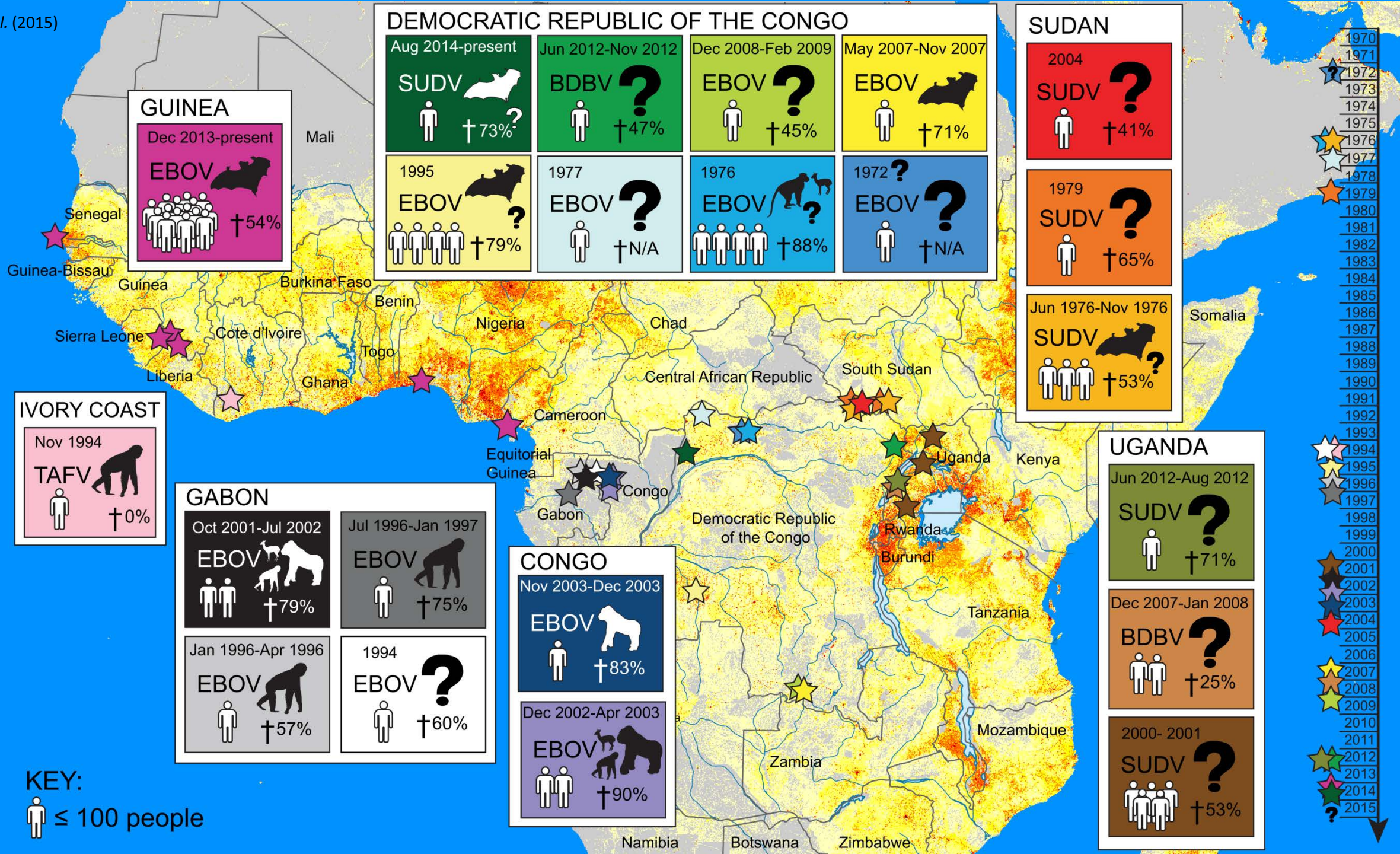


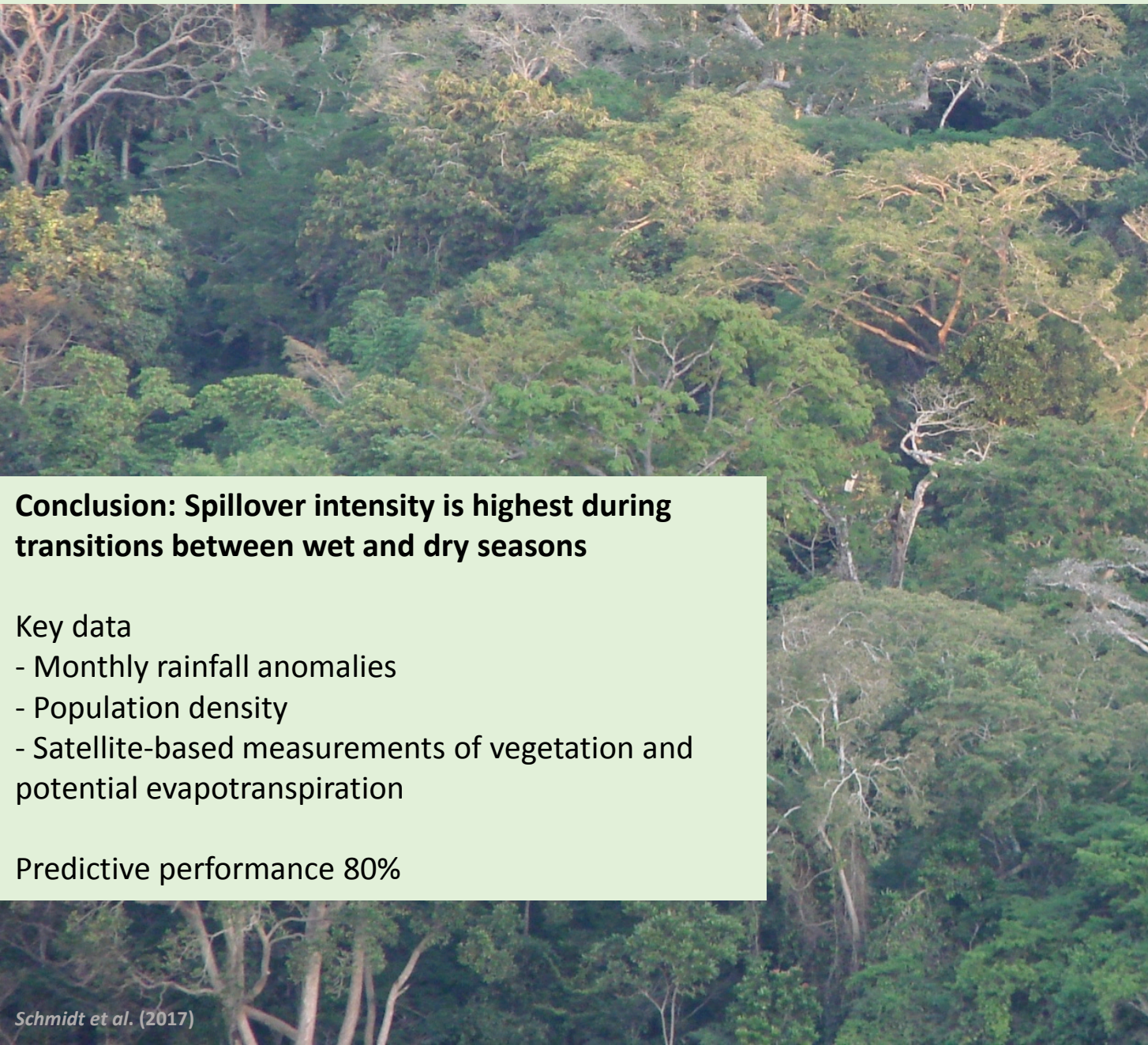
Mining Ecosystem Data for Prediction of Infectious Disease Outbreaks: The State of our Science

