Rethinking Cholera Risk:
What Serology Reveals Beyond Case Data

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WHO-EPI-WIN Webinar
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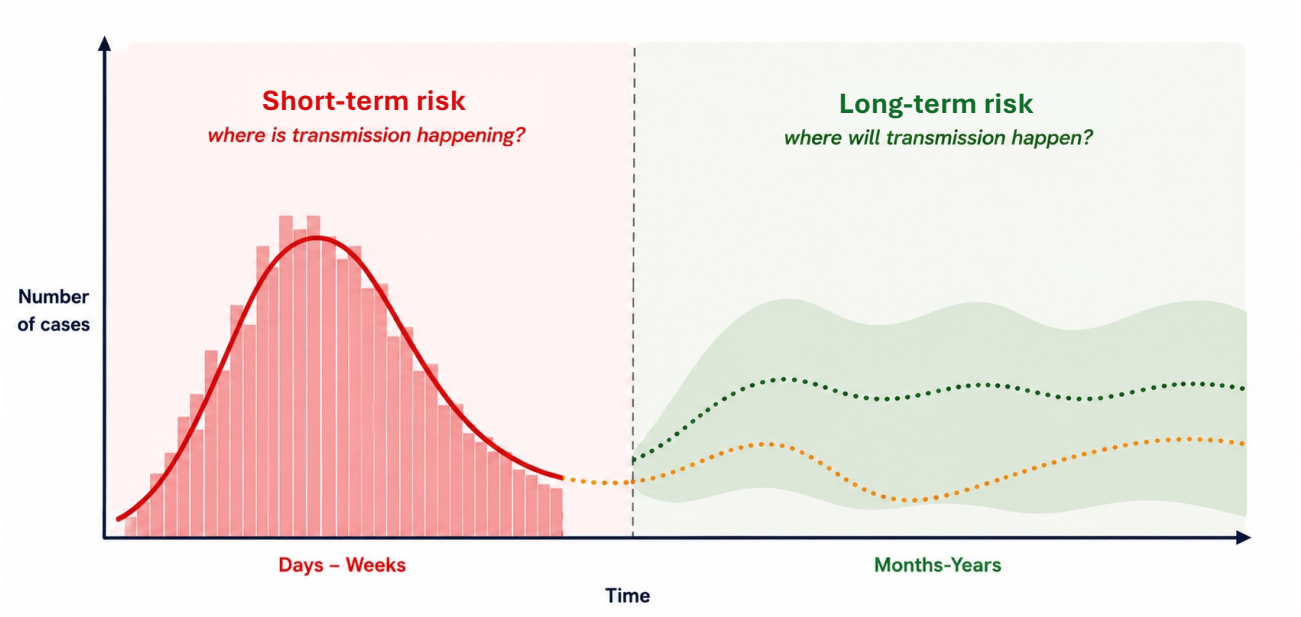
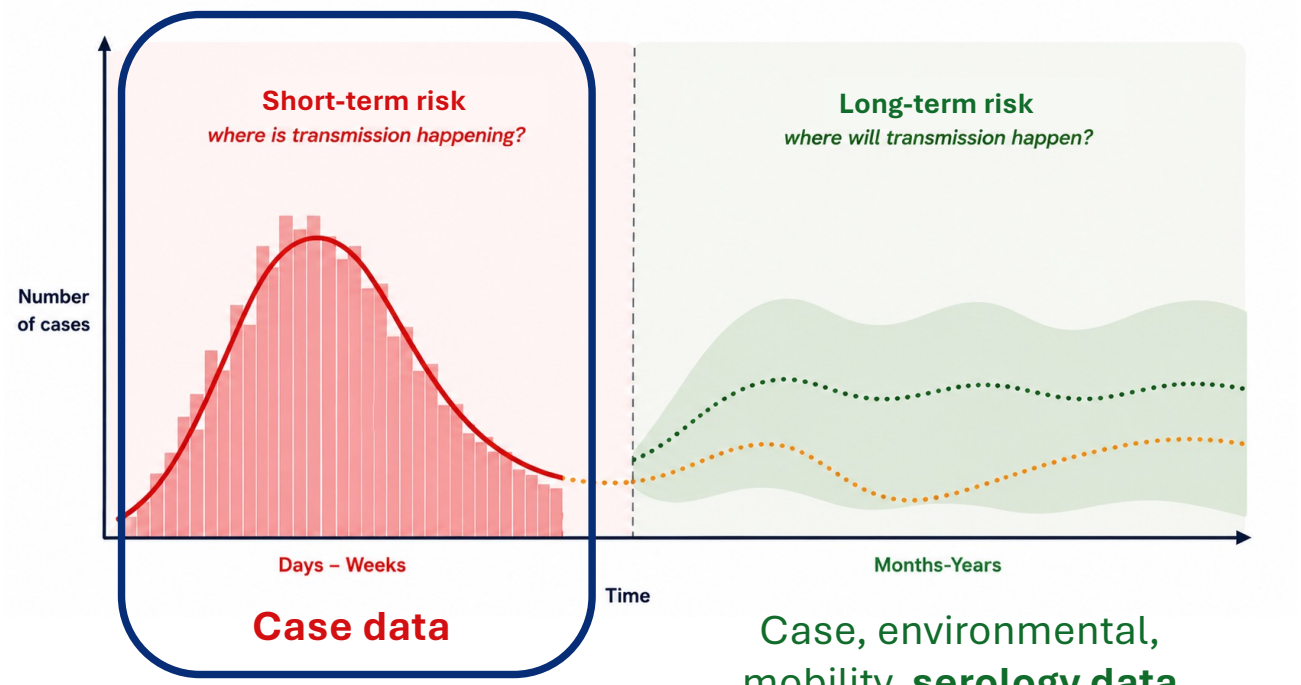
Identifying *risk* means different things



