

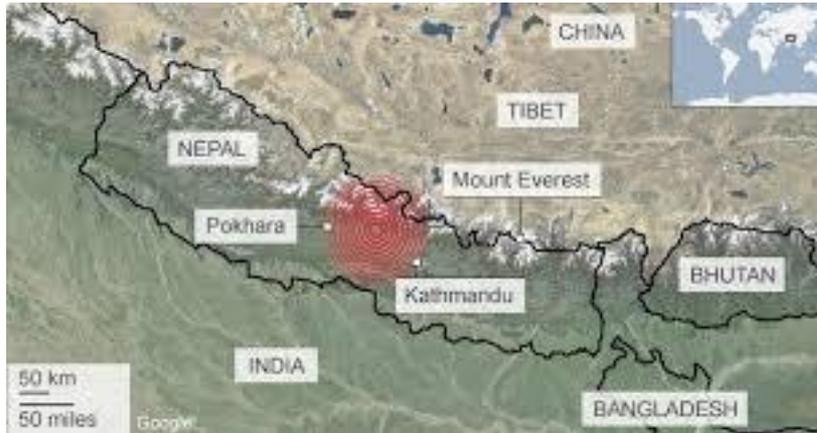
Linking typhoid transmission to the water distribution system in Katmandu, Nepal

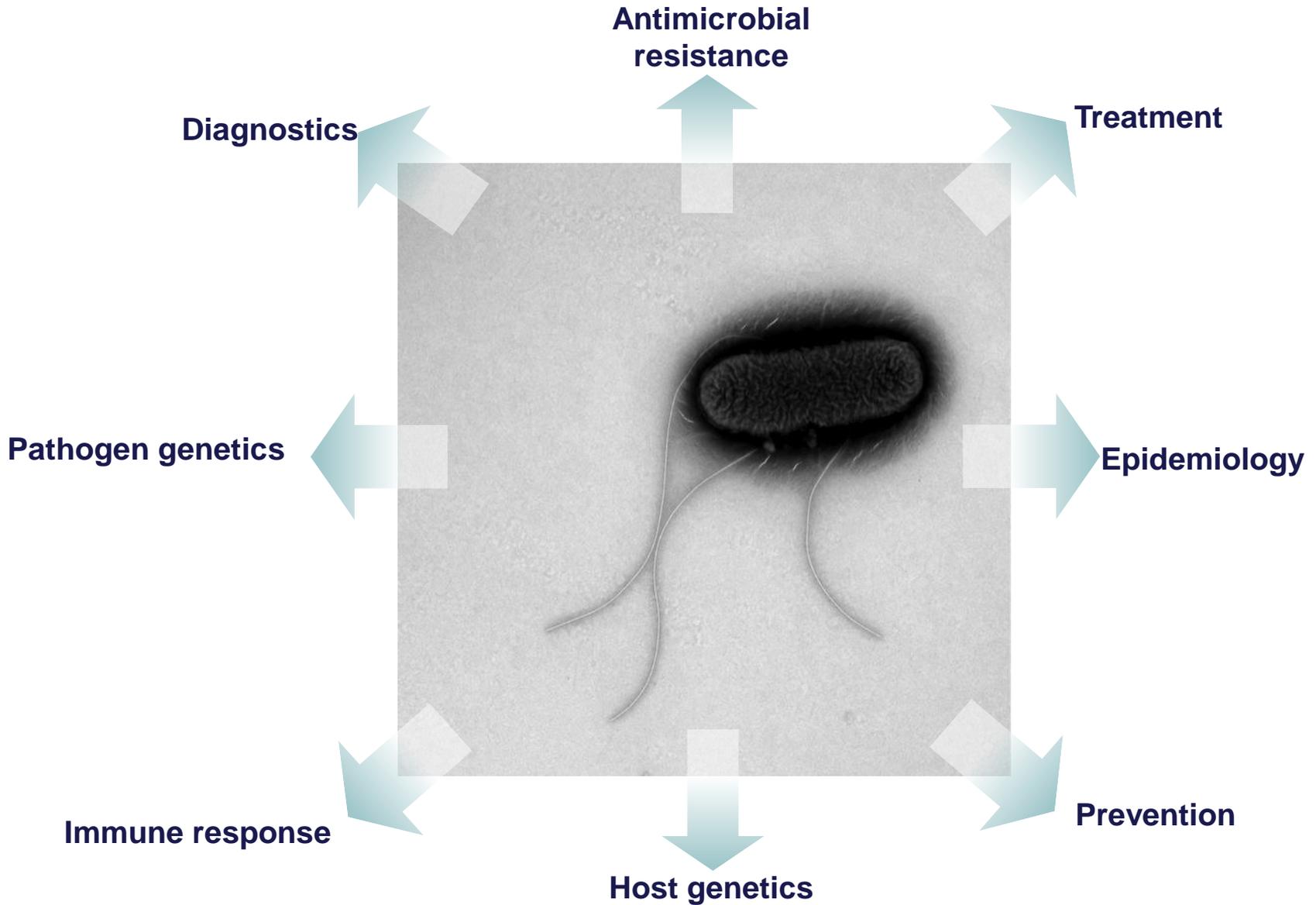
Stephen Baker

Bali 01/05/15

Stephen Baker

and others...







