



National sewage sur for COVID-19

5.1.2e

RIVM CDC

Supported by Dutch MOH
WHO CC for Risk Assessment of
Pathogens in Food and Water
UU Chair in global changes and
environmentally infectious disease

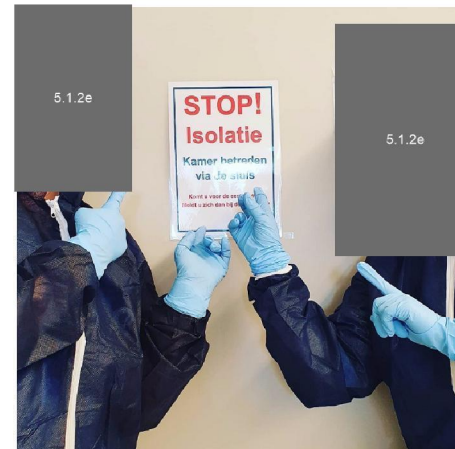
AIDIS / Sanitary Engineering Institute

Environmental surveillance @RIVM | 29-09-2020

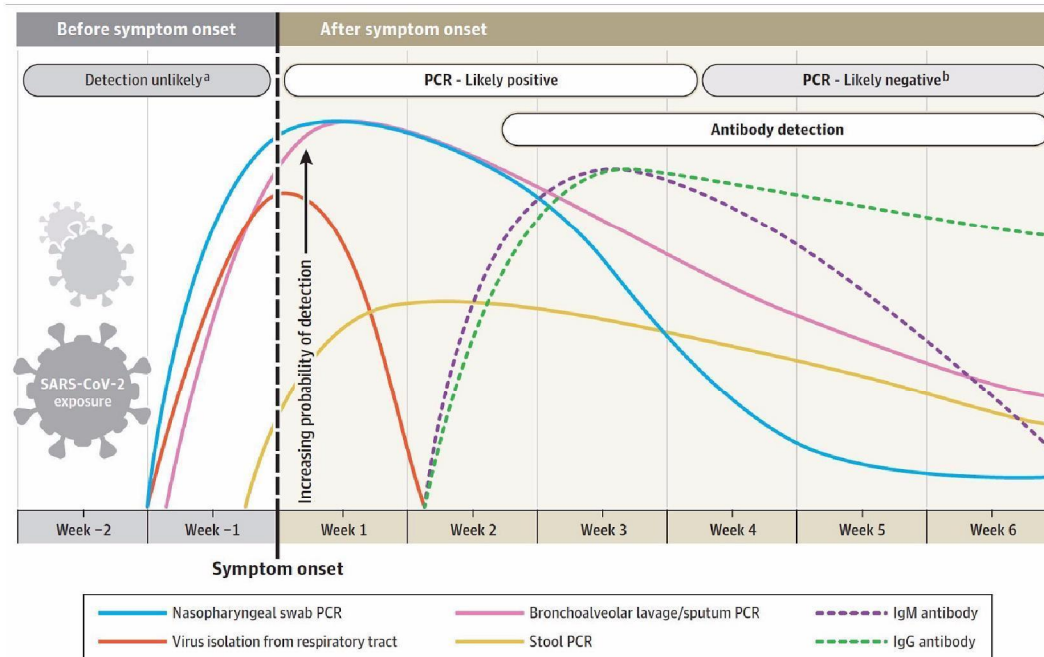


COVID-19

- December 2019 outbreak of viral pneumonia of unknown aetiology in Wuhan region in China (WHO 2020)
- Symptoms: none (asymptomatic) to severe pneumonia and death
- Mild to moderate disease with fever, dry cough, and fatigue
- From 2-23% diarrhea (Wang et al. 2020; Huang et al. 2020; Chen et al. 2020; WHO 2020; Chen et al. 2020; Lin et al. 2020)
- Asymptomatic infections rare, most presymptomatic (Wei et al. 2020)
- At risk: over 60 years, and underlying conditions

