

# Dengue disease and vector surveillance, early identification of outbreaks in Singapore

7 September 2023

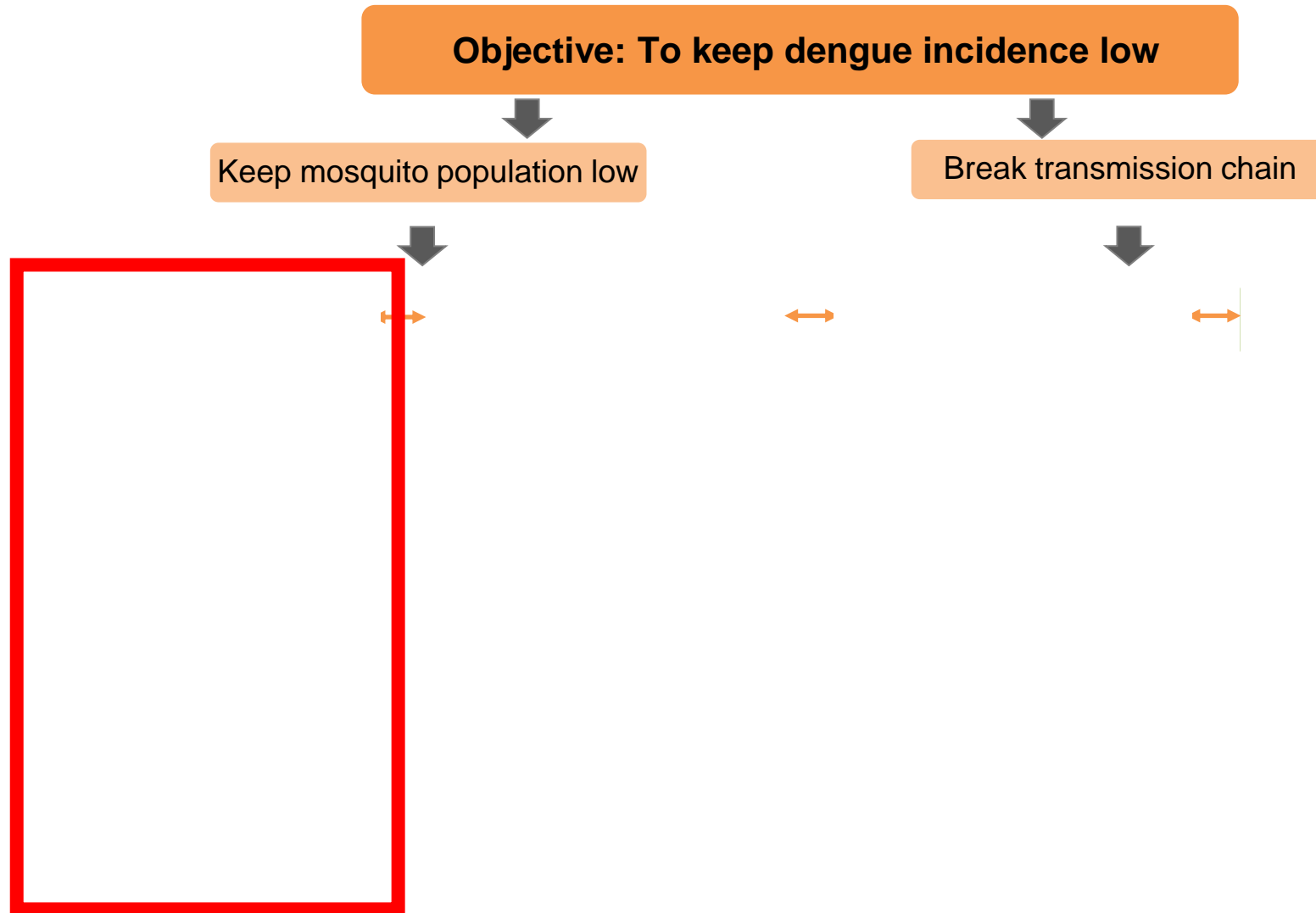
Chang Chia-chen, Scientist

Environmental Health Institute



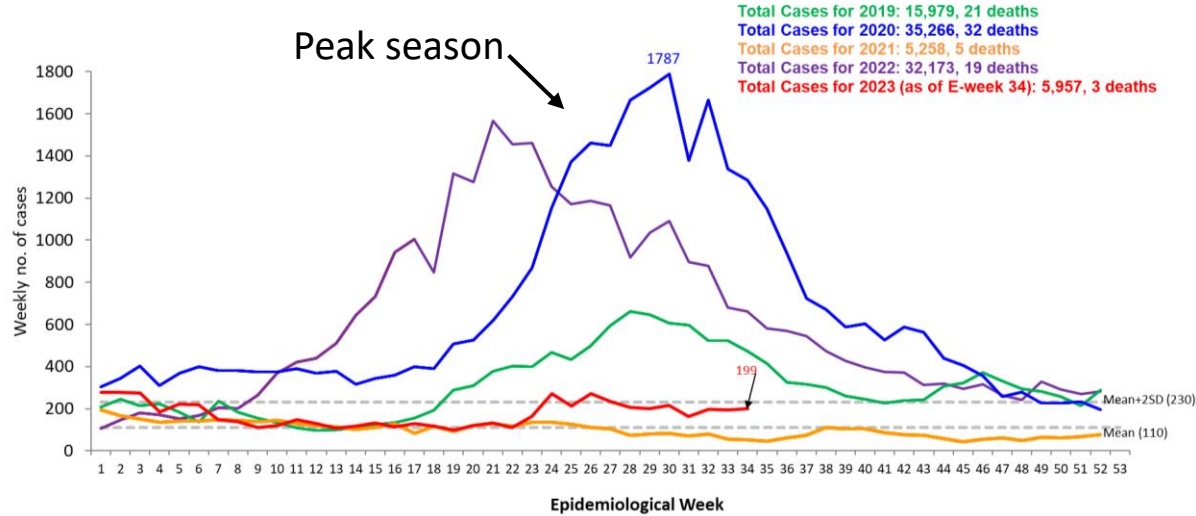
# Dengue control system in Singapore

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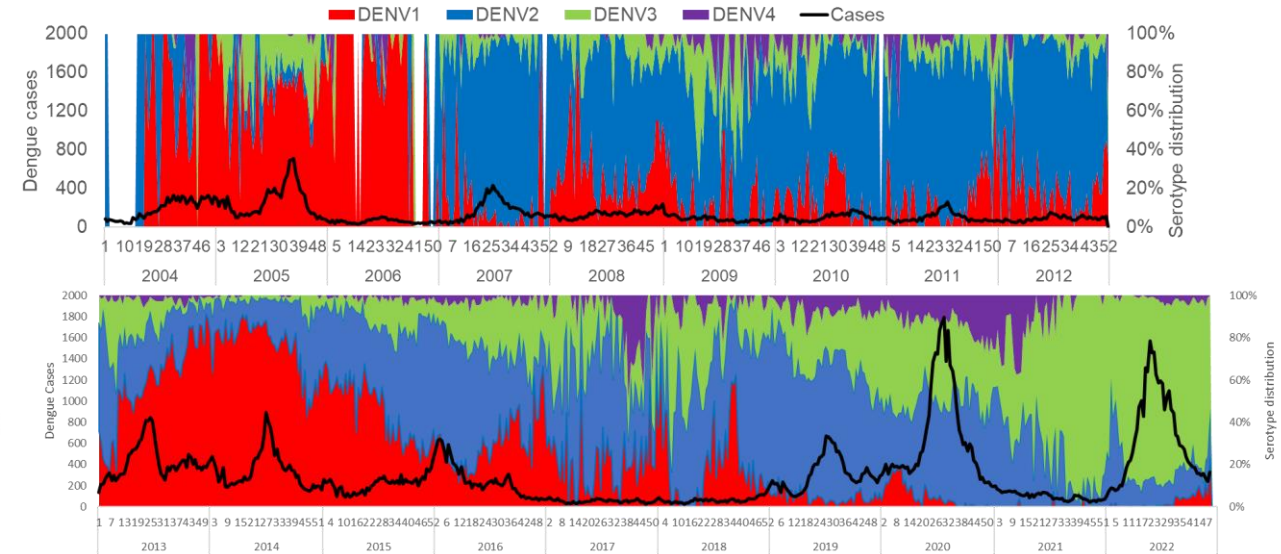


