

# Operational plan for the prevention and control of Chikungunya, Dengue and Zika in the Republic of Mauritius

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## 1. INTRODUCTION

Chikungunya, Dengue and Zika are important viral diseases that are transmitted by day-biting mosquitoes. The principal vectors during outbreaks are the mosquitoes of the genus *Aedes*. In Mauritius; it is *Aedes albopictus* which is the local vector.

Chikungunya was first described in Tanzania in 1952, whilst Dengue Fever and Dengue Haemorrhagic Fever (DF/DHF) were first recognized in the 1950s, during the dengue epidemics in Philippines and Thailand.

Chikungunya usually produces a transient illness often, clinically, confused with dengue. Symptoms include fever, headache, polyarthralgia, myalgia and rash. Although serious complications are uncommon, the arthralgia is incapacitating and may persist for months. It is a self-limiting disease found in tropical and sub-tropical regions around the world, predominantly in urban and semi-urban areas.

Dengue usually causes two main types of clinical disease, namely dengue fever and dengue haemorrhagic fever. Dengue fever is usually associated with symptoms such as sudden onset of fever, headache, retro orbital pain, severe myalgia, arthralgia and in many cases body rashes may also appear.

Dengue haemorrhagic fever is associated, in addition to above, with bleeding manifestations. This condition may, in some cases, progress to a dangerous condition known as dengue shock syndrome. The latter is associated with a high mortality rate.

Zika virus infection is commonly not symptomatic. However when symptomatic, typical symptoms occur which include rash, mild fever, non-purulent conjunctivitis, arthralgia and myalgia. Two possible complications of this disease include Guillain Barre Syndrome and Microcephaly.

### ***1.1 Causative agents***

Chikungunya fever is caused by Chikungunya virus which is member of Alpha virus. There is one serotype of chikungunya so far. Immunity to infection is believed to be lifelong.

DF/DHF is caused by dengue virus which belongs to genus Flavivirus family Flaviviridae and includes serotypes 1, 2, 3 and 4 (Den-1, Den-2, Den-3 and Den-4). When a person has had classic dengue (i.e. infection by one serotype), a second infection later by another serotype increases the likelihood of suffering from DHF.

Zika Virus Disease is caused by a virus belonging to genus Flavivirus belonging to the same family as Dengue.

### ***1.2 Vulnerability of Mauritius to Chikungunya, Dengue Fever and Zika Virus Disease***

A preparedness plan for the prevention of control of chikungunya , dengue and zika is critical for Mauritius because the island is vulnerable to outbreaks of Chikungunya ,Dengue fever and Zika for the following reasons:

1. The mosquito vectors *Aedes albopictus* for transmission of the three viruses are present in Mauritius
2. Mauritius has suffered from epidemics of Chikungunya in 2006 and Dengue fever in 2009
3. Once introduced in a country dengue is very difficult to eradicate and tend to recur periodically
4. Chikungunya epidemic tend to recur in a population, if the percentage of infected population is less than 70%
5. Mauritius has extensive travel and trade links to Dengue and Chikungunya and Zika endemic zones
6. Shipment of tyres containing infected larva has been established as a source in many countries
7. There are many high risk environmental pockets in the island favouring spread of imported viruses of the diseases in the local mosquito population

### ***1.3 Goal and Objectives of the Preparedness Plan***

The main goal of the preparedness plan is to reduce morbidity and mortality from Chikungunya, Dengue and Zika. Consequently, the focus during epidemic phase is containment and mitigation while during the quiescent interepidemic phase is early warning by surveillance and control. Hence the surveillance objectives will accordingly be different in each phase. The main goals are to:

1. Provide a step-step approach to the management of the epidemics by all stakeholders
2. Provide a step-by-step approach to forecasting an epidemic
3. Provide a step-by-step approach to the quelling of an epidemic at the onset.

### ***1.4 The target users of the preparedness plan***

This document is intended to all those involved in planning and in responding to the threat that represent dengue, chikungunya and zika and include: 1) policy and decision makers, 2) Hospital Administrators, 3) Regional Health Directors, 4) Regional Public Health Superintendents, 5) Public Health Inspectors, 6) Surveillance Officers and 7) Other Stakeholders.

## **2. EPIDEMIOLOGY OF CHIKUNGUNYA, DENGUE AND ZIKA**

The global prevalence of dengue has grown significantly in recent decades. The disease is now endemic in more than 100 countries in South-east Asia, Western Pacific, Eastern Mediterranean, Africa and the America. South-east Asia and Western Pacific are most seriously affected. Once introduced in a country, dengue fever has a tendency to cause regular epidemics. A period with no epidemic is known as the interepidemic period. Before 1970 only nine countries had experienced DHF epidemic, a number that had increased more than four-fold by 1995. Recently dengue epidemics have been reported from Australia, New Caledonia, Malaysia, Puerto Rico, Reunion and Seychelles. Some 3900



million people are now at risk from dengue. WHO currently estimates that there may be 390 million cases of dengue infection worldwide every year with 90 million cases presenting with clinical symptoms.

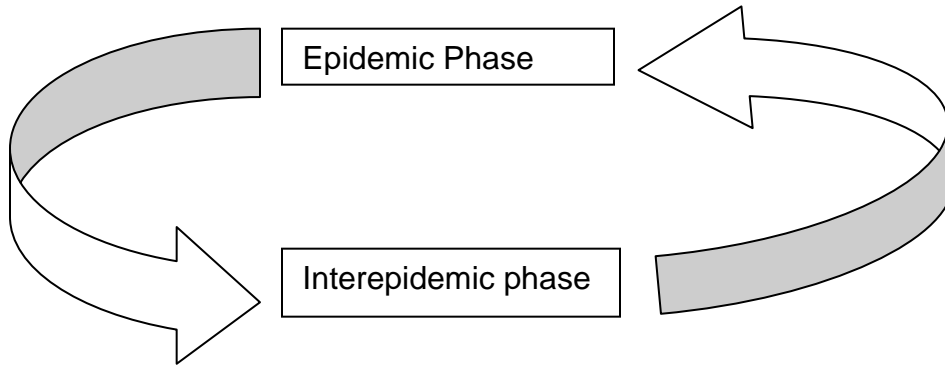
Chikungunya epidemics have been reported in both Asia and Africa for a long time. In 2006, an epidemic of chikungunya swept across the Indian Ocean islands of Comoros, Reunion, Mauritius and Seychelles. Subsequent outbreaks, in 2007, affected India and other Asian countries.

The Zika virus caused major outbreaks in French Polynesia in 2013 and has spread around the world to Latin America and the Caribbean islands, prompting WHO to summon an advisory committee on IHR and declaring Zika pandemic as a Public Health Emergency of International Concern (PHEIC). On 18<sup>th</sup> November 2016 the PHEIC status was lifted.

For Chikungunya Dengue and Zika, the epidemiology of the disease may be divided into two marked phases as shown in Figure 1 below. The viruses cause overt outbreaks during the *epidemic phase*. Following the epidemic phase, the viruses go into a quiescent phase also referred to the *interepidemic phase* from where it erupts back into the epidemic phase depending on various environmental factors. The environmental factors triggering the viruses from the one phase to another poorly understood but includes temperature, rainfall, vector population and the number of immune subjects in the population commonly referred to as herd immunity.

Figure 1: Cyclic nature of CHIK, DEN and ZIKA epidemics:

The control Strategy is different for the epidemic and the interepidemic phase



### **3. CONTROL STRATEGY OF CHIKUNGUNYA, DENGUE AND ZIKA**

The control strategy for chikungunya, dengue and zika depend on whether one is in the epidemic or the interepidemic phase. The activities for interepidemic period primarily focus on the control of the larval population of the vector since there are no infected adult mosquitoes. During the epidemic phase the focus is on the control of both larval and adult mosquito population since the adult mosquitoes are infective. It is to be noted that, in the case of dengue, the virus can be transmitted to the eggs of the mosquito transovarially.

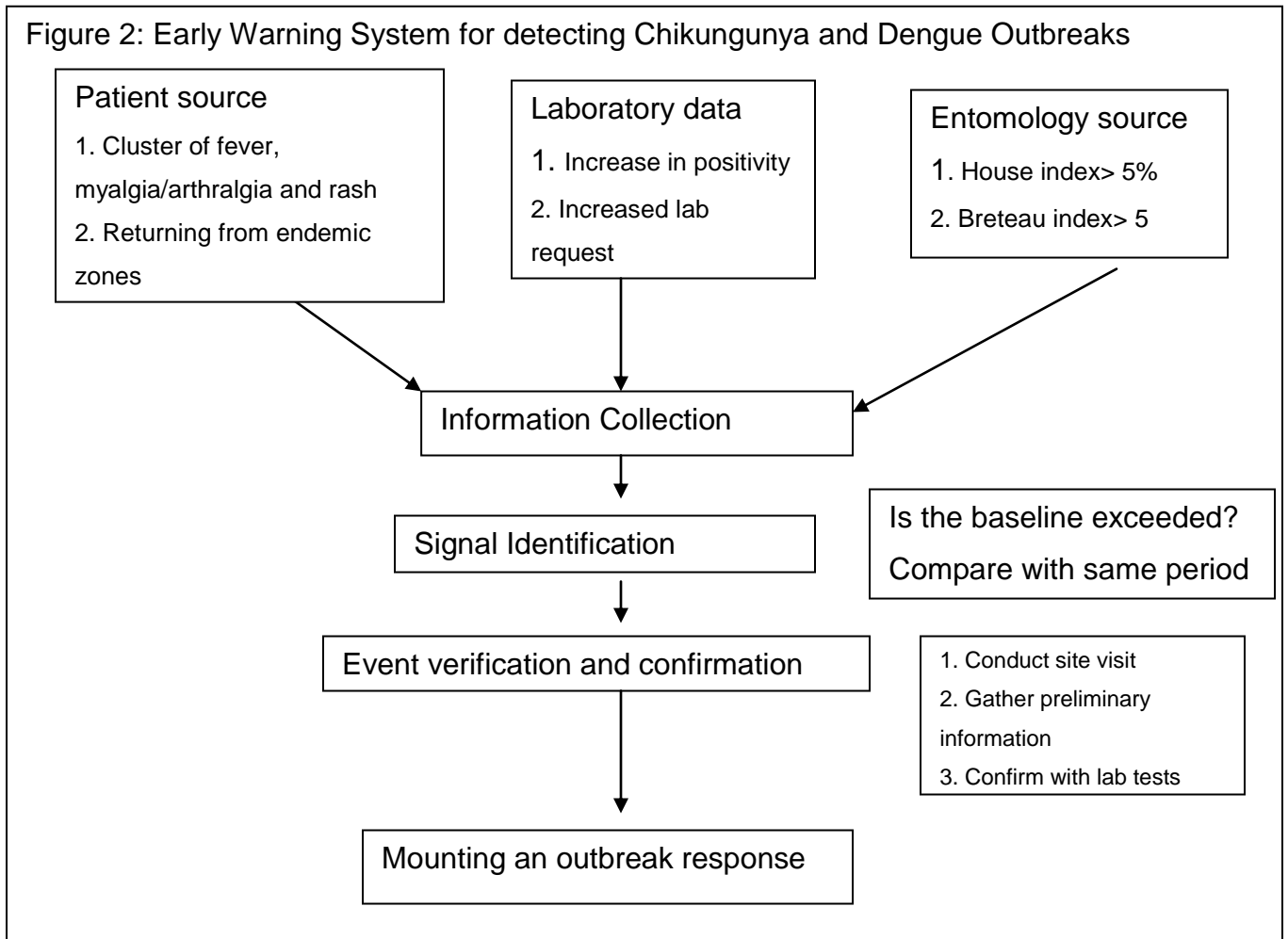
#### ***3.1 Triggers of outbreak investigation and control***

Forecasting and recognizing an outbreak at the outset is important for reducing the full impacts of the outbreak. As shown in Figure 2, an early warning system (EWARS) must be used to detect triggers of an outbreak. The CDCU shall use the following trigger criteria for outbreak investigation and control:

1. Patient source data of the occurrence of more than one suspected case of Dengue , Chikungunya or Zika in a locality

2. Entomology data from the vector biology control unit consisting of house index and Breteau Index (BI) of greater than 5 in any locality. The BI is determined as per annexes 15-16.
3. Laboratory data showing increased laboratory request or positivity rate

Flow chart 1 depicts the decision point for switching from interepidemic to epidemic periods. The set of activities are described below:



#### **4. OPERATIONAL PROCEDURE FOR MANAGING OUTBREAKS**

The main goals during an outbreak are to manage the patients to reduce morbidity and mortality by prompt and efficient management of the cases. In addition one must also promptly quell the outbreak and protect the community at large. A set of tasks outlined in the ensuing sections are aimed at achieving these goals.

