Previous Arbovirus Outbreaks: Lessons Learned

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Mitigating Arboviral Threats and Strengthening Public Health Preparedness
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Selected arboviral outbreaks and emergence in last 20 years[1]

Eastern equine encephalitis U.S. 2019

Chikungunya in and around Indian Ocean 2005-2006

Yellow fever Paraguay and Argentina 2007

Chikungunya in Americas 2013-2014

West Nile virus spread across U.S. 2000-2004

Japanese encephalitis Australia 2022

Zika virus in French Polynesia 2013-2014

Yellow fever Kenya 2022

Zika virus in Yap 2007

Dengue in Africa, Americas, Asia, Europe, Indian Ocean, Middle East, Western Pacific

Yellow fever Angola 2015-2016

West Nile virus in Texas 2013

Western equine encephalitis South America 2023

Yellow fever Brazil 2016-2017

Zika virus in Americas 2015-2016

Heartland virus in U.S. identification 2011

West Nile virus in Arizona 2010 and 2021

Bourbon virus in U.S. identification 2014

Chikungunya in Italy 2007

Yellow fever Nigeria 2017

Severe fever with thrombocytopenia syndrome China 2011

West Nile virus activity increasing in Europe 2018

Yellow fever Uganda 2010 and 2016

Chikungunya in Burkina Faso and Paraguay 2023

[1]Does not include BSL-4 pathogens

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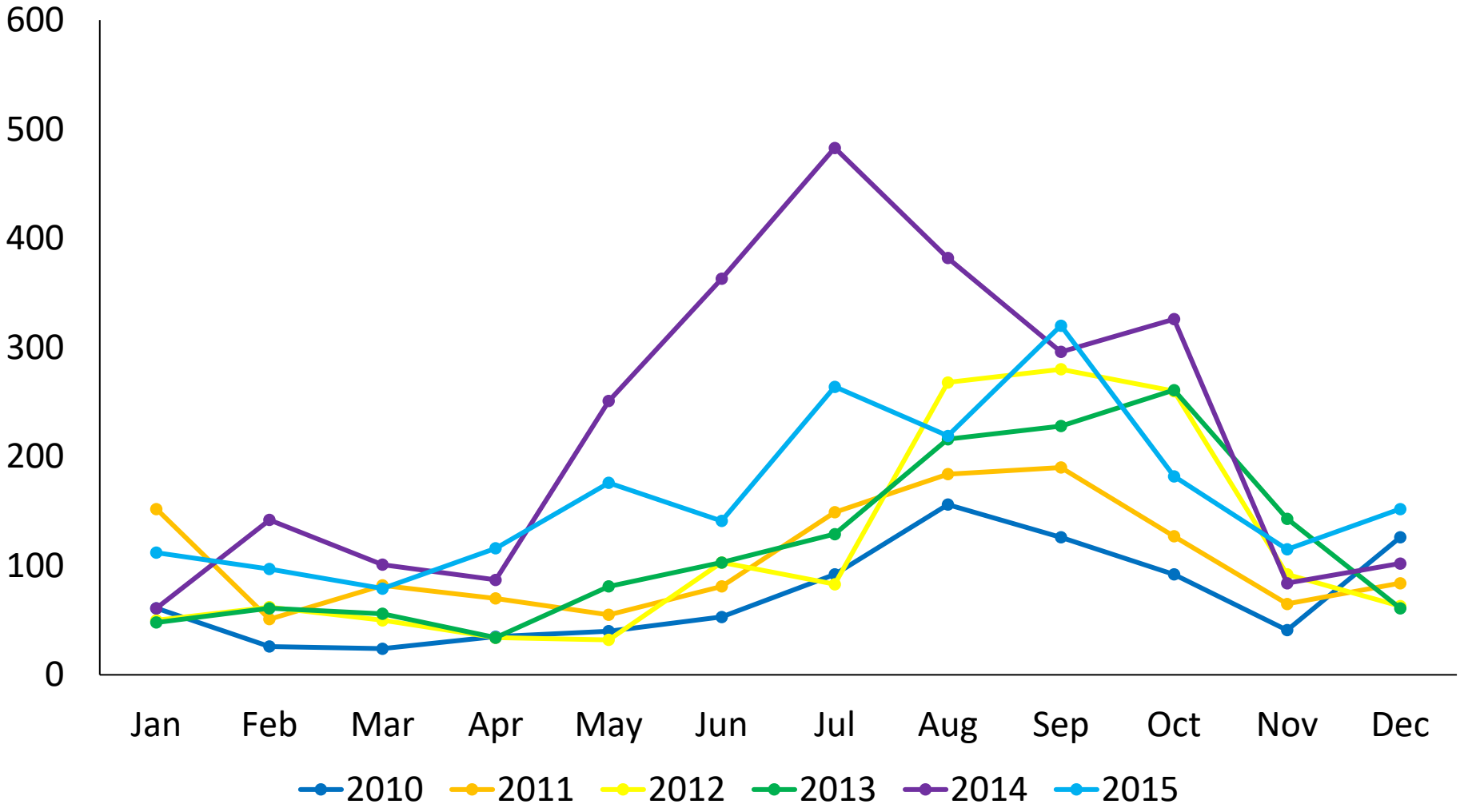
Ensuring diagnostic capacity

Diagnostic samples received CDC's Arboviral Diseases Branch Diagnostic Laboratory by month, 2010-2015



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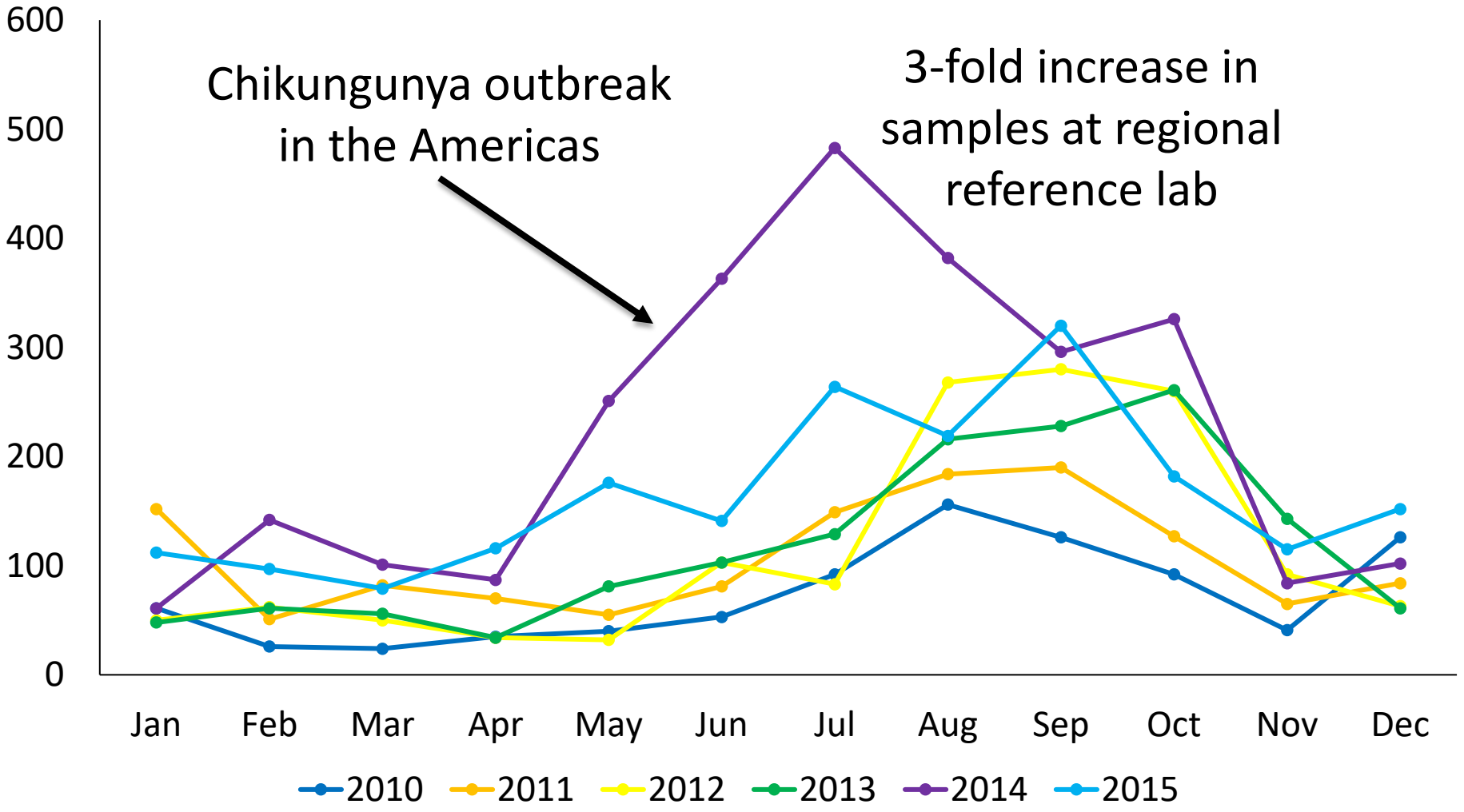

