

Technologies Accelerating Detection and Response in the One Health Approach

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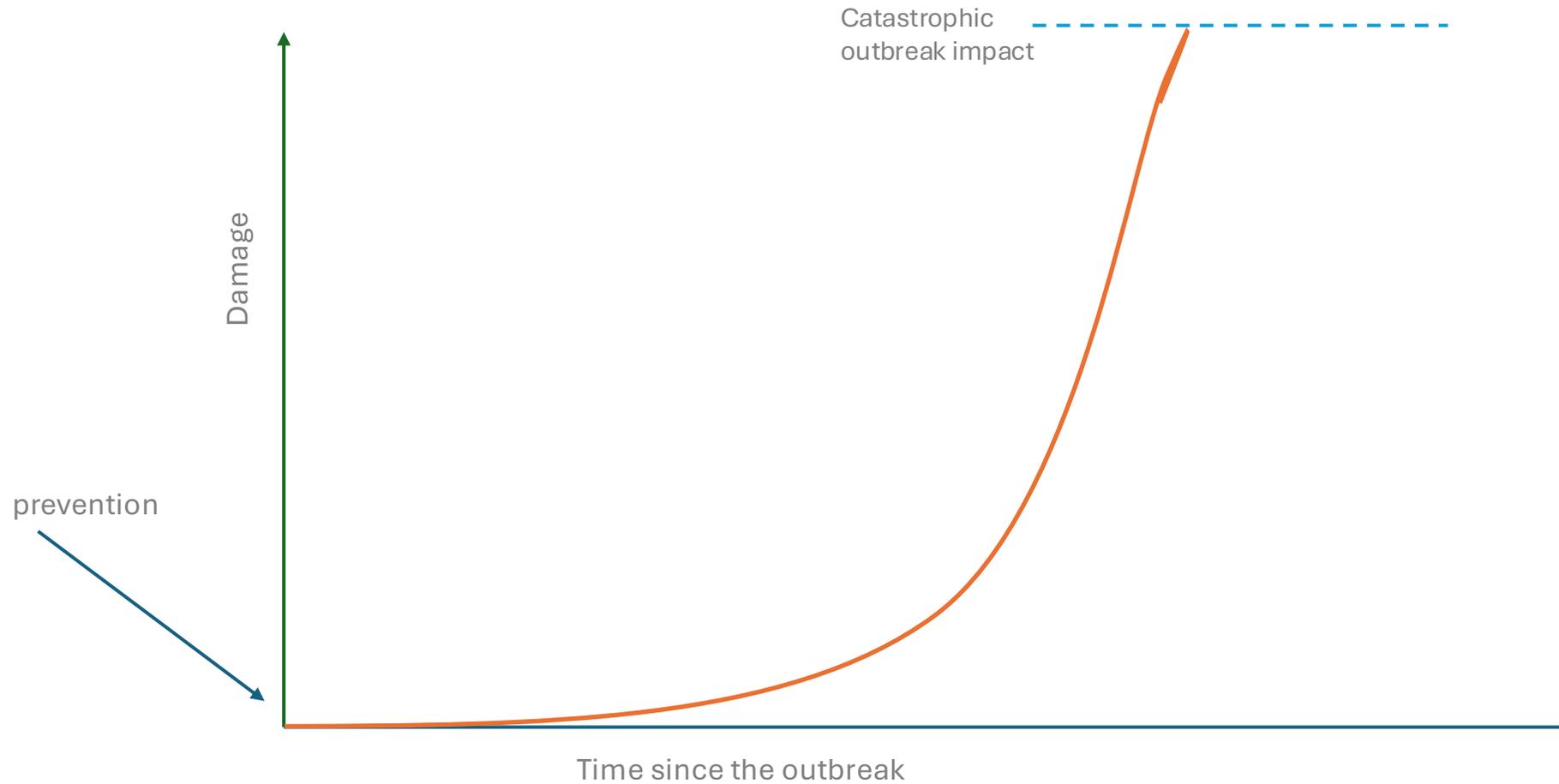