##### ***4.1 Objectives during outbreaks***

The objectives during outbreaks are:

1. Planning and coordination
2. Outbreak investigation
3. Management of cases
4. Situation monitoring
5. Mosquito control
6. Social mobilization
7. Communicatio

##### ***4.2 Algorithm for mounting a response to an outbreak***

The algorithm for mounting an outbreak response shall be as shown in figure 3

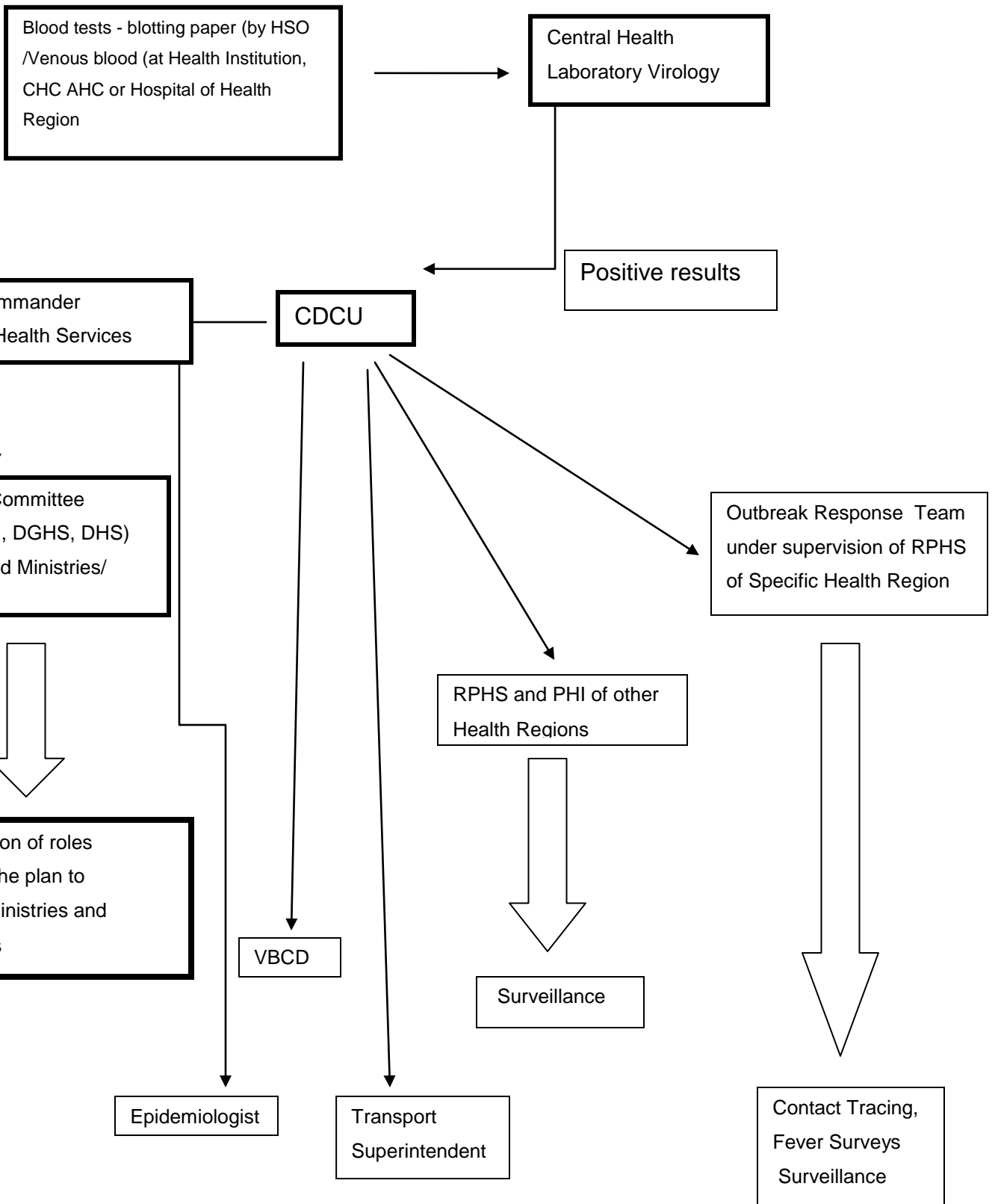
##### ***4.3 Overall Planning and coordination for logistic of an outbreak***

Since several stakeholders are involved in the outbreak phase, it is important to define the roles and functions of each stake holder, through planning and coordination, to ensure smooth supervision and minimize duplication, redundancy or contradictory activities. From the health sector the following main persons have clearly defined roles and responsibilities: (1) the RPHS of CDCU, (2) the head of the rapid response team,

(3) the head of the vector control unit, and (4) the CHI. From the non-health sector the following department and Ministries are involved: (1) the Ministry of Environment, Ministry of Local Government, (2.) Ministry of Agro Industry, food production, and security, (3) Ministry of Education, (4) Ministry of Tourism, (5) Ministry of Women Rights and (6) representative of Private Sector such as Mauritius Chamber of Commerce and Industry, The Chamber of Agriculture, L'AHRIM and other stakeholders. The participation of the non health sectors will be ensured through the setting of a task force. The general roles of these persons are described.

DRAFT PLAN OF ACTION FOR DENGUE CONTROL IN MAURITIUS

**Figure 3**  
**Algorithm**  
**for mounting**  
**an Outbreak**  
**Response**



#### **4.3.1 Role of the CDCU**

The role of the Communicable Disease Control Unit (CDCU) is as follows:-

1. Coordinate and oversee all activities pertaining to outbreaks
  - a. Collect and compile data and submit reports
  - b. Coordinate implementation of activities at regional levels through the Regional Public Health Superintendents
  - c. Arrange for submission of daily technical report, for each region, to the DGHS, DHS .
  - d. Set up an evaluation committee to examine all reports
2. Direct all operations for
  - a. Outbreak investigations to be undertaken by the regional rapid response team
  - b. Outbreak controls
3. Monitor the following activities
  - a. Larviciding and Fogging operations effected in the regions
  - b. The implementation of strategies for vector control and vector surveillance
  - c. Analyze the trend of the disease in person, place and time
  - d. Conduct additional epidemiological studies if necessary
4. Produce and disseminate information for action
  - a. Guide the fogging and larviciding operation by directing them where the “hot zones” of the disease are.
  - b. Produce and disseminate updated case definitions and case management protocols to all RPHS
  - c. Supervise the training of clinicians in case definition and management
  - d. Publish weekly bulletin of the disease trend and operation conducted
  - e. Maintain a list of dengue-endemic countries and supply it to the SHI

#### **4.3.2 The role of the Epidemiologist**

The Epidemiologist is responsible to the Director Health Services through the Regional Public Health Superintendent and his role is as follows:

1. To plan, design and implement epidemiological studies with a view to investigating human disease and risk factors
2. To participate in research activities and special investigations ( including disease outbreak investigations)
3. To determine and utilize appropriate statistical methods/analysis to evaluate and interpret data
4. To perform duties as assigned in the event of a Public Health emergency and other response programmes
5. To produce periodical reports on the epidemiological trends of communicable diseases and their risk factors.

#### **4.3.3 The role of the head of the regional rapid response**

The role of the head of the regional rapid response team is as follows:

1. To carry out field investigation of the outbreaks according to set procedures
2. To report daily to the central command unit at the CDCU
3. To construct an epidemic curve of the disease
4. To analyze the prevalence of the disease in different risk groups and geographic areas
5. To instruct the fogging team for fogging operations
6. To liaise with local government, municipality or town council for cleaning up campaign



#### **4.3.4 The role of the Vector Biology and Control Division**

The role of the Vector Biology and Control Division is as follows:

1. To map the density of the larvae, pupae and adult mosquitoes by the various indices listed under section 4.6.4
2. To send daily report of the vector densities to the Operations centre at the CDCU by fax and email
3. To participate in the multi-sectoral meeting at the regional level for fogging and larviciding operation

#### **4.3.5 The role of the Health Inspectorate Cadre**

The role of the Health Inspectorate Cadre is as follows:

1. Carry out environmental survey of breeding places of vectors
2. Undertake or assist in fever surveys
3. Assist in active and passive case detection and contact tracing (see section 4.6.1-4.6.2)
4. Send daily reports to the central unit at CDCU and vector biology unit
5. Liaise with vector biology unit for undertaking larval and pupal survey
6. Direct the fogging and larviciding operations
7. Liaise with local government for environmental cleaning of “hot zones”
8. To give technical advice for sensitizing the community and distribute information pamphlets
9. Reinforce enforcement of appropriate legislation

#### **4.3.6 Setting up of a Task Force for coordination of health and non-health sectors**

A task force has been set up under the chairmanship of the Minister of Health & Wellness comprising of Senior Officials of other Ministries namely: the Ministry of Environment and NDU; Ministry of Local Government, Rodrigues and outer Islands ; Ministry of Agro Industry ,Food production and Security; Ministry of Education, Culture

and Human Resources ;Ministry of Tourism, Leisure and External Communications ;Ministry of Women Rights and representatives of Private Sector such as Mauritius Chamber of Commerce and Industry, the Chamber of Agriculture, L'AHRIM and other stakeholders.

The role of the task force is as follows:

1. Identify and monitor control measures to be implemented by each sector
2. Meet regularly during an outbreak to review progress and advise the government on the control measures to be taken.

#### **4.3.7 The role of the Ministry of Environment and NDU**

The role of the Ministry of environment is as follows:

1. Step up clean up campaigns by providing waste litter bins in high risk areas
2. Help in the cleaning up of bare lands and river banks where waste accumulate.
3. Provide additional workforce whenever necessary

#### **4.3.8 The role of the Ministry of Local Government, Rodrigues and Outer Islands**

The role of the Ministry of local government is as follows:

1. Opening of temporary dump sites for receiving green waste and old tyres
2. Issuing of exemption from waste carrier 's license for carrying waste
3. Regular inspection and monitoring of bare lands/wasteland
4. Wasteland management by legal actions against offenders.
5. General cleaning campaigns in collaboration with "forces vives"
6. Carrying larviciding and fogging in collaboration with Ministry of Health &W.

#### **4.3.9 The role of the Ministry of Agro Industry, Food Production and Security.**

1. Ensure elimination of breeding sites from irrigation areas.
2. Sensitize planters on proper water storage for irrigation
3. Supplement workforce for vector control activities.

#### **4.3.10 The role of Ministry of Tourism, Leisure and External Communications**

1. Support the national awareness campaign
2. Support the vector control activities
3. Sensitize hotels for the need to identify cases within their premises.

#### **4.3.11 Role of Ministry of Education, Culture and Human Resources**

1. Support the awareness campaign
2. Ensure a clean environment within their premises.

#### **4.3.12 The role of the Business Sectors**

1. Support the cleaning campaign
2. Support the awareness campaign
3. Empower workers for a clean working environment

#### **4.3.13 Activation of emergency control teams**

Emergency control teams have been set up in each Health Region. See section 6.2.3. During an outbreak, the RPHS of CDCU will activate the rapid response team as follows:

1. Instruct by phone all RPHS to activate the regional team
2. Assist in logistic arrangement for full outbreak operation
3. Procuring any missing equipment and supplies
4. Arrange for additional staff or redeployment of staff
5. Consult and advise relevant RPHS on the extent of the operation

#### **4.3.14 Activation of the operation centre**

During an outbreak, operation centres should be set up at the central and regional levels. *At the central level*, the unit will be headed by the Regional Public Health Superintendent of CDCU and will be assisted by

- i. One epidemiologist
- ii. 3 community physicians
- iii. one Principal Health Inspector,
- iv. one Senior Health Inspector,
- v. two Health Inspectors
- vi. 3 staff of medical records department
- vii. 3 staff of medical statistics
- viii. Two administrative staff.

