



POLYU SPEED

Integrating Zoonotic Surveillance into Primary Healthcare: Mitigating Climate-Driven Rat Hepatitis E Risks in Community Settings in Hong Kong

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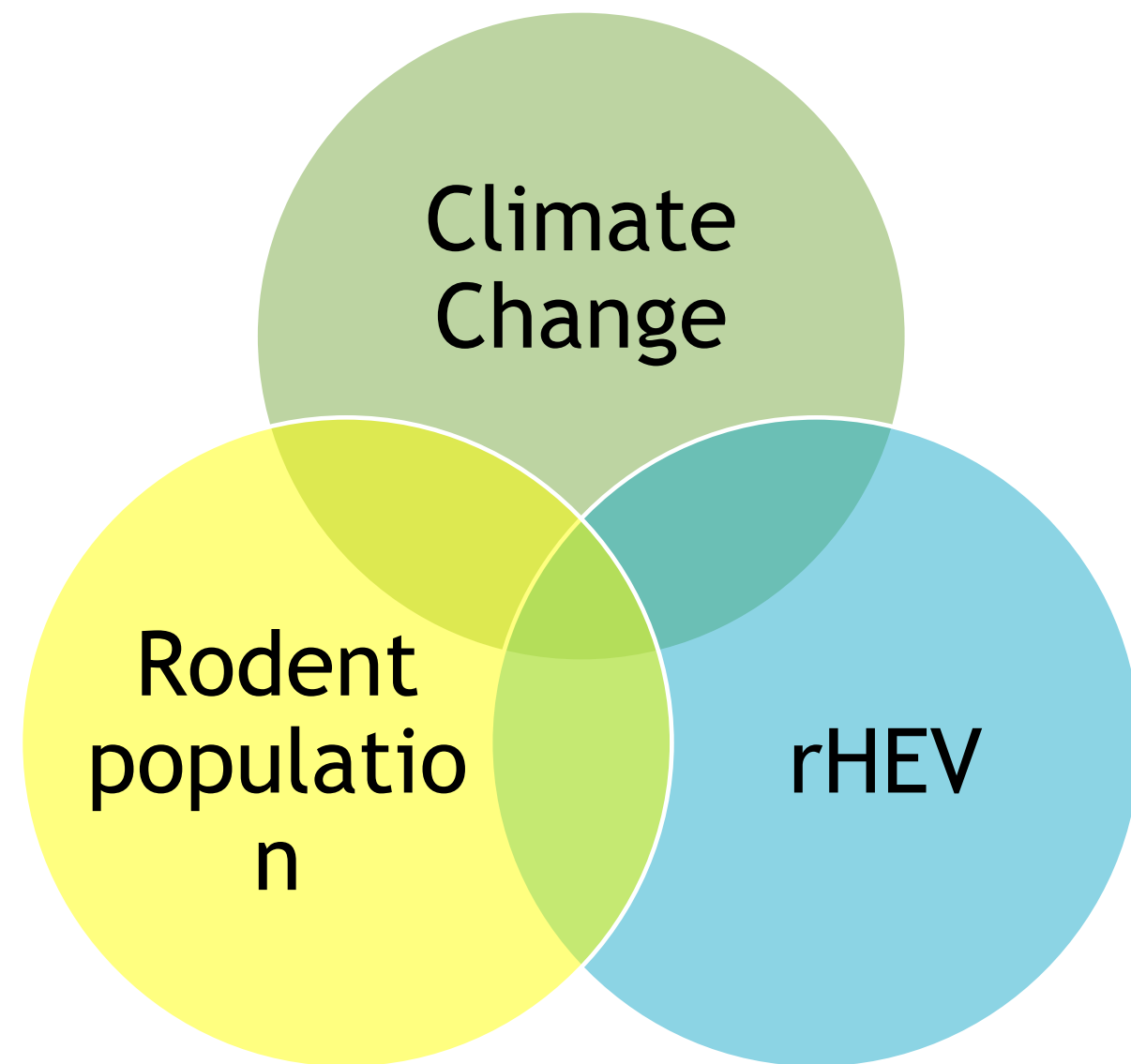
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The Climate-Vector-Pathogen Axis: Climate Change, Urban Rats, and Rat Hepatitis E virus (rHEV)



