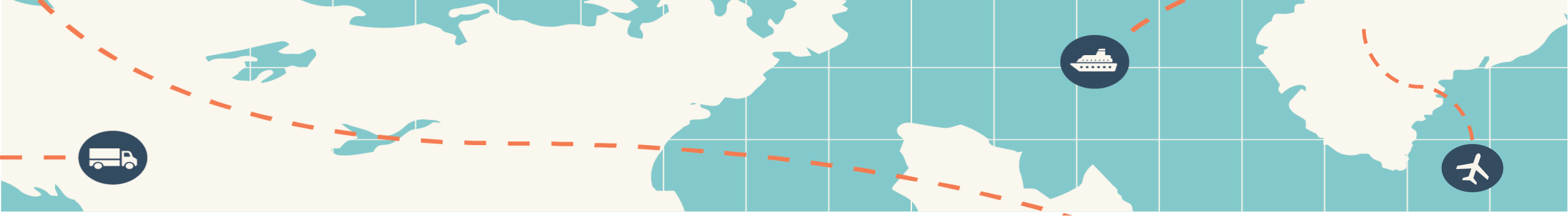

# CDC's Division of Global Migration and Quarantine

## Understanding Population Mobility & Connectivity Patterns to Inform Public Health Interventions

Dr. Barbara Knust & Dr. Dana Schneider

1st SAFETYNET Scientific Conference, Canberra, Australia

14 September 2023


Lassa fever data provided by Benin International Health Regulations (IHR) National Focal Point

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Lassa fever data provided by Benin IHR National Focal Point

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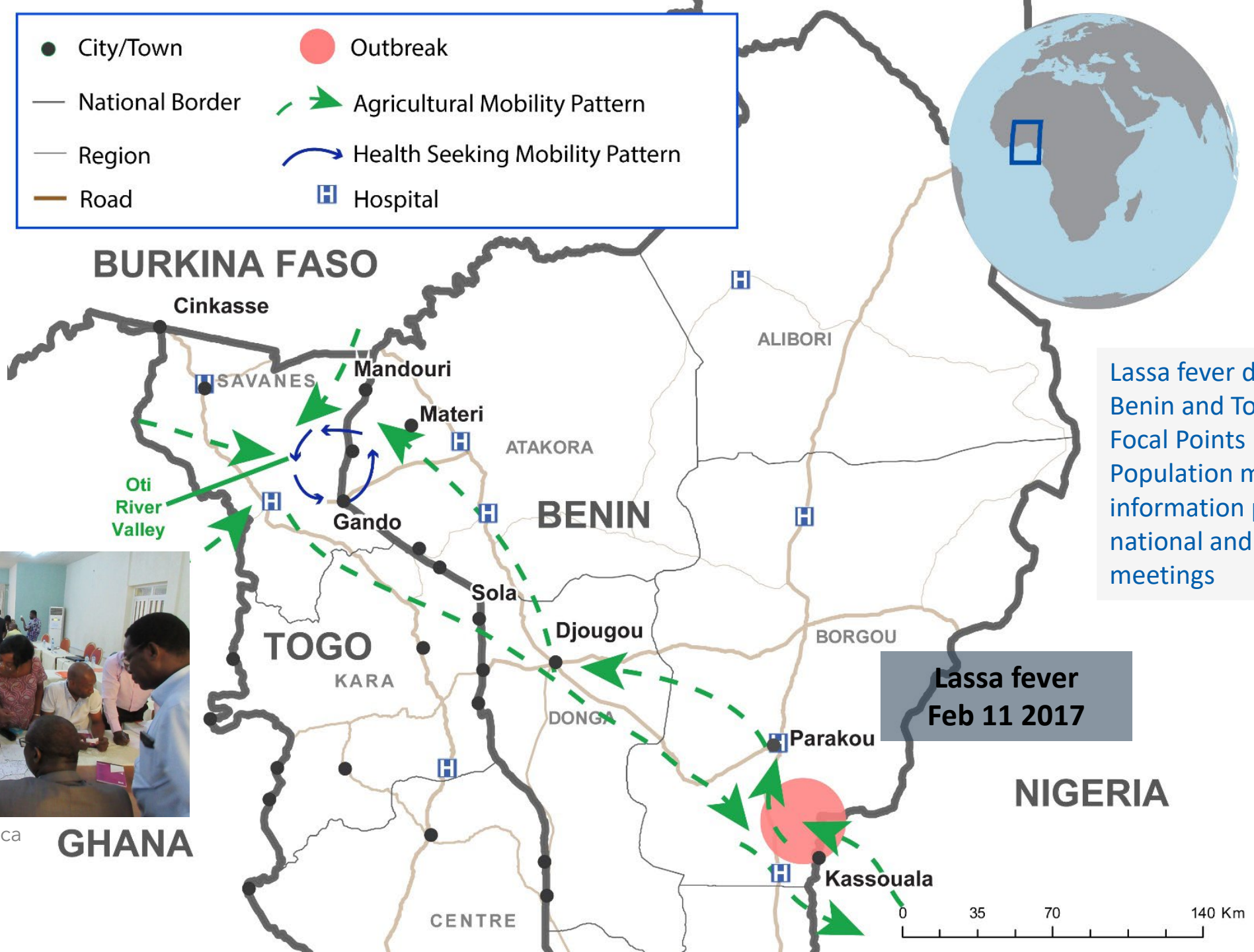
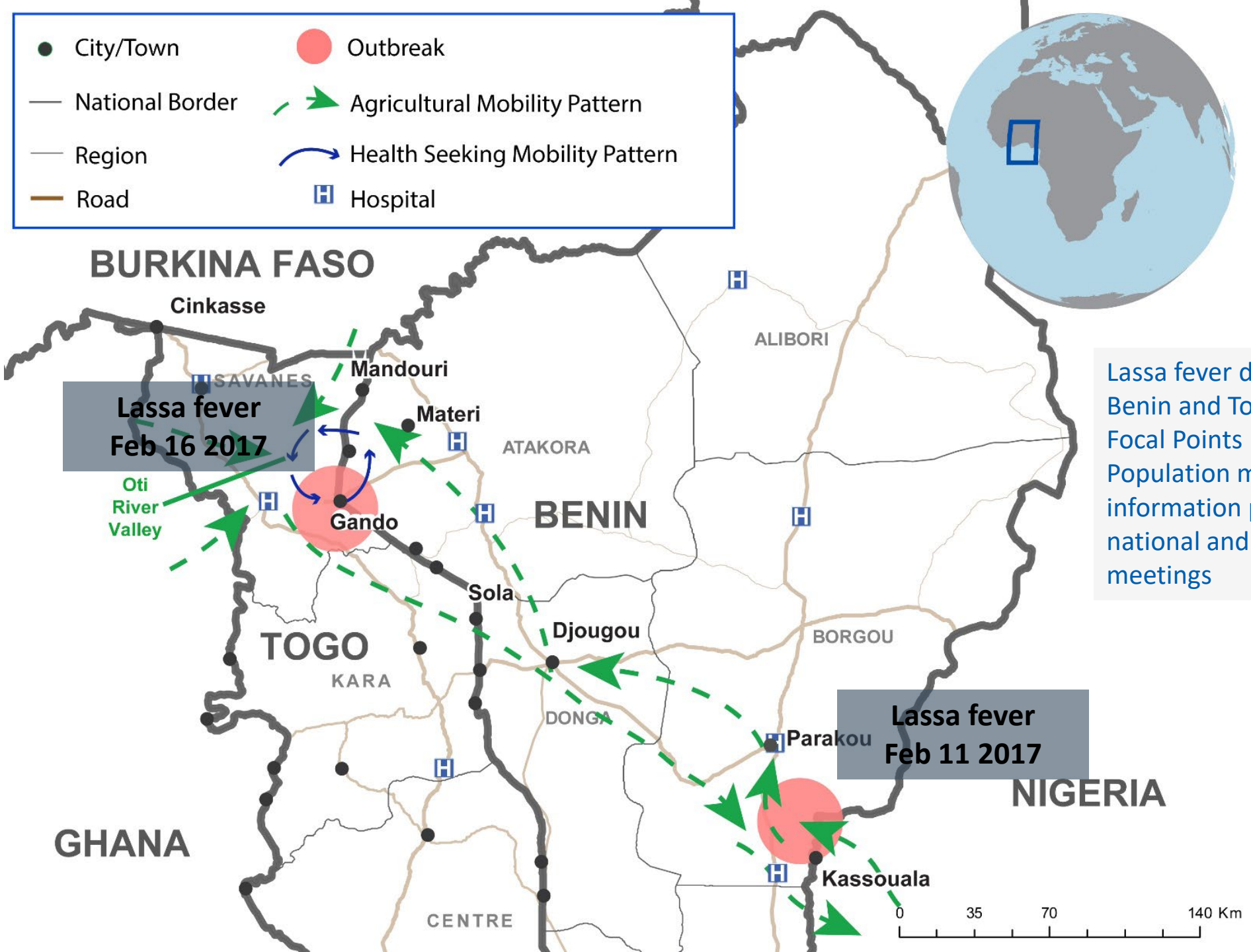
Photo Source: Rebecca Merrill, CDC




Lassa fever data provided by Benin and Togo IHR National Focal Points
Population movement information provided in national and binational meetings

**Lassa fever**
**Feb 11 2017**




Lassa fever data provided by Benin and Togo IHR National Focal Points
Population movement information provided in national and binational meetings

# SESSION LEARNING OBJECTIVES

- Understand how human movement and connectivity influence where  communicable diseases spread
- Describe types of population movement information and how it can be collected
- Explain how population movement information can be applied to inform public health interventions

