COVID-19 monitoring with sparse sampling of sewered and non-sewered wastewater in urban and rural communities

*Dhammika Leshan Wannigama, Mohan Amarasiri, Parichart Hongsing, Cameron Hurst, **Charin Modchang**, et al.*

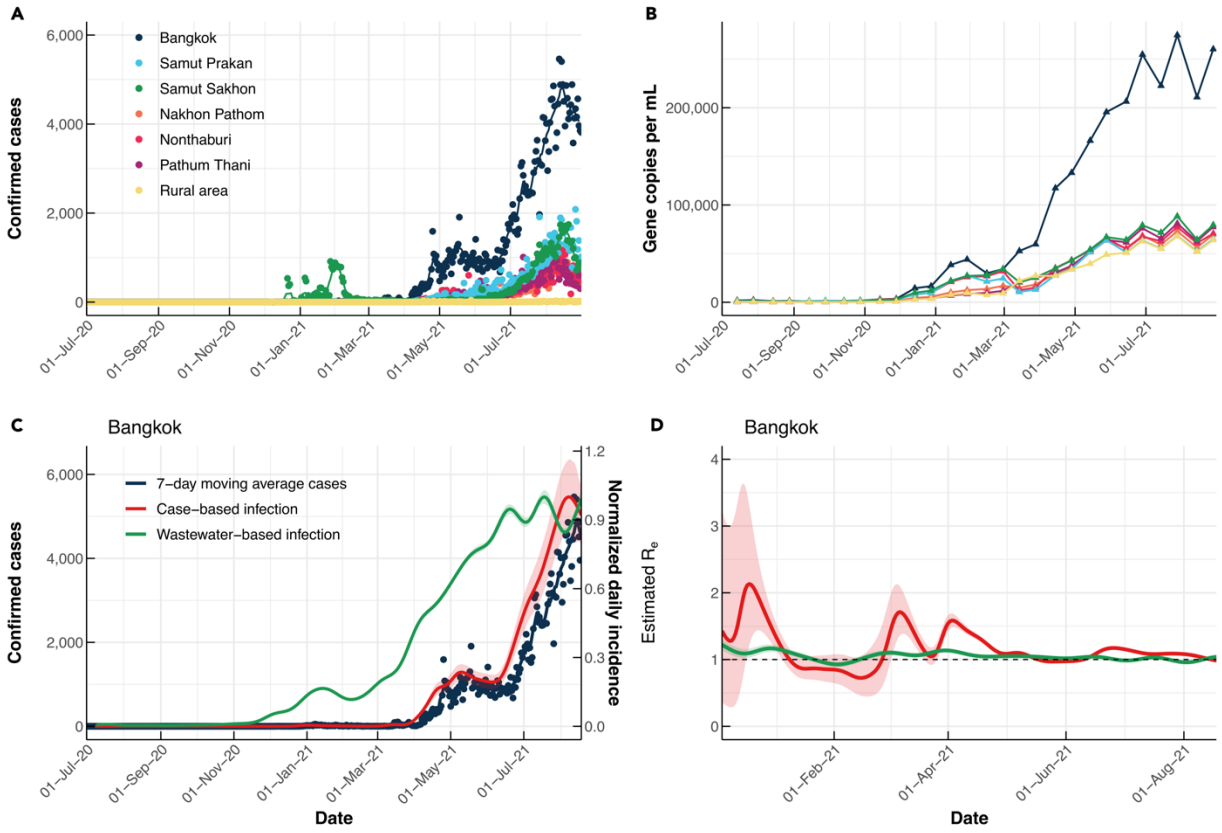
Rationale and objective: Equitable SARS-CoV-2 surveillance in low-resource communities lacking centralized sewers is critical as wastewater-based epidemiology (WBE) progresses. However, large-scale studies on SARS-CoV-2 detection in wastewater from low-and middle-income countries is limited because of economic and technical reasons.

Summary: In this study, wastewater samples were collected twice a month from 186 urban and rural subdistricts in nine provinces of Thailand mostly having decentralized and non-sewered sanitation infrastructure and analyzed for SARSCoV-2 RNA variants using allele-specific RT-qPCR. Wastewater SARS-CoV-2 RNA concentration was used to estimate the real-time incidence and time-varying effective reproduction number (Re). Results showed an increase in SARS-CoV-2 RNA concentrations in wastewater from urban and rural areas 14–20 days earlier than infected individuals were officially reported. It also showed that community/ food markets were ‘‘hot spots’’ for infected people. This approach offers an opportunity for early detection of transmission surges, allowing preparedness and potentially mitigating significant outbreaks at both spatial and temporal scales.

Outcome: WBE can help local public health officials bypass access and affordability issues associated with diagnostic testing and provide action-oriented insights about where to focus public health resources, such as booster vaccination, mask-wearing, and social distancing and also to evaluate the progress of these infection control programs. Wastewater can also help reduce the risk of transmission from people with asymptomatic infections. On top of this, it is our assertion that WBE discipline itself would benefit from more studies based on decentralized and non-sewered sanitation systems in low and middle-income countries.

Research grant and acknowledgement: 1. The National Science and Technology Development Agency, Thailand (PO20008199). 2. The National Research Council of Thailand. 3. The Thailand Center of Excellence in Physics (ThEP). 4. The Centre of Excellence in Mathematics, Thailand.

Related SDGs goal: 3. Good health and well-being.



Graphical summary: Estimation of infection incidence and effective reproductive number for SARS-CoV-2. (A) confirmed positive cases, (B) RNA concentration in wastewater, (C) comparison of daily SARS-CoV-2 confirmed cases, infection incidence estimated based on confirmed cases, and infection incidence estimated based on SARS-CoV-2 RNA concentration in wastewater for Bangkok, and (D) comparison of the effective reproductive numbers estimated using the case-based infection incidence (red line) and wastewater-based infection incidence (green line). The ribbons display the standard deviation of 1,000 bootstrap replicates.

Related publications:

Dhammika Leshan Wannigama, Mohan Amarasiri, Parichart Hongsing, Cameron Hurst, Charin Modchang, et al. COVID-19 monitoring with sparse sampling of sewered and non-sewered wastewater in urban and rural communities. iScience. (2023) 26(7):107019. https://doi.org/10.1016/j.isci.2023.107019