Vector Expansion

Increased heat extends breeding cycles & accelerates organic waste decomposition

High Reservoir burden

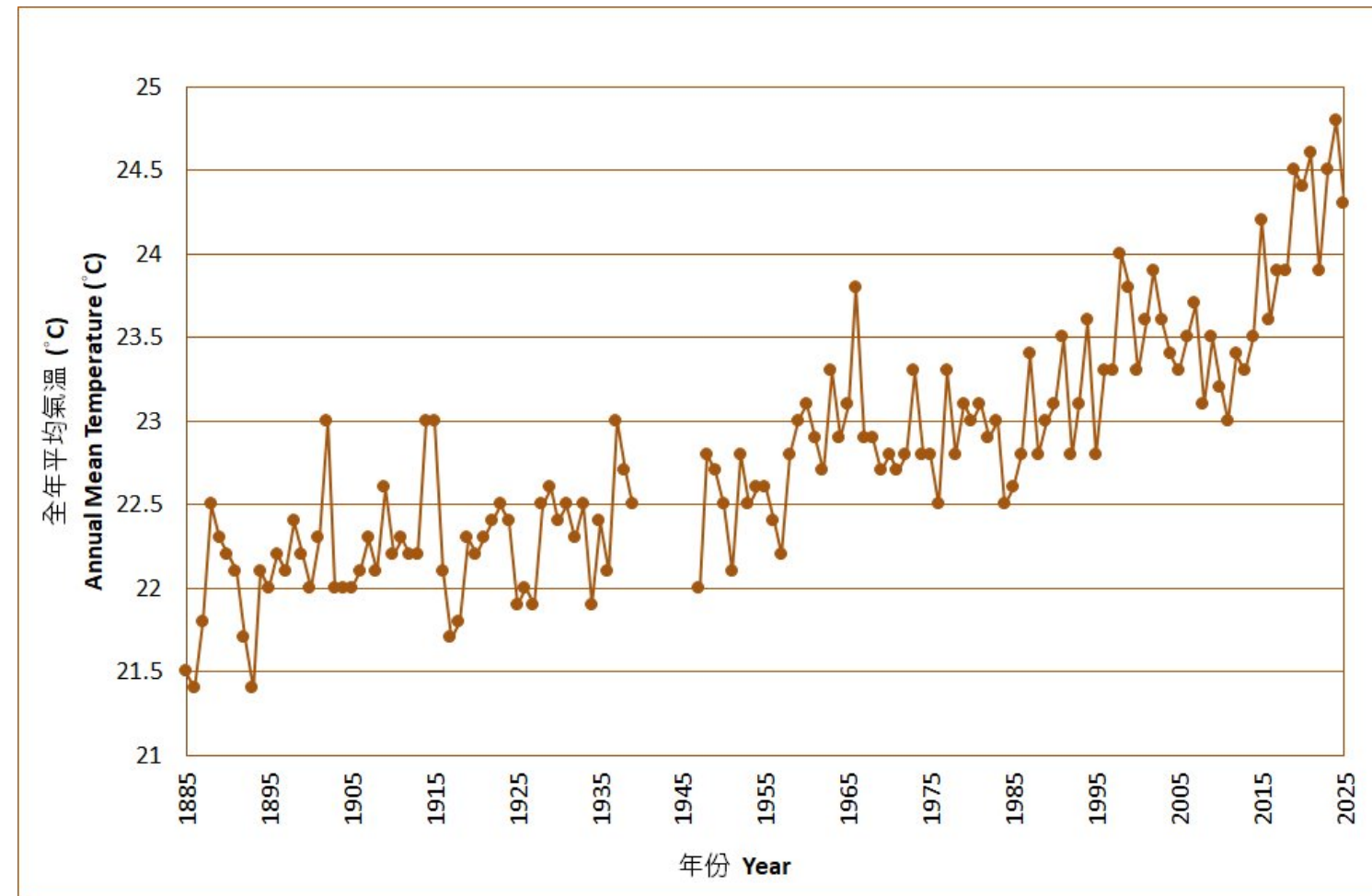
15-30% urban rats carry rHEV, high levels of viral shedding in rat droppings & excreta across urban areas (Soriano et al., 2026)

Environmental Dispersal

Extreme rainfalls & typhoons creates a “flushing effect”, increasing chance of contaminating wastewater with viral RNA (Guo et al., 2022).



Climate Change Factors – Rising Temperatures



- Hong Kong's annual mean temperature has increased by 0.8 °C from 1996 to 2025

Different results due to different types of habitats and global warming

Urban commensal rodents:

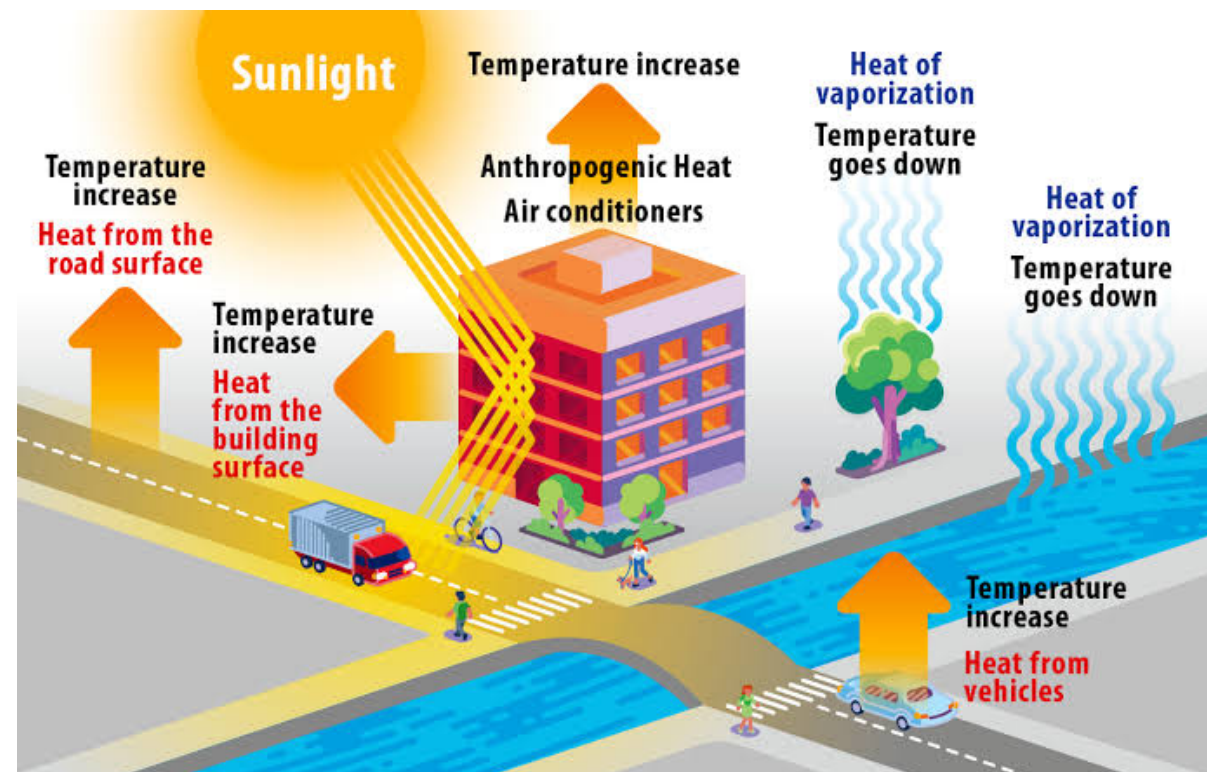
- Rat population proliferation over a period of 7-17 years (increased foraging time) (Richardson et al., 2025)