# What is Border Health?

- An applied discipline of public health
- Aims to identify and address the risks of communicable disease spread associated with **human mobility** along a traveler's entire journey
  - From their point of origin to their destination
  - Emphasis on preventing and limiting the importation or exportation of health threats across an international border

# **Goal:** Strengthen public health systems and workforce capacities through…

1. Assuring public health preparedness and response capacities at points of entry (POE)

2. Analyzing population movement patterns to:
   - Identify at-risk areas or populations for disease spread
   - Strengthen disease surveillance in at-risk areas

3. Enhancing public health communication and collaboration between countries

# Mobility and population connectivity create risks for spread of communicable diseases

- Geospatial spread of communicable diseases is influenced by human mobility
- Patterns of human mobility and connectivity are complex and are impacted by a variety of factors
- Movement patterns challenge ability of public health systems to detect and respond efficiently to communicable disease events

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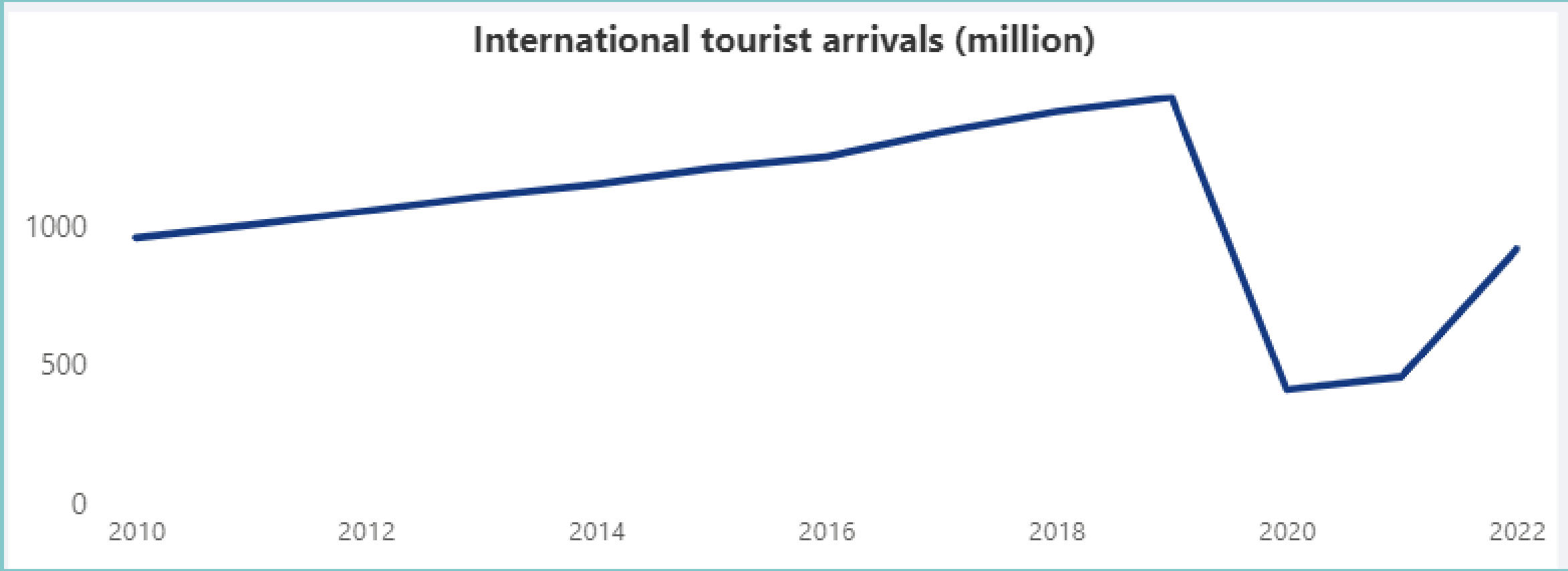
# Context:
# Global Mobility Trends

# Tourism is an increasing trend worldwide




Source: UN World Tourism Organization
https://www.unwto.org/tourism-data/global-and-regional-tourism-performance

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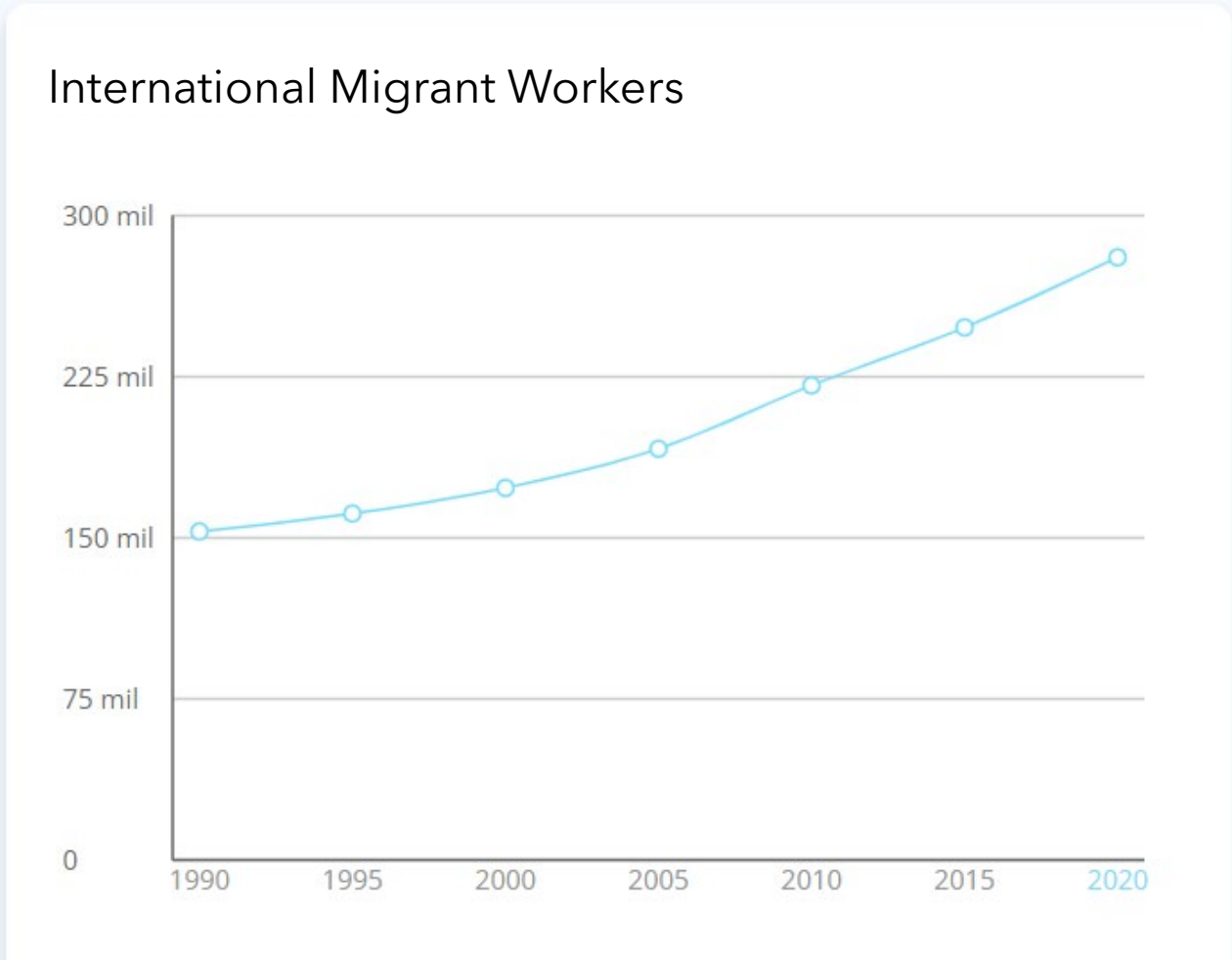
# People are increasingly traveling overseas to work




- 23.6 million migrant workers in SE Asia
- 10.6 million remain in SE Asia, triple the amount as reported in 1990
- Top destination countries: Thailand, Malaysia, Singapore
- Approximately 1/3 of migrant workers arrived in destination country informally→ challenges with healthcare access