The functions of the Central Operations Centre will be as follows:

- i. Maintain a data base of outbreak investigation on a daily basis
  - a. Task to be performed by medical record and administrative staff
- ii. Analyze the trend of the epidemic by locality
  - a. Tasks to be performed by medical statistics unit, with the support of the Epidemiologist
- iii. Disseminate the result daily to all interested parties

#### **4.4 Outbreak investigation**

Outbreak investigation will be carried by the regional response team. The composition of the team and their function of each member are as follows:

1. Epidemiologist from CDCU
  - a. For role of CDCU see section 4.3.1
2. RPHS
  - a. Function: directs the operation. See section 4.3.2
3. Entomologist

- a. Function: map larval and pupal density. See section 4.3.3
4. PHI, now Principal Public Health and Food safety Inspectorate
  - a. Function: carry out environmental investigation of risk factors.
  - b. Assist in active and passive case detection and contact tracing
  - c. See section 4.3.4
5. Community physician
  - a. Apply case definition for classifying cases
  - b. Collect clinical and demographic information
  - c. Arrange collection and dispatch of specimens for laboratory confirmation of etiologic agents
  - d. Analyze the data for person, place and time
6. Public health nurse
  - a. Assist the community physician in the above task
7. Laboratory representative
  - a. Advises on the collection, storage and transport of specimens

The 7 components of outbreak response, establishing an outbreak has occurred, orienting the disease in person, place and time, looking for sources etc. is detailed below

#### **4.4.1 Establishing the outbreaks**

An outbreak is confirmed by showing that the number of positive cases is above the expected baseline number. This will be done the following steps:

1. Clinically confirming the suspected diagnosis by the application of the standard case definition
2. Laboratory confirmation of the index and linked cases

#### **4.4.2 Notification of outbreaks**

An outbreak is declared when the two criteria of section 4.4.1 are fulfilled. If only criterion 1 is fulfilled, the event is classified as potential outbreak.

It is incumbent of the CDCU in collaboration with the RPHS with the RHD to declare confirmation of an outbreak by:

1. Informing the SCE and DGHS
2. The PAS
3. The press attaché
4. Members of the regional outbreak rapid response team

#### **4.4.3 Orienting the data in person, place and time**

In order to understand the outbreak, it is essential to orient the data with respect to person, place and time. The tasks of the emergency control team shall be:

1. Collect minimum data set on clinical and epidemiological features using the case investigation form in Annex 9.
2. Analyze the distribution of the cases in persons of different age group, gender, exposure category and geographical distribution.
3. Use table 1 of Annex 10 to summarize the data
4. Draw a hand map of the distribution of the cases

### ***4.5 Management of cases***

Proper patient management is critical for reduction of case fatality and limiting the spread of the infected mosquito in the community at large. As detailed in Annexes 2, 4, 6 and 7, the strategy for management shall be:

1. Isolation of cases
2. Administering clinical management

#### **4.5.1 Isolation of cases**

1. Patients suffering from dengue fever and receiving treatment to be confined in a health institution or in their homes
2. Additional beds are to be provided for in hospitals
3. Mosquito nets to be made available in all hospitals

4. Community to be sensitized in the need to restrain themselves from travelling to high risk zones and to visits dengue fever affected patients

#### **4.5.2 Clinical Management of Suspected cases**

1. Case definition of the diseases given in Annexes 1 and 3 be circulated to all Medical Practitioners
2. Guidelines on Clinical Management of suspected or confirmed cases of Chikungunya or dengue are given in annexes 2-4 must be distributed to all Medical Practitioners
3. All medical practitioners (physicians) must be made fully aware of the case definition through the web site or by mailing.
4. All medical practitioners should be fully aware of the guidelines on clinical management through the web site or by mailing

A strategy of triage must be followed to reduce the surge capacity on the hospitals and reduce morbidity and mortality of the patient.

#### ***4.6 Situation Monitoring***

The CDCU will be responsible for situation monitoring by both active case detection and passive surveillance from sentinel sites.

##### **4.6.1 Active case detection**

Whenever an index case is detected, active case search will be undertaken for all contacts of the case. The following procedure will be used:

1. Interview the index case to enumerate a list of immediate contact
2. Draw a map of the location of all contacts
3. Trace the contacts using the above list
4. Interview the contacts to get epidemiological data using the contact investigation form in Annex 9.
5. Collect acute blood sample as per annex 12
6. Observe the contacts for 7 days

#### **4.6.2 Passive Case detection**

Passive surveillance for case detection must be conducted by using sentinel sites comprised of:

1. Government Hospital and clinics
2. Private clinics
3. Private practitioners

The procedure for passive surveillance shall be as follows:

1. The sentinel sites should be chosen to represent all the health regions
2. Focal points for all sentinel sites should be identified for each health region
3. The focal point should be supplied with documentation and complete instruction on case definition and case investigation form including laboratory collection
4. Weekly communication should be maintained with the focal points

#### **4.6.3 Laboratory Surveillance**

Virology Unit of the Central Health Laboratory will be responsible for virological surveillance. The main roles of the virology unit will be as follows:

- i. To confirm the first and initial suspected cases by the most rapid test of PCR and ELISA
- ii. To perform virus isolation for Chikungunya
- iii. Perform PCR for DEN , CHIK and ZIKA on mosquito population
- iv. Submit daily report to CDCU in a standard format by fax and email
- v. To provide magnitude of the disease and the viral serotypes as the epidemic progresses
- vi. Participate in planning meeting for control of outbreak control

#### **4.6.4 Vector Surveillance**

The unit responsible for vector population density is the “Vector Biology and control Division”. The roles of this unit in outbreak control are:



1. To a survey of larval and adult density of the vector from the area of the index case and all houses within 500 meters radius of the index case house within 24 hour of notification of the first case.
  2. Calculate the density by the following indices: See Annexes15-16 for details
    - a. House index (HI)
    - b. Container index (CI)
    - c. Breteau index (BI)
    - d. Pupal index
  3. To map the vector density of known high risk dengue and chikungunya prone areas
  4. To submit a daily report on Vector population density to the operation center CDCU and the relevant regional health centre
- 4.122 Mosquito control

#### ***4.7 Adult control by space spray***

For the control of adult vector population the following procedures are used:

1. Space spray operations (thermal fogging or ULV aerosols) must be carried out immediately following the notification of the index case by the CDCU operation team
2. Spraying must be done within a radius of 300 meters of the case house
3. The protocols for space spraying are given in annexes 17-18

##### **4.7.1 Larval source reduction**

The following procedures will be used for larviciding:

1. All houses within 300 meter radius of the case house must be totally surveyed for Aedes breeding grounds by the PHI

2. Larval surveys must be carried out within 24 hours of notification of the first case from an outbreak by vector biology unit
3. The protocol to be used are given in Annexes 19-21

#### **4.7.2 Reporting of mosquito control activities**

During the epidemic period, the following daily reports must be submitted to the Ministry:

1. Advance programme of work for larviciding for the week as per annex 19
2. Advance programme of work for fogging for one day as per annex 20
3. Daily report on larviciding as per annex 21
4. Daily report on fogging as per annex 22
5. Advance programme for Entomological survey as per annex 23
6. Daily Entomological report as per annex 24
7. Daily application report

#### ***4.8 Social mobilization and Communication***

Social mobilization or community participation is a key component for sustainable prevention and control of mosquito-borne diseases. Community participation includes mobilization of civil society groups and inter-sectoral groups in health education, personal protection and law enforcement. The target is to deliver the messages of environmental management for:

- a) Container management to reduce the sources of mosquito breeding habitats
- b) Elimination or alteration of breeding sites including rubbish disposal, tyres etc
- c) Proper management of water storage device
- d) Environmental protection through larviciding and use of repellents etc.

The WHO COMBI model for social mobilization and communication must be used to deliver the above messages and consists of the following components

#### **4.8.1 Public relations/Advocacy/Administrative Mobilization**

This component should target healthy behavior on the business sector's and administrative programme management's agenda via mass media such as news coverage, talk shows, soap operas, celebrity spoke persons etc. Active participation of the following Ministries should be included in the campaign against dengue:- 1) Ministry of Local Government, Rodrigues and Outer Islands, 2) all the Local Authorities, 3) Ministry of Education, Culture and Human Resources, 4) Ministry of Environment and NDU, 5) Ministry of Youth and Sports, 6), Ministry of Tourism, Leisure and External Communications, 6) Ministry of Agro Industry, Food Production & Security , 7) L'AHRIM, 8) The Mauritius Chamber of Commerce and Industry, and 9) the Chamber of Agriculture and other stakeholders

#### **4.8.2 Sustained Appropriate Advertising and Promotion**

The approach here should be massive, repetitive, intense and persistent advertising via radio, television, newspapers and other available media to engage the people in recommended behavior change and the health cost of not changing the behavior. An effective media program should be developed and implemented in order to create awareness of dengue, proper disposal of refuse and waste and source reduction measures.

#### **4.8.3 Community mobilization**

The approach here is to use participatory research, group meetings, partnership sessions, school activities, community drama and home visit to distribute leaflets, posters, pamphlets and video for personal protection

#### **4.8.4 Law enforcement**

Describe the law and the enforcement mechanism

#### **4.8.5 Communication**

In addition to the above approaches it is also to provide regular press briefing and press communiqué on the situation of the outbreaks.

### **5. SURVEILLANCE TASKS FOR INTEREPIDEMIC PERIOD**

#### ***5.1 Objectives during interepidemic period***

The objectives during the quiescent interepidemic period are:

1. Capacity building and preparedness
2. Planning and coordination
3. Situation monitoring
4. Mosquito control
5. Social mobilization and communication

#### ***5.2 Capacity building and Preparedness***

The interepidemic phase provides an opportunity to build the capacity in preparedness of the CDCU for responding to outbreaks of day-biting mosquito-borne diseases.

#### ***5.3 Planning and coordination for logistic for interepidemic period***

The interepidemic period is an excellent opportunity to foster and consolidate coordination. Since several stake holders are involved in the control of day-biting vector diseases, it is important to define the role and function of each stake holder through planning and coordination to ensure smooth surveillance and minimize duplication,

redundancy or contradictory activities. In particular the following four main persons have clearly defined roles and responsibilities: (1) the director of CDCU, (2) the head of the rapid response team, (3) the head of the vector control unit, and (4) the CHI. The general roles of these persons are described.

### **5.3.1 Role of the CDCU**

The roles of the Communicable Disease Control Unit (CDCU) are as follows:-

1. Coordinate and oversee all activities pertaining to outbreaks prevention
  - a. Collect and compile data and submit reports
  - b. Coordinate all RPHS
  - c. Arrange for submission of weekly technical report to the DGHS, DHS under the responsibility of the RPHS
  - d. Set up an evaluation committee to examine all reports and
2. Direct all operation for
  - a. Environmental monitoring of mosquito-prone areas
3. Monitor the following activities
  - a. Larviciding and Fogging operations effected in the region
  - b. The implementation of strategies for vector control and vector surveillance
  - c. Analyze the trend of the mosquito population place and time
  - d. Conduct additional epidemiological studies if necessary
4. Produce and disseminate information for action
  - a. Guide the fogging and larviciding operation by directing them where the “hot zones” of the disease are
  - b. Publish weekly bulletin of the disease trend and operation conducted

### **5.3.2 The role of the Epidemiologist**

The Epidemiologist is responsible to the Director Health Services through the Regional Public Health Superintendent and his role is as follows:

1. To plan, design and implement epidemiological studies with a view to investigating human disease and risk factors
2. To participate in research activities and special investigations ( including disease outbreak investigations)
3. To determine and utilize appropriate statistical methods/analysis to evaluate and interpret data
4. To provide appropriate training in the field of epidemiology
5. To produce periodical reports on the epidemiological trends of communicable diseases and their risk factors.

