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VECTORBORNE DISEASES

Wastewater-based surveillance for tracing the circulation of dengue and chikungunya viruses

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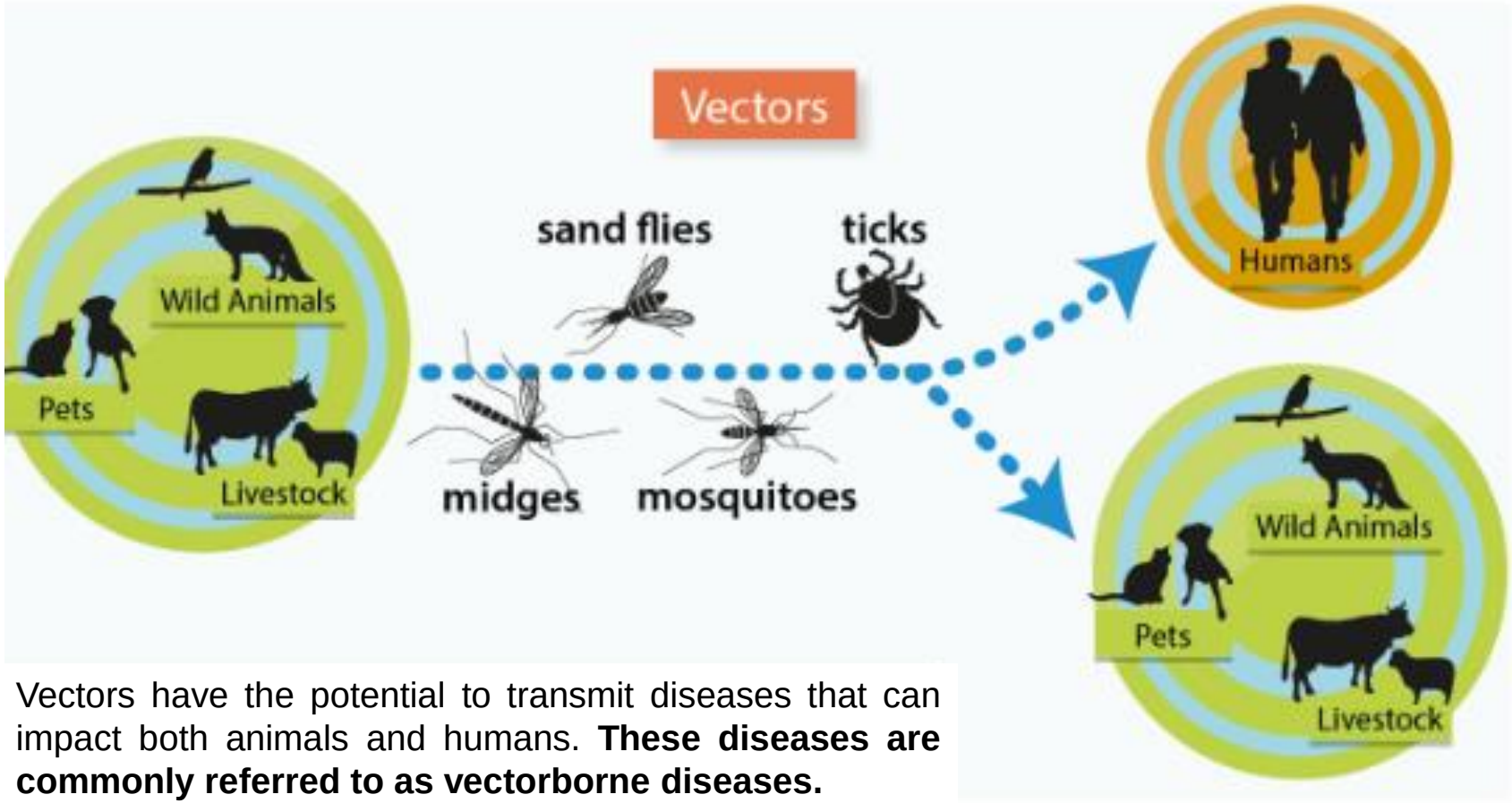
Vectorborne diseases



Vectors have the potential to transmit diseases that can impact both animals and humans. **These diseases are commonly referred to as vectorborne diseases.**