Source: https://www.migrationdataportal.org

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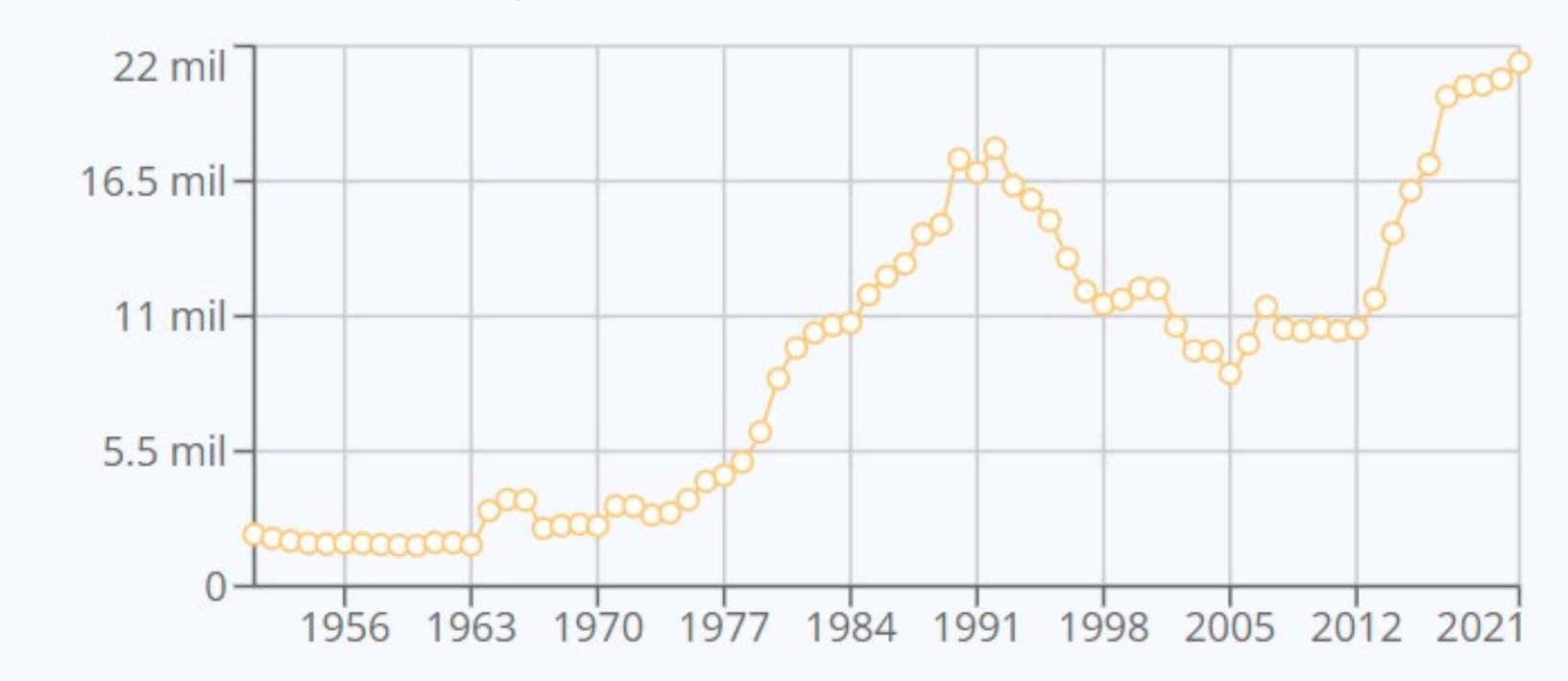
# More people are crossing borders to avoid conflict

## Worldwide refugees in host countries




- 230,000 asylum seekers in Southeast Asia, mostly in Thailand and Malaysia.
- Bangladesh hosts approximately 1M displaced persons

Source: https://www.migrationdataportal.org

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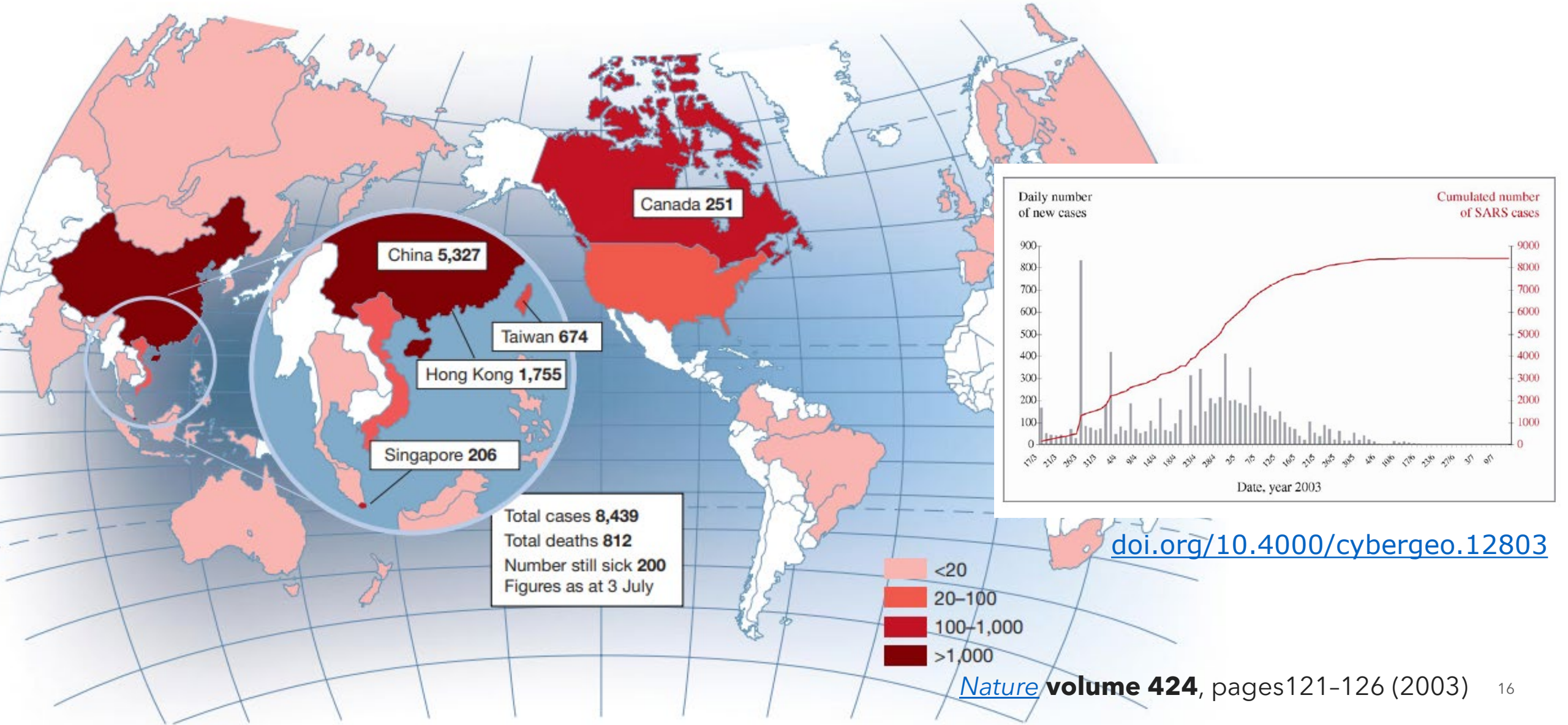
# Recent Health Threats of International Concern

# SARS cases and distribution, 2003





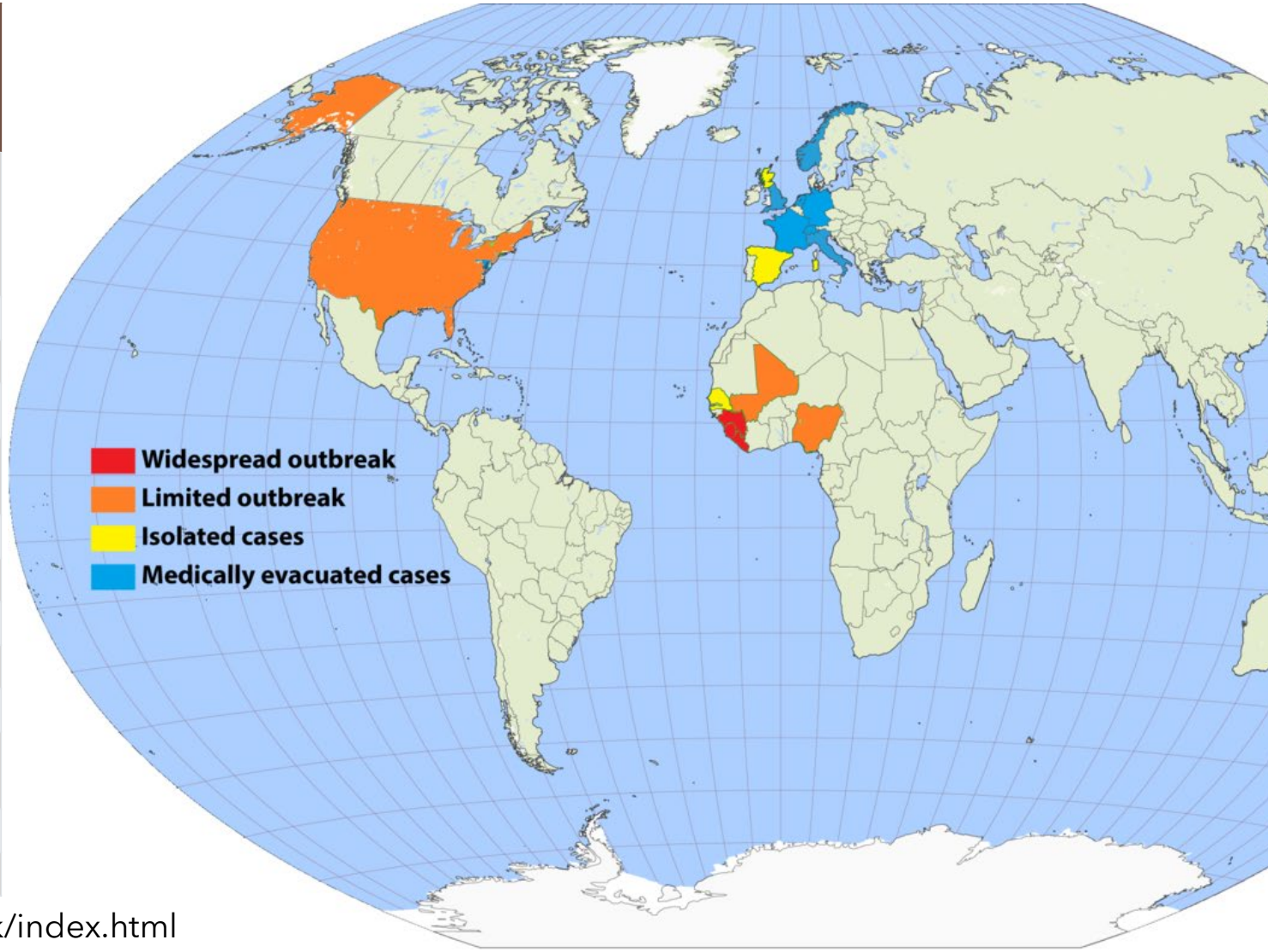


doi.org/10.4000/cybergeo.12803

*Nature* **volume 424**, pages121–126 (2003)