Dr. John Drake

October 24, 2017



Ecological models predict pathogen spillover



Conclusion: Spillover intensity is highest during transitions between wet and dry seasons

Key data

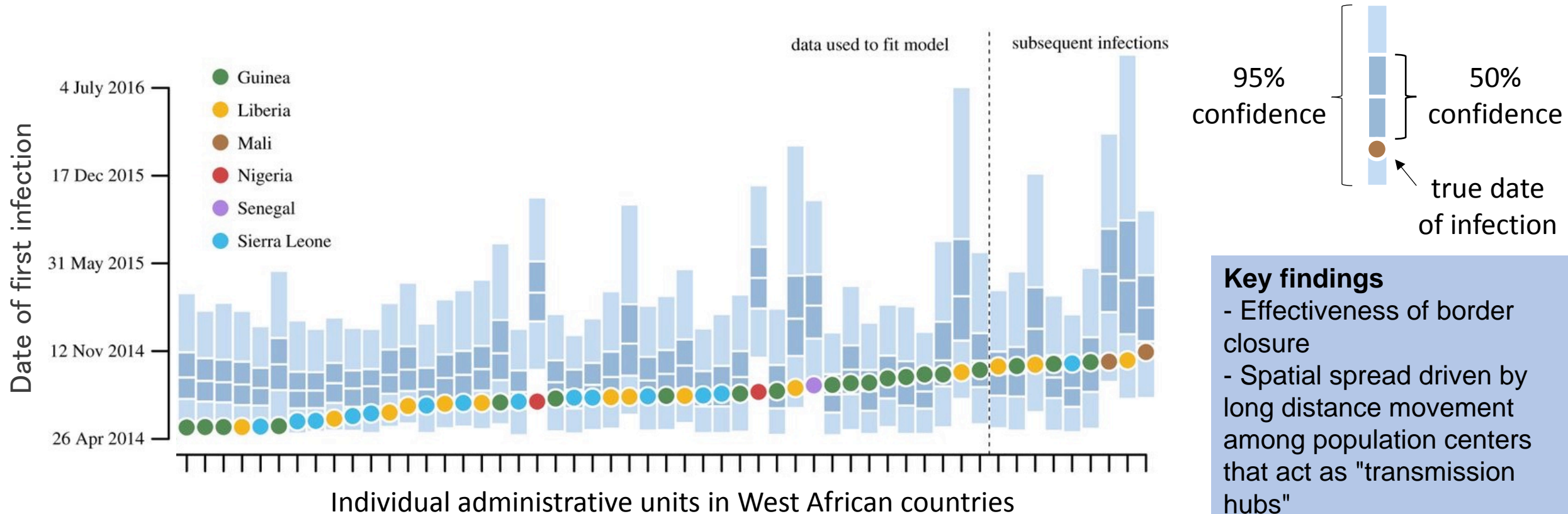
- Monthly rainfall anomalies
- Population density
- Satellite-based measurements of vegetation and potential evapotranspiration

Predictive performance 80%

Ebola spillover risk model



Metapopulation models for epidemic forecasting



Models can be updated in real time to complement health care interventions

Key findings

- Effectiveness of border closure
- Spatial spread driven by long distance movement among population centers that act as "transmission hubs"
- Natural "firebreaks"

