Characterising global risk profiles of Mpox clade Ib importation

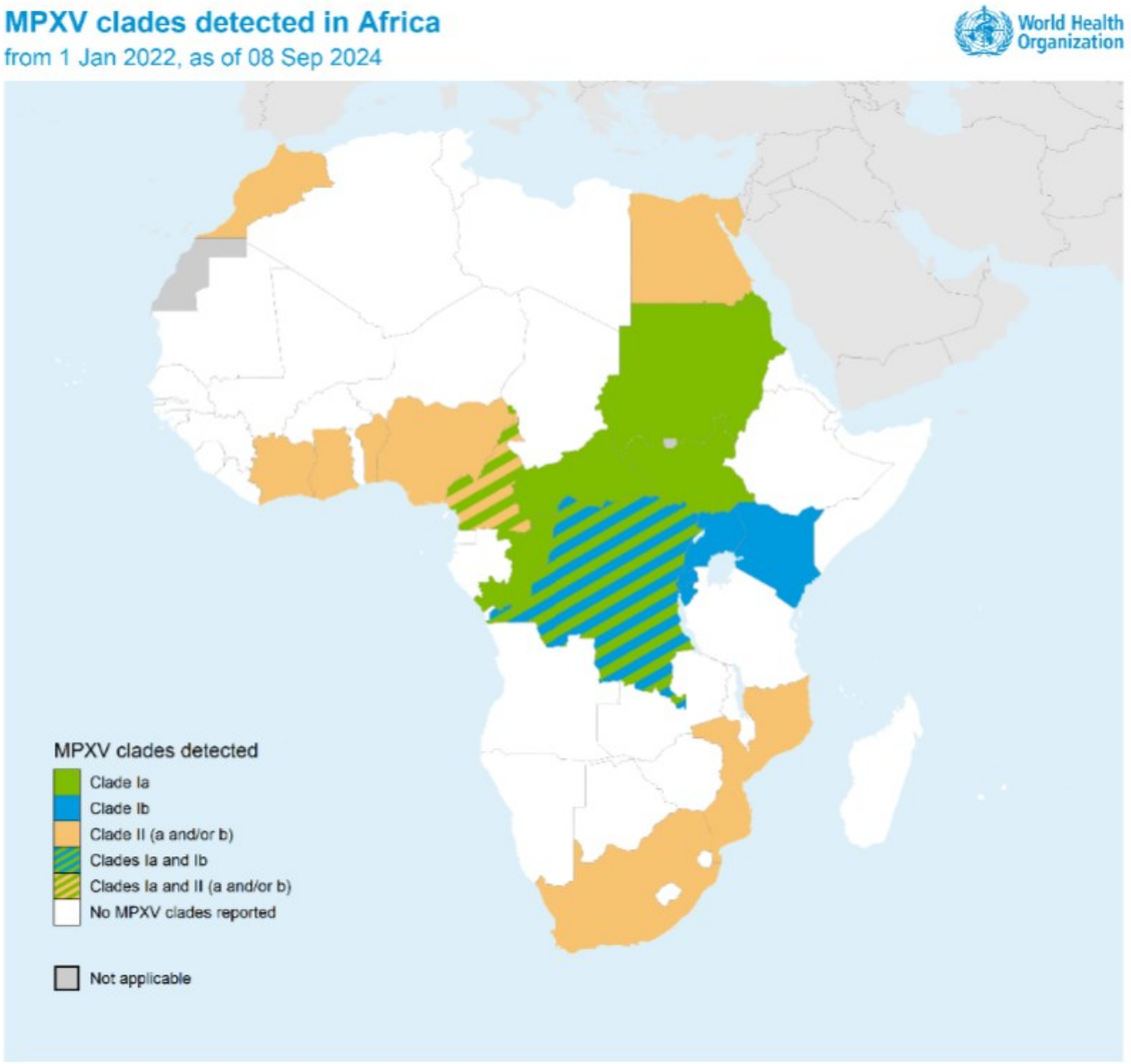
Toshiaki Asakura, Sung-mok Jung, Shuihui Jin,
Gang Hu, Akira Endo, Borame Lee Dickens

