

# Dengue & Japanese Encephalitis

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# Introduction

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- ▶ Both belongs to Flaviviridae family (Genus - Flavivirus)
    - ▶ Tick borne
    - ▶ Arthropod borne
    - ▶ Viruses with no identified arthropod vectors
  - ▶ Both are mosquito borne, No patient to patient transmission (vertical transmission??)
  - ▶ Both pathogenic to human
  - ▶ Both doesn't have treatments. Supportive care only (if get infected)
  - ▶ Both are notifiable diseases in Sri Lanka
  - ▶ Both can be prevented by vaccines
    - ▶ JE - EPI
- 
- ▶ ▶ Sri Lanka is in the high risk/ endemic maps



Dengue



# Dengue

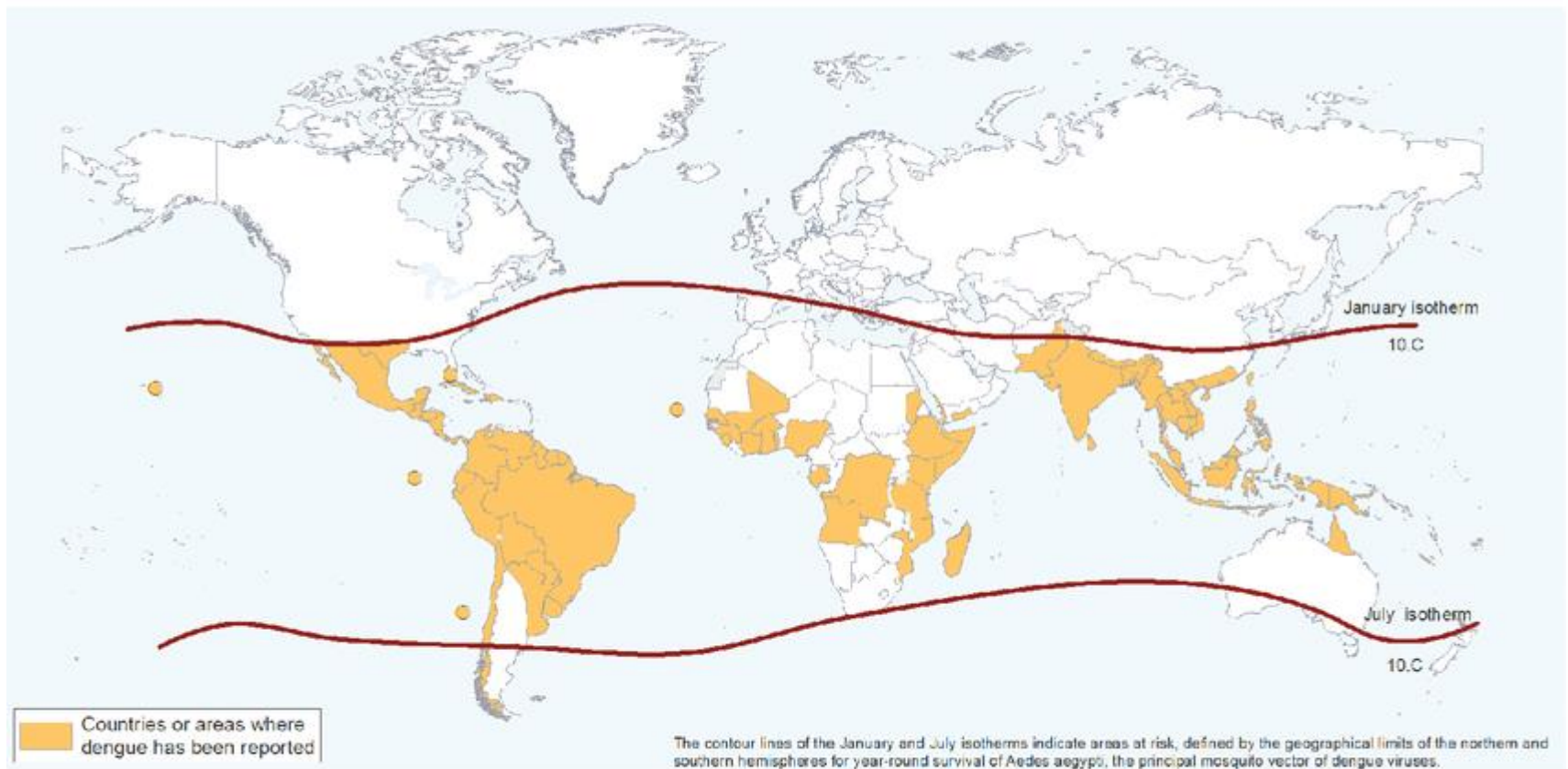
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## ▶ History

- ▶ The first record of a case of probable dengue fever is in a Chinese medical encyclopaedia from the Jin Dynasty (265–420 AD) which referred to a “water poison” associated with flying insects
- ▶ The first recognized Dengue epidemics occurred almost simultaneously in Asia, Africa, and North America in the 1780s, shortly after the identification and naming of the disease in 1779.
- ▶ The first confirmed case report dates from 1789 and is by Benjamin Rush, who coined the term "breakbone fever" because of the symptoms of myalgia and arthralgia.
- ▶ The first epidemic of dengue hemorrhagic fever (DHF) was described in Southeast Asia, Manila in 1953. After that, outbreaks of dengue fever became more common

# Dengue...

## Dengue, countries or areas at risk, 2013



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.


Data Source: World Health Organization  
Map Production: Health Statistics and  
Information Systems (HSI)  
World Health Organization



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# Dengue...

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- ▶ Sri Lankan history
    - ▶ 1962 1st reported (Sero confirmed)DF case - (Western province)
    - ▶ 1967 1st reported Epidemic - 29 cases / 8 deaths
    - ▶ 1990 resurgence – 440 cases / 11 deaths
    - ▶ 1997 335 cases / 17 deaths
    - ▶ 1999 669 cases / 14 deaths
    - ▶ 2000 Dramatic increase (5213 cases / 37 deaths)
    - ▶ 2001 8931 cases / 64 deaths
    - ▶ 2003 4805/32 deaths
    - ▶ 2004 15463 / 88 deaths (Mortality < 1%)
    - ▶ 2005 5994 / 27 deaths
    - ▶ 2006 11980/48 deaths
    - ▶ 2007 7332/25 deaths
    - ▶ 2008 6607/24 deaths
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# Dengue...

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- ▶ Sri Lankan History...
  - ▶ 2009 -35,095/346 deaths
  - ▶ 2010 -34,188/229 deaths
  - ▶ 2011 -28,140/185 deaths
  - ▶ 2012 -
  - ▶ ...
  - ▶ ...
  - ▶ 2017 - 186,101 /440 Deaths !!!