### **5.3.3 The roles of the head of the Regional Rapid Response Team**

The roles of the head of the regional rapid response team are as follows:

1. Carry out the field investigation of the “hot zones” according to set procedures
2. To report weekly to the central command unit at the CDCU
3. To construct a map of hot spots of mosquito breeding sites
4. To analyze the prevalence of the mosquito population in different geographic areas
5. To instruct the fogging and larviciding teams for operation of hot spots
6. To liaise with local government, municipality or town council for cleaning up campaign

### **5.3.4 The roles of the Vector Biology and control Division**

The roles of the Vector Biology and Control Division are as follows:

1. To map the density of the larvae, pupae and adult mosquitoes by the various indices listed under annex xx.
2. To send daily report of to the vector densities to the Operation centre at the CDCU by fax and email
3. To participate in the multi-sectoral meeting at the regional level for fogging and larviciding operation

### **5.3.5 The roles of the Health Inspectorate Cadre**

The roles of the Health Inspectorate Cadre are as follows:

1. Carry out environmental survey of breeding places of vectors from hot zones
2. Support survey of adult and larval vectors
3. Inspect port areas and warehouses or supply depots of imported tyres
4. Quarantine infected tyres with no fumigation and undertake methyl bromide fumigation
5. Set up of ovitraps around airports and seaport terminals
6. Regularly undertake larviciding with temephos at the airport and seaports.
7. Undertake or assist in fever survey on a regular basis
8. Assist in active and passive case detection and contact tracing (see section xx)
9. Send weekly reports to the central unit at CDCU and vector biology unit
10. Liaise with vector biology unit for undertaking larval and pupal survey
11. Direct the fogging and larviciding operation
12. Liaise with local government for environmental cleaning of “hot zones”
13. To give technical advice for sensitizing the community and distribute information pamphlets
14. In consultation with head of CDCU and Vector biology unit, Issue warning and fine for persistent offenders.

### **5.3.6 Setting up of a Task Force**

A task force should be set up under the chairmanship of the Minister of Health & Wellness comprising of Senior Officials of other Ministries namely:

1. the Ministry of Environment, Ministry of Local Government,
2. Ministry of Agro Industry food production and security, Ministry of Tourism,
3. Ministry of Women Rights and

4. representative of Private Sector Organization such as Mauritius
5. Chamber of Commerce and Industry,
6. The Chamber of Agriculture,
7. L'AHRIM
8. Other stakeholders.

During the interepidemic period, the roles of the task force should:

1. Meet monthly to review the situation of mosquito
2. determine on control measures to be implemented
3. advises on action to be taken

### **5.3.7 Constitution of regional rapid response teams**

Rapid response teams should be set up in each regional health centres. The rapid response team will consist of:

- i. One epidemiologist/community physician
- ii. one public health nurse
- iii. one Principal Health Inspector,
- iv. one Senior Health Inspector,
- v. One laboratory representative.
- vi. One data manager/administrative support staff

During the interepidemic period the rapid response team as follows:

1. Review all protocols and SOP for outbreak controls and prevention in logistic
2. Undertake outbreak training modules and conduct regular exercises
3. Enlist and stock-pile the necessary supplies and equipment for outbreaks investigation and control



### **5.3.8 Constitution of operation centres**

Operation centres should be designated and set up at the central and regional levels. The operation centres shall be equipped with:

*Communication devices including fax, email, computers, printers and telephones*

### **5.4 Situation Monitoring**

The CDCU will be responsible for situation monitoring that shall consist of both active case detection and passive surveillance from sentinel sites.

#### **5.4.1 Active case detection at point of entry**

Health Inspectorate Division at points of entry to put under surveillance all passengers arriving from list of dengue, Chikungunya and zika endemic countries maintained by CDCU.

- 1) A list of such passengers to be submitted to all health offices and CDCU
- 2) Visiting of incoming passengers will be done by HSO according to protocol annexed.
- 3) Suspected cases will be requested to attend nearest health institution. RPHS of region informed
- 4) Regionalized training for HSO
- 5) Control to be tightened at both the airport and the harbor
- 6) A list of such passengers is to be submitted to the Ministry of Health and Wellness and to the Dengue Unit for monitoring surveillance
- 7) Contact tracing will be done by health inspectors. In case of appearance of any dengue – like symptoms prompt action to be taken

#### **5.4.2 Active case detection in the community**

Whenever an index case is detected, active case search will be undertaken for all contacts of the case. The following procedure will be used:

1. Interview the index case to enumerate a list of immediate contact
2. Tract the contacts using the list
3. Observe the contacts for 7 days

#### **5.4.3 Passive Case detection in the community**

The sentinel sites for case detection will be comprised of:

1. Government Hospital and clinics
2. Private clinics
3. Private practitioners

#### **5.4.4 Laboratory Surveillance**

Virology Unit of the Central Health Laboratory will be responsible for virological surveillance. The main roles of the virology unit will be as follows:

1. To confirm the first and initial suspected cases by the most rapid test of PCR and ELISA
2. To perform virus isolation for Chikungunya
3. Perform PCR for DEN ,CHIK and ZIKA on mosquito population
4. Submit daily report to CDCU in a standard format by fax and email
5. To provide magnitude of the disease and the viral serotypes as the epidemic progresses
6. Participate in planning meeting for control of outbreak control

#### **5.4.5 Vector Surveillance**

The unit responsible for vector population density is the “Vector Biology and Control Division”. The roles of this unit in outbreak control are:

1. To a survey of larval and adult density of the vector from the area of the index case and all houses within 500 meters radius of the index case house within 24 hour of notification of the first case.
2. Calculate the density by the following indices: See Annexes 15-16 for details
  - a. House index (HI)
  - b. Container index (CI)
  - c. Breteau index (BI)
  - d. Pupal index
3. To map the vector density of known high risk dengue and chikungunya prone areas
4. To submit a weekly report on Vector population density to the operation center CDCU and the relevant regional health centre

### ***5.5 Mosquito control***

### ***5.6 Adult control by space spray***

For the control of adult vector population the following procedures are used:

1. Space spray operations (thermal fogging or ULV aerosols) must be carried out immediately following the notification of the index case by the CDCU operation team
2. Spraying must be done within a radius of 300 meters of the case house
3. Spraying should also be used at the terminals of airports, seaport and deposit of tyres
4. The protocols for space spraying are given in annex 17

#### **5.6.1 Larval source reduction**

The following procedures will be used for larviciding:

1. All houses within 300 meter radius of the case house must be totally surveyed for Aedes breeding grounds by the PHI
2. Larval surveys must be carried out within 24 hours of notification of the first case from an outbreak by vector biology unit
3. The protocol to be used are given in Annexes 14-18

### **5.6.2 Reporting of mosquito control activities**

Reports are submitted to the Ministry on a daily basis

1. Advance programme of work for larviciding for the week (Specimen per annex 21 )
2. Advance programme of work for fogging for one day (Specimen per annex 22)
3. Daily report on larviciding (Specimen per annex 21)
4. Daily report on fogging (Specimen per annex 22 )
5. Advance programme for Entomological survey (Specimen per annex 14 )
6. Daily Entomological report (Specimen per annex 24 )

### **5.7 Social mobilization and Communication**

Social mobilization or community participation is a key component for sustainable prevention and control of mosquito-borne diseases. Community participation includes mobilization of civil society groups and inter-sectoral groups in health education personal protection and law enforcement. The target is to deliver the messages of environmental management for:

- a) Container management to reduce the sources of mosquito breeding habitats
- b) Elimination or alteration of breeding sites including rubbish disposal, tyres etc
- c) Proper management of water storage device
- d) Environmental protection through larviciding and use of repellents etc.

The WHO COMBI model for social mobilization and communication must be used to deliver the above messages and consists of the following components

#### **5.7.1 Public relations/Advocacy/Administrative Mobilization**

This component should target healthy behavior on the business sector's and administrative programme management's agenda via mass media such as news coverage, talk shows, soap operas, celebrity spoke persons etc. Active participation of the following Ministries should be included in the campaign against dengue:-1) Ministry of Local Government, 2) all the Local Authorities, 3) Ministry of Environment, 4) Ministry of Youth and Sport, 5) Ministry of Tourism, Ministry of Agro Industry, 6) L'AHRIM, 7) The Mauritius Chamber of Commerce and Industry, and, 9) the Chamber of Agriculture and other stakeholders

#### **5.7.2 Sustained Appropriate Advertising and Promotion**

The approach here should be massive, repetitive, intense and persistent advertising via radio, television, newspapers and other available media to engage the people in recommended behavior change and the health cost of not changing the behavior. An effective media program should be developed and

implemented in order to create awareness of dengue, proper disposal of refuse and waste and source reduction measures.

### **5.7.3 Community mobilization**

The approach here is to use participatory research, group meetings, partnership sessions, school activities, community drama and home visit to distribute leaflets, posters, pamphlets and video for personal protection

### **5.7.4 Law enforcement**

Describe the law and the enforcement mechanism

### **5.7.5 Communication**

In addition to the above approaches it is also to provide regular press briefing and press communiqué on the situation of the outbreaks any imminent outbreaks.

## LIST OF ANNEXES

### *Annex 1: Case definition of Chikungunya*

<p style="text-align: center;"><b>Chikungunya</b></p> <ol style="list-style-type: none"><li>1. Incubation period:</li><li>2. 3-12 days Onset of symptoms Usually 4-7 days after mosquito bite</li></ol>	<p style="text-align: center;"><b>Suspect Chikungunya if</b></p> <ol style="list-style-type: none"><li>1. High grade persistent fever (&gt;38.5c) (Note: Fever may be modified by prior use of antipyretics)</li><li>2. Arthritis – usually severe and several joints A skin rash – may be present in 35% in cases (When notifying suspected case state whether rash is present or not)</li></ol>
<p style="text-align: center;"><b>Notification</b></p> <ol style="list-style-type: none"><li>1. All suspected cases should be notified to the nearest health office (Do not wait for virological studies)</li><li>2. Patients details – Mandatory age, sex,</li></ol>	<p style="text-align: center;"><b>Virological Studies</b></p> <p>Send: 5ml of blood – Collected in sterile plain tube to virology lab at first visit:</p> <ol style="list-style-type: none"><li>(i) In all sporadic cases; and</li><li>(ii) In only random selected cases during an epidemic</li></ol>

***Annex 2: Management of Chikungunya***

Majority will be treated as outpatients

Admission necessary for:

- (i) Critically ill patients
- (ii) Severe dehydration
- (iii) Associated complications i.e. major organ involvement:
  - Renal
  - Neurological
  - Cardiac
  - Pulmonary etc
- iv) Gastrointestinal complications i.e. suspected perforation/bleeding
- (v) Pregnancy – all pregnant females with fever  $\geq 39^{\circ}\text{C}$  should be referred for specialist assessment or admitted as appropriate
- (vi) All neonates
- (vii) Infants and small children at doctor's discretion



### ***Annex 3: Treatment of Chikungunya***

#### **GENERAL MEASURES:**

1. Ensure adequate hydration
2. Period of rest in selected cases
3. Give antibiotics if there is secondary infection

Note: Breast-feeding is not contraindicated

#### **ANTIPYRETICS:**

1. Paracetamol in all age groups
2. Dose adult 1 gm orally and rectally 4-6 hours (up to a maximum of 4 gm/24 hourly)
3. Children (i) 15mg/kg/6 hourly to a maximum 60mg/kg/24hourly
4. Note: 5mlsyrup=120mg paracetamol  
Paediatric suppositories = 15 mg or 300 mg  
(Treatment up to one week)

#### **ARTHRITIS**

1. Paracetamol may be adequate in mild cases
2. NSAIDS – small doses may be adequate
3. Diclofenac 50 mg BD instead of 100 mg doses
4. Children >6months 1buprofen syrup may be given in divided doses 5mg/kg 8 hours maximum 20 mg/kg/24hr (5ml syrup equivalent to 100 mg 1 ibuprofen)

***Annex 4: further Chikungunya treatment for adults only***

**For persisting and disabling arthritis**

1. Consider short course of opiate analgesics i.e. Codeine phosphate 30-60 mg 8 hourly
2. Tramadol preparations 50 mg up to 8 hourly
3. Hydroxychloroquine 200-400 mg daily for 2-4 weeks
4. Refer for specialist opinion and treatment for resistant arthritis

**NSAIDS – Contra Indications/Precautions**

Toxic to G.I tract and other organs

**AVOID:**

1. Patients with known or suspected peptic ulcer disease
2. Patients with chronic kidney disease, chronic liver diseases and congestive
3. 3<sup>rd</sup> trimester of pregnancy
4. Multiple NSAIDS preparations at the same time
5. Combination with steroids, aspirin or anticoagulant

**NOTE: Non-oral routes of administration do not prevent complications.**

G.I side effects may be reduced by combination with a Proton Pump Inhibitor i.e. Omeprazole 20-40mg daily or equivalent

**NOTE: AVOID USE OF STEROIDS IN ACUTE PHASE OF ILLNESS**

### ***Annex 5: Case Definition of Dengue Fever (DF)***

An acute febrile illness (temperature 39-40 C) of 2 – 7 days duration with 2 or more of the following manifestations:

1. Headache
2. Retro-orbital pain
3. Myalgia
4. Arthralgia
5. Rash
6. Haemorrhagic manifestations
7. Leucopenia / thrombocytopenia (platelets less than 100,000).