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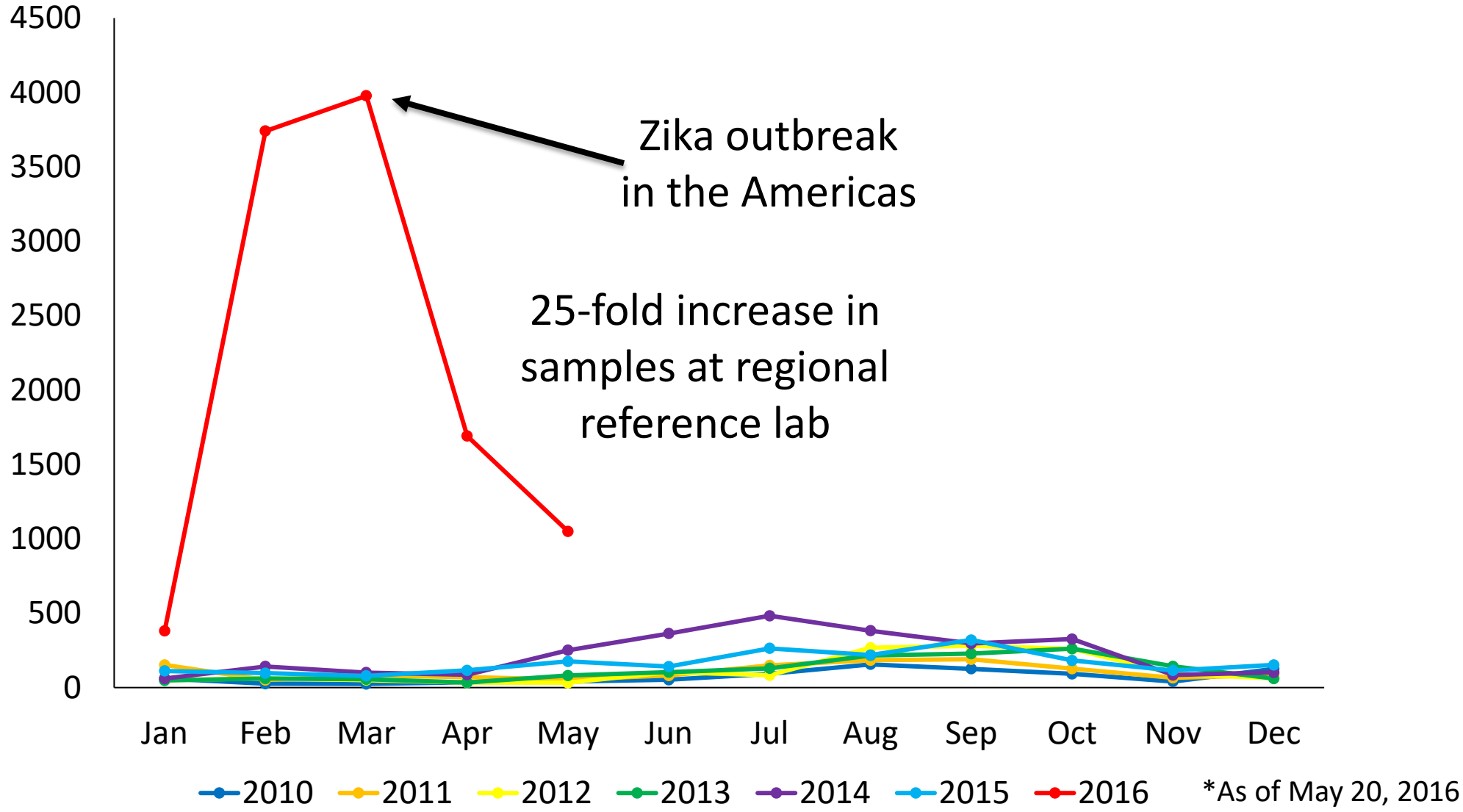
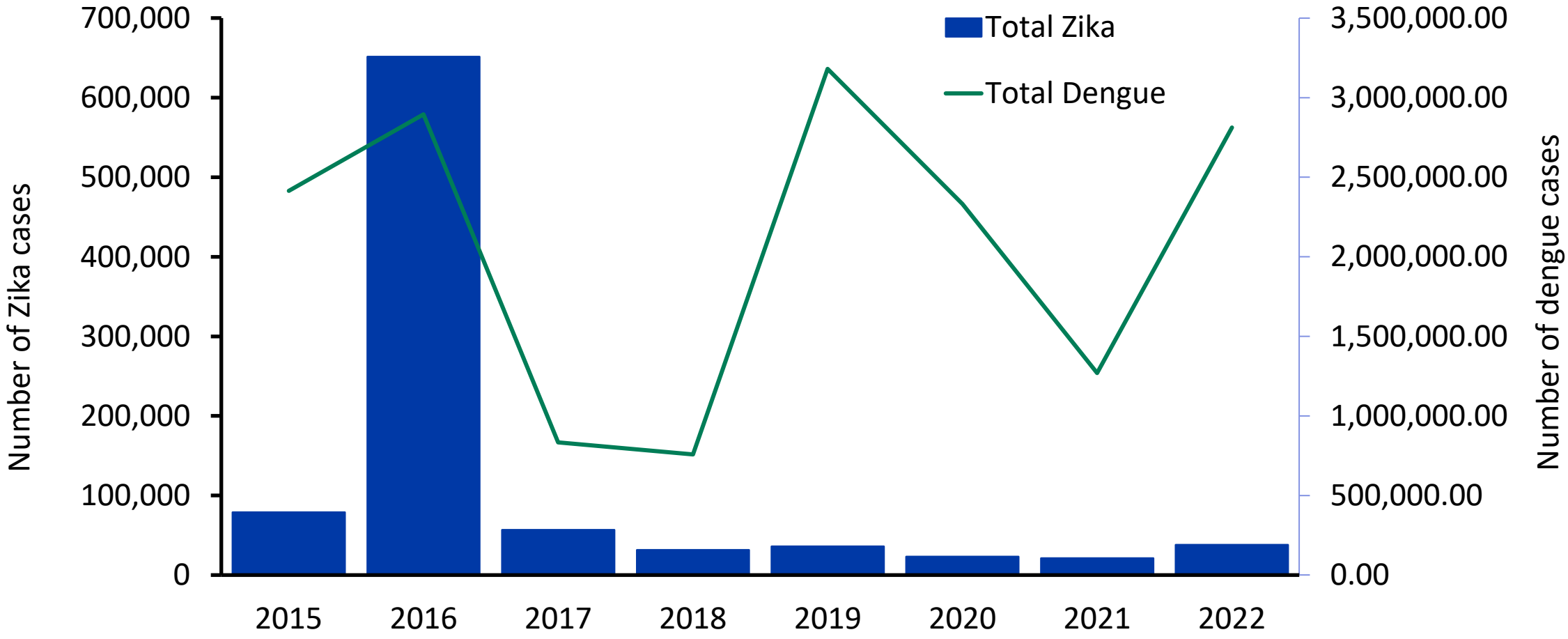


