Wastewater Based Epidemiology

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Wastewater-Based epidemiology (WBE) is spreading of any disease or disorder caused by the chemicals or pathogens that come from waste materials such as urine, fecal materials, medical waste or any solid or liquid waste product. The extraction, detection, analysis, and interpretation of chemical/biological compounds (biomarkers) excreted in the sewage system can eventually contribute to WBE. So wastewater analysis could be equivalent to community-based urine and fecal analysis that can subsequently give a reflection of community health. Under pandemic situation with time limitations and restrict access to massive diagnostic, an alternative approach as a complementary tool to investigate virus circulation in the community is essential. In the situation of limited and time-consuming diagnostic tests, monitoring sewage systems could better estimate the spread of the virus and determine whether there are potential cases because wastewater surveillance can also account for those who contract mild or asymptomatic state.

Keywords: wastewater-based epidemiology ; SARS-CoV-2 ; COVID-19 ; coronavirus ; detection and quantification protocols

1. Surveillance System

Fast and effective surveillance systems works as the bedrock for prevention and control of infectious outbreak. It is because of dissimilar conditions of different health of various individuals on which different entities around the world are working on it[1][2][3]. Under such and this pandemic situation, having time limitations and restrict access to massive diagnostic centers, an alternative approach as a complementary tool to investigate virus circulation in the community is essential[4].

The importance of such a surveillance system has been more highlighted with the emergence of coronavirus respiratory disease (COVID-19) In December 2019, Wuhan, China[2][4]. Although air mediated infection mode of the COVID-19 was first not accepted by many including WHO, now it is an well established fact that SAR-CoV-2 is air borne in nature. This fact has been accepted prior to the 2nd wave of COVID-19 hit the world and under the prevalence of the 3rd wave of the disease, Wastewater-based epidemiology (WBE) now gained most of the attraction to be studied.

Since many SARS-CoV-2 patients might have exhibit few or non-specific symptoms, rapid and accurate diagnosis of potential virus carriers and identification of asymptomatic cases is a critical step to suppress the risk of disease transmission at the early stage[5]. This is because in many parts of the word, waste eater detection of the virus has been found to be positively correlated with the unset of the disease in communities.

2. Wastewater-Based Epidemiology

Wastewater-based epidemiology provides comprehensive information on community health status in near real-time based upon analyses of wastewater compounds. More importantly, the data from WBE is not only useful to detect the onset of pandemics but also is useful to detect various other toxins and pathogens that can cause massive health damages to the communities. All the physical, chemical and biological substances of the community are excreted to the sewer systems and transported to wastewater treatment plants (WWTP) that serves as catchment areas[2]. So, wastewater analysis could be equivalent to community-based urine and fecal analysis that can give a reflection of community health state[3][6][7]. The obtained data are not only useful for the adaption of preventives against water water treatment but also useful for the treatment of solid waste (that act as carrier of many compounds and pathogens) including soil based contaminations.

This approach was previously used to monitoring pharmaceutical consumption, early detection of infectious outbreaks, and detection of viral pathogens such as adenovirus, poliovirus and hepatitis A[8]. Since the first report of SARS-CoV2 detection in patient’s feces and identification of virus genomes in wastewater in the Netherlands, Australia, and Paris, France, WBE has been proposed as a surveillance tool to investigate the presence and prevalence of the virus in the

community[9][10]. In the situation of limited and time-consuming diagnostic tests monitoring sewage systems could provide a better estimate of the spread of the virus and determine whether there are potential cases because wastewater surveillance can also account for those who have only mild or no symptoms[11].

3. WBE and COVID-19

Early and population-wide scale analysis, represent the WBE as a potential early warning tool to strengthen health entity's preparedness and limit the health and economic burden caused in (re) emergence of the infectious outbreak[3].

Despite the promising aspects of utilizing WBE in COVID-19 surveillance, there are still challenges in representative sampling, virus recovery, and concentration methods as well as population normalization and ethical issues that should be considered[12]. Establishing the water borne nature of COVID-19 is still wanting because only waste water surveillance for the detection of the viral RNA has been done but their infectious nature has to be correlated with clinical states.

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