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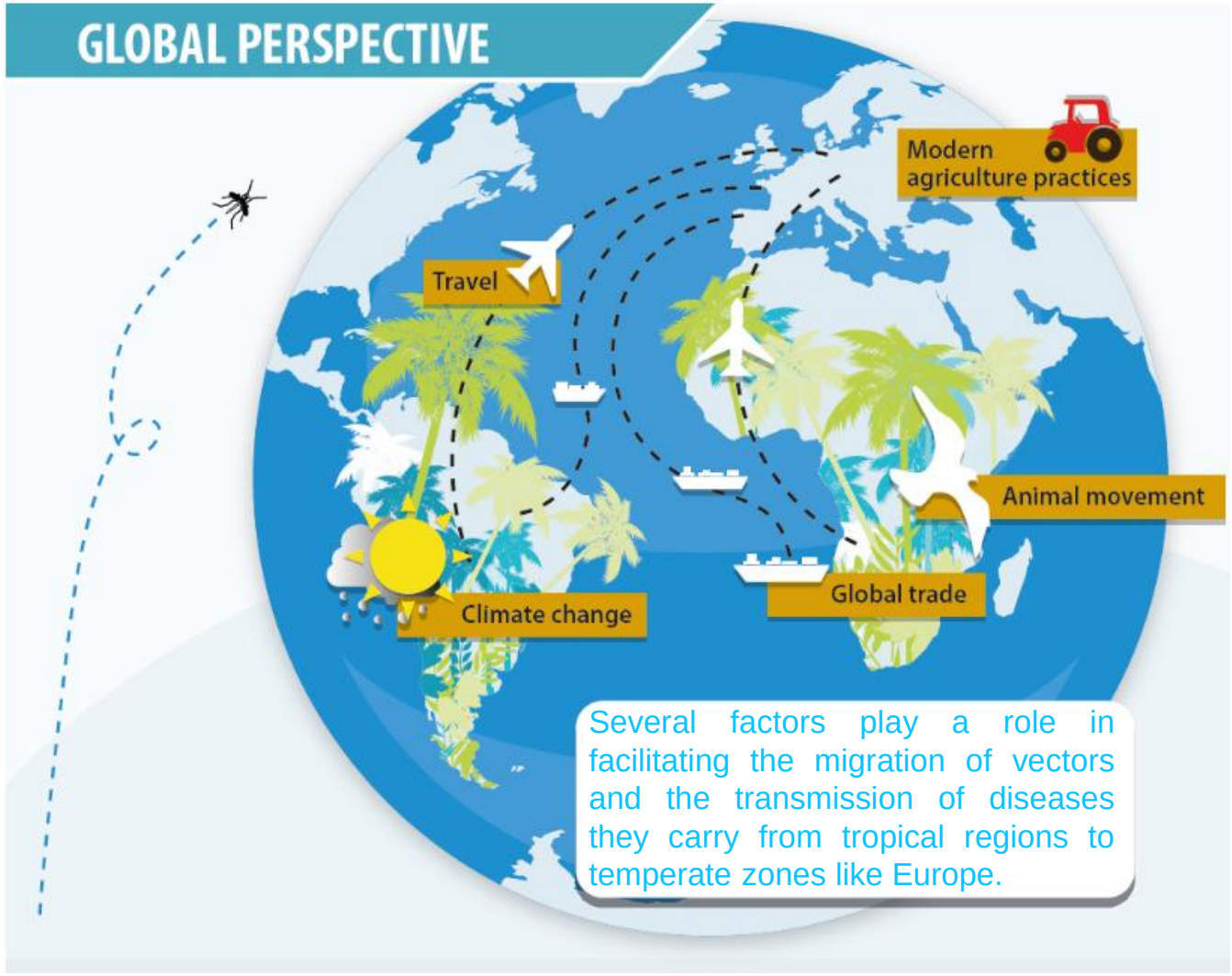
Vectorborne diseases



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Vectorborne diseases

Mosquito-borne diseases

- transmitted by different mosquito species
  - *Aedes*
  - *Culex*
  - *Anopheles*

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Vectorborne diseases

Mosquito-borne diseases

- transmitted by different mosquito species
  - *Aedes*
    - Chikungunya
    - Dengue
    - Lymphatic filariasis
    - Rift Valley fever
    - Yellow Fever
    - Zika
  - *Culex*
  - *Anopheles*

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Vectorborne diseases

Vectorborne viruses - Arboviruses (Arthropod-borne viruses)

- many infections are asymptomatic or cause mild symptoms, similar to several other viruses including the flu and common cold

- detected in the urine of infected patients in concentrations of up to 5.2 $\log_{10}$ copies/mL (Dengue)

Virus	Detected in urine/feces
Dengue virus (DENV)	Yes
West Nile virus	Yes
Zika virus	Yes
Yellow fever virus	Yes

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Vectorborne diseases

Vectorborne viruses - Arboviruses (Arthropod-borne viruses)

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Raw urban wastewater can be used to detect and follow

