENTRAL PUBLIC HEALTH LABORATORY YABA, LAGOS
Borno	Niger	Jigawa	Abia	Akwa Ibom	Ekiti
Yobe	Plateau	Kaduna	Anambra	Cross River	Lagos
Adamawa	Benue	Kano	Ebonyi	Bayelsa	Ogun
Gombe	Kogi	Katsina	Enugu	Rivers	Ondo
Taraba	Kwara	Kebbi	Imo	Delta	Osun
Bauchi	Nasarawa	Sokoto		Edo	Oyo
	FCT	Zamfara			

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7. WHO 2016 Yellow Fever Knowledge Pack *https://www.who.int/immunization/documents/who_pp_yf_fractional_dose_june2017_references.pdf?ua=1*
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20.	Udoka Nwangwu	NARVAC
21.	Joy Mariam Eke	NPHCDA
22.	Cynthia Okedo	NCDC
23.	Dr. Sandra Mba	NCDC
24.	Makava Favour	UMB
25.	Akeem Alaka	NCDC
26.	Dr. Odianosen Ehiakhamen	NCDC
27.	Aiyegbusi Oluwatetisimi	NCDC
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Yellow Fever Guideline Review/ Post SIMEX Meeting

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24.	Mrs. Dawodu Roseline	LSMoH
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28.	Dr. Owsaye V	LSMoH
29.	Dr. Sedjna Catraye	WAHO
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39.	Dr. Bamidele Matiu	LASUTH, LSMoH
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42.	Dr. O.A Kola Kardo	LASMBUS, LSMoH
43.	Babarere Ololade	LSMoH
44.	Bankole M.A	LSMoH
45.	Dr. Okunromade Oyeladun	NCDC
46.	Abdulrahim Abdullateef	Measles/YF Lab NCDC Lagos
47.	Dr. W.T.Haggai	NCAA/Aviation
48.	Nanpring D. Williams	NCDC
49.	Dr. M.O Alex-Okoh	FMoH, Port Health Services
50.	Dr. Obani H.K.	LSMoH
51.	Oladipupo Christianah	LSMoH
52.	Dr.Oladipo Ogunbode	NCDC
53	Dr. Theresa Madubuko	NCDC

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NATIONAL GUIDELINES FOR YELLOW FEVER PREPAREDNESS AND RESPONSE

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