Model validation

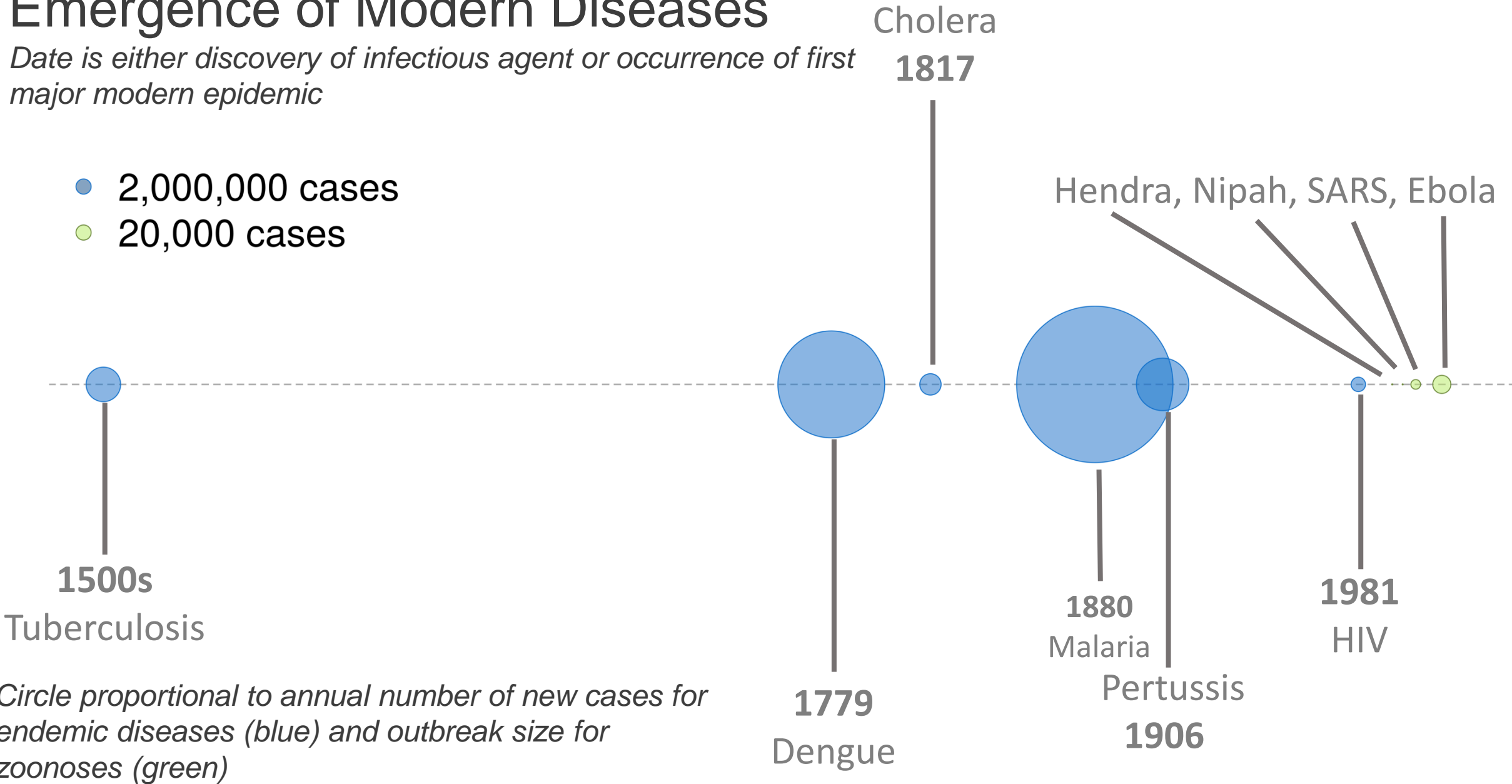
- Predicts out-of-sample data
- Well calibrated 95% prediction intervals



