

# Predictive assessment of transmission conditions of cholera in the environment and human population using earth observations

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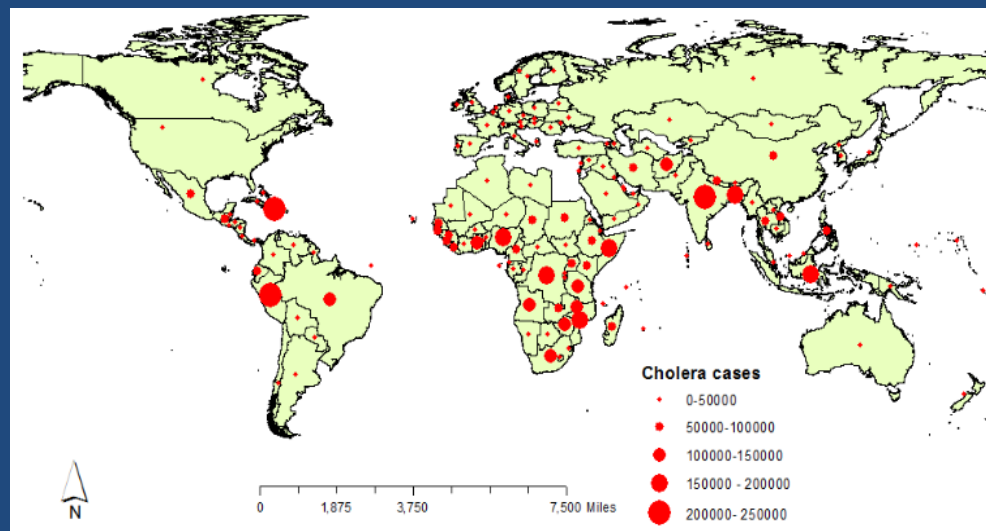
DfID, UK-Africa operations  
UK Met Office  
OCHA  
UNICEF

# Goal of Research Project

We thematically envision “Cholera Ready Nations” where satellite based prediction (of risk of trigger and likelihood of transmission of cholera in the human population) will provide sustainable and resilient readiness to prevent outbreak of disease, saving human lives and improving quality of life.

## Objectives

- Systematically validate the epidemic and endemic cholera hypothesis for trigger component of cholera in Africa
- Develop, calibrate, and validate predictive model for transmission component of cholera.



# Research Pathway

Relevant earth observations

## EPIDEMIC CHOLERA

MODIS/VIIRS [LST, Land cover]  
TRMM/GPM [Precipitation]  
SRTM [DEM]

## ENDEMIC CHOLERA

MODIS/VIIRS [Chlorophyll, SST,  
Organic matter, Land Cover]  
AVHRR [SST]  
TRMM/GPM [Precipitation]  
SRTM [DEM]  
TOPEX/JASON [SSH]  
Aquarius [Salinity]

*SST: Sea Surface Temperature; SSH: Sea Surface Height; LST: Land Surface Temperature; MODIS: Moderate Resolution Imaging Spectroradiometer; TRMM: Tropical Rainfall Measuring Mission; GPM: Global Precipitation Mission; AVHRR: Advanced Very High Resolution Radiometer; DEM: Digital Elevation Model; SRTM: Shuttle Radar Topography Mission*

Use of earth observations to advance science of cholera (Section 2.1)

Validation of trigger hypothesis for Epidemic mode of cholera (Task 1)

Validation of trigger hypothesis for Endemic mode of cholera (Task 2)

Cholera Transmission Model (CTM) (Task 3)

Anticipated Results (Section 3)

