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"Track the Drain to crack the chain" (sewage surveillance for COVID-19)

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ABSTRACT: The Covid-19 pandemic continues to expose various problems all over the world involving global domino effects such as public health and its safety. Tracking the spread and changing trends of covid-19 at wide scale is one of the major challenges that we are facing. The most important task is the ability to identify the infected persons. An epidemiological method developed by environmental scientists is Wastewater surveillance which is a key tool in COVID-19 outbreak. Wide application of waste water surveillance began in 1990s during poliovirus outbreak. Waste water surveillance is being used for the detection of SARS -COV-2 which gets shed into waste water from the upper gastrointestinal and upper respiratory system via feces. Detection of non-infective RNA fragments of SARS-COV-2 in untreated waste water and sludge have been found. Wastewater- based- epidemiology (WBE) played an important role in covid-19 pandemic. WBE helped to solve the problem of insufficient diagnostic testing by rapid inexpensive mass tastings. WBE made it easy to predict patients' number in a particular area on wide scale rather than individual testing. According to the latest research of the scientists from IIT Gandhinagar, Ahmedabad collaborated with the Gujarat Biotechnology Research Centre (GBRC) and Gujarat Pollution Control Board (GPCB) they studied sample from Old Pirana Waste Water Treatment plant in Ahmedabad they found all the three SARS-COV-2 genes ORF1ab, N and S were found in treatment plant. According to these scientists' study WBE is an effective tool during these outbreaks such as COVID-19, Poliovirus and Hepatitis A.The concept is based upon the unsheathing, detection and then subsequent analysis and interpretation of chemical and/or biological compounds and has been used as an exploration tool to assess illicit drug use, antibiotic resistance prevalence and infectious diseases phenomenon.

KEYWORDS: Current Status, Methodology, Impact on Society, Future Scope

I. INTRODUCTION

The ongoing global pandemic of coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been a public health emergency of international concern, as of now it has been spread to 216 countries and territories, and over 7.7 million of the confirmed cases and more than 425,000 deaths worldwide, symptoms which were reported includes diarrhoea, fever, cough, difficulty in breathing and SARS-CoV-2 ribonucleic acid (RNA) has been tracked down in phases of not only symptomatic but also asymptomatic patients which should go through the investigation and surveillance of selected indicators of community health and action which will reflect in the formation of urban wastewater. Like the wastewater of an area is controlled via UWTP (urban wastewater treatment plant), investigating as well as sampling the wastewater composition can disclose the existence of the SARS-CoV-2 genetic fingerprint in wastewater. The sufficient statistics or data is provided on the population served by the treatment plant so that the fingerprint can be allotted to it, providing a cross-section of the public health status of the society.

NSW (New South Wales) Health at present operating research to find out exactly how many people shedding SARS-CoV-2 in a geographical area will cause a positive sewage outcome. This will depend on the number of people who live or work in that geographical area. It will also depend on other factors such as depletion in virus shedding over the time that people have COVID-19, reduction of virus within sewage, the duration in which the sewage sample is collected,

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lastly the existence of chemicals, bacteria and microorganisms in the sewage that work on how well the testing can revel SARS-CoV-2 virus fragments. Many of the academic research groups and private companies have already begun sampling and monitoring wastewater for COVID-19 markers in recent months.

Compare to the normal testing of COVID-19 the tracking of virus with water analysis is much more time efficient and at low cost, instead of going for individual testing of thousands of patients, collecting, analyzing and further testing the small number of wastewater samples is much more cost-efficient for acquiring population-wide data.

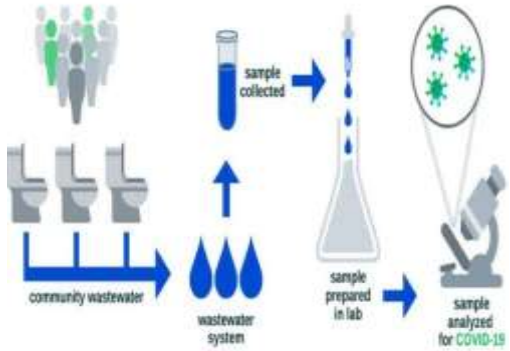

Fig: 1 Studying sewage for public health information is known as Wastewater-based epidemiology (WBE).

II. CURRENT SCENARIO

[1].The issues relevant to India and developing countries were considered by a group of experts who got in touch in May and June 2020 to deliberate on the way within which WBE (wastewater-based epidemiology) may be adapted for India. Authorities in India test people directly victimization the RT-PCR test and the rapid antigen test. As States ramped up testing and accumulated the quantity of antigen tests within the past several months, the numbers of people detected with COVID-19 has risen up quickly. What this means is there are limitation for testing people due to prices, logistics, and social examination.