Case/outbreak detection, RDT confirmation, **reactive** response

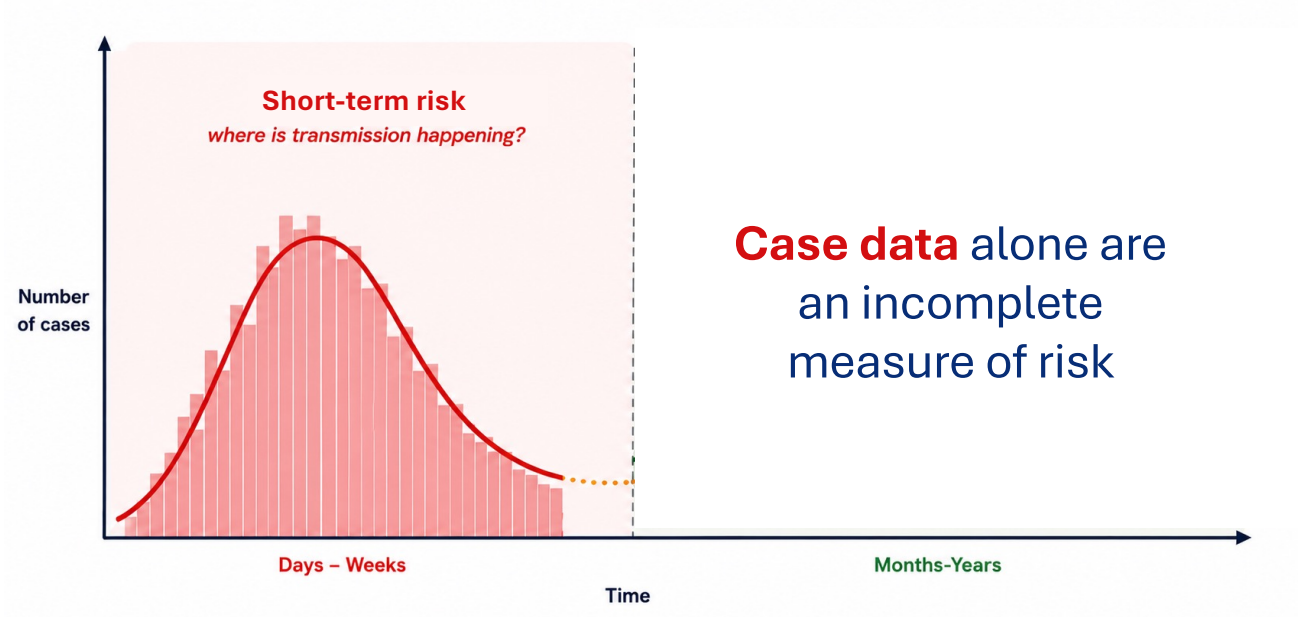
Immunity landscapes (susceptibility), exposure, transmission dynamics, **prevention** strategies