Risk maps showing probabilities of occurrence of inland cholera infection

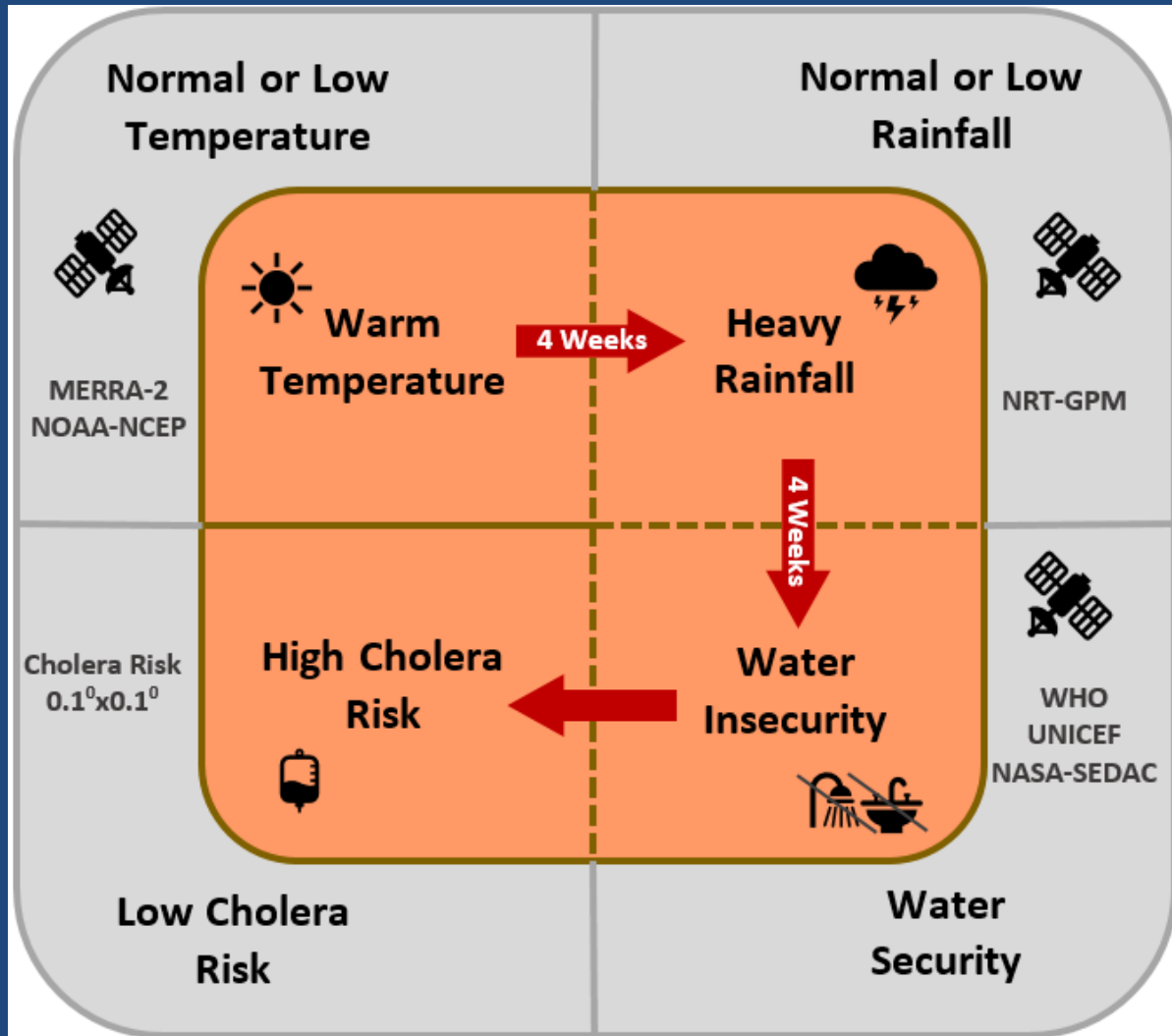
Risk maps showing probabilities of occurrence of cholera infection along coasts

Ensemble scenarios on how cholera infection may spread in human population

Capacity building initiatives (Section 2.2)

- Communication plan with African partners identified by GEO Secretariat to identify core working group for cholera (Task 4)
- Determine feasibility of encourage use of earth observations and testing algorithms by partner foundations (Task 5)
- Workshop on African Cholera Initiative, social media and dissemination kit to advance Agenda 2030 plan (Task 6)

