Geographical Information System (GIS)-based maps for monitoring of entomological risk factors affecting transmission of chikungunya in Sri Lanka

M.D. Hapugoda\textsuperscript{1}, N.K. Gunewardena\textsuperscript{1}, P.H.D. Kusumawathie\textsuperscript{2}, G.A.J. S.K. Jayasooriya\textsuperscript{2}, H.C. Hapuarachchi\textsuperscript{1} and W. Abeyewickreme\textsuperscript{1}

\textsuperscript{1} Faculty of Medicine, University of Kelaniya, Ragama, Sri Lanka

\textsuperscript{2} Anti-Malaria Campaign, Kandy, Sri Lanka
Chikungunya fever is a viral disease transmitted to humans by the bite of infected mosquitoes.

Chikungunya virus is a member of the genus *Alphavirus*, in the family *Togaviridae*.

This virus is spread by *Aedes aegypti* and *Aedes albopictus* mosquitoes.
Chikungunya virus was first isolated from the blood of a febrile patient in Tanzania in 1953, and has since been identified repeatedly in west, central and southern Africa and many areas of Asia.

The disease has been cited as the cause of numerous human epidemics in those areas since that time.

Most recent outbreaks have been reported from India and various Indian Ocean islands including Sri Lanka.
At present, chikungunya is an important disease in Sri Lanka.

Chikungunya remains very much a “neglected disease” and a public health issue, and clearly, there is an urgent need to study on possible risk factors affecting transmission of the disease to bridge the gap of knowledge concerning this pathogen.

Possible risk factors- entomological epidemiological environmental socio-economic knowledge attitude and practices of human
To monitor entomological risk factors affecting transmission of chikungunya using GIS mapping.
Entomological risk factors affecting transmission of chikungunya were examined in a selected chikungunya hot-spot in Sri Lanka from April to July in 2008.
Study area

- Study area was situated in the District of Kandy, in the central part of the island.

- Kandy Municipal Council area was selected.
  - the latitude of $7^\circ15'53.55"$ - $7^\circ17'16.00"$ N
  - the longitude of $80^\circ36'37.55"$ - $80^\circ37'44.75"$ E
Map 1. Sri Lanka showing the study area
Study population

- Ninety nine house-holds in 33 clusters were recruited. The distant between clusters was at least 200 m which is beyond the maximum flight range of *Aedes* mosquitoes.

- 3 house-holds/ cluster

- 99 house-holds/ 33 clusters
Collection of data

- Position of each house was recorded using a Global Position System (GPS) receiver.

- Monthly surveillance was conducted using standard entomological surveillance methods followed by obtaining information through a pre-tested questionnaire.

  Adults  - Human landing diurnal collection technique
  Larvae  - Normal larval surveillance technique
Analysis and presenting data

- Monthly cluster index for the presence of *Aedes* vectors in each cluster was calculated.

  Cluster index = \( \frac{\text{No of positive clusters}}{\text{No of clusters examined}} \times 100 \)

Cluster index for each species was indicated in each map.

- 66%
- 33%
- 0%
Monthly container index for each cluster was calculated.

Container index = \frac{\text{No of positive containers}}{\text{Total no of containers in a cluster}} \times 100

Container index for each species was indicated in each map.

- 66%
- 33%
- 0%
GIS was used to display:

1. Spatial distribution of selected households and clusters; GPS readings of each household were overlaid on digital land use maps using GIS and presented all households and clusters on GIS-based maps.

2. Spatial and temporal distribution of vectors; Monthly cluster index for each vector species was overlaid on GIS-based maps.

3. Spatial and temporal distribution of key breeding sites; Monthly container index was overlaid on GIS-based maps.
RESULTS

Spatial distribution of selected house-holds and clusters

- Major land use pattern of the selected area was human dwellings.
Map 2. Spatial distribution of selected clusters

Results cont.
Map 3. Spatial distribution of selected clusters
Map 4. Spatial distribution of all 33 clusters
Spatial and temporal distribution of vectors

- Presence of high density/cluster index of *Ae. albopictus* mosquitoes was observed in all clusters throughout the study period.
Map 5. Spatial and temporal distribution of vector mosquitoes
Cluster index for *Aedes*, June, 2008

Results cont.
Spatial and temporal distribution of key breeding sites

- Presence of *Ae. albopictus* mosquitoes in more than 90% of the key (artificial) breeding habitats was observed in all clusters throughout the study period.
Map 6. Spatial and temporal distribution of vector breeding sites
Container index, June, 2008

Results cont.

- 66% *Ae.ae* larvae
- 33% *Ae.ae* larvae
- 66% *Ae.al* larvae
- 33% *Ae.al* larvae
- 66% All possible
- 33% All possible
CONCLUSIONS

- Generalized high density of *Ae. albopictus* suggests that this species may play a major role in transmitting chikungunya in the study area.

- GIS-based maps may be used as an important tool to find out spatial and temporal distribution of vectors and key breeding sites in a selected hotspot, which would enable cost effective and efficient interventions for vector control in disease endemic areas.
Further, information regarding long term surveillance activities conducted in a chikungunya risk area can be manipulated and presented using tools of GIS.

This is important to predict impending epidemics in order to use limited resources in a cost effective and efficient manner to control the epidemics.
THANK YOU