

Control at the sewers to curb the COVID-19 pandemic in India- is the negligence perilous?

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Abstract

COVID 19 PANDEMIC has stricken in multiple waves, crippling the nation with each strike. Attempts at curbing its spread has been focused on a few established modes of transmission. Current literature evidence suggests possibility of Feco-oral transmission, detection of viable virus in stools of covid infected individuals, viral shedding several weeks post recovery and potential persistence of viable virus in sewage. Guidelines and protocols laid down have not included this potentially dangerous mode of spread. Many countries including Australia, Finland etc have utilized waste water epidemiology as a tool in surveillance. This can be used as a warning signal for early detection and control. This review article proposes the addition of new guidelines in this spectre to aid in curbing the spread of pandemic as well as adopting sewage surveillance as a tool in primary prevention.

Keywords: Feco-oral transmission, Sewage Surveillance, Waste Water Based Epidemiology, SARS-CoV2, Sewage treatment plant

Abbreviations

SARS-CoV-Severe Acute Respiratory Syndrome Coronavirus2,
CDC- Centres for Disease Control and Prevention, WHO -World Health Organization,
STP-Sewage treatment Plant, WBE-Waste Water Based Epidemiology

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Introduction

Ever since its entry into our country, all attempts at controlling the COVID 19 pandemic has offered only a brief respite. It is imperative that all modes of transmission be thoroughly reviewed at this juncture as the death tolls are peaking every day. The current guidelines on controlling the spread of SARS CoV2, viz social distancing, masks, isolation of infected individuals etc has been established on a few modes of transmissibility that focuses to prevent person to person transmission.

Recent literature emphasizes a strong possibility on feco-oral transmission of the virus. In a country like India, where the ground rules of sanitisation of waste water has not been given due relevance, persistence of the virus in the sewage and its transmission through such a route could give an insight as to why we are not able to bring down the numbers despite the measures followed for the past several months.

Although not considered highly pathogenic historically, Coronaviruses have changed their behaviour over the last decade , with the outbreak of SARS (severe acute respiratory syndrome) in 2002. The highly pathogenic coronaviruses include SARS-CoV, Middle East respiratory syndrome coronavirus (MERS-CoV) and SARS-CoV-2 (the Covid-19 virus), with its multiple variants that has emanated in the last few years. The respiratory tract is affected most, through attachment to the angiotensin converting enzyme 2 (ACE2) receptor.⁽¹⁾ Most of the research and preventive guidelines have been focused on the clinical symptoms affecting the respiratory tract. The gastro intestinal symptoms and the high expression of ACE2 receptors in the intestine⁽²⁾ are not being looked upon with enough significance.

Established Modes of Transmission and Current Guidelines

The established modes of transmission include inhalation of air carrying aerosols and fine droplets of infectious virus, splashes and sprays deposited on mucous membranes and transmission of the virus to the mucosa through hands soiled from contaminated inanimate surface⁽³⁾

The current guidelines on prevention of transmission include social distancing, wearing masks, Avoiding closed, crowded spaces and close contacts. Regular hand sanitisation and sanitisation of

inanimate surface that are frequently exposed. Home and self-isolation in case of symptoms.⁽⁴⁾

Feco-Oral Transmission

In 1972, White et al classified water related diseases functionally, of which two may be relevant in COVID 19 transmission; Water borne (water as a passive vehicle for transmission of infectious agent) and water washed (prevention of infection by provision for sufficient water for personal and domestic hygiene).⁽⁵⁾ In regard to excreta related diseases classification by Feachem et al, 1983, two categories pose relevance; SANITATION1, nonbacterial Feco-oral infections of low infectivity which spread when hygiene is compromised and SANITATION 6 which includes transmission through insect vectors which can be even more worrisome. In addition, another category that requires further attention is the “water cleaning category” wherein contaminated water used to clean inanimate surfaces can come in contact to oral mucosa through hands.⁽⁶⁾

Gastrointestinal symptoms such as Diarrhea, nausea, vomiting, abdominal pain, anorexia and often constipation , malena , acid reflux etc have been reported in many patients.⁽²⁾

A meta-analysis that included 10,089 patients concluded that the pooled prevalence of gastrointestinal symptoms were diarrhoea (7.7%), nausea or vomiting (7.8%), and abdominal pain (2.7%).⁽⁷⁾ Detection of viable SARS-CoV-2 in stools of COVID-19 patients has been reported^(8,9) and virus RNA has been found in sewage⁽¹⁰⁻¹²⁾ raising the possibility of faecal-oral transmission⁽⁶⁾ A literature review by Singer et al concludes that SARS CoV 2 virus is detectable in wastewater in presence of active or convalescent cases and that the use of this to estimate the prevalence is beneficial as it is not affected by age, gender or racial differences.⁽¹³⁾ It has been suggested that SARS-CoV-2 may persist longer in the digestive tract than in the respiratory tract⁽¹⁴⁾ Wu et al. (2020) found that the faecal samples of a patient in China were continuously positive for the viral RNA even after 33 days of seeing negative results for the respiratory samples⁽⁹⁾

Wastewater Based Epidemiology- its Application in Surveillance and its Potential Application in Modifying Preventive Strategies

Ahmed et al in 2020 reports to conduct the first

Wastewater-based epidemiology (WBE) study for SARS CoV2 in Australia. They concluded that wastewater monitoring can provide early warning signs especially when asymptomatic or mildly symptomatic cases are present in the community.⁽¹⁰⁾

In 2020, Nemudryi et al concluded that community qRT-PCR wastewater monitoring for SARS-CoV-2 RNA provides a measure of viral prevalence in real-time. However, the study failed to correlate clinical cases to these results.⁽¹⁵⁾