# Epidemic cholera model



Warm temperature= above climatological average temperature

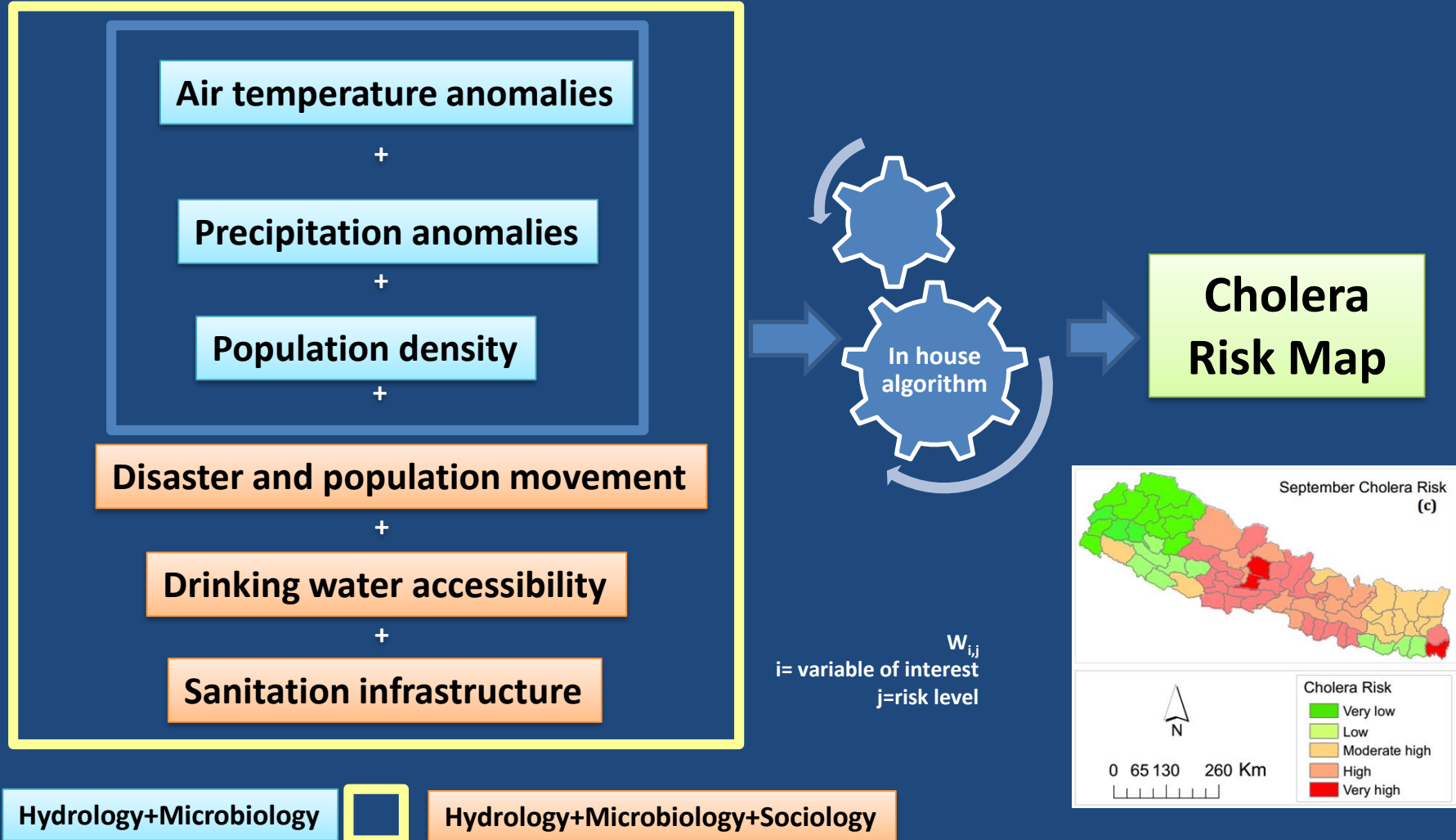
Heavy rainfall= above climatological average precipitation

