What does quality sanitation look like from a public health perspective? :

Presented by Christine Moe, Freya Mills, and Nuhu Amin

Drawing on two research projects:

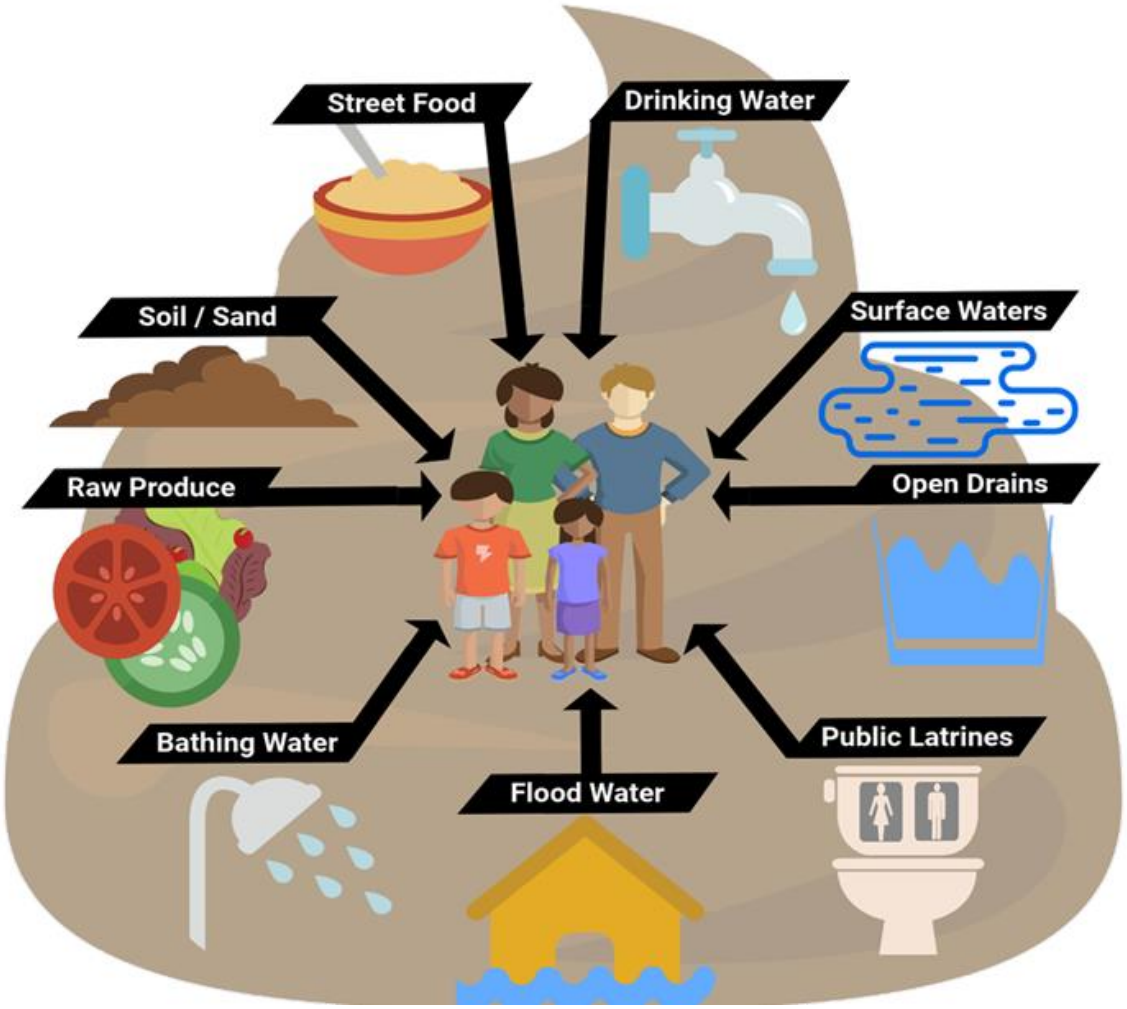
- *Modelling faecal pathogen flows in urban environments*
- *Dhaka SaniPath study*

Sanitation quality from a public health perspective

- Poor sanitation and faecal sludge management (FSM) leads to numerous pathways for exposure to faecal contamination and pathogen transmission
- In order to protect public health, quality sanitation and FSM should reduce or eliminate exposure to faecal contamination
  - for the user
  - in the residential environment
- Pathogen release, survival, and concentration in different compartments of the environment poses public health risk

