

GLOBAL WATER PATHOGEN PROJECT
PART FIVE. CASE STUDIES

PATHOGEN FLOWS IN URBAN ENVIRONMENTS AND THEIR PUBLIC HEALTH RISKS: A NEW CONCEPTUAL APPROACH TO INFORM SANITATION PLANNING

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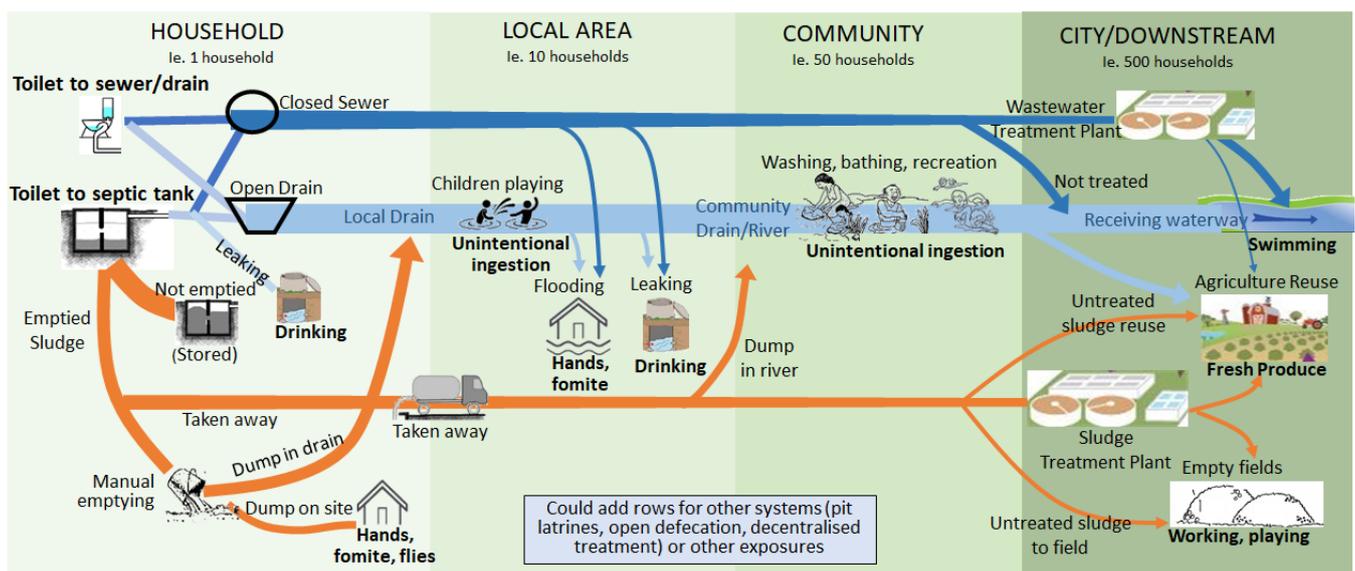
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Summary

Highlights

- Conceptual approach to assess how sanitation services (or lack thereof) are contributing to health risks by modelling pathogen flows in urban environments.
- Through a structured decision-support framework, provides a quantitative basis for comparison of the relative health impacts of sanitation option to inform decision making
- Considers all types of sanitation improvements across the entire service chain, and multiple pathogens and exposure pathways
- Provides a way forward to improve consideration of public health in sanitation planning in the face of data constraints that are typical in developing country urban contexts

Graphical abstract



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Risk Management Objective

Health improvement is often a key political driver for sanitation investment and there is growing evidence of the exposure risks and health impacts from pathogens in poor-sanitation urban environments. However, health is usually not explicitly considered when selecting sanitation improvement options, with investment

traditionally focused on centralised wastewater treatment plants at the city's periphery to protect downstream waterways. Through a systematic consideration of both the pathogen flows and exposure risks, this approach aims to inform sanitation investment decisions in developing countries by comparing predicted health risks of alternative sanitation.

Location and Setting

The conceptual approach was designed to be applied to suit the local urban context in developing countries and considers on and off-site sanitation across the service chain. The model was applied to a hypothetical case, based

on the sanitation system in Dhaka Bangladesh and global literature for pathogen excretion, reduction, exposure and illness. At this stage the findings are to be considered illustrative of the model's application, not reflective of the reality in Dhaka.

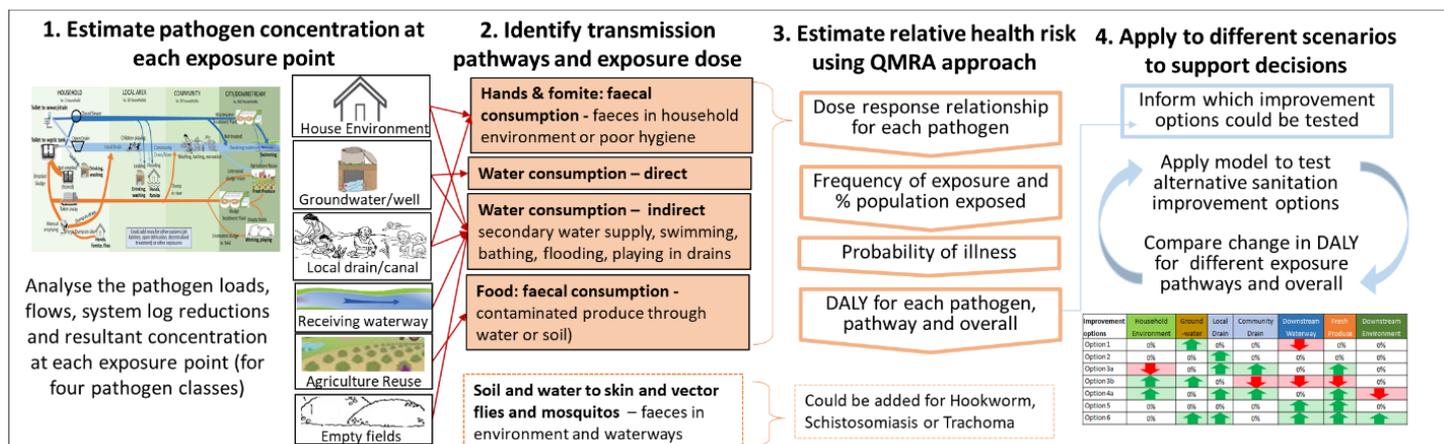


Figure 1. Steps of the spreadsheet-based model developed to apply the conceptual framework

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Description of the System

Through a source-pathway-receptor approach, the pathogen concentration in the environment due to faecal waste discharge across the sanitation service chain was estimated based on an excreta flow assessment (modified SFD) and GWPP data on pathogen removal in systems and the environment. The potential pathogen exposure from various pathways was then calculated using quantitative microbial risk assessment (QMRA) to quantitatively compare six improvement options based on their relative effect on disability life adjusted years (DALYs). It provides a systematic approach to assess how sanitation services (or lack thereof) are contributing to health risks of varying magnitudes, and what the most appropriate solutions might be.

Outcome and Recommendations

Through a holistic approach that considers all types of sanitation improvements across the entire service chain, and multiple pathogens and exposure pathways, this concept provides a way forward in the face of data constraints that are typical in developing country urban contexts. Further development of the proposed conceptual approach on the basis of empirical research in selected case-study locations of varying conditions is suggested.

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