# 2014-2016 West Africa Ebola Epidemic

| Country | Total Cases (Suspected, Probable, Confirmed) | Laboratory Confirmed Cases | Total Deaths |
|---|---|---|---|
| *Countries with Widespread Transmission* | | | |
| Guinea | 3,814 | 3,358 | 2,544 |
| Liberia | 10,678 | 3,163 | 4,810 |
| Sierra Leone | 14,124 | 8,706 | 3,956 |
| *Affected Countries* | | | |
| Italy | 1 | 1 | 0 |
| Mali | 8 | 7 | 6 |
| Nigeria | 20 | 19 | 8 |
| Senegal | 1 | 1 | 0 |
| Spain | 1 | 1 | 0 |
| United Kingdom | 1 | 1 | 0 |
| United States | 4* | 4 | 1 |
| **Total** | **28,652** | **15,261** | **11,325** |




https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html

Source: https://commons.wikimedia.org/w/index.php?curid=37168068

# Cross-border spread of disease, Ebola epidemic, West Africa, 2014-2015

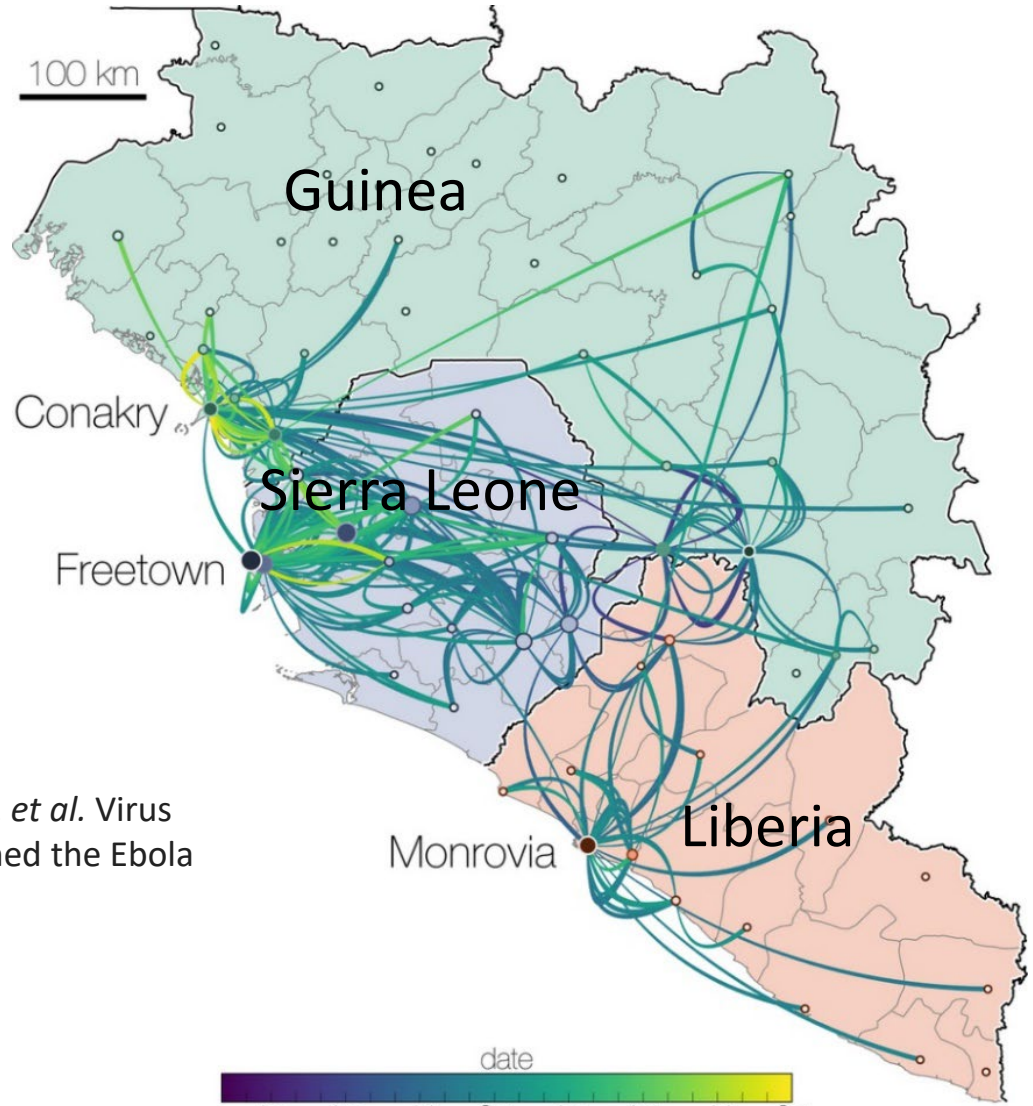



Figure from: Dudas, G., Carvalho, L., Bedford, T. *et al.* Virus genomes reveal factors that spread and sustained the Ebola epidemic. *Nature* **544**, 309–315 (2017). https://doi.org/10.1038/nature22040

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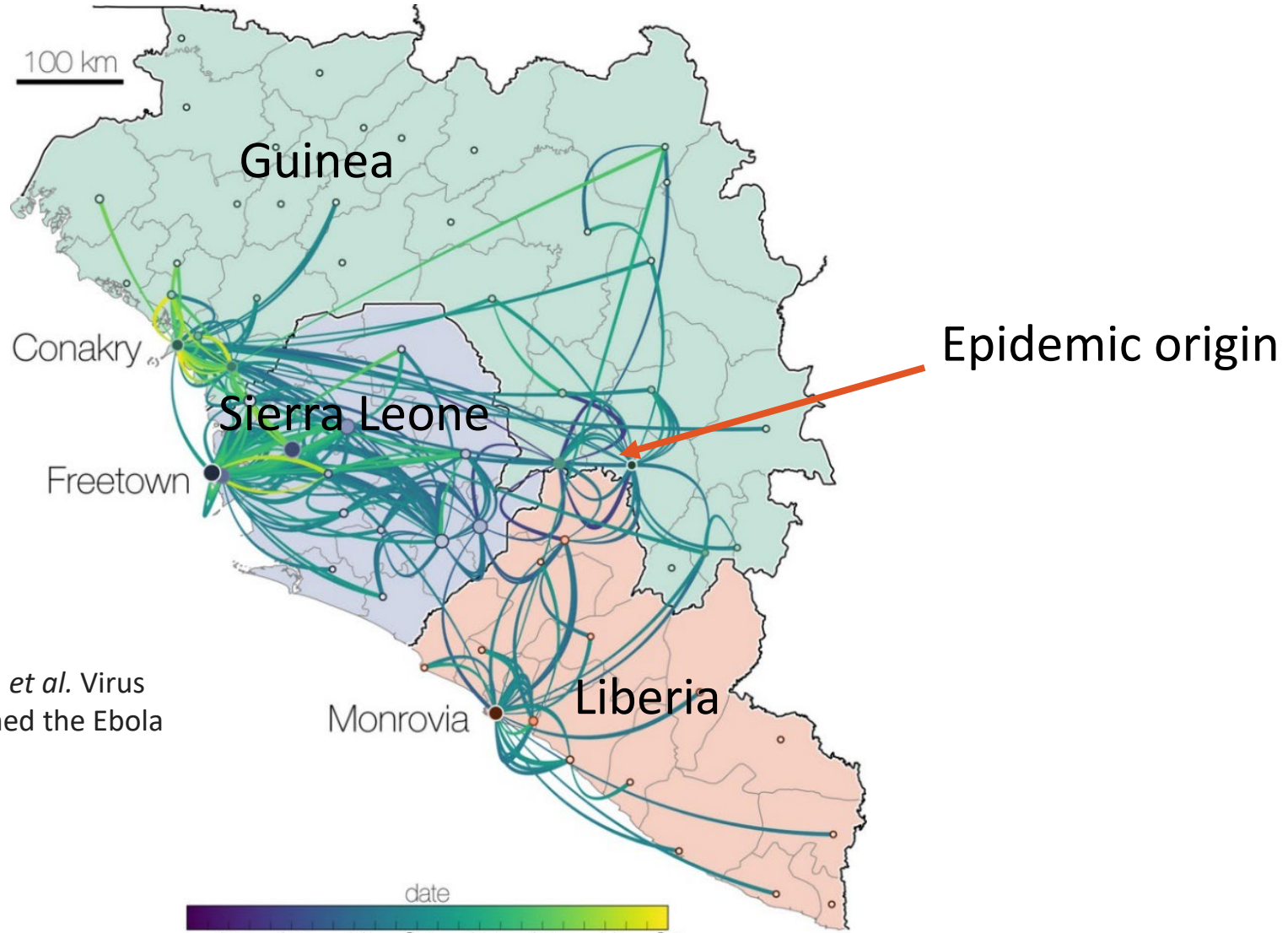