SaniPath

- We can examine risks from poor sanitation by measuring faecal contamination in the environment and how people interact with their environment
- Exposure to faecal contamination in the environment is related to:
  - Magnitude of contamination in the environment
  - Frequency and duration of exposure behavior – such as type of drinking water consumed or contact with open drains or surface water
- We collected data from 10 neighborhoods in Dhaka to identify the major pathways of exposure to faecal contamination



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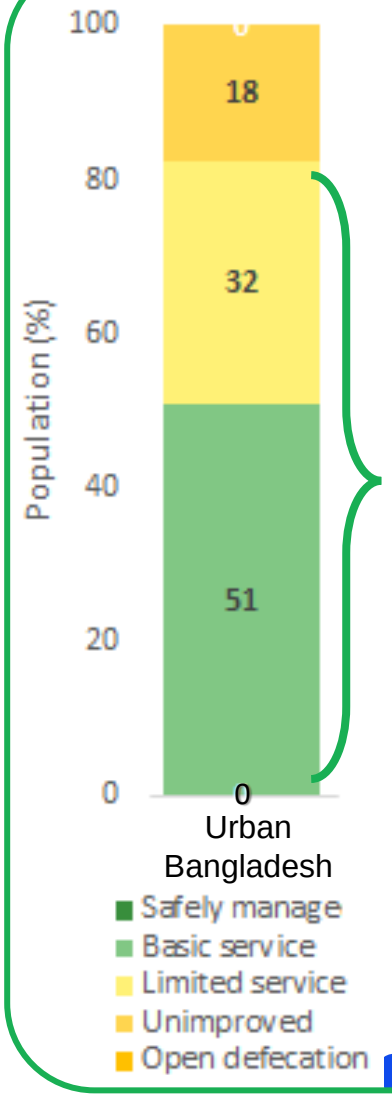
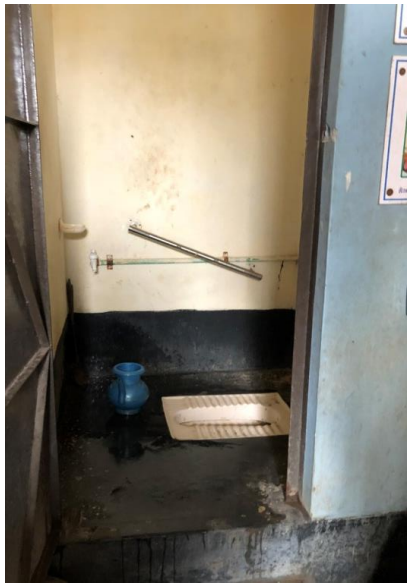
Quality challenges with current approaches to sanitation: focus on toilet access only is insufficient