[2].Detecting COVID-19 cases by testing waste matter for the presence of the SARS-CoV-2 virus traces, however, has not got a lot of traction in India. The number of COVID-19 patients detected in a population is directly proportional to the number and types of tests being used.

[1].Low testing rates and methods like the antigen test give a false imitation of a low predominance of the un wellness.Alternatives like wastewater-based epidemiology are obtainable and are earning currency.

[4].Research findings from past coronavirus epidemics, like the Severe Acute Respiratory Syndrome (SARS), that indicated that viruses are ejected by infected humans through their stools, form the basis for wastewater-based epidemiology in the circumstances of COVID-19 prior to the remains of these viruses are acknowledge in sewage waste water matter and plotting such locations can help to determine the presence and confirmation of infections in a geographic region. In such conditions, people testing and social distancing is a major issue. Although WBE(wastewater-based epidemiology) cannot pinpoint wherever COVID-19 positive cases exist, it can be a sensitive tool to monitor circulation of the virus in a population of specific geographical areas from wherever samples are drawn.

[3].Thus, around the world, especially in Europe and North America, there's a great deal interest and analysis into fine-tuning sewage waste water testing into a surveillance methodology. Detection of non-infective RNA fragments of SARS-CoV-2 in untreated waste product or sludge has been reported in many settings, such as Italy, Spain, Australia, the Netherlands, the U.S., France, and Germany.

[2].Researchers within the European nation, France, and the U.S. have also additionally exhibited a connection between wastewater SARS-CoV-2 RNA concentrations and the variety of COVID-19 clinical case reports.

[3].France and also the U.S. have urged that the RNA concentrations may offer a four to seven days advance notice prior to COVID-19 confirmed case data. In different words, the case load in a given Geographic's is proportional to the quantity of SARS-CoV-2 fragments detected within the sewage waste water.

[4].In India, The Chennai Metropolitan Water Supply and Sewerage Board (Chennai Metro water) was 1st in India to conduct a preliminary study in early May in which it scans the traces of the virus in sewage wastewater. The utility collected 2 samples each from areas that had COVID-19 patients and were freed from infections. Remains of the virus were found in samples from the former locations. It planned to develop a

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protocol for testing sewage water waste for the virus with the WHO (world health organisation).

[1].Researchers from the Indian Institute of Technology, Gandhinagar (IIT-G), Gujarat, also started testing sewage water waste later in May and scan the traces of the virus, and are operating work with about fifty research organizations to develop a systematic manner of testing. Sewage Wastewater is an important source to monitor the presence and progress of the infection prior to excreta of both symptomatic and asymptomatic individuals had the virus.

[4].The city municipal corporation, however, has not been cooperative. alternatively, the Gujarat State Pollution Control Board gave the permission to the researchers to collect and test samples from Gandhinagar. A consortium of organization's in Bengaluru is additionally operating to work towards developing a protocol for testing sewage.

III. METHODOLOGY

There is well-researched and documented evidencefrom several countries that sewage can be tested for SARS-Co2 as a quick way to predict the COVID-19 pandemic's spread in a community. There are several reasons this has worked:

- Firstly, most of these countries have well-established sewage networks and wastewater treatment plant managers know from where the sewage comes.
- Secondly, this reduces the guesswork in collection as all samples have been collected from the intakes of sewage treatment plants.
- Thirdly, all have followed similar procedures to collect and test samples.
- Fourthly, they have successfully correlated the number of virus fragments detected in sewage samples to the number of patients in areas from where the sewage come

For sampling to make sense, a town needs to be mapped and divided into zones. The sanitation and sewage or faecal sludge system need to be mapped in detail for each zone. Where there are sewers, collection points from places where sewage from about 10,000 houses collect need to be identified. In areas using on-site sanitation systems (OSS) connected to septic tanks, the timings and routes of pit-emptying machines need to be mapped.

However, they add a note of caution that in India, continuous sampling is possible only in extremely limited conditions – where sewer networks are connected to WWTPs or at sewage pumping stations. Grab sampling over a period of 3-4 hours during peak toilet usage, usually between 7 a.m. and 11 a.m. is better suited to Indian conditions. This was used in Queensland, Australia. The individual grab samples can be stored in an ice box and combined in the laboratory.

Sampling personnel need standard personal protective equipment (PPE) for sewage or faecal sludge sampling, such as long pants, steel-capped boots, hard hats, safety glasses, and gloves. They need training to collect and disinfect the sample bottles so there is no danger of contamination or catching the infection.