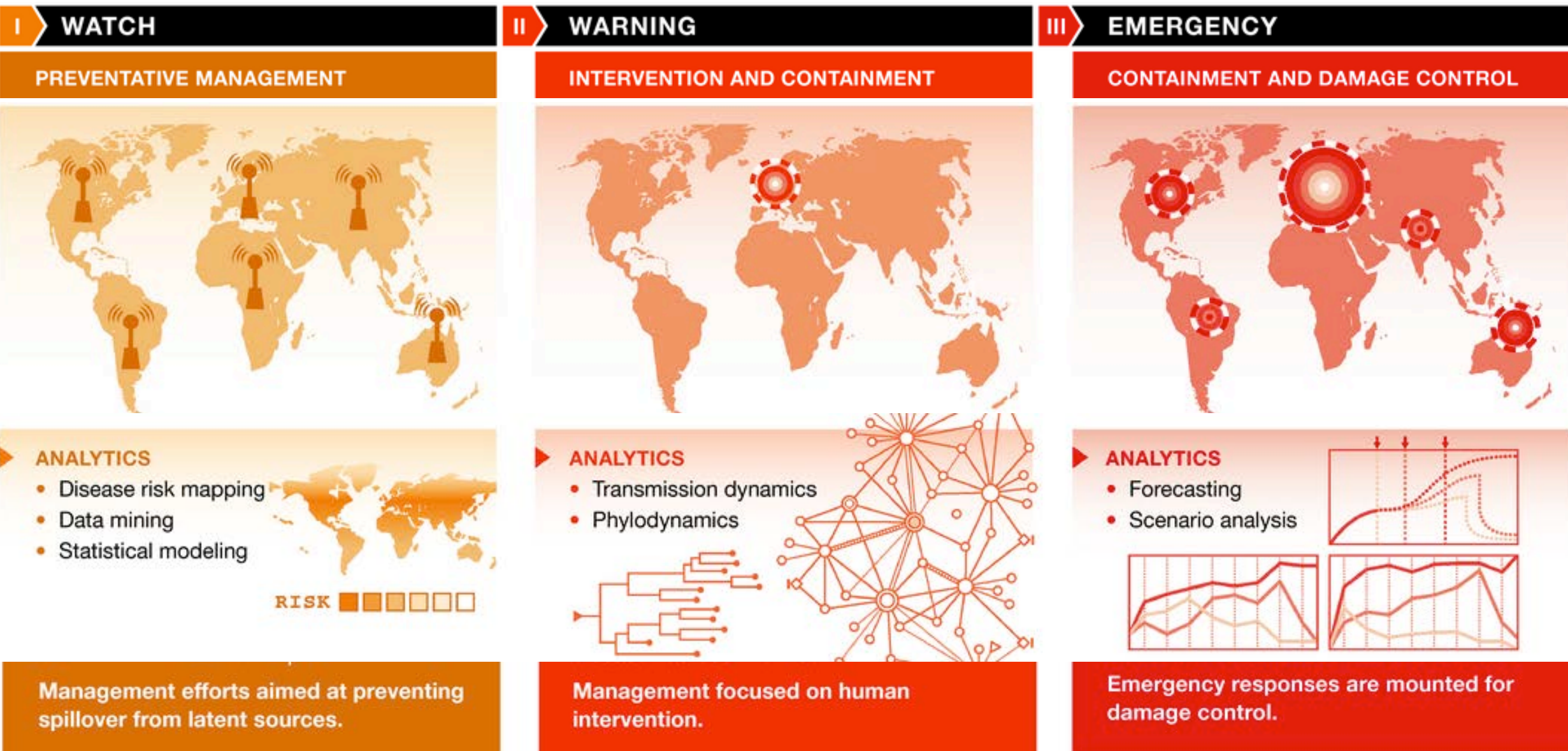
Emergence of Modern Diseases

Date is either discovery of infectious agent or occurrence of first major modern epidemic