# Dengue...

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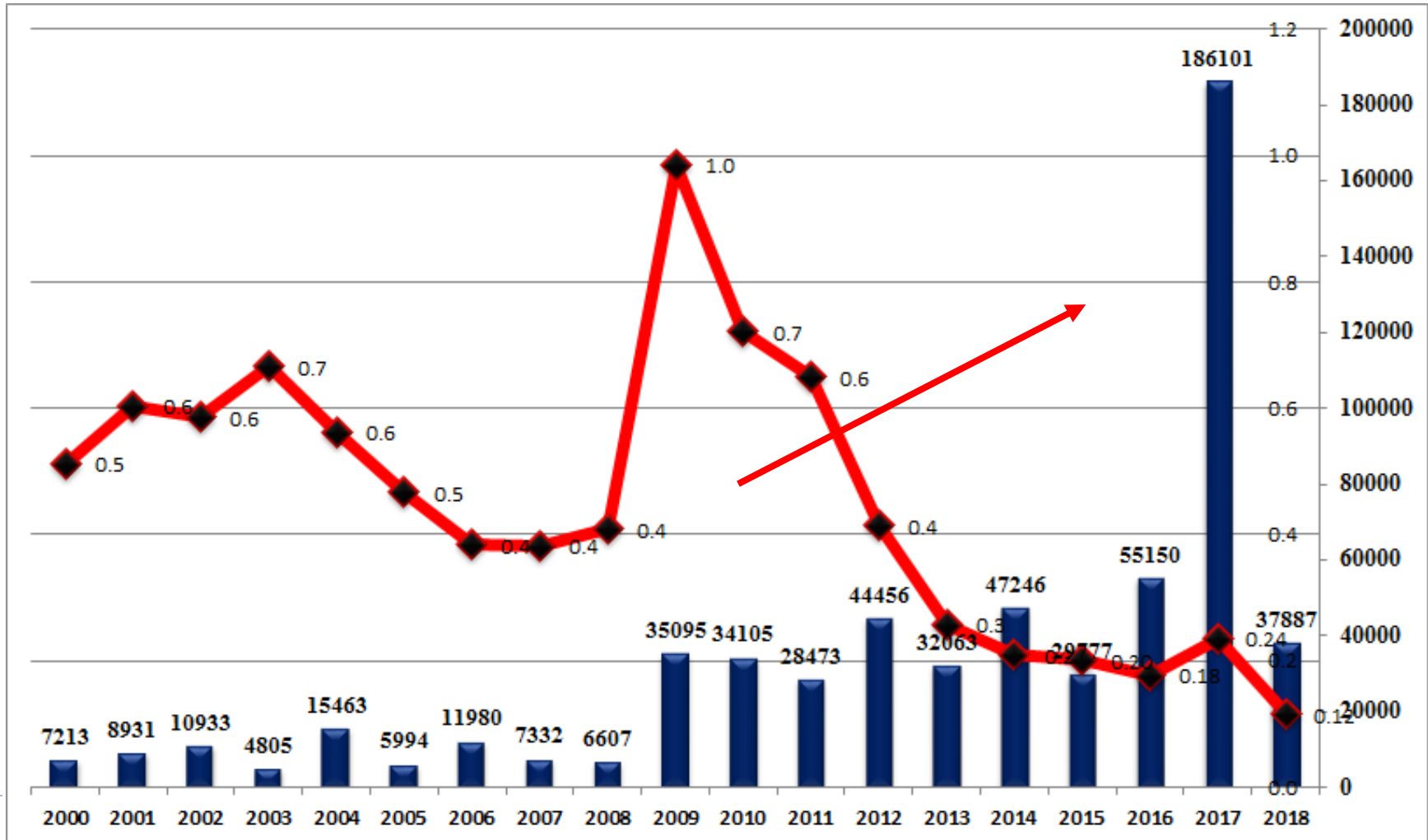
- ▶ Reasons for Dengue epidemic situation
  - ▶ Improper ,unplanned urbanization – High population density in urban areas
  - ▶ Poor solid waste management and increase of using non-degradable containers
  - ▶ Non continuous water supply
  - ▶ Increase of vector mosquito density and distribution
  - ▶ Lack of proper mosquito control
  - ▶ Increase population migration within the country.  
(Increase spreading of virus and vectors )
  - ▶ Lack of public participation and coordination among different institutions





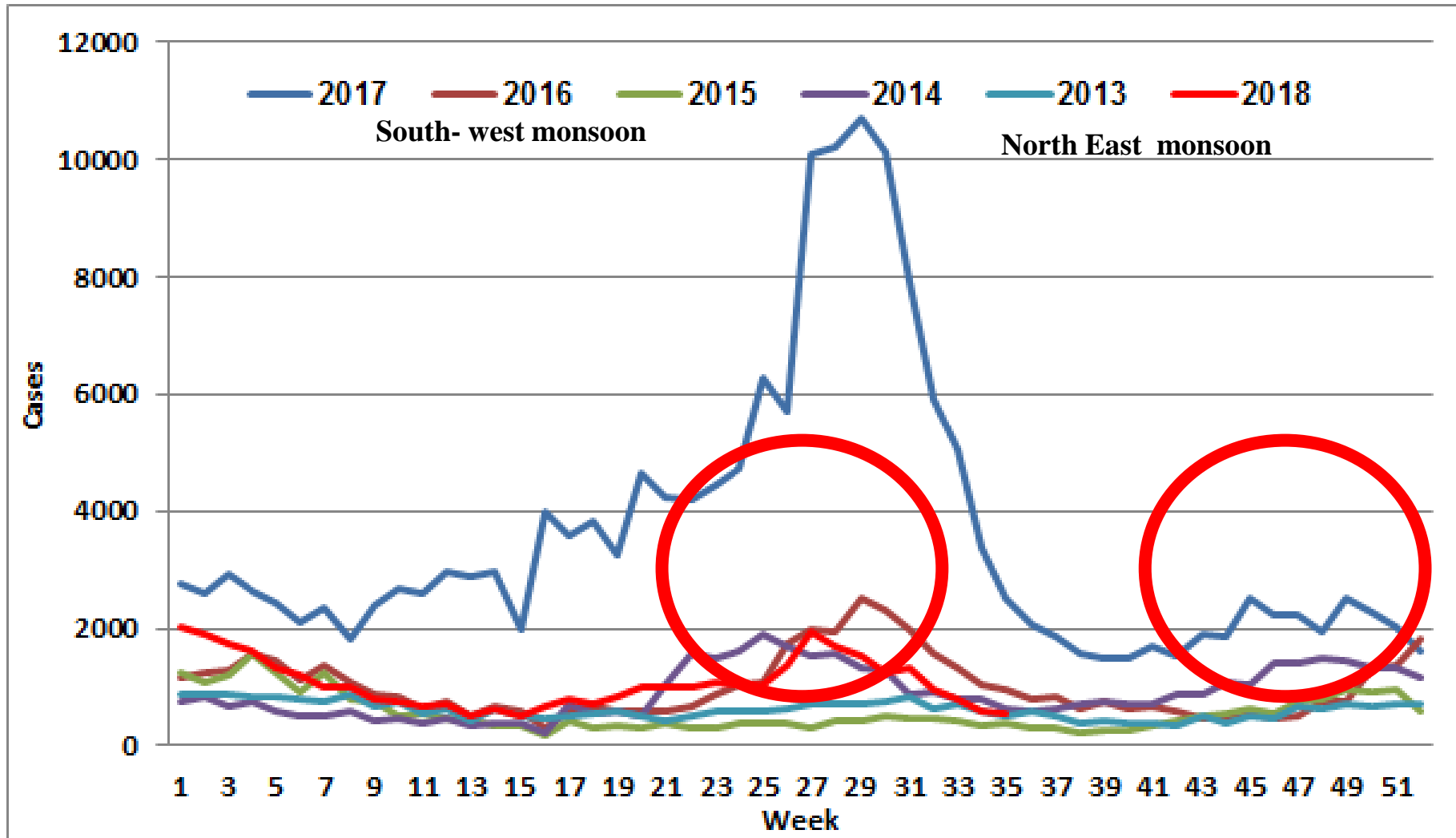
# Dengue...