Diagnostic laboratory issues during arboviral outbreaks

- Ensuring surge capacity for arboviral disease testing
- Having adequate reagents and control material
  - Sample sharing policies and resources
- Maintaining common testing platforms
- Addressing role of laboratory developed tests (LDTs) for public health response in context of increasing regulatory requirements

Maintaining awareness and infrastructure

Suspected and confirmed Zika virus and dengue disease cases, by year — Americas, 2015–2022*



Pan American Health Organization. PLISA Health Information Platform for the Americas

*Excludes imported cases; confirmed cases – a suspected or probable Zika virus cases with positive test result

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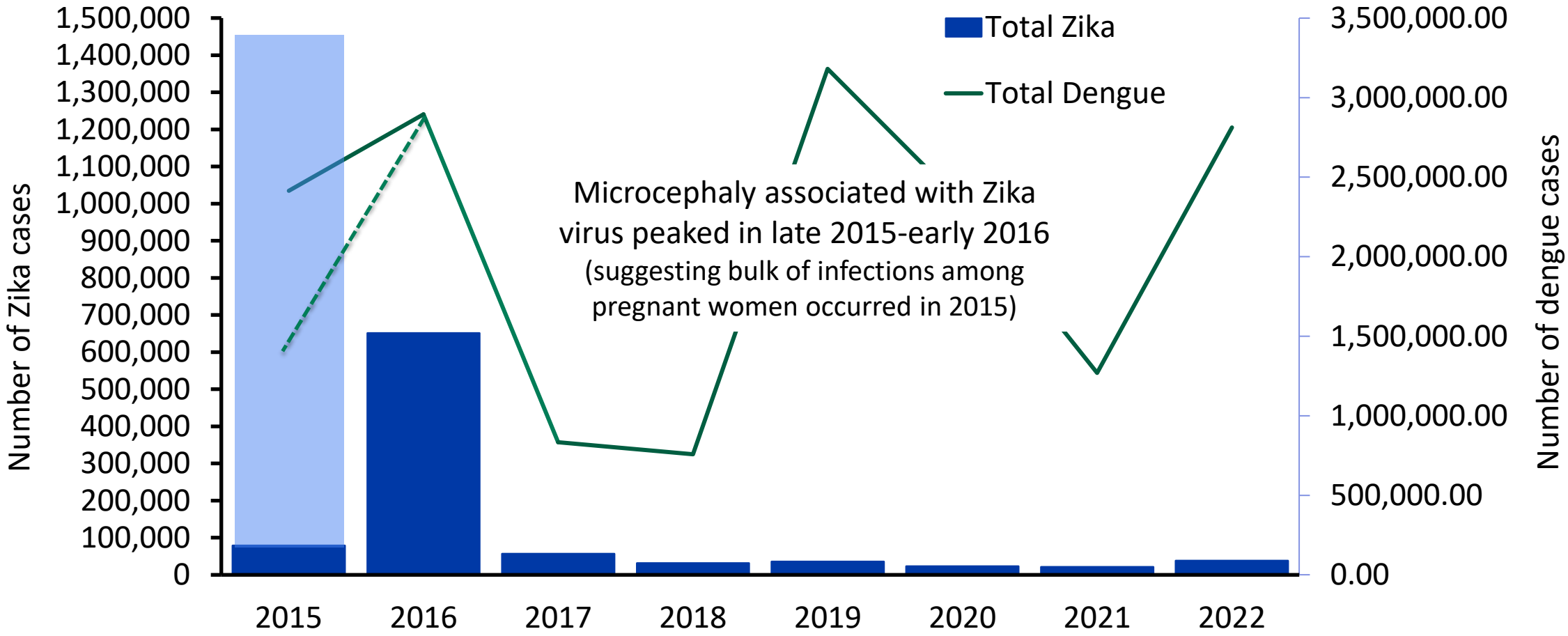

