Is the provision of on-site sanitation a threat to rural domestic water supplies in India?

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water for people

Sanitation in India

- 600 million people practise open defecation
- Greatest numbers in rural areas in less affluent states

Sanitation in India

- Every year, diarrhoea kills 188,000 children <5 in India
- 1 in 10 children
- Highest incidence in the world

Way forward…

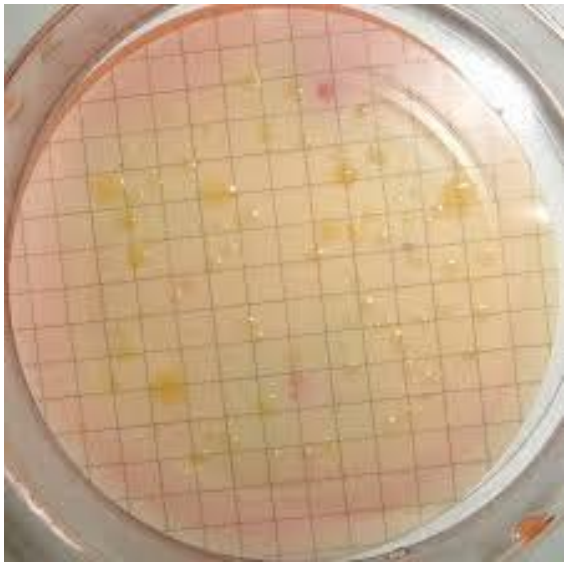
- Every home shall have a toilet by 2019

Toilet building

- Nationally 5.8 million toilets were constructed in the first year of Modi's reign
- On-site sanitation – no reticulated sewerage system

So what's the problem?

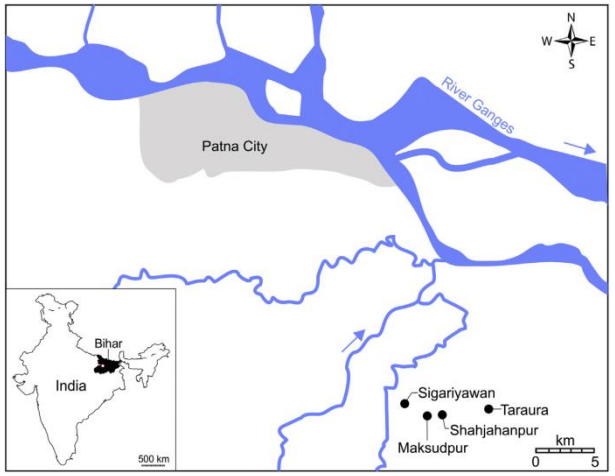
- In theory, less human faeces on the surface can only be a good thing. But…

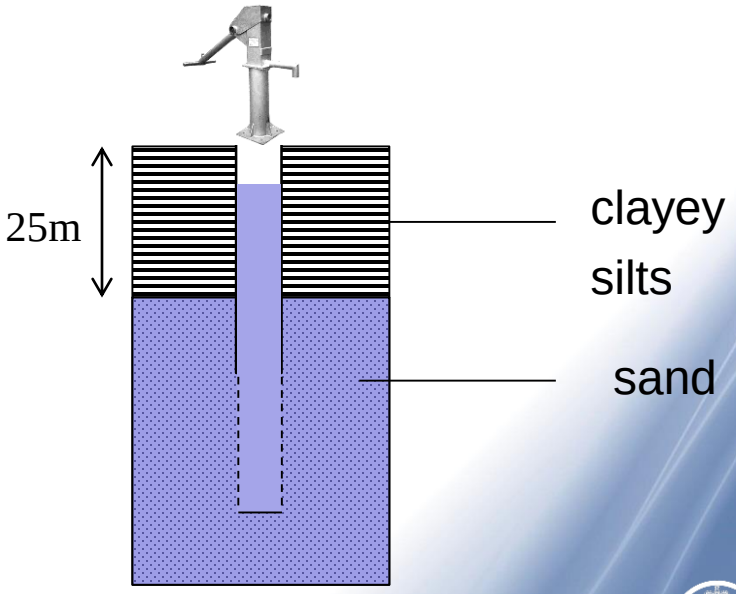


- Groundwater contamination?
  - Rural India is heavily dependent on groundwater

Bihar study

- Bihar – 77% of households are without a toilet
- Visited 4 villages undergoing sanitary interventions (toilet building)
- Alluvial sediments of the Ganges Plain – Aquifer is Low Vulnerability
- Domestic water supply is from handpumps (private and communal) – intake typically 55-60 m below ground