Water insecurity=lack of access to water and sanitation access

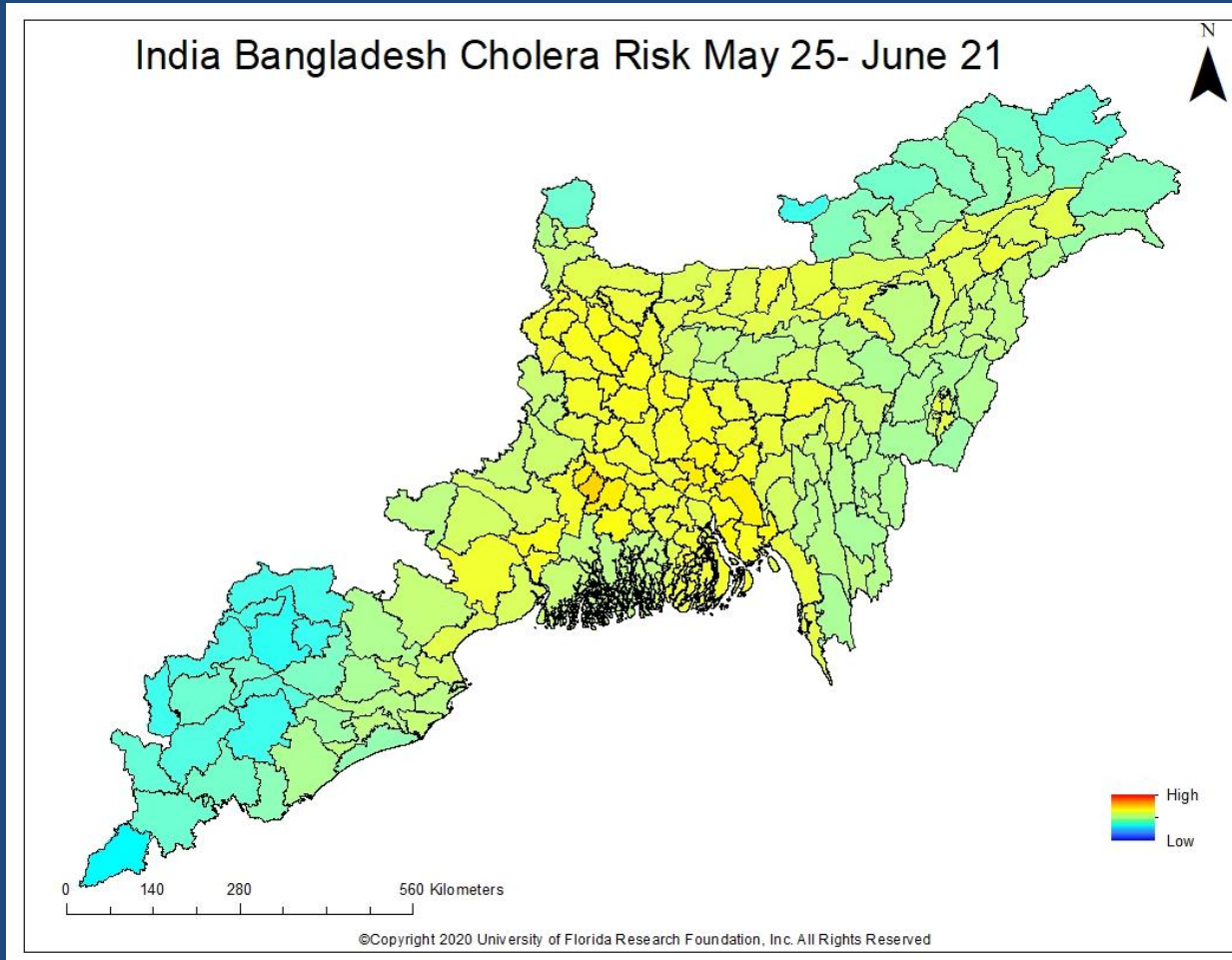
High cholera risk=probability of cholera greater than 50%