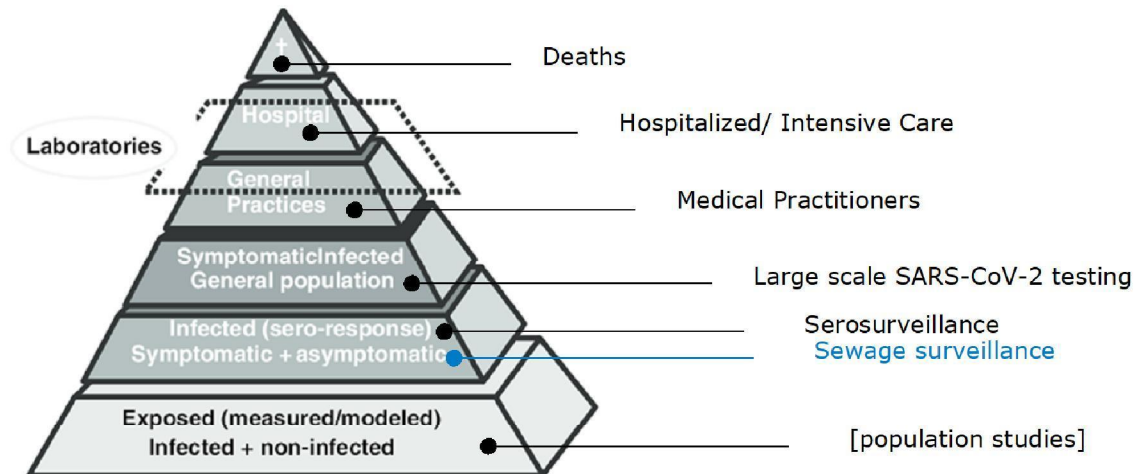


Bron: 5.1.2e Amphio Ziekenhuis Breda





COVID-19 surveillance



Adapted from Havelaar et al. 2006



Environmental surveillance – Multipurpose

- 1) Molecular tracing of contaminated water source that caused infectious disease cases/ outbreaks (e.g. norovirus, hepatitis E virus, *Trichobilharzia*)
- 2) Water- and foodborne transmission routes e.g. norovirus, *Coxiella burnetii*, rotavirus, enterovirus, *Cryptosporidium* and *Giardia*
- 3) Retrospective environmental surveillance to origin e.g. norovirus, parechovirus, aichi virus
- 4) Risk-based monitoring e.g. poliovirus
- 5) Emerging pathogens e.g. *Francisella tularensis*, nontuberculous mycobacteria, antibiotic resistant pathogens
- 6) Environmental surveillance in addition to pathogen and disease surveillance e.g. poliovirus and measles virus, resistant pathogens



Some lessons learned from AMR surveillance

Lesson 1

Contribution largely from open population since resistant bacteria of concern were detected at Sewage Treatment Plants without discharges from health care facilities. Information complementary to clinical surveillance.



Lesson 2

As shown previously for different viruses e.g. polioviruses, resistant bacteria originated from few people among thousands.

Lesson 3

Global sewage surveillance useful in data-limited regions. improving sanitation and health potentially limit global AMR burden.

Complementary systems

Sewage-based surveillance using metagenomics is flexible, scalable, and easy to quickly implement and standardize, while complementing clinical, isolate-based surveillance.

Community population
Hundreds of thousands mostly healthy people (but also includes patients in the health care system)

Hospital or clinical patients
Hundreds to thousands of people within the health care system

Proposed
Sewage samples are tested by DNA purification.

Sequence data contain information on all known types of resistance.

Bioinformatics analysis extracts resistance information.

Current
Samples from patients are tested by bacterial isolation and culture.

Resistance to only a few antibiotics is tested.

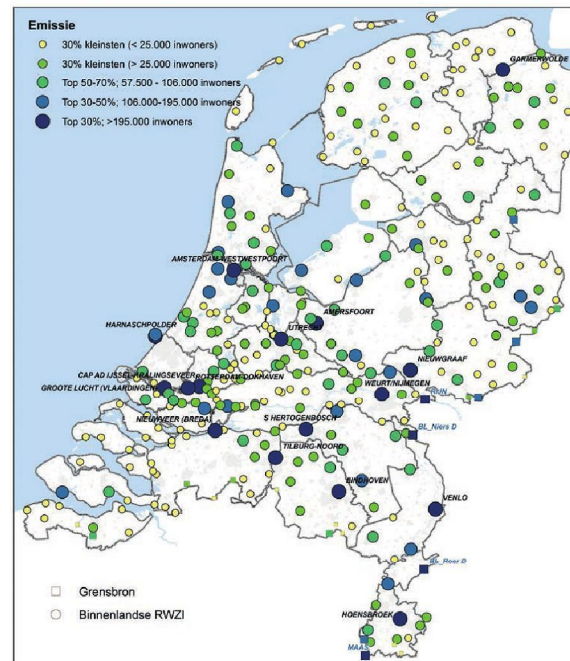
Results are manually recorded.