Bihar study

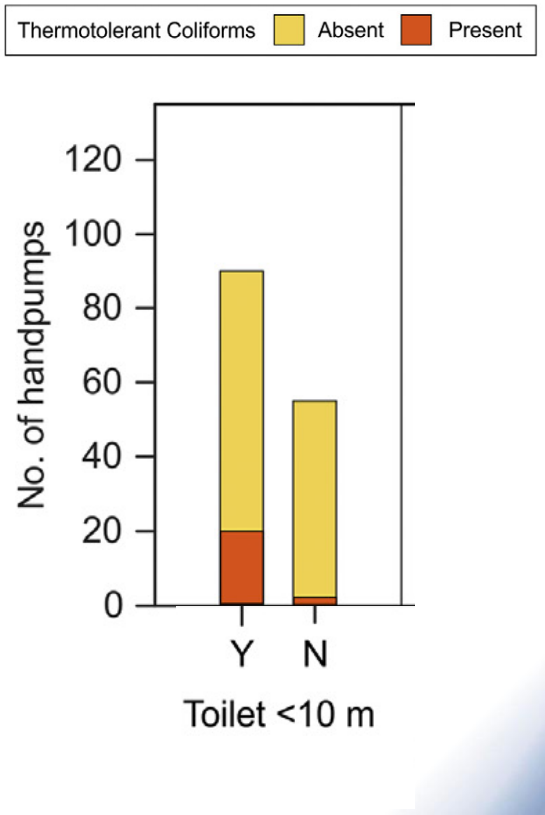
- Sampled 145 groundwater supplies across villages – approximate split between those adhering to installation guidance and those not
- Thermotolerant coliforms
- Sanitary risk assessments

Results

- 18% of all supplies were contaminated with thermotolerant coliforms

- 91% of contaminated supplies were within 10 m of a recently installed toilet

- Stepwise logistic regression model
- Proximity to toilet (p-value = 0.01) only significant sanitary risk predictor

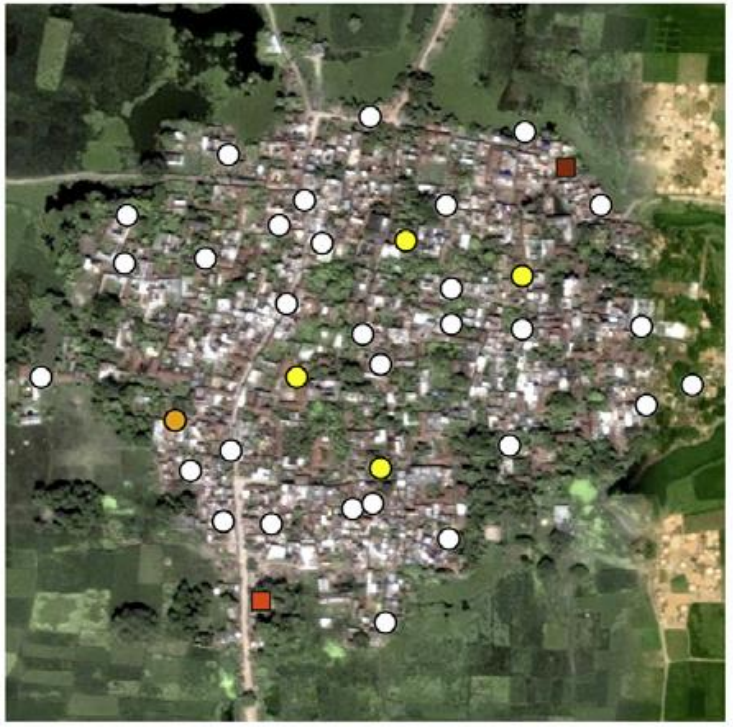


Pathways for contamination?

- Aquifer is low vulnerability – 25m of protective clayey silt

- Contaminated supplies are spatially isolated
- No widespread aquifer contamination

- An issue of water point vulnerability
- not natural pathways



Wider implications

- If contamination is occurring in this low vulnerability locality…
- Coarser sediments upstream in the Ganges Basin
- Fractured bedrock covering much of the country
- This is likely to be a widespread problem and escalating rapidly

Solutions

- Difficult to enforce lateral separation between toilet and supply
- Accept groundwater contamination as lesser evil?
- Centralised water supply?
- Improve borehole construction and protection?
- Decentralised water treatment?

The full story…

Sorensen, J.P.R.; Sadhu, A.; Sampath, G.; Sugden, S.; Dutta Gupta, S.; Lapworth, D.J.; Marchant, B.P.; Pedley, S.. 2016. Are sanitation interventions a threat to drinking water supplies in rural India? An application of tryptophan-like fluorescence. Water *Research*, 88. 923-932.

Questions?