Managing Dengue: a rapidly expanding epidemic
Dengue overview

• Dengue fever is a mosquito borne viral disease.
• There is no specific treatment for dengue or severe dengue.
  ▶ But early detection and access to proper medical care lowers fatality rates to below 1%.
• 80% or more of dengue cases are asymptomatic
• It is the most prevalent mosquito borne disease in the world.
• Dengue is continuing to expand due to climatic conditions and movement of people and goods.
More about Dengue

• Symptoms typically begin 3 to 14 days after getting infected.
  ▶ Wide ranging symptoms including high fever, headache, joint pains and skin rash.

• Four distinct serotypes of the dengue virus can cause infection.
  ▶ Recovery from infection by one provides lifelong immunity against that serotype.
  ▶ Cross-immunity to the other serotypes is partial and temporary.
  ▶ Subsequent infections by other serotypes increase the risk of developing severe dengue (secondary infection).
Global situation

- Number of cases each year may exceed 400 million
- 4 billion living in areas at risk
- In over 129 countries

Global Dengue trends reported cases 2010–2022

Global Dengue deaths reported 2010–2022
Transmission

• The virus is transmitted to humans by the bite of an infected female Aedes mosquito.

• *Aedes aegypti* and other species such as *Aedes albopictus* are highly adaptive.

• Their combined distribution continues to affect more northern countries in Europe, North America and southern regions of South America and Africa during summer.

• Travelers already infected with the virus, but not symptomatic, can spread the disease when they get bitten by the local Aedes mosquito population.

• High humidity and temperature are conditions that favour mosquito multiplication.
Aedes aegypti and Aedes albopictus

- Eggs can remain dry for months and hatch when in contact with water
- Need to control both immature and adult stage
- Day biter - can bite in houses or place of work/schools
- Prefers to bite several people during a feeding round.
## Tests frequently used in dengue diagnostics and surveillance: strengths and limitations

<table>
<thead>
<tr>
<th></th>
<th>Rapid Diagnostic Tests (RDT)</th>
<th>ELISA</th>
<th>Real-time PCR/ PCR</th>
<th>Sequencing</th>
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<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Diagnostics</td>
<td>Diagnostics</td>
<td>Diagnostics/ Surveillance</td>
<td>Surveillance</td>
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<tr>
<td><strong>Detects</strong></td>
<td>NS1/ IgM/ IgG</td>
<td>NS1/ IgM/ IgG</td>
<td>Virus RNA</td>
<td>Virus RNA</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Multiplex PCR detects other arboviruses and/or serotypes</td>
<td>• Able to identify specific strains and mutations</td>
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<tr>
<td><strong>Test Frequency and Turnaround Time (TAT)</strong></td>
<td>&lt;1 hr</td>
<td>1-5 hrs</td>
<td>1-5 hrs</td>
<td>3-7 days</td>
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<td><strong>Strengths</strong></td>
<td>• Simple procedure</td>
<td>• Good for large sample batches</td>
<td>• Allows for differential diagnosis and serotyping</td>
<td>• Provides high-resolution virus information</td>
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<tr>
<td><strong>Limitations &amp; Common Pitfalls</strong></td>
<td>• Varied performance across kit brands and batches</td>
<td>• Longer TAT</td>
<td>• Higher cost</td>
<td>• Significant cost</td>
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<td></td>
<td>• Cross reactivity with other flaviviruses / antinuclear antibodies (ANAs)</td>
<td>• Requires 1 assay for each analyte</td>
<td>• Requires specialised laboratory equipment</td>
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<td></td>
<td>• False-positivity IgM</td>
<td>• Requires specialised laboratory equipment</td>
<td>• Need to monitor circulating strains to avoid ‘drop off’ targets</td>
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<td></td>
<td>• Misleading IgG</td>
<td>• Cross reactivity with other flaviviruses / ANAs</td>
<td>• Trade-offs between sensitivity &amp; no. of targets</td>
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</table>
Clinical phases & problems of dengue management

**Viremic phase (3-5 days)**
- Clinical Problems:
  - High fever, nausea:
  - Dehydration, Electrolyte Imbalance
  - Ketosis
  - Co-morbid conditions

**Immunological phase (from 3 to 7th day onwards)**
- Clinical Problems:
  - Hypovolemia — **Plasma Leakage + Severe Bleeding**
  - Organ Impairment
  - Dehydration & Electrolyte Imbalance
  - Co-morbid conditions
  - Paracetamol/
  - NSAIDS toxicity

**Clinical Problems: Fluid Overload**
- Respiratory Distress/Failure
Vector Control Approaches

**Chemical**
- Insecticide-treated bed nets (for daytime sleeping)
- Spraying of insecticides
- Larviciding
- Topical repellents

**Non-chemical**
- Covering, emptying and cleaning of water storage containers
- Elimination of old tyres and containers
- Use of long clothing
- Biological: using organisms (e.g., bacteria) to control vector populations
- House improvements
- Novel tools under development
Useful links and resources

- WHO: Dengue and severe dengue fact sheet. Available at: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue

- WHO: Dengue and severe dengue. Questions and Answers. Available at: https://www.who.int/news-room/questions-and-answers/item/dengue-and-severe-dengue