trends of arboviral diseases in the community

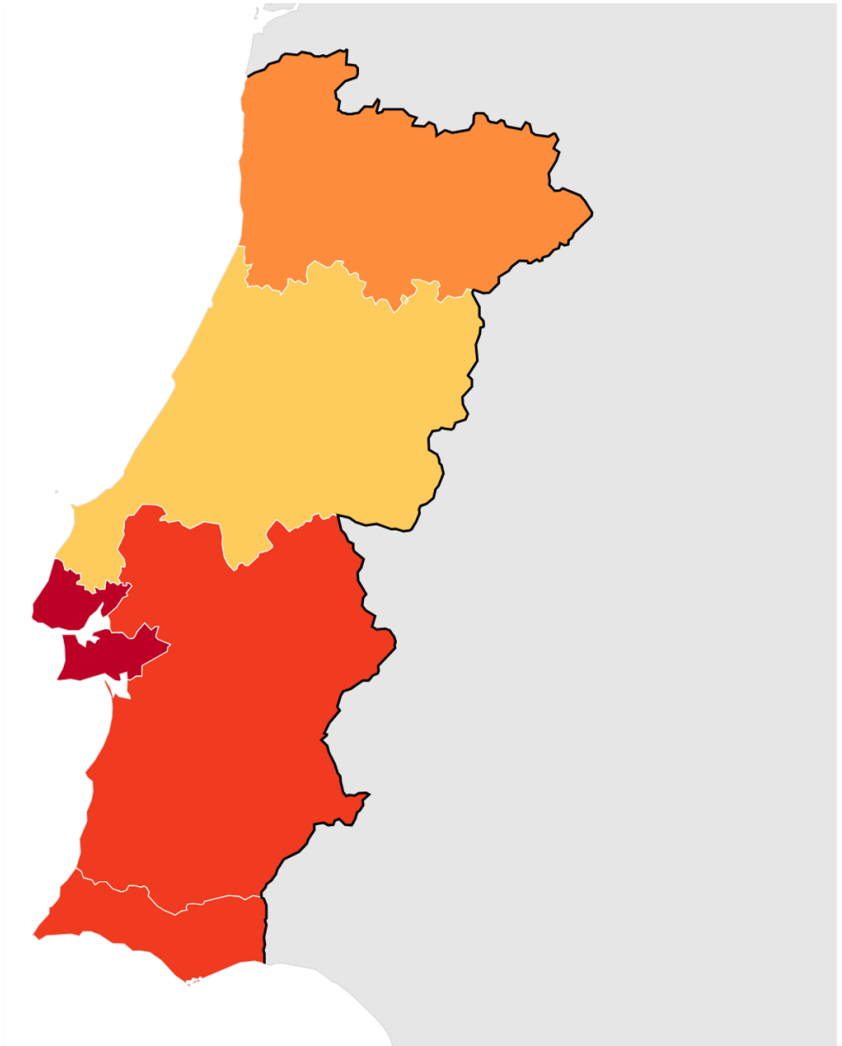
Detection of DENV and CHIKV

Sampling strategy

- Total of 273 samples analysed every two weeks between May 2022 and April 2023:

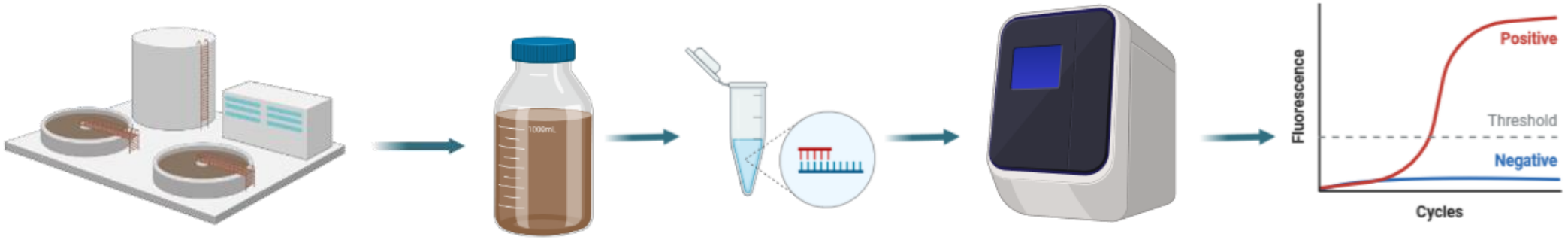
  - North: three wastewater treament plants
  - LVT: four wastewater treatment plants
  - South: four wastewater treatment plants

  } 24 h composite sample



Detection of DENV and CHIKV

Methodology



Concentration

Nucleic acid extraction

One step RT-qPCR

Dengue
Chikungunya: genes Nsp1 e E
Normalization: crAssphage

Recovery: 45 – 81%

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Detection of DENV and CHIKV

- Limit of detection:
  - DENV: 2.05 x 10^3 copies/L
  - CHIKV Nsp1 and E: 3.41 x 10^3 copies/L

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Detection of DENV and CHIKV

Results

- 273 samples analysed every two weeks between May 2022 and April 2023

Target	N. Positive samples (%)	Median (copies/L)	Normalized
DENV	68 (25)	8.6×10^{4}	1.1×10^{-4}
CHIKV	30 (11)	3.2×10^{5}	6.2×10^{-4}
CHIKV Nsp1	20 (7)	2.6×10^{5}	3.1×10^{-4}
CHIKV E	20 (7)	3.3×10^{5}	7.8×10^{-4}

