RESPUESTA EN CLIMA Y AMBIENTE PARA LA SALUD EN LAS AMÉRICAS

Introducción a los enfoques de investigación transdisciplinarios

Estudio de caso

20 de septiembre, 2022

Anna Stewart
Cargo y organización/institución a la que pertenece

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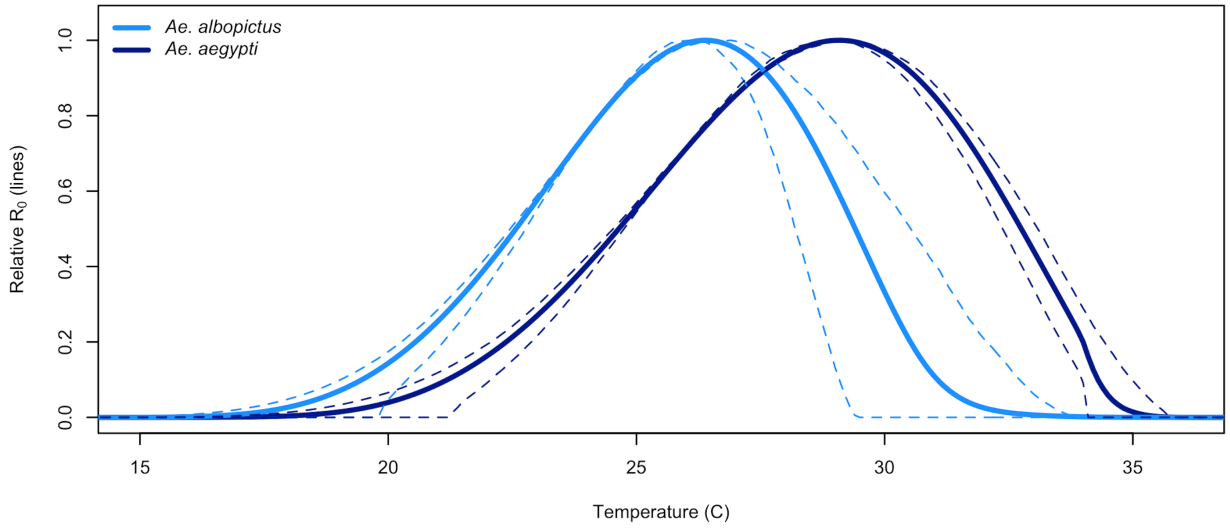
Co-creation of a dengue early warning system for the health sector in the Caribbean

Aedes mosquitoes and climate

Mosquitoes that transmit arboviruses are sensitive to temperature conditions

Possible transmission: 18-34 ℃

Optimum transmission: 26-29 ℃



Both drought and excess rainfall can increase *Aedes aegypti* populations and risk of outbreaks of disease depending on water access and storage.

Mordecai et al 2017 PLOS NTD https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0005568

Sorenson et al. GeoHealth https://agupubs.onlinelibrary.wiley.com/doi/10.1002/2017GH000104

Impactos observados

El cambio climático está afectando a la epidemiología de las enfermedades infecciosas sensibles al clima en la región.

Ej: **efectos del calentamiento de las temperaturas en el aumento de la idoneidad de la transmisión de enfermedades transmitidas por vectores**, incluidas las enfermedades arbovirales endémicas y emergentes como dengue, chikungunya y Zika.

Impactos proyectados

Se prevé que en las próximas décadas aumenten las enfermedades infecciosas endémicas y emergentes sensibles al clima.

Esto puede ocurrir por la expansión de la distribución de los vectores, especialmente de enfermedades infecciosas virales de origen zoonótico en las zonas de transición entre entornos urbanos y suburbanos o rurales, y en las laderas de las montañas.

Question #1

How is climate change affecting dengue fever transmission?
A. More frequent extreme climate events (drought, heavy rainfall) can increase the habitat for mosquito vectors
B. More cloudy days make it easier for the mosquito to hide
C. Warming temperatures, up to an optimal temperature range, can increase the suitability for disease transmission
D. A & C