**We all want to live in a
secure World.**

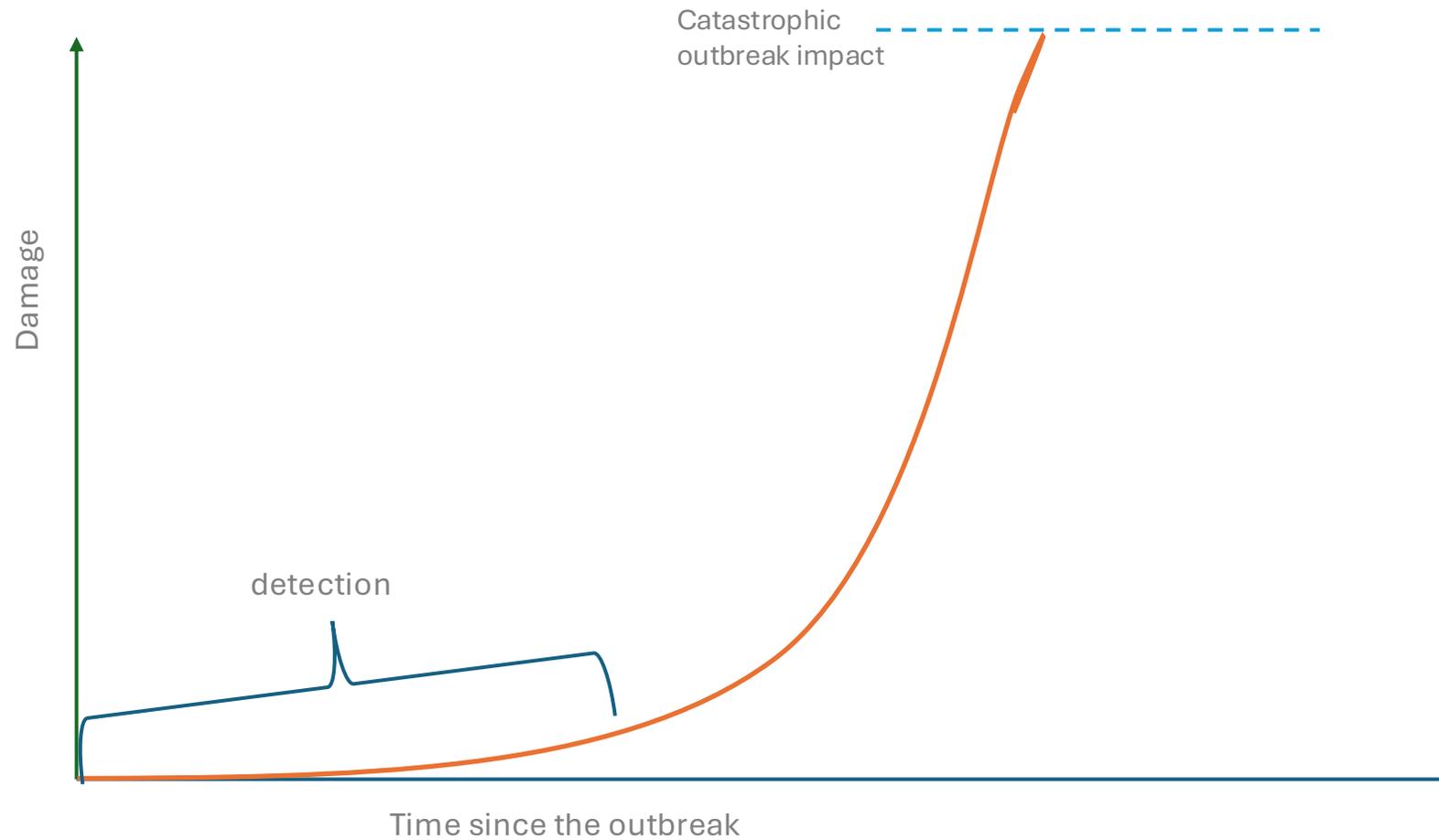
**But new and existing
health threats are
constantly emerging.**