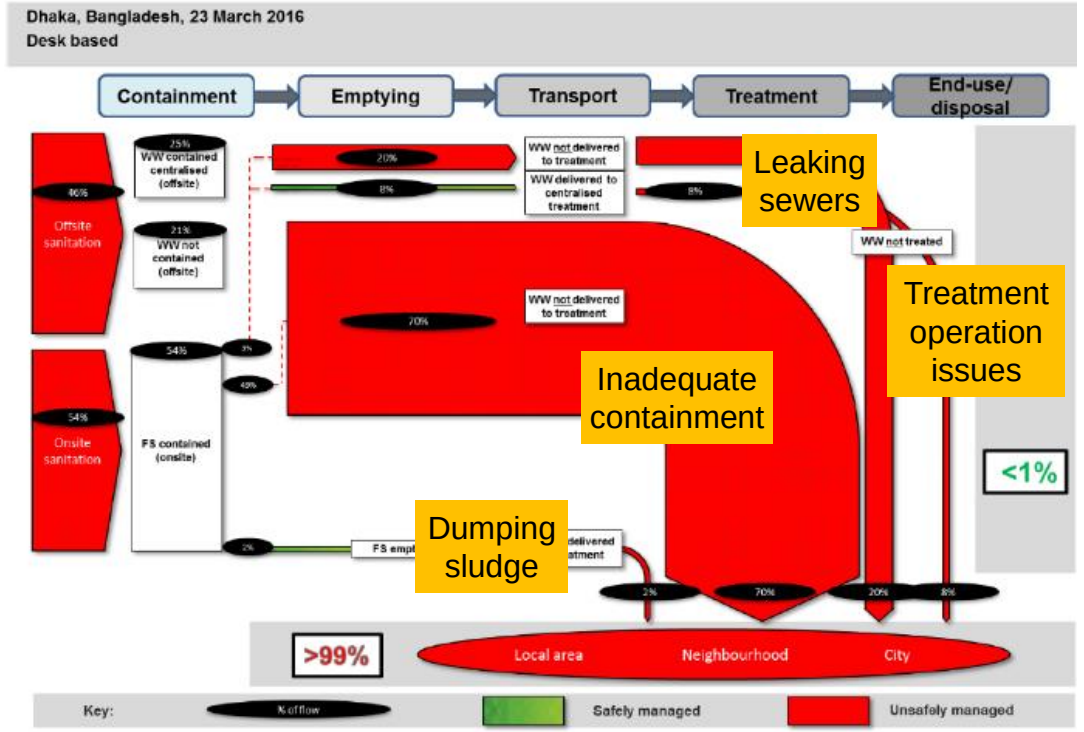




Improved latrine: provides barrier to faecal waste at the user interface

Reality = Unsafely managed

untreated excreta discharge to environment at all steps of chain



SFD Dhaka WEDC 2016

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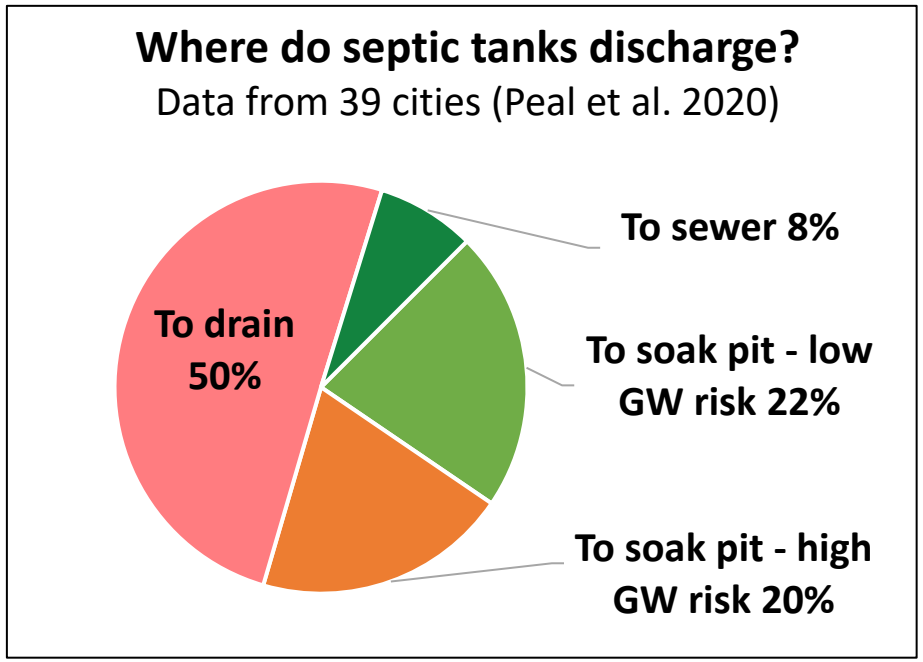
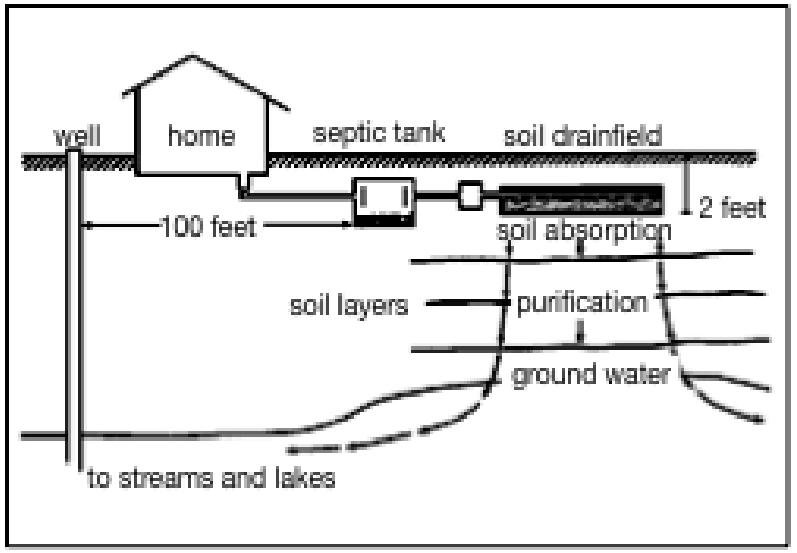
Quality issues at the first step in service chain: unsafe containment