Votación en Zoom

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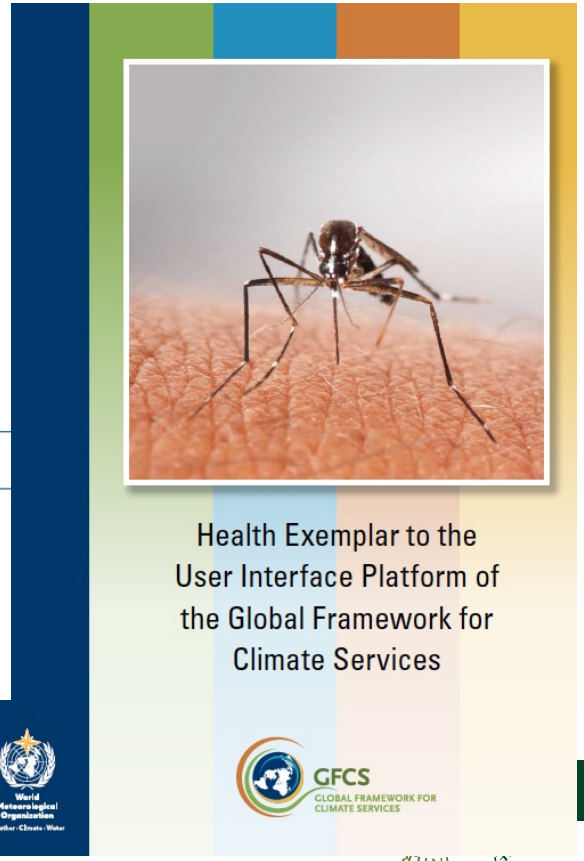
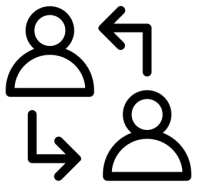
Climate services for health: A key adaptation strategy

Early warning systems are one of the main climate services being developed by/for health sectors.

"If we can put mechanisms in place, long in advance, then we have more success in dealing with outbreaks. Or we can even prevent outbreaks."



Global Framework for Climate Services (GFCS)
Health Exemplar Goals, Objectives, and Outcomes



Engage

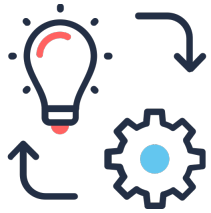
Strengthening communication and partnerships among climate and health actors at all levels

Build Capacity

Increase the capacity of the health sector to effectively access, understand, and use climate and weather information for health decisions.

Generate Evidence

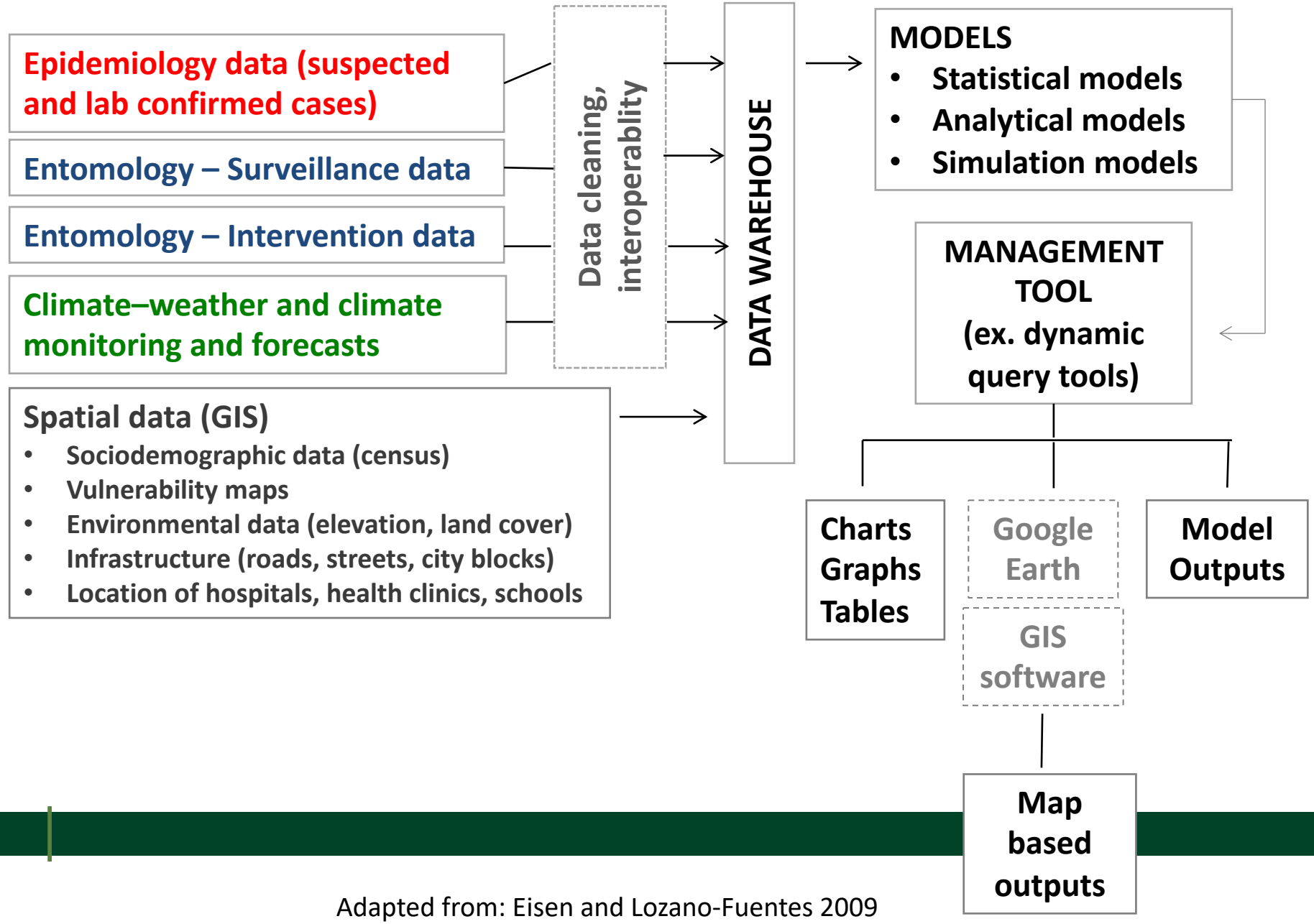
Improved health and climate research and evidence of the linkages