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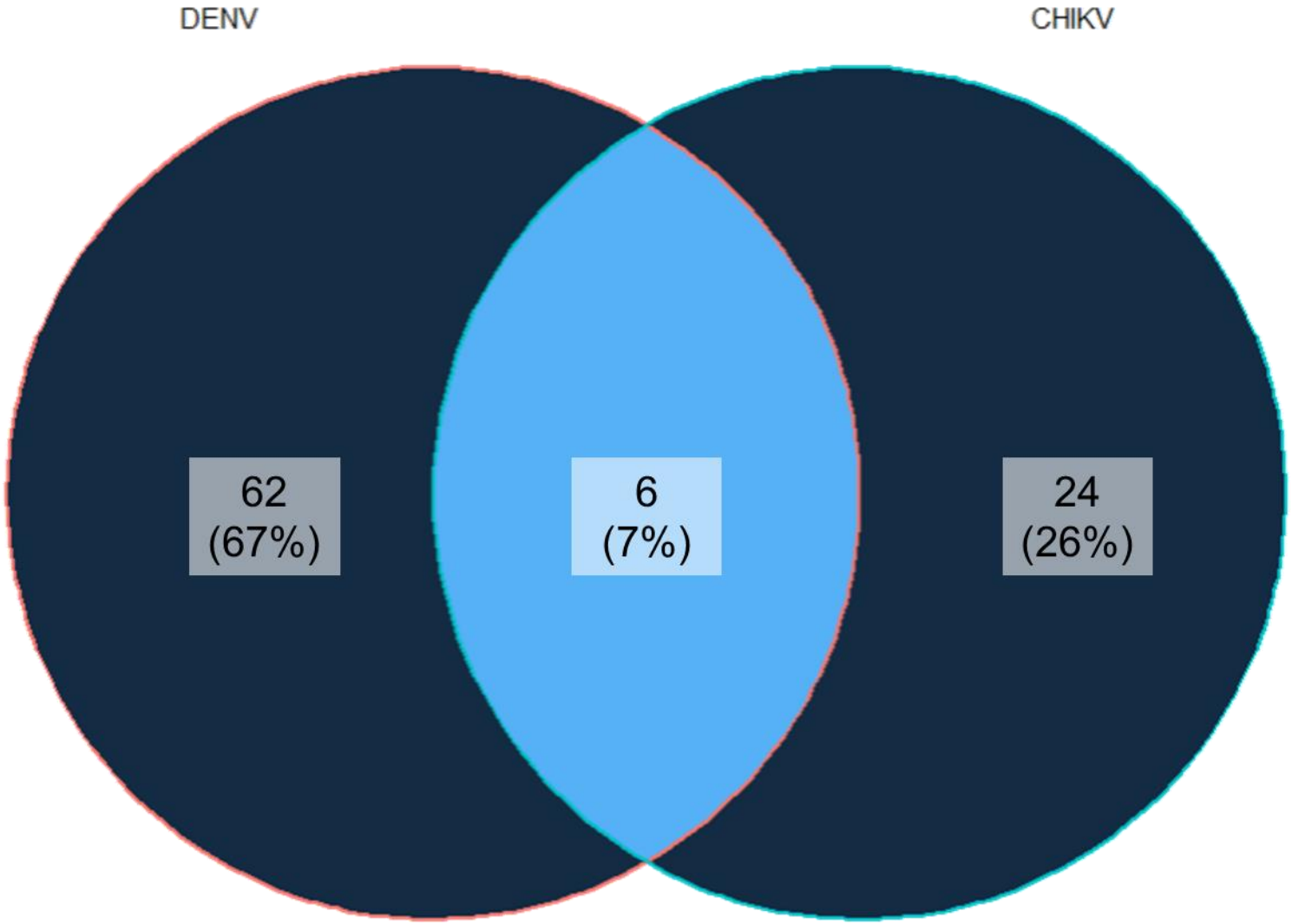
Detection of DENV and CHIKV

Results



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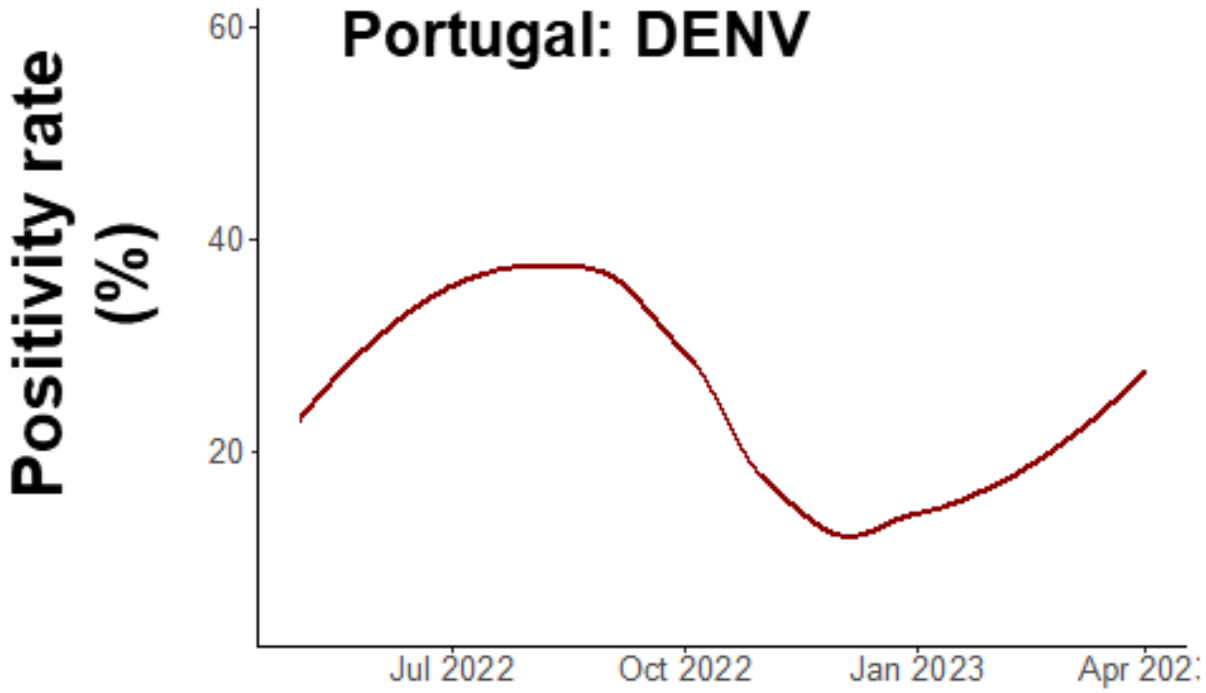
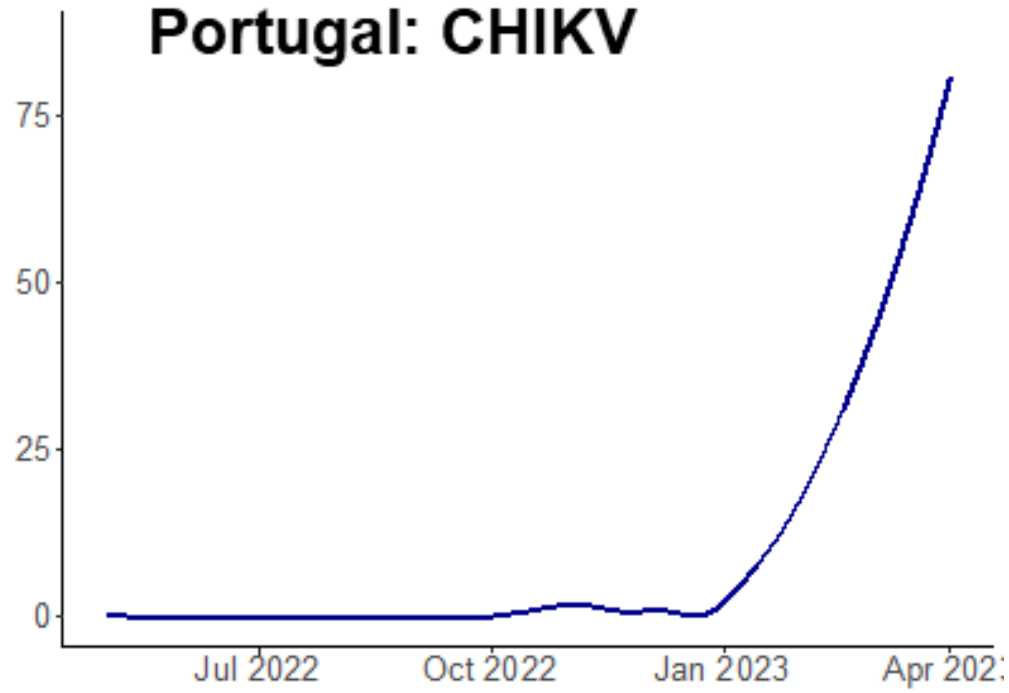
Detection of DENV and CHIKV