長崎大学
NAGASAKI UNIVERSITY

17 October 2024
Mpox Community Call
WHO Collaboratory

Context of our analysis – In early September

Country	Cumulative confirmed cases Jan-Aug 2024
DRC	4799
- South Kivu	1370
Burundi	328
Uganda	10
Rwanda	4
Kenya	2
Sweden	1
Thailand	1



Travel history – among African countries

Country	Cumulative confirmed cases Jan-Aug 2024
DRC	4799
- South Kivu	1370
Burundi	328
Uganda	10
Rwanda	4
Kenya	2
Sweden	1
Thailand	1

5 did not have travel history to Mpox affected countries

All four cases had travel history to DRC/Burundi

Patient 1: Travel history
from Kampala, Uganda, to Mombasa, Kenya
at the time of identification,
the patient was travelling to Rwanda through Tanzania.

Patient 2: Long-distance truck driver to DRC

Complicated travel history – outside Africa

As of September,

No	Country	Confirmation date	Age, sex, nationality	Travel history
1	Sweden	2024-08-15	Aged between 30-40 years	Travelled to Sweden from an outbreak-affected country in the African region. The travel itinerary included more than one transit and some longer stopovers.
2	Thailand	2024-08-22	66-year-old European man	Arrived in Bangkok from unnamed African country on 14 August.
3	India	2024-09-23	38-year-old man	Landed in Kerala, India from the UAE

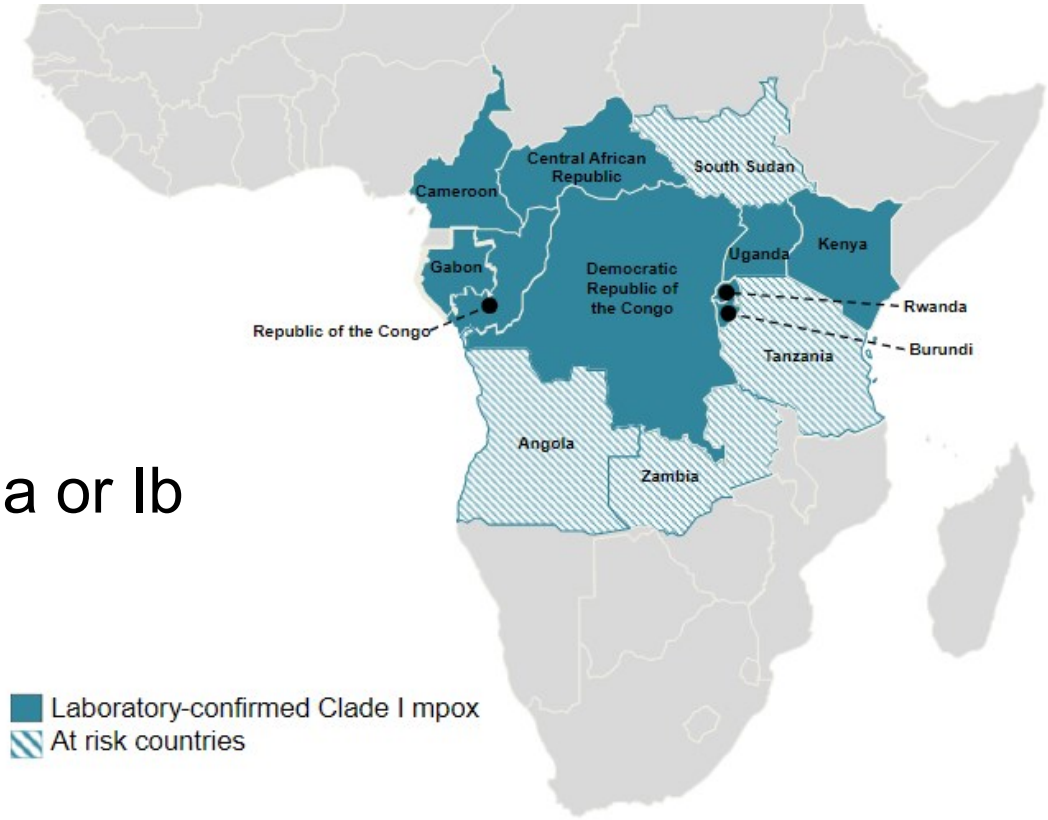
We expect more importations in the future,
-> Characterise global risk profiles and compare that risk with the observations