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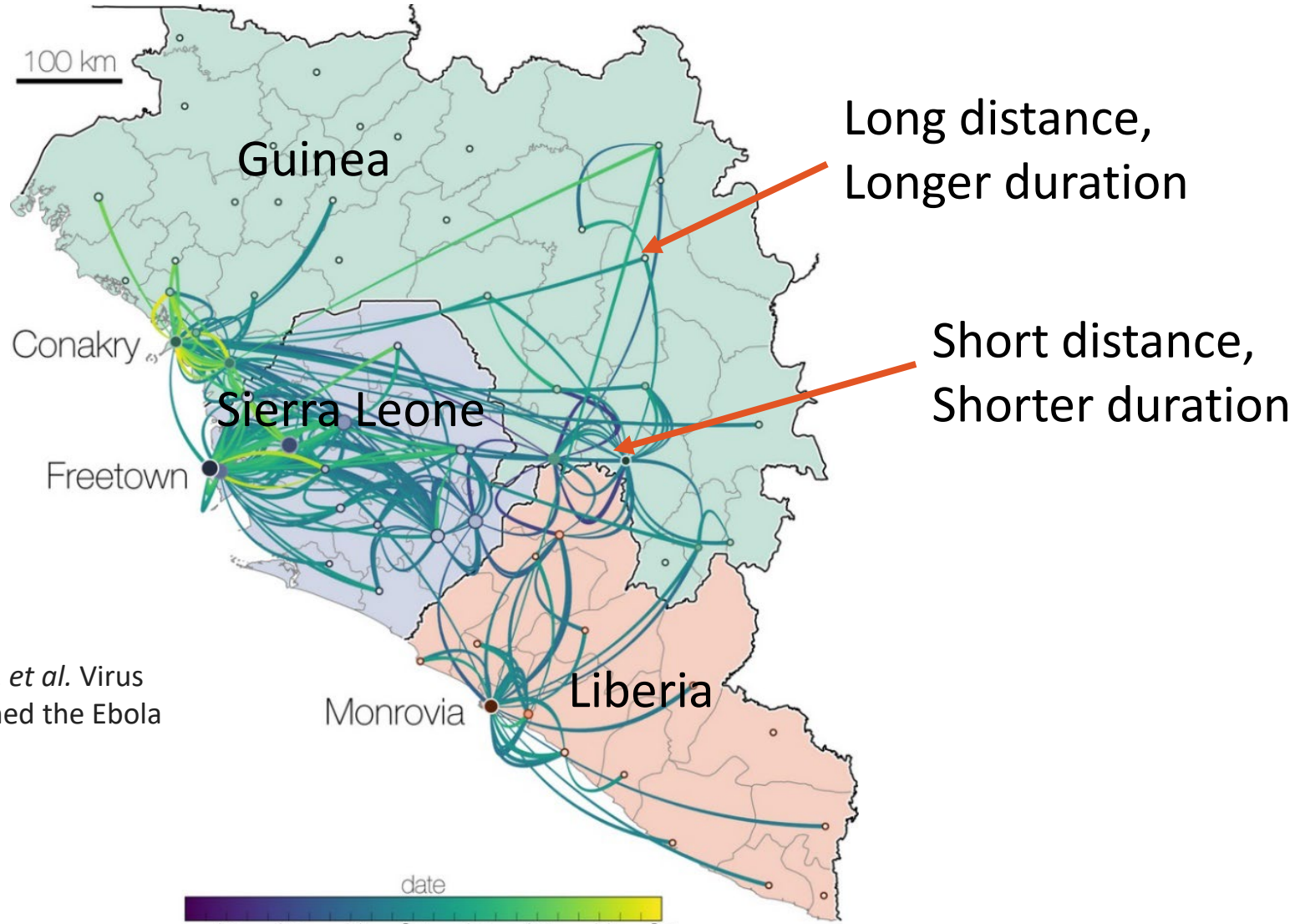


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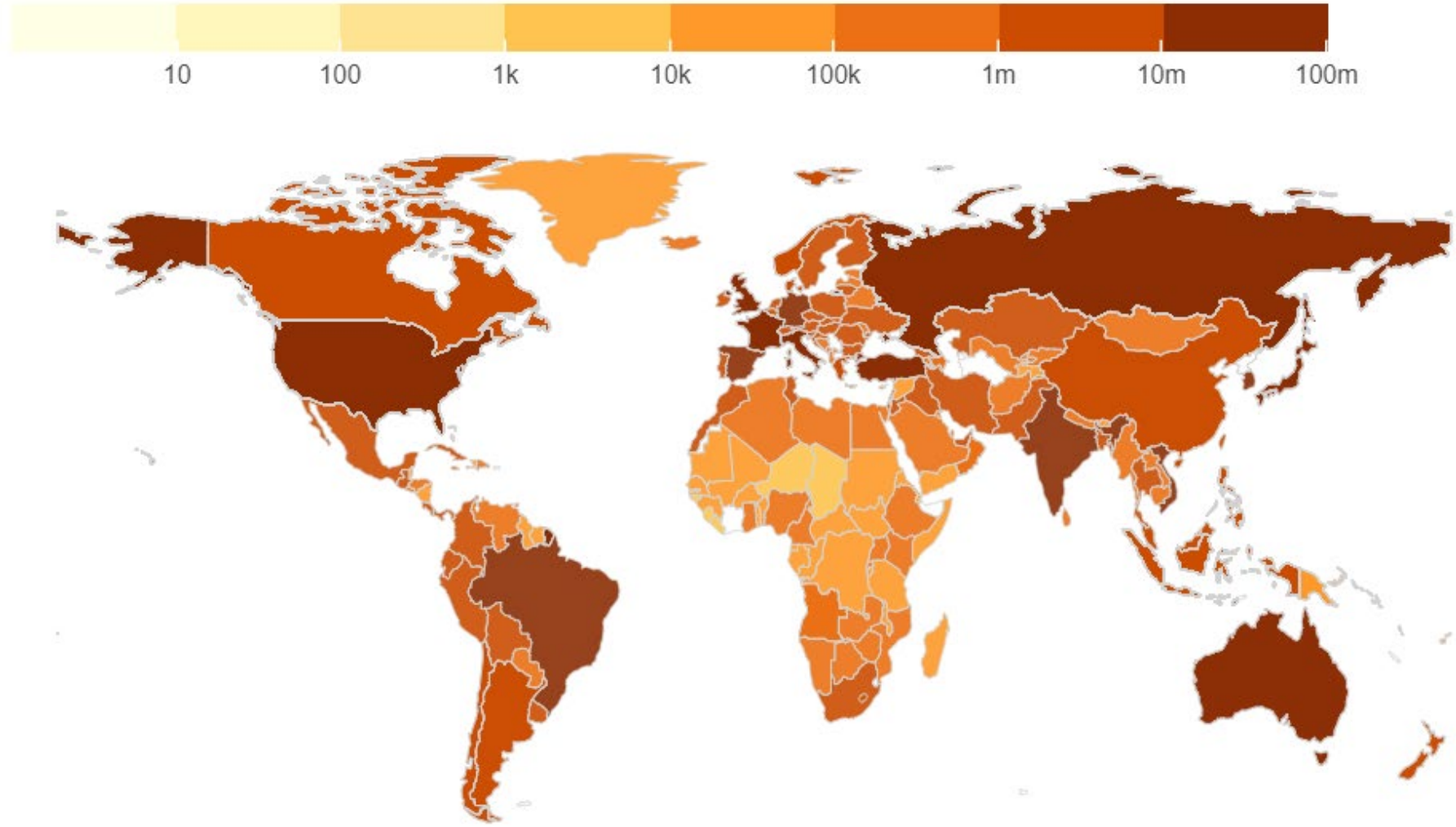
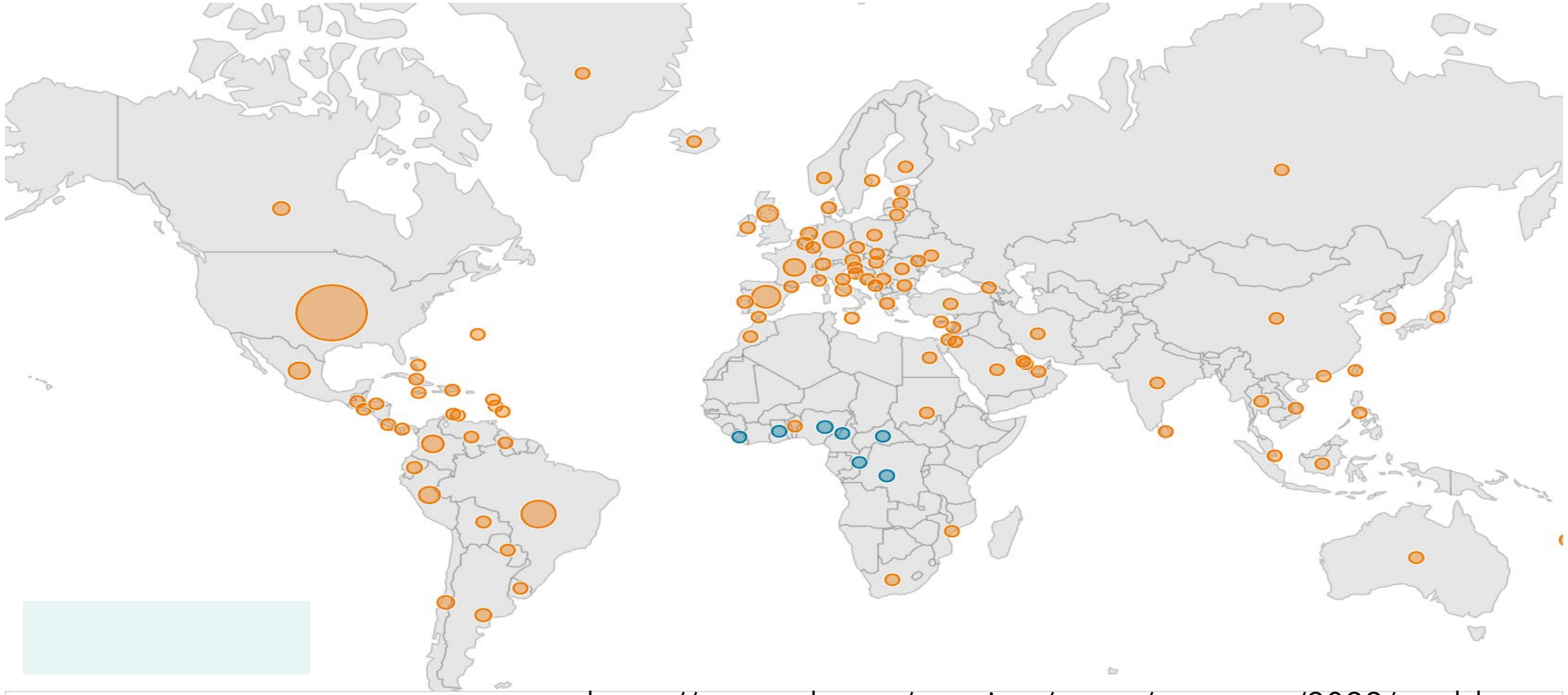
# COVID-19 worldwide spread