National and international reporting





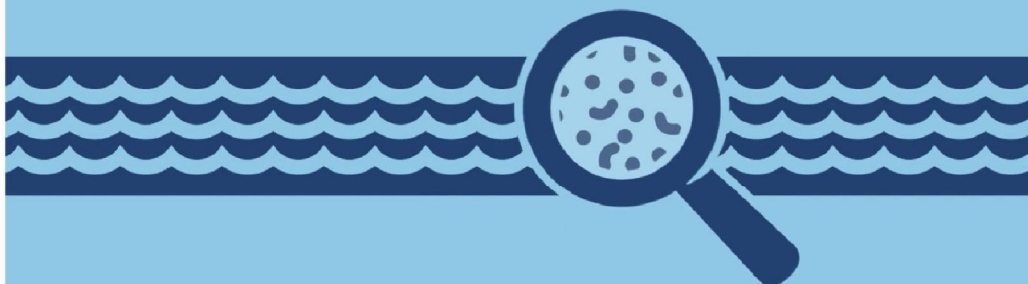
Weekly sampling
at all >300
Sewage
Treatment Plants
in the
Netherlands
~95% connected
~17 million i.e.





Environmental surveillance for SARS-CoV-2 RNA in The Netherlands and metadata

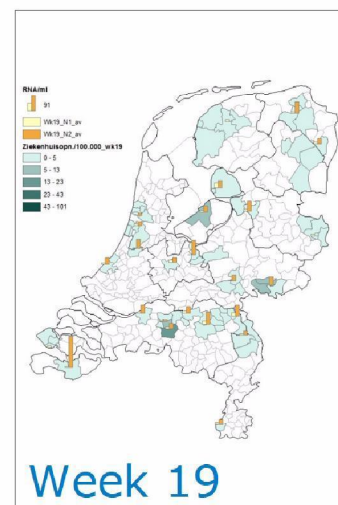
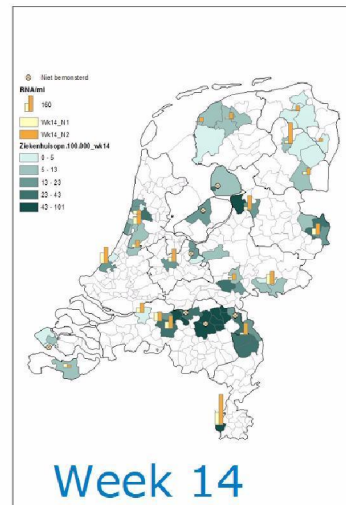
<https://www.rivm.nl/coronavirus-covid-19/onderzoek/rioolwater>



Sewage water surveillance

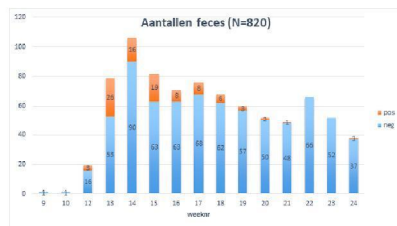
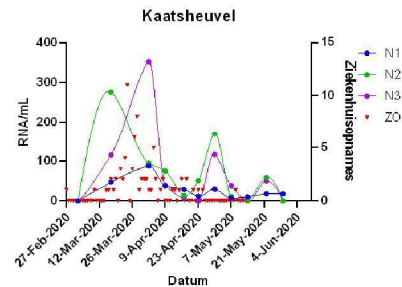
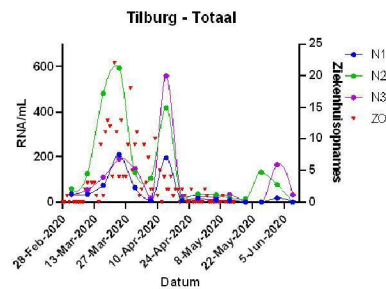


Decrease in SARS-CoV-2 RNA signal in wastewater in the Netherlands compared to the number of hospital admissions per 100.000 citizens of the municipality that is connected to the WWTP