Implement

Climate and weather data are effectively mainstreamed for health operations.

VECTOR BORNE DISEASE DECISION SUPPORT STSTEM



Adapted from: Eisen and Lozano-Fuentes 2009

Available climate modeling tools for infectious diseases

Explore the 37 available tools and learn about key findings.

Example: AeDES

AeDES	Aedes-borne diseases	environmental suitability for Aedes-borne transmission (R0)	Americas	International Research Institute for Climate and Society's (IRI) Climate Predictability Tool (CPT) and Python	See details

Model name: AeDES

Full Model Name: Aedes-borne Diseases' Environmental Suitability

Infectious diseases (pathogens): Aedes-borne diseases

Mode of transmission: vector-borne

Countries: NA

Region: Americas

Region 2:

Type of model: multi-model ensemble

Software: International Research Institute for Climate and Society's (IRI) Climate Predictability Tool (CPT) and Python

Scale of study or model: Regional (~56 km), Monthly

Input Data: ento-epidemiological parameters, environmental observations

Climate Products: GHCN-CAMS, CanSIPv2

Climate Variables: temperature, seasonal climate predictions

Model Output: environmental suitability for Aedes-borne transmission (R0)

Availability: website, maproom

Link to Tool: http://iridl.ldeo.columbia.edu/maproom/Health/R0/R0_Obs.html

https://hetco.io/tools-for-climate-sensitive-diseases/

https://cms.wellcome.org/sites/default/files/2022-01/landscape-mapping-software-tools-CSID-modelling.pdf

Question #2

To develop climate services for the health sector, you need to:

1. Build strong partnerships between climate and health actors
2. Generate evidence of the effects of climate on health outcomes
3. Build the capacity of the health sector to use climate/weather information
4. Implement the tools into day-to-day decision making processes
5. All of the above

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Partnership for dengue early warning in Barbados