Different data, different decisions



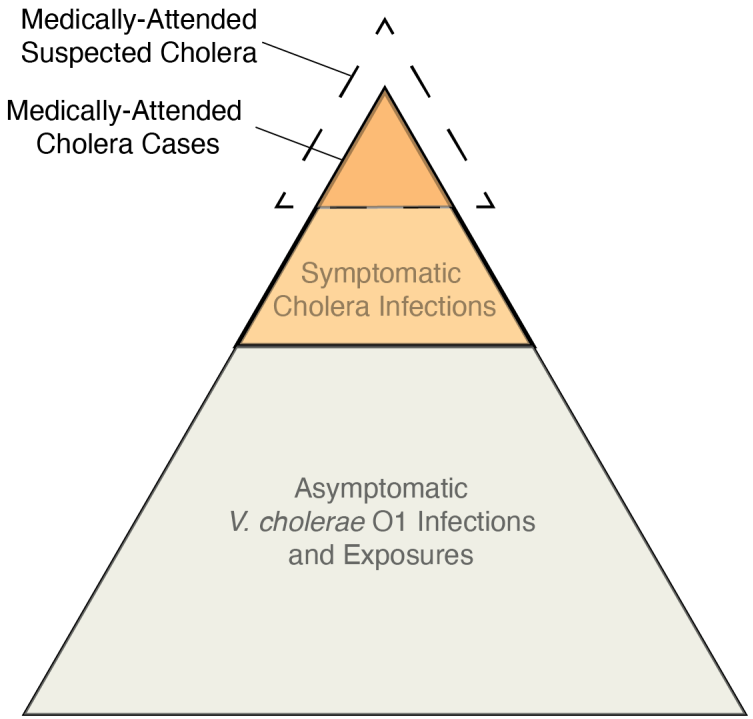
Case, environmental, mobility, **serology data**

Different data, different decisions



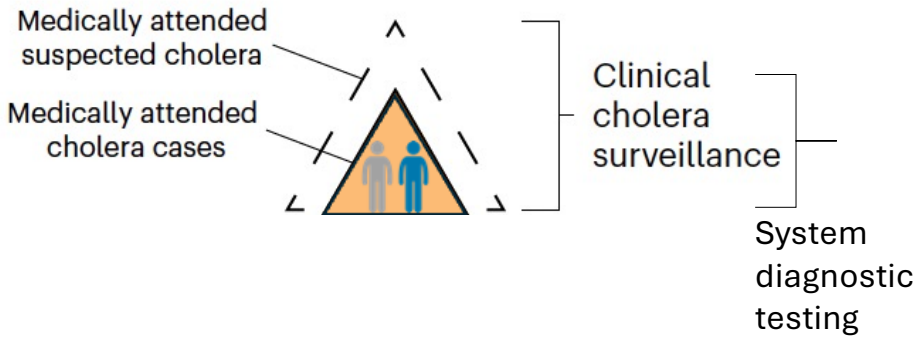
Case data alone are an incomplete measure of risk

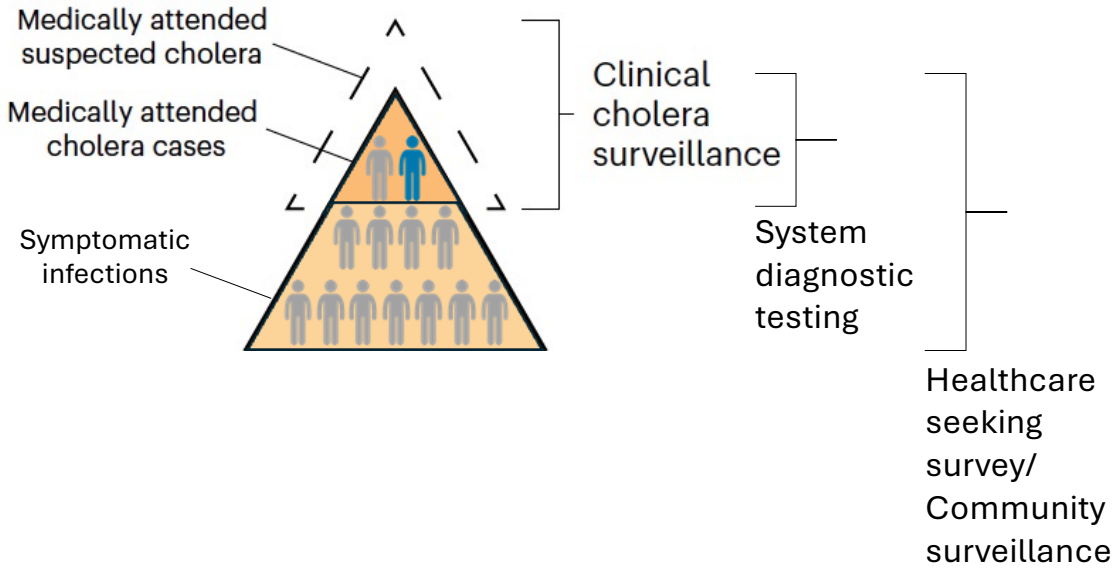
Clinical surveillance underestimates true cholera exposure

