Estimated Covid Cases from Wastewater and the Reported Cases from Public and BU

1. Objective

In December 2021, Omicron has rapidly spread over US, and the daily new cases increased dramatically. The test results showed that the daily positive cases at BU increased higher than the public test results. Our hypothesis is the reason for higher number of positive cases is the test policy at BU, which asks students, faculties, and staff to have the test on campus. The test could detect the positive cases at the beginning and also the asymptomatic ones. Considering and asymptomatic and the self-test at home, we could assume that many of them would not report to the surveillance system, which made the estimated daily positive cases much less than the actual number.

However, the genome copies from wastewater shows that the positive cases are expected to be much more than the reported ones. Thus, we are wondering if we could use the data from wastewater to estimate the number of positive cases in a specific area and compare it with the report number and the estimated number from BU data. In this way, we might have a sense on the actual positive number.

The ratio changes for wastewater to new cases.

The project could we divided into several small questions:

1. How to use the wastewater to estimate the positive cases in an area (6 counties in MA).
2. How to use the BU positive cases to estimate the positive cases around.
3. Comparison about the wastewater variance changes with BU changes.
4. Process analysis ?

1. Datasets we have
2. Wastewater by county data includes: Explanation of the value meaning is needed, can find the information from Wu, 2020, SARS-CoV-2 Titers in Wastewater Are Higher than Expected from Clinically Confirmed Cases.
3. the date (Wednesday of the week)
4. normalized concentration rolling average (normalized genome copies per ml of wastewater)
5. population
6. county name
7. Daily Wastewater: it only has the Southern and Northern, a map with Southern and Northern is needed as reference. Concern: a) Does the temperature impact the number of copies in wastewater? Thus the high temperature areas has lower values of detected SARS-Cov-2 RNA? b) Does there any delay in detect the copies when the wastewater was collected? c) Does these wastewater values have been adjusted by the PMMov ?
8. the number of copies/ml
9. 7 day average
10. confidence intervals
11. Variant Results
12. Positive cases by county data includes: date (USA facts reported date), rolling average cases per 100k (centered 7-day rolling average), county name.
13. Positive cases by town level: the datasets also has the daily test counts, death and yearly cumulative counts
14. Covid-19 Death by county data includes: County name, daily death
15. BU Case data: may be pull from the covid dataset we want to create. Include the students and employees records
16. Weather Data: in progress (may not needed, since the PMMoV might already corrected it)
17. For question a. Data collections regarding to [1] [2]
18. Create a model with variables: such as precipitation (rainstorm, use PMMoV so might not need to be considered), death, population, degraded at different temperatures (be stored at 4C for more than 9-15 days without degradation) [1]. Not sure if the PMMoV also normalized based on the population.
19. Unknow: the timeline and load fecal shedding, loss of viral particles in sewage lines, the exact loss of RNA during experimental procedures [1]
20. Assumptions: typical stool size, average daily flow volume, population size, frequency of producing stool per day, no loss of viral RNA in processing, including collecting, excreted viruses. [1]
21. Consider the long incubation time, how long for the incubation time for different types of covid vires, does it have infectious impact during the incubation time?
22. Instead of daily incidence cases (7 -days rolling average), maybe daily prevalence data match better with the wastewater viral titers.
23. Different variants products different amount of RNA copies in sewage, it makes even harder to compare the wastewater / covid cases ratio.
24. For question b.

References:

1. @article{wu2020sars,

title={SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases},

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volume={5},

number={4},

pages={e00614--20},

year={2020},

publisher={Am Soc Microbiol}

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