Study setting

Study setting

- Clade Ib of MPXV was assumed to be exported from
  - DRC (main analysis)
  - DRC or Burundi
  - DRC, Burundi, Uganda, Rwanda, Kenya

- and imported
  - through flight routes
  - to countries except ones reporting clade Ia or Ib

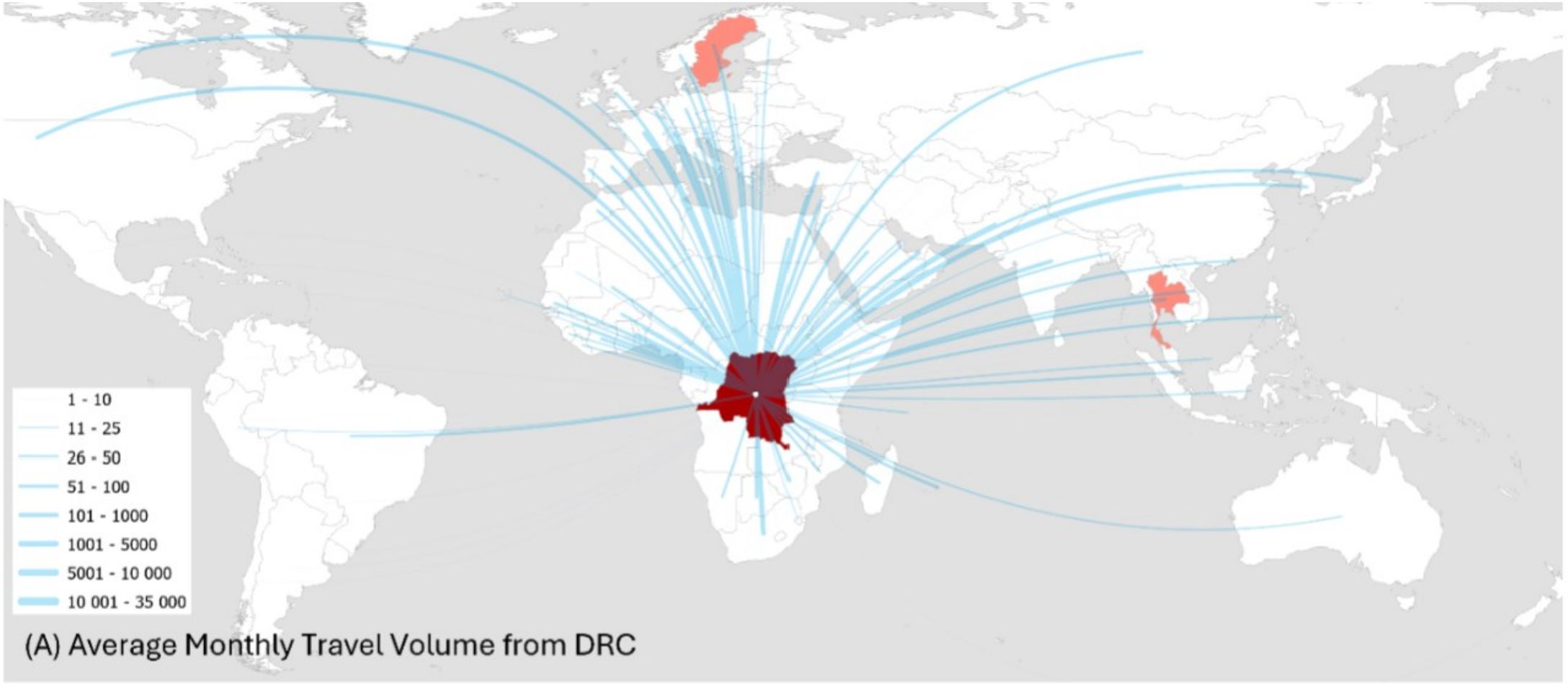


Operational mpox HCID (Clade I) case definition,
https://www.gov.uk/guidance/operational-mpox-monkeypox-hcid-case-definition