Cite this article: Baker S, Holt KE, Clements ACA, Karkey A, Arjyal A, Boni MF, Dongol S, Hammond N, Koirala S, Duy PT, Nga TTV, Campbell JI, Dolecek C, Basnyat B, Dougan G, Farrar JJ. 2011 Combined high-resolution genotyping and geospatial analysis reveals modes of endemic urban typhoid fever transmission. *Open Biol* 1: 110008.
<http://dx.doi.org/10.1098/rsob.110008>

Combined high-resolution genotyping and geospatial analysis reveals modes of endemic urban typhoid fever transmission

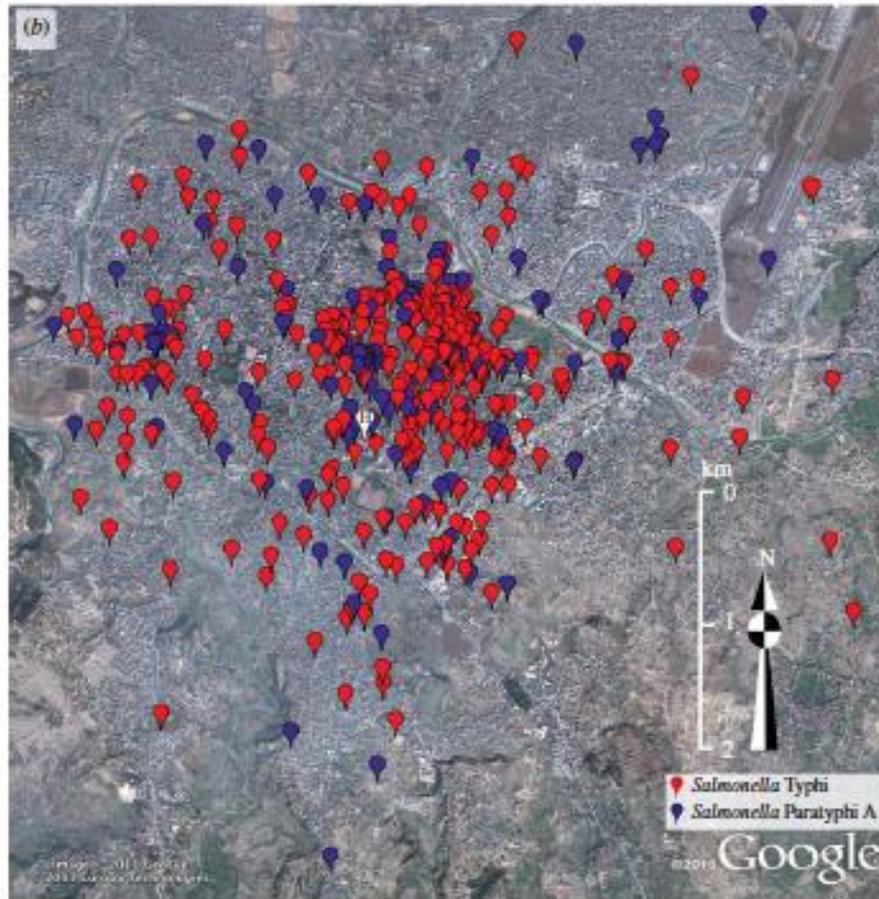
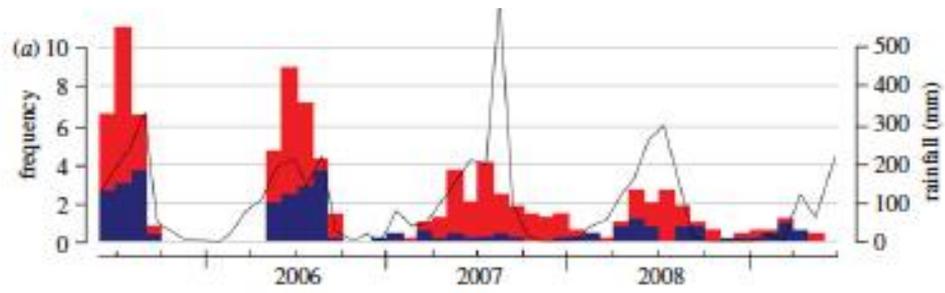
Stephen Baker^{1,2,*}, Kathryn E. Holt^{3,4,†}, Archie C. A. Clements⁵, Abhilasha Karkey², Amit Arjyal², Maciej F. Boni^{1,6}, Sabina Dongol², Naomi Hammond⁴, Samir Koirala², Pham Thanh Duy¹, Tran Vu Thieu Nga¹, James I. Campbell¹, Christiane Dolecek^{1,2}, Buddha Basnyat², Gordon Dougan⁴ and Jeremy J. Farrar^{1,2}