A global issue



- Dhaka SFD: 54% toilets discharge to septic tanks, 90% connected to drain
- Study site: 24% toilets discharge to septic tanks, 100% discharge to drain

Septic tank **systems** include treatment of effluent



Knowledge gaps:

- Performance of on-site systems in actual conditions
- Pathogen discharges to the environment from sanitation systems
- Extent to which on-site sanitation solutions protect public health

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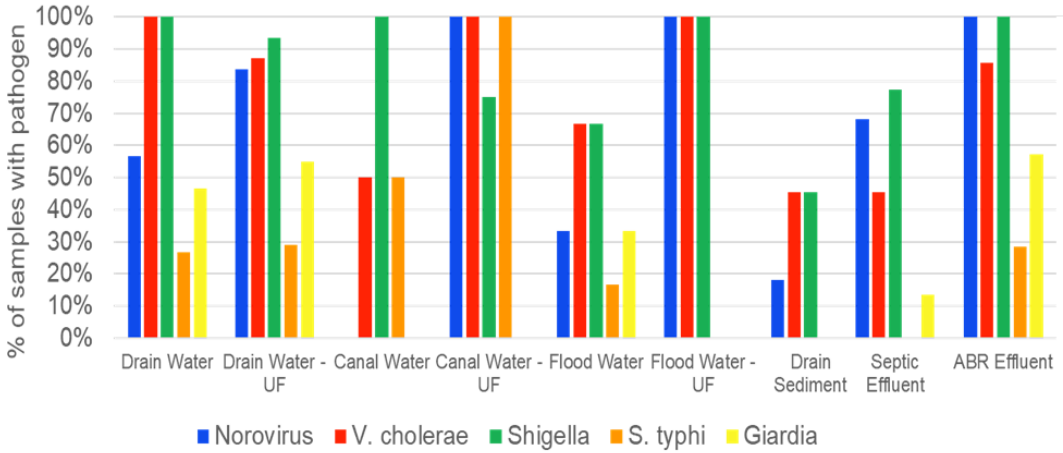
Containment issues in practice – pathogen analysis in a Dhaka slum: high pathogen presence and concentration in urban drains

Figure 1. Percentage of positive samples for different pathogens in different sample types



Overall pathogen contamination

Pathogens (N=150 Samples)	Positive (overall)
Shigella/EIEC	89%
V. cholera/NoV-GII	68%
Giardia	32%
S. Typhi	17%
Cryptosporidium	6%