Wild rodents:

- Sustained decline of rodent population (exceeds optimal temperature range of rodents) (Wan et al., 2022)

- A total of 53 hot days in 2025

Climate change Factors - Urban Heat Island (UHI) Effect & Extreme typhoons/ rainfalls



- Overproduction of greenhouse gases due to industrialization & urbanization

Causes microclimate stability, creating a thermal energy retention effect

- Increased breeding periods of rats
- Increased decomposition of organic waste

- Improves nesting condition of rats, more food availability

(Htwe et al., 2024)

- Destruction of their habitats

(Gheri et al., 2021)

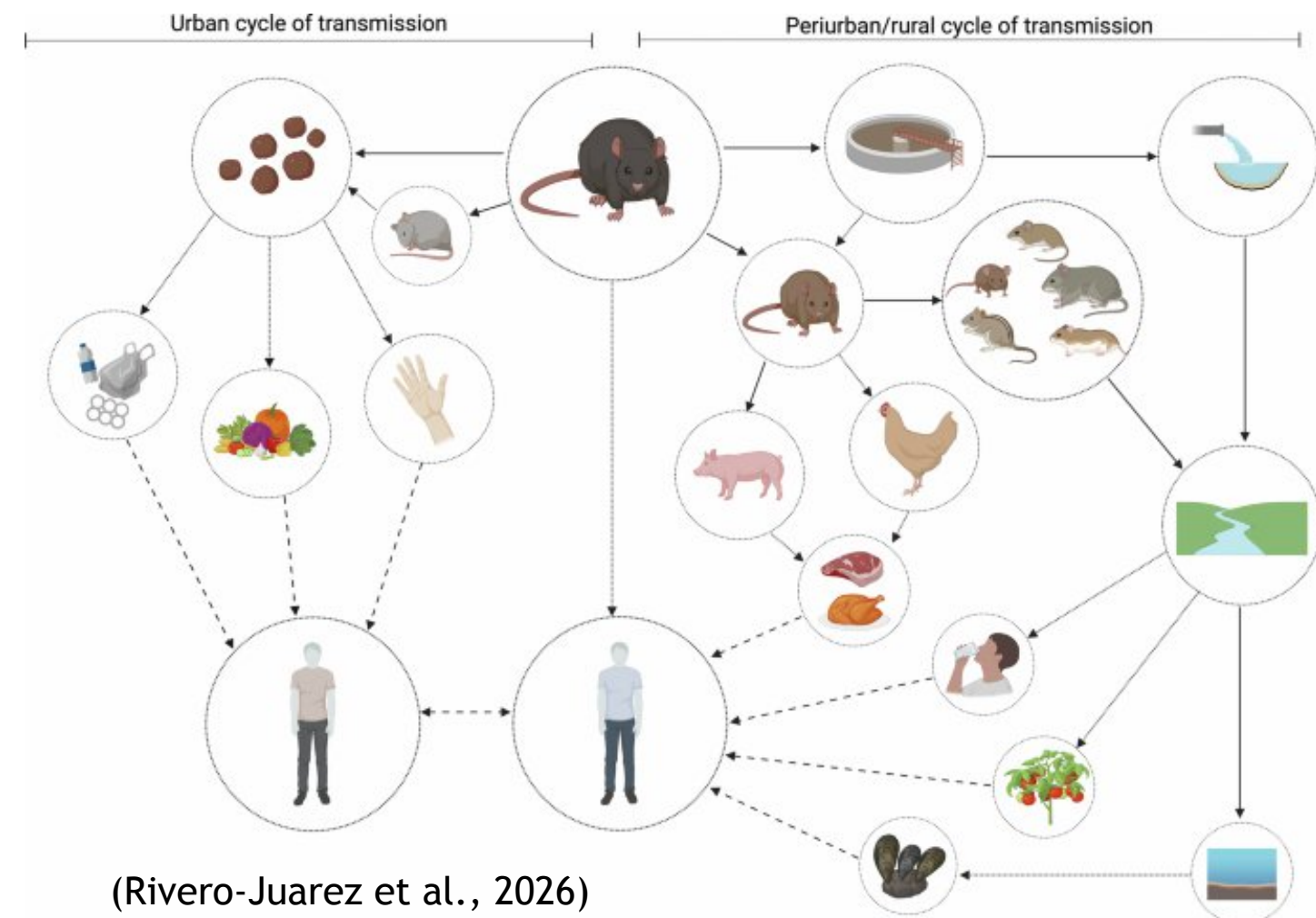
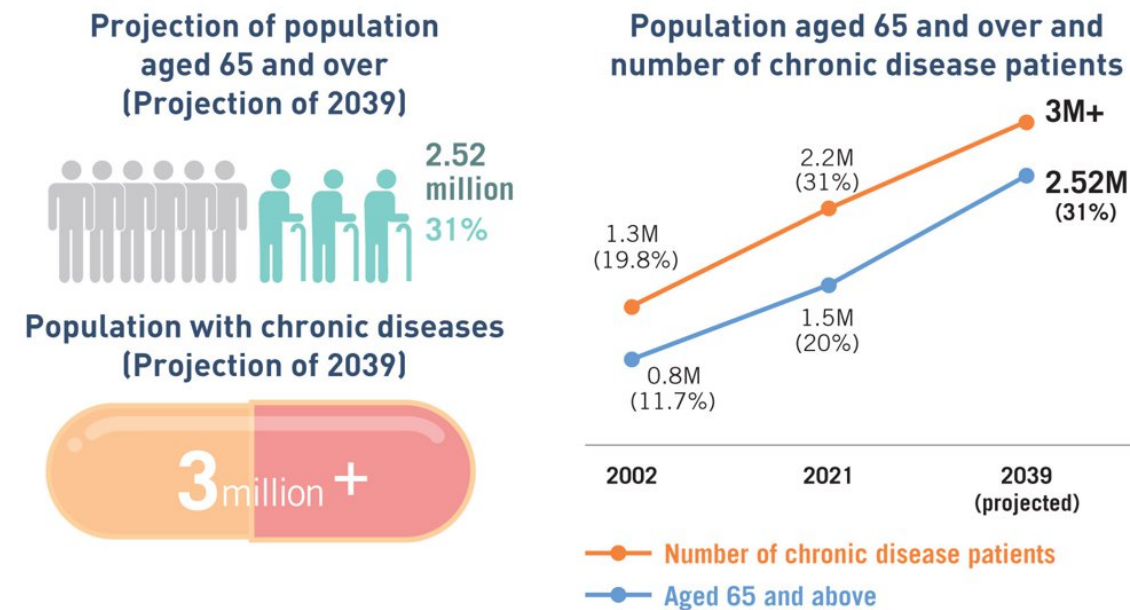
Zoonotic Threat - rHEV