# Epidemic algorithm: Hydrology + Microbiology + Sociology

## CHOLERA ALERT SYSTEM (CAS-version 4)



# Additional validation point



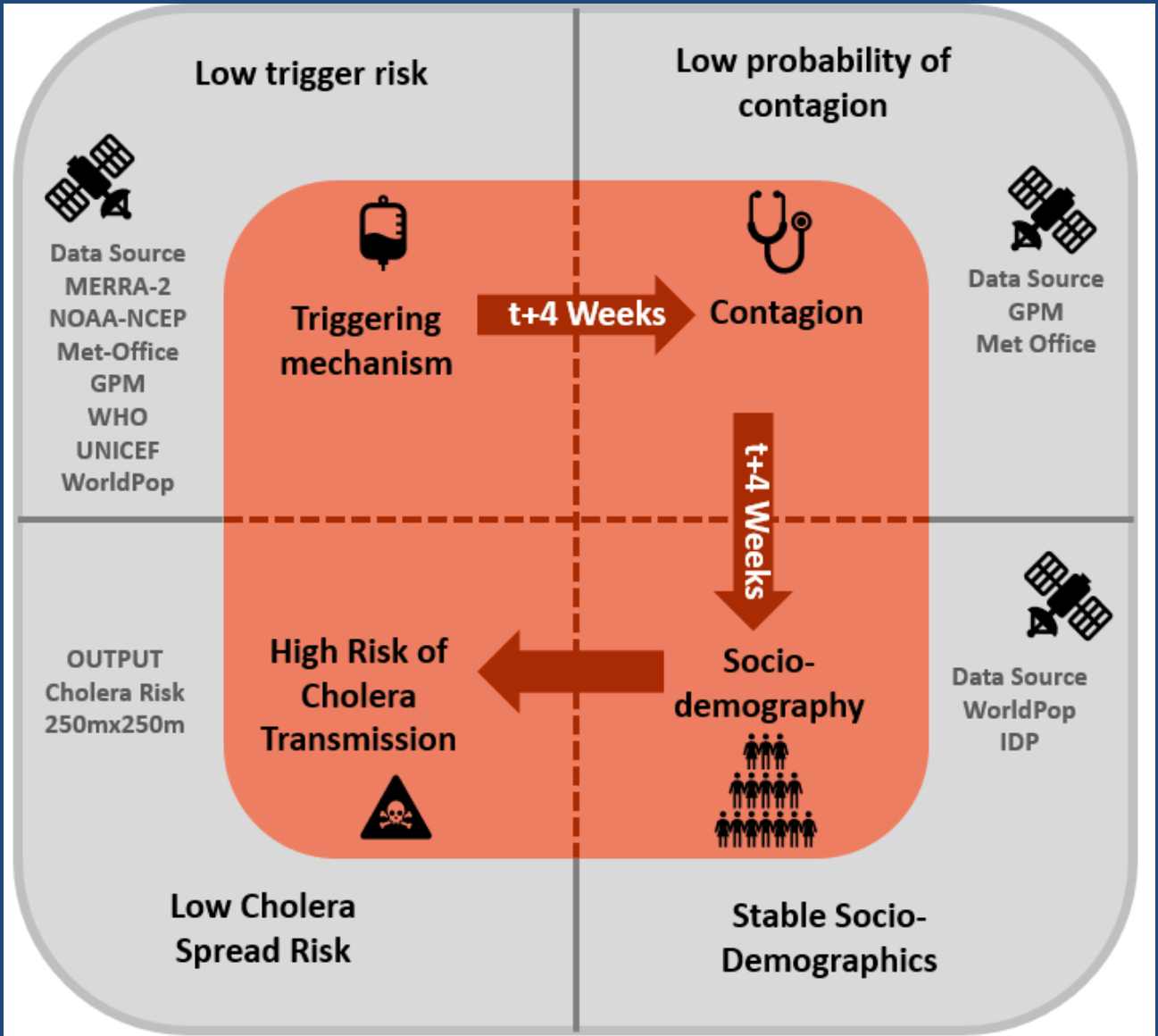
## How to interpret “Level of Threat” and “What to Do”?