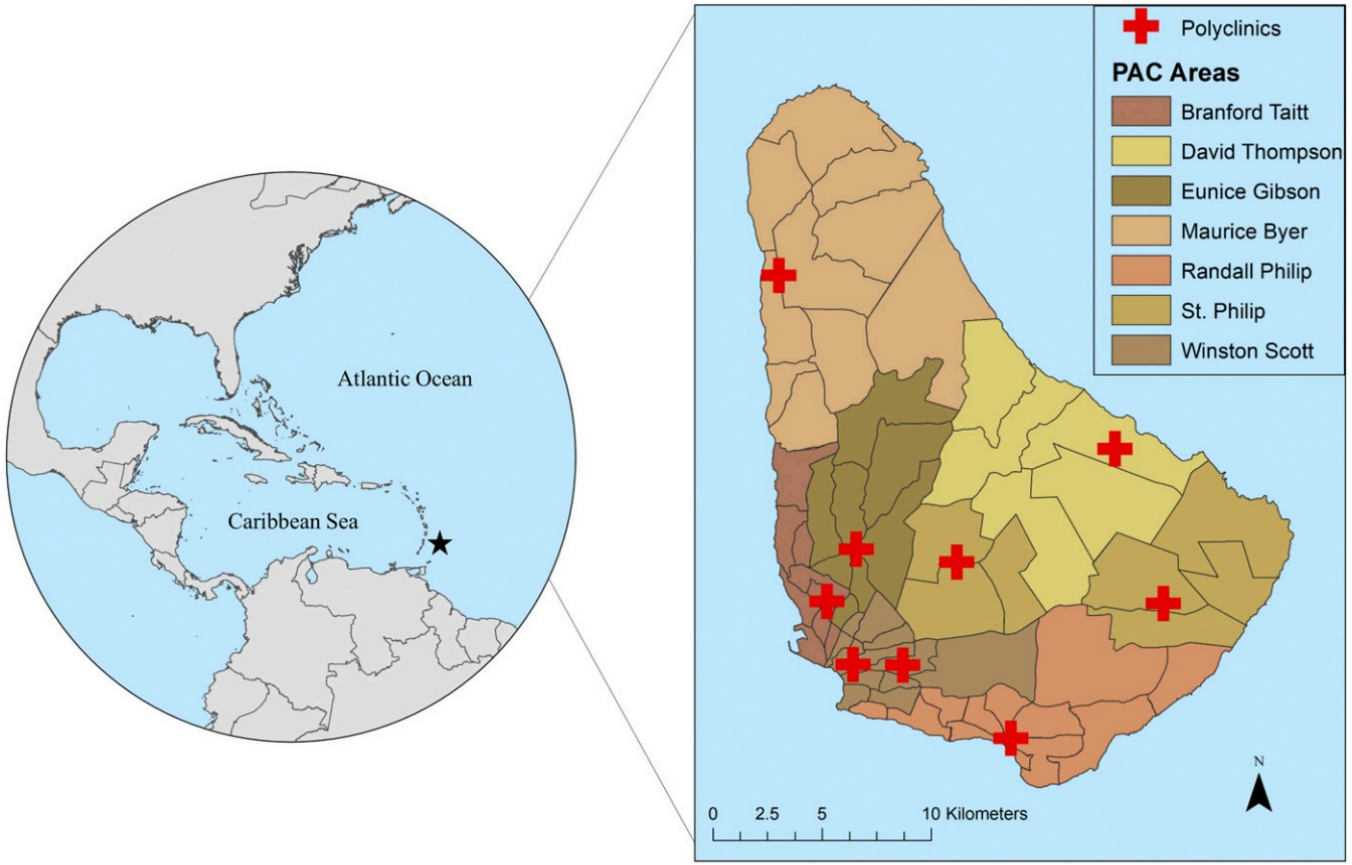


FIGURE 1. Health districts and polyclinic administrative catchment (PAC) areas in Barbados. This figure was produced in ArcMap 10.4 (ESRI) using shapefiles from the GADM database of Global Administrative Areas, v. 2.8 (gadm.org), and shapefiles provided by the Ministry of Health, Barbados. This figure appears in color at www.ajtmh.org.

(Lippi et al 2020 AJTMH)

Building trusting partnerships

BMJ Global Health

Co-learning during the co-creation of a dengue early warning system for the health sector in Barbados

Anna M Stewart-Ibarra ,[1] Leslie Rollock,[2] Sabu Best,[3] Tia Brown,[3] Avriel R Diaz,[4] Willy Dunbar,[5] Catherine A Lippi ,[6] Roché Mahon,[7] Sadie J Ryan ,[6] Adrian Trotman,[7] Cedric J Van Meerbeeck,[7] Rachel Lowe [8,9,10]