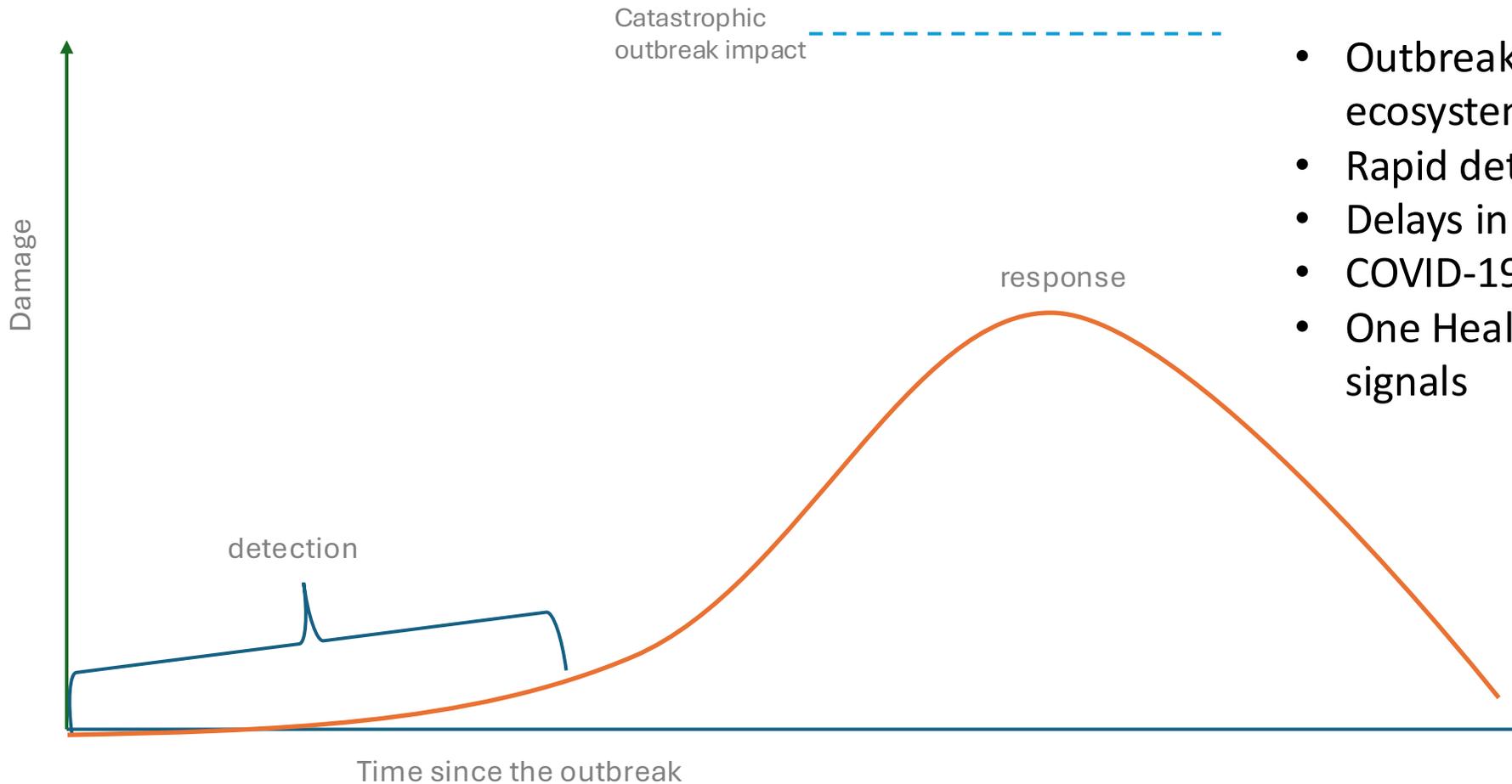
We can intervene at **different times**



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- Outbreaks affect humans, animals, ecosystems
- Rapid detection = early warning
- Delays in detection = delays in response
- COVID-19 taught us this
- One Health requires shared diagnostic signals

Evolution of Viral Detection Technologies

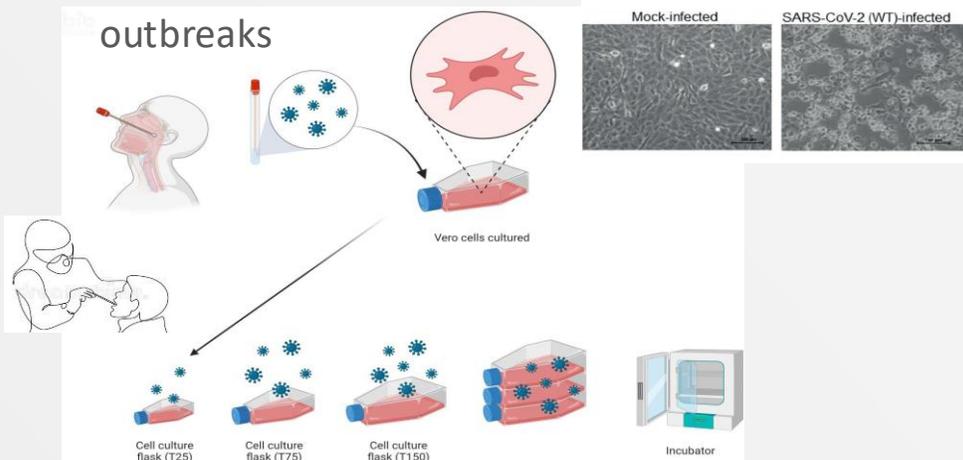
1940–1990

Cell culture

 Slow, low sensitivity

 Not suitable for

outbreaks



1987→today

PCR era

 Highly sensitive & specific

 Gold standard for labs

1990–2010

Immunology & early isothermal

 ELISA, early **LAMP**

 Faster, but limited

2020–2023

COVID-driven innovation

 Fast optimization of RT-PCR

 CRISPR-Dx

 ddPCR

 **Multiplex panels**

 **Portable sequencing (ONT)**

Current Landscape of Viral Detection Tools

CRISPR-Dx

- ✓ Ultra-specific
- ✓ Fast
- ✓ Variant-level detection
- ✗ Still emerging

ddPCR

- ✓ Highest sensitivity
- ✓ Low viral load detection
- ✓ Accurate quantification
- ✗ High cost