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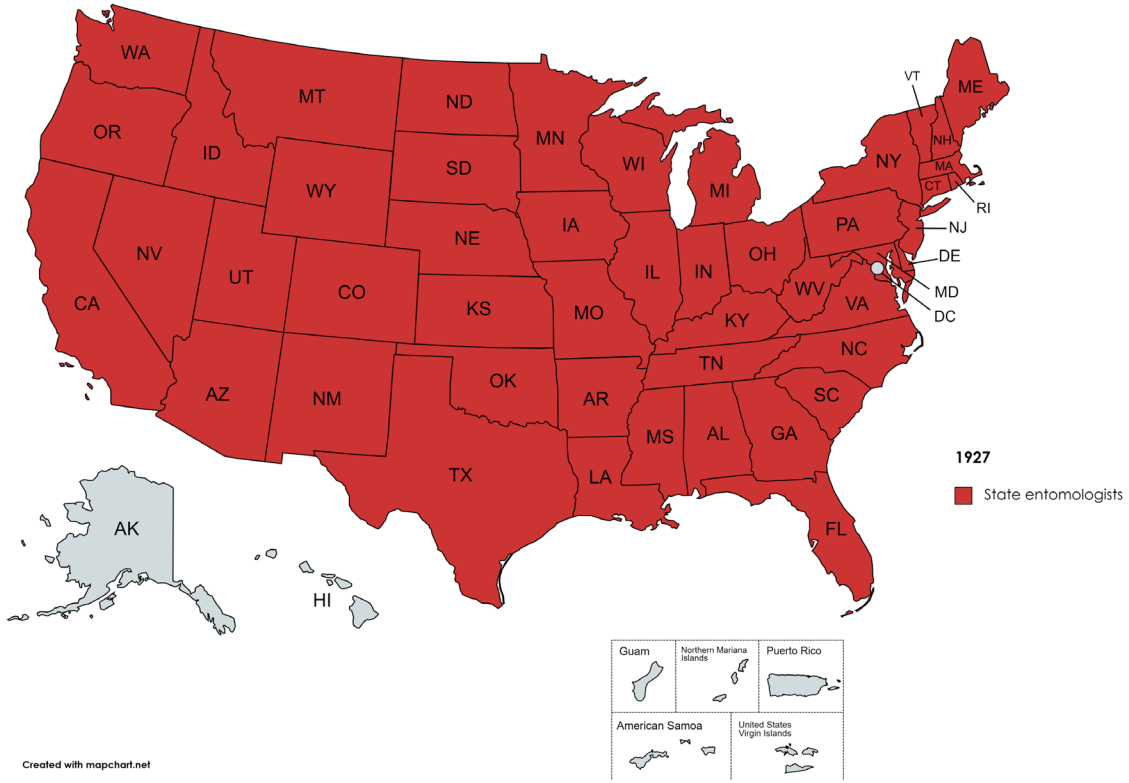
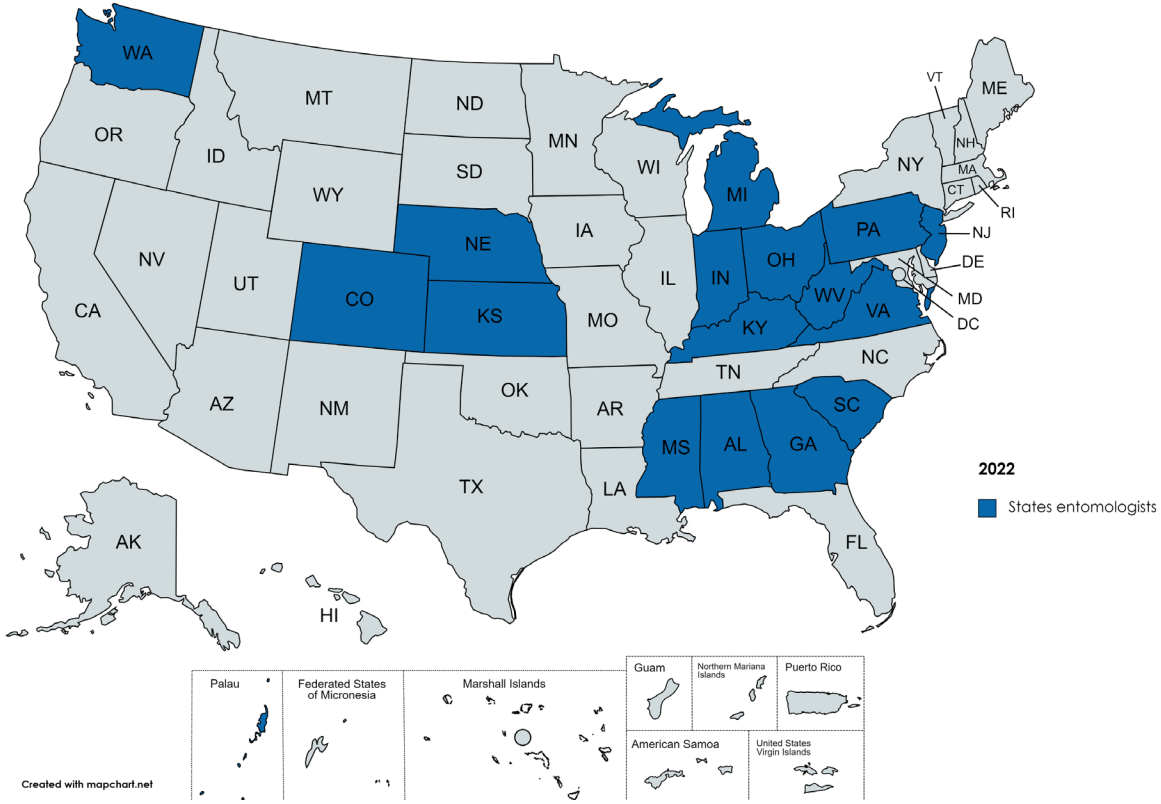
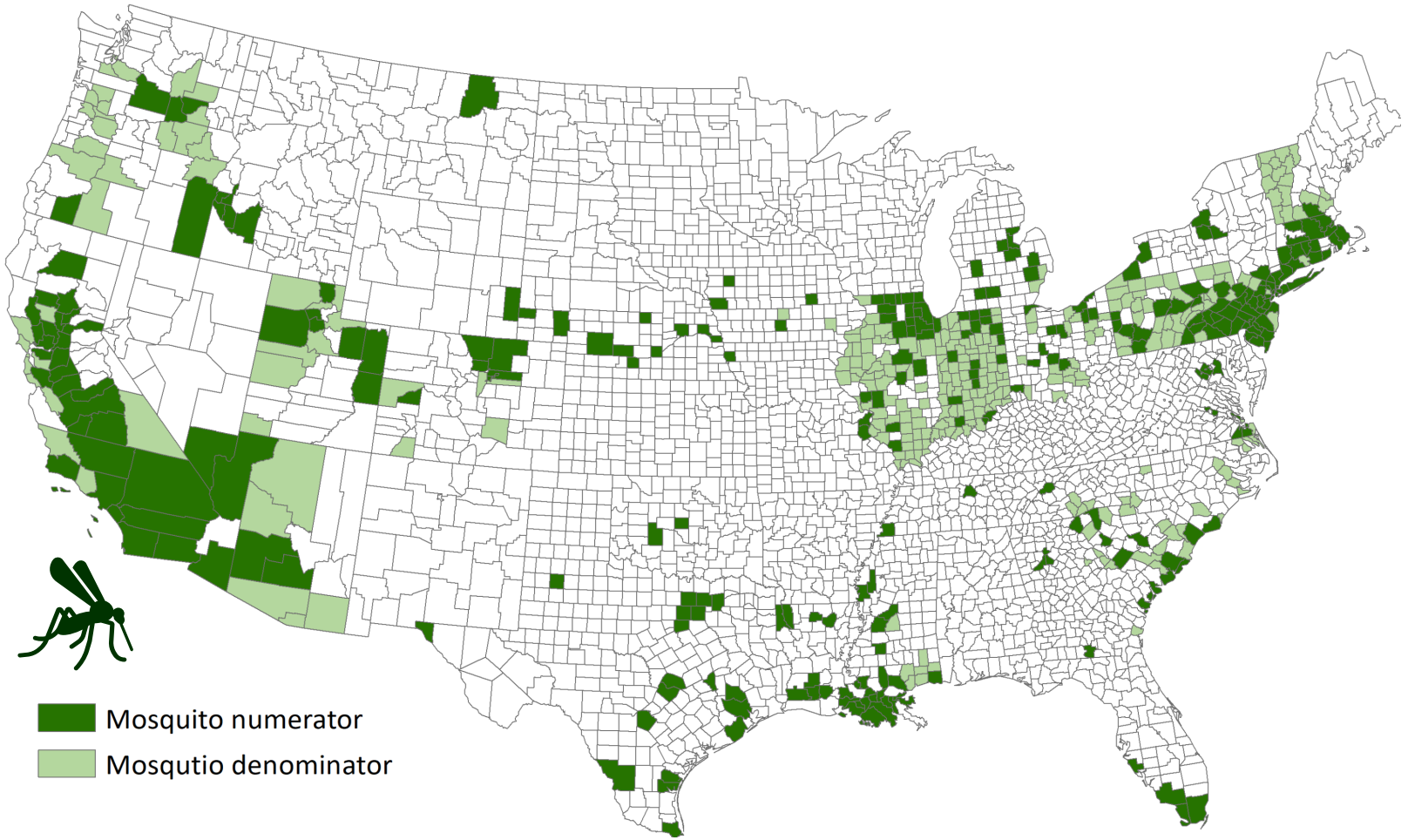
U.S. states with state entomologist in 1927 and 2022





Variable non-human West Nile virus surveillance and reporting – United States, 2022