[5]The second part of the process is transporting samples to a laboratory for testing. Nearly all places where tests have been conducted have used the same method. This is done in a cool pack container (a normal ice box) to minimise the sample degradation. The optimum temperature is 4°C. Samples must reach the laboratory within one hour of collection. This is how researchers from the KWR Water Research Institute, the Netherlands, transported samples and is now the gold standard: samples were transported to the laboratory on melting ice and the RNA isolated on the day of sampling**.**Genetic picks outPrimers and probes targeting certain areas of the SARS-COV-2 that have been reported to be delicate and specific for quantifying SARS-COV-2 RNA in wastewater. When possible, compare wastewater measurements using the same target genes.

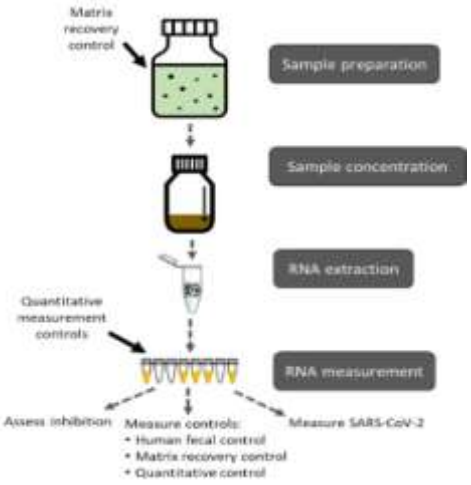

Fig: 2 Overview of waste water sample processing.

IV. IMPACT ON SCOCITY

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[6].The research workers examine one hundred settled solid samples from the San Jose-Santa Clara Regional Wastewater material Facility from March to July 2020, tallying daily gathering numbers. By Applying statistic, they differentiate these absorptions with Covid-19 established cases given by the country.

[6].Their results track down the trend of the country's cases, downgrading in both May and June and increasing in July.

[7].The presents a possible way to identify new outbreaks, find hotspots, confirm the decrease of cases and inform public health interventions.

[8].As schools reopen, the technology could be implemented by districts to identify whether areas lacking the resources for robust individual clinical testing, such as testing sites in Illinois that reportedly closed early after running out of tests.

[9].There are quite some pieces of information which are needed to better understand the restriction of wastewater testing and improve what can we obtainand research makers note that the virus's rate of decay in wastewater and the range and timeline of viral RNA from getting rid of whensick and varying operations of different wastewater plants all have the potential to impact results. upcoming studies on these factors could lead to better awareness about case trends.

V. FUTURE SCOPE

[10].Biologically processes which are based on aerobic and anaerobic technologies have been developed to monitor waste water treatment and currently employed to reduce the contaminants discharge levels in the environment. Most methodologies applied for monitoring are too much labour intensive and time consuming. Thus, spectroscopy applications are nowadays considered a rapid alternative technology for monitoring all the time.

[11].Administration of spectroscopically techniques for locating aerobic and anaerobic systems may be used for focusing on ultraviolet, infrared and fluorescence spectroscopy. Chemometric techniques can also be used for extracting relevant data. Aerobic systems can also be used in wastewater treatment plants with activated sludge systems.

[11].In addition, use of membrane bioreactors have been applied in waste water treatment plant. Furthermore, spectrometry combined with multivariate statistical analysis can be shown as a valuable tool in future researches.

[11].According to certain researches waste water can be used as important tool in future for curing harmful diseases.

[10].Countries around globe are now launching waste water surveillance programs with an aim to overcome new outbreaks.

[12]."The Science of wastewater sewage surveillance is still developing, but there is too much authentications that it is useful indicator for protecting any community in future."

VI. CONCLUSION

By analysing wastewater, we can learn about the spreading disease way earlier than the other known methods for detecting COVID 19. Measuring COVID 19 in waste water has a potential to help health officials or agencies to use this tool as an early warning system.

Waste water surveillance can help us in real time because many infectious agents are excreted through the body before activation. These body fluids get transported through sewage systems to the wastewater treatment plant where the presence of virus can be detected. It is helpful to collect data where people lack access to good health facilities.

Increasing globalization and international travel results in rapid spread of infectious diseases. To tackle such situations, the data provided about the disease spread and its surveillance through the wastewater must be real time.

Wastewater surveillance is a cost-effective and swift. Instead of monitoring the number of infected people, this method works as a boon as it is capable of mass detection of spreading disease and determine different disease patterns in short time period.

Rise of pathogens / active disease spreading agents can be prohibited without delay and thus this WBE proves reliable to get the control over such pandemics, ultimately decreasing global illness.

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