Nanopore Sequencing

- ✓ Detect + sequence
- ✓ Real-time
- ✓ Useful for zoonoses, WNV, HPAI
- ✗ Needs trained staff

RT-qPCR / Multiplex

- ✓ Gold standard
- ✓ High sensitivity
- ✓ Ideal for labs
- ✗ Requires equipment

RT-LAMP / RPA (Isothermal)

- ✓ Rapid & low-resource
- ✓ Field-friendly
- ✓ Ideal for rural One Health
- ✗ Less quantification power





Priority diseases/Diagnostic needs

Local Manufacturing

Tech Providers
RUO/IVDR/LDTs

Technology transfer

Field Testing/Regulatory Approval/Roll-out

ONT MinION sequencing



Genomic Surveillance

Capacity building
Networking
Training

Long term
Sustainability

Climate change

Neglected

Mistreated

Cases underreported



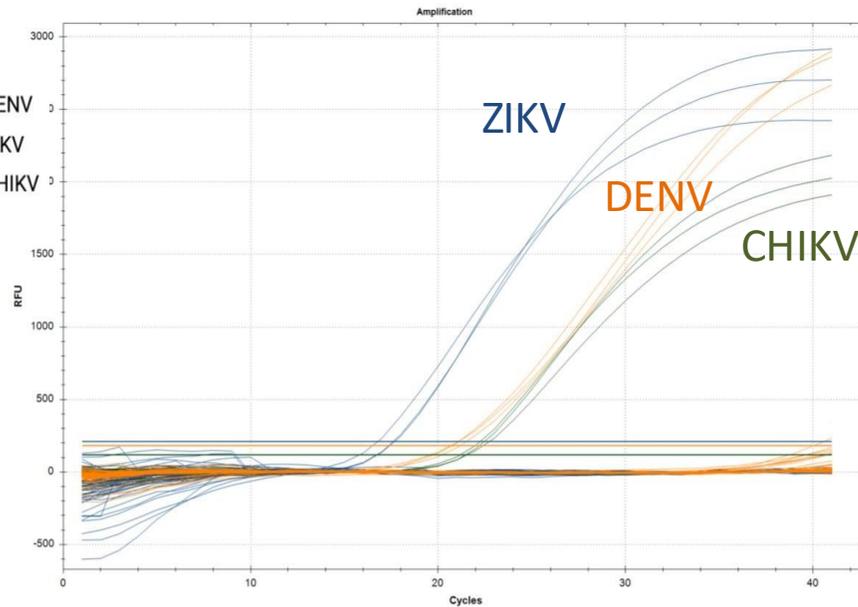
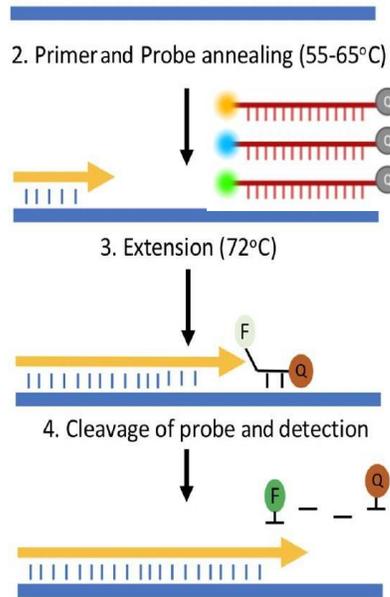
Misdiagnosed

NEEDS ASSESSMENT

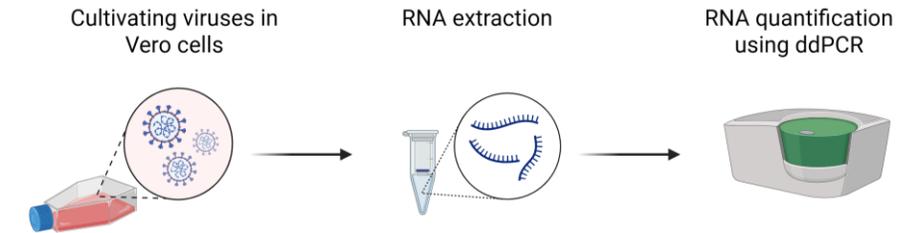
- Claimed presence of arboviruses
- Reported outbreaks of Dengue and Chikungunya
- Lack of reliable tests for arbovirus diagnosis