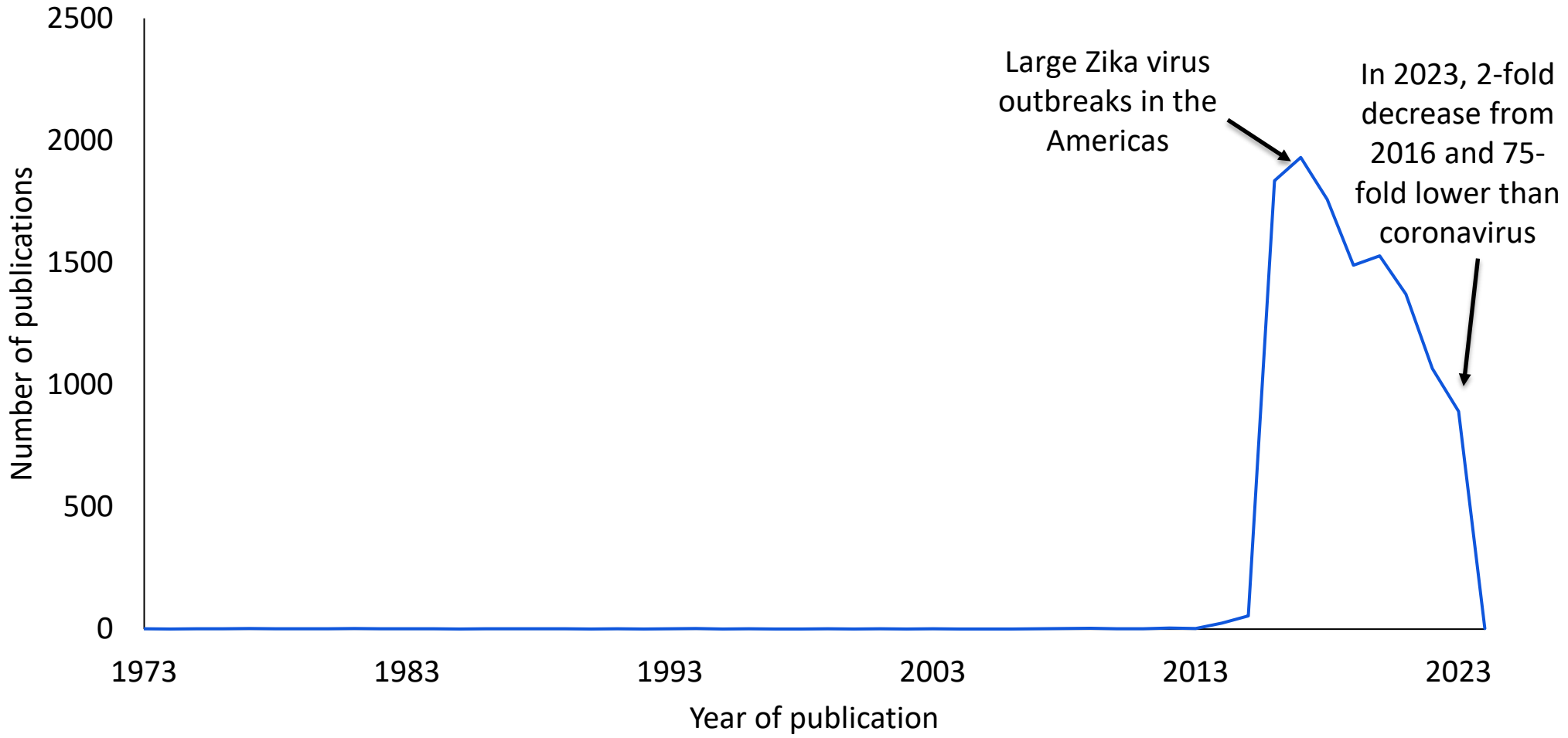


Awareness and surveillance infrastructure important for detecting, monitoring, and control efforts

- Most recent arboviral disease outbreaks relied on detection of human disease cases or atypical findings
- Arboviral disease surveillance optimally should include human, vector, and animal components
- Most areas of world lacking vector surveillance and control capacities
- Poor integration of animal data with other surveillance data

Continuing to address knowledge gaps

Last 50 years of Zika virus publications in PubMed



Selected knowledge gaps after Zika virus outbreak in the Americas

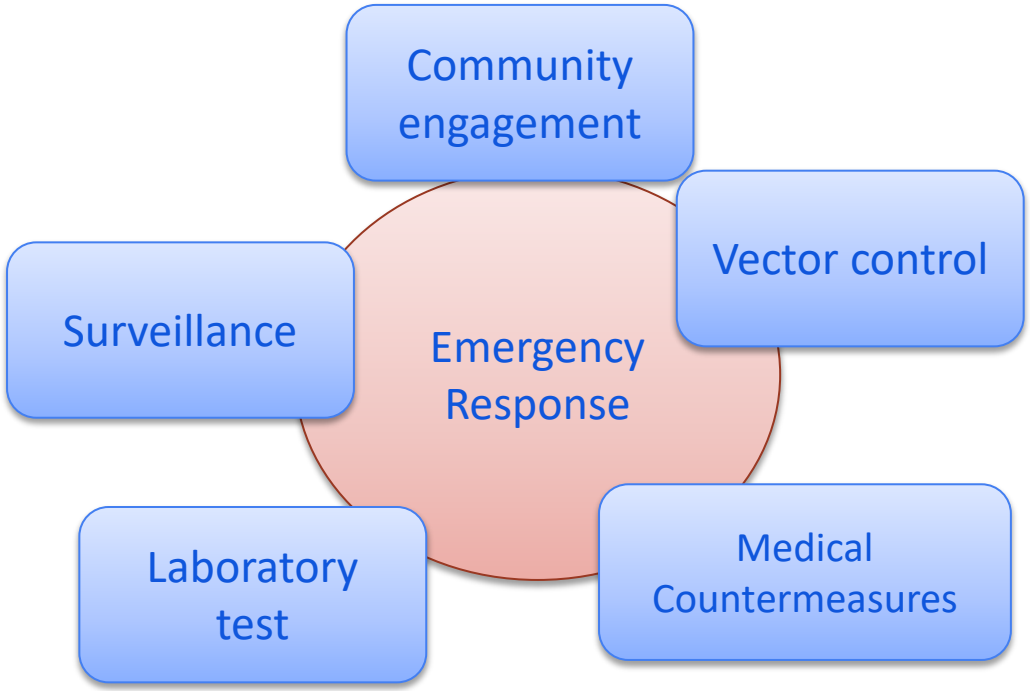
- Potential non-human circulation and endemicity
- Optimal diagnostic testing for congenital Zika virus syndrome
- Potential antibody dependent enhancement with dengue virus infections
- Most important epitopes for vaccine neutralization
- Time interval between outbreaks

Issues for addressing knowledge gaps

- Lack of sustained funding
- Competing priorities preventing continued efforts
- Need existing protocols and networks readily available to address knowledge gaps
- Improved partnerships between industry, academia, and government to overcome challenges

Considering alternative agreement and regulatory needs

Arboviral emergency response selected considerations and components



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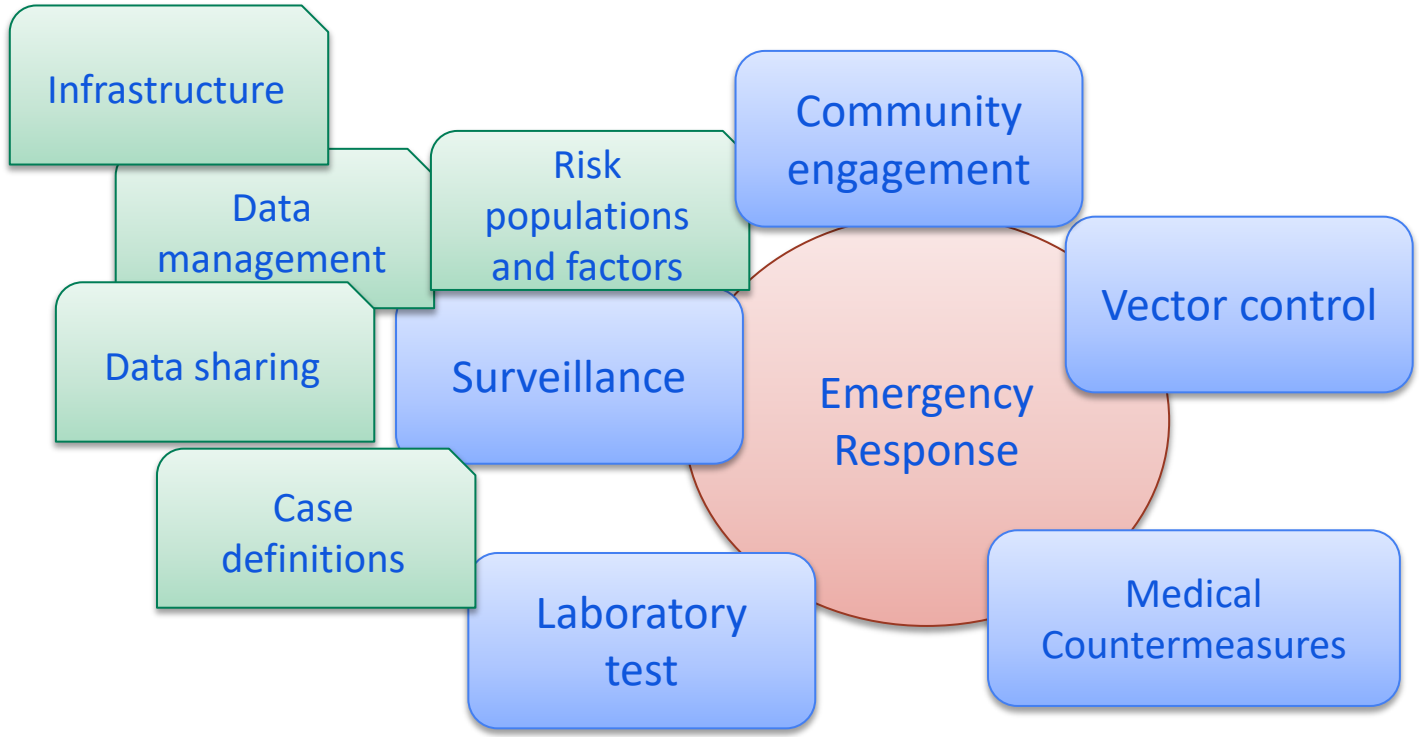

