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Background:

Human travel is often seasonal driven by social and environmental factors.

Statistical Model Question:

What is the relationship between seasonal increases in travel with social and environmental variables?

Mechanistic Model Question:

How does seasonal changes in travel impact the spatial spread of a novel pathogen?

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Multinational patterns of seasonal asymmetry in human movement influence infectious disease dynamics

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Nature Communications **8**,
Article number: 2069 (2017)
doi:10.1038/s41467-017-02064-4

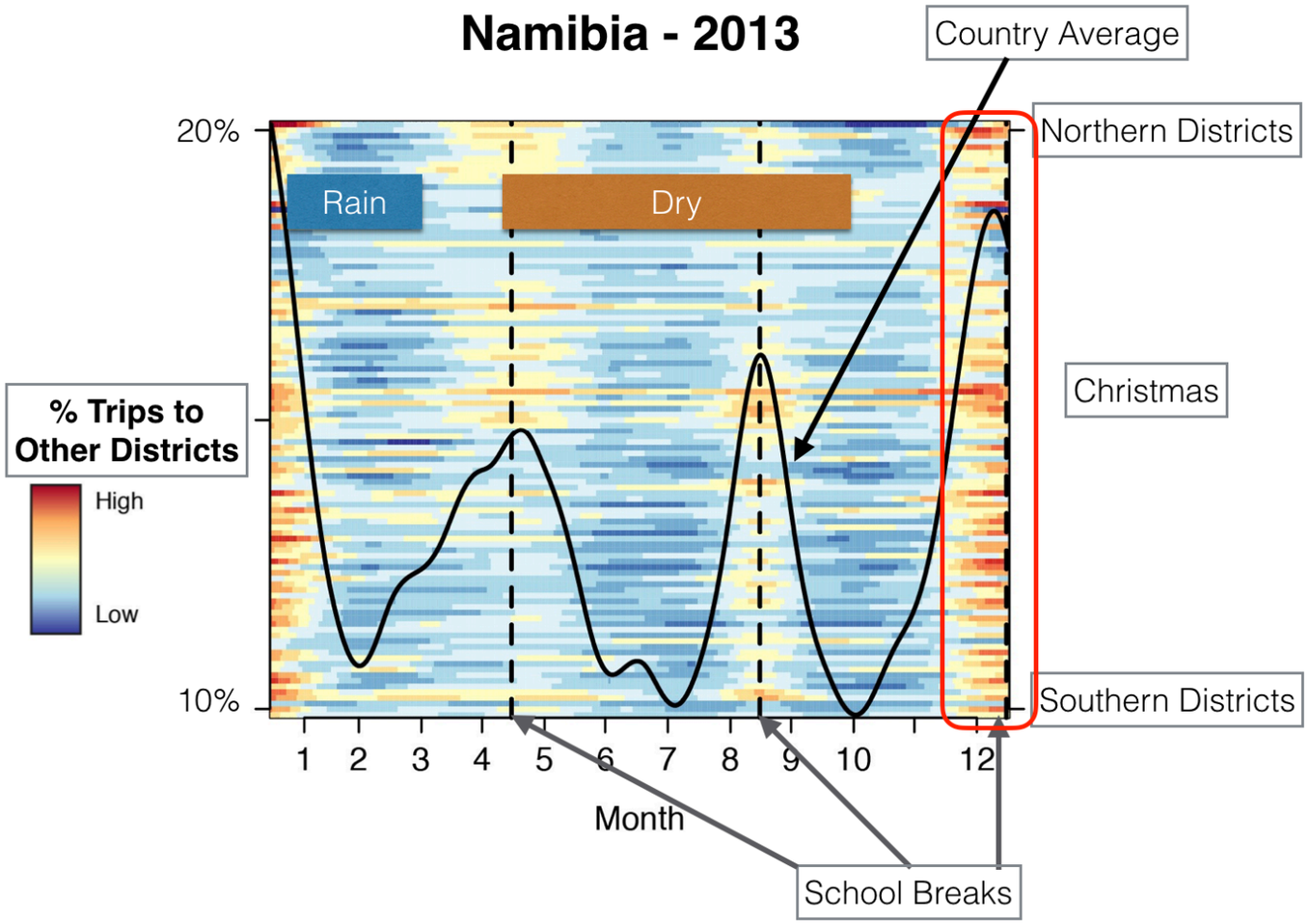
Received: 06 April 2017
Accepted: 03 November 2017
Published online: 12 December 2017

Acknowledgements

Jess Metcalf, Christian Ranaivoson

Statistical Model Question:

What is the relationship between seasonal increases in travel with social and environmental variables?