RTqPCR – ZIDECHIP

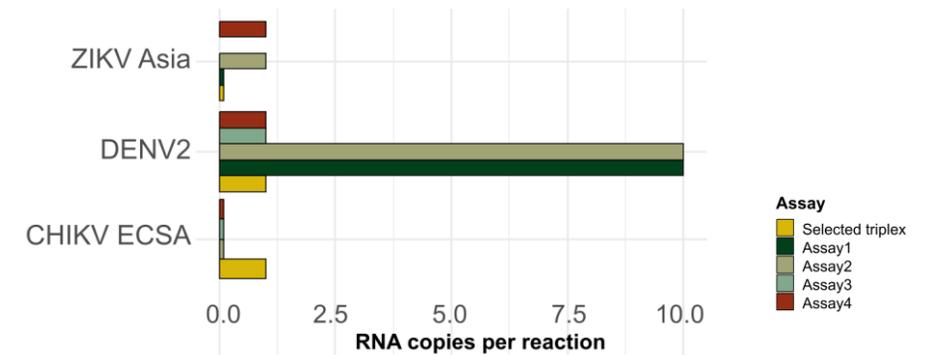
MULTIPLEX – 3 sets of primers and probes.
Probes tagged with different fluorophores.
One reaction for 3 targets.



Viral standards - different strains



Analytical sensitivity

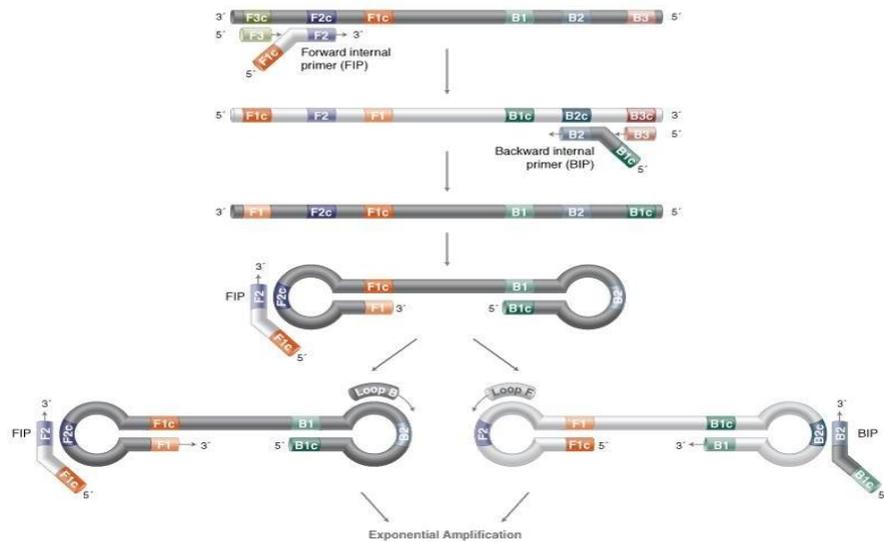


What is LAMP?



- Loop-mediated isothermal amplification (**LAMP**) is a **single-tube technique** for the **amplification of DNA** and a low-cost alternative to detect certain diseases.
- Reverse transcription loop-mediated isothermal amplification (**RT-LAMP**) **combines LAMP** with a **reverse transcription step** to allow the **detection of RNA**.

LAMP principle



LAMP workflow

Sample inactivation



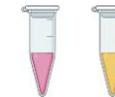
Lysis / DNA or RNA extraction



Amplification



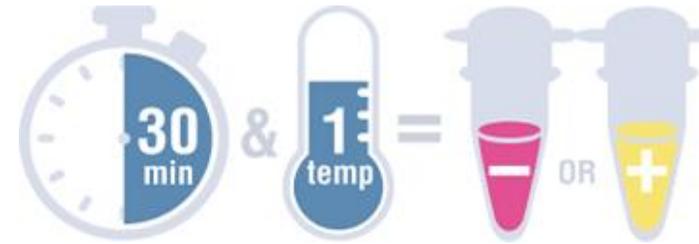
Detection



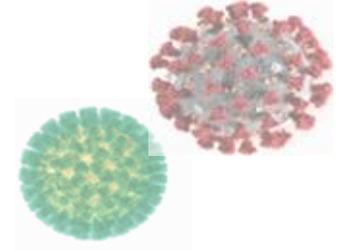
Why LAMP?



- Very sensitive (amplification-based assay)
- Rapid (~ 30 min)
- No special equipment needed (isothermal, colorimetric read-out)
- No trained personnel (easy to assemble, specific)
- Robust (6 primers, DNA polymerase less sensitive to inhibition)
- Cost-effective



Use in diagnostics



- Point of care (POC) testing
- Molecular diagnostics, e.g., infectious diseases
- Research applications (infectious disease research)
- Food testing ...

