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Wastewater-Based Epidemiology to Infer COVID-19 Transmission

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Abstract

A promising and novel method for measuring a wide range of illicit drugs consumed in communities is wastewater-based epidemiology. Wastewater-based epidemiology is a promising method for comprehending the prevalence of viruses at the community level, just like it is for illegal drugs. Due to the need for extensive laboratory testing, the ongoing coronavirus disease 2019 (COVID-19) pandemic placed an unprecedented strain on diagnostic and public health laboratories worldwide. A centralized wastewater-based epidemiology (WBE) approach, in which samples are collected at WWTPs, has been shown to be applicable in numerous studies.

Keywords: Epidemiology

Introduction

A more recent idea for WBE is a decentralized approach in which samples are taken at polluted water bodies and various points in the sewer system. The second is especially significant in nations where there are insufficient connections between homes and municipal sewage pipelines, resulting in the direct discharge of untreated wastewater into environmental waters.

By monitoring wastewater in areas of the population where an outbreak is likely to occur, such as student dorms, retirement homes, and hospitals, a decentralized approach can be utilized to focus the value of diagnostic tests in what we refer to as targeted-WBE. For an affordable, long-lasting, and successful WBE implementation in high-, middle-, and low-income nations, a combination of centralized and decentralized WBE should be considered.

Viruses' discovery and diagnosis have become increasingly important in clinical diagnostics and public health as a result of the constant changes in their emerging dynamics. Zoonoses have emerged and reemerged as a result of climate change and its impact on vector distribution, as well as the globalization of travel and trade in pets and animal products, bushmeat trade, political instability, and bioterrorism. Viruses that were once restricted to a single host species or geographic region may now appear in unexpected locations, causing clinicians who are ill-prepared to recognize new syndromes or pathogens using their current diagnostic tools to become perplexed.

The most precise method for determining active transmission and disease prevalence is individual sampling and testing. However, in many nations, the time and space required for individual testing to achieve sufficient penetrance to obtain information is unreasonable and financially prohibitive. In addition, clinical diagnosis-based surveillance systems are heavily dependent on the reporting of clinical symptoms, their severity, and their relationship to the population's existing diseases. This can result in a significant underestimation, which is made worse by infections that don't show symptoms [1-5].

Discussion

WBE (wastewater-based epidemiology) was proposed in response to these difficulties. WBE was first described in 2001, and its initial application was to trace cocaine and other illegal substances. This method assumes that any substance that is stable in wastewater and excreted by humans can be used to determine the initial concentration. WBE is a very useful tool for generating data on illicit drug use and can quickly detect trends in the consumption of illicit drugs, according to a recent review.

WBE can also be used to treat infectious diseases, just like illicit drugs. Since viruses cannot grow outside of host cells, their concentrations in wastewater may represent those excreted by the relevant population. As a result, WBE is a promising strategy for figuring out how prevalent viruses are at the community level.

The term "centralized WBE" refers to the widespread use of WBE based on samples from raw sewage treatment plants. In contrast, samples from rivers, sewer networks, and sewage collectors have also been used in studies instead of samples from WWTPs (decentralized WBE). The ongoing COVID -19 pandemic and the concept of a decentralized approach to wastewater-based epidemiology are the focus of our discussion in this overview. The generated data that represent the population being studied may be affected by the temporal and spatial difficulties associated with WBE sampling. The anticipated critical pathways need to be the basis for the sampling time. It is necessary to take into consideration the catchment area's size, its susceptibility to daily shifts in water flow, and the virus detection rates. Autosamplers with cooling units that help prevent virus degradation are frequently used to collect composite samples over time. Temperature has an effect on viral degradation and fate, and it may be different in systems with septic tanks, catchment basins, and open environments than in systems with enclosed underground sewers and storm tanks. In contrast to rural wastewater systems, urban wastewater systems collect the wastewater of the entire population through catchment basins that can be used to divide the population. In rural areas, there may be no wastewater collection systems and no proximity to testing facilities. Urban wastewater systems are able to provide a sample that is more representative than rural systems, despite the fact that industrial wastewater and other types of wastewater can dilute viral particles. Accessing the viral load in wastewater and preventing disease spread throughout the community are both dependent on weather conditions, such as rain-induced dilution.