## ► Trends

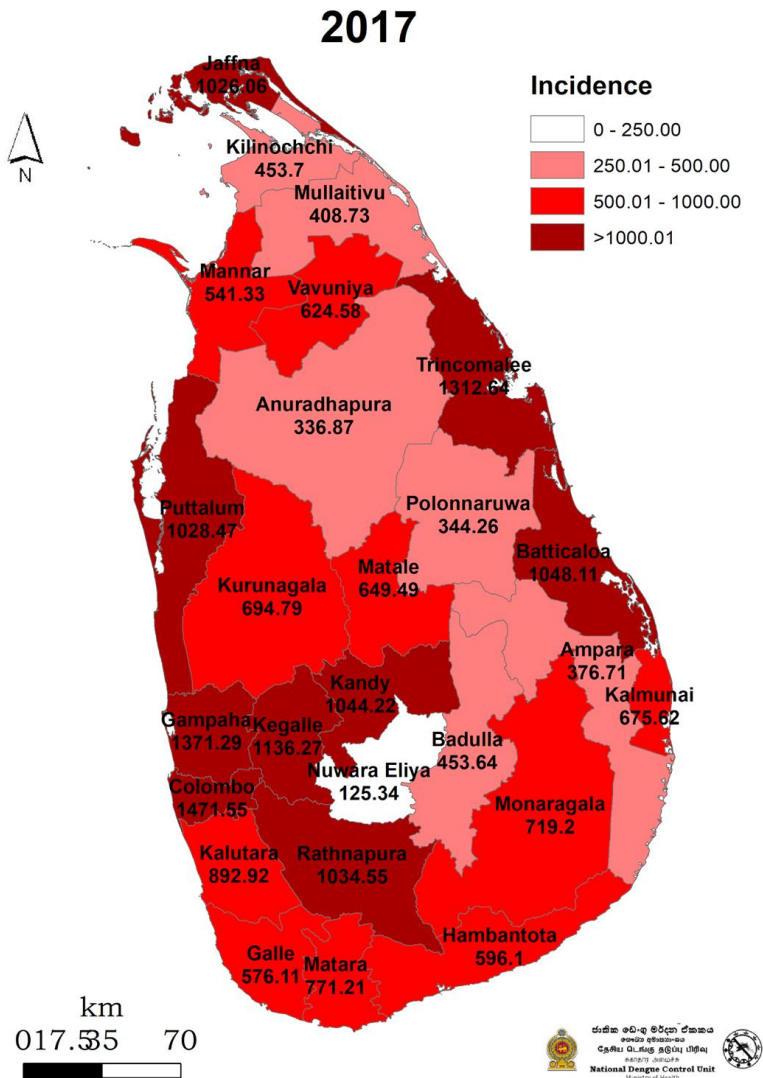


# Dengue -Seasonality

## ► Seasonality



# Dengue...

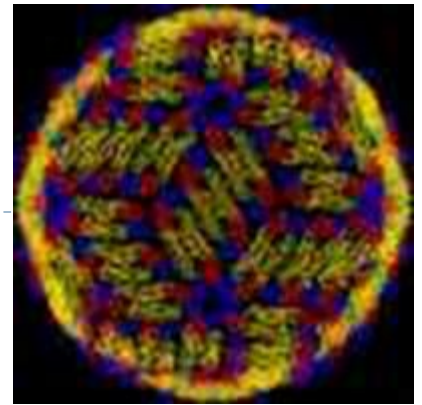


## 2017

- ▶ Overall national incidence was 865.9 per 100,000
- ▶ Western province had the highest followed by Sabaragamuwa province (1,263.5 and 1,027.66 per 100,000 respectively)
- ▶ North central province had the lowest 319.57 per 100,000

# Dengue...

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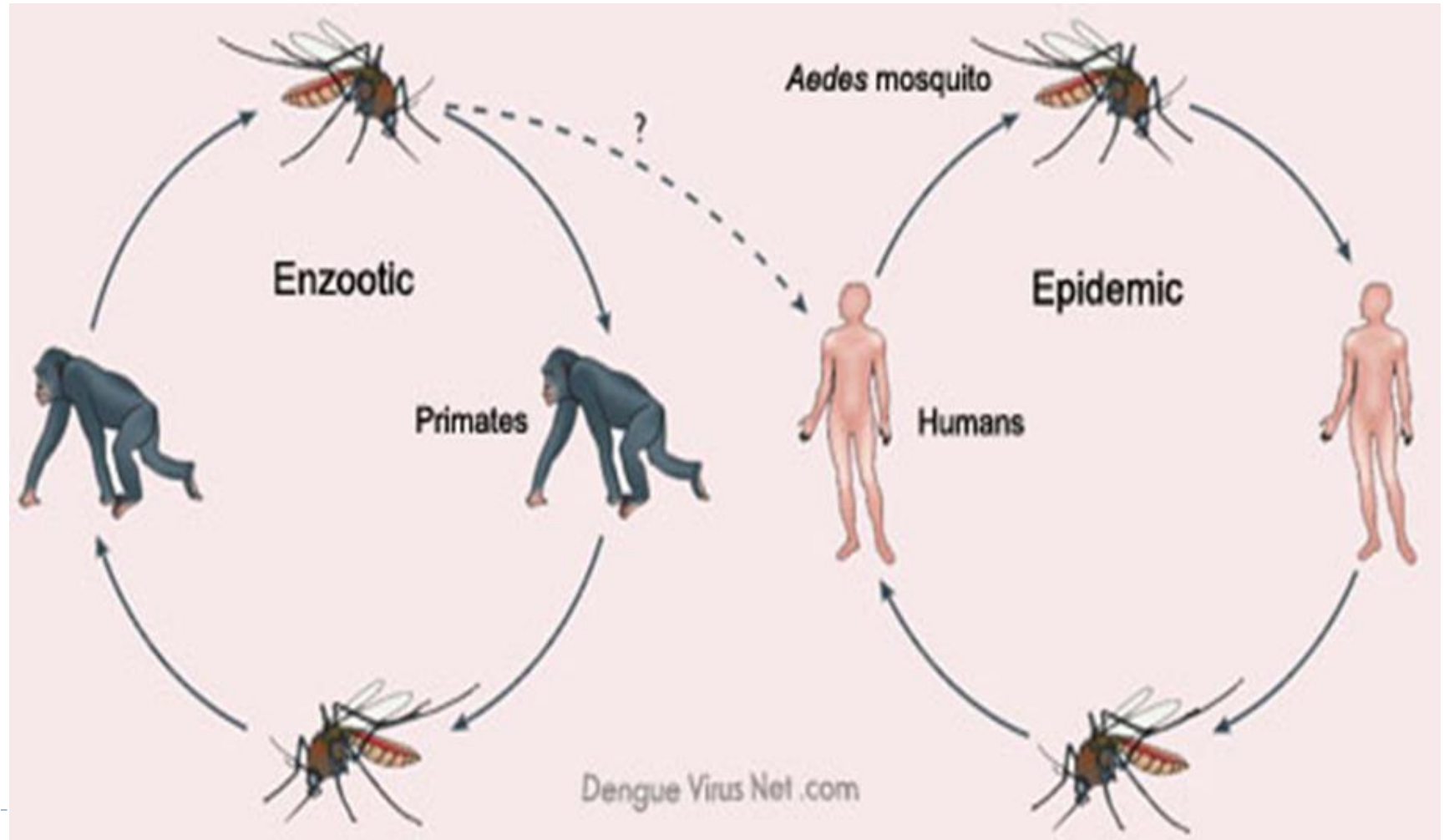
## ► Dengue Virus...