#### **Case classification**

**Suspected case:** A case compatible with the clinical description

**Confirmed case:** A case compatible with the clinical description that is laboratory-confirmed

#### **Laboratory criteria for diagnosis**

1. Demonstration of IgG and IgM antibody titres by the Rapid Test
2. Demonstration of Dengue antibodies in serum samples by ELISA
3. Detection of viral genomic sequences in serum or CSF samples by PCR

## ***Annex 6: Management Protocol for Paediatrics Dengue Fever***

### **Febrile phase: 2 to 7 days**

Treatment is symptomatic and supportive.

Paracetamol in a dose of 60 mg / kg body weight / day in not more than 4 doses per day.

### **DO NOT GIVE ASPIRIN OR BRUFEN**

Antibiotics are not recommended.

Oral fluids and electrolyte therapy is recommended for patients with signs of dehydration.

### **A febrile phase: (Critical Stage) 2 to 3 days after febrile phase.**

Management is same as during febrile phase but needs careful monitoring of:

1. Complications e.g. abdominal pain, passage of black stool, bleeding into skin or from the nose or gums, sweating and cold skin constitute danger signs. (These cases need admission to hospital)
2. Platelets counts
3. Haemotocrit values

### **Convalescence phase: 7 to 10 days after critical stage**

1. Further improvement in general condition with return of appetite.
2. Bradycardia
3. Confluent petechial rash with white centre / itching
4. Weakness lasting 1 to 2 weeks

Management of this phase: No special advice. Normal diet encouraged.

## ***Annex 7: Proposed Management Protocol Dengue Fever/ Dengue Haemorrhagic Fever/Dengue Shock Syndrome***

**Chart 1: DF/DHF Management Charts Dengue Fever**

<b>Febrile phase</b>	<b>Manifestation</b>	<b>Management</b>
Duration 2 – 7 days	<ul style="list-style-type: none"> <li>-Temp 39-40<sup>0</sup>C</li> <li>-Headache</li> <li>- Retro-orbital pain</li> <li>- Muscle pain</li> <li>- Joint/bone pain</li> <li>- Flushed face</li> <li>- Rash</li> <li>- Skin haemorrhage, bleeding from nose, gums</li> <li>- Positive tourniquet test</li> <li>- Liver often enlarged</li> <li>- Leucopenia</li> <li>- Platelet/haematocrit normal</li> </ul>	<ul style="list-style-type: none"> <li>- Bed rest</li> <li>- Keep the body temperature below 39<sup>o</sup>C</li> <li>- Paracetamol-Yes*</li> <li>- No steroids no NSAIDS</li> <li>- No antibiotics</li> <li>- Fluid Therapy</li> <li>- Follow-up for any change in platelet/haematocrit daily</li> <li>- Oral fluids</li> <li>ORS ± IV fluids</li> </ul>
<b>Afebrile phase (Critical)</b>	<b>Manifestation</b>	<b>Management</b>
Duration – 2 – 3 days after febrile stage	<ul style="list-style-type: none"> <li>- Same as during febrile phase</li> <li>- Improvement in general condition</li> <li>- Platelet/haematocrit normal</li> <li>- Appetite rapidly regained</li> </ul>	<ul style="list-style-type: none"> <li>- Bed rest</li> <li>- Check platelets/haematocrit daily</li> <li>- Fluid Therapy as required (Critical)</li> </ul>
<b>Convalescence Phase</b>	<b>Manifestation</b>	<b>Management</b>
Duration – 7 – 10 days after critical stage	<ul style="list-style-type: none"> <li>- Further improvement in general condition and return of appetite</li> </ul>	<ul style="list-style-type: none"> <li>- No special advice</li> <li>- No restrictions</li> </ul>

	- Bradycardia -Confluent petechial rash with white centre/itching -Weakness for 1 or 2 weeks	- Normal diet
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\*Platelet Transfusion recommended in patients having thrombocytopenia with significant bleeding.

- Platelet transfusion to be considered in patients with platelet <10,000 even in absence of obvious bleeding.

**Chart 2: Dengue Haemorrhagic Fever (Grades I and II)**

<b>Afebrile Phase (Critical stage)</b>	<b>Manifestation</b>	<b>Management</b>
Duration 2 – 3 days	Same as during febrile phase. - Thrombocytopenia and rise in haematocrit level (more than 20%)	<ul style="list-style-type: none"> <li>- ORS</li> <li>- Check platelets/haematocrit. If haematocrit is more than 20%:</li> <li>- Initiate IV therapy (5% D/NS) 6 ml/kg/hr (for 3 hours) or Normal Saline or R/L</li> <li>- Check haematocrit/vital signs/urine output after 3 hours and in case of improvement</li> <li>- Reduce IV therapy to 3ml./kg/hr (for 3 hours)</li> <li>- In case of further improvement continue IV therapy at 3 ml/kg/hr (6 – 12 hours) and then discontinue IV therapy.</li> <li>- In case of no improvement increase IV therapy to 10 ml./kg/hr (for 1 hr). In case of improvement now, reduce the volume of IV from 10 ml/kg/hr to 6 ml/kg/hr and further to 3 ml/kg/hr accordingly.</li> </ul>
<b>Convalescence Phase</b>	<b>Manifestation</b>	<b>Management</b>
Duration 2-3 days after critical stage	Further improvement in general condition and return of appetite - Bradycardia - Confluent petechial rash with white centre/itching - Asthenia and depression (Sometimes for a few weeks, common in adults)	<ul style="list-style-type: none"> <li>- Normal diet</li> <li>- No need for any medication</li> </ul>

Figure 1: Volume Replacement Flow Chart for Patients with DHF Grades I and II

Haemorrhagic (bleeding) tendencies,  
Thrombocytopenia,  
Haematocrit rise. Pulse pressure is low

Initiate IV Therapy 6m/kg/hr  
Crystalloid solution for 1 – 2 hrs

**Improvement**

**No Improvement**

Reduce IV 3 ml/kg/h  
Crystalloid duration  
6 – 12 hrs

Increase IV 10 ml/kg/h  
crystalloid duration 2 hrs

**Further  
Improvement**

**Improvement**

**No Improvement  
Unstable Vital Signs**



Discontinue IV After 24 hrs	Reduce IV to 6 ml/kg/h Crystalloid with Further reduction to 3 ml/kg/h. Discontinue after 24 – 48 hrs	<b>Haematocrit Rises</b> IV Colloid (Dextran (40) 10 ml/kg/hr duration 1 hr.	<b>Haematocrit Falls</b> Blood transfusion 10 ml/kg/h duration 1 hr.
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**Improvement**

IV therapy by crystalloid  
Successively reduce the  
Flow from 10 to 6.6 to  
3 ml/kg.hr. Discontinue  
after 24 – 48 hrs

**Chart 3: Dengue Haemorrhagic Fever (Grades III and IV)**

Afebrile Phase	Manifestation	Management
<p>Duration two days after febrile stage</p>	<p>In addition to the manifestations of DHF Grade II:                      Circulatory failure manifested by rapid and weak pulse, narrowing of pulse pressure (20 mmHg or less) or hypotension with the presence of cold clammy skin and restlessness                      - Capillary relief time more than two seconds</p>	<ul style="list-style-type: none"> <li>- Check haematocrit/platelet</li> <li>- Initiate IV therapy (5% D/NSS) 10 ml/kg/h (N S or R/L)</li> <li>- Check haematocrit, vital signs, urine output every hour</li> <li>- If patient improves IV fluids should be reduced every hour from 10 to 6, and from 6 to 3 ml/kg/h which can be maintained up to 24 to 48 hours</li> <li>- If patient has already received one hour treatment of 20 ml/kg/hr or IV fluids and vital signs are not stable, check haematocrit again and</li> <li>- If haematocrit is increasing, change IV fluids to colloidal solution preferably Dextran or Plasma at 10 mg/kg/h every hr.</li> <li>- If haematocrit is decreasing from initial value, give fresh whole blood transfusion, 10 ml/kg/h and continue fluid therapy at 10 ml/kg/h and reducing it stepwise bring down the volume to 3 ml/kg/h and maintain it up to 24-48 hours.</li> <li>- Initiate IV therapy (5% D/NSS) 20 ml/kg as a bolus one or two times</li> <li>- Oxygen therapy should be given to all patients</li> <li>- In case of continued shock, colloidal fluids (Dextran or Plasma) should be given at 10 – 20 ml/kg/hr</li> </ul>

DRAFT PLAN OF ACTION FOR DENGUE CONTROL IN MAURITIUS

<b>Afebrile phase</b>	<b>Manifestation</b>	<b>Management</b>
	<p>Profound shock with undetectable pulse and blood pressure</p>	<ul style="list-style-type: none"> <li>- if shock still persists and the haematocrit level continues declining, give fresh whole blood 10 ml/kg as a bolus</li> <li>- Vital signs should be monitored every 30 – 60 minutes</li> <li>- In case of severe bleeding, give fresh whole blood 20 ml/kg as a bolus</li> <li>- Give platelet rich plasma transfusion exceptionally when platelet counts are below 5,000 – 10,000/ mm<sup>3</sup></li> <li>- After blood transfusion, continue fluid therapy at 10 ml/kg/h and reduce it stepwise to bring it down to 3 ml/kg/h and maintain it for 24 – 48 hrs.</li> </ul>
<b>Con. Pulse</b>	<b>Manifestation</b>	<b>Management</b>
<p>Duration 2 – 3 days after recovery from critical/shock stage</p>	<ul style="list-style-type: none"> <li>- 6-12 hours after critical/shock stage, some symptoms of respiratory distress (pleural effusion or ascites)</li> <li>- 2-3 days after critical stage, strong pulse, normal blood pressure</li> <li>- Improved general condition/return or appetite</li> <li>- Good urine output</li> <li>- Stable haematocrit</li> <li>- Platelet count &gt; 50,000 per mm<sup>3</sup></li> <li>- Patient could be discharged from hospital 2-3 days after critical stage.</li> <li>- Bradycardial/arrhythmia</li> <li>- Asthenia and depression (few weeks) in adults</li> </ul>	<ul style="list-style-type: none"> <li>- Rest for 1-2 days</li> <li>- Normal diet</li> <li>- No need for medication</li> </ul>

**Figure 2: Volume Replacement Flow Chart for patient with DHF Grades III and IV**



**Improvement**

**No Improvement**

IV Therapy by crystalloid

Successively reducing from 20

To 10, 10 to 6, and 6 to 3 ml/kg/hr

Oxygen

**Further**

**Haematocrit**

**Haematocrit**

**Improvement**

**Rises**

**Falls**

Discontinue intravenous  
Therapy after 24-48 hrs

IV Colloid (Dextran  
40) or plasma 10ml/kg/hr  
As intravenous bolus  
(repeat if necessary)

Blood transfusion  
(10 ml/kg/hr) if  
haematocrit is  
still >35%

**Improvement**

IV therapy by crystalloid,  
Successively reducing the flow from 10 to 6.6 to 3 ml/kg/hr  
Discontinue after 24-48 hrs

## **Fluids Required for Intravenous Therapy**

### **Fluids Recommended**

#### **Crystalloid:**

- (a) 5% dextrose in isotonic normal saline solution (5% D/NSS)
- (b) 5% dextrose in half-strength normal saline solution (5% D/1/2/NSS)
- (c) Ringer lactate
- (d) Normal saline

### **Important Instructions for Treatment of DHF**

- Cases of DHF should be observed every hour.
- Serial platelet and haematocrit determinations drop in platelets and rise in haematocrits are essential for early diagnosis of DHF.
- Timely intravenous therapy – isotonic crystalloid solution – can prevent shock and/or lessen its severity.
- If the patient's condition becomes worse despite giving 20 ml/kg/hr for one hour, replace crystalloid solution with colloid solution such as Dextran or plasma. As soon as improvement occurs replace with crystalloid.
- If improvement occurs, reduce the speed from 20 ml to 10 ml, then to 6 ml, and finally to 3 ml/kg.