# Key surveillance components

## Cases



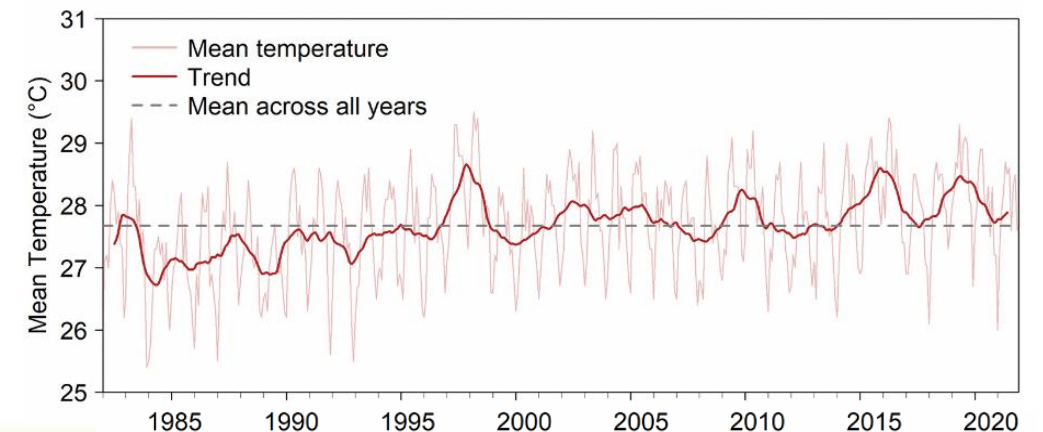
## Serotype



## Vector

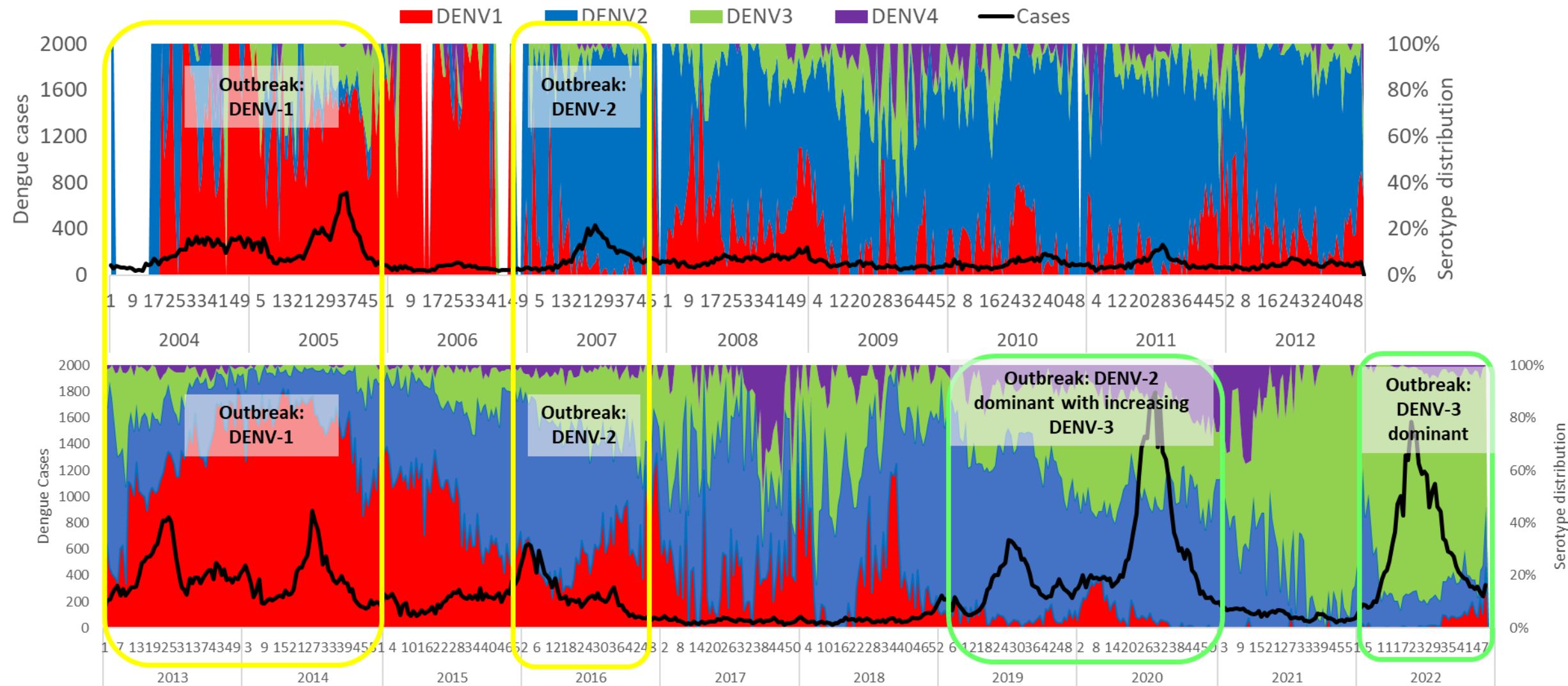


## Weather

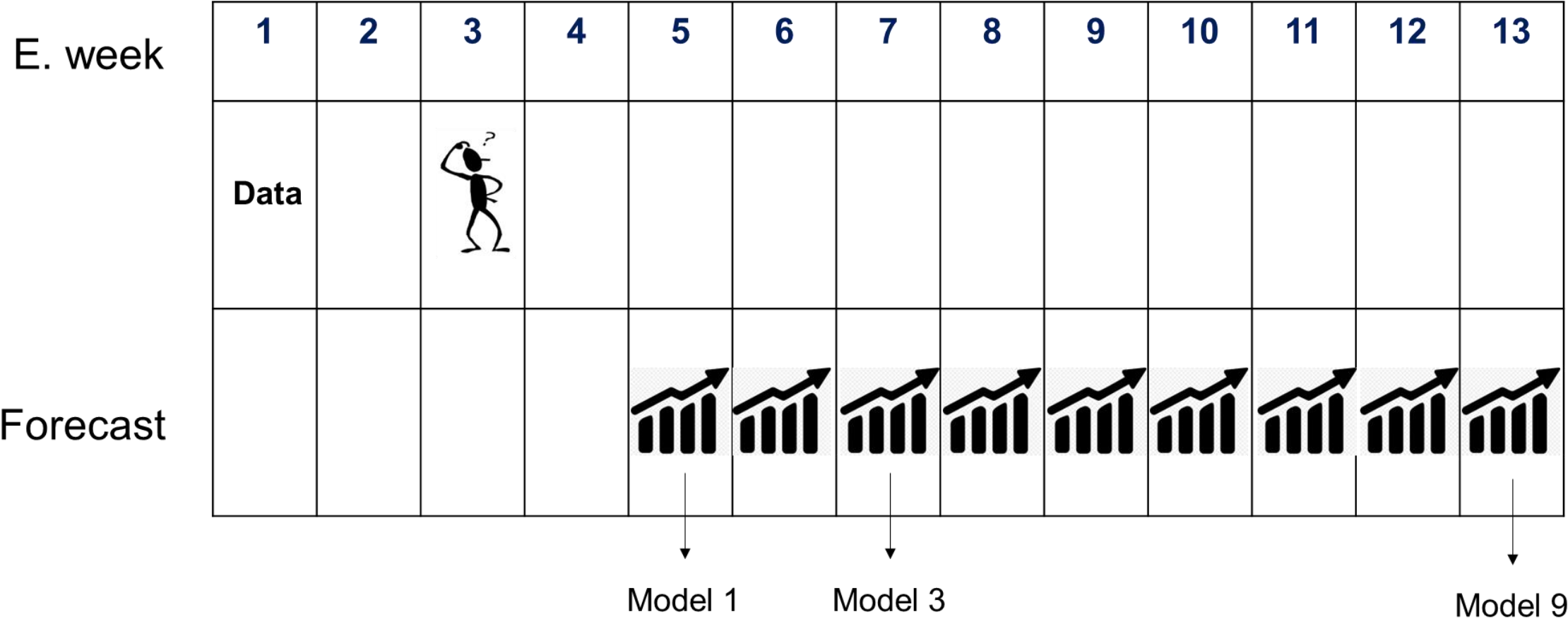