- Dengue virus is the cause for Dengue Fever and Dengue Haemorrhagic fever
- Humans get the virus from the female *Aedes aegypti* and *A.albopictus* mosquito species
- Dengue virus has 4 subtypes (V 1,2,3 & 4 )
- One subtype cannot infect a person for the second time
- But the remaining other subtypes can infect the same person
- Therefore, theoretical risk of getting Dengue for 4 times during their lifetime



# Dengue...

## ► Transmission



# Dengue...

## ► Transmission



**1. Female Mosquito bites infected human and contracts the virus.**

**2. Female mosquito bites and infects another human and begins to replicate.**

**3. Virus infects white blood cells and lymphatic tissues.**

**4. The virus is released and circulates into the blood.**



# Dengue...

## ► Transmission..



**5. Virus get into the other mosquitoes when biting infected humans**

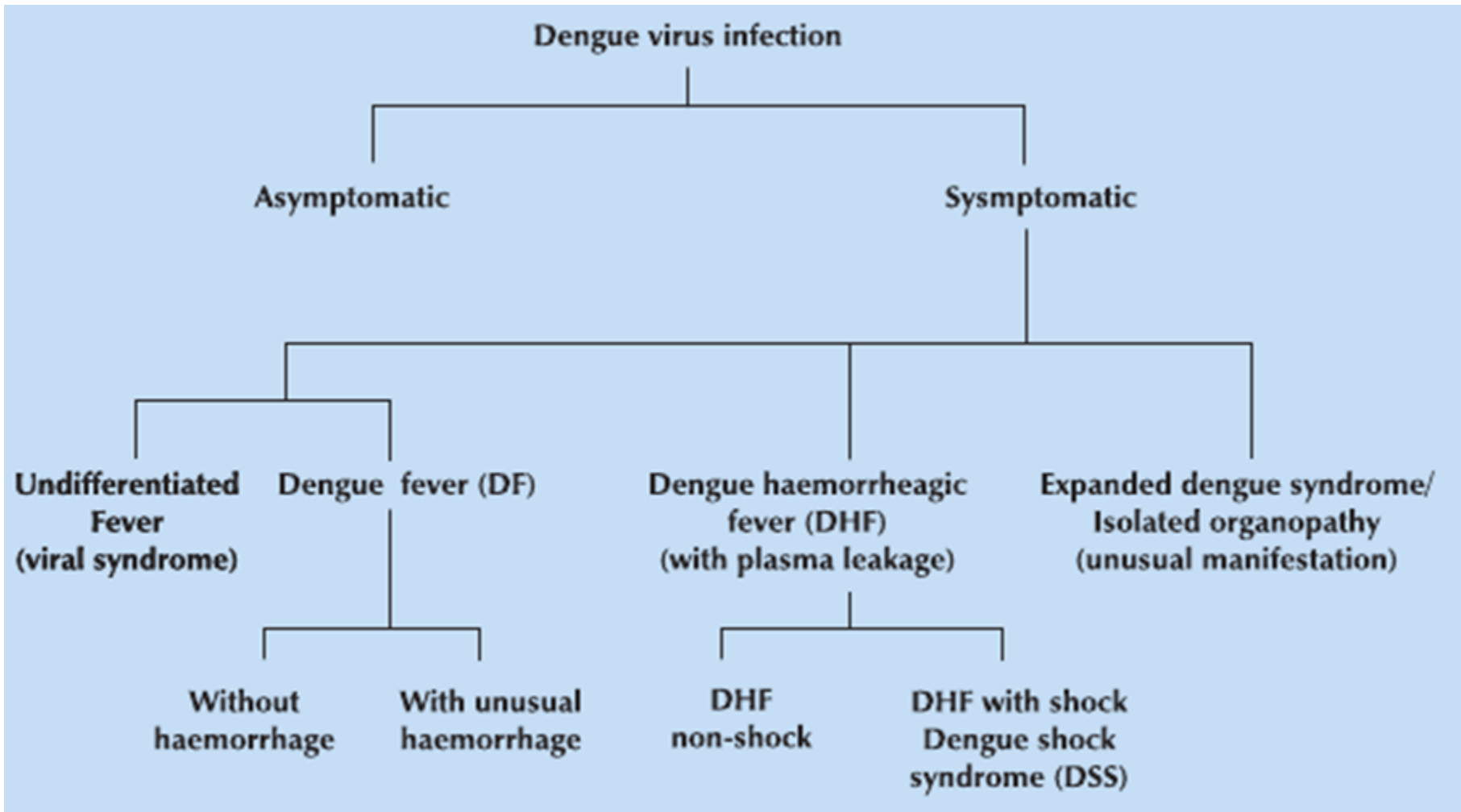
**6. Virus grows inside the mosquito gut and infect the salivary glands of the mosquito**