- If haematocrit falls, give blood transfusion 10 ml/kg and then crystalloid IV fluids at the rate of 10 ml/kg/hr.
- In case of severe bleeding, give fresh blood transfusion about 20 ml/kg/hr for two hours. Then give crystalloid at 10 ml/kg/hr for a short time (30 -60 minutes) and later reduce the speed.
- In case of shock, give oxygen.
- For correction of acidosis (sign: deep breathing), use sodium bicarbonate.

## What not to do

- Do not give Aspirin or Brufen or NSAID for treatment of fever.
- Avoid giving intravenous therapy before there is evidence of haemorrhage and bleeding.
- Avoid giving blood transfusion unless indicated, reduction in haematocrit or severe bleeding.
- Avoid giving steroids. They do not show any benefit.
- Do not use antibiotics.
- Do not change the speed of fluid rapidly, i.e. avoid rapidly increasing or rapidly slowing the speed of fluids.
- Insertion of nasogastric tube to determine concealed bleeding or to stop bleeding (by cold lavage) is **not** recommended since it is hazardous.

## Signs of Recovery

- Stable pulse, blood pressure and breathing rate
- Normal temperature
- No evidence of external or internal bleeding
- Return of appetite
- No vomiting
- Good urinary output
- Stable haematocrit

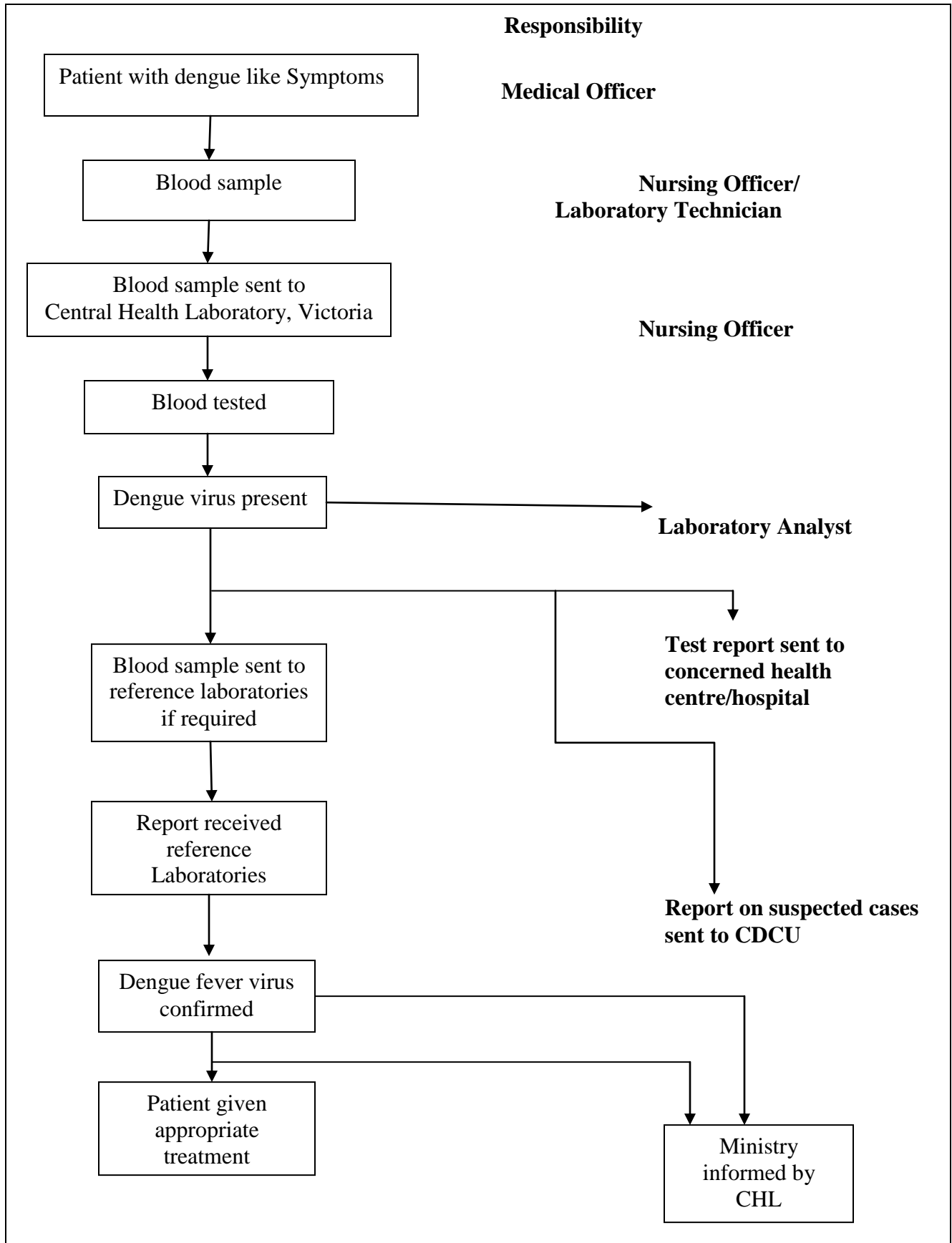


- Convalescent confluent petechiae rash

### **Criteria for Discharging Patients**

- Absence of fever for at least 24 hours without the use of anti-fever therapy
- Return of appetite
- Visible clinical improvement
- Good urine output
- Minimum of three days after recovery from shock]
- No respiratory distress from pleural effusion and no ascites
- Platelet count of more than 50,000/mm<sup>3</sup>

**Annex 8: Flow chart for management of Dengue**



#### **4. Mortality review**

To identify any preventable deficiencies during the pre-hospital or hospital course of management, mortality review to be held at institutional level.

**Annex 9: Sample Case Investigation Form For Viral Fevers**

**CHIKUNGUNYA  OR DENGUE  Or ZIKA**   
*(Click as appropriate)*

**1. IDENTIFICATION**

UNIQUE STUDY ID: -----

NAME OF CASE: SURNAME ----- NAME: -----

Age in years & in months: Year  Month  Sex: Male  Female

Health center where detected: -----

Residential Address : -----

Occupation: -----

Occupational Address:-----

**2. CLINICAL DATA**

- |                          |                          |                                  |                |
|--------------------------|--------------------------|----------------------------------|----------------|
| <input type="checkbox"/> | Fever                    | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Rash                     | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Conjunctivitis           | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Joint pains (arthralgia) | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Muscle pains (myalgia)   | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Retro-orbital pain       | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Headaches                | Date of onset: -----/-----/----- | ----- Duration |
| <input type="checkbox"/> | Neck stiffness/          | Date of onset: -----/-----/----- | ----- Duration |

disorientation/confusion/convulsion

Admitted  yes  no Date of Admission: -----/-----/-----

If yes, name of Health Institution or Hospital: -----

**EPIDEMIOLOGICAL DATA**

History of travel overseas: -----

Date of Departure: ----- Date of Arrival-----

Duration of travel: ----- countries visited: -----

Has there been another case in the same household having similar symptoms?

**3. LABORATORY DATA**

Blood sample taken?  Yes  No

Urine sample taken?  Yes  No

If yes, date of sample collection and sent to the laboratory: -----

Results of the blood samples: -----

Types of tests: ----- virus type: ----- date of results: -----

**VIRAL RESULTS**

	<b>Virus Type</b>	<b>Date of Results</b>
<input type="checkbox"/> ELISA for IgG	-----	-----
<input type="checkbox"/> ELISA for IgM	-----	-----
<input type="checkbox"/> PCR for viral genomes	-----	-----

**BLOOD RESULTS**

<input type="checkbox"/> Blood counts	-----	-----
<input type="checkbox"/> WBC -----	Platelets <input type="checkbox"/>	-----
<input type="checkbox"/> ESR -----	Hb <input type="checkbox"/>	-----

**4. DIAGNOSIS**

- Suspected
- Epidemiologically linked/contacts
- Laboratory confirmed

**5. OUTCOME**

- Alive and well
- Alive and hospitalized       Date of discharge: -----/-----/-----
- Dead
- Unknown
- Lost to follow

## ***Annex 10: Case definition of Zika virus infection***

### ***Suspected Case***

A suspected case is a patient presenting with rash and/ or elevated body temperature ( $t > 37.2\text{ }^{\circ}\text{C}$ ) with one or more of the following symptoms, not explained by other medical conditions:

- Non-purulent conjunctivitis or conjunctival hyperemia
- Arthralgia or Arthritis
- Myalgia

### ***Probable Case***

A probable case is a patient presenting with the above symptoms and having an epidemiological link, that is, contact with a confirmed case, or having a history of residing and or travelled to an area with local transmission of Zika virus within the last two weeks prior to onset of symptoms.

### **Confirmed case:**

A confirmed case is either a suspected or probable case with positive laboratory result of Zika virus by RT-PCR (Reverse Transcriptase Polymerase Chain Reaction).

## ***Annex 11: Management of the Zika cases***

Proper patient management is critical for limiting the spread of the Zika virus in the community at large. The strategy for management shall comprise of:

- Isolation of cases
- Clinical management

### ***Isolation of cases***

1. Patients suffering from Zika will be admitted and isolated under mosquito net.
2. Additional beds will be provided for in hospitals

3. Mosquito nets will be made available in all hospitals

During the first week of illness, several precautions will be taken to prevent the Zika infected person to be bitten by Aedes mosquitoes to prevent the transmission of Zika to other people. The Zika virus infected person will be placed under a bed net (treated or without insecticide) and will stay in a place with intact window/door screens. Furthermore the hospital staff will be advised to use insect repellents and wear long sleeves and pants to prevent being bitten by mosquitoes. The VBCD will also work to reduce the mosquito level around the residence of the confirmed case and the hospital where the case will be receiving treatment, (same as protocol for Dengue)

***Clinical Management of ZIKA cases***

Until now there is no specific treatment or vaccine for people infected with Zika virus. Therefore, the treatment for Zika is mainly symptomatic and supportive. The patient is advised to take rest and drink plenty of fluids.

Acetaminophen or paracetamol is recommended to relieve fever.

*The use of aspirin and ibuprofen is not advised due to the risk of bleeding and of developing Reye's syndrome in children. Antihistamines are used to relieve the patient of pruritus arising due to the macula-papular rash.*

Pregnant women suspected of having been exposed to Zika virus during the first or second trimester should be referred to a gynaecologist for advice and management., as outlined in Annex---

**Measuring possible sequelae associated with Zika virus disease**

Measures are put in place for the assessing the possible consequences of Zika virus infections by using existing baseline indicators for the two following conditions in Mauritius.

Microcephaly

Guillain Barre Syndrome



## ***Annex 12: Guidelines and Recommendations for the management of microcephaly***

Microcephaly is a condition where a baby's head is much smaller (less than 2 standard deviations or less than the 3<sup>rd</sup> percentile) than expected.