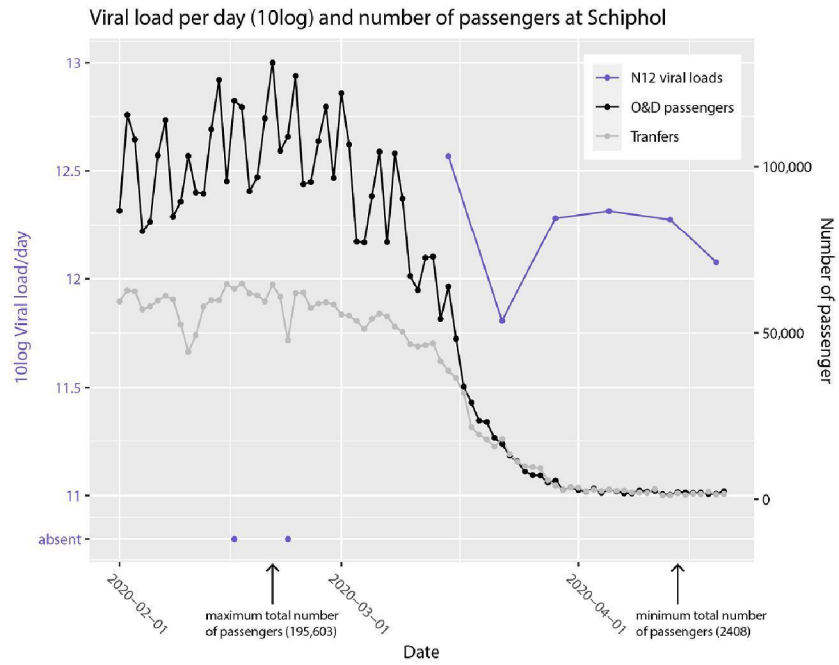
Early stages of COVID-19 outbreak - Tilburg



Weeks 9-11 no SARS-CoV-2 in feces of patients in Tilburg

From week 10 (March 2nd) SARS-CoV-2 in sewage

>> Presymptomatics or people with mild symptoms





Proofs of principle for SARS-CoV-2 in wastewater

SARS-CoV-2 RNA fragments detected in feces (published beginning of February) approx. 50% samples independent of GI and severity

Virus cultured from stool, failed in other study - tbd

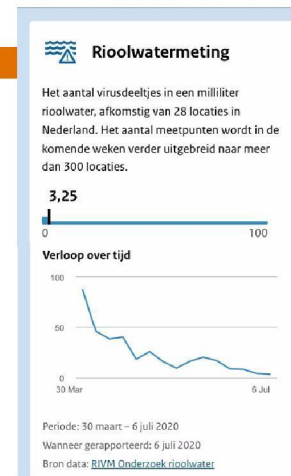
Wastewater sampled at different locations, analysed for SARS-CoV-2

1. In absence of severe cases: in line with the contribution of virus in feces or other excreta from for instance presymptomatic people
2. Near the first notified case: showing wastewater surveillance is a sensitive tool detecting few in 1000s of cases

- Wastewater of importance for COVID-19 surveillance
- But less so for spread of SARS-CoV-2
- Protection for those working with human waste and wastewater needed



MOH COVID-19 Dashboard



Next steps

- Continue close communication with water boards, their union, ministries
- Updated national figures and inclusion of regional figures
- Develop protocol for response when RNA signal value is exceeded
- Further pilot and indepth studies concerning @risk locations
- From weekly to more intense sampling at all >300 STPs

<https://coronadashboard.rijksoverheid.nl/>



SARS-CoV-2 RNA in sewage

1. Testing sewage means you actually test not one person but thousands of infected persons at the same time. This makes it cost-effective and non-invasive.
2. Sewage surveillance should be complementary to COVID-19 and SARS-CoV-2 in people yielding other information e.g. for contact tracing or need for hospitalization.
3. Wastewater surveillance can show trends in virus spread over time within the localized population from symptomatics AND asymptomatics, presymptomatics, postsymptomatics.
4. Especially in countries with limited resources it may aid policy making, especially if performed for multiple pathogens such as poliovirus for which it is already globally used (WHO Global Polio Eradication Initiative) and for antimicrobial resistance in One Health context (WHO Tricycle project). Capacity building (to be) initiated in Pakistan, South-Africa, Iraq, Mozambique etc.

Interested? Send email to 5.1.2e@rivm.nl





Acknowledgements

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Dutch Water Boards
Union of Water Boards



- And many others