**7. The virus get into a human being via mosquito bites .This occurs in a cyclical manner. (8-12 days)**

# Dengue...

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- Spectrum of symptoms





# Dengue...

## *Aedes* life cycle

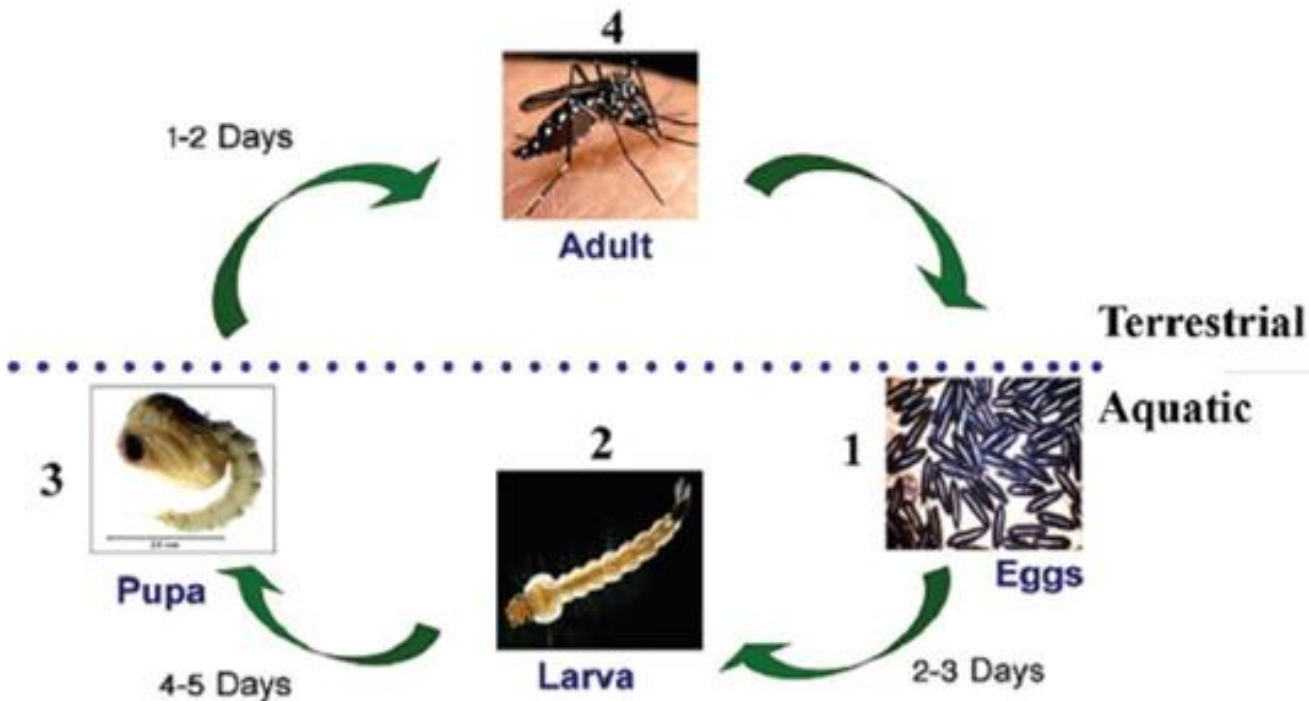


Fig. 2.1. Life cycle of the dengue vector (7 – 10 days)

## ▶ Life cycle...

- ▶ Single female lays about 100 eggs (3-4 cycles in life)
- ▶ Eggs can withstand long period (tolerant to extreme weather conditions)
- ▶ Transovarial transmission ???

# Dengue...

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- ▶ National Dengue Control Programme



# Dengue...

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## ► Expected outputs

- ◉ Strengthen surveillance system of DF/DHF
- ◉ Strengthen dengue vector surveillance and control activities
- ◉ Improve DF/DHF case management
- ◉ Enhance community participation for sustainable DF/DHF control and prevention programme
- ◉ Enhance outbreak response
- ◉ Enhance inter- sectoral collaboration
- ◉ Strengthen dengue control and prevention activities at National, provincial, district and divisional levels

# Dengue...

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- ▶ Integrated Vector Management(IVM)
  - ▶ Dengue Vectors in SL

*Aedes aegypti*



*Aedes albopictus*





# Dengue...

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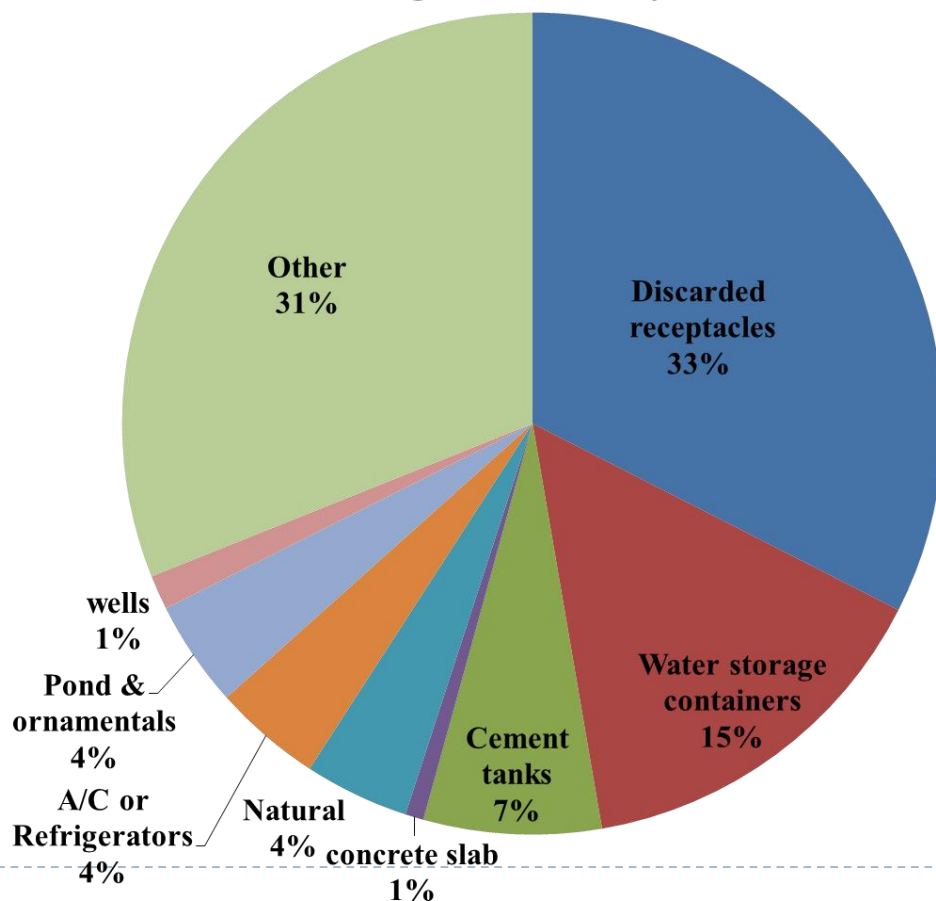
- ▶ Key Elements of IVM strategy
  - ▶ Advocacy, social mobilization and legislation
  - ▶ Inter and intra- sectoral collaboration (collaboration within and outside the health sector)
  - ▶ Integrated approach - Ensure rational use of available resources, integrate non-chemical and chemical vector control methods, use of a range of interventions, often in combination and synergistically
  - ▶ Evidence-based decision making
  - ▶ Capacity-building
- ▶ Vector management consists of two components
  - Vector Surveillance
  - Vector Control



# Dengue...

## ► Vector surveillance

**Breeding Summary 2016**



1.Eggs

2.Larval

3Pupa

4.Adults

5.Other - Insecticide resistance monitoring, etc.