Hong Kong

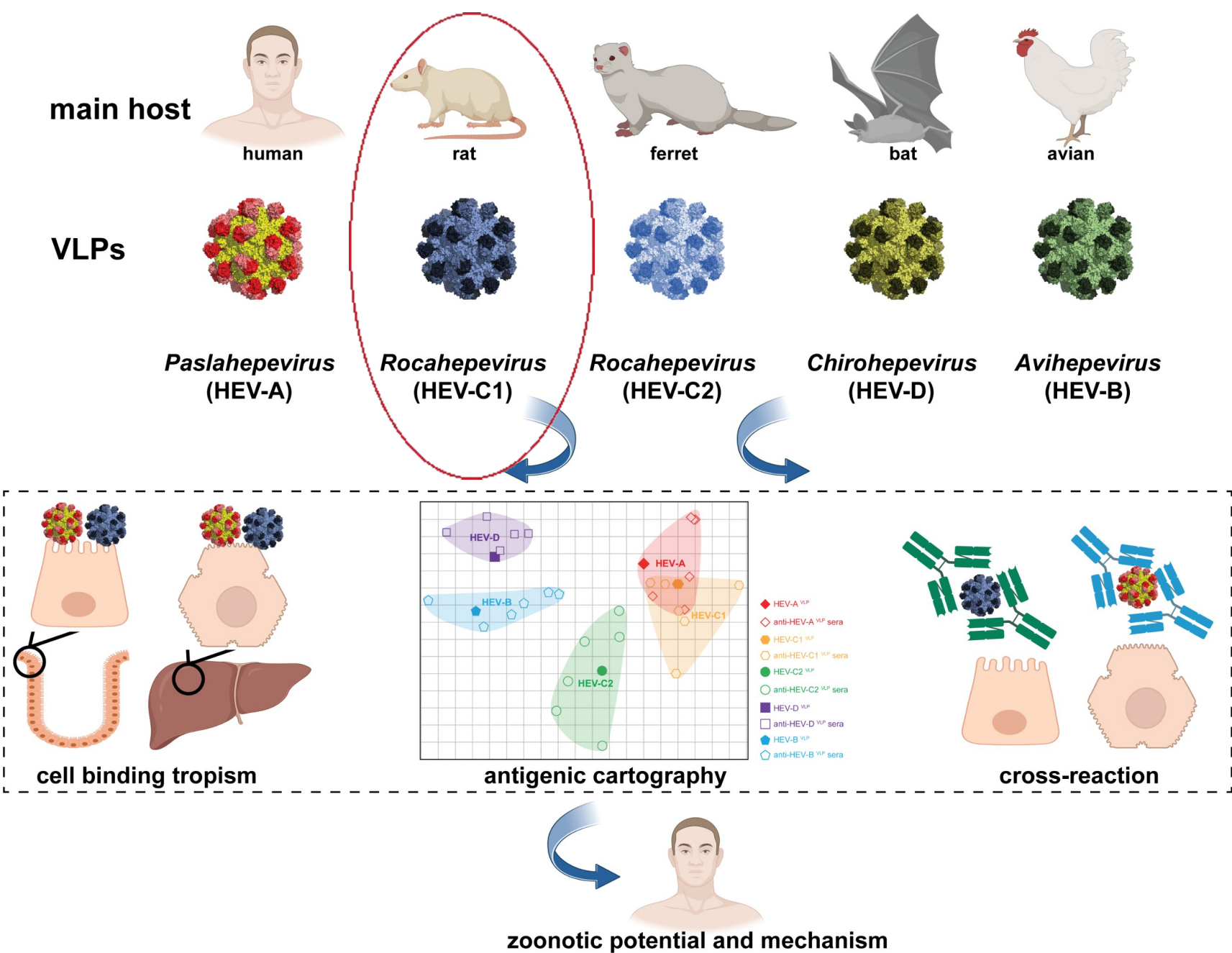
- World's first documented rHEV case in 2018
- 22 human cases from 2017 - 2025 (14 found in immunocompromised individuals)

