Thesis Portfolio

Sewage Surveillance Tool for Detection of SARS-CoV-2 in Urban Bangladesh
(Technical Report)

Beyond the biomedical effects: Health disparities and missing components of COVID-19 mitigation in Bangladesh
(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The Coronavirus disease 2019 (COVID-19) has had a severe physiological effect on millions globally, and therefore many health systems have had to divert resources and personnel to mitigate the disease. Bangladesh, in particular, is densely populated and has faced challenges in tracking the disease and managing a surplus of COVID-19 cases. During high surges of the disease, lockdown orders have been enacted in Bangladesh that limit human movement and have placed severe restraints on the financial security and access to essential health services. Many health programs that serve vulnerable populations like women, children, and lower-income individuals were made unavailable or inaccessible when these COVID-19 mitigation strategies were employed. Therefore, the STS portion of this thesis conducts an analysis of three major health disparities that were caused as a result of COVID-19 solutions in Bangladesh and employs Actor Network Theory as a STS framework that explores the sociocultural power-imbalance among COVID-19 solutions and discusses how forgotten actors can be incorporated into future pandemic management strategies.

Among the challenges faced with COVID-19 mitigation in Bangladesh have been asymptomatic testing and rapid wide-spread transmission of the disease in dense areas, such as the capital city of Dhaka, which has a population of about 21 million people. Wastewater surveillance has proven to be a successful and accurate method of identifying the SARS-CoV-2 virus several days before symptoms are presented and is of no cost to residents in the study area. The Engineering capstone portion of this thesis explains the development and application of a sewage surveillance tool for tracking of SARS-CoV-2 in urban Bangladesh. The sewage surveillance tool is in the form of an online dashboard, and is the first of its kind to provide

spatiotemporal tracking of the both COVID-19 clinical case data and the viral load of SARS-CoV-2 found in wastewater across 8 wards and 33 sewage catchment sites in Dhaka. The dashboard was developed to inform both public health officials and residents in Dhaka about informative trends in sewage surveillance and to identify locations that may experience a future increase or decrease in cases.

The sewage surveillance tool for tracking of SARS-CoV-2 in urban Bangladesh and STS analysis of health disparities caused by COIVD-19 mitigation in Bangladesh share more than just their geographical application. The dashboard serves as an example of holistic data that aims to provide a picture of the health of all people in the study areas, regardless of their economic standing or background. Wastewater surveillance creates no barriers to health services and persists even when mitigation methods like lockdown or inequitable access to traditional COVID-19 tests limit health access for vulnerable populations. If placed within the context of Actor Network Theory analysis, the sewage surveillance tool would be an example of COVID-19 mitigation that enrolls all potential actors and has been successfully mobilized by the support of the Government of Bangladesh and major funding sources. More holistic and equitable health solutions need to be considered when developing pandemic mitigation plans in Bangladesh and that is what this thesis, as a whole, aims to capture.