It can be an isolated condition, or it can occur in combination with other major birth defect.

It may be associated with other problems like

- Seizures
- Developmental delay
- Intellectual disability
- Hearing loss
- Vision problems

Microcephaly is not a common condition.

The incidence ranges from 2 per 10,000 live births to about 12 per 10,000 live births in the United States.

The causes of microcephaly in most babies are unknown.

It may be - Genetic

-Certain infections, like rubella, toxoplasmosis, or cytomegalovirus

-Severe malnutrition

- Exposure to harmful substances, such as alcohol, certain drugs, or toxic chemicals

Some babies with microcephaly have been reported among mothers who were infected with Zika virus while pregnant. Researchers are studying the possible link between Zika virus infection and microcephaly.

Diagnosis

During pregnancy, microcephaly can sometimes be diagnosed with an ultrasound, late in the 2nd trimester or early in the third trimester.

After birth, the head circumference, the largest diameter around the head also known as the occipito frontal diameter is measured during a physical exam. This measurement is compared to population standards by sex and age.

Microcephaly is defined as a head circumference that is smaller than 2 standard deviations (SDs) below the average for babies of the same age and sex.

Severe microcephaly is defined as a head circumference that is less than 3 standard deviations (SDs) below the average for babies of the same age and sex.

The head circumference may be taken when the baby is at least 24 hours old when compression due to delivery through the birth canal (molding) has resolved.

#### Treatments

Microcephaly is a lifelong condition. There is no known cure or standard treatment for microcephaly.

Because microcephaly can range from mild to severe, treatment options can range as well.

Babies with mild microcephaly often don't experience any other problems besides small head size. These babies will need routine check-ups to monitor their growth and development.

For more severe microcephaly, babies will need care and treatment focused on managing their other health problems.

Developmental services early in life will often help babies with microcephaly to improve and maximize their physical and intellectual abilities. These services include speech, occupational, and physical therapies.

#### RECOMMENDATION

A. Head circumference should be measured using standardized technique and equipment at least 24 hours after birth and within the first week of life.

B. Head circumference should be interpreted using SD scores specific for sex and gestational age.

C. WHO Growth Standards for term neonates and Intergrowth Standards for preterm neonates should be used.

Midwives and nurses should be trained to measure and interpret head circumference measurements according to these standards.

D. Neonates with a head circumference of less than -2 SD i.e. more than 2 standard deviations below the mean should be considered to have microcephaly

### ***Annex 13: Management of Guillain Barre Syndrome in the context of Zika virus***

WHO interim recommendations for the management of Guillain Barre Syndrome are being respected in Mauritius

1. Health care providers are well trained to recognize, evaluate and manage patients with GBS. Neurological examination skills and training in the acute management of GBS are being strengthened.
2. The Brighton criteria are being used for the case definition of GBS. Neurological examinations are being performed on all patients with suspected GBS. Lumbar puncture and CSF analysis are also being performed on all patients with suspected GBS. **Note:** CSF analysis for Zika Virus detection is also available in all hospitals.
3. Hospitals in Mauritius have well equipped ICUs, HDUs which can cater for cases of GBS which may require supportive care. The risk of death in patients with GBS associated with complications including respiratory failure, cardiac arrhythmias, and thrombosis; are kept very low. Optimal supportive care including frequent neurological assessments, vital sign and respiratory function monitoring are provided to patients with GBS.
4. Intravenous immunoglobulin therapy is provided to all patients with suspected GBS. Accesses to medications and training for their appropriate administration are available and free of charge in all public hospitals.
5. Hospital beds for patients with mild, moderate and severe manifestations of GBS are available, and patients with severe manifestations of GBS will receive optimal supportive care in HDUs and ICUs which are very well equipped.

### ***Annex 14: Recommendations on Breast Feeding in the context of Zika***

The World Health Organization (WHO) recommends that infants start breastfeeding within one hour of birth, are exclusively breastfed for six months, with timely introduction of adequate, safe and properly fed complementary foods while continuing breastfeeding for up to two years of age or beyond.

Current WHO breastfeeding recommendations remain valid in the current context of Zika virus transmission.

Mothers with suspected, probable or confirmed Zika virus infection, during pregnancy or postnatally, should receive skilled support from health care workers to initiate and sustain breastfeeding, like all other mothers.

Likewise, mothers and families of infants with suspected, probable or confirmed Zika virus infection should receive skilled support to adequately breastfeed their infants.

Mothers and families of infants born with congenital anomalies (e.g. microcephaly) should be supported to breastfeed their infants in line with WHO recommendations.

Feeding support by skilled breastfeeding counsellors should be provided, if required.

Breastfeeding has significant benefits for mothers and children, in low-and middle-income countries as well as high-income countries. Breastfeeding contributes towards sustainable development goals related to maternal and child health, nutrition, education, poverty reduction and economic growth.

Zika virus RNA has been detected in breast milk from two mothers with confirmed Zika virus infection, but no replicative virus was identified in cell culture.

The breast milk samples where Zika virus RNA was found were collected at a time when the mothers were RT-PCR positive for Zika virus in serum samples and had clinical disease.

There are currently no documented reports of Zika virus being transmitted to infants through breastfeeding.

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### ***Annex 15: Ensuring blood safety during zika epidemic***

ZIKA outbreak poses a problem to blood safety due to possible transmission of virus through blood. There have been few reported cases of ZIKA transmission through blood donation in Brazil and French Polynesia. The Rapid Risk Assessment document released by ECDC on 19<sup>th</sup> January 2016 states that:

- ZIKA Virus epidemic in Americas is likely to continue may spread
- Transfusion of ZIKA virus through blood transfusion may have serious consequences for the recipient.

In Mauritius so far no case of ZIKA has been reported. However, in the event that ZIKA virus is introduced in Mauritius, NBTS proposes the following protocol to prevent ZIKA transmission through blood transfusion:

#### **1. Donor Surveillance and Deferral:-**

- Defer any asymptomatic donor for 28 days with a history of recent (within 4 weeks) travel to ZIKA affected countries.
- Test the donors with recent travel to ZIKA affected countries for ZIKA Virus RNA.
- Defer a donor suffering from symptomatic ZIKA infection for six months after recovery.
- Counsel the donors

#### **2. Donors to Inform BTS:**

Donors, who develop symptoms of ZIKA virus infection within a week following their blood donation will be asked to inform Blood Transfusion Service (In such cases, the blood pint will be rejected as it is intended, as far as possible, to “quarantine” blood collected for a period of one week before release for transfusion).

Donors shall be provided with telephone numbers of NBTS and Blood Collection Centres at regional hospitals.

#### **3. Screening of Blood Donors**

All blood units / units intended for transfusion to pregnant women will be screened for ZIKA Virus.

#### **4. Clinical Use of blood and strengthening of Hemovigilance:**

As ZIKA Virus may be transmitted through blood transfusion, in view of a blood unit being collected from donors with asymptomatic infection and which may potentially infect the blood recipients, **clinicians should be advised to refrain from unnecessary transfusions.** They should also report to NBTS Candos, if they come across, any incident of Microcephaly or GBS in patients with a recent history of blood transfusion.

**Public Health Surveillance unit will update the NBTS of countries affected by ZIKA Virus on a regular basis**

### DONOR INFORMATION ON ZIKA VIRUS

ZIKA Virus is mostly transmitted through the bite of an infected mosquito, *Aedes aegypti*, same mosquito which also transmits Chikungunya and Dengue. However in affected countries there have been some reports of the virus being transmitted through blood transfusion and sexually.

There have been reports that ZIKA Virus can cause babies to be born with small head and mental retardation if a pregnant woman is infected. Also it may cause paralytic disorder in those who are infected.

Transmission of ZIKA virus through an infected blood can therefore have serious consequences for the person receiving this blood.

In view of above, we kindly ask you to answer the following questions, in order to ensure blood safety

Yes                  No

1. Have you visited any of the following countries in past four weeks        

2. Have you had any sexual contact with a person who is a resident of these countries or visited these countries in the past four weeks

According to CDC, as at 02 December 2016 the countries and territories with autochthonous transmission of Zika are Anguilla, Antigua, Argentina, Aruba, The Bahamas, Barbados, Barbuda, Belize, Bolivia, Bonaire, Brazil, British Virgin Islands, Cayman Islands, Colombia, Commonwealth of Puerto Rico, Costa Rica, Curacao, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Monserrat, Nicaragua, Panama, Paraguay, Peru, Saba, Saint Barthélemy, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, Sint Eustatius, Sint Maarten, St Kitts and Nevis, Suriname, Trinidad and Tobago, Turks and Caicos, United States U.S. Virgin Islands, Venezuela, American Samoa, Fiji, Kosrae, Federated States of Micronesia, Marshall Islands, New Caledonia, Papua New Guinea, Samoa, Singapore, Tonga and Cape Verde.

### ***Annex 16: Guidelines on Larval Surveys***

These surveys could be carried out by the Vector Biology and Control Division of the Ministry.

- 2.1 These surveys could be to identify the presence of mosquito larvae in already identified types of containers in vulnerable areas and to quantify the number of such breeding sites. These surveys would not require the identification of vector species present and may be carried out by teams made up of a Health Surveillance Officers and two or more spray machine operators/General Workers.



### ***Annex 17: Methodology of surveys by Entomological Teams***

- A minimum of 100 houses should be surveyed within a radius of 200 – 300 meters at the sites selected. Factors that could help in identifying these sites are;
  - a. Localities in which previous dengue outbreaks have been reported
  - b. Localities with known potential for high vector breeding
  - c. Localities from which several dengue cases are being reported.
- During surveys receptacles should be visually examined for evidence of vector larvae, pupae or eggs. All receptacles should be checked using dipping or siphoning techniques. At each premises the name of occupant or establishment, address, types of containers with water collections, no. of larvae and pupae collected should be documented. This data may be entered into a format shown at annex 10 & 11. All collected larvae and pupae should be identified by Entomological Technicians into species. Teams should help occupants to modify or destroy breeding sites and educate the community on how to minimize dengue vector breeding.

### ***Annex 18: Indices used for pupal surveys***

The rate of contribution of newly emerged adults to the adult mosquito population from different container types can vary widely. The estimation of relative adult production based on pupal counts (counting all pupae found in each container) will help to identify the most productive containers which will be important for the control programme. The corresponding index is the pupal index.

**Pupal Index (PI):** No. of pupae per 100 houses

$$\text{PI} = \frac{\text{No. of pupae} \times 100}{\text{No. of houses inspected}}$$

#### **2.5 Activities to be undertaken by surveillance teams during vector surveillance –**

These surveillance units can be organized in the following manner.

This unit should consist of one Senior Health Surveillance Officer, 9 Health Surveillance Officers, 3 General Workers, 4 Insecticide Sprayer man and two drivers for each team.

For the time being there should be three units for the island.

2.6 A regional surveillance and intervention team attached to the regional Health Offices should follow the activities initiated by the above team.

- i. Possible risk areas should be identified and prioritized.
- ii. One surveillance unit should survey 50 houses per day.

- iii. Duration of one round should be within 10 days. (that means each house is surveyed twice a month)
- iv. Health education should be given to the occupants of the houses with *Aedes* positive breeding places for elimination /reduction of breeding places
- v. The team can help the occupants on the houses to eliminate the breeding places
- vi. When necessary larviciding could be carried out in the area

## ***Annex 19: Guidelines for use of chemicals for vector control***

### **Fogging**

**Objective of Fogging:** To reduce the adult female population and its longevity as quickly as possible as a supplementary measure for source reduction during outbreaks of dengue.

### **Fogging treatments**

#### **Organization of the fogging team as per existing SOP**

A fogging team should consist of one Public Health Inspector and three hot fog generators.

- The Health Inspector is responsible for one fogging team which is constituted as follows: 2 Hot fog generator with 2 helpers or a man power of 3 Hot fog generators with 3 helpers.
- All persons involved in fogging operation must wear personal protective equipments overalls, protective gloves, suitable respirator, ear plugs, goggles, and boots.
- Filter of the respirator must be periodically changed.

### **Pre Fogging activities**

The steps listed below are to be followed in carrying out the fogging of a designated area.