Co-creation: transdisciplinary & collaborative

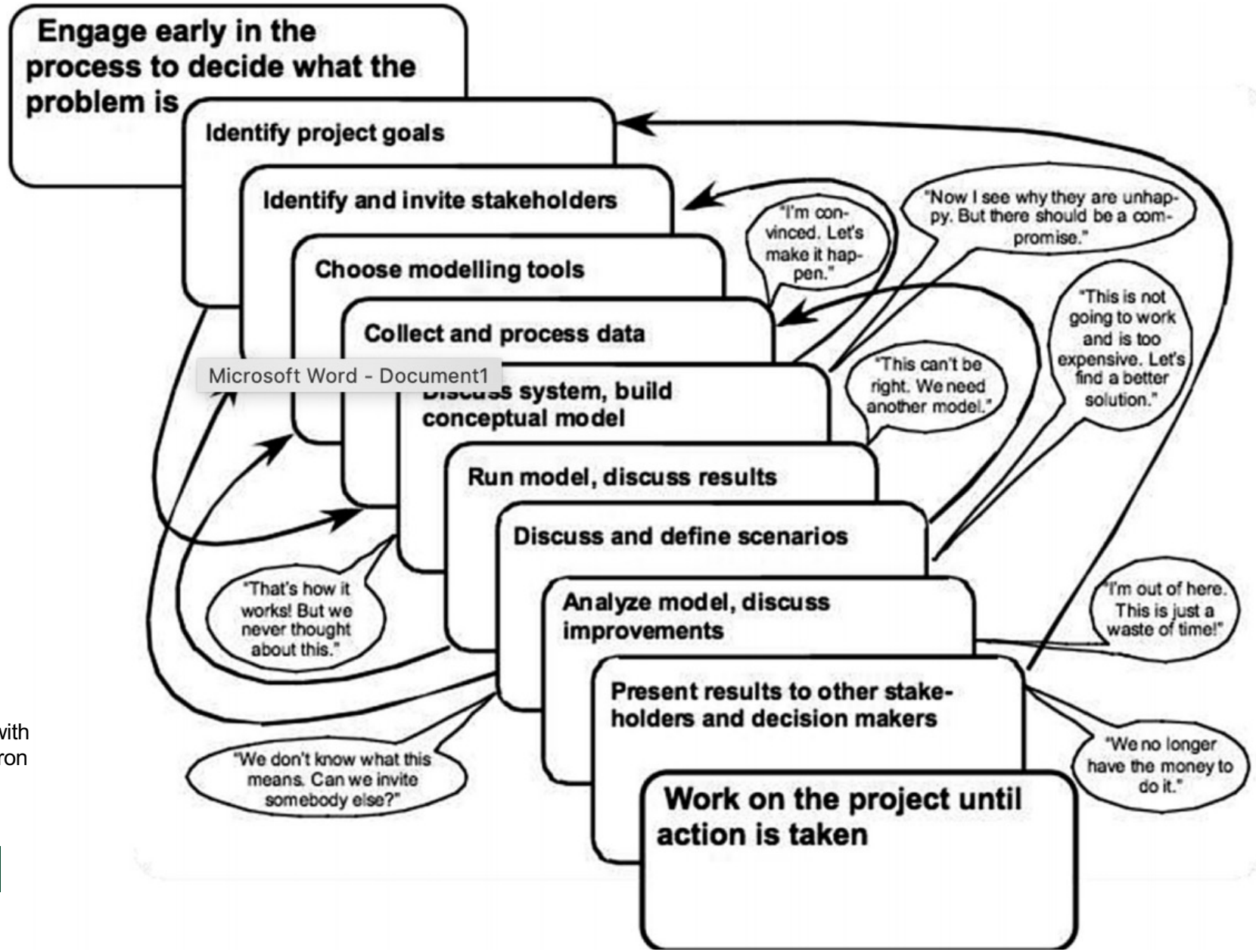


Fig 4 from Voinov, et al. Modelling with stakeholders–next generation. Environ Model Softw. 2016;77:196–220.

Who is part of the network?

How to strengthen climate-health partnerships?

- Mandates to address climate impacts on health.
- Support from the senior leadership
- Formal institutional agreements
- Data sharing agreements and protocols
- National committees on climate and health
- Annual climate-health forums
- Quarterly meetings for climate-health practitioners to review seasonal forecasts.
- Joint spaces for dialogue and training

The application of climate information can reduce the risk of diseases like Zika. Credit: Moory M. Romero, SUNY.