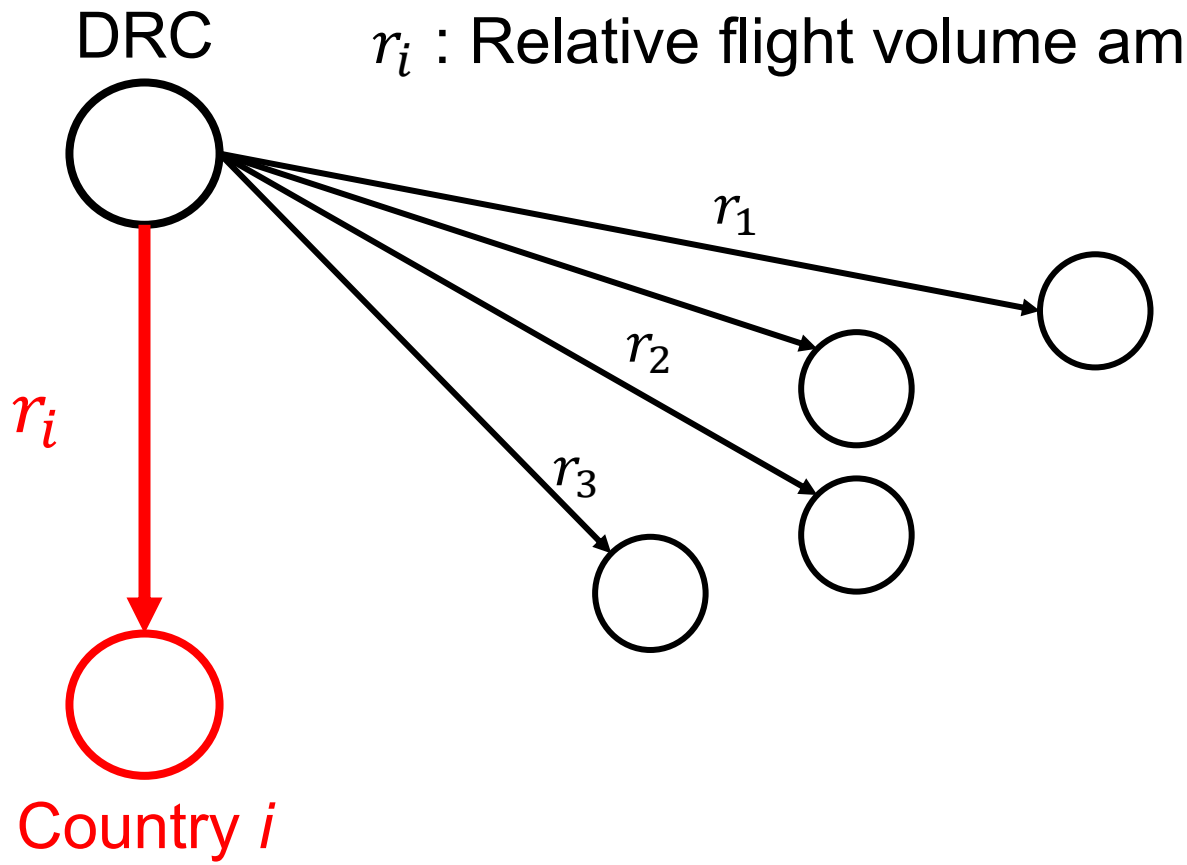
Data

IATA flight volume data averaged over May 2023 to June 2024

Note: No use of incidence data



Method

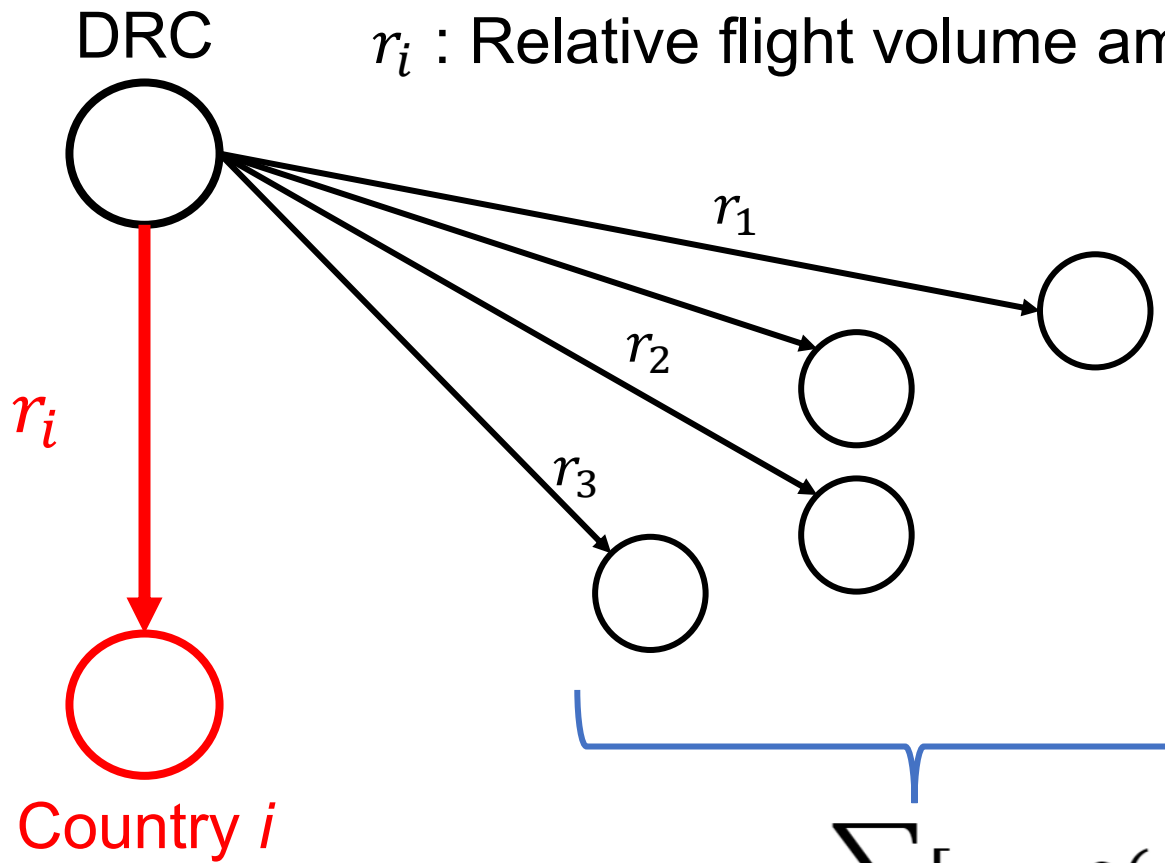


r_i : Relative flight volume among the countries at risk of importation

$$D_i \sim \mathrm{Geom}(r_i)$$

Number of imported cases globally before country *i* observed an importation.