## Larval indices

1.Premise Index

2.Container index

3.Breteau Index

# Dengue...

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- ▶ Vector control Activities
  - ▶ Environmental Management (Environmental modification, Environmental manipulation and changes to human habitation or behaviour)
  - ▶ Biological methods (Larval control)
  - ▶ Chemical methods (Larval control and Adult control)
  - ▶ Integrated vector management
  - ▶ Intersectoral coordination and social mobilization
  - ▶ Enforcement of law against offenders



# Dengue

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## ▶ Vector control Activities

- ▶ Environmental Management - change the environment to prevent or minimize vector breeding and/or man vector mosquito contact by destroying, altering, removing or recycling containers that produce larval habitats
- ▶ Environmental Modification -Permanent or long lasting physical transformation of vector breeding sites in order to eliminate/ reduce vector larval habitats. Eg: Provision of reliable water supply to the community in order to prevent water storage
- ▶ Environmental Manipulation -Temporary changes to vector breeding habitats to prevent/ minimize vector breeding  
.e.g. • Frequent emptying and cleaning by scrubbing of water storage tanks, barrels and other containers, flower vases, refrigerator trays



# Dengue...

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- ▶ Changes to human habitations or behaviour-
  - ▶ Installing mosquito proof screens on windows, doors and other entry points
  - ▶ Use of mosquito nets while sleeping during day time
- ▶ Biological Control
  - ▶ Larvivorous fish -Guppy,Nalahandaya
  - ▶ Microorganisms -Bti
- ▶ Chemical Methods
  - ▶ Adulticides
  - ▶ Larvicides
- ▶ Intersectoral collaboration and social mobilization



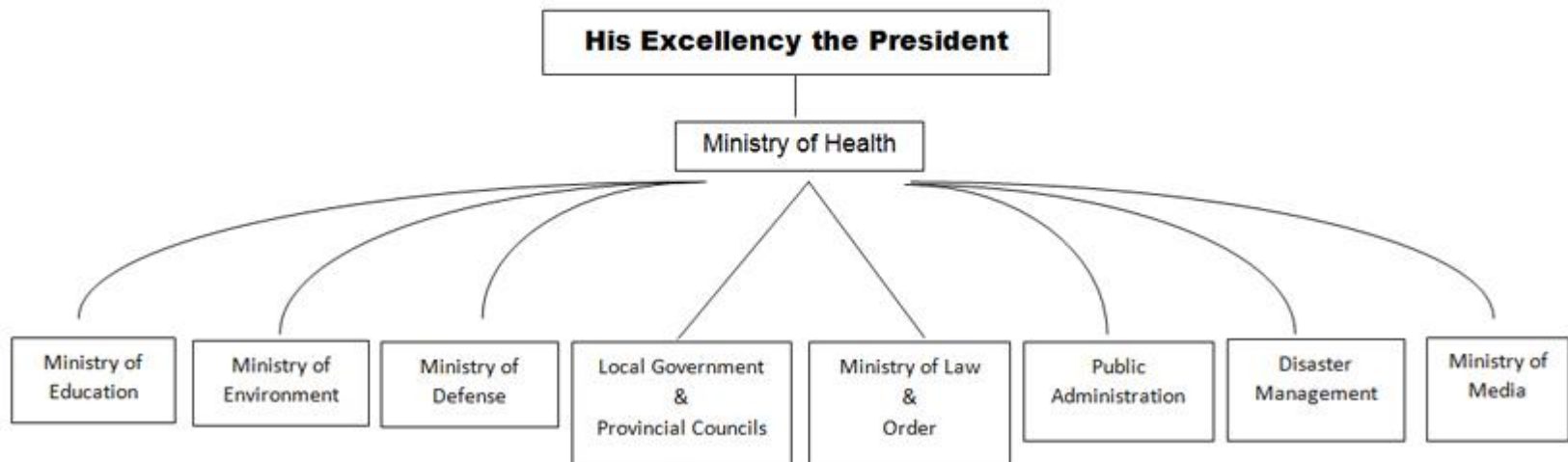
# Dengue...

- Presidential Task force on Dengue Prevention - 2010



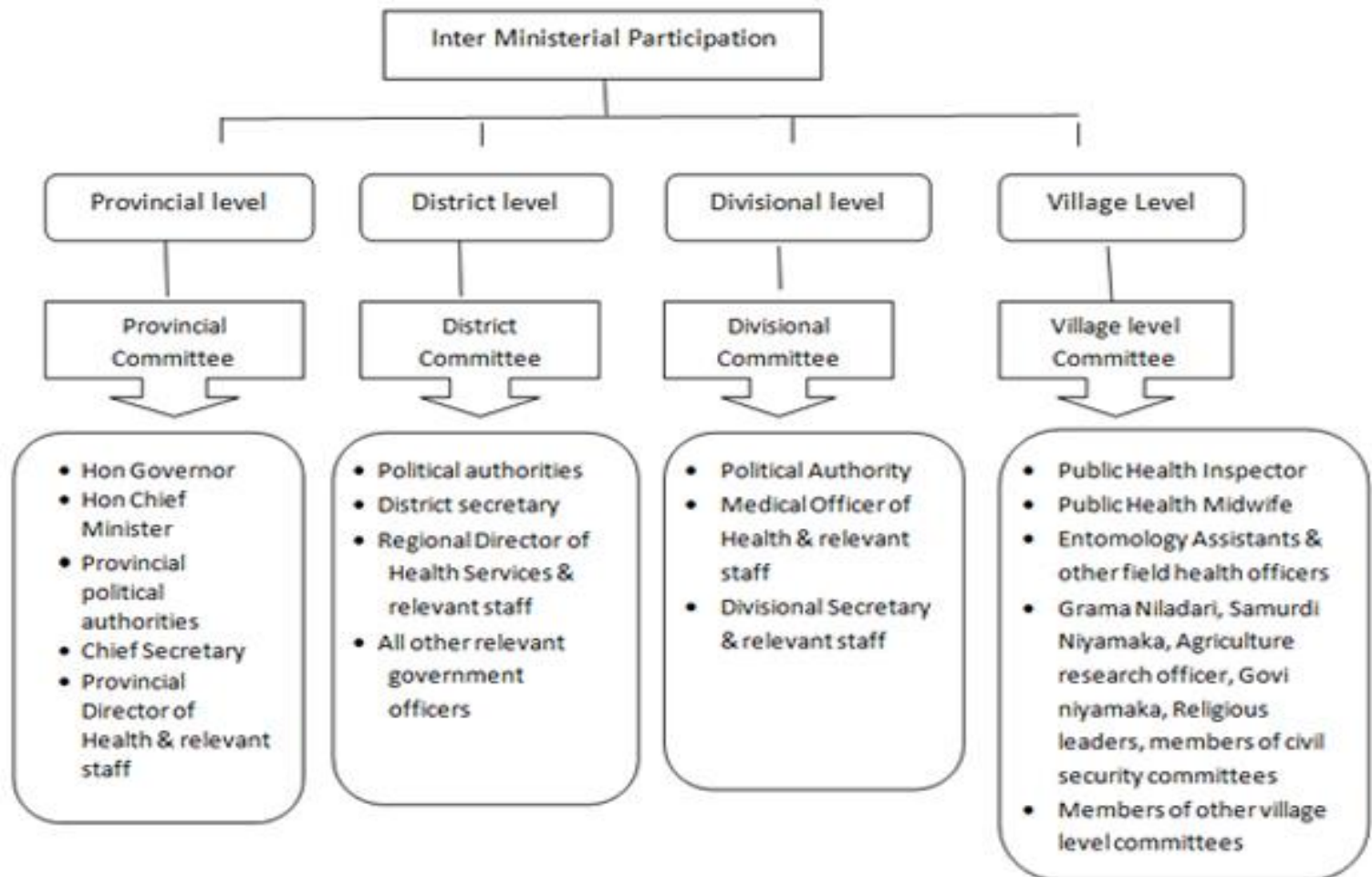
Composition of Task Force

National level



# Dengue...

## ► Interministerial participation



# Dengue...

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- ▶ **Social Mobilization**
  - ▶ Declaration of Mosquito Control Weeks and media seminars
  - ▶ Production of Information, Education and Communication(IEC) materials
  - ▶ Advertising campaigns through electronic and print media to create awareness of public on control / prevention strategies & to promote health seeking behaviour
  - ▶ School programs & competitions
  - ▶ Teacher trainings







