QuickSolutions

Smart way for efficient CoVID testing

PROBLEMS

0.4

% tested

50

% predicted to become infected

Several test centers backlogged
(Overflowing with test)

Reacting with assumptions, not data

# Our Solution - Mass Testing through Priority based Wastewater analysis and Sample Pooling

A potential way to detect **Covid 19** is through **Sewage Surveillance**.

Related Research

- In 2005, researchers from China were able to detect SARS-CoV from stool samples collected from Sewage systems [1].

- Recently, a group researchers investigated a wastewater plant serving a huge metropolitan area in Massachusetts and established the fact that SARS-CoV2 is also detectable from samples of stool or various bodily fluids collected from sewage systems [3].

- In [2], the authors performed a study that Stool sample test provides a better result than the respiratory sample test.

Composite Sewage Samples

- Represents the **average wastewater characteristics** during the compositing period
- Fixed volume samples are collected at **equally spaced time periods**
- Preferably sampled at locations of highly turbulent flow in order to **ensure good mixing**
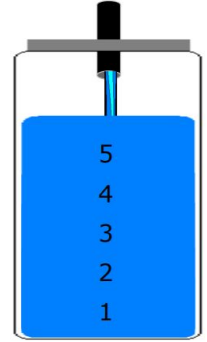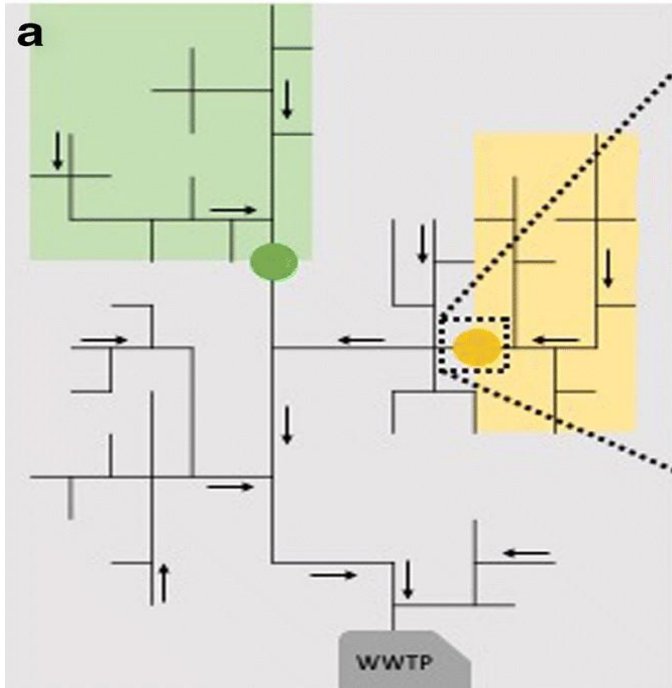
Strategy

For **test centers** overwhelmed by shortages, **QuickSolutions** is providing an **algorithmic platform** that optimizes test kit usage by **employing segmentation** and **pooling of patients,** depending on **CoVID percentage in sewage mass testing**.