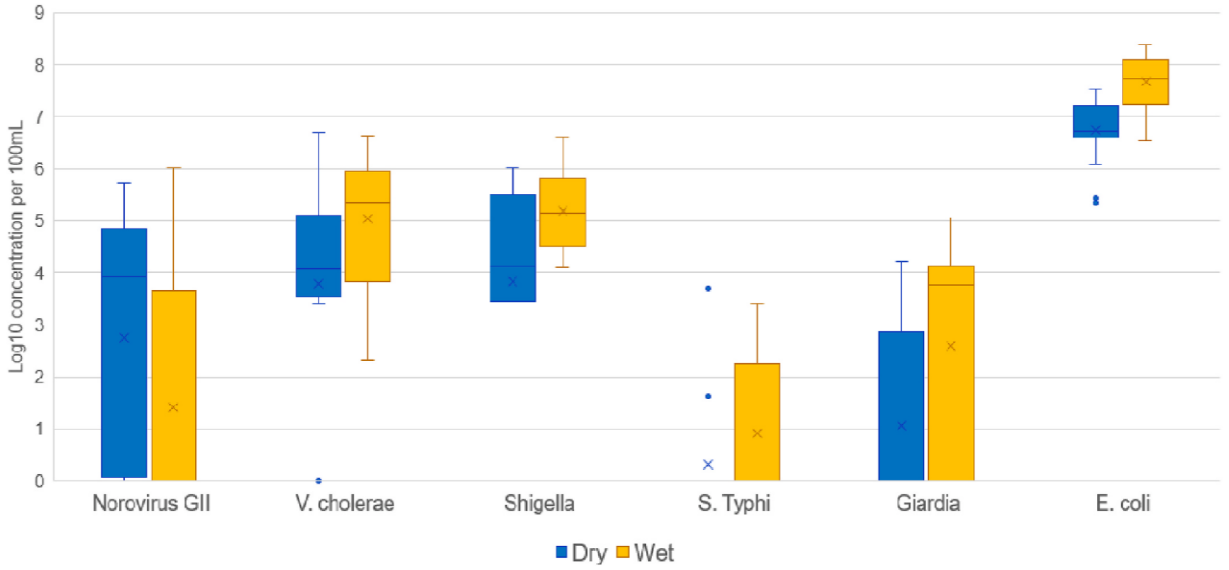


Fig. 1. Concentration of specific pathogens (equivalent genome copies per 100 mL) and **E. coli*, in drain water samples during wet and dry season Dhaka, Bangladesh **E. coli* (MPN per 100 mL) were detected by different method (IDEXX Quanti-tray technique).

Figure 2. Concentration (Mean Log10 EGC) of *E. coli* and pathogens in wet and dry season

…and limited improvement were seen in streets with a high proportion of septic tanks…