# Japanese Encephalitis (JE)



# JE

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- ▶ Leading cause of vaccine-preventable encephalitis in Asia and the western Pacific (24 countries- WHO)
- ▶ JE virus is maintained in a cycle involving mosquitoes and vertebrate hosts, mainly pigs and wading birds (zoonotic disease)
- ▶ The case fatality rate is reported to be varied between 5-30%. In addition, 30 - 50% of survivors have significant neurological sequelae. The burden of disease, death and disability is predominantly borne by children
- ▶ Transmission principally occurs in rural agricultural locations where flooding irrigation is practiced. The risk of transmission is higher in rural areas, especially where pigs are raised and where rice fields, marshes and standing pools of water provide breeding grounds for mosquitoes.

# JE...

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## ▶ History

- ▶ 1st Isolated in Japan in 1935 from a brain of a patient dying from encephalitis.
- ▶ First isolated in Sri Lanka by Hermon and Anandarajah in 1968 from the serum of a child admitted to hospital in a comatose state
- ▶ Possible outbreak of JE in ?? 1948.
- ▶ The first major outbreak was experienced in 1984 (November) - 1985 (February) in the North Central Province (NCP) in Anuradhapura district.
- ▶ Total number of 385 individuals were reported to have contracted JE and 64 of them died with a case fatality rate (CFR) of 17%.
- ▶ Predominantly affected age groups in this outbreak were 5-9 years and 20-29 years.



# JE...

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- ▶ Neurological sequelae



Figure 4: Sequelae of Japanese encephalitis; an Indian child with dystonic posturing

# JE...

- ▶ History...
  - ▶ In the following outbreak occurred in the districts of Anuradhapura and Polonnaruwa in the NCP with the extension of the outbreak to 4 Kurunegala and Puttalam in the North Western Province.
  - ▶ Incidentally, this was the largest outbreak reported so far with 812 cases, 192 deaths with a CFR of 24%.
  - ▶ Since then, JE cases have been identified from various parts of the country.
  - ▶ Outbreaks of JE were consistent with the rainy season in particular with the North-East monsoonal rains (November to February). During this period, vector density tends to increase due to water logging in paddy fields , irrigation canals and shallow ditches
  - ▶ The last such outbreak was reported in the Ratnapura district in 2002.

# JE...

## Japanese encephalitis, countries or areas at risk\*



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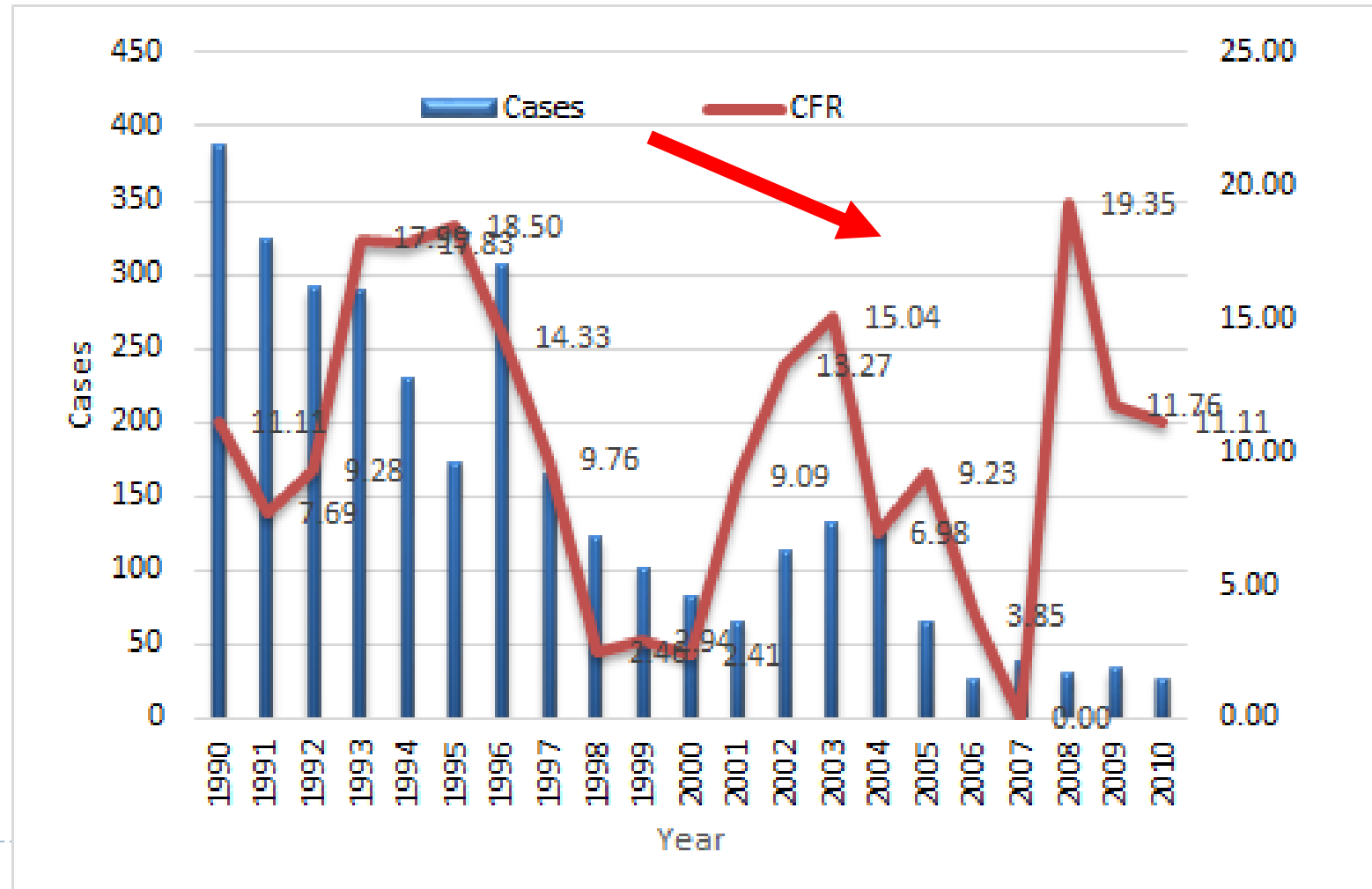
Data Source: World Health Organization/CDC  
Map Production: Public Health Information  
and Geographic Information Systems (GIS)  
World Health Organization