Method

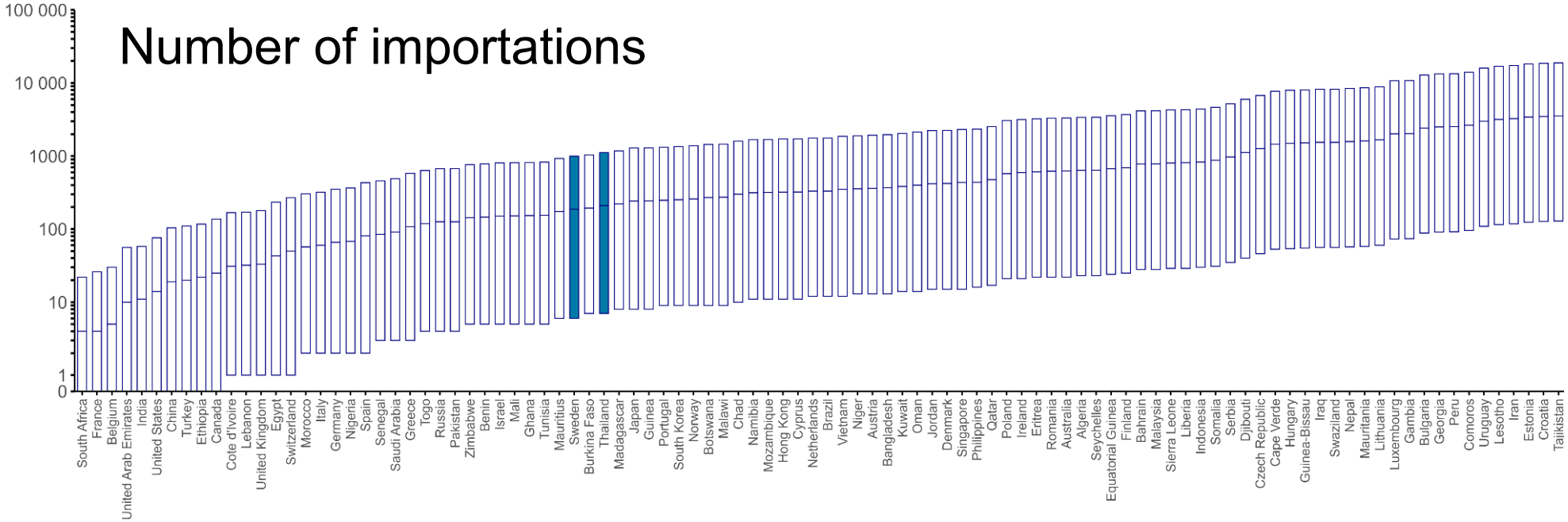


r_i : Relative flight volume among the countries at risk of importation

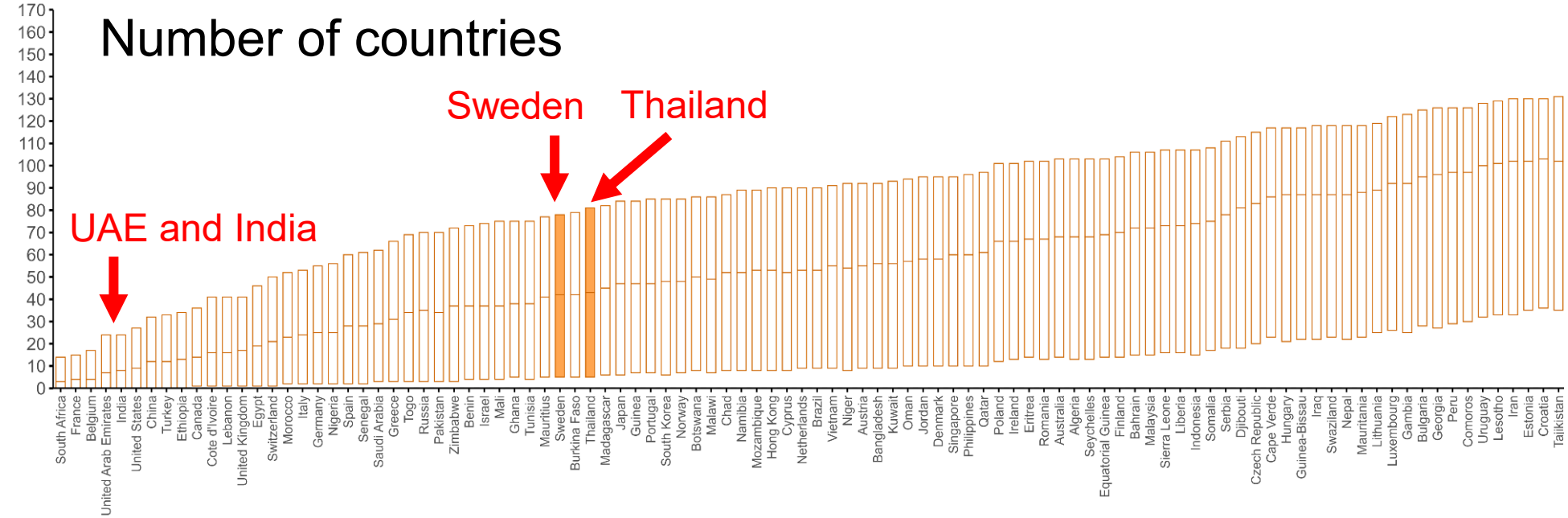
$$D_i \sim \text{Geom}(r_i)$$

$$N_i = \sum_{j \neq i} [1 - \delta(d_j)], \quad \mathbf{d}_{-i} \sim \text{Multinom}(D_i, \mathbf{r}_{-i}),$$

Number of countries with nonzero importations before country *i* observed an importation.