[Animated Maps - Johns Hopkins Coronavirus Resource Center (jhu.edu](#)

# Global Mpox cases

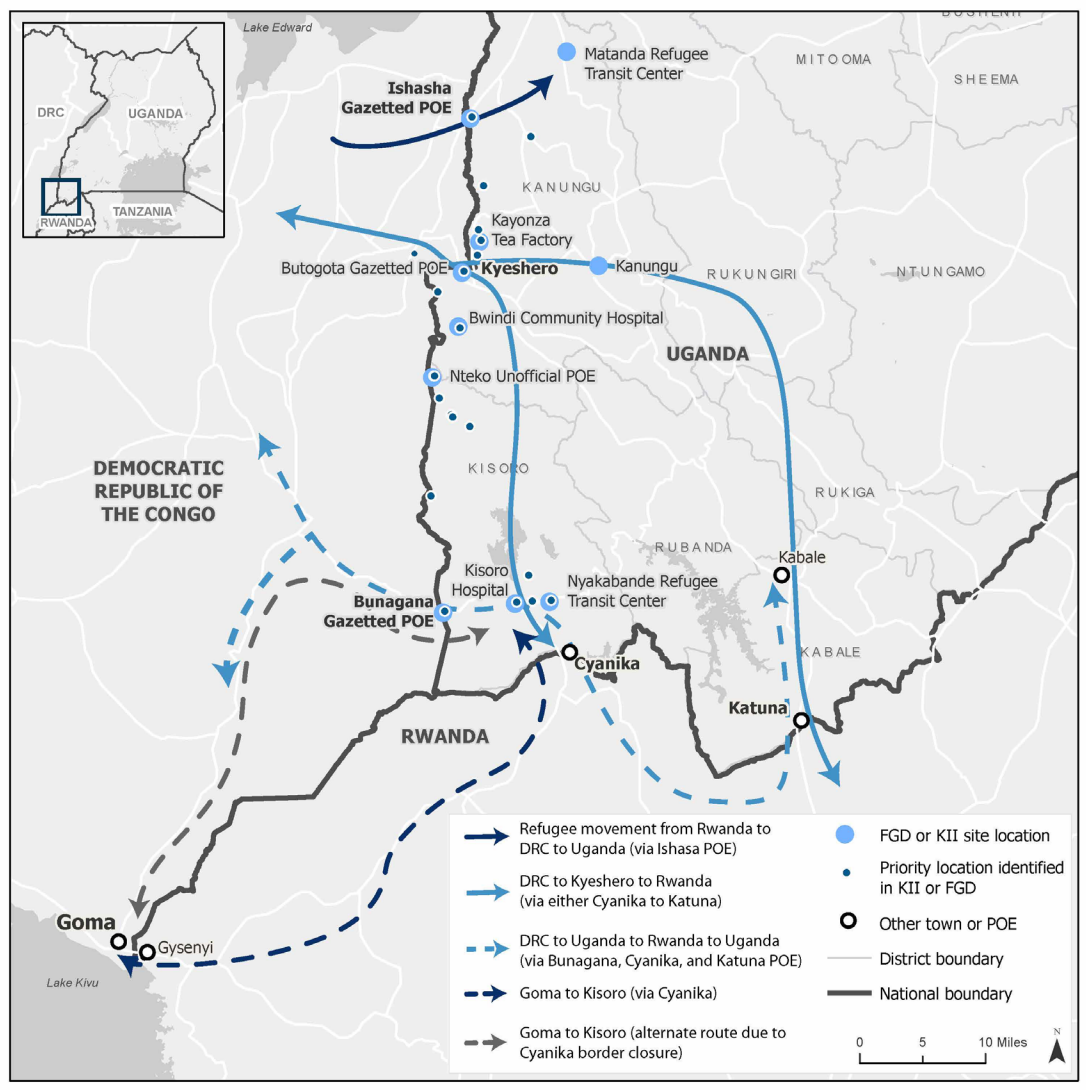


https://www.cdc.gov/poxvirus/mpox/response/2022/world-map.html

Legend

Has not historically reported mpox

Has historically reported mpox




Nakiire L, Mwanja H, Pillai SK, et al. Population Movement Patterns Among the Democratic Republic of the Congo, Rwanda, and Uganda During an Outbreak of Ebola Virus Disease: Results from Community Engagement in Two Districts – Uganda, March 2019. MMWR Morb Mortal Wkly Rep 2020;69:10–13.

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# Population Connectivity Across Borders ("PopCAB")

https://www.cdc.gov/immigrantrefugeehealth/popcab-toolkit.html

# Illuminating pathways of connectivity: Population connectivity across borders (PopCAB)

## Characterize community-level population movement patterns

- Learn directly from prioritized stakeholders, community members, and populations on the move
- Gather who, when, where, why, and how populations are moving

## Inform surveillance, preparedness, and response

- Guide public health assessments and interventions
- Contribute to risk forecasting
- Tailor long-term strategies

## Low-burden field-based method

- Gather multisector information through community assessments in a matter of hours