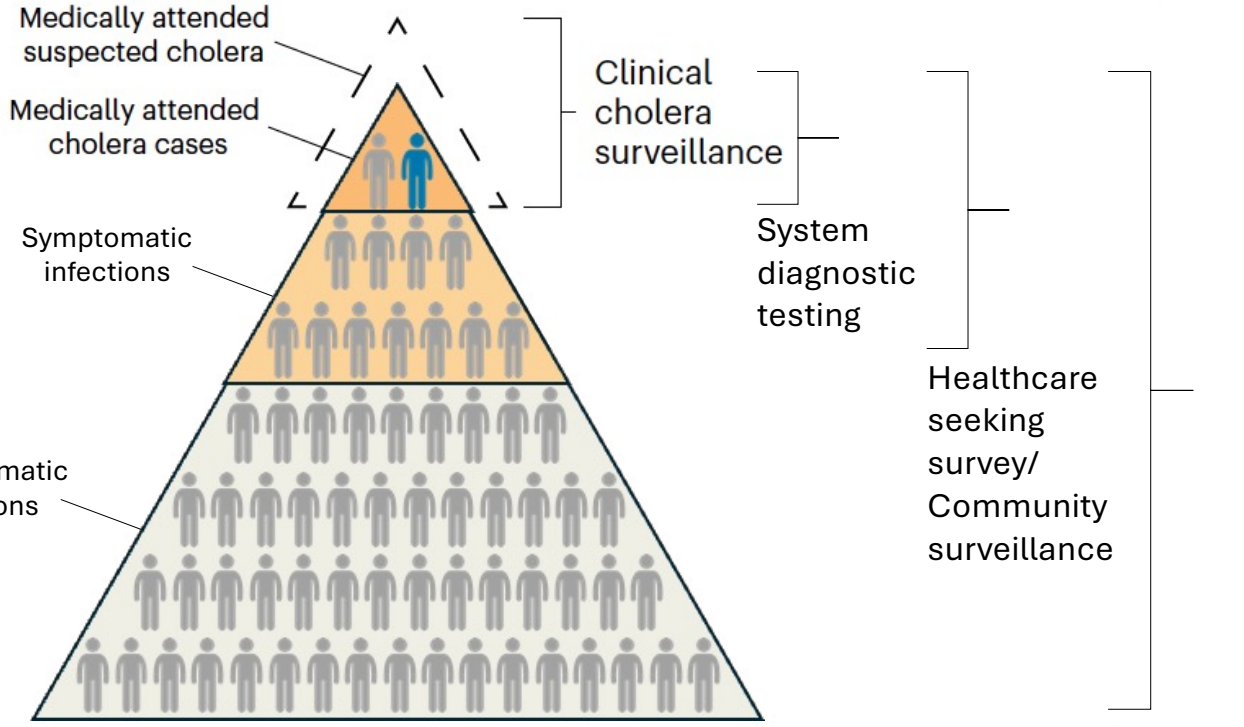


Hegde S et al, 2024, *Nature Medicine*

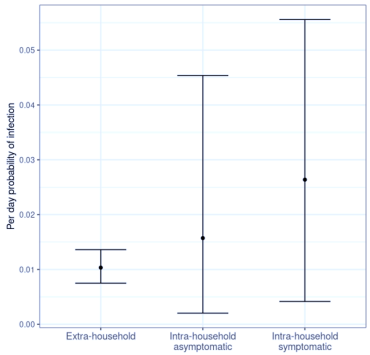
Case data accounts for an *unknown* **fraction of cases** and **infections**


Medically attended suspected cholera
Medically attended cholera cases
Clinical cholera surveillance
System diagnostic testing


Medically attended suspected cholera
Medically attended cholera cases
Symptomatic infections
Clinical cholera surveillance
System diagnostic testing
Healthcare seeking survey/ Community surveillance