(B) Simulated total number of importations before a specific country observed one importation



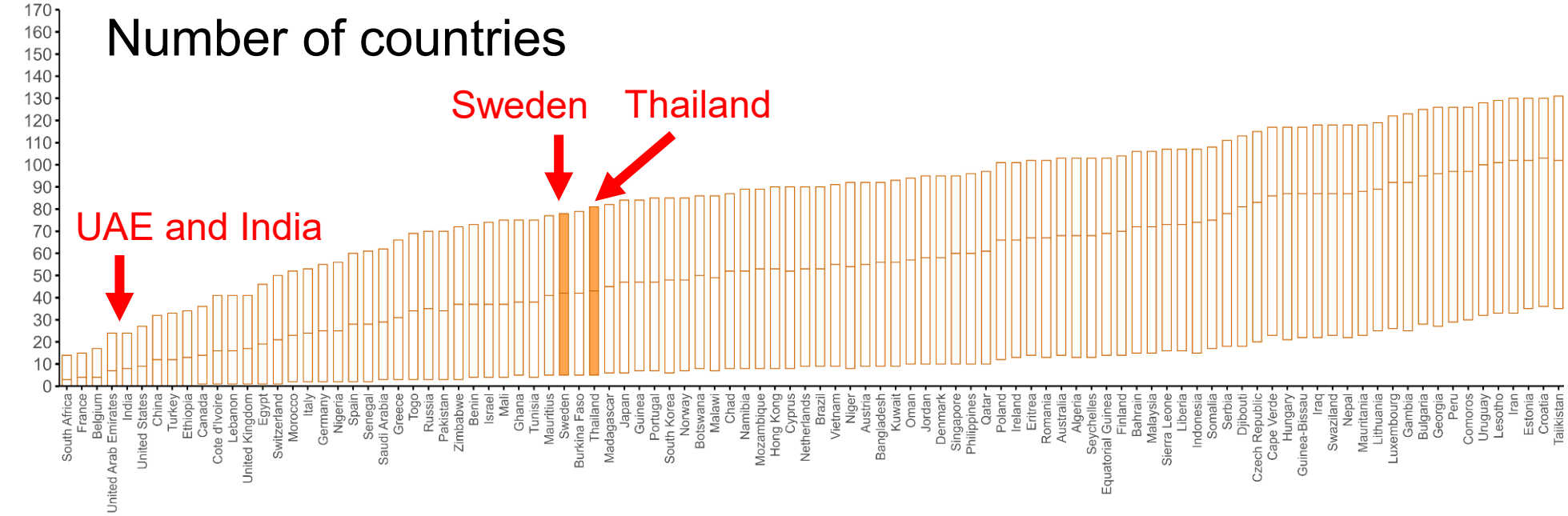
(C) Simulated number of countries with importations before a specific country observed one importation

Sweden – 36th [95% range: 3-74th] country to import clade Ib

Thailand – 47th [95% range: 6-88th] country to import clade Ib

-> Statistically, those two were not among countries most likely

to report 1st and 2nd importations (same conclusions from the sens. ana.)



(C) Simulated number of countries with importations before a specific country observed one importation

Interpretation and conclusion

Explanation for early Sweden and Thailand importations would be

- Potential underreporting in high-risk countries.
  - First few importations in countries with the largest travel volume may have been missed? e.g. South Africa, France, Belgium, etc…
  - Deletion of target domain affected PCR test accuracy for clade differentiation.
- Model limitations
  - Complicated travel histories might not be captured by flight data.

Conclusion

- Highlighted the need to ramp up surveillance capacity for early detection.
- Our results showed the likely phase at which a country may experience importations (e.g. India and UAE are likely to report importations early from our results)

Thank you

LONDON SCHOOL of HYGIENE &TROPICAL MEDICINE

長崎大学 NAGASAKI UNIVERSITY

cmmid centre for mathematical modelling of infectious diseases

UNC CAROLINA POPULATION CENTER

NUS National University of Singapore