- 2,000,000 cases
- 20,000 cases

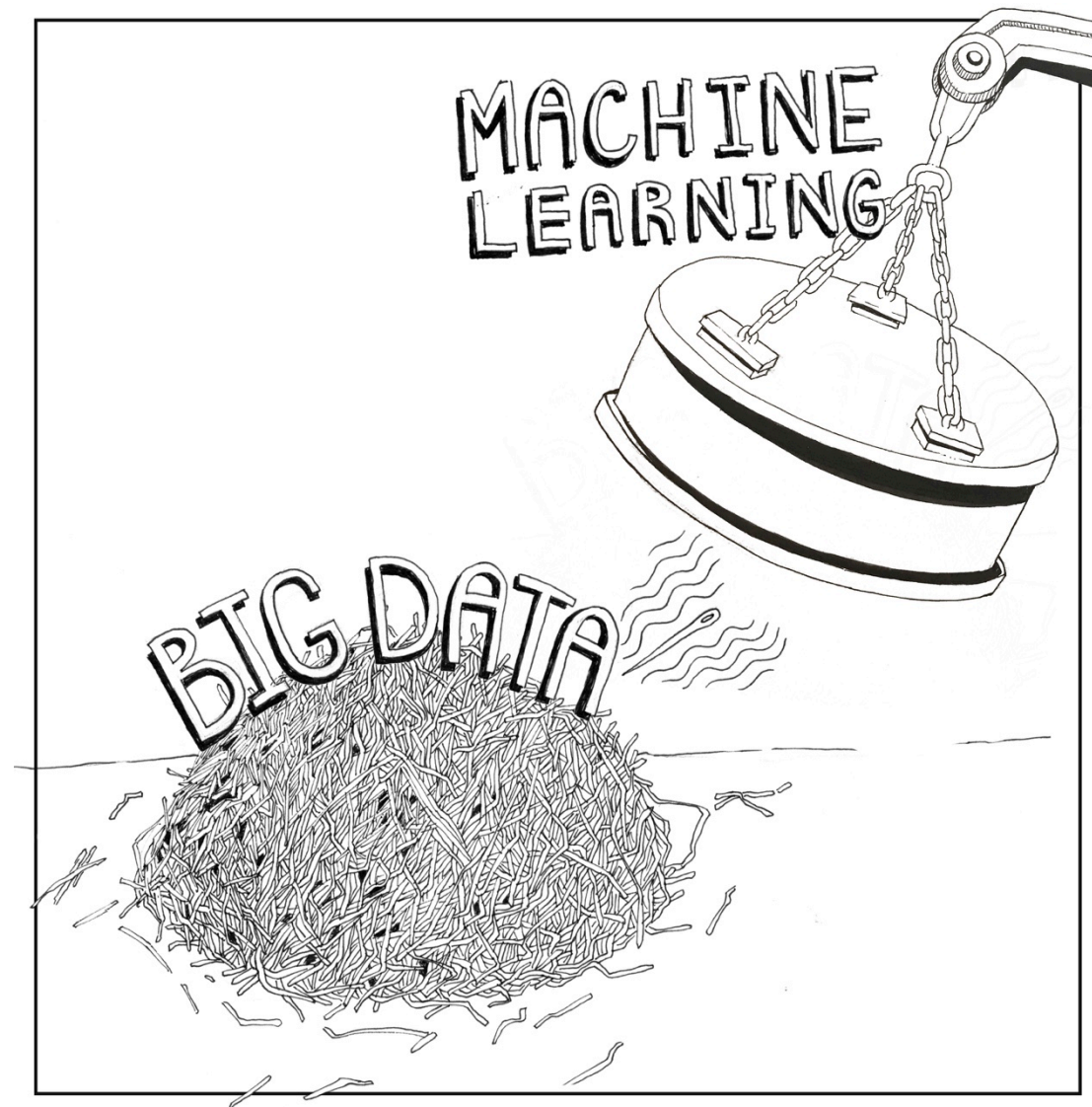


Vision: A future global warning system for infectious disease emergence



Steps towards a proactive science

- Better, faster, richer data streams
- Strategic "data stockpile"
- Research in quantitative analytics and models for infectious disease forecasting and decision support
- Stronger collaborations between scientists, policy makers, and government agencies





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