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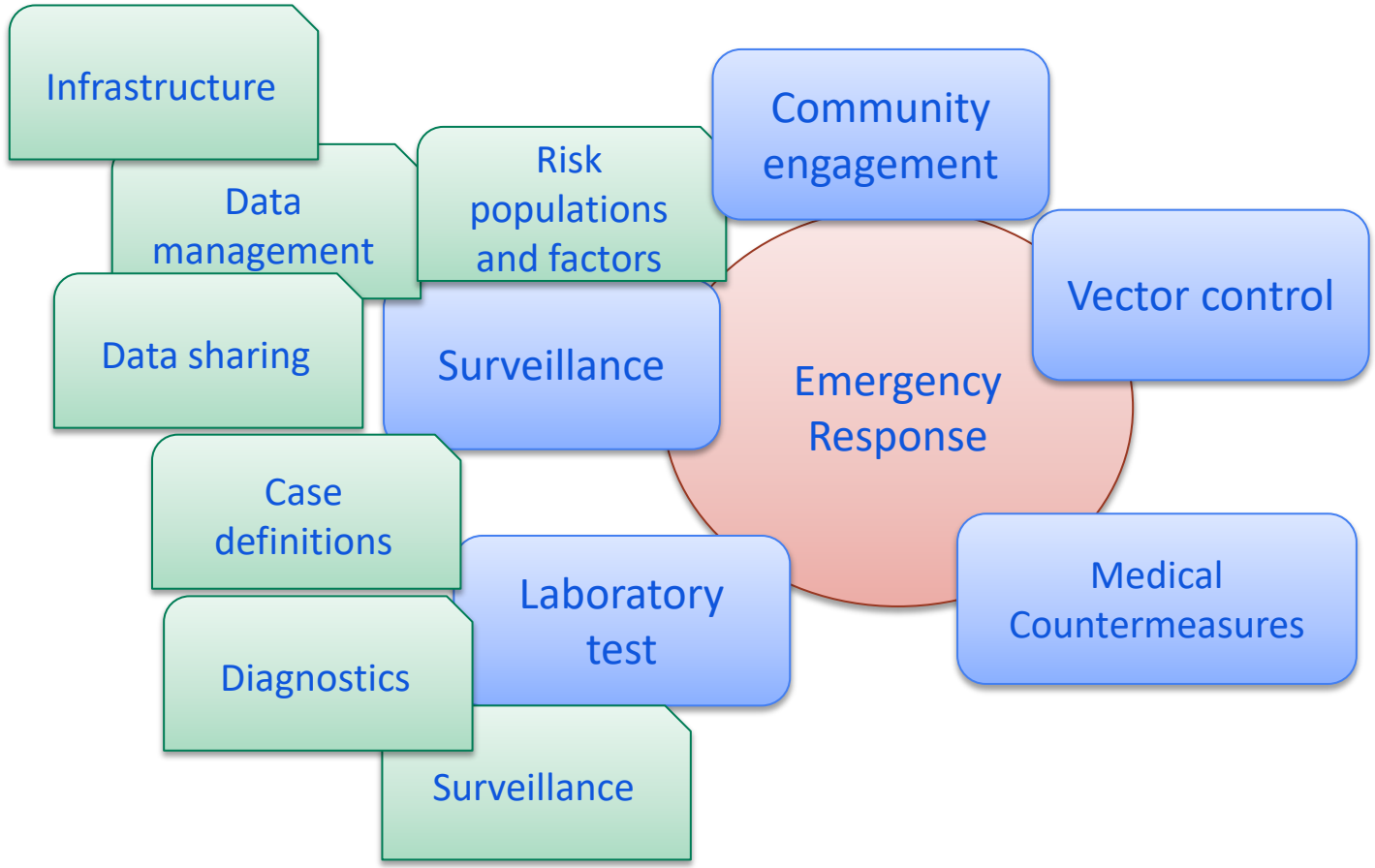

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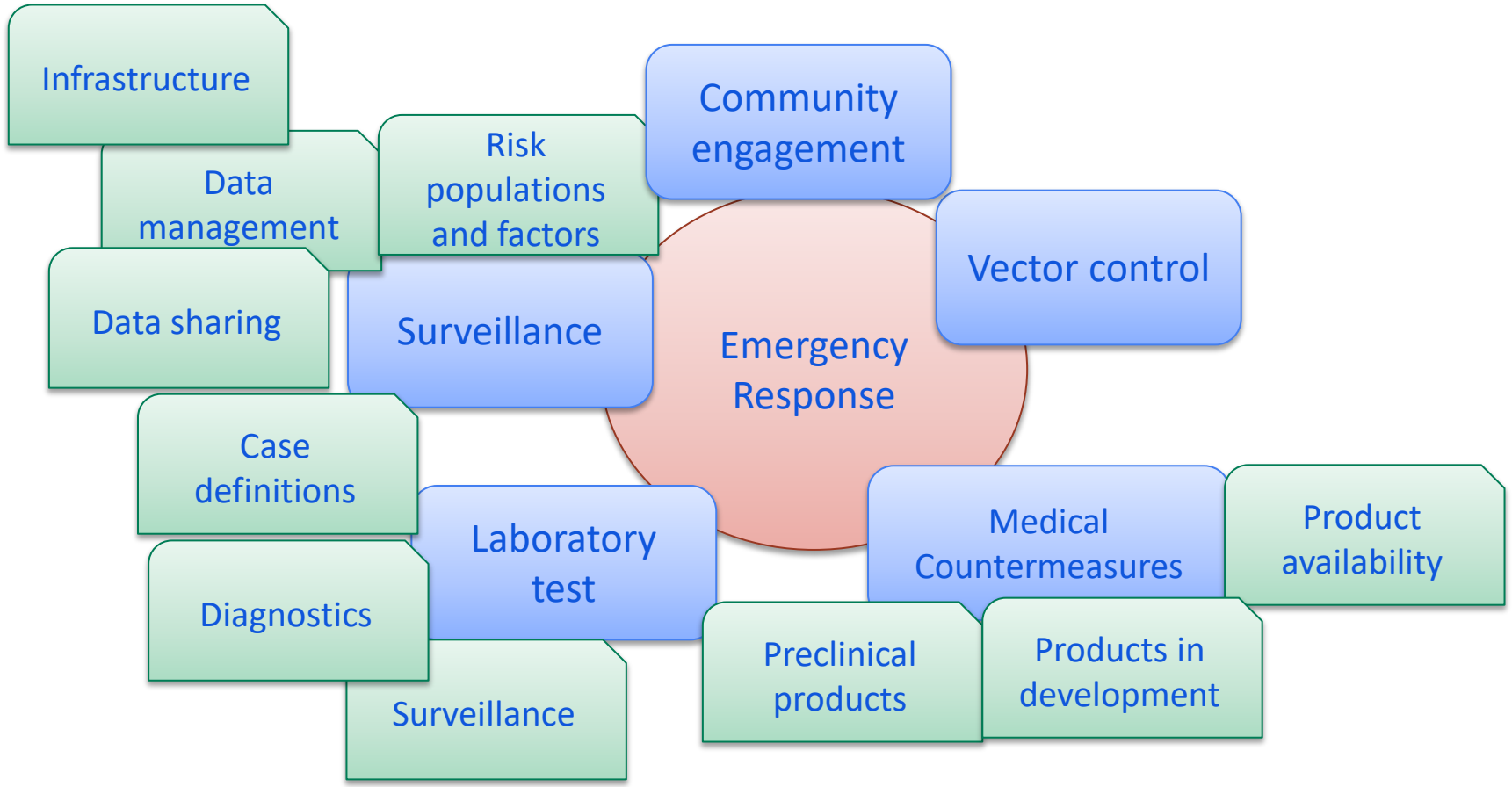