Barbados Port, 2017

Health sector strengths and limitations to implement an EWS

Strengths

Health messaging & education

Surveillance infrastructure

Coordination with other institutions

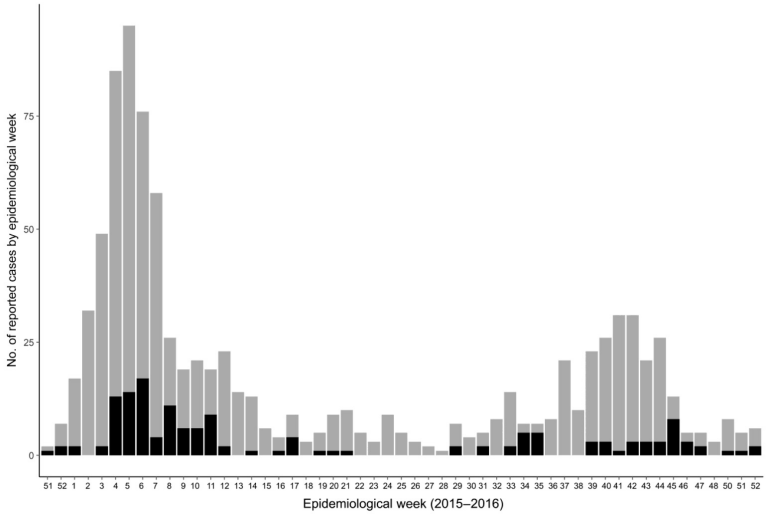
Limitations

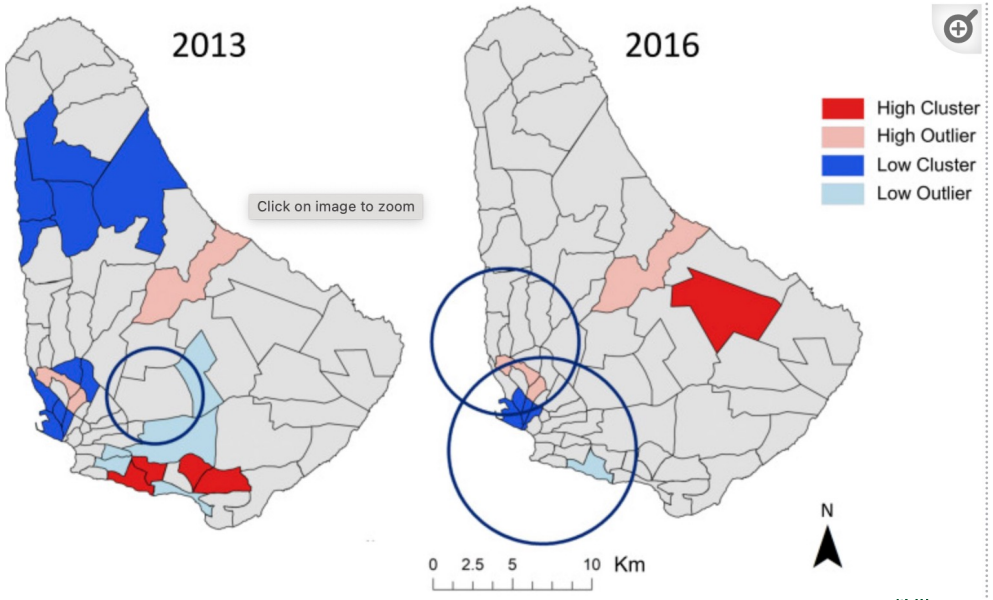
GIS expertise

Statistical/modeling skills

Financial resources

Exploring the data together





Am. J. Trop. Med. Hyg., 98(6), 2018, pp. 1857–1859
doi:10.4269/ajtmh.17-0978

Zika Virus Outbreak, Barbados, 2015–2016

Am J Trop Med Hyg. 2020 Jul; 103(1): 149–156.
Published online 2020 Apr 27. doi: 10.4269/ajtmh.19-0919

PMCID: PMC7356414
PMID: 32342853

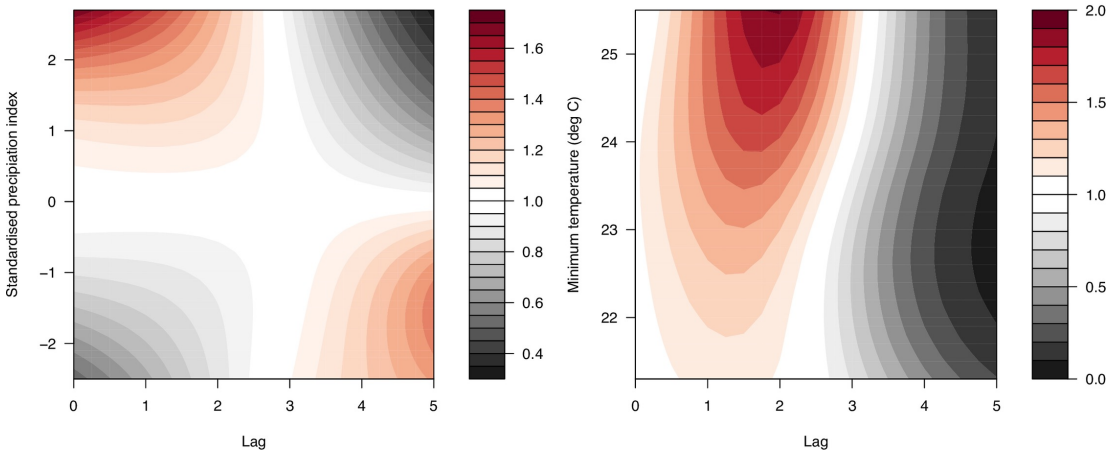
Spatiotemporal Tools for Emerging and Endemic Disease Hotspots in Small Areas: An Analysis of Dengue and Chikungunya in Barbados, 2013–2016

Dengue Early Warning Prototype

PLOS | MEDICINE

RESEARCH ARTICLE

Nonlinear and delayed impacts of climate on dengue risk in Barbados: A modelling study



Relative risk of dengue across time lags

Key health messages:

- A drought period followed by intense rainfall 4 to 5 months later could provide optimum conditions for an imminent dengue outbreak.
- There is an increasing risk of dengue outbreaks with increasing minimum temperatures up to 25ºC.