Study site (1500hh)
70% toilets to drain
24% toilets to septic tank to drain

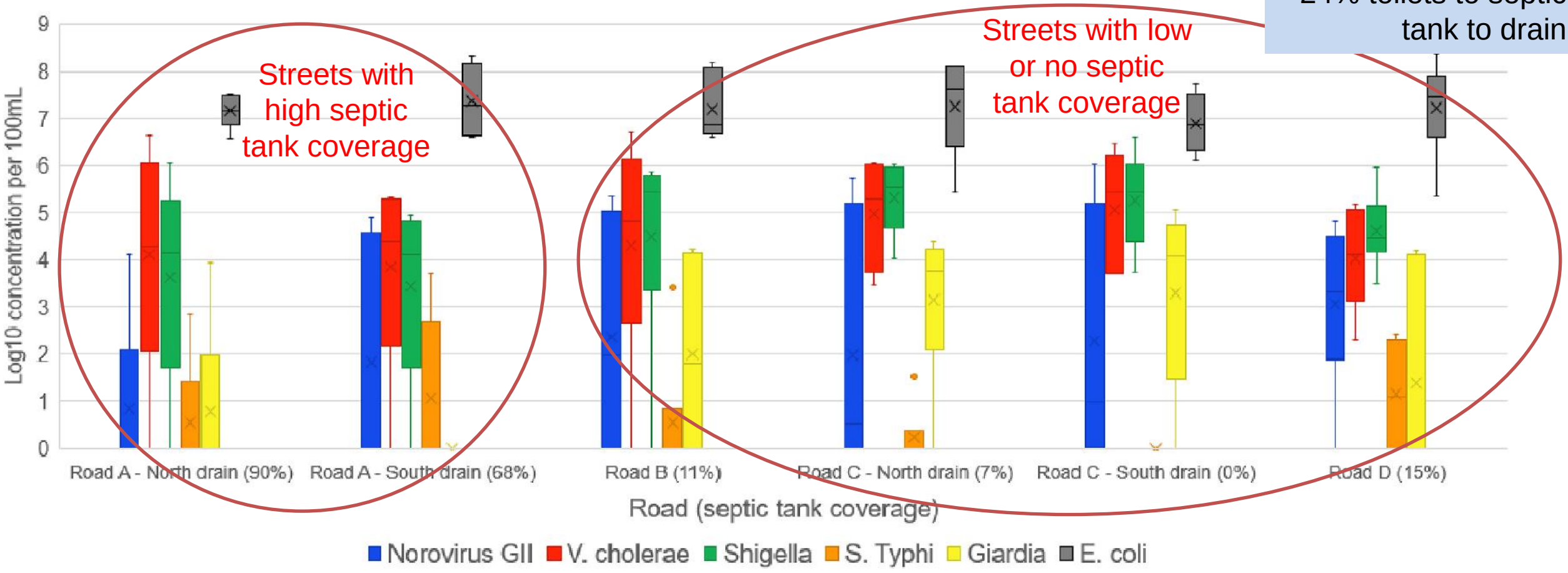
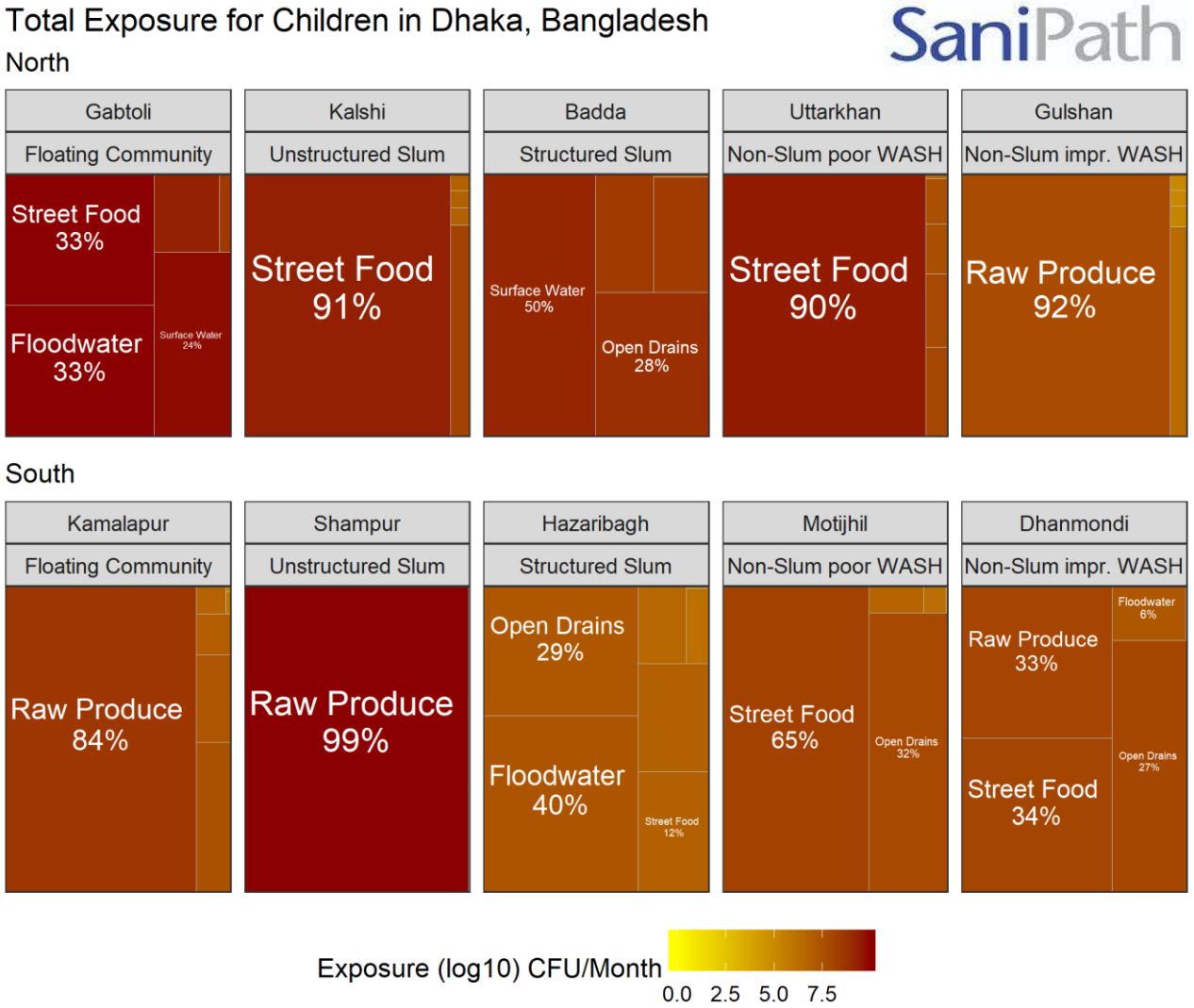


Fig. 2. Concentrations of pathogen (*equivalent genome copies per 100 mL) and **E. coli* in different drains in roads with high, low and no septic tank coverage in study site A at Mirpur, Dhaka 2019