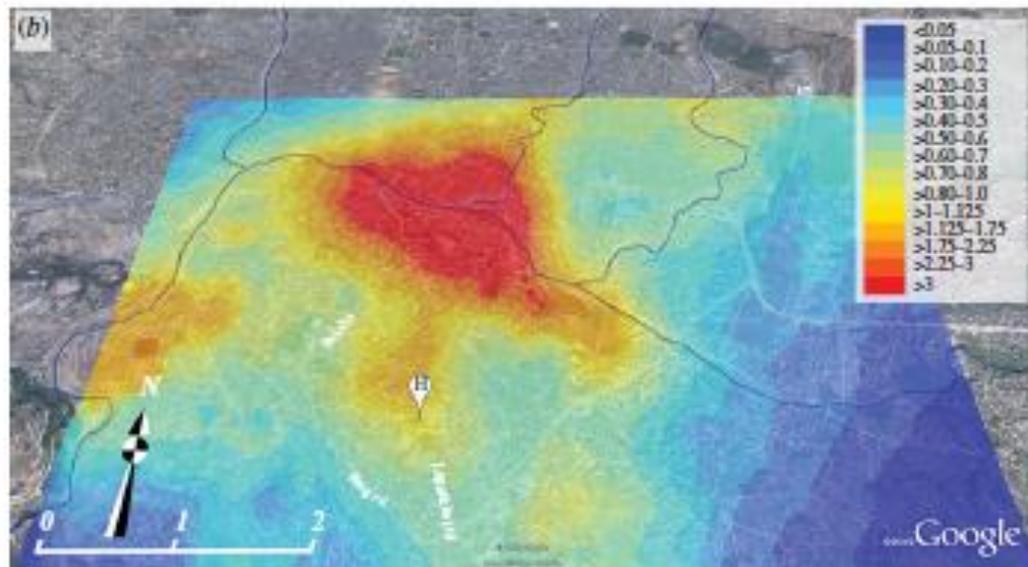
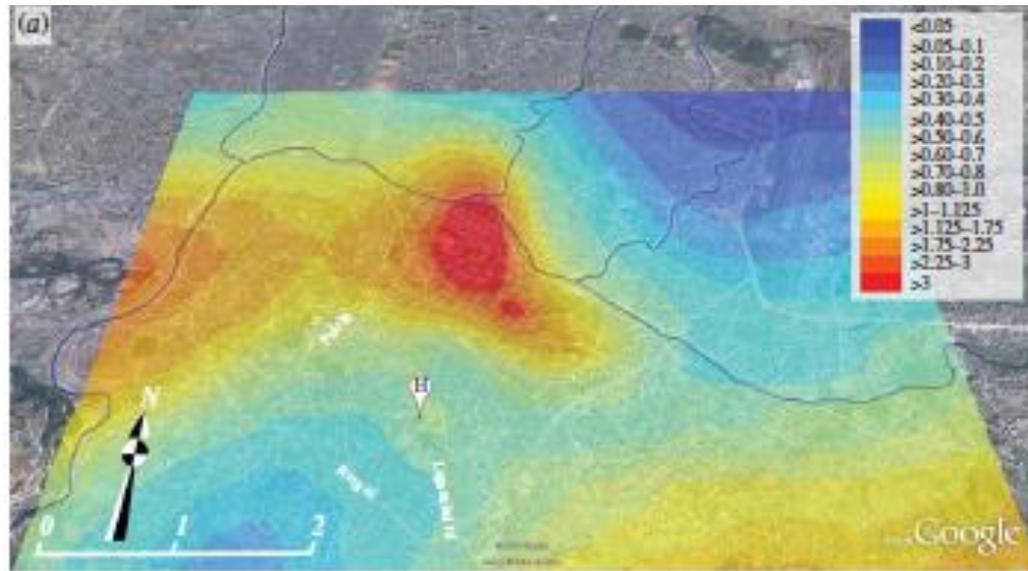
- What are the main factors for transmission?
- Does where you live change your risk?
- Do specific haplotypes circulate and how?