Occupational Health Risks

- Workers (e.g. wet market vendors, street cleaners, garbage collector) are prone to getting infected

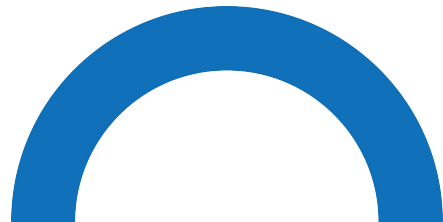


Difference between HEV-A and rHEV Genotype C1



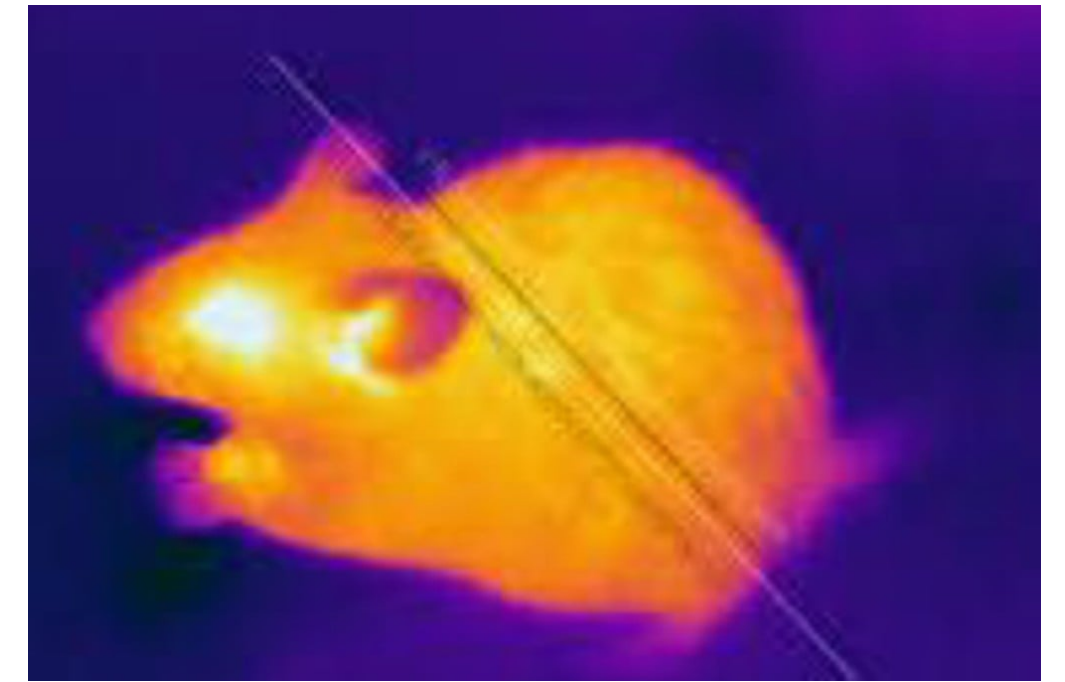
	HEV-A	rHEV Genotype C1
Primary Vector	Undercooked porks	Commensal rats
Route of Transmission	Faecal-oral	Excreta of the infected rat through environmental exposure & contaminated water (Casares-Jimenez et al., 2023; De Sabato et al., 2024)
Clinical Chronicity	Acute; rare chronicity	Persistent liver inflammation and cirrhosis
Target Population	General Public	Highly severe in immunocompromised patients

(Guo et al., 2024)



Hong Kong's Surveillance Strategies

Methods	Sweet potato baits	→	Thermal Imaging Cameras & AI
Metrics	Rodent Infestation Rate (RIR)	→	Rodent Absence Rate (RAR)
Gaps	Not sustainable	→	Can't accurately generalize rodent population. Masks hidden population