**Level of Threat:** The four categories of threat level include

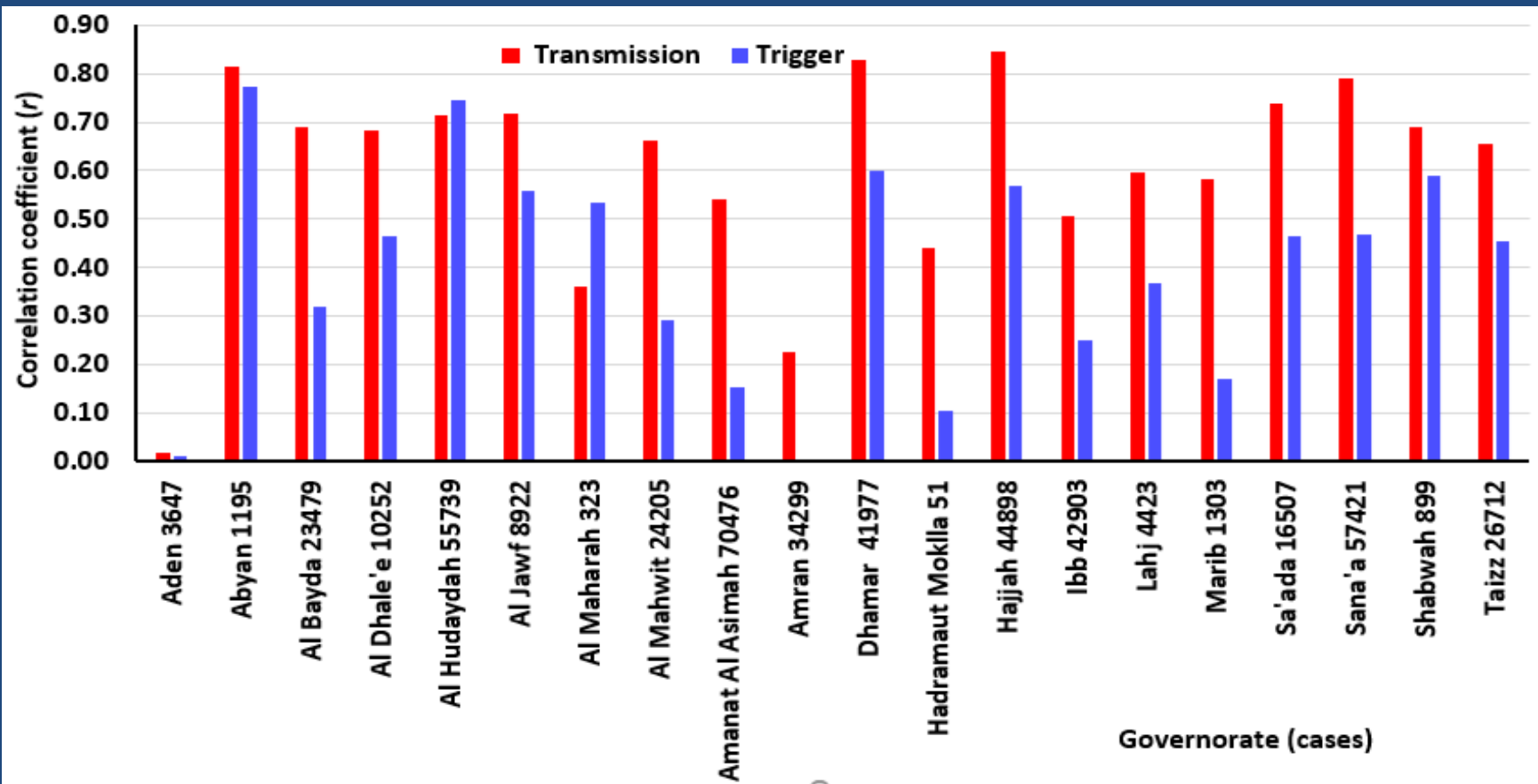
Threat Level	Interpretation
Increasing	Overall risk of cholera is increasing in several regions
Stable	Risk of cholera is stable with respect to the previous forecast
Decreasing	Overall risk of cholera is decreasing in several regions
Decreasing-Stable	Overall cholera risk remains very low

What to Do	Interpretation
Strengthen WASH	Immediate need to provide WASH and education to high risk communities
Stable WASH	Keep providing WASH and education, given the risk exists but not at an alarming level
Sustain WASH	Low cholera risk and an opportunity to develop policies for sustaining WASH and education then in community.