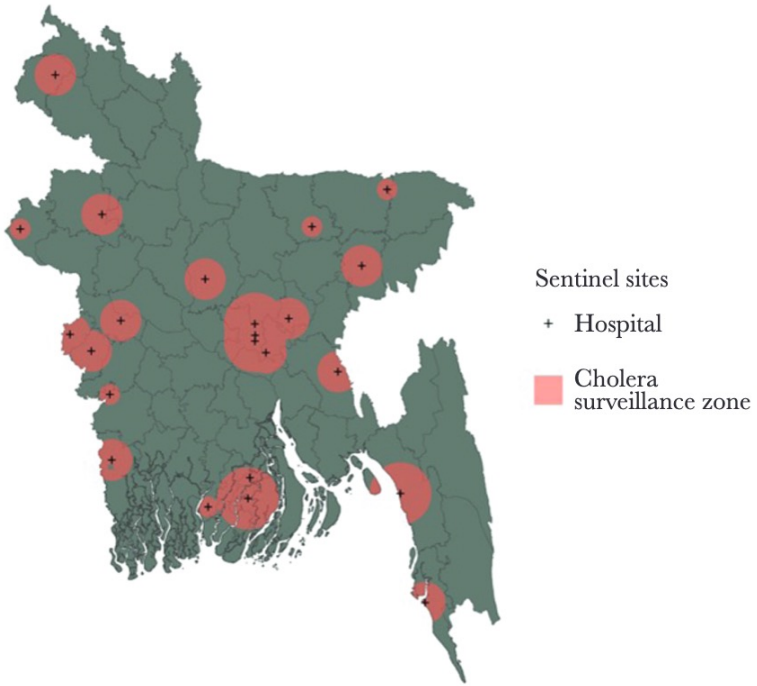
Hegde S et al, 2024, *Nature Medicine*



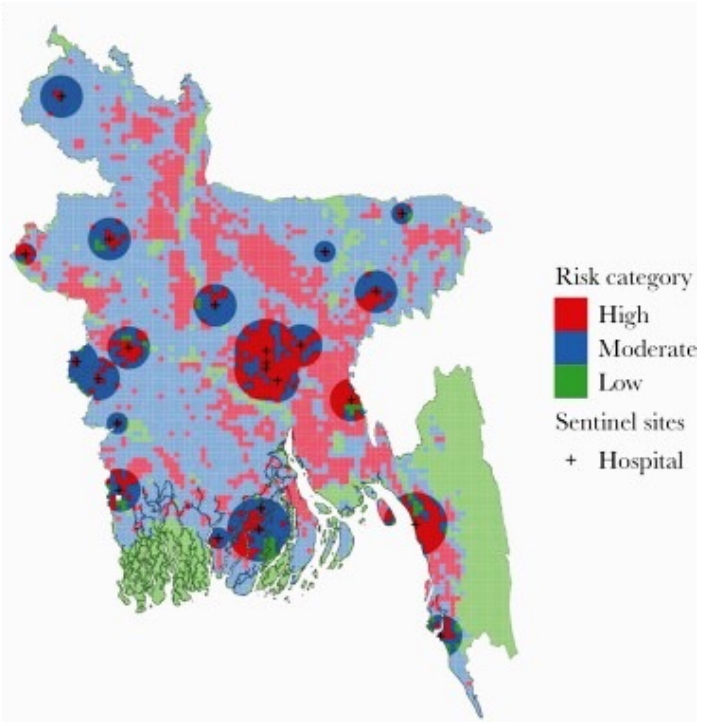
C Smith et al. *JID* 2026

Low reported cases ≠ low risk; serology reveals hidden burden

Clinical data misrepresents spatial dynamics of cholera

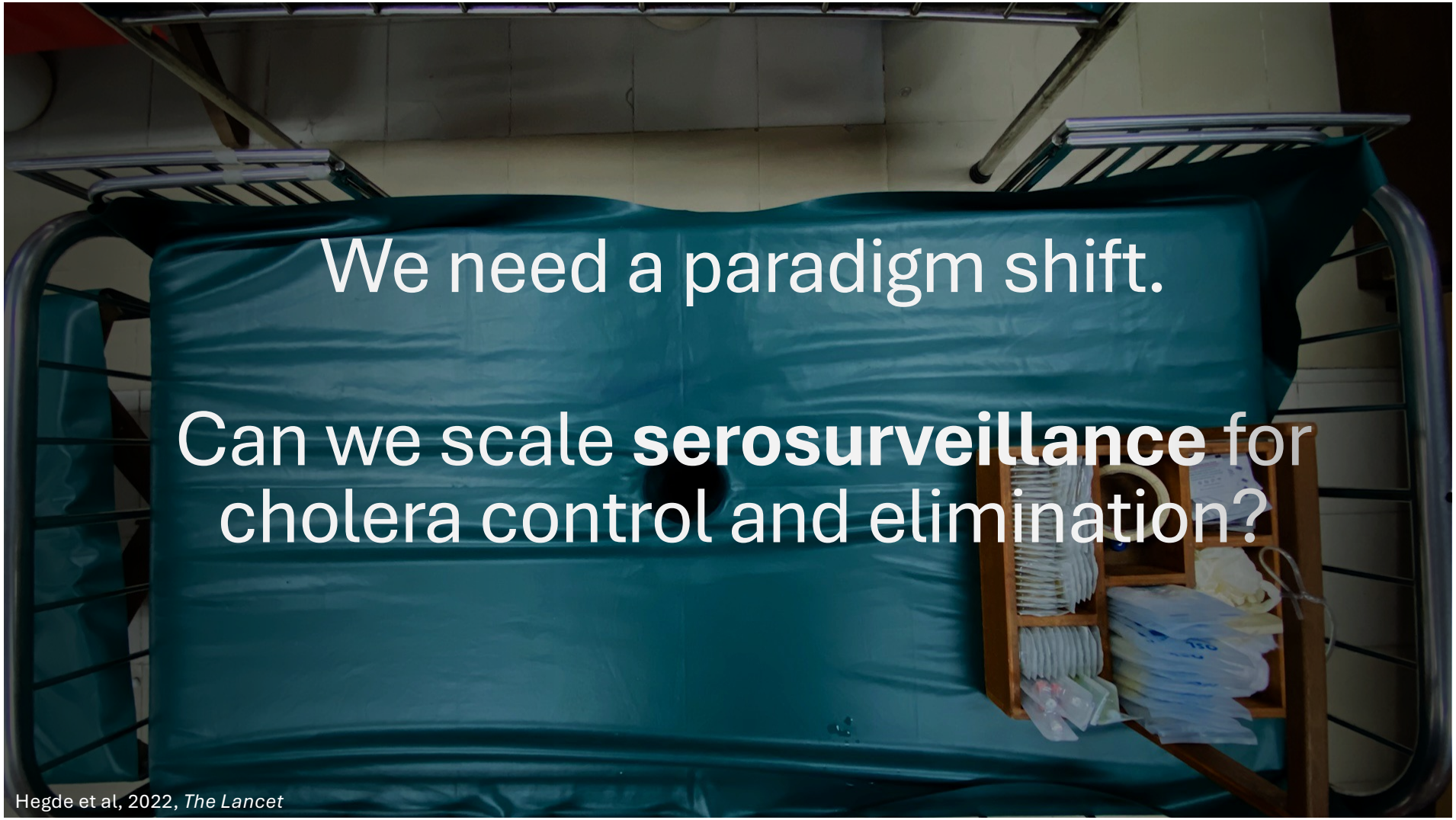


Clinical surveillance catchment



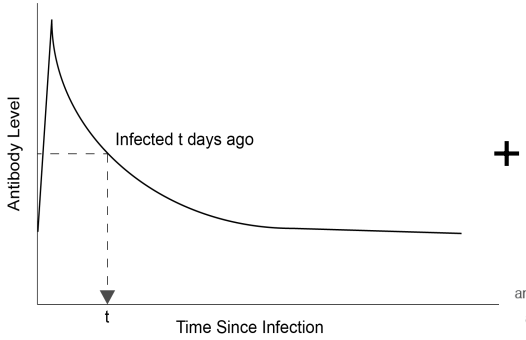
Underlying *V. cholerae* infections