# Predominant Serotype switch associated with Dengue Outbreaks

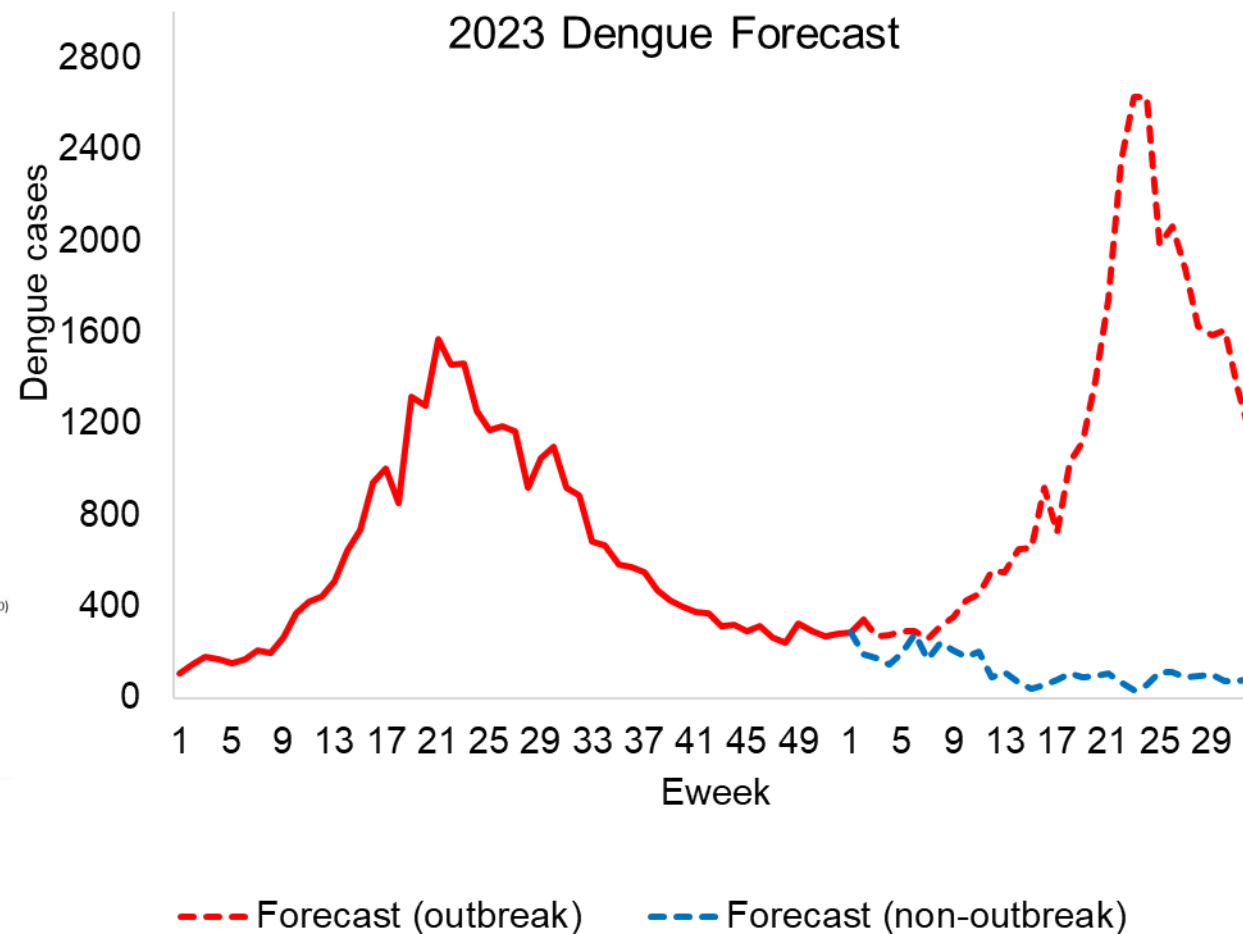
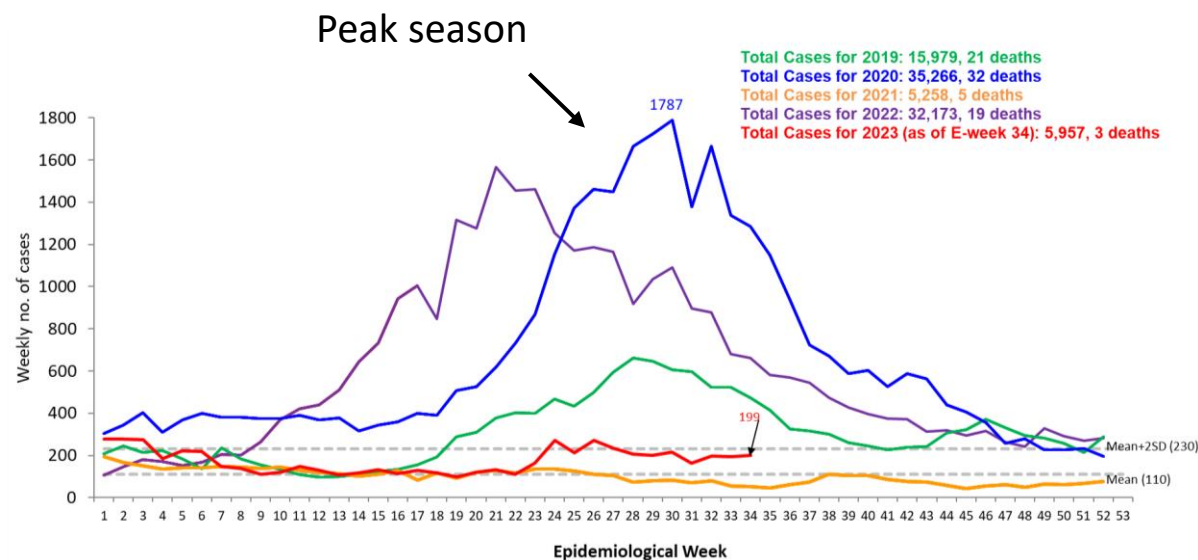