Reactive > Predictive/Proactive



Smart & Climate-Adaptive Surveillance

Continuous & Real time monitoring

Interdisciplinary “One Health” Framework

HKO:
Climate
Data

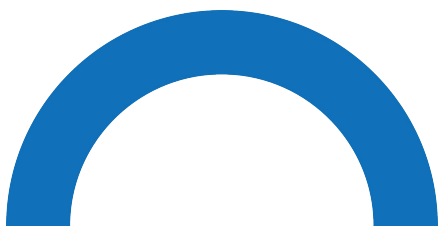
EPD:
Environmental
Data

FEHD:
Vector (Rats)
Surveillance

WBE:
rHEV RNA
shedding

Interdisciplinary data sharing

- Integrates climate data with the virus levels in municipal wastewater
- Detect virus spikes & rodent population BEFORE human exposure



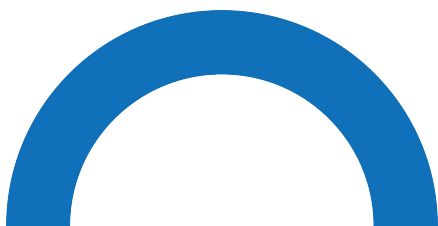
District Health Centres (DHCs): Operationalizing One Health in Primary Care



地區康健中心
District Health Centre

- 18 DHCs in total
- For at risk individuals & patients with chronic diseases
- Builds trust with local residents & public health authorities

1. Early Warning Reception
Automated alerts from EPD & FEHD data
2. Targeted Risk Outreach
Deploy healthcare professionals to high-risk places
3. Clinical & Environmental Liaison
 - Family doctors for rHEV test
 - Report local hygiene gaps to FEHD



Recommendations

Cases from Singapore & New York



Singapore's IoT-based RATSENSE system

- Deploy Low-Power Wide-Area Network (LPWAN) motion sensors in sewers, drains, ceilings
- Reduced rat burrows from 5200 (2023) to 2,700 (2024) in Singapore



April 1, 2024

Enforcement of mandatory containerization rules for all businesses begins!

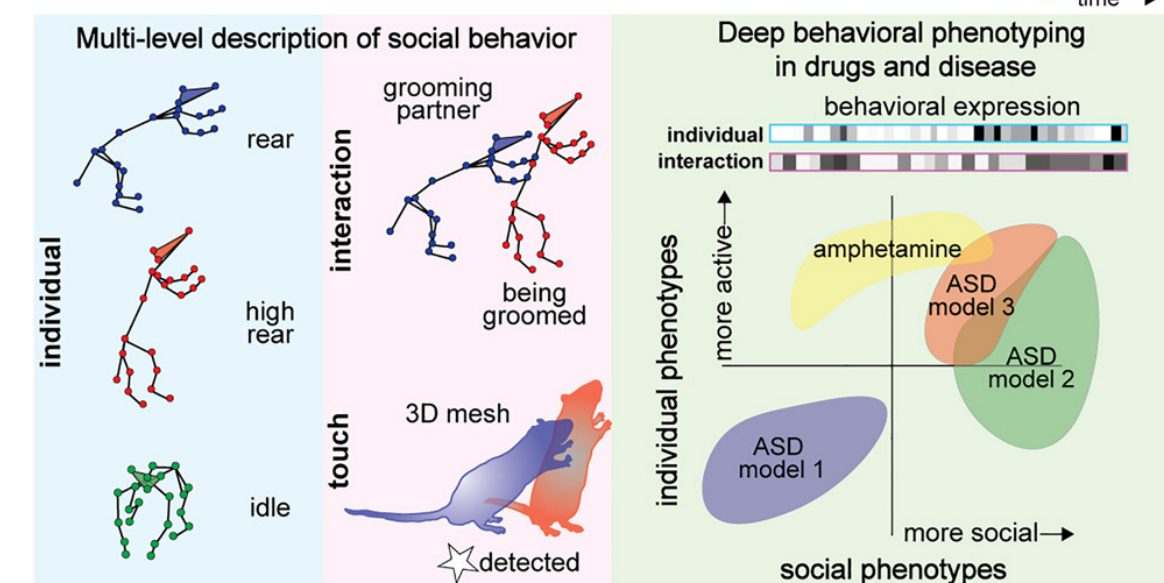
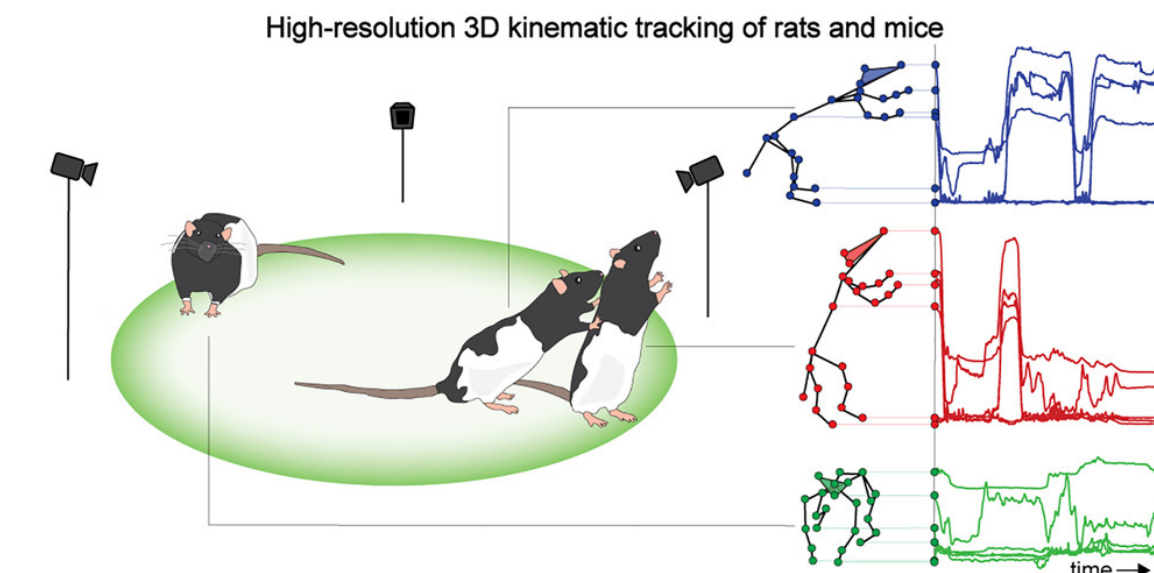