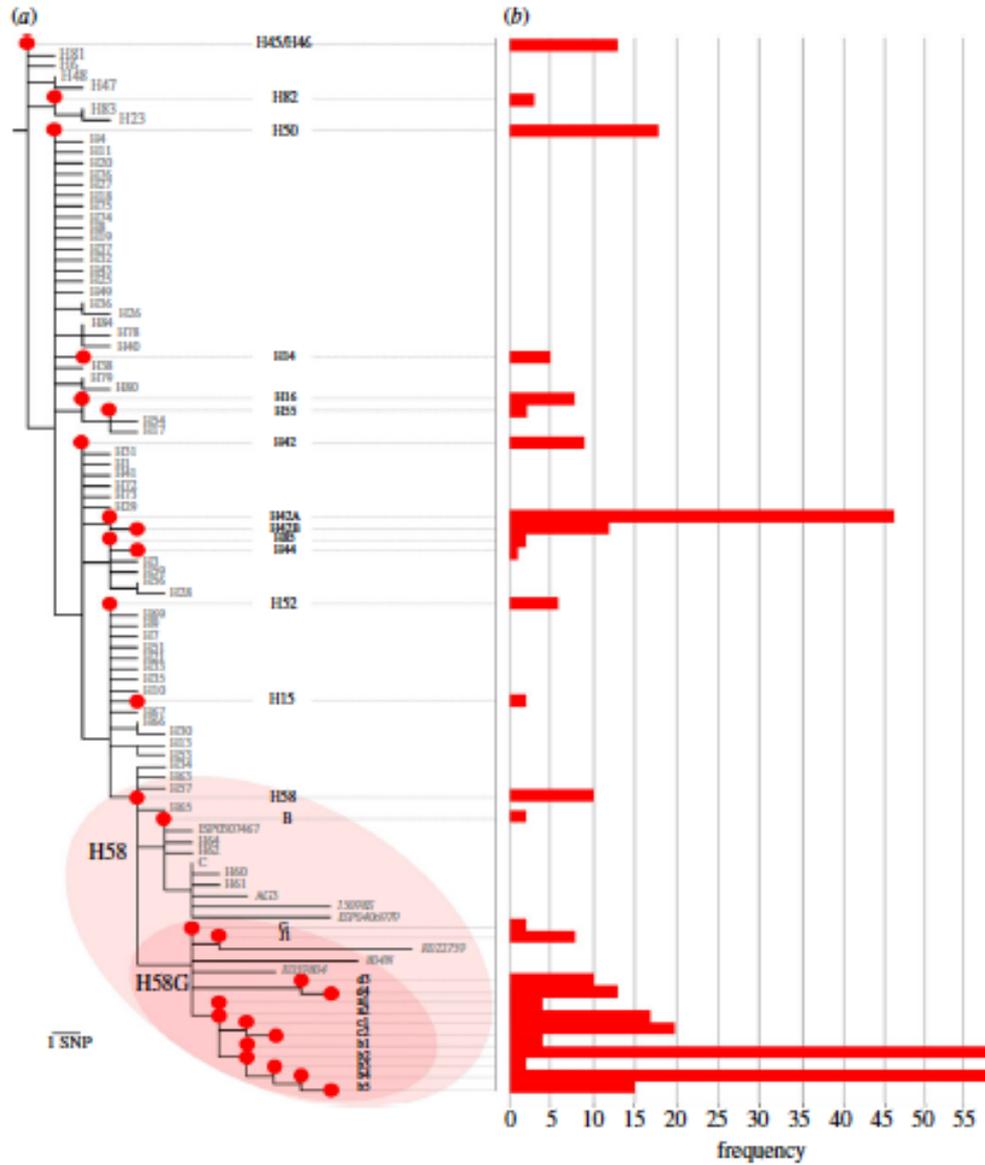
- Household GPS mapping of cases and controls
- Study local patterns of disease
- Epidemiological factors of infection

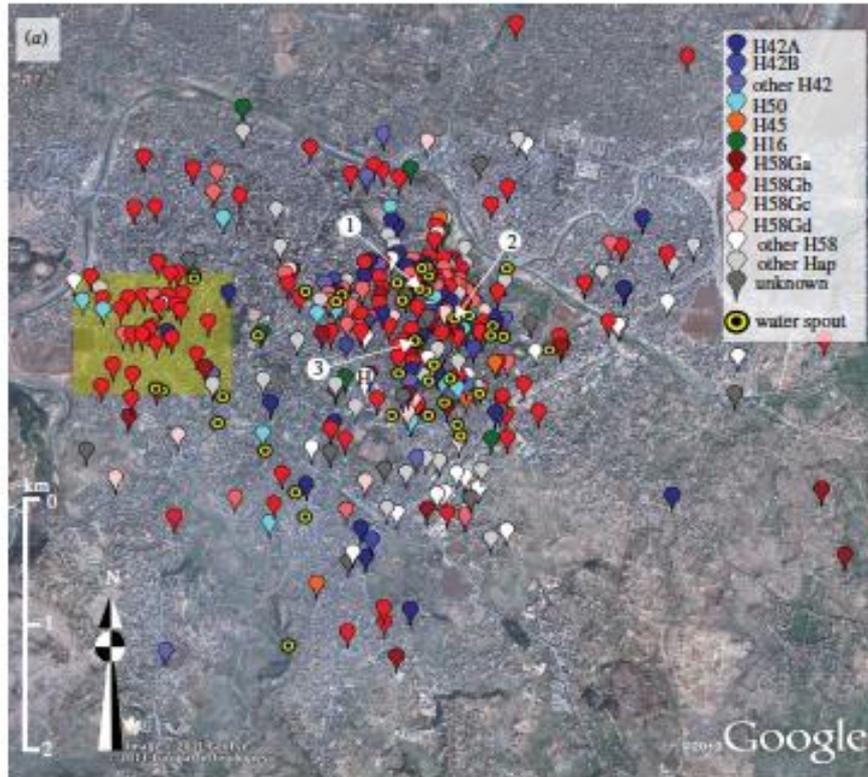
- Genotyping of all S. Typhi
- Identify dominant haplotypes / circulating organisms
- Study temporal and spatial haplotype patterns