**E. coli* (MPN per 100 mL) were detected by different method (IDEXX Quanti-tray technique).

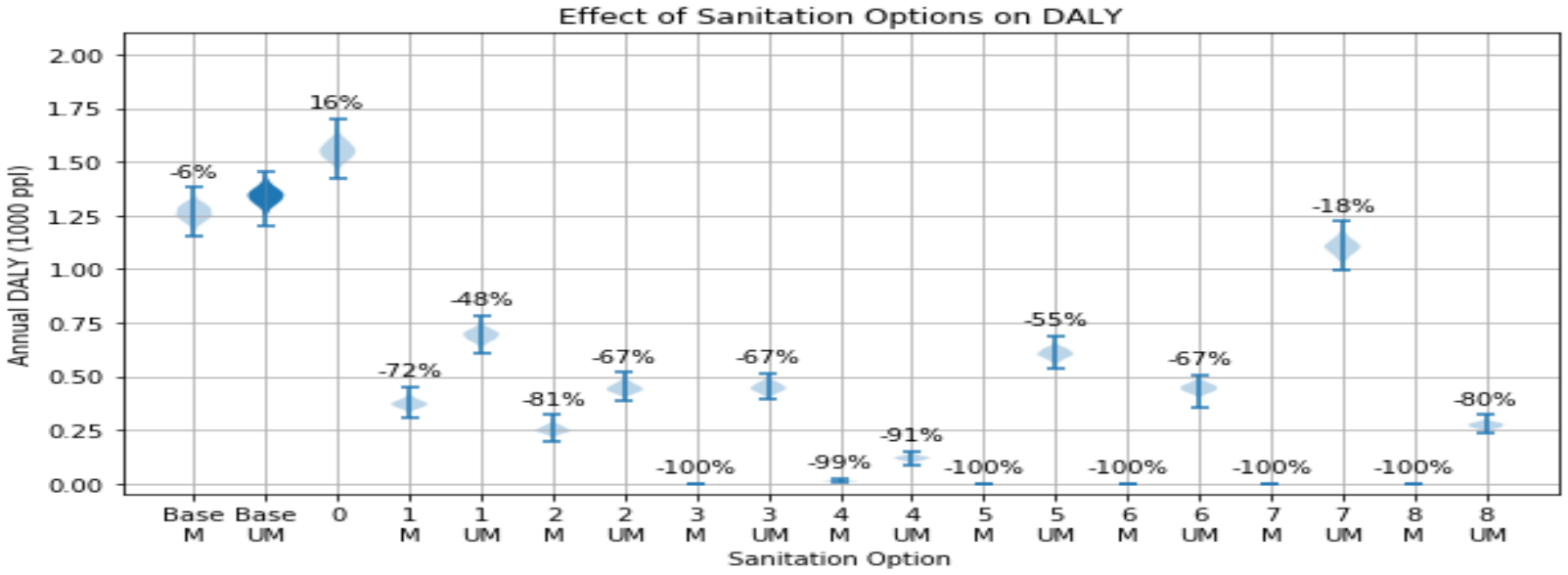
…which is a concern since we have evidence on faecal exposure to children in Dhaka

Figure: Study Site where above pathogens were measured



So what does this tell us about quality sanitation to protect public health

- Model developed to estimate the health risks in DALY and compare sanitation options
- Options developed to address the key exposure pathway in this slum – open drains
- Considered how the systems are operated and managed (e.g. emptying, leaking, overflow)
- Building more septic tanks connected to drains had limited benefit, even well managed
- Closed sewer pipes for wastewater or septic tank effluent with secondary treated could significantly reduce health risk. As could covering drains but this raises other problems in practice.



M = managed
UM = unmanaged

Reduction of Disability Affected Life Years (DALY) for different sanitation options

More to do! Remaining evidence gaps to achieve sanitation quality from a public health perspective

On-site sanitation is a key component for achieving city-wide inclusive sanitation initiatives, so it is critical that these systems protect public health.

Evidence gaps:

- Is there any/sufficient pathogen removal in “septic tank” systems in low-income urban settings as currently built and maintained, given potential for exposure to open drains, flood water and canals?
- What design, operation, and maintenance measures would improve the performance of these systems?
  - Eg. Does regular desludging improve septic tank performance in terms of microbial removal?
- What are effective and affordable options for safe on-site sanitation in low-income urban areas where there is no space for a soil absorption field or soak-away?
- Where would investments in on-site sanitation be most effective for improving sanitation quality and protecting public health?

Thank you!

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