Results – Positivity Rate Portugal

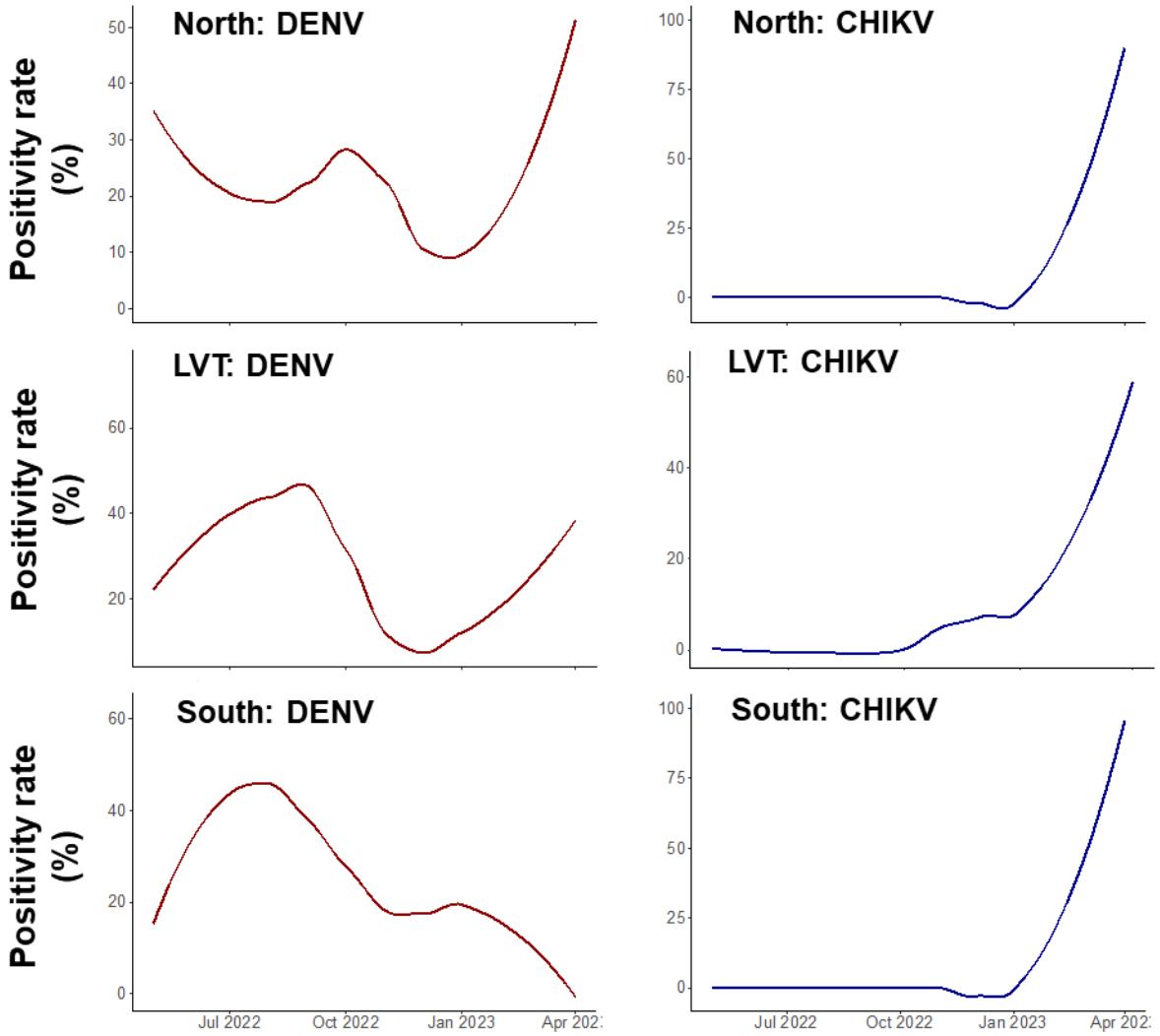




Detection of DENV and CHIKV

Results

Positivity rates by Location



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