

Report from breakout session  
Statistical inference for  
compartmental/dynamical  
models

Discussion leaders:

Vladimir Minin and Jennifer Hoeting

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# Themes

1. Model/theory tractability
2. Parameter sensitivity and identifiability
3. Inference vs prediction

# Models/theory

- Creating tractable models:
  - Low versus high population sizes in some compartments.
  - Is there something that is in between jump processes and diffusion limit?
- Better models that mix discrete and continuous spaces.
- Using latent continuous models for discrete spaces
- Computational methods

# Inference vs prediction

- The classic dichotomy: What is the focus of the study?
  - Inference (what factors influence cholera outbreaks)
  - Prediction (when will cholera strike next)
- How to quantify the importance of
  - Phenomenological model of the environmental drivers
  - Mechanistic model of the spread of infection (SIR)?

# Parameter sensitivity and identifiability

- How to detect identifiability?
  - More people should superimpose the prior and posterior
- What to do when the model is weakly identifiable?
  - Get better data
    - Work with scientists to design new studies
    - Multiple data sources: combining genetic data and epidemiological data
  - Change the model
  - Does your parameter combination and/or estimates make physical sense?
  - Admit the problem and develop a very informative prior

## Some references

- Fong, Y., Rue, H., and Wakefield, J. (2010). “Bayesian inference for generalized linear mixed models.” *Biostatistics*, 11(3): 397–412.
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- Schliep, E. M., & Hoeting, J. A. (2013). Multilevel latent Gaussian process model for mixed discrete and continuous multivariate response data. *Journal of agricultural, biological, and environmental statistics*, 18(4), 492-513.