RT-LAMP for detection of SARS-CoV-2



RT-LAMP tested on >3,000 samples

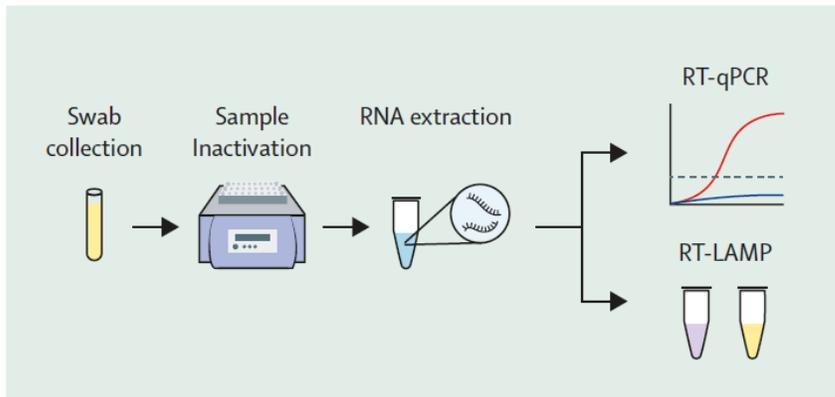
RNA extracted from nasopharyngeal swabs
Baba et al. 2021, EClinicalMedicine

89% sensitivity and 95% specificity

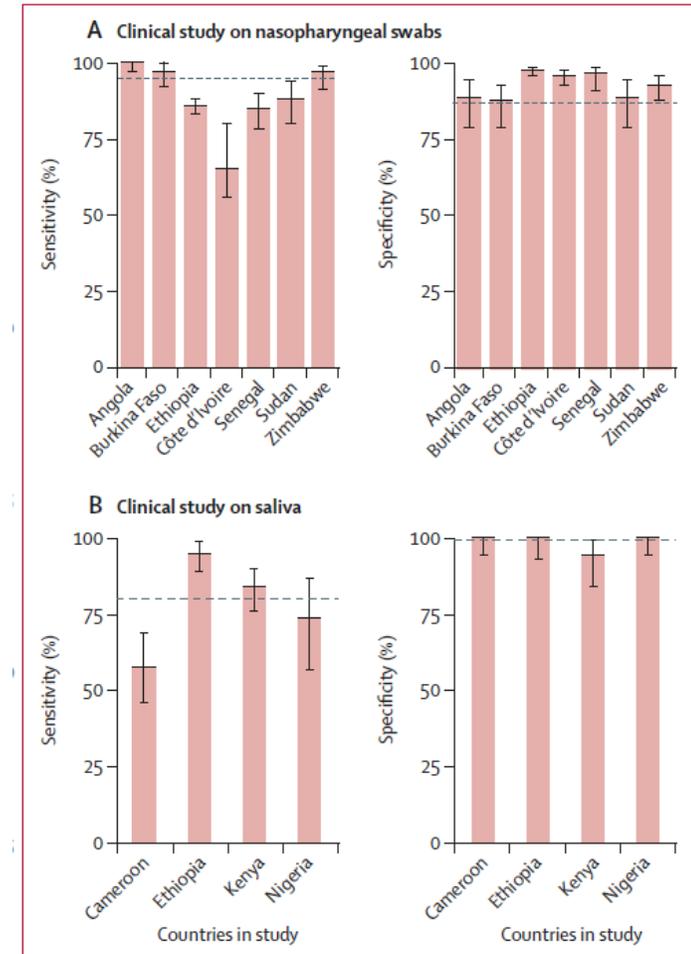
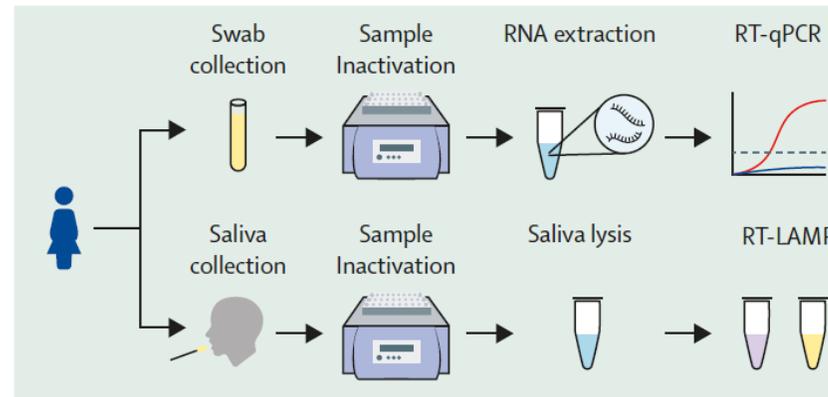
Crude saliva
Šušnjar et al. 2025 Lancet Glob Health

80% sensitivity and 99% specificity

B Clinical study on nasopharyngeal swabs



C Clinical study on saliva

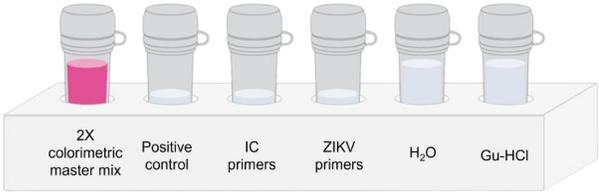


RT-LAMP kit for detection of ZIKV



1. ASSAY DEVELOPMENT

RUO kit for detection of ZIKV



PRIMER DESIGN

Multiple-primer versions were used to detect all known ZIKV genotypes.