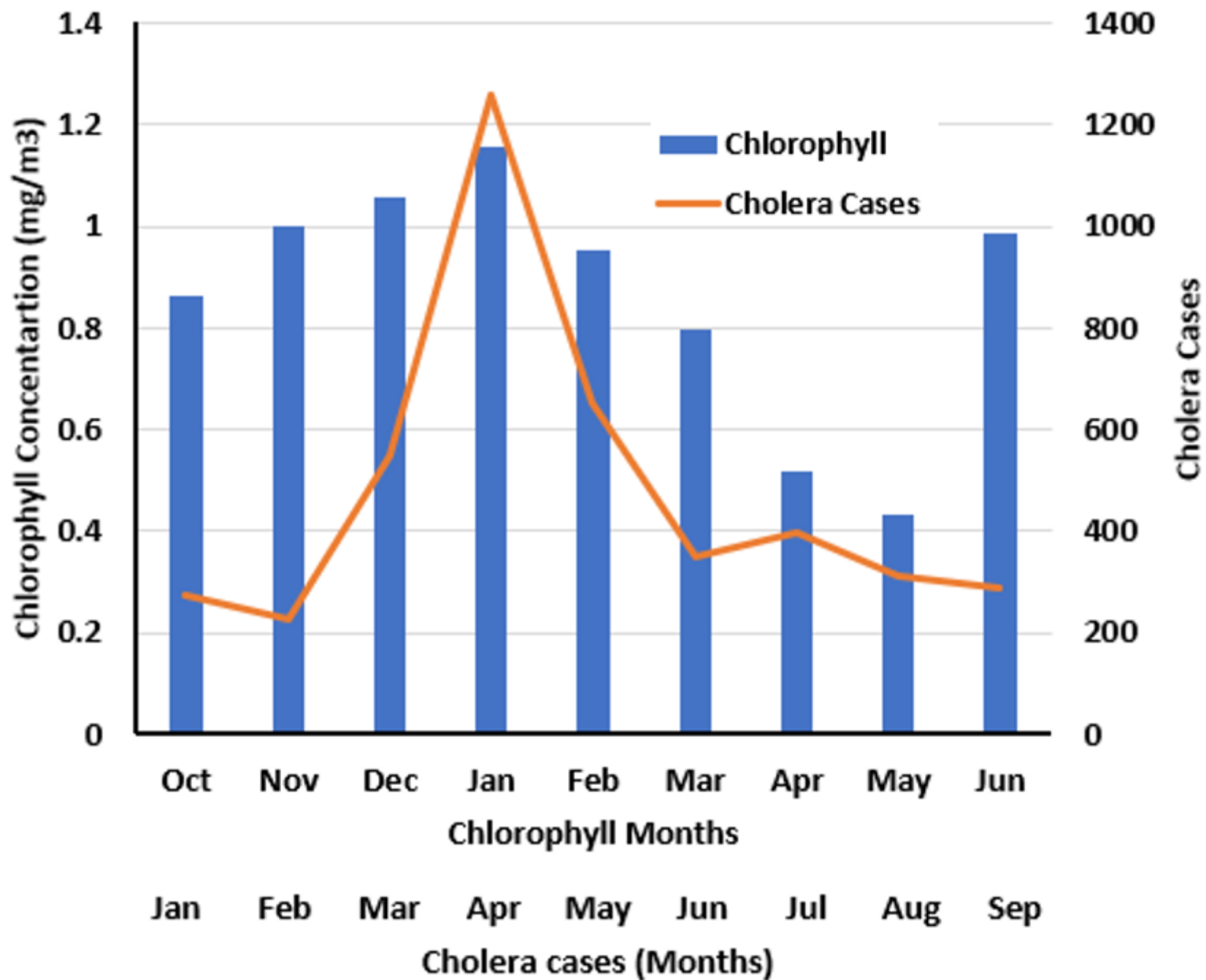
# Cholera Transmission Module



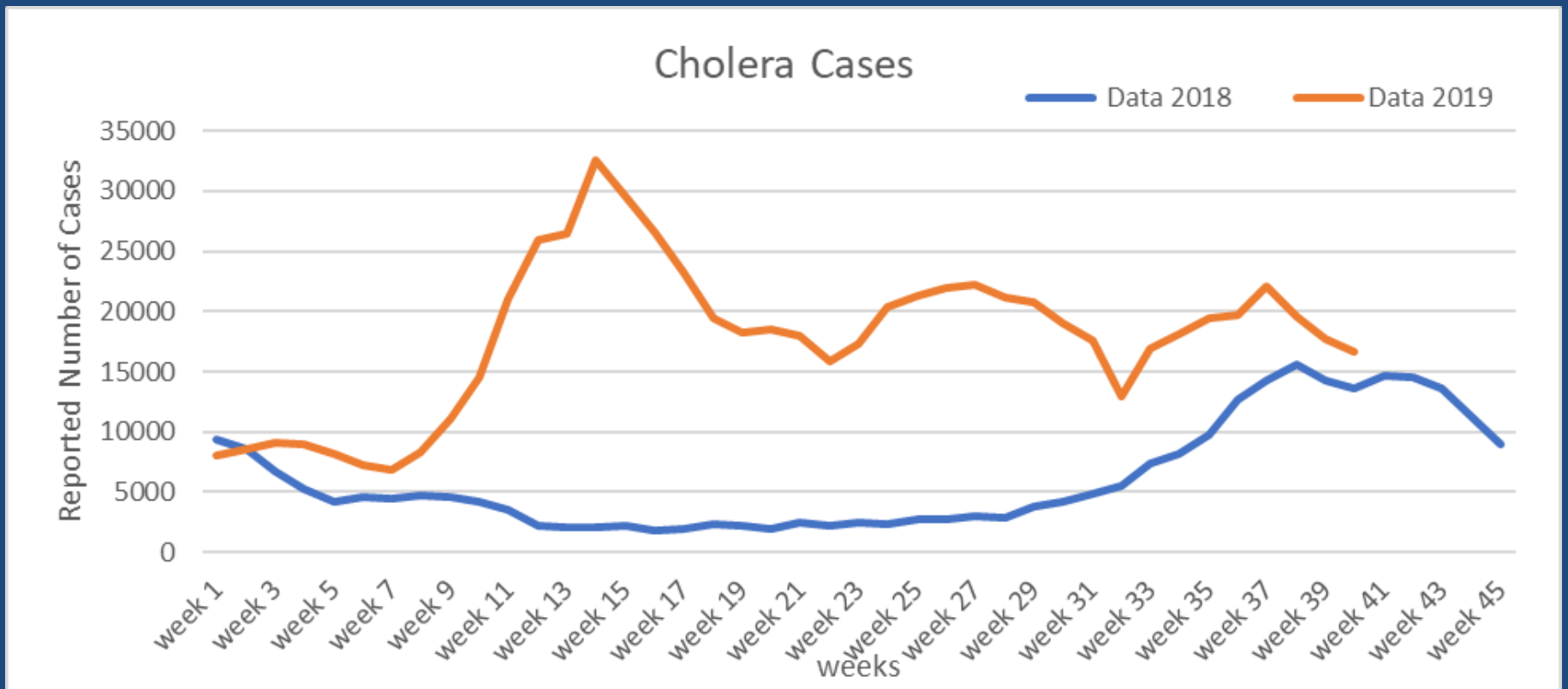




Correlation between actual cholera cases and trigger and transmission module of CPS. X-axis shows the name of governorate followed by total number of cholera cases for first 28 weeks of 2019



# Changing dynamics of cholera



# ARL information

**Starting ARL: 3**

**Current ARL: 6 (approaching 7)**

**Target ARL: 8**

# Overall timeline for research objective and activities at end user organization

Timeline of proposed activities and key milestones												
Activity	Year 1				Year 2				Year 3			
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Kick off meeting (Skype)	C											
Task 1: Epidemic cholera		C	C	C	C	C						
Task 2: Endemic cholera				C	C	IP	IP					
Task 3: CTM							IP	IP	X	X	X	
Task 4: Core group formation	C	C	C	C	C	C	IP					
Task 5: Training/ dissemination plan with foundations					C	C	IP					
Task 6: Workshop								x <sup>1</sup>	*	*	*	*
PI meeting	Third week of every month											
Meetings with stakeholders (OCHA, Dfid)				C				C				*

x<sup>1</sup> : planning; \*: status unknown due to COVID19  
 UF; Q1, Q2, Q3, Q4 represent quarter in a given year.

Thank you