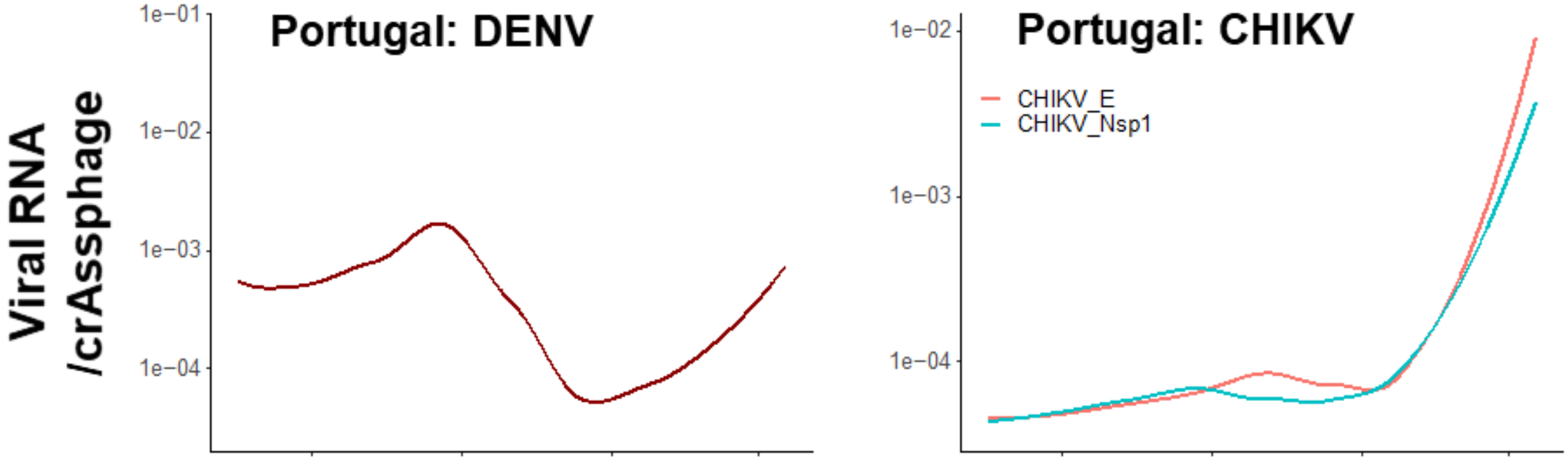
Detection of DENV and CHIKV

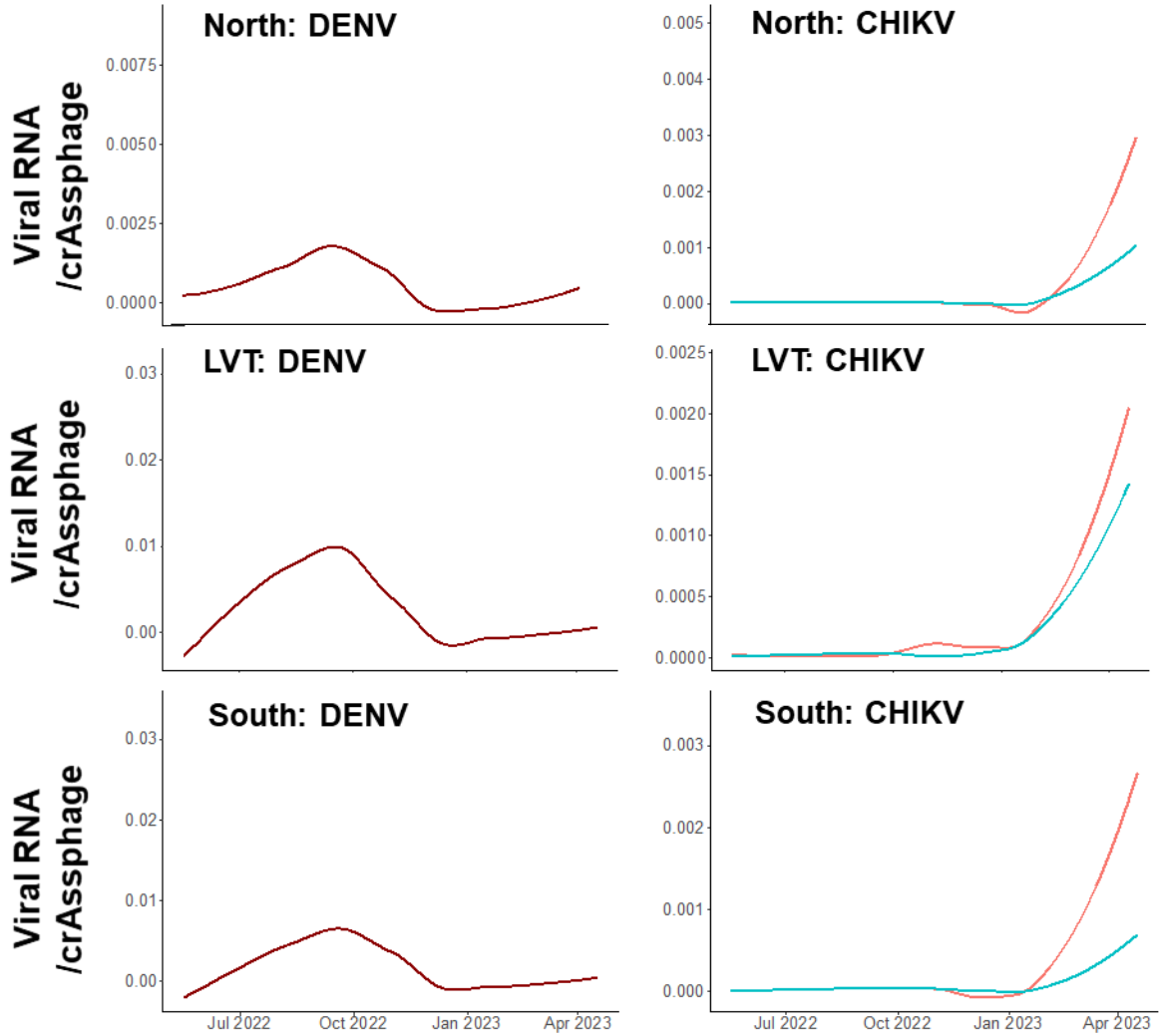
Results – Normalized Concentration Portugal