NYC's Mandatory Waste Containerization

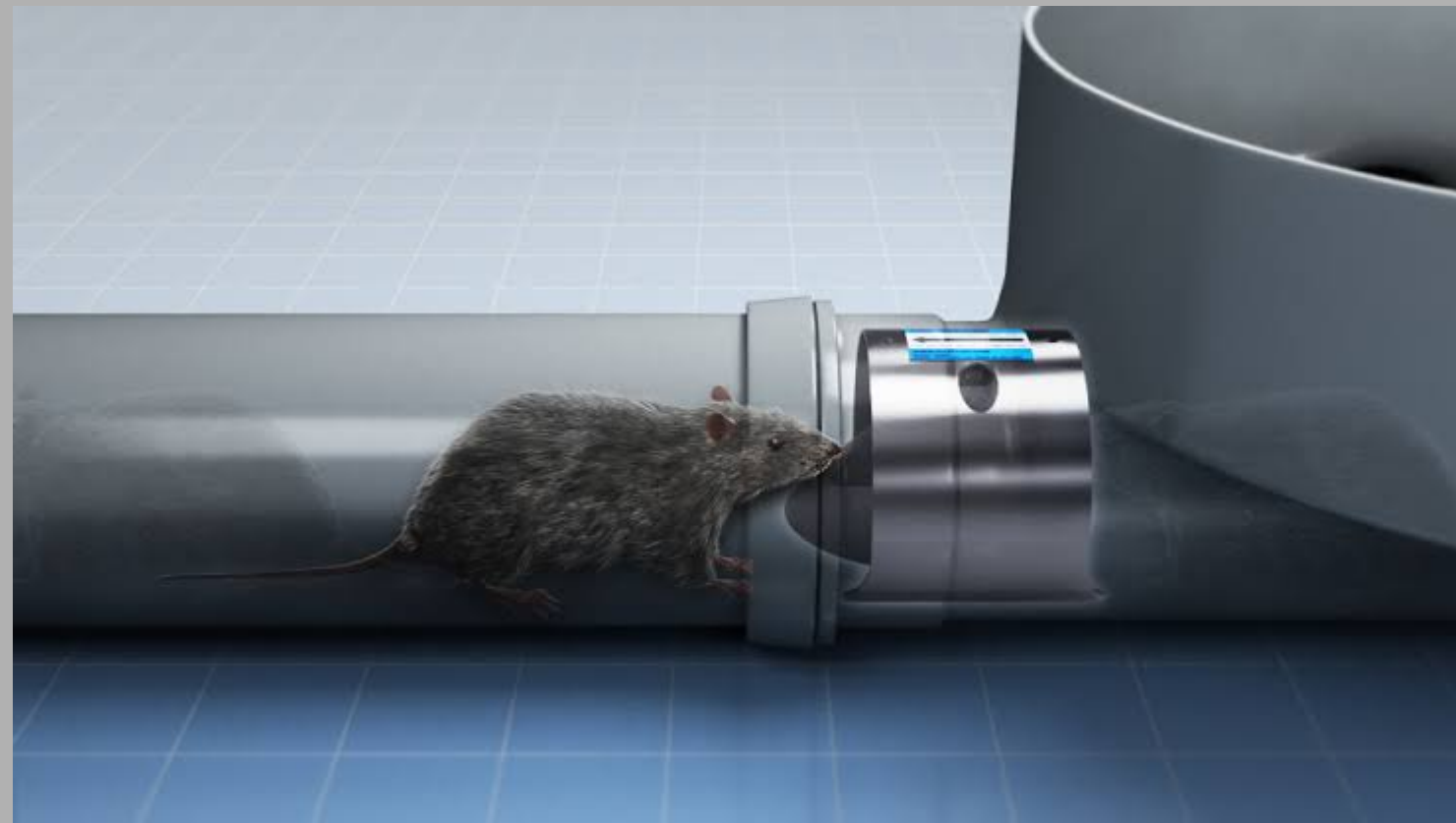
- Ban open street trash bag disposal to eliminate food sources in thermal hotpots
- 20.6% drop in citywide rat sightings

Hong Kong 3D Spatial Mapping Model (DANNCE)

- Place 1-2 DANNCE pilot rigs in high-risk surveyed areas to understand rat behaviours
- FEHD's AI thermal imaging cameras can detect early-warning signs



Drainage & Flood Management



- Droppings of infected rat could mix with wastewater.
- The flushing effect could create human-rodent contact

Install specialized wire mesh & rat flaps in drainage pipes -> Blocks rats from entering residential areas during extreme weather