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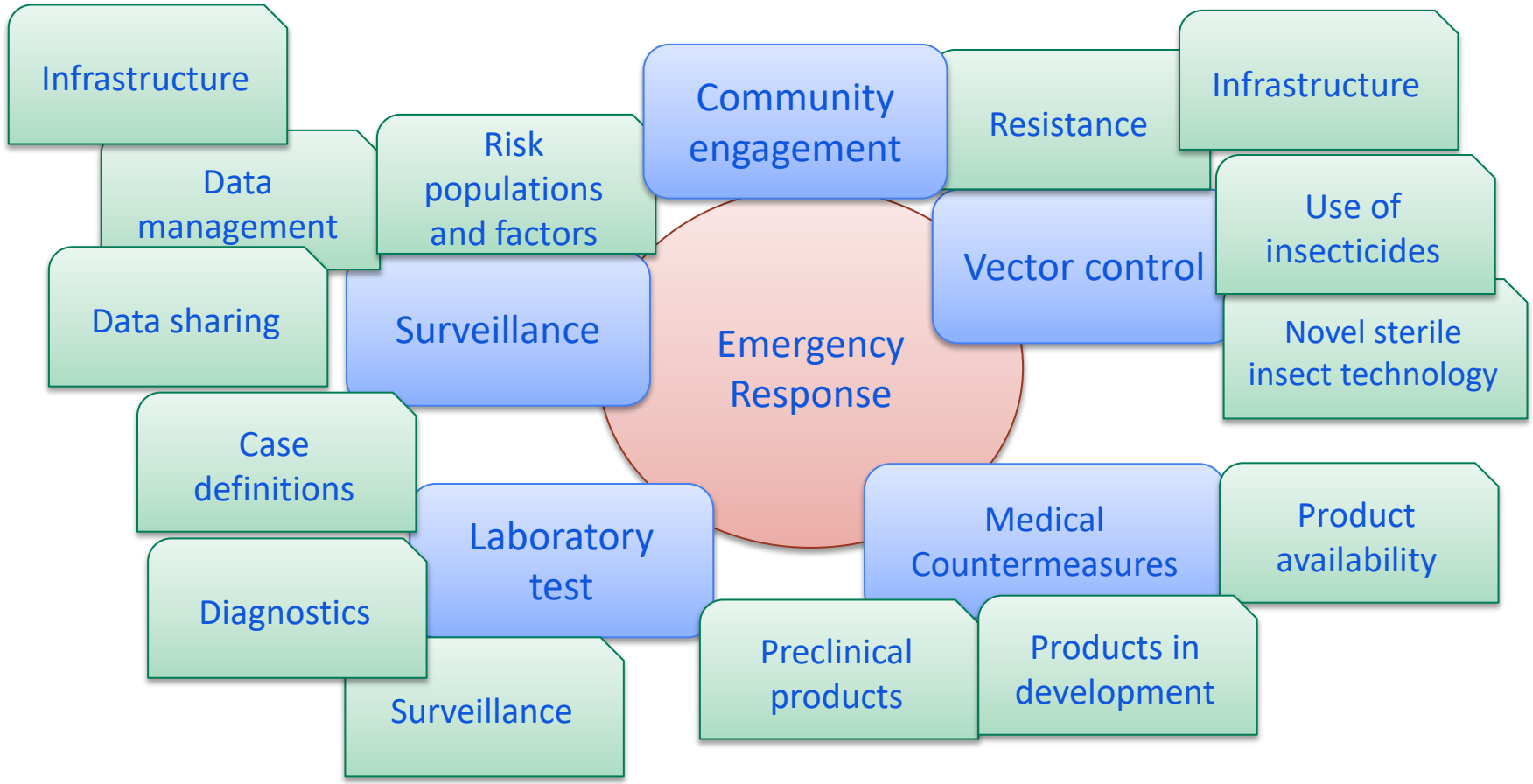