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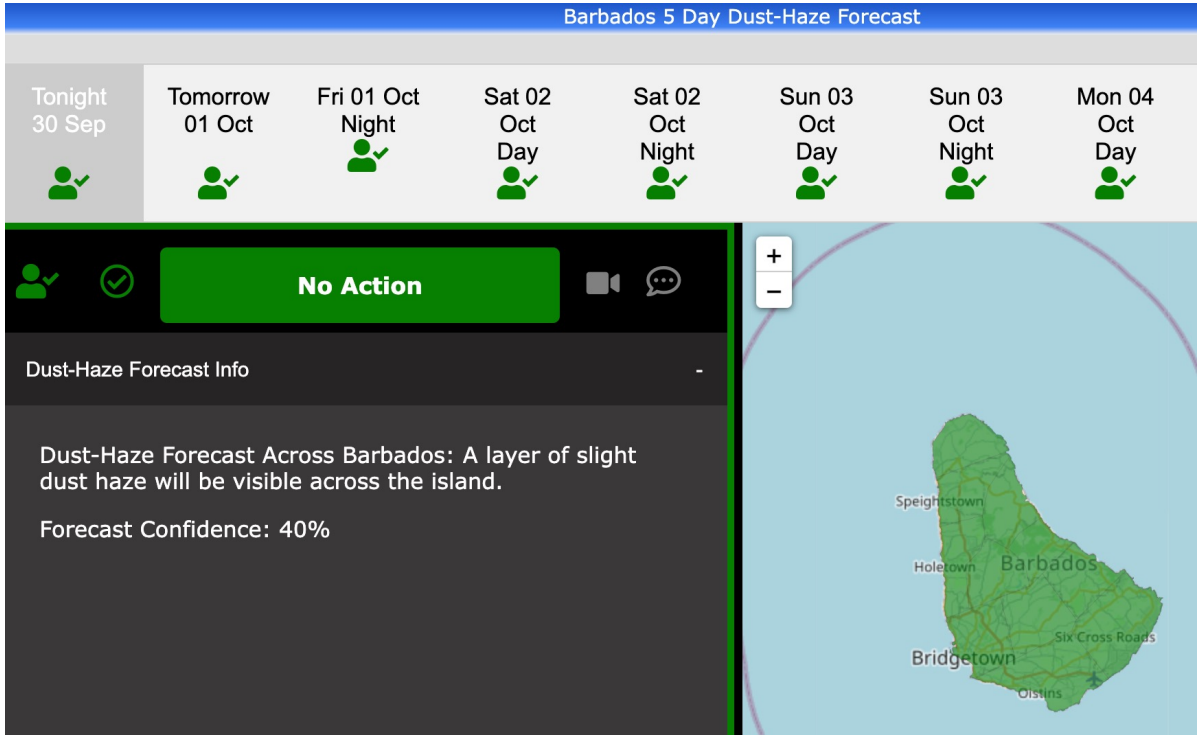
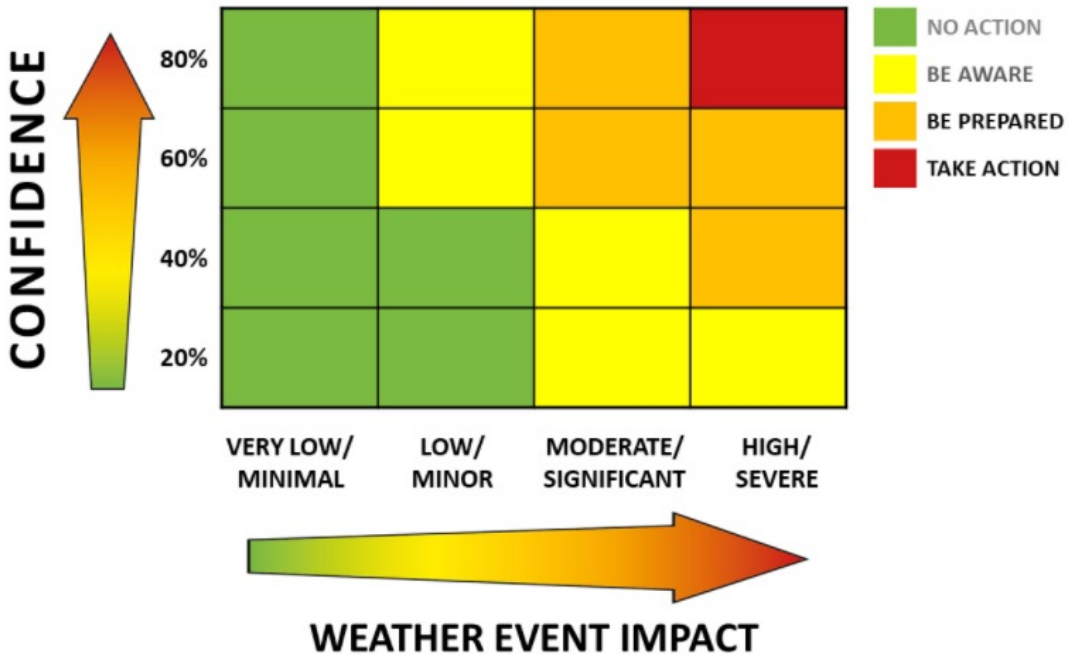
Impact-based forecasting for dengue