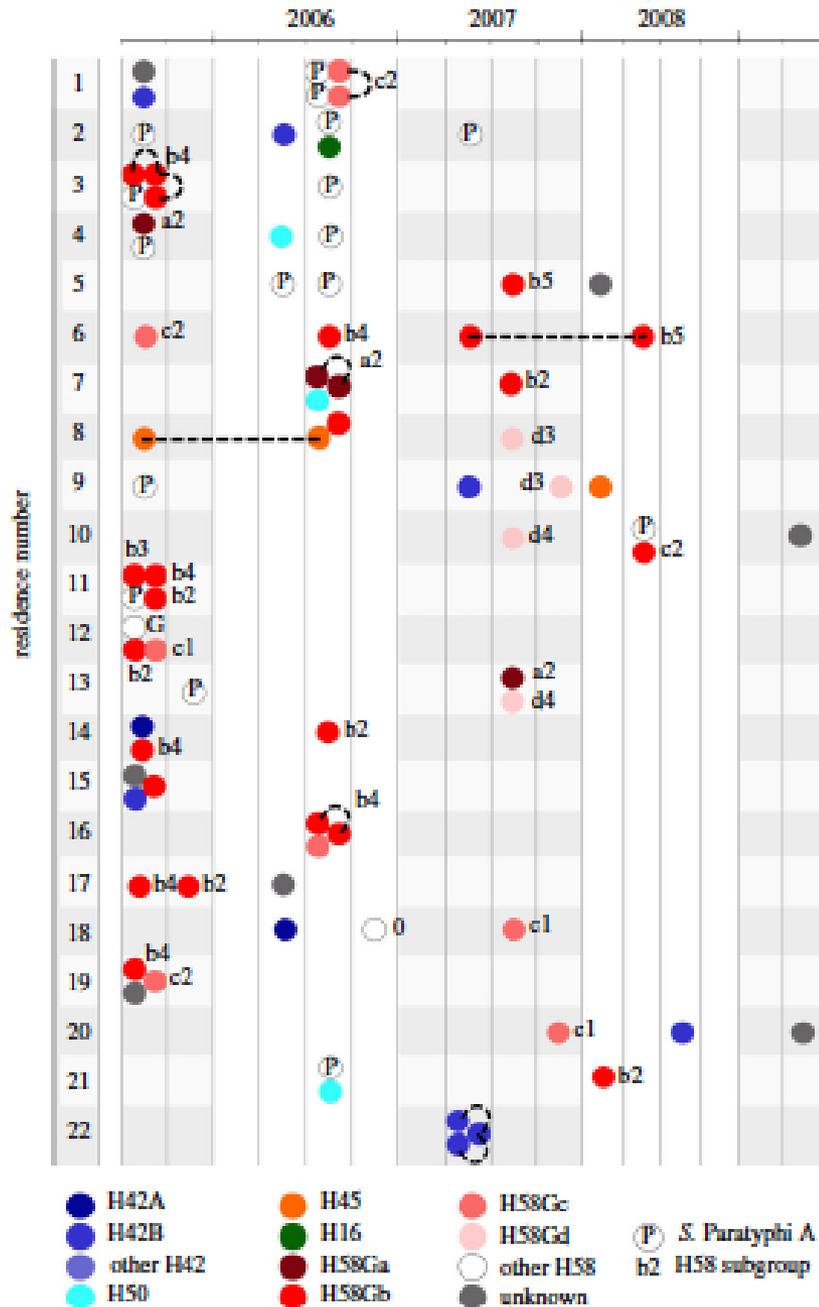
- How generalizable is this setting and our findings?











- Spatiotemporal case clustering for both serovars
- Highest risk in low lying areas
- Paratyphi A more diffuse

- 14 Typhi clades (68% H58)
- H58 clonal expansion
- Random haplotype distribution

- Water spout proximity highest risk
- Household transmission events evident
- 3 times more likely to be infected with a different organism

- What role does local the water play?