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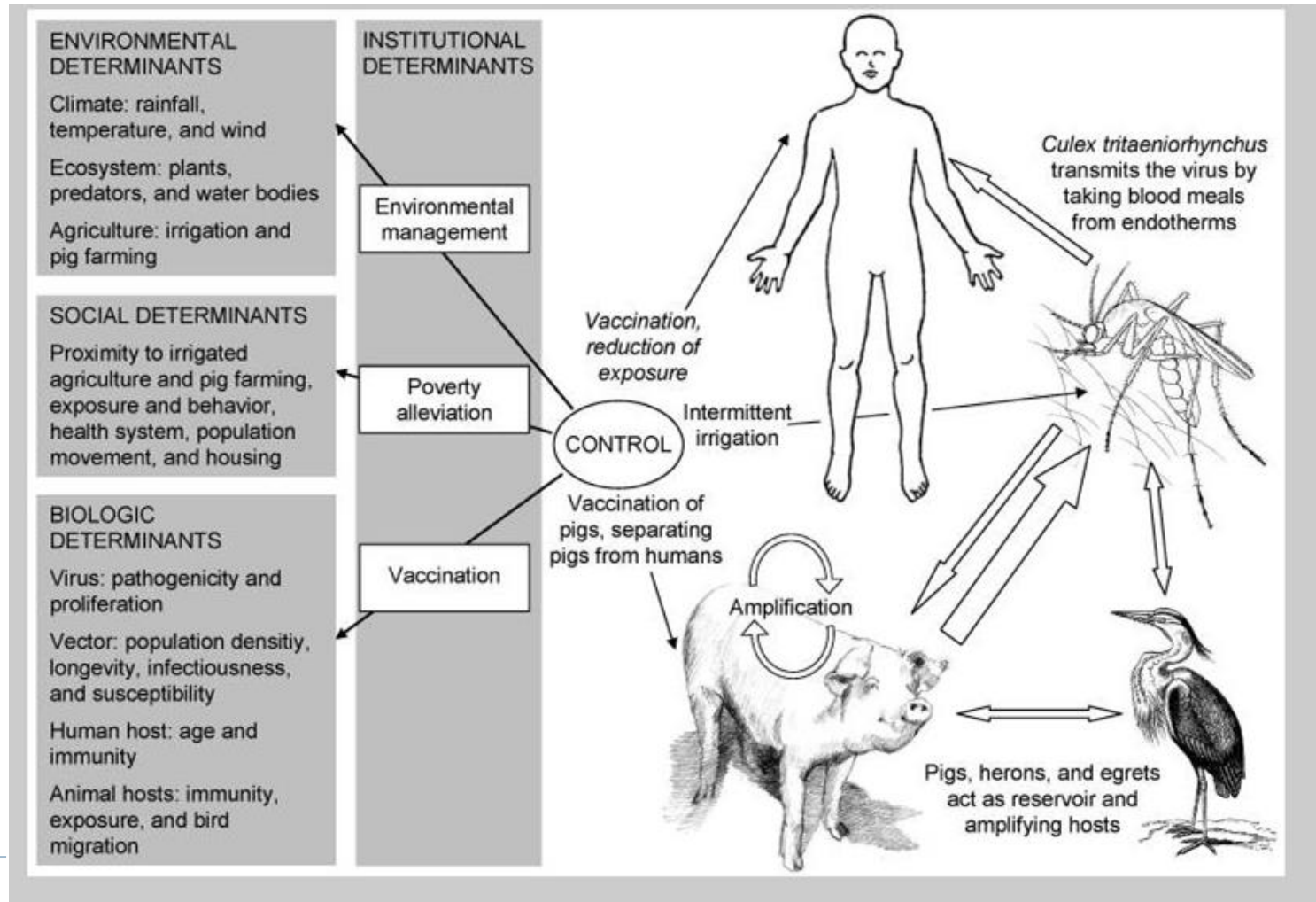
# JE...

## ► Trend



# JE..

## ► Transmission

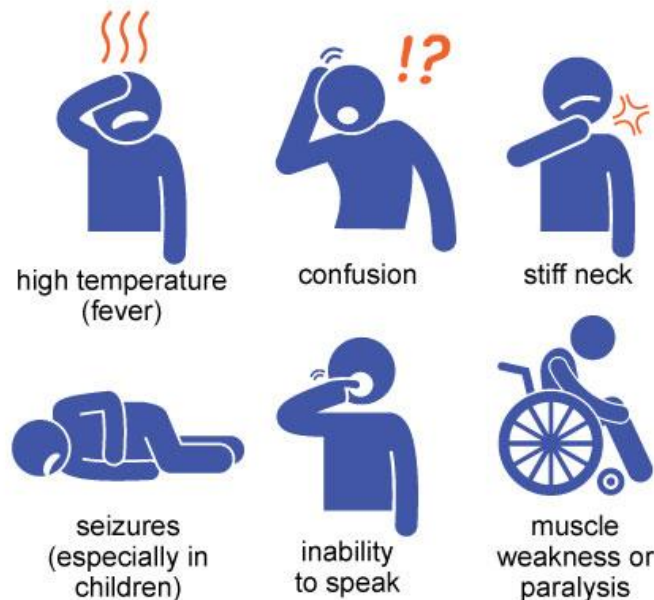


# JE...

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## ► Symptoms

- Incubation period of JE infection range from 4-14 days.
- A majority of JE infections ends up with asymptomatic or mild symptomatic disease.
- On average, only 1 in 300 JE infections results in clinical illness



# JE...

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- ▶ Vectors

- ▶ *Culex tritaeniorhynchus*, *Culex gelidus* are the principal vectors.
- ▶ some other culicine mosquito species such as *Culex vishnui*, *Culex pseudovishnui* and *Culex fuscocephala* are also responsible for the transfer of the virus to humans from amplifying hosts.
- ▶ Breeding places
  - ▶ Rice fields, irrigation canals and water pools.
  - ▶ In an urban setting, the vector can breed in contaminated water such as standing puddles, open sewers, fish ponds etc



# JE...

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## ▶ Prevention & Control

- ▶ Awareness among general public on the prevention and control of the disease
- ▶ Vector control
  - ▶ Short term
  - ▶ Long term
- ▶ Immunization.
  - ▶ Ministry of Health initiated an immunization programme against JE on phase basis in 1988 in Sri Lanka.
  - ▶ Children in the age group of 1- 10 years were targeted for immunization against JE
  - ▶ Four doses of the Nakayama strain of the inactivated JE vaccine during the inter-epidemic period.
  - ▶ In 1988, 409888 doses given
  - ▶ the programme was existent in the 17 districts in the country.





# JE...

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- ▶ Immunization
  - ▶ Animal Vaccination
    - ▶ A programme for immunization of pigs was carried out in some areas by the Department of Animal Production and Health (DAPH), with the assistance of Public Health Veterinary Services of the Ministry of Health in the past.
    - ▶ However, currently this programme is not conducted considering its limited effectiveness.
- ▶ Current surveillance
  - ▶ Acute Encephalitis Syndromic surveillance - Syndromic surveillance



# JE...

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**Japanese Encephalitis**  
**A manual for Medical Officers of Health**



Epidemiology Unit  
Ministry of Health



Available at  
[www.epid.gov.lk](http://www.epid.gov.lk)

**ASIA**





Thank you