Detection of DENV and CHIKV

Results

Normalized Concentration by Location



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Detection of DENV and CHIKV

Conclusions

- DENV detected throughout the study
- DENV with slighly different behavior between regions
- DENV following two trends: i) the Northern hemisphere trend with increased number of cases in the second part of the year (2022); and ii) the Southern hemisphere with increased number of cases reported in the first half of the year (2023)

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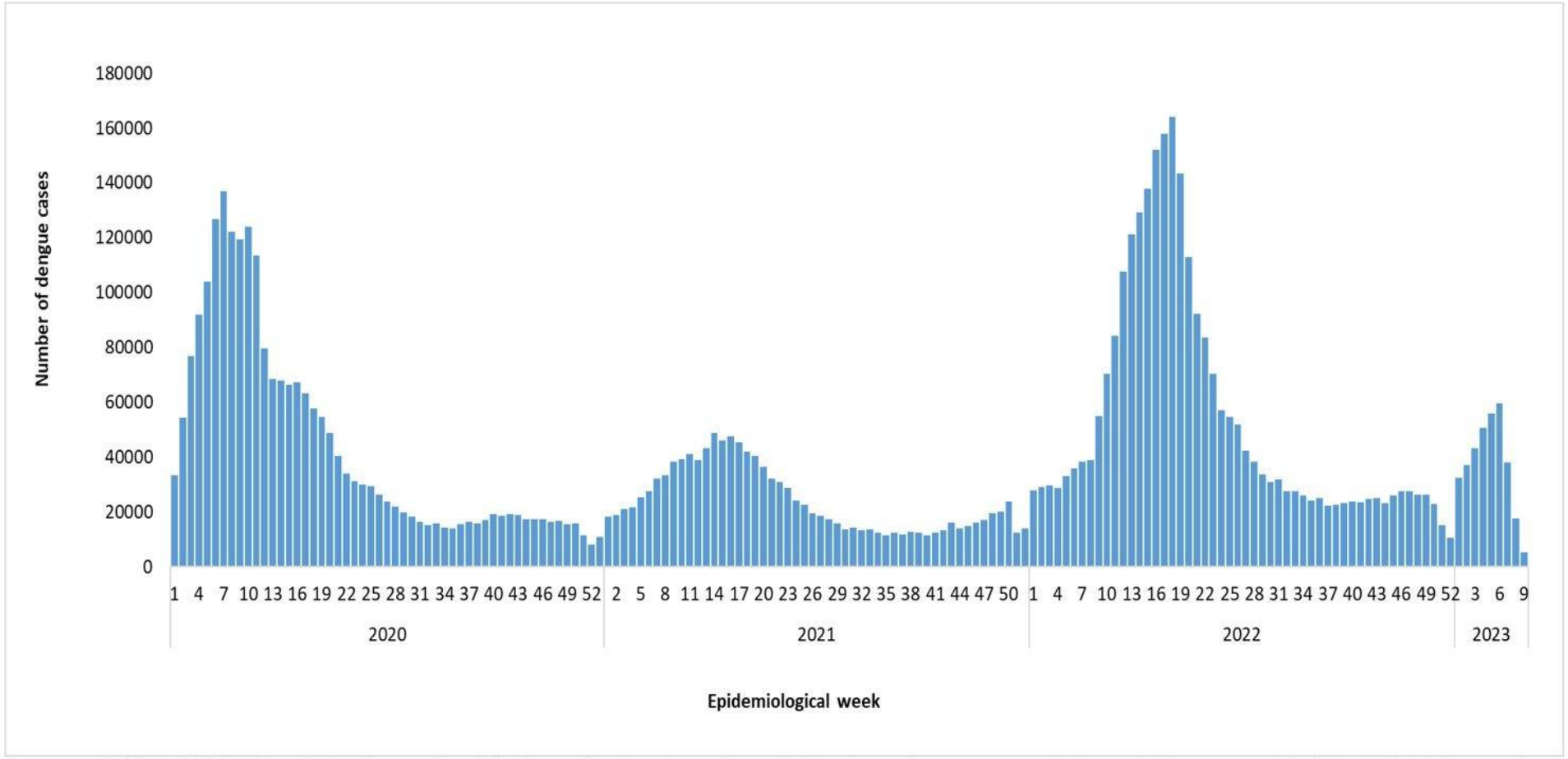
Detection of DENV and CHIKV