New dominance of DENV3 in 2022-2023 – outbreak alert in 2022



# Real-time dengue forecast model: an early warning system

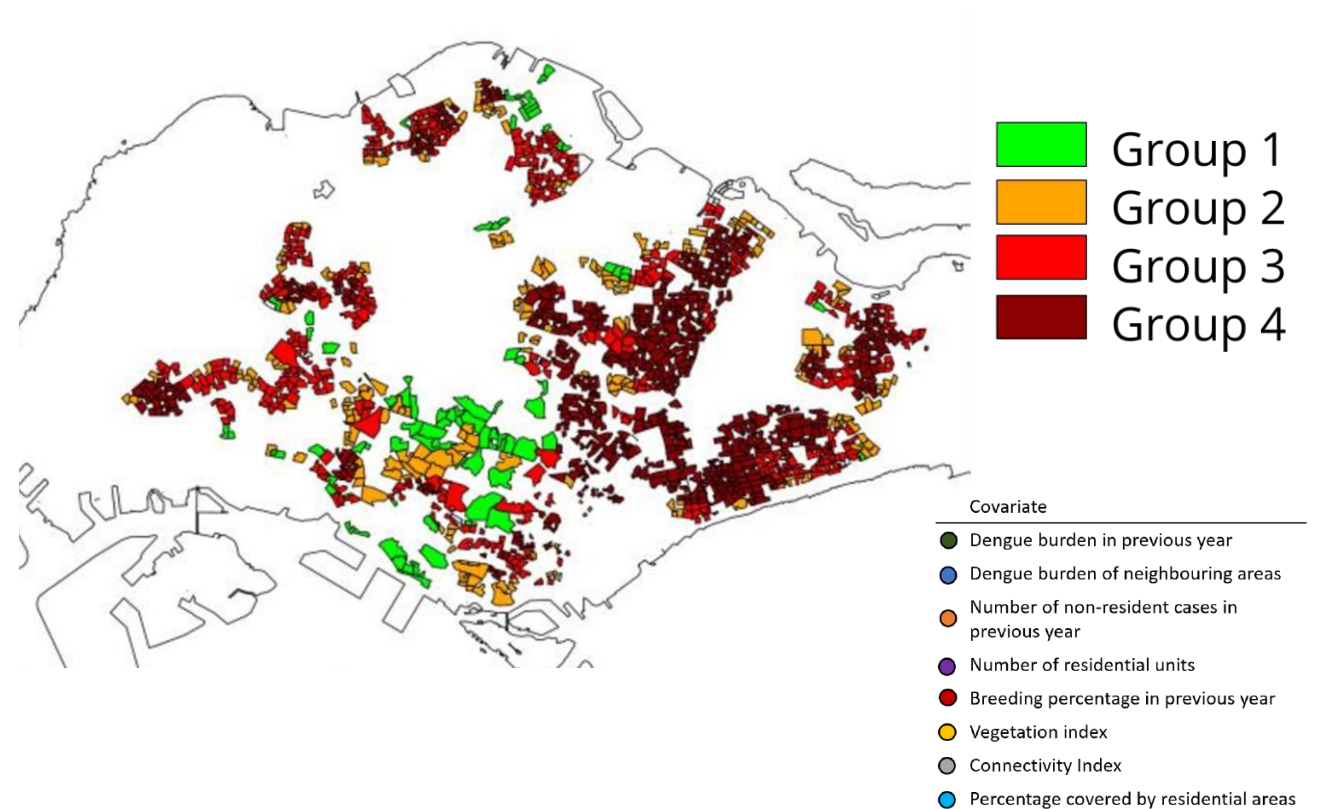
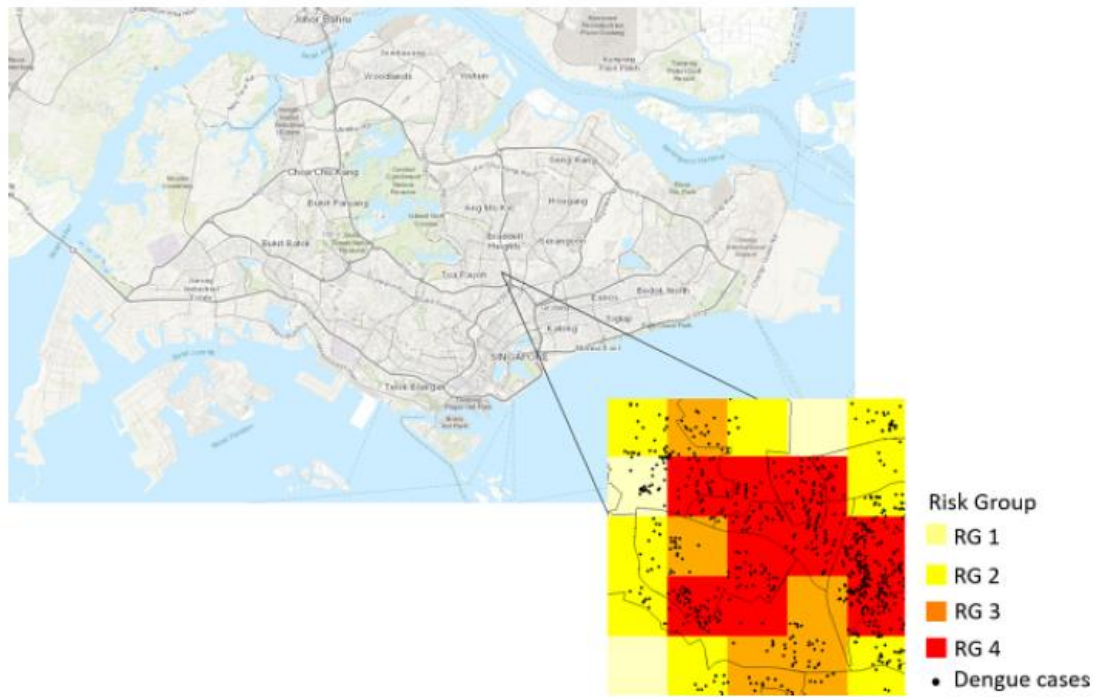