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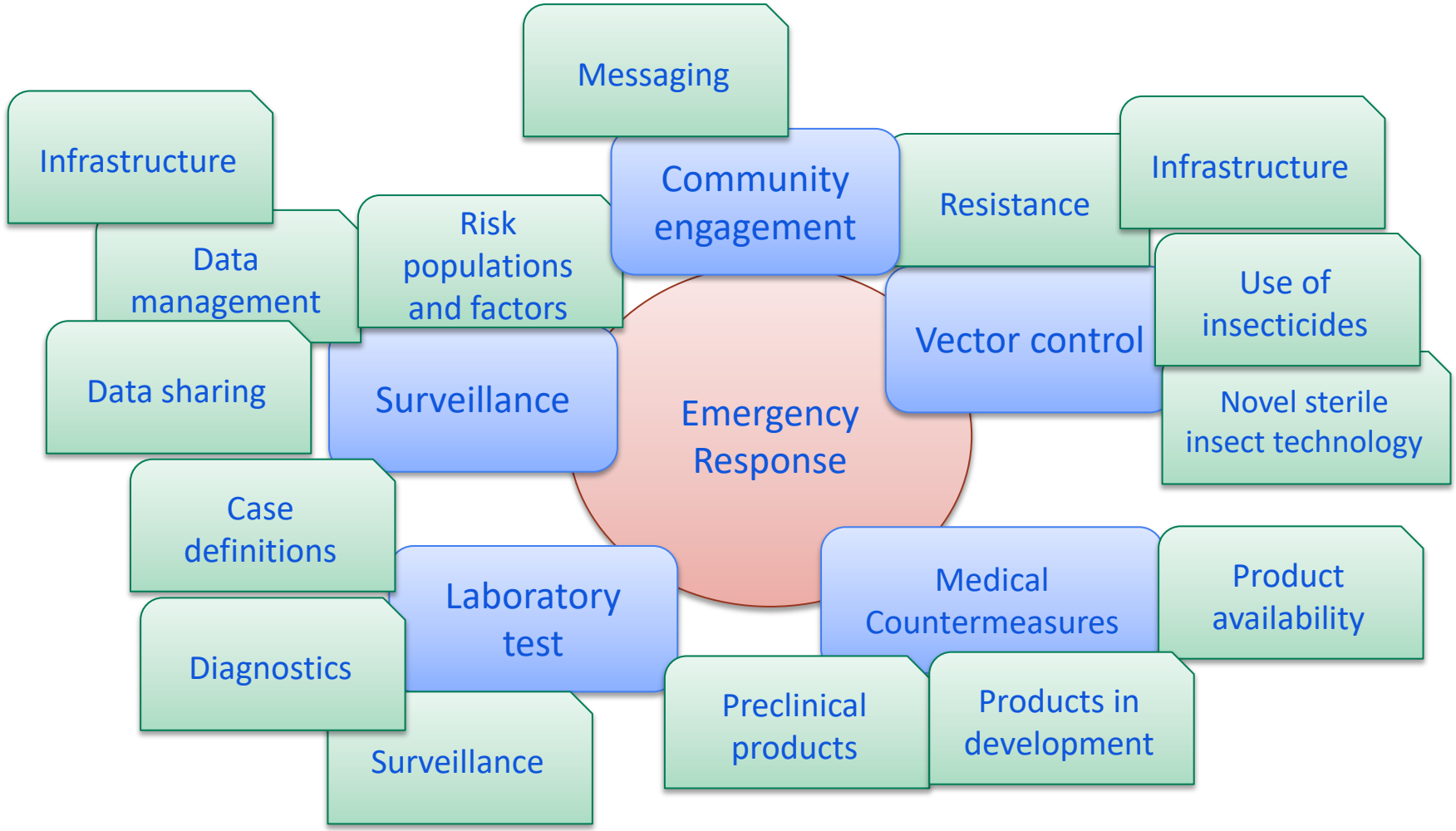
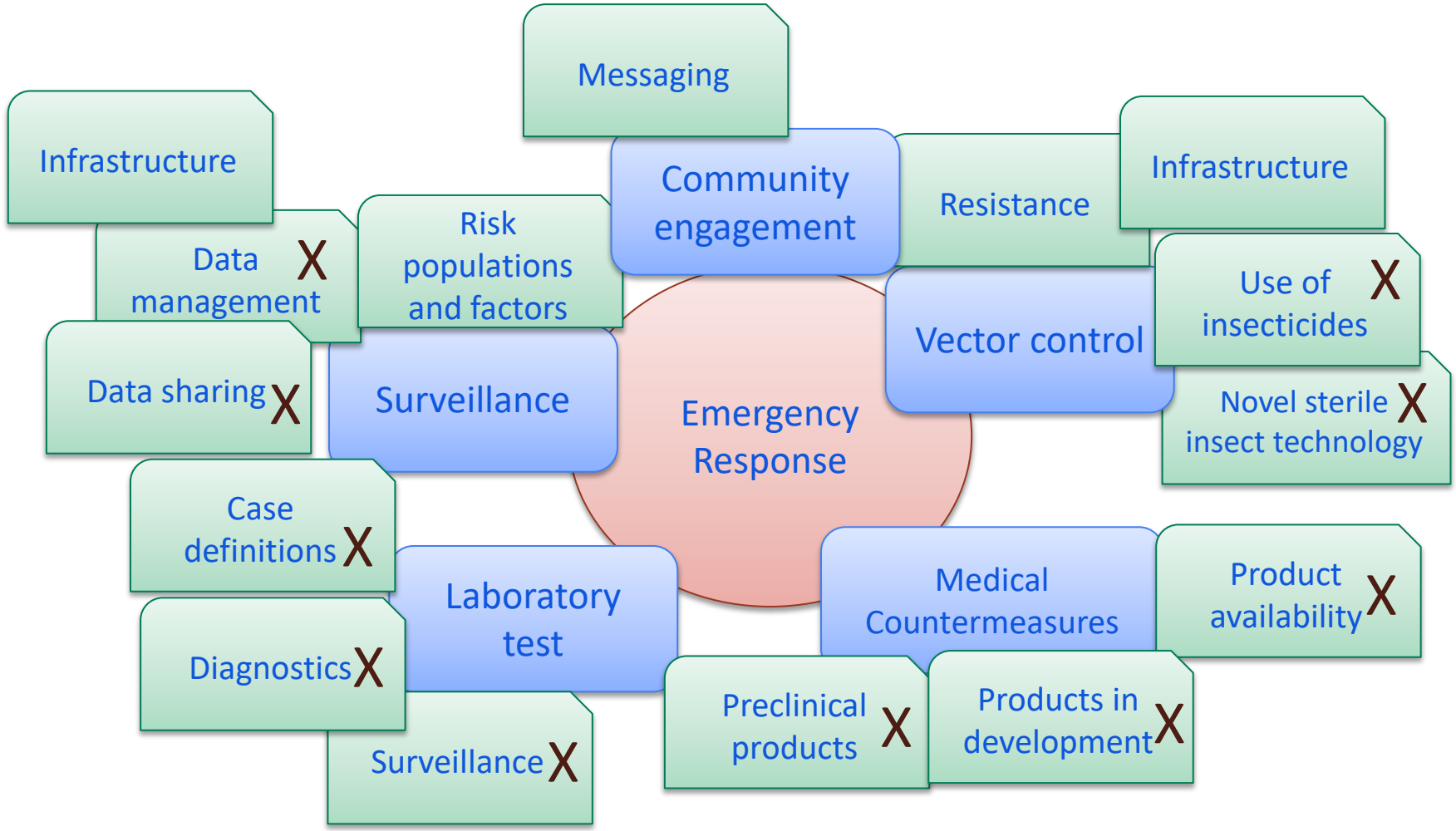


Intersection of emergency response and regulations



X = Areas subject to agreements and regulations

Issues for areas needing agreement and regulatory approval

- Existing mechanisms not conducive to quick and emerging response
- Increasing regulatory requirements impacting readiness
- Need additional consideration on most appropriate emergency response regulations

Planning for future outbreaks

Considerations to be prepared to response to next arboviral disease outbreak

- Expect the unexpected
- Define hot spots for emergence of various arboviral diseases and target for network sites
- Develop regulatory pathways to preapprove common arboviral test platforms (e.g., ELISA)
- Foster more open regulatory discussions for countermeasures to allow obstacles to be addressed more proactively
- Advance considerations for alternative mosquito control techniques for multiple mosquitoes' species
- Evolve relationship of public and private entities to coordinate efforts

Questions

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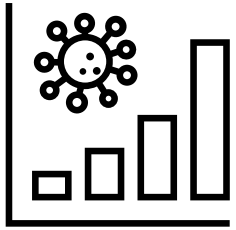
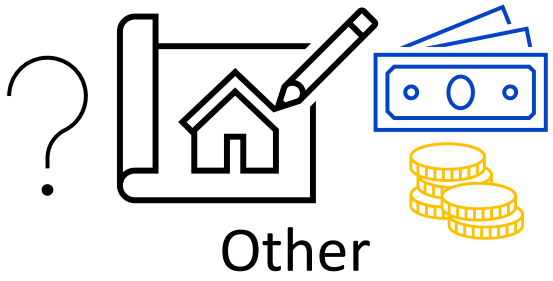
For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

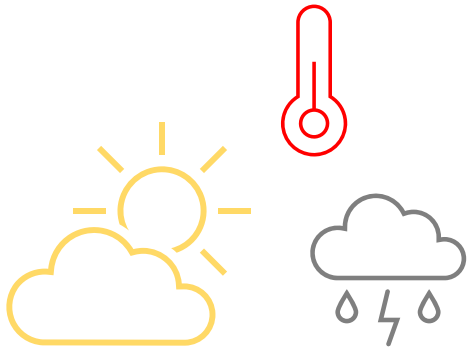
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Arboviral diseases impacted by several factors



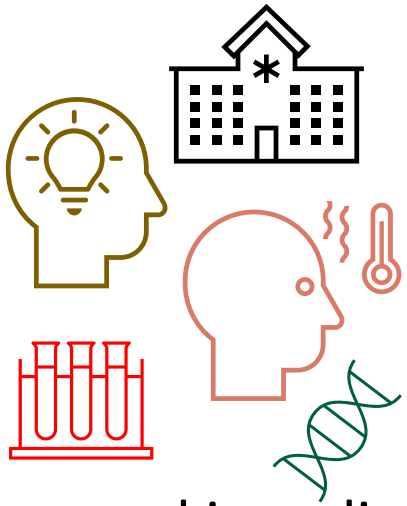


Other



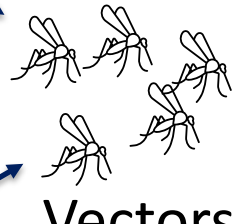
Climate

Ecology

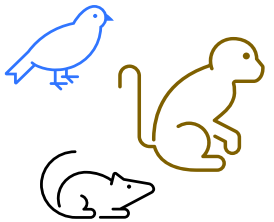


Care seeking, clinical awareness, and testing

Human interface and actions



Vectors



Hosts

Vector Control

SIT

SIT – sterile insect technique

Networks created to prepare for next outbreak

- **Zika Preparedness Latin American Network (ZikaPLAN)** research consortium funded by the European Commission with primary goal of addressing knowledge gaps related to Zika epidemic and secondary goal of establishing Latin American-European research network for emerging vector-borne diseases
- **Centers for Research in Emerging Infectious Diseases (CREID)** from NIH is multidisciplinary investigations into how and where viruses and other pathogens emerge from wildlife and spillover to cause disease in people
  - 10 funded sites covering Africa, Central and South America, and Southeast Asia