Conclusions



Source: PAHO/WHO Health Information Platform for the Americas (PLISA per its acronym in Spanish) as provided by Ministries and Institutes of Health of the countries and territories of the Region of the Americas. Washington DC: PAHO.

Detection of DENV and CHIKV

Conclusions

- CHIKV first detection in Lisbon in December, but increased detection following January 2023
- CHIKKV detection followed the trend in the number of cases for the Southern hemisphere

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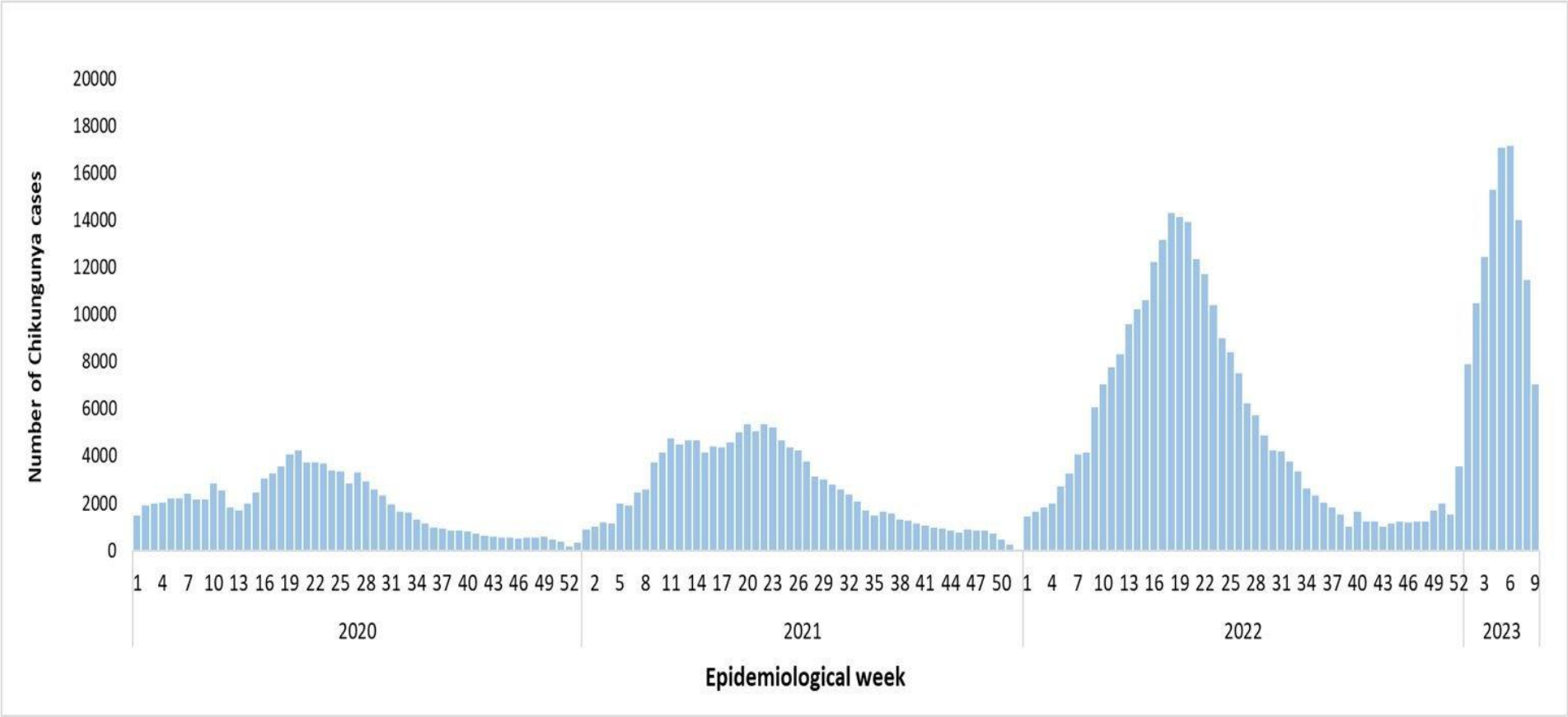
Detection of DENV and CHIKV

Conclusions



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Detection of DENV and CHIKV

Conclusions

- Detection of viral RNA from asymptomatic, syptomatic, resident, and transient population

- Wastewater is an important tool as a complement to syndromic and vector surveillance

VECTOR BORNE DISEASE

THANK YOU

COMMON VECTORS

MOSQUITOES

SAND FLIES

TICKS

"Don't let the tiny beings win"

"Spread awareness"

Small Bite Big Threat

"Beware of the Bite"

"Prevention is better than cure"

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