# Real-time dengue forecast model: an early warning system



# Spatial Risk Stratification: resource allocation and planning of vector control interventions

Close to 90% of the dengue clusters occur in high risk areas.



# Publishing Surveillance Data To Raise Awareness



Mr Desmond Tan (left) distributing repellent and B-L-O-C-K magnet & sticker set to Mr Lim Chin Poh on March 30, 2022. ST PHOTO: LIM YAOHUI



Dengue ambassador Mirrah Masturah with her mum Tutty Raudah, Minister of State for Sustainability and the Environment Desmond Tan (centre) and Holland-Bukit Timah GRC MP Edward Chia visiting the home of Mr Shanmugam Yagna Pranja yesterday. ST PHOTO: MOHD KHALID SABA

## NEA urges vigilance to avoid dengue resurgence

Situation has improved this year but number of cases has gone up in recent weeks

Audrey Tan  
Environment Correspondent

ing grounds at home to avoid a resurgence of the disease. More than 2,000 cases have

year, NEA expects cases to rise to- wards the middle of the year, with the weather getting warmer. Two

### FIGHT ZIKA AND DENGUE

The Zika and Dengue viruses are both transmitted by the female Aedes mosquito. Zika is generally mild and most people infected with the virus do not develop symptoms.

### LAWAN ZIKA DAN DENGGI

Kedua-dua virus Zika dan Denggi disebarkan melalui nyamuk Aedes betina. Zika umumnya adalah penyakit ringan dan kebanyakan orang yang dijangkiti virus ini tidak menunjukkan sebarang tanda.

Get rid of stagnant water at home to protect our families and neighbourhoods:

Hapuskan takungan air di rumah untuk melindungi keluarga dan keiranan kita:

1 Turn the pail

Telungkapkan bekas air

2 Tip the vase

Buangkan air pasu bunga

3 Flip the flower pot plate

Telungkapkan pengalir pasu bunga

4 Loosen the hardened soil

Gemburkan tanah yang keras

5 Clear the roof gutter and place Bti insecticide

Bersihkan alur bumbung dan bubuhkan racun serangga Bti

THERE ARE TERDAPAT 您的社区已发生

OR MORE DENGUE CASES IN YOUR NEIGHBOURHOOD. ATAU LEBIH KES DENGGI DI KAWASAN KEJIRAN ANDA. 起或已上青痛热症案例.

Get updates on dengue clusters: <http://www.nea.gov.sg/dengue> <https://www.facebook.com/StopDengueNow> <https://twitter.com/NEAsg> 1800 Call-NEA (1800-2255 632) Download myNE app

OUR LIVES. OUR FIGHT. DO THE 5-STEP MOZZIE WIPEOUT TODAY.

THANK YOU FOR YOUR EFFORTS. PLEASE STAY VIGILANT. TERIMA KASIH ATAS USAHA ANDA DALAM MENEWASKAN DENGGI. HARAPTERUS BERTAWASPAD. 感谢您对预防骨痛热症所作出的贡献。请继续保持警惕。

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THERE IS AN OUTBREAK OF DENGUE IN YOUR NEIGHBOURHOOD. TERDAPAT PENULARAN DENGGI DI KAWASAN KEJIRAN ANDA. 骨痛热症正在您的社区蔓延。 有痛热症正在您的社区蔓延。

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OUR LIVES. OUR FIGHT. DO THE 5-STEP MOZZIE WIPEOUT TODAY.

Operationally, a dengue cluster indicates a locality with active transmission where intervention is targeted. It is formed when two or more cases have onset within 14 days and are located within 150m of each other (based on residential and workplace addresses). The clusters are categorised according to their current status. There are 3 alert levels:

Definition	Alert Level
High-risk area with 10 or more cases	Red
High-risk area with less than 10 cases	Yellow
No new cases, under surveillance for the next 21 days	Green

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What if clinical surveillance is not picking up transmission?