About 10%

About 0.01%

**Segmented further based on priority**
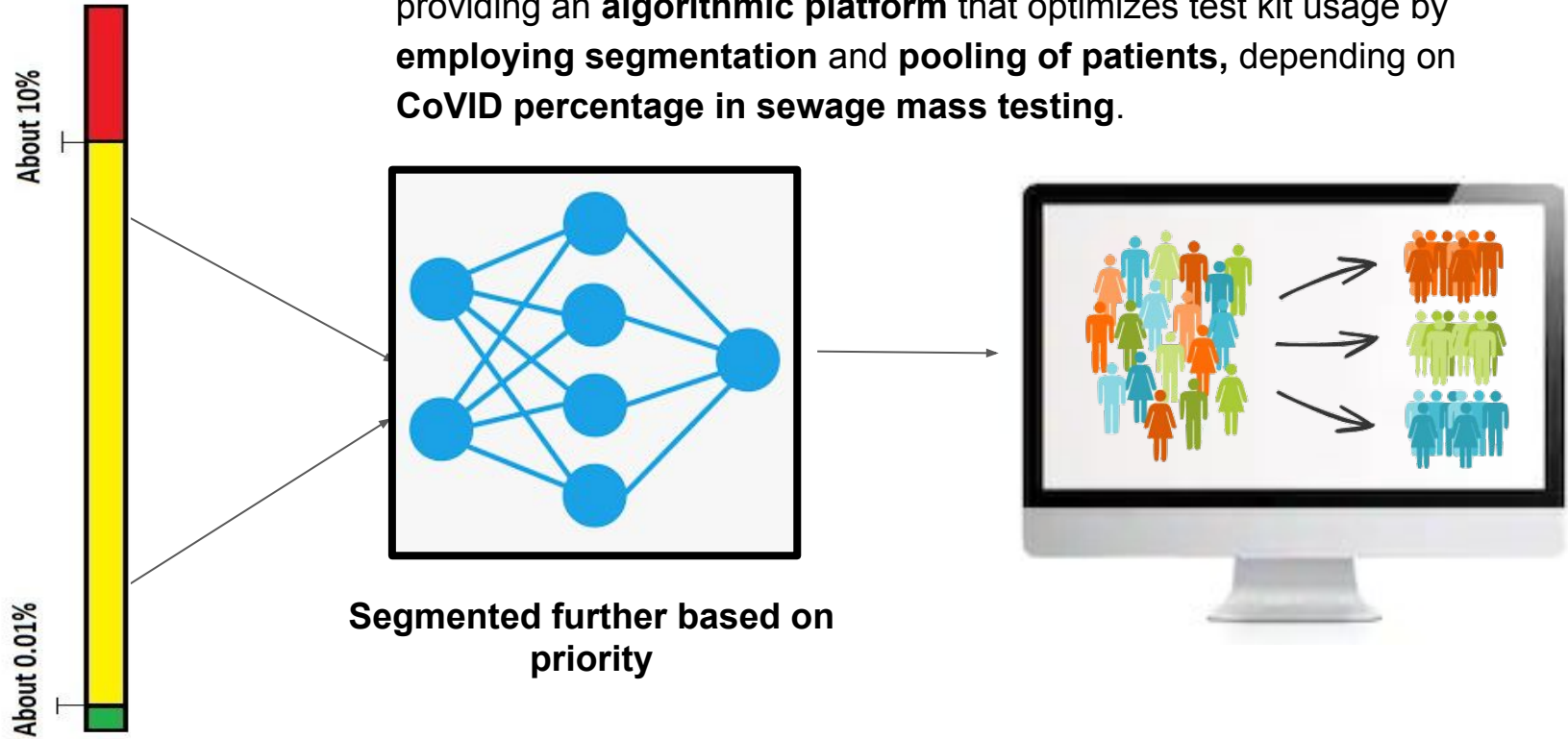
Working Model

Schematic Representation of sewage system
associated with a Wastewater treatment plant
(WWTP)

- The sewage pooling algorithm provides a procedure to perform testing for the virus by collection and testing of wastewater samples according to the algorithm
  .

- Collection of wastewater samples should be performed at several points using an **automatic sampler** to collect samples.The initial level 0 points are selected based on the sensitivity of the test.

- If a certain level 0 point is found positive, then the probability based backtracking will be used to guide the subsequent testing towards the catchment areas. We will be requiring the help of sewage worker to manually collect wastewater samples from these different regions within this point.

Sewage Pooling Algorithm
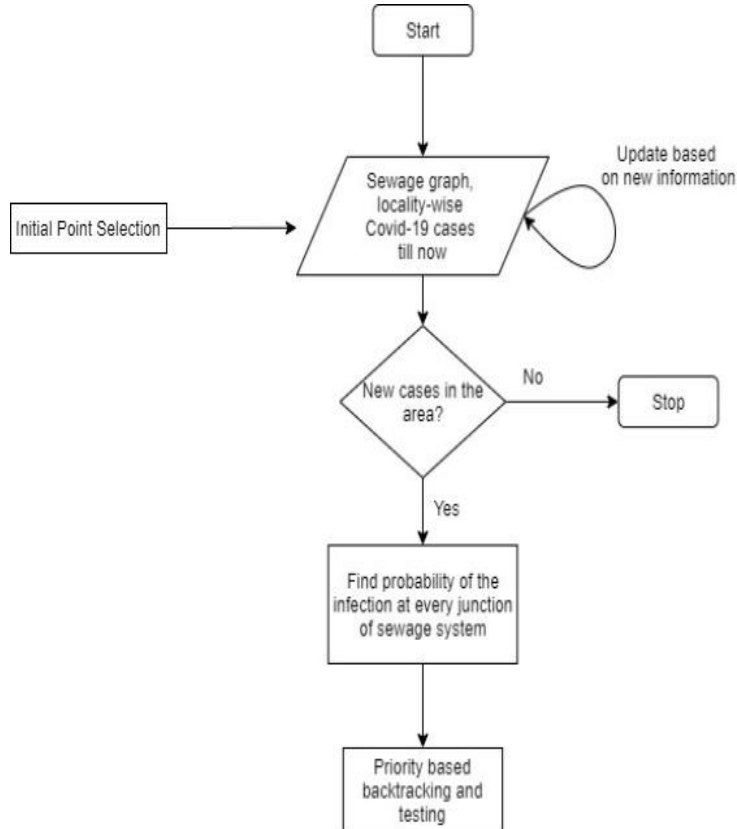
We intend to propose this algorithm for sample pooling and testing from sewage samples. The algorithm proceeds through three very important steps.

Step 1:   **Data collection and database updation.**
This step is very important. The accuracy of the entire algorithm will depend on the accuracy and recency of the data. This data should include various information like the sewage system of the area, no. of houses connected to a point, no. of corona cases and its rate of increase.

**Step 2:**   **Probability calculation.**
Based on the data, the probability of infection will be calculated for every link at each junction of the sewage system.