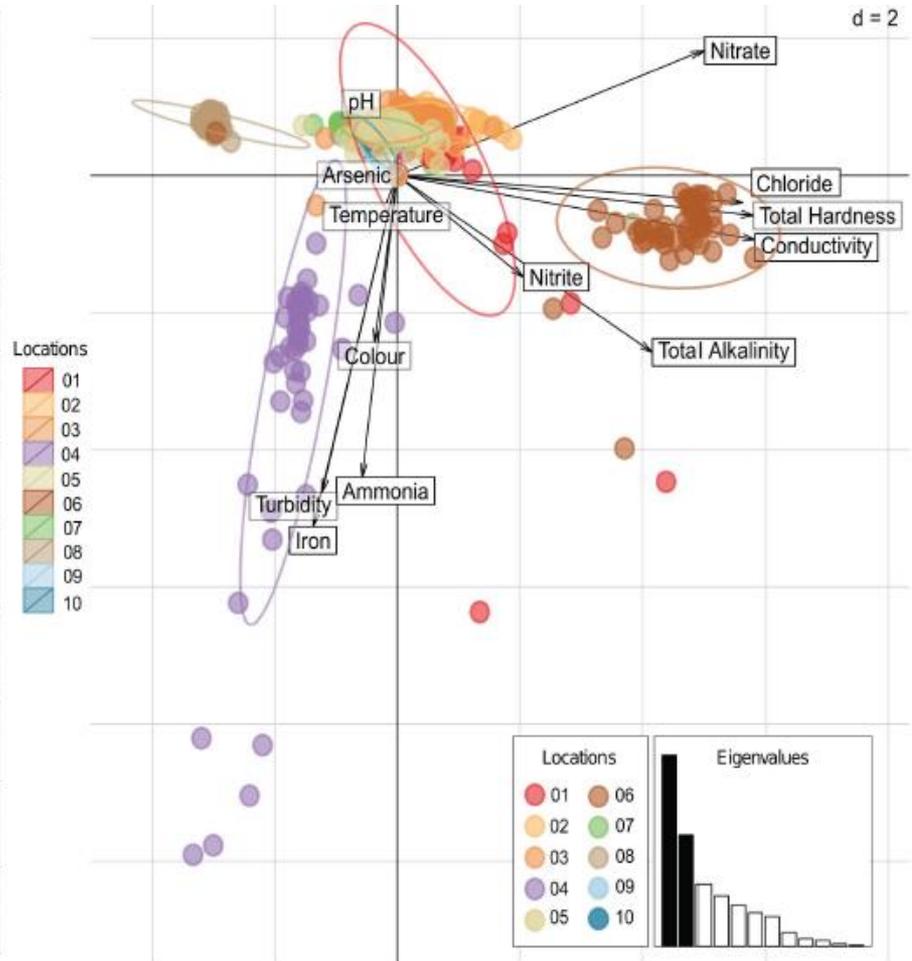
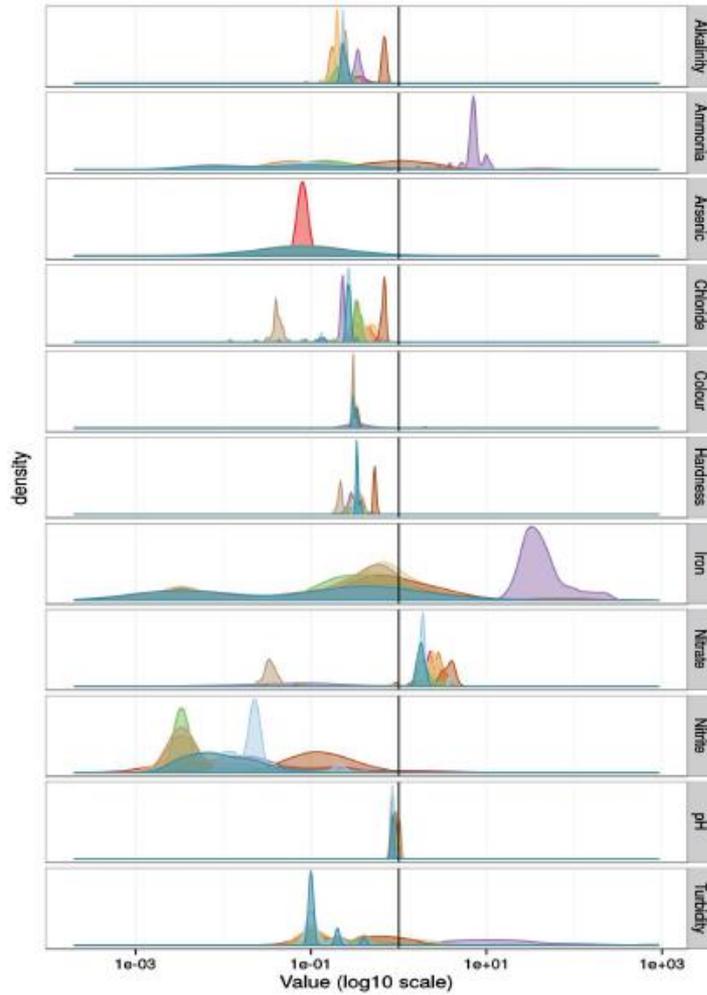