# An islandwide adult-based *Aedes* surveillance system

Gravitrapp *Ae. aegypti* Index (GAI) = no. of female *Aedes aegypti* trapped / no. of traps

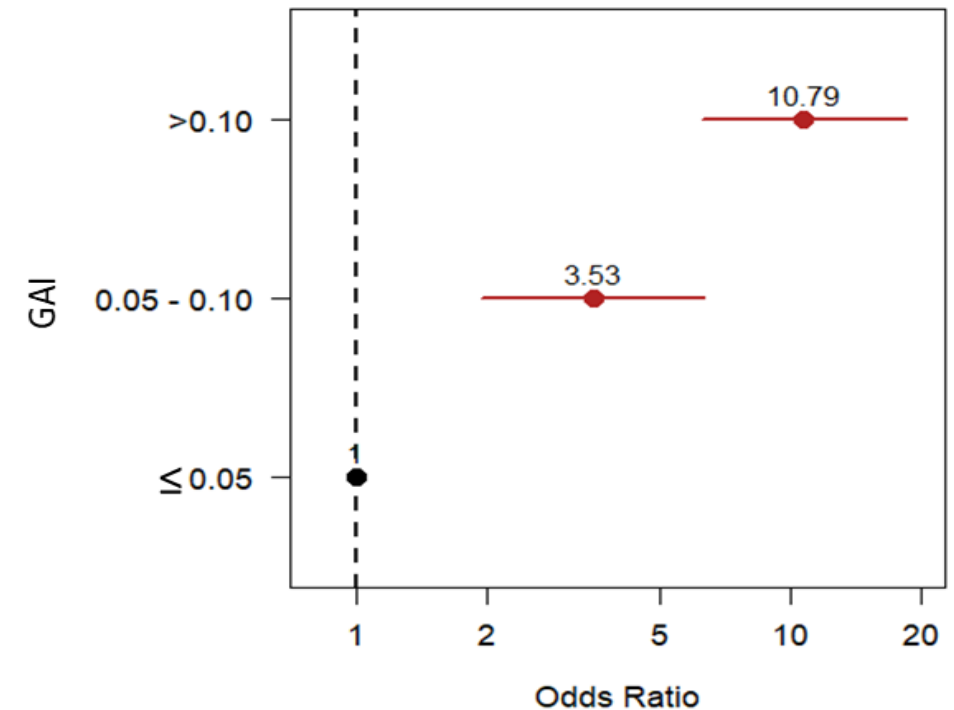
- Know where the mosquitoes are
- Indication of risk of transmission



Trap density (1 Gravitrapp to 20 homes)



Large cluster vs Non-cluster



# Adult-based *Aedes* surveillance system is also used to monitor efficacy of the release of male *Wolbachia*-carrying *Aedes aegypti*

Sites	Jun 2018	Jun 2019	Jun 2020	Jun 2021	Jun 2022	Jul 2023
Yishun						
Tampines						

Legend:

Risk of large dengue cluster formation			
Risk	Low	Moderate	High
GAI <sup>1</sup>	<0.05	0.05-0.1	>0.1
Increase in risk	1X	4X	10X



Release area (weekly releases since Jul 2018 in Yishun and Sep 2018 in Tampines)

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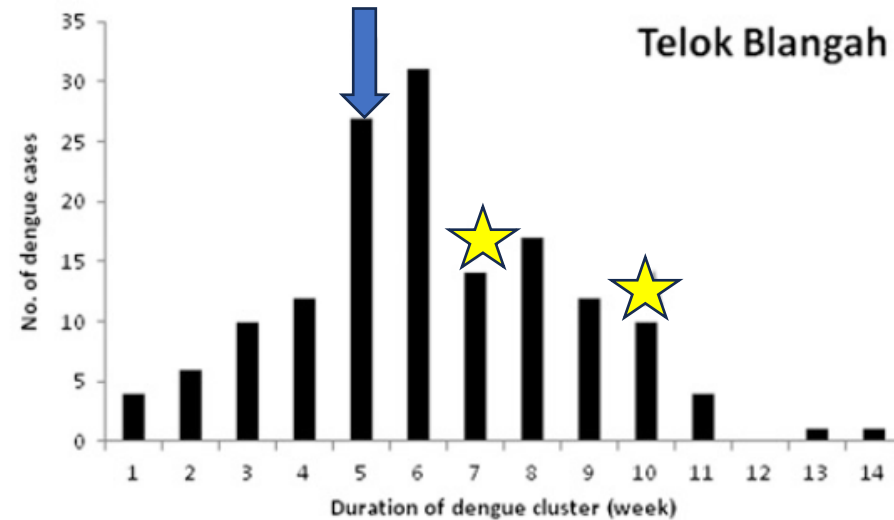
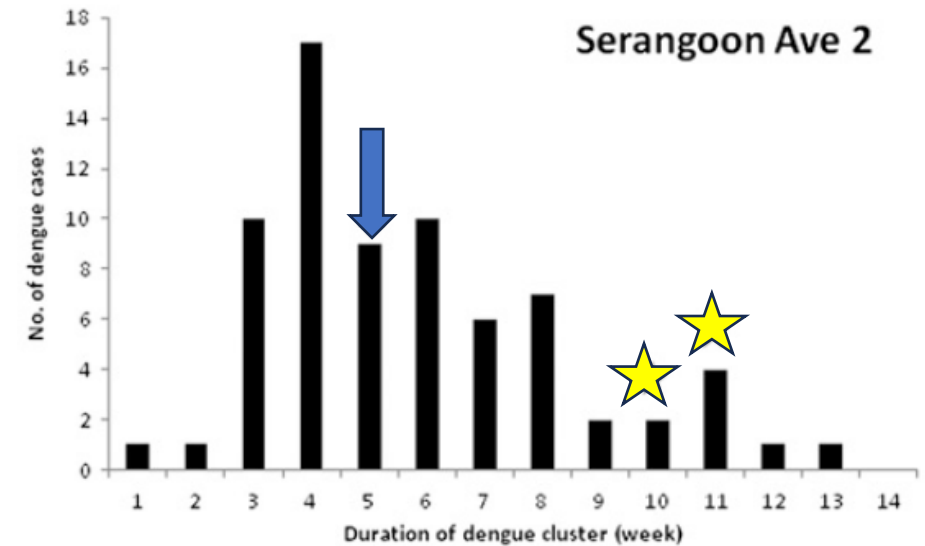
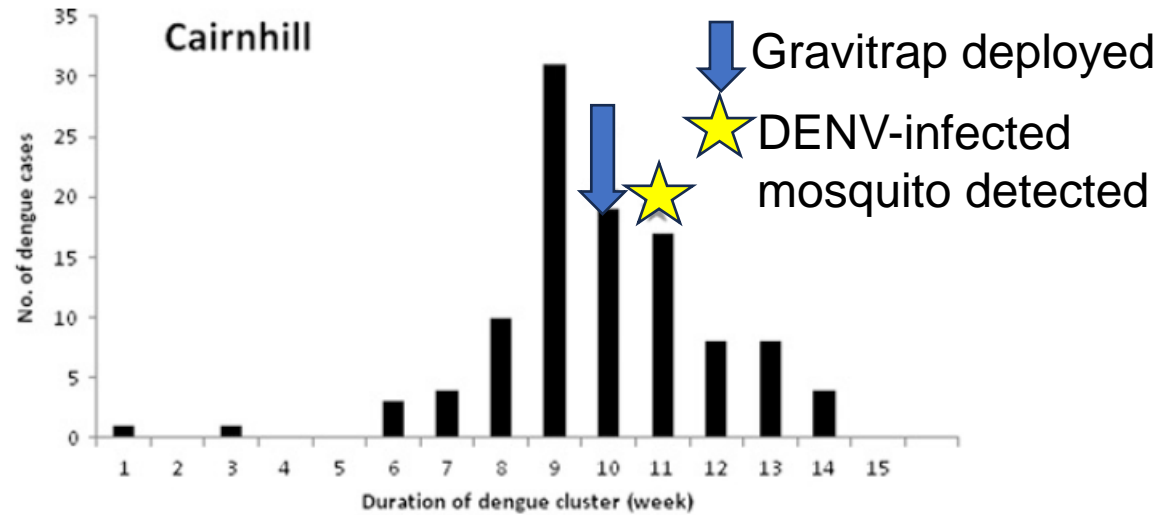
***Wolbachia*-mediated sterility suppresses *Aedes aegypti* populations in the urban tropics**