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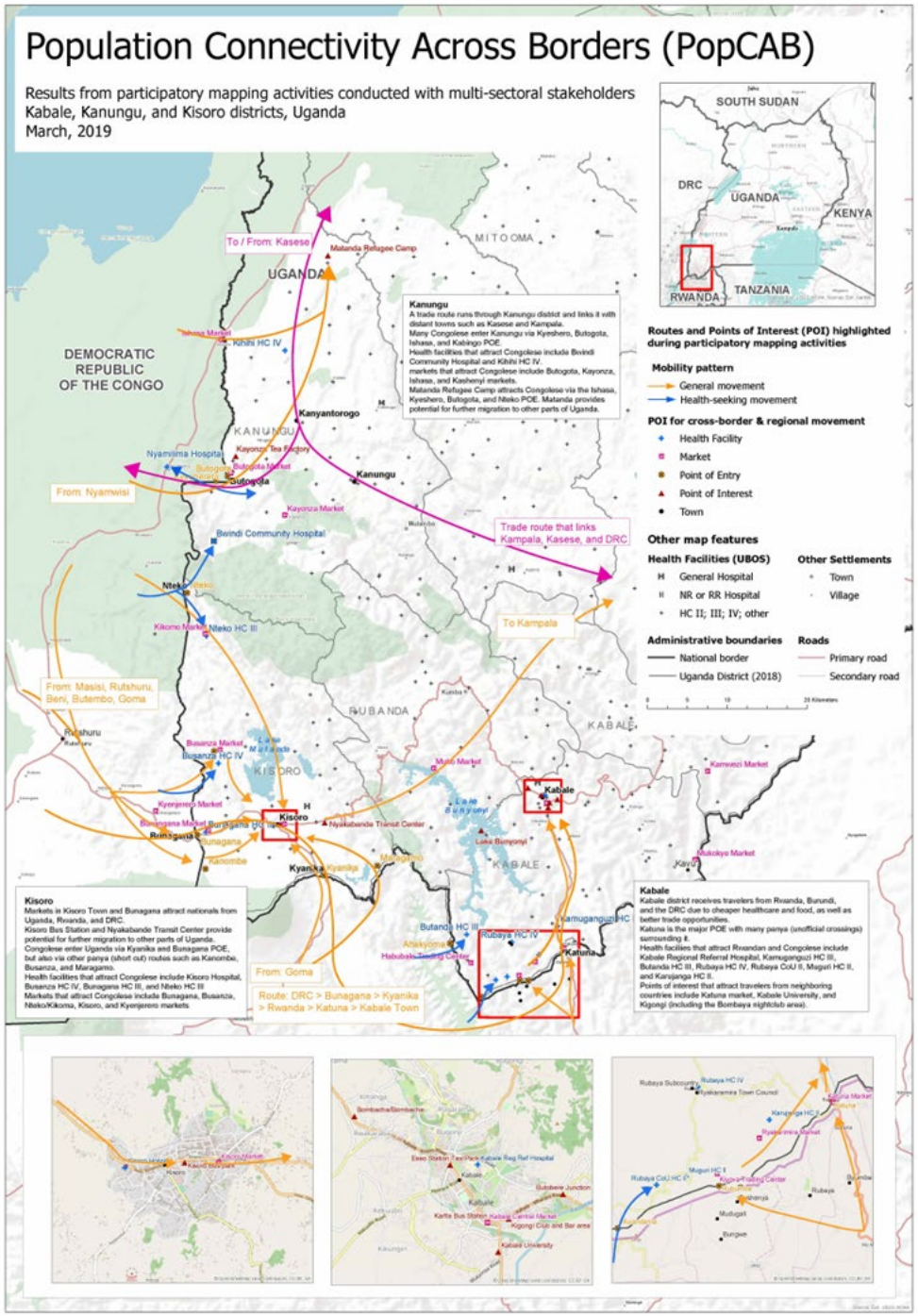
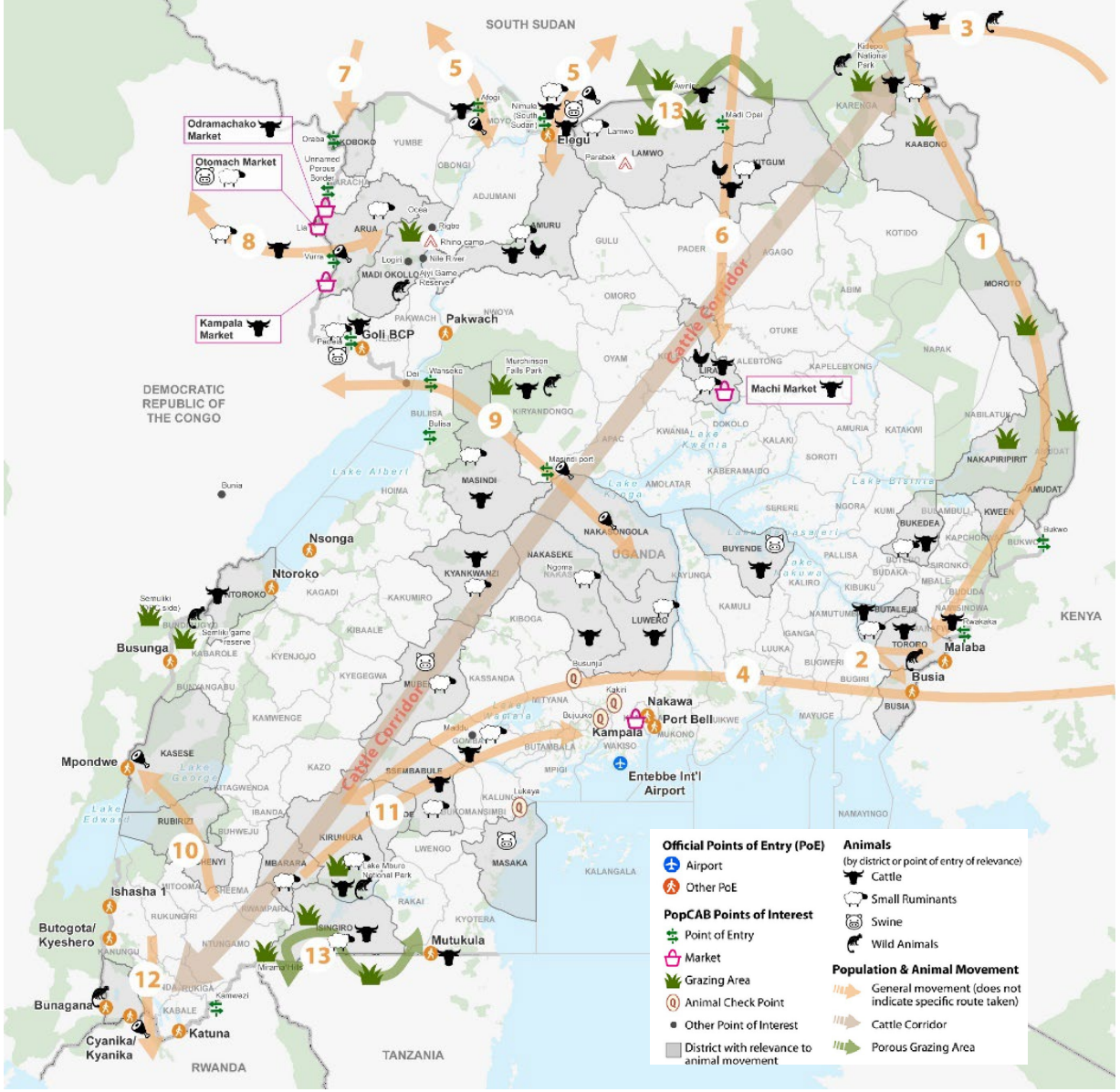
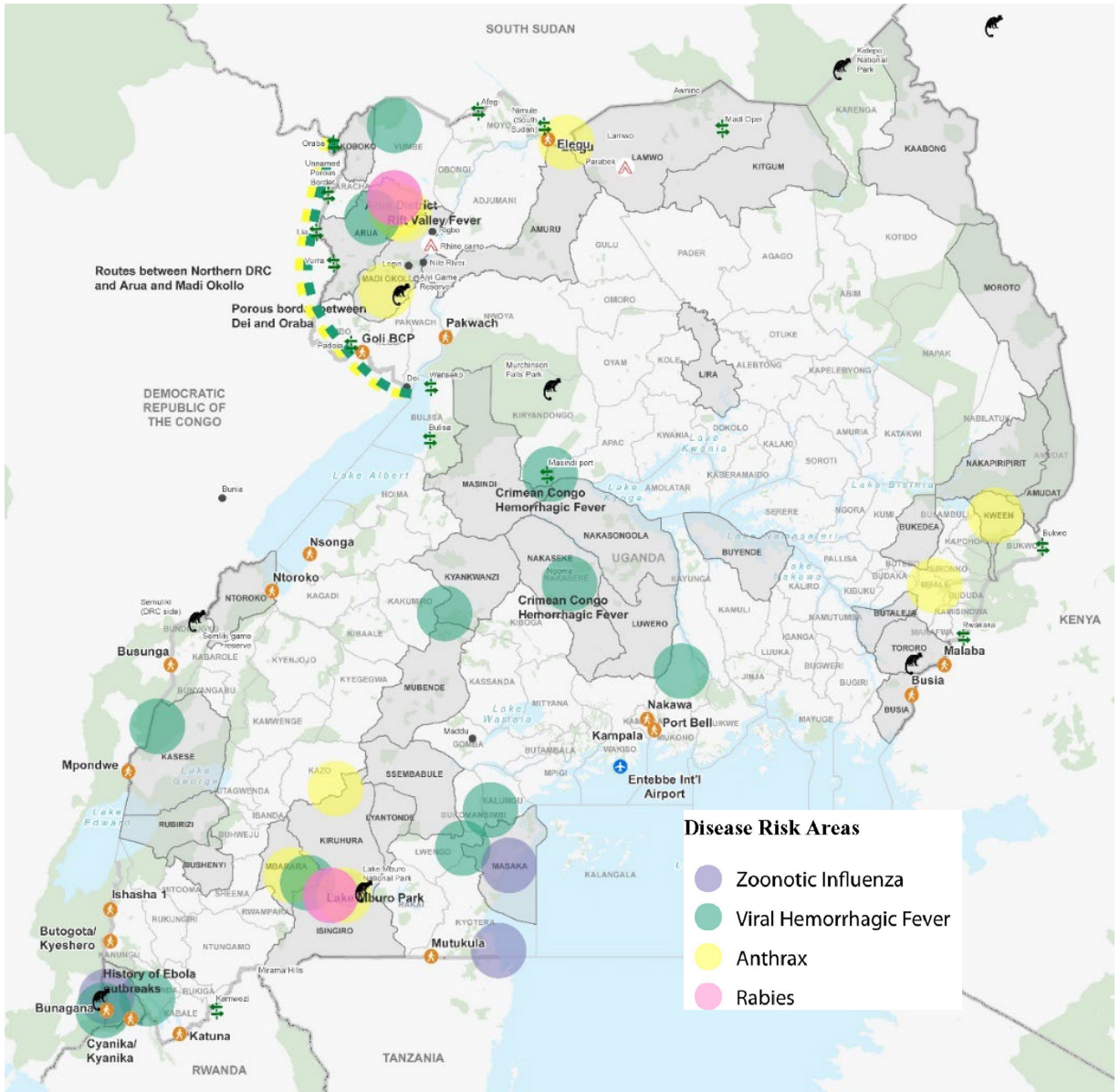
# Applying Results to Inform Interventions

- Highlighting at-risk communities within and across borders
- Prioritize markets, schools, places of worship, and trading centers that attract populations from outbreak-affected areas
- Identify major border crossing points for enhanced preparedness planning, screening, and increased surveillance
- Identify locations for increased risk communication and strengthened community surveillance
- Identifying health care facilities for strengthened Water, Sanitation, and Hygiene/Infection, Prevention, and Control (WASH/IPC) and surveillance
- Enhancing national and regional collaboration to strengthen cross-border public health information sharing and coordination