One of the most crucial steps in WBE is the measurement of viruses

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because an increase in the concentration of viruses in wastewater can indicate the onset of future diseases, trends in infections, and hospitalizations. Urea, bile salts, ethanol, phenol, polysaccharides, sodium dodecyl sulfate, tannic acid, humic acids, and melanin are all common qPCR inhibitors found in wastewater. There are a lot of proteins, including collagen, myoglobin, hemoglobin, lactoferrin, immunoglobulin G (IgG), and proteinases, that are known to inhibit qPCR. Additionally, high sensitivity methods are required due to the small viral particles that are frequently present in environmental samples. Before sub-atomic recognition of viral RNA or DNA, a fixation step is generally utilized as a preliminary step preceding sub-atomic identification. A lot of people use adsorption-elution-based methods to concentrate enteric viruses. Electropositive or electronegative filters, flocculation for sedimentation, ultracentrifugation for size exclusion, and ultrafiltration are used in these primary concentration techniques. Classical reverse transcription PCR (RT-PCR) and reverse transcription real-time PCR (RT-qPCR) are the gold standard for RNA virus detection and quantification following concentration. Both qualitative and quantitative data can be gathered using these techniques.

To link epidemiological data to viral RNA concentrations, various calculations are required. To accurately relate a sample's virus concentration to the population's viral load, viral decay and flow rate in wastewater systems may be required, depending on the sewer infrastructure at the local level. In addition, watershed modeling and microbial source tracking ought to be incorporated into the creation of WBE strategies in order to evaluate the transportation and disposal of wastewater as well as the locations where sampling ought to be carried out. Work has attempted to estimate shedding rates in feces, which are affected by viremia, duration and severity of the disease, and age. The speed at which viruses are released from the body is also a challenge for the implementation of WBE systems. The estimation of the population's contribution to wastewater samples is another important aspect of the implementation of WBE. Both census and biomarker data are required for population normalization. Normalization is necessary to ensure that a significant rise in viral concentrations in a sample is not linked to an increase in the population of the catchment area and to permit comparisons between cities [6-10].

Conclusion

A near-real-time picture of a community's viral load is possible through the use of WBE. Urine, stool, skin, saliva, and blood are just a few of the ways in which viruses are released into waste streams. The potential and advantages of wastewater monitoring systems have been demonstrated by previous studies. As part of the Global Polio Eradication Program, WBE was used to assess the effectiveness of immunization against the poliovirus and the prevalence of polio in the population. It has also been applied retrospectively to the prediction of norovirus-associated gastroenteritis and hepatitis A outbreaks. WBE is primarily useful for providing information on the efficacy of public health measures and for providing early warning of disease outbreaks. For enteric viruses like poliovirus, norovirus, rotavirus, and hepatitis A virus, the advantages of WBE have already been demonstrated. WBE has the potential to significantly improve decision-making and reduce the number of severe cases that can overwhelm intensive care facilities.

References

1. Shaw DS, Gilliom M, Ingoldsby EM (2003) Trajectories leading to school-age conduct problems. Dev Psychol 39: 189-200.
2. Romeo R, Knapp M, Scott S (2006) Economic cost of severe antisocial behaviour in children – and who pays it. Br J Psychiatry 188: 547-553.
3. Briggs-Gowan MJ, Carter AS, Skuban EM (2001) Prevalence of social-emotional and behavioral problems in a community sample of 1- and 2-year-old children. J Am Acad Child Adolesc Psychiatry 7: 811-819.
4. Mathiesen KS, Sanson A (2000) Dimensions of early childhood behavior problems: stability and predictors of change from 18 to 30 months. J Abnorm Child Psychol 28: 15-31.
5. Skovgaard AM, Houmann T, Christiansen E (2007) The prevalence of mental health problems in children 1½ years of age – the copenhagen child cohort 2000. J Child Psychol Psychiatry 48: 62-70.
6. Eisendrath SJ, McNiel DE (2002) Factitious disorders in civil litigation: twenty cases illustrating the spectrum of abnormal illness-affirming behavior. J Am Acad Psychiatry Law 30: 391-399.
7. Freyberger HJ (2006)Artifizielle Störungen. Fortschr Neurol Psychiatr 74: 591-606.
8. Krahn LE, Bostwick JM, Stonnington CM (2008) Looking toward DSM V: Should factitious disorder become a subtype of somatoform disorder? Psychosomatics 49: 277-282.
9. Galli S, Tatu L, Bogousslavsky J, Aybek S (2018) Conversion, factitious disorder and malingering: a distinct pattern or a continuum? Front Neurol Neurosci 42: 72-80.
10. Bass C, Wade DT (2019) Malingering and factitious disorder. Pract Neurol 19: 96-105.