2. CLINIAL EVALUATION

Zika Virus: Research Priorities for Preparedness and Response 1

Zika virus: advancing a priority research agenda for preparedness and response

Lackriz et al., 2025 Lancet Infect Dis

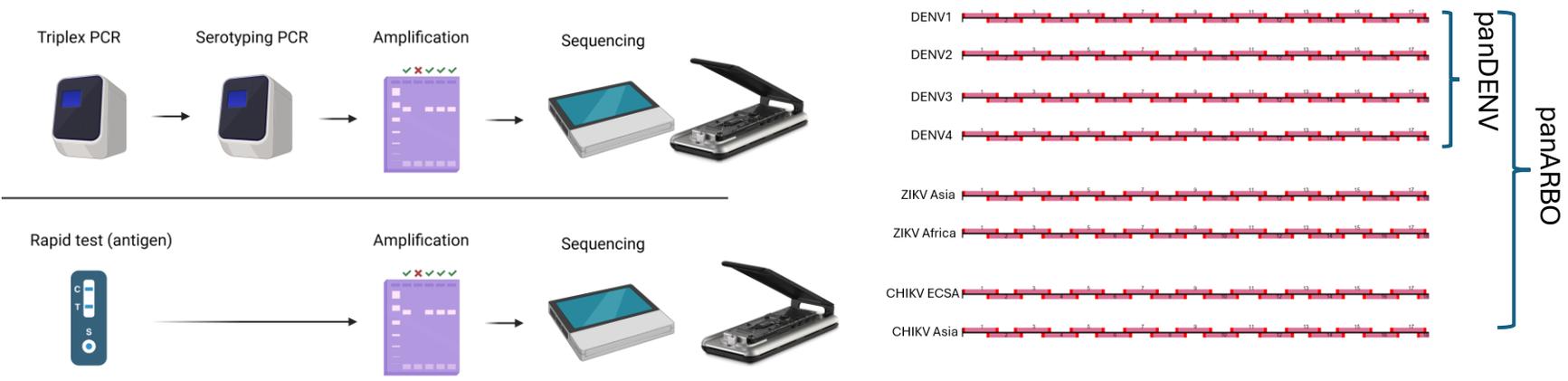
PRE-CLINICAL EVALUATION

	ZIKV Africa	ZIKV Asia
84		
42		
21		
10		
5		
neg		

Primer multiplexing did not affect the LoD.



Genomic surveillance – informing on genetic variants and explaining disease spread