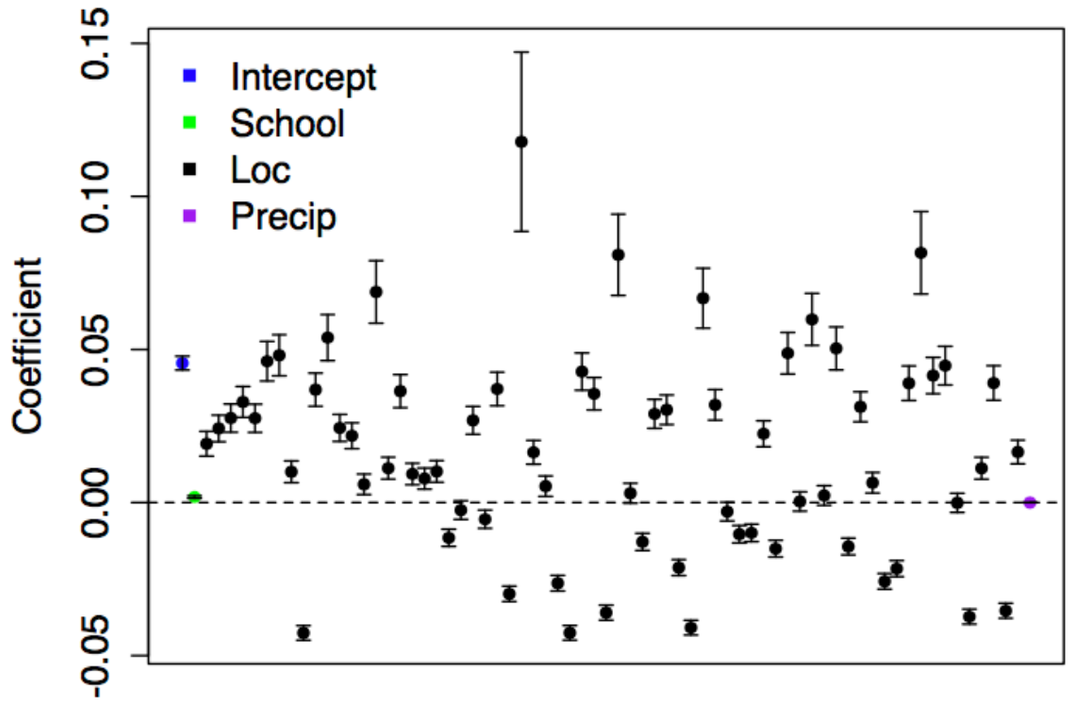
Hypothesized outcome: School terms will be positively related to an increase in the number of trips.

Data: the number of trips between districts measured using mobile phone data from three countries (Namibia, Kenya, and Pakistan)

Response variable: the number of trips between districts per month

Predictor variables: school terms, national holidays, location, temperature, precipitation

R Code: glm(trips ~ as.factor(school terms) + as.factor(national holidays) + location + temperature + precipitation, family = 'poisson', link = 'logit')



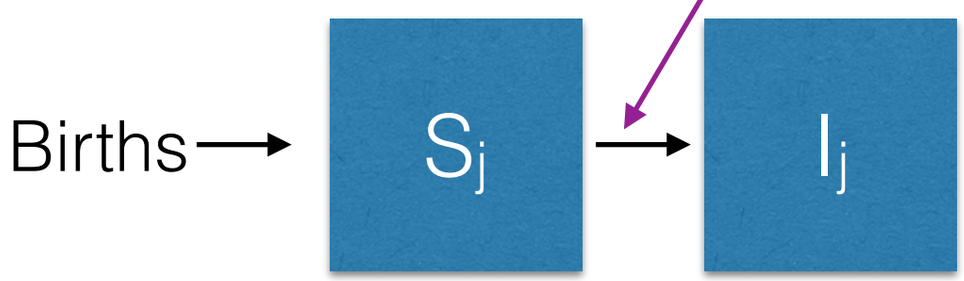
Mechanistic Model Question:

How does seasonal changes in travel impact the spatial spread of a novel pathogen?