Example: Dust Haze Forecast



https://www.barbadosweather.org/dustHazeBarResp.php



When there is a high confidence in a high impact event, it is time to take action.

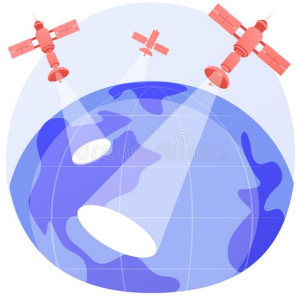
Caribbean Health Climatic Bulletin

Climate Conditions and Dengue in 2020

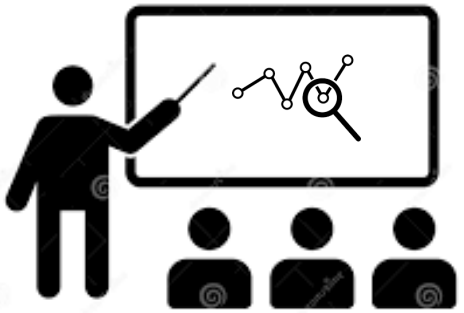
- Recent research (e.g. Lowe et al., 2018) on the link between climate conditions and dengue cases in eastern Caribbean countries suggests that drought conditions followed 4-5 months later by warmer than usual temperatures and excessive rainfall, increases the chance of Dengue outbreaks.
- In that regard, climate conditions in the Caribbean have been optimal for mosquito proliferation and dengue outbreaks throughout 2020, particularly in the eastern Caribbean. A regional drought implied increased water storage in the first half of 2020. This was followed by an intense heat season, particularly in the eastern Caribbean. Higher temperatures lead to increased rates of mosquito breeding, biting and disease transmission. The 2020 Caribbean wet season further brought episodes of excessive rainfall and flooding in many parts of the region, which contributed to an increase in mosquito breeding sites. Increased dengue case confirmations were recorded in several of the Eastern Caribbean

Opportunities and challenges

Data collection, harmonization, sharing, integration



Institutional capacity, administrative feasibility, political feasibility



Training in GIS and data analysis, and **creation of user-friendly tools**

Question #3

Which of the following methods were NOT used by the Barbados team?

1. Mapping of key actors
2. Collaborative modeling
3. Field entomology studies
4. Interviews and national consultations

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Thank you!

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PLOS NEGLECTED TROPICAL DISEASES

Co-developing climate services for public health: Stakeholder needs and perceptions for the prevention and control of *Aedes*-transmitted diseases in the Caribbean

Anna M. Stewart-Ibarra, Moory Romero, Avery Q. J. Hinds, Rachel Lowe, Roché Mahon, Cedric J. Van Meerbeeck, Leslie Rollock, Marquita Gittens-St. Hilaire, Sylvester St. Ville, Sadie J. Ryan, Adrian R. Trotman, Mercy J. Borbor-Cordova

PLOS BIOLOGY

Building resilience to mosquito-borne diseases in the Caribbean

Rachel Lowe[1,2]*, Sadie J. Ryan[3,4,5], Roché Mahon[6], Cedric J. Van Meerbeeck[6], Adrian R. Trotman[6], Laura-Lee G. Boodram[7], Mercy J. Borbor-Cordova[8], Anna M. Stewart-Ibarra[9]

Strengthening Climate Services for the Health Sector in the Caribbean

Author(s): Adrian Trotman, Roché Mahon, Joy Shumake-Guillemot, Rachel Lowe and Anna M. Stewart-Ibarra

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