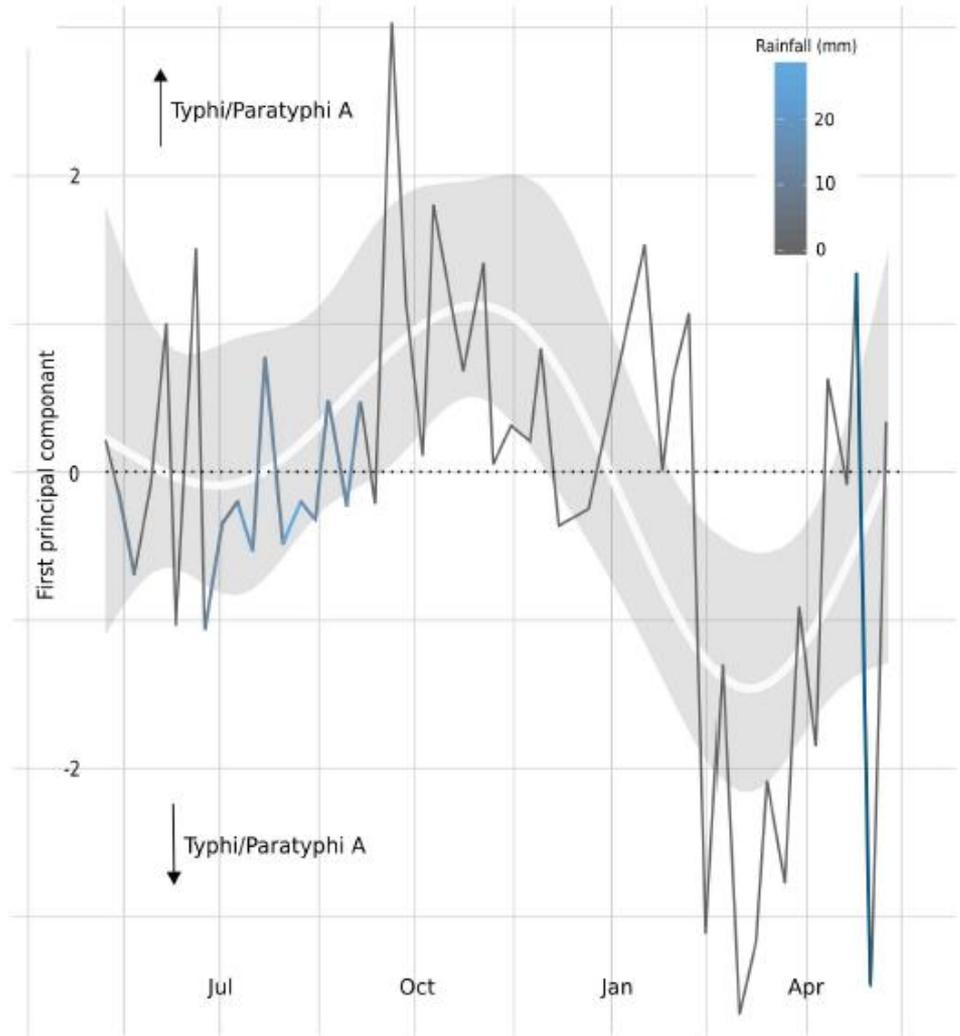
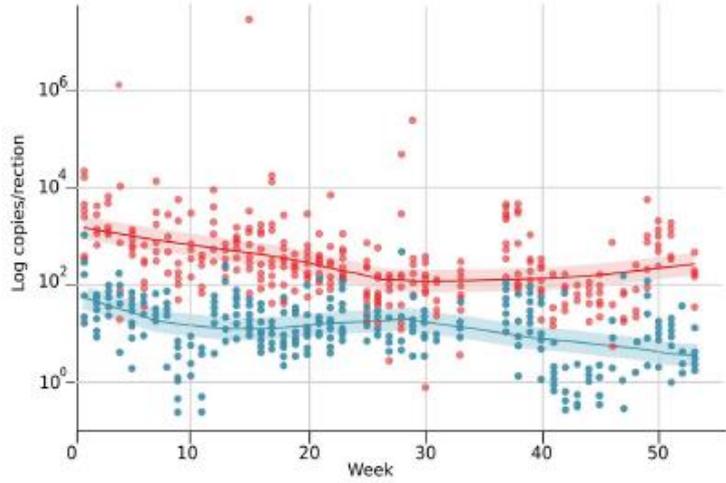
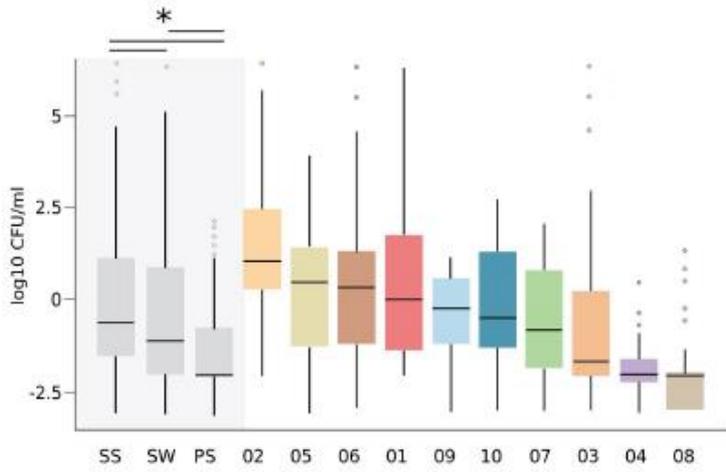
- What is the role of the water supply?
- Does it differ between locations?
- What is the extent of the contamination?

- 10 locations sampled for one year
- Chemistry, coliforms, pathogens
- Typhi, Paratyphi A, 16S rRNA

- Performed multifaceted analysis
- Compared PCR profiles and other variables
- Study temporal and spatial bacterial populations

- How can this help control typhoid?