The World Health Organization recommends the used of common waste water treatment methods such as chlorination and UV light to inactivate the SARSCoV2 virus. However, its adequacy is questioned through several studies that suggested the use of multiple methods of disinfection such as anaerobic digestion and pond aeration, moving bed biofilm reactor (MBBR), and sequencing batch reactor (SBR) technologies, as well as secondary treatment combined with a tertiary disinfection step using peracetic acid, high-intensity UV lamps, or chlorine to reduce the virus concentration.⁽¹⁶⁾Zhang et al suggested that current disinfection guideline by WHO and China CDC might be inadequate to secure a complete removal of SARS-CoV-2 in medical wastewater after reporting an unexpected presence of SARS-CoV-2 viral RNA in septic tanks after disinfection with 800 g/m³ of sodium hypochlorite.⁽¹⁷⁾

Wastewater-based epidemiology (WBE) is beneficial as viral shedding subsequent to initial infection precedes the confirmed cases. This viral shedding can be accounted for nearly 100 million genome copies per liter of wastewater generated⁽¹⁸⁾

La Rosa et al. detected SARS-CoV-2 in wastewater of Milan and Turin two months before the first Italian case of COVID-19 was reported in February 2020⁽¹⁹⁾ Chavarria-Miro et al. detected the presence of SARS-CoV-2 RNA in a wastewater sample from Barcelona in January 2019, 41 days before Barcelona's first confirmed case in February 2020.⁽²⁰⁾

Vallejo et al 2021, reports a waste water-based epidemiological statistical model with 90% reliability and universal applicability which takes into account the entire population of the area , symptomatic as well as assymtomatic which help in tracking the disease for potential outbreaks.⁽²¹⁾

The factors to be taken into consideration in sewage treatment include the fact that sewage protected by organic matters are not susceptible to adequate disinfection, thus solid waste should be separated from hospital sewage and the fact that non centralized disinfection systems in isolation cabins can serve as a secondary source of infection⁽¹⁷⁾

Finland, Spain, Australia, and Netherlands have already launched national wastewater surveillance programs .⁽¹⁶⁾Since WBE can detect the virus earlier than the appearance of confirmed clinical cases, its importance in preventing an outbreak or wave is crucial.

Recommendations

The drainage and sewerage system standards in India are lagging far beyond the community needs. However, Urban areas and metropolitan cities are known to have STPs which utilize the waste water for further use as in irrigating agricultural lands or for other non drinking purposes. These can be put into effective use for surveillance as the pandemic is striking in multiple waves and with the vaccination process lagging behind the infectious surge.

Although many countries have adopted the WBE based surveillance system, Researches towards this end are lacking in our country. The potential for sewage as a source of infection also should not be neglected. Many gated communities and apartment complexes utilizes the retreated water efficiently in many cities . The prime STPs in major cities are alternate sources of irrigation.

In the current scenario where the measures to curb the Pandemic have been proven inadequate with increasing numbers of morbidity and mortality, Researches towards this end should be encouraged and adequate steps should be taken to prevent Feco-Oral Transmission.

1. At areas where STPs are non functional, People should be made aware of the importance of containing the sewage of infected persons and its proper disinfection with as much importance given to wearing Masks, social distancing and Hand sanitisation
2. The following pictorial representation can be adopted to the existing measures of Primary prevention at areas where WW/STPs are functional:

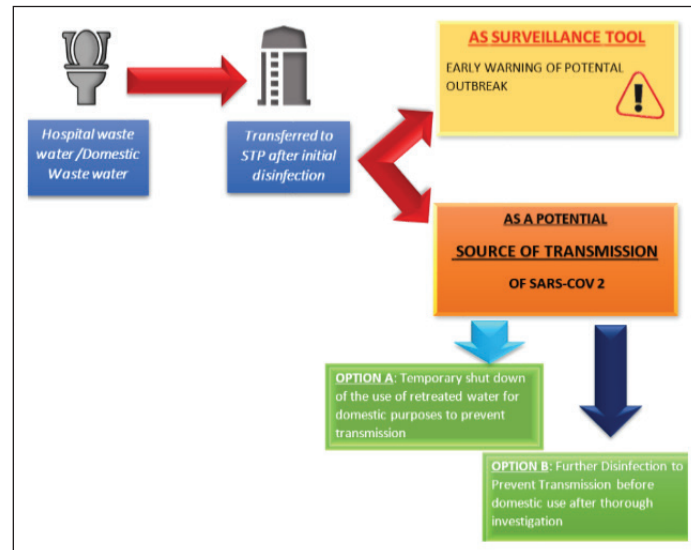


FIG 1: The waste water from COVID isolation hospitals and homes should be directed to a separate STP (sewage treatment plant), wherein it can be used as a surveillance tool to provide early warning of a potential outbreak. As it is a potential secondary source of transmission, additional disinfection must be carried out before implementation for domestic use.

Conclusion

Given the fact that substantial literature evidence supports the possibility of existence of viable virus in sewage, waste water treatment standards has to be escalated to meet the requirements of eliminating it as a potential source of transmitting the virus. In a developing nation like India, financial constrains can make additional disinfection of waste water difficult. In which case, we can choose to prevent usage of the retreated water for a substantial time. We can also adopt the sewage as a surveillance tool like many other countries for early warning of an outbreak to implement stringent controls at an earlier stage and thus diminish the morbidity and mortality rates.

Conflicts of Interest

No conflict of interest declared.

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Ethical Clearance

Ethical clearance not required

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