- The maps of the area to be fogged must be studied carefully before the spraying operation begins.
- The area covered should be at least 200 metres within the radius of the house where the dengue case was located.
- Residents should be warned before the operation so that food is covered, fires extinguished, and pets are moved out together with the occupants.
- The most essential information about the operation area is the wind direction. Fogging should always be done with back in the direction of wind.

**Information to be given to inhabitants 17 00 to 20 00 (if required)**

- Time of spraying, for example 17 30 to 20 00 hours.
- All doors and windows should preferably be opened.
- Dishes, food, fish tanks, and bird cages should be covered.
- Stay away from open doors and windows during spraying or temporarily leave the house and/or the sprayed area until the spraying is completed.

To ensure proper quality of spraying the factors should be considered.

**1. Optimum fogging conditions**

- Fogging should be done in the early morning and at sunset as adult *Aedes* mosquitoes are most active at these hours.

- Fogging should not be done in the middle of the day, when the temperature is high as convection currents from the ground will prevent concentration of the spray close to the ground where adult mosquitoes are flying or resting, thus rendering the spray ineffective.
- Fogging should be carried out in steady winds (3-13 km/hr) while it shouldn't be carried out in strong windy conditions (>13km/hr).
- In heavy rain, spraying should be stopped and the spray head of the ULV machine should be turned down to prevent water from entering the blower.
- Fogging is ineffective in rainy period.

**Timing of application**

Spraying should be carried out only when the right weather conditions are present and usually only at the prescribed time. These conditions are summarized below.

Most favorable conditions	Average conditions	
Time	Early morning (0600*-0800 hrs) or late evening (1800-2000 hours)	
Wind	Steady, between 3-13 km/hr	0-3 km/hr
Rain	No rain	
Temperature	Cool	

## **Frequency of application**

The commencement and frequency of fogging generally recommended is as follows:

- fogging should be started in an area (residential houses, offices, factories, and schools) as soon as possible after a suspected DF/DHF case from that area is reported.

Fogging should not be carried out if a period of over 2 weeks has lapsed since the case was detected, if no secondary cases have been reported.

- At least two treatments should be carried out within each breeding cycle of the mosquitoes (seven to ten days for *Aedes*). Therefore, a repeat spraying should be carried out within seven to ten days after the first spraying.

## **Hand operated (Portable) thermal fogging**

- Thermal fogging with hand operated thermal foggers should be done from house to house, always fog with wind on the back.
- All windows and doors should be shut for half an hour after the fogging to ensure good penetration of the fog and maximum destruction of the target mosquitoes.
- In single-storey houses, fogging can be done from the front door or through an open window without having to enter every room of the house. All bedroom doors should be left open to allow dispersal of the fog throughout the house.

- In multi-storey buildings, fogging should be carried out from upper floors to the ground floor and from the back of the building to the front to ensure the good visibility of the operator along his spraying path.
- When fogging outdoors, it is important to direct the fog at all possible mosquito resting sites, including hedges, covered drains, bushes, and tree-shaded areas.
- The most effective type of thermal fog for mosquito control is a medium/dry fog, i.e. it should just moisten the hand when the hand is passed quickly through the fog at a distance of about 2.5-3.0 meters in front of the fog tube. Adjust the fog setting so that oily deposits on the floor and furniture are reduced.

## **Back pack aerosol spraying with ULV attachments**

### **House spraying technique**

- Stand 3-5 meters in front of the house and spray for 10 to 15 seconds, directing the nozzle towards all open doors, windows and eaves. If appropriate, turn away from the house and, standing in the same place, spray the surrounding vegetation for 10 to 15 seconds.
- If it is not possible to stand three meters from the house due to the closeness of houses and lack of space, the spray nozzle should be directed towards house openings, narrow spaces and upwards.
- While walking from house to house, hold the nozzle upwards so that particles can drift through the area. Do not point the nozzle towards the ground. In multi-storey houses spraying is carried out inside the houses.
- Spray particles drift through the area and into houses to kill mosquitoes which become irritated and fly into the particles. The settled deposits can be residual for



several days to kill mosquitoes resting inside houses and on vegetation not exposed to the rain.

- This technique permits treatment of a house with an insecticide ranging from 1 to 25 grams in one minute. The dosage depends on the discharge rate, concentration of insecticide applied, and time it takes to spray the house.

### **General Considerations**

To obtain correct dosage calibration of a machine should be done periodically, usually after 25 hours of operation, or at any time when major maintenance is performed. Machines should be calibrated in a way to ensure adherence of following parameters;

#### **1. Optimum droplet size:**

Optimum droplet size should be 10-30  $\mu$ m. Teflon coated slides should be used to measure the droplet size of thermal fogging. Where water has been used to dilute the spray, water sensitive papers stripes can be used to collect droplet for sizing. Treating the water-sensitive paper with ethyl acetate will make the stains more permanent.

#### **2. Flow rate:**

When using hand operated thermal fogging machine, at a walking speed of 60 meters per minute, and with track spacing of 10 meters, 600 m<sup>2</sup> can be sprayed in one minute. For an application rate of 0.5 litre per hectare, the flow rate must therefore be 30 ml/minute (500 ml – 0.06) calibrate.

Measurement of flow rate can be carried out by either

DRAFT PLAN OF ACTION FOR DENGUE CONTROL IN MAURITIUS

- i. marking the level on the tank, then to spray for one minute and measure the volume of liquid needed to fill the tank back to the mark.

or

- ii. Adding a measured volume of an insecticide, spray until the tank is empty and time how long it takes to spray the liquid.

## **Flow rate for vehicle mounted thermal foggers**

### **Outdoor applications**

To calculate the output rate of vehicle-mounted equipment, following formula can be used.

$$\text{OUT PUT RATE (m}^2\text{/minute)} = \text{Vehicle speed (m/hour) X width of the track spacing (m)}$$

$$10,000 \text{ m}^2 = 1 \text{ hectare}$$

If the insecticide label recommends an application rate of 0.5 litre of UL formulation per hectare, the flow rate must be adjusted to deliver 0.5 litre per minute.

### **For ULV fogging machine**

#### **Indoor applications**

Time required for spraying a house can be calculated using the following formula:

$$\text{Target application rate (ml/hectare) X area of the house (hectare)} \\ \text{flow rate (ml/min)}$$

## **2. Spray concentration**

The WHO recommended targeted amount of active ingredient per unit area must remain within the specified range given below. Susceptibility/resistance levels of the recommended insecticide target species should be monitored regularly.

**Insecticides suitable as cold aerosol sprays and for thermal fogs for mosquito control**

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<b>Insecticide</b>	<b>Chemical<sup>a</sup></b>	<b>Dosage of air.<sup>b</sup> (g/ha)</b>	
<b>Cold</b>		<b>Thermal</b>	
Deltamethrin	PY	0.5 – 1.0	-

<sup>a</sup> PY = Synthetic pyrethroid, OP = organophosphorus,

<sup>b</sup> ai. = active ingredient

Source: WHO (1997), WHO/CTD/WHOPES/97.2

## ***Annex 20: Evaluation of epidemic spraying***

Epidemic spraying can be evaluated using the following indicators

### **I Parous rate:**

A parous rate of 10% or less in comparison to a much higher rate before spraying indicates the effectiveness of spraying

However, a low parous rate after spraying can occur in the absence of a marked reduction in vector density. This can be attributed to the emergence of a new population of mosquitoes which escaped the spray.

### **II Reduction in hospitalized cases**

A reduction in hospitalized cases after the incubation period of the disease in humans (about 5-7 days) has elapsed indicates the effectiveness of spraying.

### **Use of Larvicides for Dengue Vector Control**

Themephos 50 E.C to be used 8.5 ml/ gallon.

**1 cubic meter = 1000 litres**

**Annex 21: Form for Weekly Programme of Larviciding**

Weekly Program of work - LARVICIDING EXERCISE

Health Office:

DAY	TEAM A	TEAM B	TEAM C	TEAM D	TEAM E
	Team Leader:	Team Leader:	Team Leader:	Team Leader:	Team Leader:
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

***Annex 22: Form Program of work - Fogging***

**Program of work - FOGGING EXERCISE**

Health Office:

Date/Time	Manpower	Region to be covered/ Sector/ Blocks	Remarks

**Annex 23: Form: Daily report on Fogging**

**Ministry of Health & Wellness**

**Daily Return of Fogging Exercise for .....**

Health

Office:

Date	Time	Region Covered Sector/Block	No of Premises treated	Wasteland Treated	Health Institutions/Schools Treated	Amount of Insecticide Used		Used (L)	Used	Principal Health Inspector	Manpower								
						K-Othrine ml	Nebol Lts				Inspector	Inspector	Timekeeper	Gangman	Sprayer man	Worker	Driver	SMF	



**Annex 24: Form: Entomological Investigation**

**ENTOMOLOGICAL INVESTIGATIONS 20....**

**..... DISTRICT**

**DENGUE VECTOR (Aedes) LARVAL SURVEY**

Locality:- .....Name of EA.....

MOH Area: - .....

Date of Investigation: - .....

Name and Address of Patient: - .....

Sn	Ass No	House Holder's Name and Address	BREEDING PLACES											Results and Remarks			
			Type of Container	In/Out	Water			+ ve	Species		No. of pupae						
					+	-	volume		A	B	No.	A	B				
				I/O													
				I/O													
				I/O													
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				I/O															
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				I/O															

**Annex 25: Form: Daily Entomological Report**

ENTOMOLOGICAL INVESTIGATION 200...

Report of Larval Surveys

..... District

Locality: - .....

MOH Area:-.....

Date: - .....

Name of Patient: - .....

Address: - .....

Type of Premises	No. Examined	No. Positive for Ae. Aegypti (A) and Ae. Albopictus (B)				
Houses						
Commercial Sites						
Government Institutions						
Dumping Yards						
Building Sites						
Others (Specify)						

Summary of containers

Type of container	No. Examined	No. positive for Aedes aegypti (A) and Ae. Albopictus (B)				
		A	B	AB	A	B
<b>INDOOR</b>						
Flower vases						
Water Storage tanks						
Water Storage Barrels						
Discarded receptacles						
<b>OUTDOOR</b>						
Tyres						
Water Storage Tanks						
Water Storage Barrels						
Discarded receptacles						

DRAFT PLAN OF ACTION FOR DENGUE CONTROL IN MAURITIUS

Ornamental						
Natural plants						
Roof gutters						
Others (specify)						

Index	A	B	AB
House Index			
Container Index			
Breauteu Index			

Recommendation by the Regional Medical / Malaria Officer: -----  
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 -----  
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.....

RMO/District

***Annex 26: Form: Daily report on Larviciding***

**Ministry of Health & Wellness**

**Daily Return of Larviciding Exercise for .....**

Health Office:

Date	Team	Region Covered	Sector/Block	No of Premises Visited	No. of Potential breeding places treated with Abate					Health Institutions/Schools Treated	Qty of Abate used (MI)	Sprayer man / General Worker	SMF
					Roof	Pool	Cistern/ Drum	Canals	Rivers				

## ***Annex 27: Management of Pregnant Women for Zika Virus Disease***

In order to have a better surveillance of pregnant woman in the context of Zika Virus infections, it is advised that all obstetricians/gynaecologists follow such guidelines for uniformity of action.

### **Antenatal Follow-up**

1. Counselling of pregnant woman in terms of protection against mosquito bite.
  2. To stay away from any person travelling from high risk country with fever.
  3. To immediately report if had fever following contact with a person who had any history of travel from a high risk country.
- During any ultrasound screening to already mention the gestational age and the ultrasound findings in relation to measurement.
  - To inform if any patient with ultrasound findings where Head circumference and biparietal diameter is smaller than gestational age where other parameters are within normal.
  - To have blood investigations done in case of discrepancy noted on ultrasound screening.
  - To inform any case post-delivery if Microcephaly has been noted or any substantive anomaly noted after delivery.
  - To have a set protocol on the investigations needed to state the reason for any anomaly.
  - To have a retrograde assessment on exposure history for patient where any anomaly noted post-delivery.