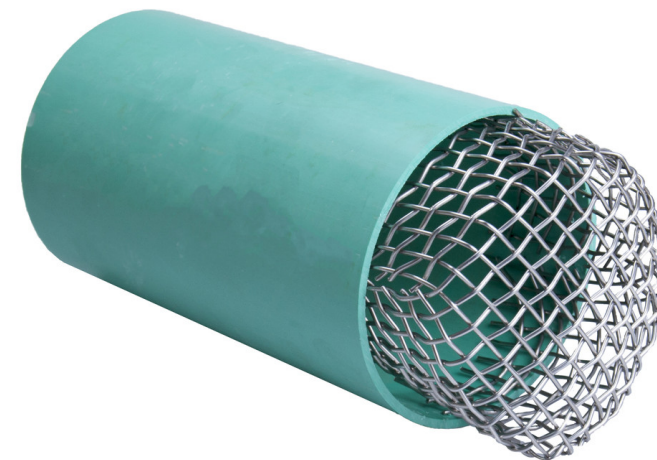
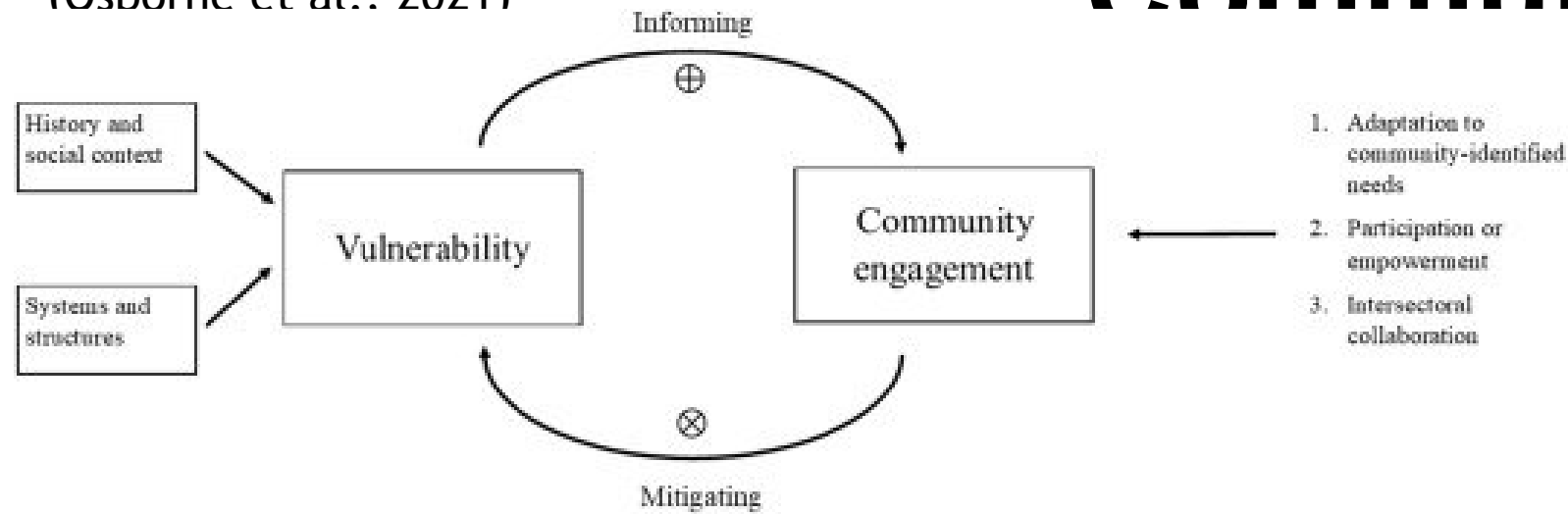
(Byers et al., 2019 ; Guo et al., 2022)

Adopt a stronger Integrated Pest Management (IPM) approach through collaboration between the Drainage Services Department (DSD) and FEHD

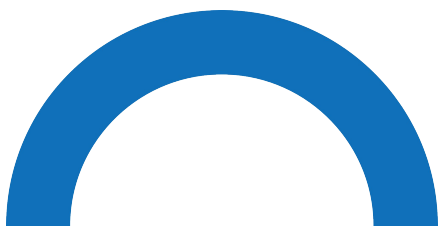


Community Involvement

(Osborne et al., 2021)



- Encourage citizens to report rat sightings & food waste in existing mobile reporting apps
- Educate vulnerable populations (elders, workers) on hygiene & handling food waste
- Provide pest-proof mesh & pipe flaps to residents in subdivided units (SDUs)





CONCLUSION

I. A major public health risk

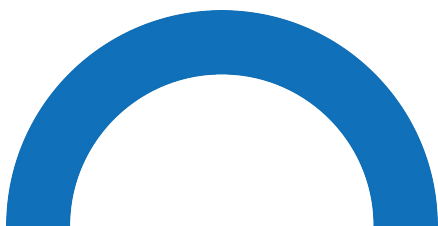
- Rising temperatures and the UHI effect have positive associations with rodent population
- Extreme rainfalls & typhoons could both benefit/harm the rodents

II. Paradigm shift : Reactive to Predictive

- Instead of waiting for patients to be treated for rHEV, a proactive & predictive approach through One Health framework strengthens primary healthcare systems

III. Upstream Prevention & Primary Healthcare Action

- Collaborations between different sectors is important
- Blocks virus from harming the vulnerable populations





THANK YOU

PRESENTED BY: Ailie Aragon

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