Hegde et al, 2021, *JID*

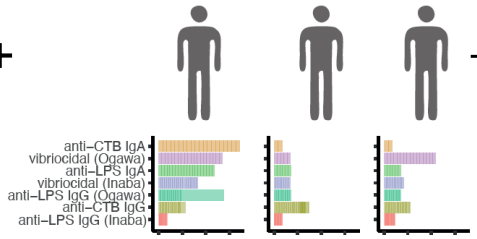


Hegde et al, 2022, *The Lancet*

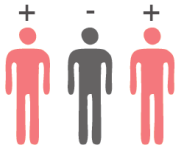
Machine learning tools can estimate cross-sectional seroincidence



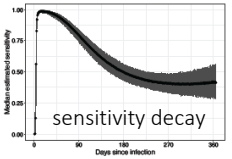
Antibody kinetic data



Antigen-specific antibody titer values



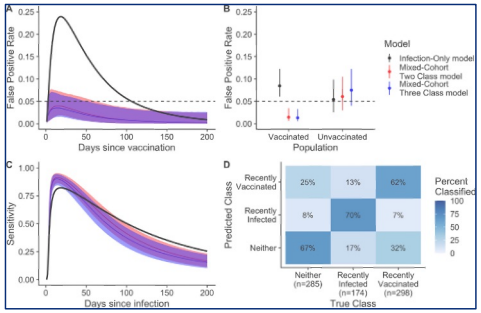
Random forest identifies recently infected