The Project Wolbachia – Singapore Consortium, Ng Lee Ching

doi: <https://doi.org/10.1101/2021.06.16.21257922>

<sup>1</sup> Gravitraps *Ae. aegypti* index (GAI, average number of female *Aedes aegypti* caught per functional Gravitraps)

# Gravitraps for management of Dengue Clusters in Singapore



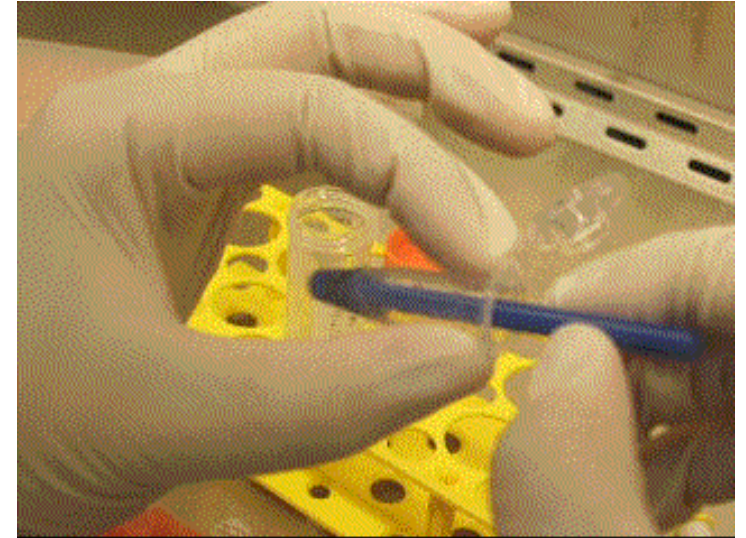
Infective status of trapped *Aedes* mosquitoes could assist in situational risk assessment and operational decision making in controlling outbreaks.

# Rapid, inexpensive, cost-efficient, sensitive and specific, and capable of detecting the pathogen under field-relevant conditions.

*Am. J. Trop. Med. Hyg.*, 88(2), 2013, pp. 260–266  
doi:10.4269/ajtmh.2012.12-0477  
Copyright © 2013 by The American Society of Tropical Medicine and Hygiene

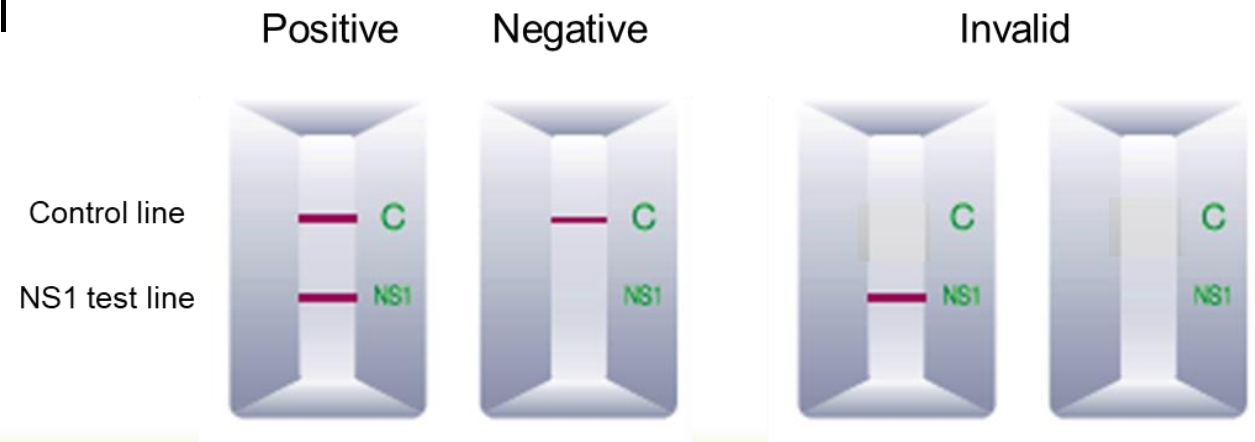
## Detection of Dengue Virus NS1 Antigen in Infected *Aedes aegypti* Using a Commercially Available Kit

Natalia V. Voge, Irma Sánchez-Vargas, Carol D. Blair, Lars Eisen, and Barry J. Beaty\*  
*Arthropod-borne and Infectious Diseases Laboratory, Department of Microbiology, Immunology, and Pathology,  
Colorado State University, Fort Collins, Colorado*