Population Connectivity Across Borders (PopCAB)
Results from participatory mapping activities conducted with multi-sectoral stakeholders
Kabale, Kanungu, and Kisoro districts, Uganda
March, 2019
SOUTH SUDAN
DRC
UGANDA
KENYA
RWANDA
TANZANIA
Routes and Points of Interest (POI) highlighted during participatory mapping activities
Mobility pattern
General movement
Health-seeking movement
POI for cross-border & regional movement
Health Facility
Market
Point of Entry
Point of Interest
Town
Other map features
Health Facilities (UBOS)
General Hospital
NR or RR Hospital
HC II; III; IV; other
Other Settlements
Town
Village
Administrative boundaries
National border
Uganda District (2018)
Roads
Primary road
Secondary road
To / From: Kasese
Matanda Refugee Camp
MITOOMA
UGANDA
DEMOCRATIC REPUBLIC OF THE CONGO
Kanungu
A trade route runs through Kanungu district and links it with distant towns such as Kasese and Kampala.
Many Congolese enter Kanungu via Kyeshero, Butogota, Ishasa, and Kabingo POE.
Health facilities that attract Congolese include Bwindi Community Hospital and Kihihi HC IV.
markets that attract Congolese include Butogota, Kayonza, Ishasa, and Kashenyi markets.
Matanda Refugee Camp attracts Congolese via the Ishasa, Kyeshero, Butogota, and Nteko POE. Matanda provides potential for further migration to other parts of Uganda.
Kihihi HC IV
Kanyantorogo
KANUNGU
Nyamwima Hospital
Kayonza Tea Factory
Butogota Market
Butogota
Kanungu
From: Nyamwisi
Kayonza Market
Bwindi Community Hospital
Trade route that links Kampala, Kasese, and DRC
Nteko
Nteko HC III
To Kampala
From: Masisi, Rutshuru, Beni, Butembo, Goma
RUBANDA
KABALE
Rutshuru
Busanza Market
Busanza HC IV
KISORO
Kyenjerero Market
Kisoro
Nyakabande Transit Center
Bunagana
Kanombe
Kyanika
Kabale
Kamwezi Market
Mutolo Market
Lake Bunyonyi
Mukokeya Market
Kisoro
Markets in Kisoro Town and Bunagana attract nationals from Uganda, Rwanda, and DRC.
Kisoro Bus Station and Nyakabande Transit Center provide potential for further migration to other parts of Uganda.
Congolese enter Uganda via Kyanika and Bunagana POE, but also via other panya (short cut) routes such as Kanombe, Busanza, and Maragamo.
Health facilities that attract Congolese include Kisoro Hospital, Busanza HC IV, Bunagana HC III, and Nteko HC III
Markets that attract Congolese include Bunagana, Busanza, Nteko/Kikoma, Kisoro, and Kyenjerero markets.
Kabale
Kabale district receives travelers from Rwanda, Burundi, and the DRC due to cheaper healthcare and food, as well as better trade opportunities.
Katuna is the major POE with many panya (unofficial crossings) surrounding it.
Health facilities that attract Rwandan and Congolese include Kabale Regional Referral Hospital, Kamuganguzi HC III, Butanda HC III, Rubaya HC IV, Rubaya CoU II, Muguri HC II, and Kanjanga HC II.
Points of interest that attract travelers from neighboring countries include Katuna market, Kabale University, and Kigongi (including the Bombaya nightclub area).
Butanda HC III
Rubaya HC IV
Kamuganguzi HC
Katuna
From: Goma
Route: DRC > Bunagana > Kyanika > Rwanda > Katuna > Kabale Town

# Understanding animal mobility to inform preparedness and response - One Health




Medley AM, Gasanani J, Nyolimati CA, et al. Preventing the cross-border spread of zoonotic diseases: Multisectoral community engagement to characterize animal mobility—Uganda, 2020. *Zoonoses Public Health*. 2021;00:1–13.

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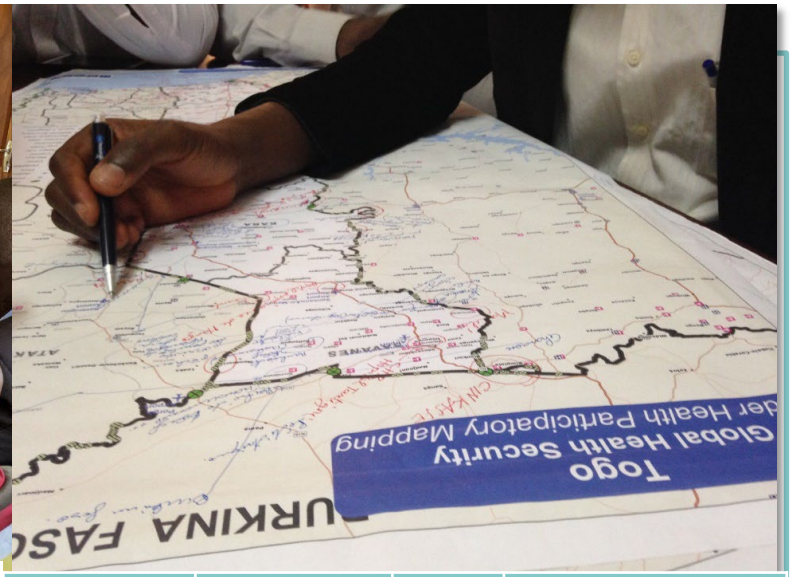
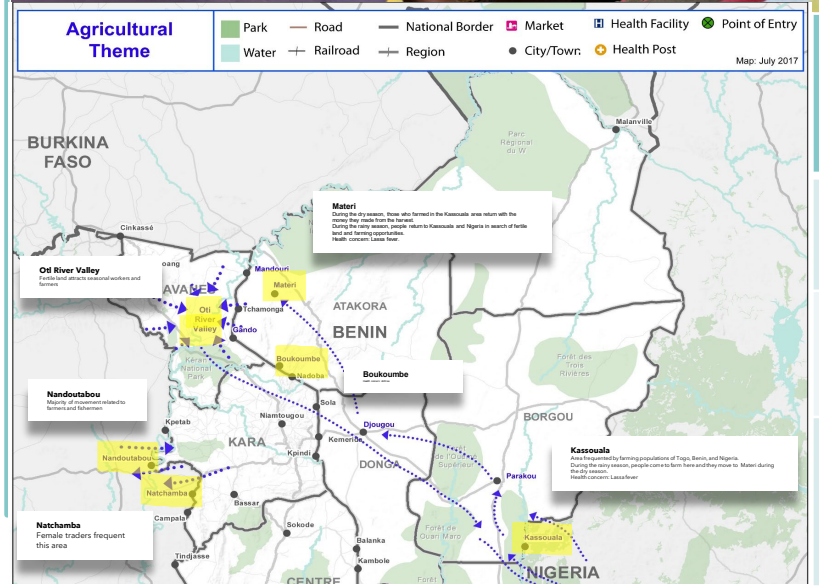
# Implementation

# Mixed-Methods Approach

3 types of data collected:

- Qualitative
- Geospatial
- Quantitative (optional)




| Origin & Destination of Route | Mode(s) of Transportation | Traveler Volume | Population Characteristics |
|---|---|---|---|
| Chihuahua to Florence | By ground, vehicle | 8,000 /yr | Young to middle-aged men seeking work |
| Casas Grandes to Saltillo | By ground, train and vehicle | 12,000/yr | Individuals and families seeking healthcare |
| Chihuahua to Nuevo Leon | By ground, vehicle and train; by air | 1200/ yr | Young men and women seeking education |

Photo source: Rebecca Merrill, CDC

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# Summary

# Enhance classic epidemiologic approaches to incorporate mobility

Integrate with classic investigation techniques to build understanding of communities that may be at risk of transmission

Strengthen national capacity to understand priority areas

Strengthen cross-border collaboration in support of IHR

Strengthen regional efforts to formalize cross-border coordination and collaboration

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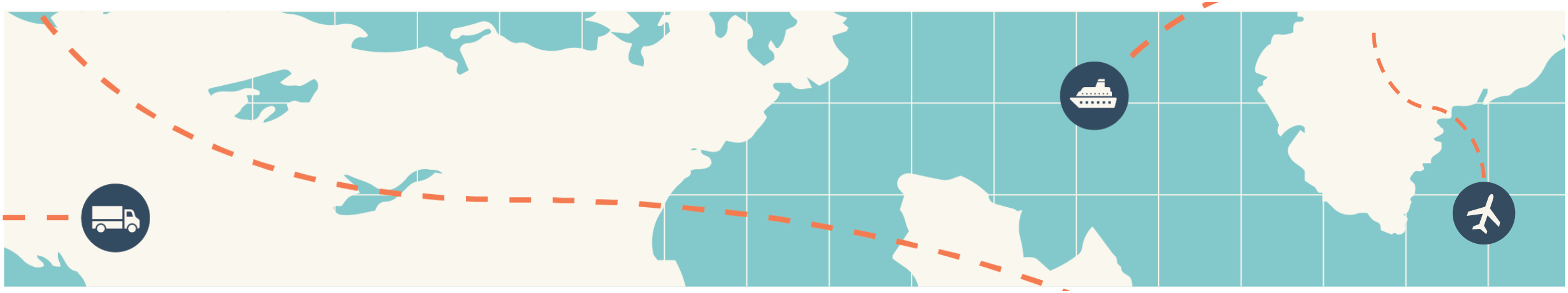
# Discussion Questions

- Are there any recent outbreaks or situations in your country/region where cross-border movement of people, animals, or materials played a role?
- What kind of questions would PopCAB be helpful to answer in your country/region?
- Who would implement PopCAB in your country/region?
- Who would be the most important stakeholders to include in a training about PopCAB?
- What kind of barriers might there be to holding a PopCAB in your country/region?

# Questions?



# Thank You

https://www.cdc.gov/immigrantrefugeehealth/popcab-toolkit.html

For more information about how to implement PopCAB, please contact gbht@cdc.gov