Step 3:   **Priority-based Backtracking.**
As Covid-19 is very contagious, even the presence of one patient may affect an entire community. Hence, we are suggesting a backtracking procedure guided by probability of infection so that every probable link is checked once.

Probability based Backtracking
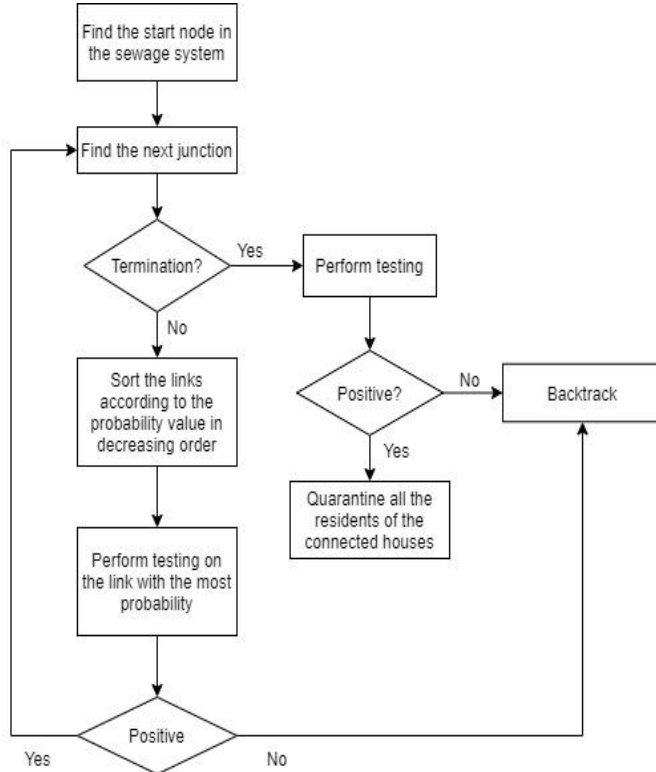
- It uses probability values to guide the search procedure. The search starts from the backbone of the sewage system and moves towards the termination links.

- At any junction, link with the highest probability which is not yet tested is tested for the virus.

- If the test result at any node comes negative, that part of the sewage system is pruned and not tested further. Else, the search continues.

- If a termination link is encountered, it is tested. If the result comes positive, all the residents of the corresponding catchment area should be tested.

NOTE: If a link is connected to hospital or factory, it may significantly affect the data. So, those links are treated as outliers and cannot be checked by this algorithm.

Prospects of the procedure

Current State:
Around 200 tests per million people are taken

Future State:
We test by negation thus saving test for more vulnerable population
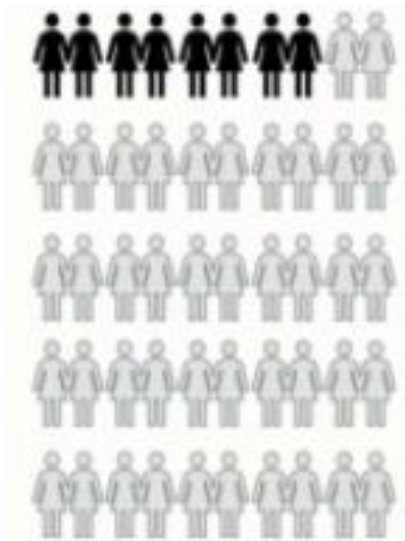
Let's **redefine** the **rules** for **testing**

Advantages of the proposed model

- The main advantage of this procedure is the **low level of human intervention**. In traditional procedures, the affected people first need to identify themselves to be probable patients, then go for testing, wait for results and finally quarantined which in the meantime may affect hundreds of others. The suggested model should be implemented at Govt. level and does not require much effort from the affected which reduces the chance of spread.

- Potential candidate to analyse **trends for future pandemic** in a community

- **Reduced number of testing** required on an average basis.

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
Local volunteers	Manage workflow & Data analysis	Hassle-free testing	Area wise contract based Govt. tender	Local municipalities
Lab Testing facility	**Key Resources** Sewage collectors & Lab Testing Kit	Reducing number of tests by pooling method	**Channels** Lab testing facility & Healthcare volunteers	Gram panchayat

Cost Structure	Revenue Streams
Software development Commission of Local volunteers Lab testing Kit	Contract based Govt. Tender

References

[1] Wang, X. W., Li, J., Guo, T., Zhen, B., Kong, Q., Yi, B., ... & Zhu, X. (2005). Concentration and detection of SARS coronavirus in sewage from Xiao Tang Shan Hospital and the 309th Hospital of the Chinese People's Liberation Army. *Water science and technology*, *52*(8), 213-221.

[2] An Tang, ZD Tong, HL Wang, YX Dai, KF Li, JN Liu, WJ Wu, C Yuan,ML Yu, P Li, et al. Detection of novel coronavirus by rt-pcr in stool specimenfrom asymptomatic child, china.Emerging infectious diseases, 26(6), 2020

[3] Wu F, Xiao A, Zhang J, et al (2020) SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases. medRxiv 2020.04.05.20051540. https://doi.org/10.1101/2020.04.05.20051540

Thank you