States: Susceptible, Infected for each location j

Processes: h: hazard function, beta = transmission
c = amount of travel per month between locations

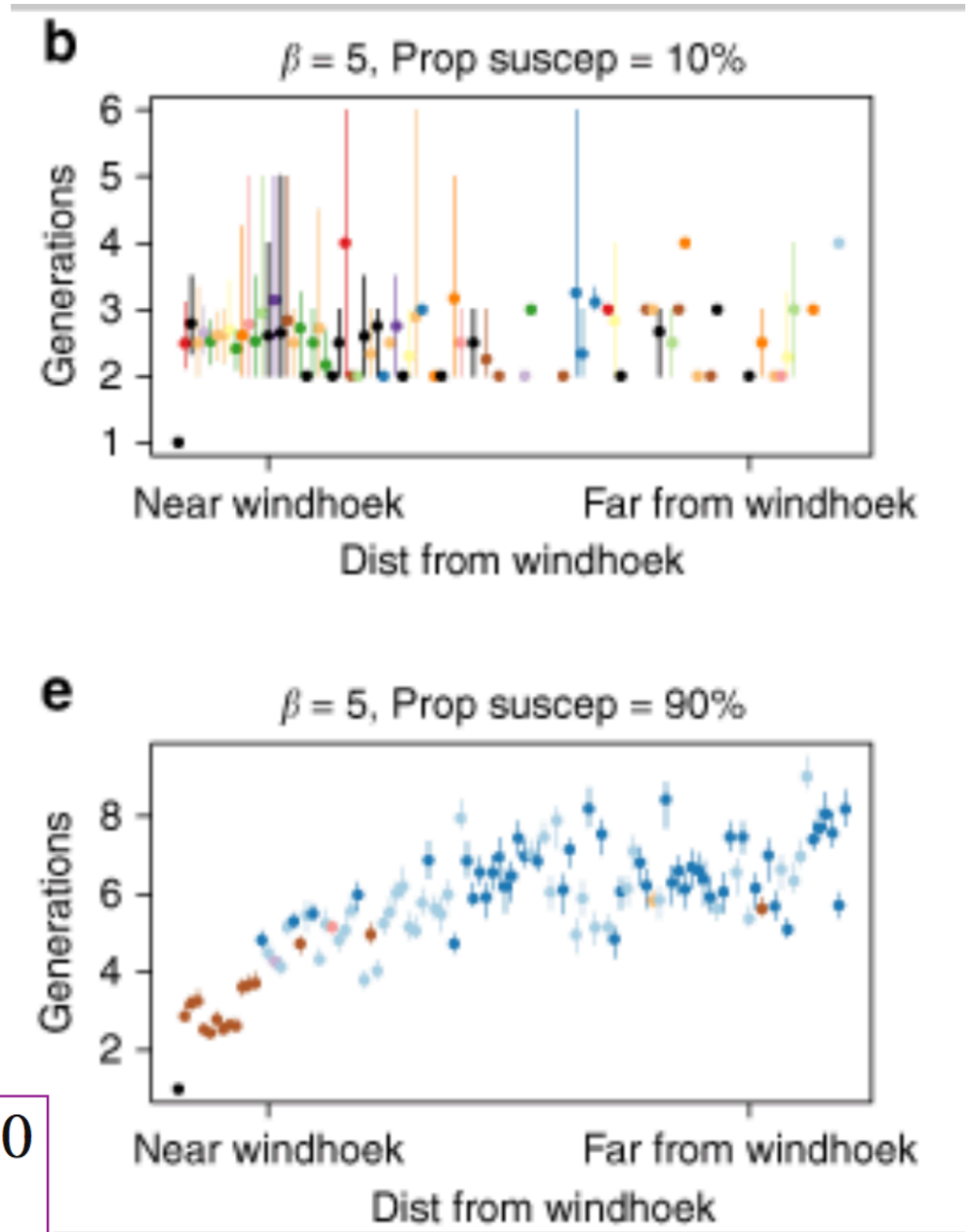
$$h(t,j) = \frac{\beta S_{t,j}\left(1 - \exp\left(-\sum_k c_{j,k} x_{t,k}\right) S_{t,j}\right)}{1 + \beta S_{t,j}}$$



$$I_{t+t,j} \sim \text{Binom}(h(t,j)) \text{ for } I_t = 0$$

$$I_{t+1,j} = \beta S_{t,j} I_{t,j} \text{ for } I_t > 0$$

$$S_{t+1,j} = S_{t,j} - I_{t,j+1} + b$$



Next Steps:

1. Incorporate the seasonal differences in the duration of trips in the mechanistic model.
2. Understanding if seasonal differences in travel are common across different countries.