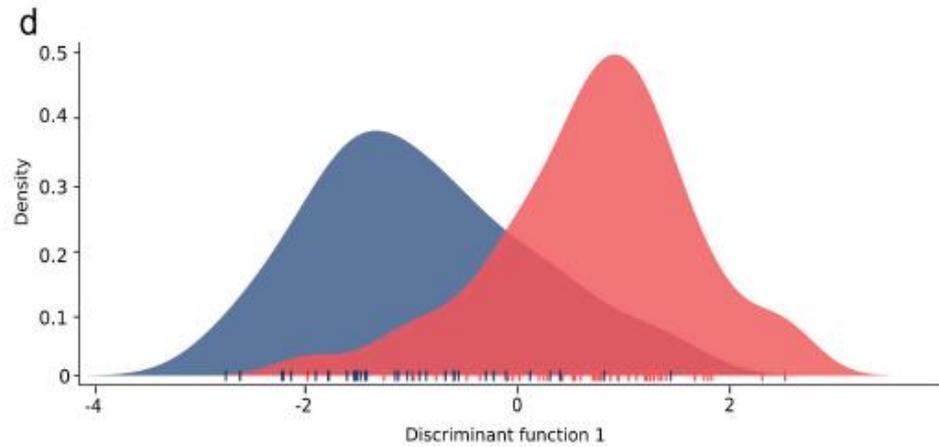
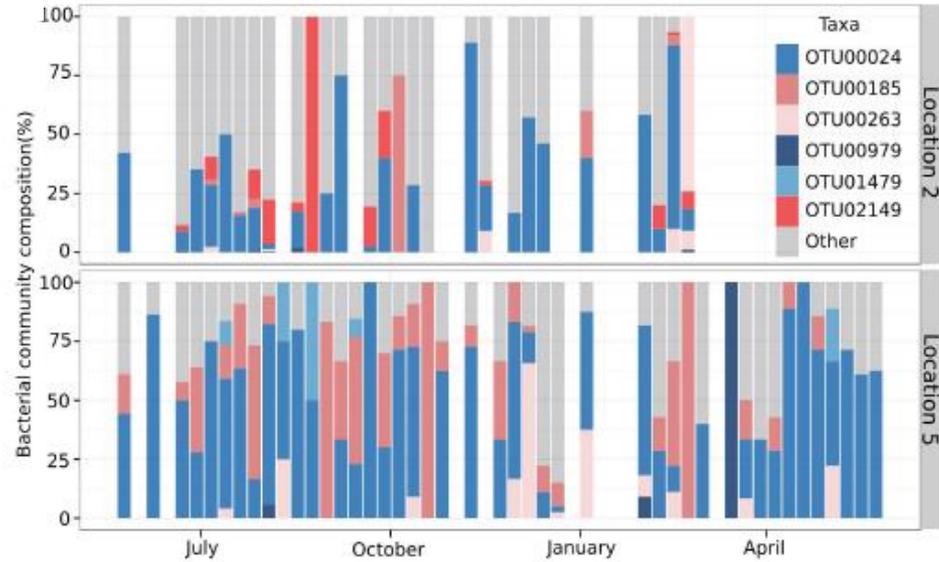
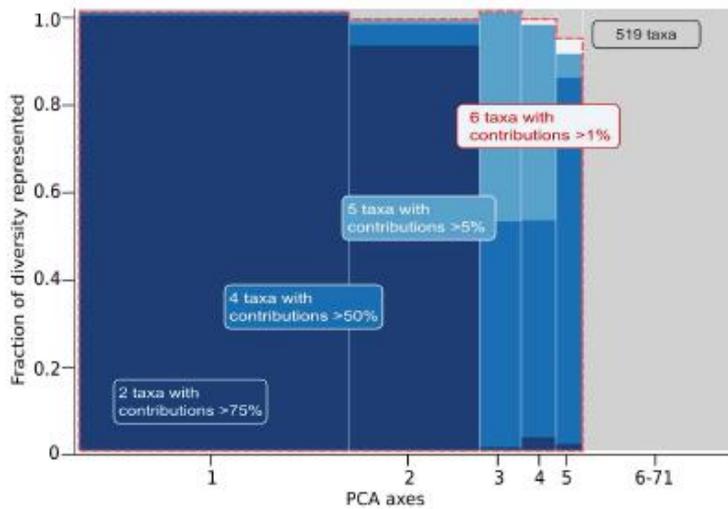
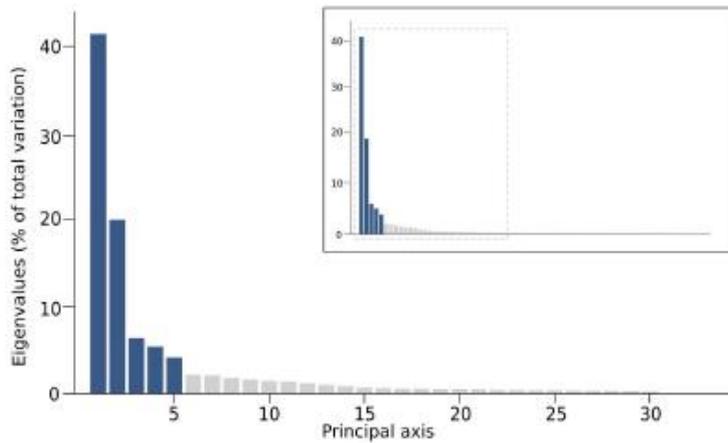


- Iron, nitrate ammonia contamination
- Location specific contamination
- Likely driven by air contamination and fecal waste

- Nitrate correlated with coliforms and rainfall
- Coliforms ranged from 0.001 to 2.5×10^6 CFU/ml
- Spouts > Wells > Piped

- No Typhi / Para A cultured
- 80 % PCR positive
- Typhi > Para A

- Fecal contamination / Typhi associated with rainfall



- Samples contain a diverse array of fecal organisms
- However 5 OTUs represent >80% variation
- These show spatiotemporal patterns

- 5 can segregate well water from spout water
- Can predict the location with 80% certainty
- Highly localized contamination

- The water quality in Kathmandu is poor
- This is a major Typhoid / Public health issue
- Substantial investment is required

- Household based interventions are likely to be the most suitable in the short term

With thanks



Sir Henry Dale Fellowships