Correction for sensitivity

Seroincidence

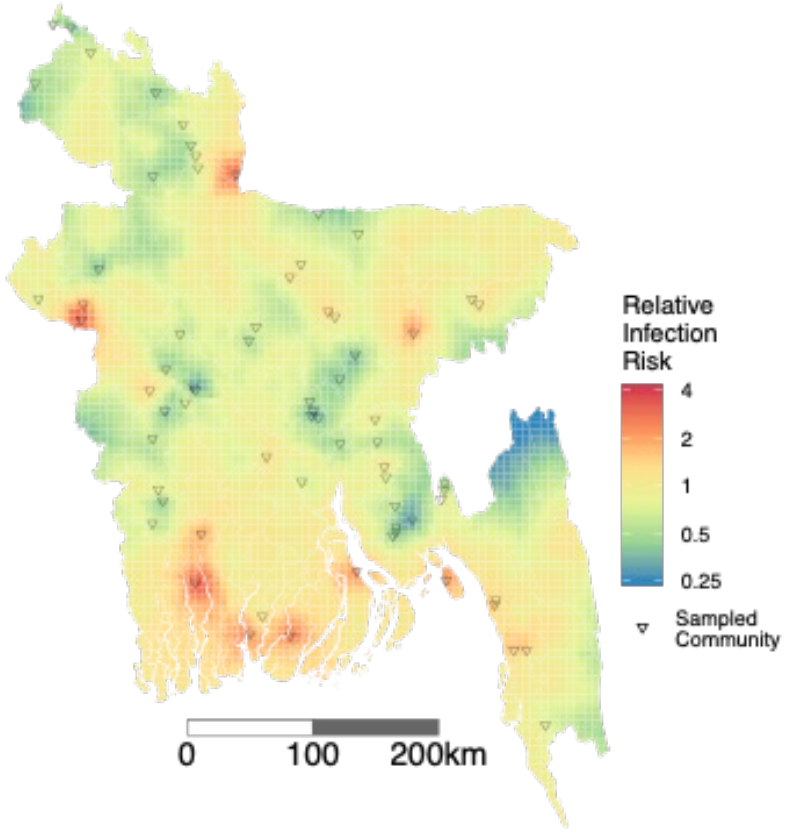
Challenges with vaccination, generalizability, and repeated exposure



Jones et al, *2025, Mbio*

Azman et al, 2019, *Sci Trans Med*
Hegde et al, *in prep*

Serology can map infection risk and immunity gaps



Allows for reconstruction of exposure timelines, identification of susceptibility pockets, and proactive resource allocation

Azman, Lauer et al, 2021, *Lancet Microbe*

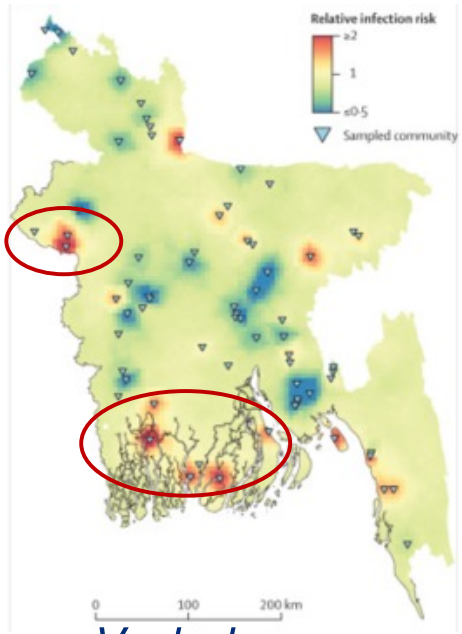
Is multipathogen serosurveillance a scalable solution?

- Multiplex Bead Assays (MBAs) measure antibodies to multiple pathogens simultaneously
- Already deployed in:
    - DHS-linked surveys
    - NTD programs (U.S. Carter Center trachoma elimination)
    - Integrated serosurveillance platforms (15 countries via Gates/Wellcome)

Is multipathogen serosurveillance a scalable solution?