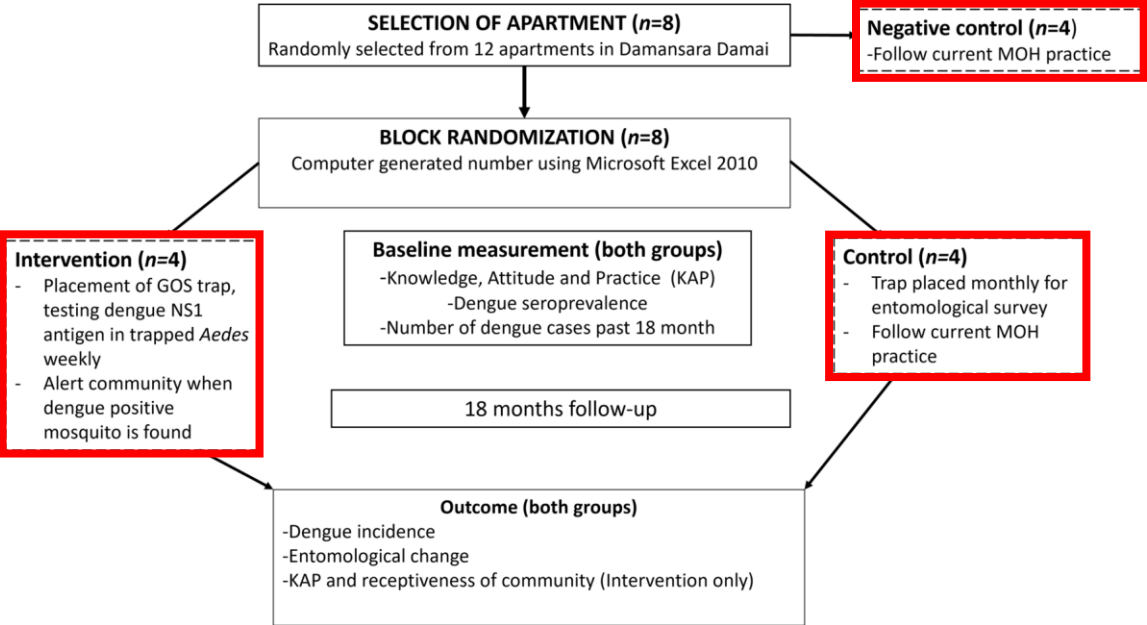


At the local level, NS1 testing is useful situation awareness, to determine effectiveness of control measures.

In places where clinical surveillance is not picking up transmission, it could help to detect local outbreaks early.

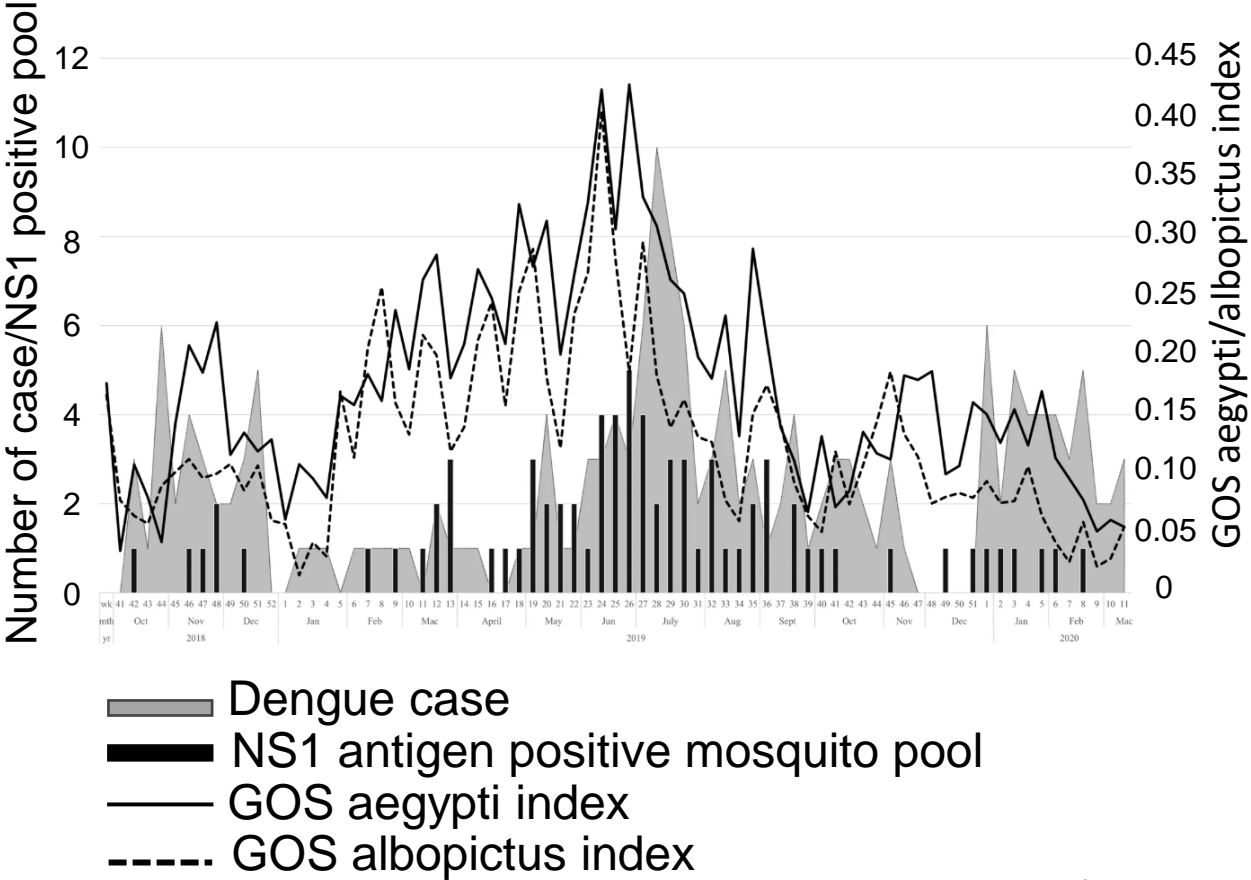


# NS1 testing triggered interventions that were then associated with reduced dengue



Group	No. of blocks	Percentage of change in dengue case ratio (%)
Intervention	35	-39.9
Control	38	-18.7
Negative control	35	15.9

A peak in dengue cases in July occurred at lag of **two weeks after** the peak in the number of NS1 antigen positive pools in June.



## Dengue intervention pipeline