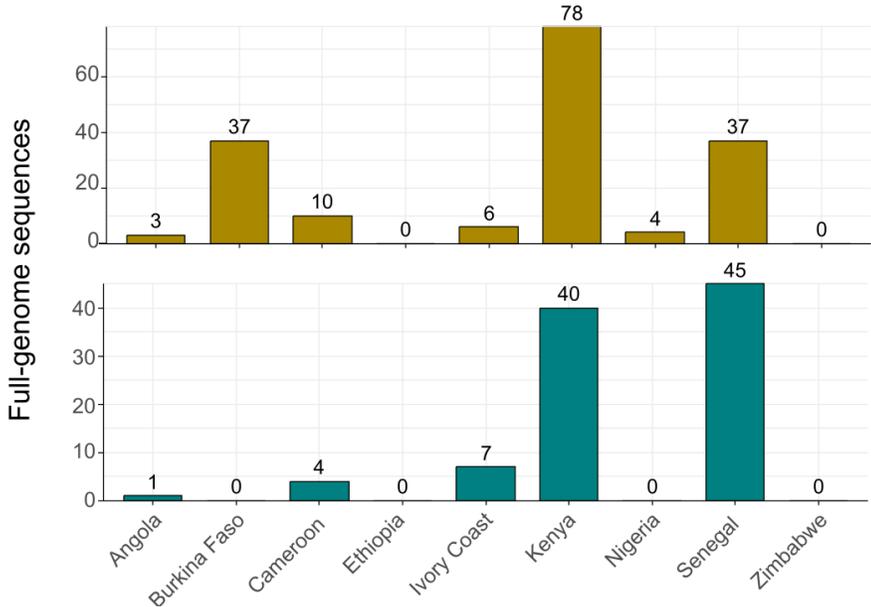


Available in genomic databases

Generated under EXPANDIA

DENV sequences

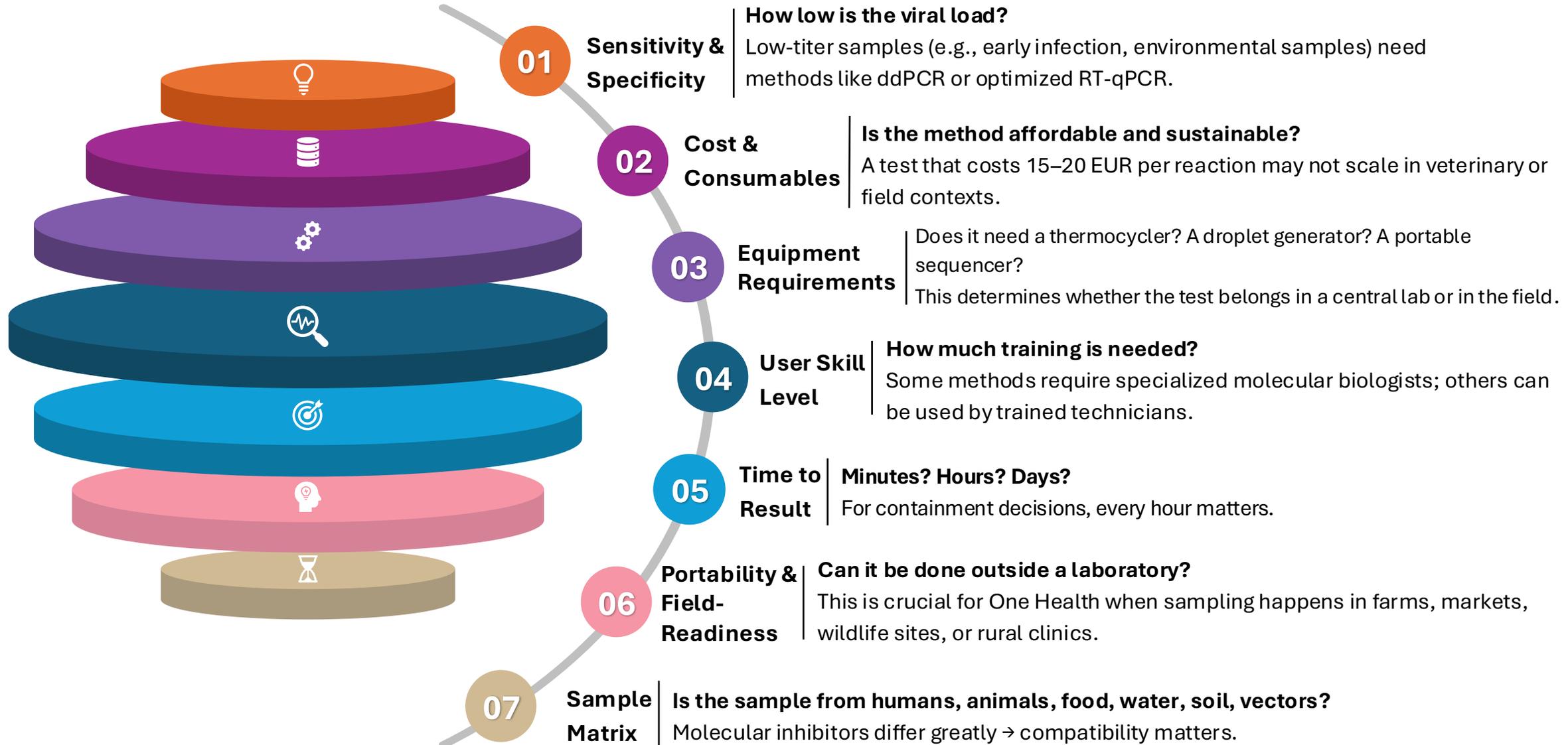
CHIKV sequences



GENOMIC SURVEILLANCE

1. Providing information on genomic variants
2. Understanding disease spread
3. Develop diagnostic tools that will be detecting locally spread genotypes

Choosing the Right Detection Tool: Context Matters



Pandemic Preparedness and Biosecurity

Enable locally to protect globally – implementing a framework of international cooperation to build capacity in pathogen detection, surveillance and biosecurity.



SURVEILLANCE, DIAGNOSTICS, R&D

Strengthening lab networks for sustainable diagnosis of (re)emerging diseases



Zoonotic disease surveillance and research



TECH TRANSFER



Evaluation



Development



Transfer to Public Health systems

CAPACITY BUILDING



Training



Fellowships & CRPs



Conferences

INTERNATIONAL COOPERATION

Enhancement of laboratory capacity for surveillance and response to biological threats in LMICs



Leveraging advanced research infrastructure and scientific collaboration



Acknowledgements



<https://www.icgeb.org/molecular-virology/>



Inovagen - Angola



IRSS-NIRL - Burkina Faso



CIRCB - Cameroon



BETin - Ethiopia



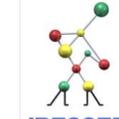
Institut Pasteur Cote d'Ivoire - Ivory Coast



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