Sewage Management Among Informal Settlements in Mumbai, Maharashtra, India
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Introduction

The global population continues to grow at an alarming rate. Consequently, the population living in urban areas has increased by eleven times since the turn of the century (Singh et al. 2018). While India is known to be a heavily populated country, the city of Mumbai takes its place as one of the most populated areas in the world, home to nearly 22 million people within just 600 square kilometers. This megapolis also hosts Dharavi, often considered "Asia's Largest Slum." While various informal settlements make up around 11% of the land area, over 40% of the city's population live in these conditions (Kuffer et al. 2018).

The lack of quality water, sanitation and hygiene (WaSH) among informal settlements in Mumbai is a public health and equity crisis needing to be addressed. While the Swachh Bharat Mission (SBM) has yielded successes in eliminating open defecation across the country, the slums of Mumbai have not seen such progress (Koppikar 2017). The local government has struggled to integrate slums into the main sewage system and has failed to provide alternatives to these communities, resulting in continued open defecation (Desai 2023).

Currently, there are around 8,000 community and public restroom facilities with a total of 80,000 toilets. This only yields around 190 users per toilet, far from the SBM standard of one toilet per 25 women or 30 men. In addition, half of the facilities lack electricity, presenting safety concerns, especially at night for women and children (Desai 2023). Furthermore, there are serious construction threats, with many instances of explosions and collapsing floors, resulting in individuals perishing in septic tanks (Koppikar 2017).

While it is estimated that around 25% of the city's sewage treated within the municipal system comes from these informal settlements (Tembhekar 2018), only a quarter of the facilities used by slum inhabitants are connected to the city sewage network and 70% of these still depend on a soak pit or septic tank system (Desai 2023). These systems are an improvement compared to open defecation, but every year the rainy season causes overflows and flooding of nearby households (The World Bank 2006). Ultimately, it is still estimated that over 80% of the city's sewage is released untreated into the Arabian Sea (Anand 2022). Such environmental contamination harms local ecosystems, including the large fishing industry of Mumbai, affecting both the livelihoods of these professions and the health of those consuming these products. The contamination also contributes to the spread of disease and results in malnutrition. Each year in India, hundreds of thousands of children die from diarrheal diseases, and failures of sewage management contributes to these numbers (Singh et al. 2018).

The concern and consequences of the poor sanitation situation among Mumbai slums are apparent, but there are many challenges to improving the WaSH landscape in these spaces. Some physical barriers to improved infrastructure include the high densities of population, non-uniform street patterns, and lack of access to the main sewage network (PAS 2014). There is also controversy around ownership, especially when local communities are not able to afford sanitation services themselves (Desai 2023). Moreover, the topic of sewage is not a pleasant one,

contributing to the lack of attention from political leaders (Prasad 2019). Despite how overwhelming the sanitation circumstances are among Mumbai's informal settlements, there are existing policies and technologies in place tackling the issue.



Photograph by: Johnny Miller, Unequal Scenes



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Existing Policies and Technologies

Mumbai Sewage Disposal Project (MSDP) was established to improve the quality and capacity of sewage management throughout the city. One goal of the project was to construct and upgrade seven sewage treatment plants, which was expected to take 4-6 years, but has yet to be completed. One reason for this is because the government has not agreed on water quality standards for these facilities; official quality standards have changed throughout the process. This has materialized much debate over quality expectations and the costs associated with meeting these metrics (Anand 2022). Unfortunately, the legal debates and bureaucracy have delayed the improvement of sewage treatment plants.

Mumbai Slum Sanitation Program (SSP) is a program within the MSDP attempting to facilitate collaboration in supporting sanitation facilities. The program is designed as a demand-responsive and community-participatory approach to toilet block implementation. This program yielded some success, supporting many public toilets and facilitating partnerships between governing branches, non-governmental organizations, and community members. However, there were barriers as slum communities were not willing to invest the upfront fees, especially when there were free alternatives. Further issues with lack of electrical and plumbing infrastructure slowed the program benefit (The World Bank 2006).

Maharashtra Housing and Area Development Authority (MHADA) constructs 65% of toilet blocks and allows for free use. The major downfall of these facilities is the lack of ownership and upkeep, leaving many as decaying pits. They are often poorly constructed, pose many safety concerns, and have no water supply (Desai 2023).

Truck-operated suction-hose sludge removal services support waste removal among toilets which are not connected to the main sewer system. Unfortunately, this critical work is often overlooked, and there are many hazardous aspects of their operations. First, the trucks are often unregistered and unlabeled. Second, the workers do not have access to soap and water while conducting the work and do not wear protective gear. Third, there is not a designated disposal zone, resulting in dumping sludge at night in illegal areas. This is often land just outside the urban borders, storm water drains, and farmlands (Prasad 2019).

Consortium for Decentralized Wastewater Treatment System Dissemination Society (CDD) supports adaptation of technologies to more affordably treat waste water locally on a smaller scale, while using renewable and more accessible resources such as bacteria, plants, and gravity rather than electricity and chemicals to treat the waste water (Chaturvedi 2017).

Policy Recommendations

Policy Recommendation #1: Promoting individual toilets in slums
Rather than relying on community toilets, promoting individual toilets in slums may be a promising approach. Surveys report that 83% of Mumbai slum residents would be willing to personally fund to construct a toilet if the government provides sewage management services (Desai 2023). More reliance on household-level toilets could bypass many of the challenges

around ownership and maintenance, safety for vulnerable communities, and availability of facilities as needed. Some barriers to implementing this approach may include challenges receiving government support for such operations, construction challenges among informal settlements, and costs of continued maintenance among lower-income households.

Policy Recommendation #2: Support for truck-operated suction-hose removal services
Despite the unpleasant topic of fecal sludge removal, these operations are a critical aspect of waste management, especially in areas lacking access to main sewage networks. Truck-operated suction-hose removal services operate throughout India, yet receive little support from the sewage treatment system, resulting in illegal dumping and other poor practices (Prasad 2019). These important operations would be much more effective if provided an approved dumping site, preferably a domain that connects to a quality treatment plant. Additionally, policy should be established around worker conditions and safety; personal protective equipment should be mandated, soap and water should be provided, and vehicles should be registered and approved.

Policy Recommendation #3: Decentralized waste water treatment
It may be unreasonable to expect all waste to reach an official city sewage treatment plant, but locally treated waste treatment may be possible. The CDD currently supports local waste treatment favoring accessible methods. There may be concerns over the quality of output from less sophisticated treatment centers, however the result would still be an improvement over the current circumstances where there is failure to treat at all.

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