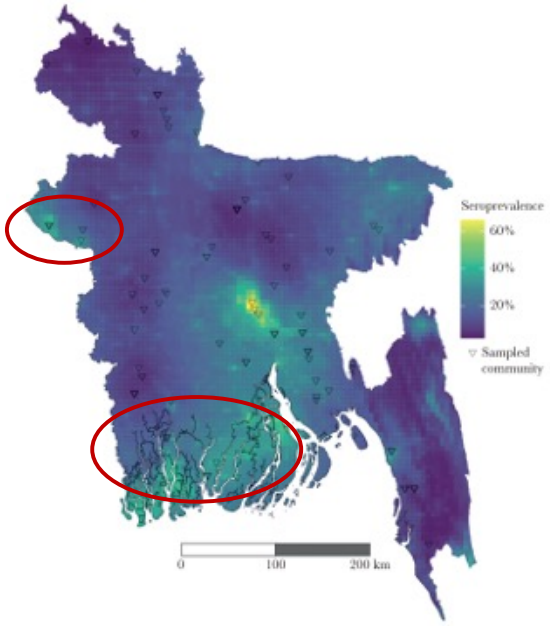
- Cost-efficient (single serum sample; low marginal cost per pathogen)
- Leverages existing survey infrastructure to embed *V. cholerae* antigens
- Enables integrated surveillance across diseases
- Allows repeated, standardized measurement without standalone cholera surveys
- Enables measurement of immunity gaps and intervention impact alongside other diseases

Leveraging data across pathogens to identify high-risk populations & inform resource allocation



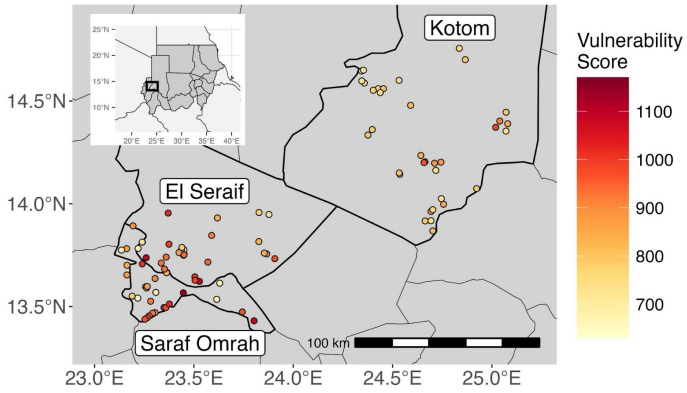
V. cholerae

Azman, Lauer et al, 2021, *Lancet Microbe*



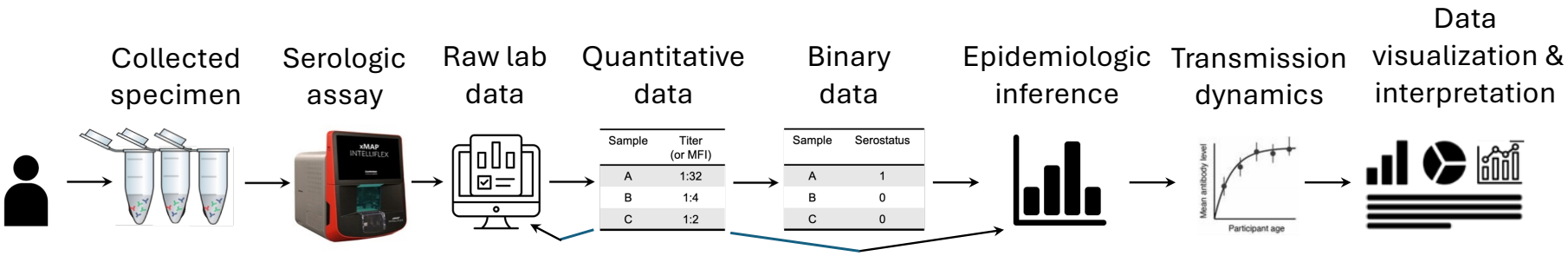
Hepatitis E

Azman et al, 2021, *JID*



Lapidus, Berube et al, 2026 *in prep*

Developing the seroanalytic pipeline with usable tools



Seroanalytics Hub

https://github.com/HopkinsIDD/seroanalytics_workshop

Creation of a secretariat and global serosurveillance network

Takeaways

1. Case data tells us where cholera was detected for reactive responses in the short-term, but provides a skewed representation of true disease transmission.
2. Integrated models should include serology, which reveals who remains susceptible (high future risk) and can guide proactive control in the long-term.
3. Multiplex platforms can enable scalable cholera surveillance though questions remain (e.g. spatiotemporal resolution of serosurveys, level of uncertainty acceptable for action, and model improvement).
4. Integrated serosurveillance platforms can map multi-disease immunity landscapes simultaneously helping to maximize field logistics, build a unified dashboard, and lower the per-pathogen cost of surveillance and possibly interventions.