30-04-2020

Sewage surveillance of COVID-19

IWRA International Water Resources Association

Bridging Science to Practice

Towards a Water-wise World

KWR Watercycle Research Institute

MICHIGAN STATE UNIVERSITY

TU Delft Delft University of Technology

Contents

- SARS Coronavirus 2 in sewage
- The value of sewage surveillance for SARS Coronavirus 2
- Is SARS Coronavirus 2 in sewage a health risk?
- Is drinking water safe?
- Knowledge needs

Sewage Surveillance for other viruses

Poliovirus

- absence of virus circulation in (unvaccinated) population
- early warning outbreaks

Adenovirus, norovirus, rotavirus, parechovirus, enterovirus, astroviruses, hepatitis A and E viruses

- early warning outbreaks
- virus circulation in population
- virus genotypes circulating in population

REVIEW ARTICLE

Role of environmental poliovirus surveillance in global polio eradication and beyond

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Detection of Pathogenic Viruses in Sewage Provided Early Warnings of Hepatitis A Virus and Norovirus Outbreaks

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Research article Open Access

Monitoring human enteric viruses in wastewater and relevance to infections encountered in the clinical setting: a one-year experiment in central France, 2014 to 2015

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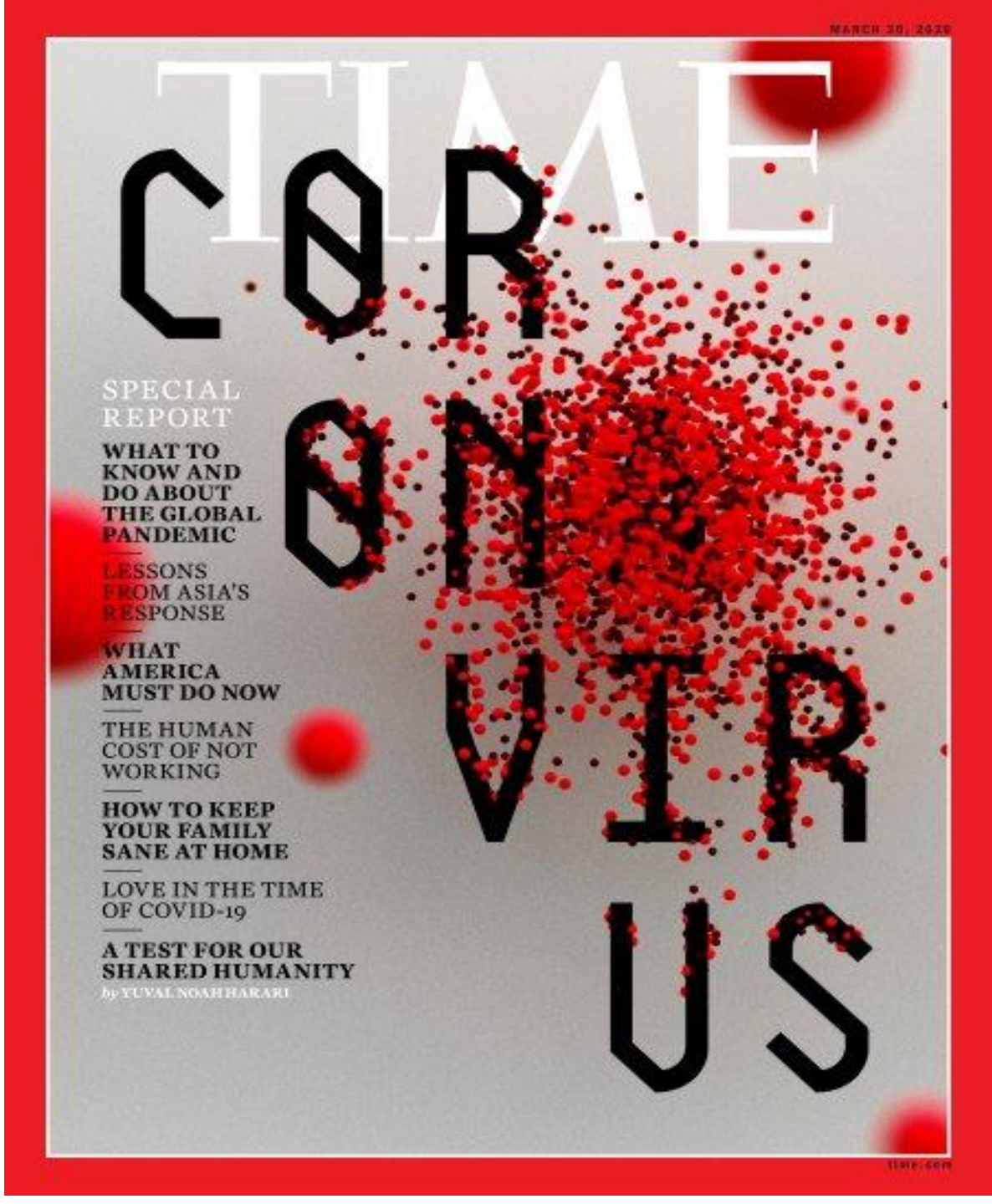
Maxime Bisseux[1,2], Jonathan Colombet[1], Audrey Mirand[1,2], Anne-Marie Roque-Afonso[3], Florence Abravanel[4], Jacques Izopet[4], Christine Archimbaud[1,2], Hélène Peigue-Lafeuille[1,2], Didier Debroas[1], Jean-Luc Bailly[1], Cécile Henquell[1,2]

SARS 2 pandemic 2019/20

Proportion of people with COVID-19 have diarrhea and shed virus with stool

SARS Coronavirus 2 detectable in sewage?

Sewage surveillance to complement health surveillance?



Images produced by Wesley Oudijk for NU.nl

Sewage surveillance: tool to study virus circulation? Early warning?

Sewage sampling at WWTP inlet: surveillance of large populations

Is it sensitive enough?

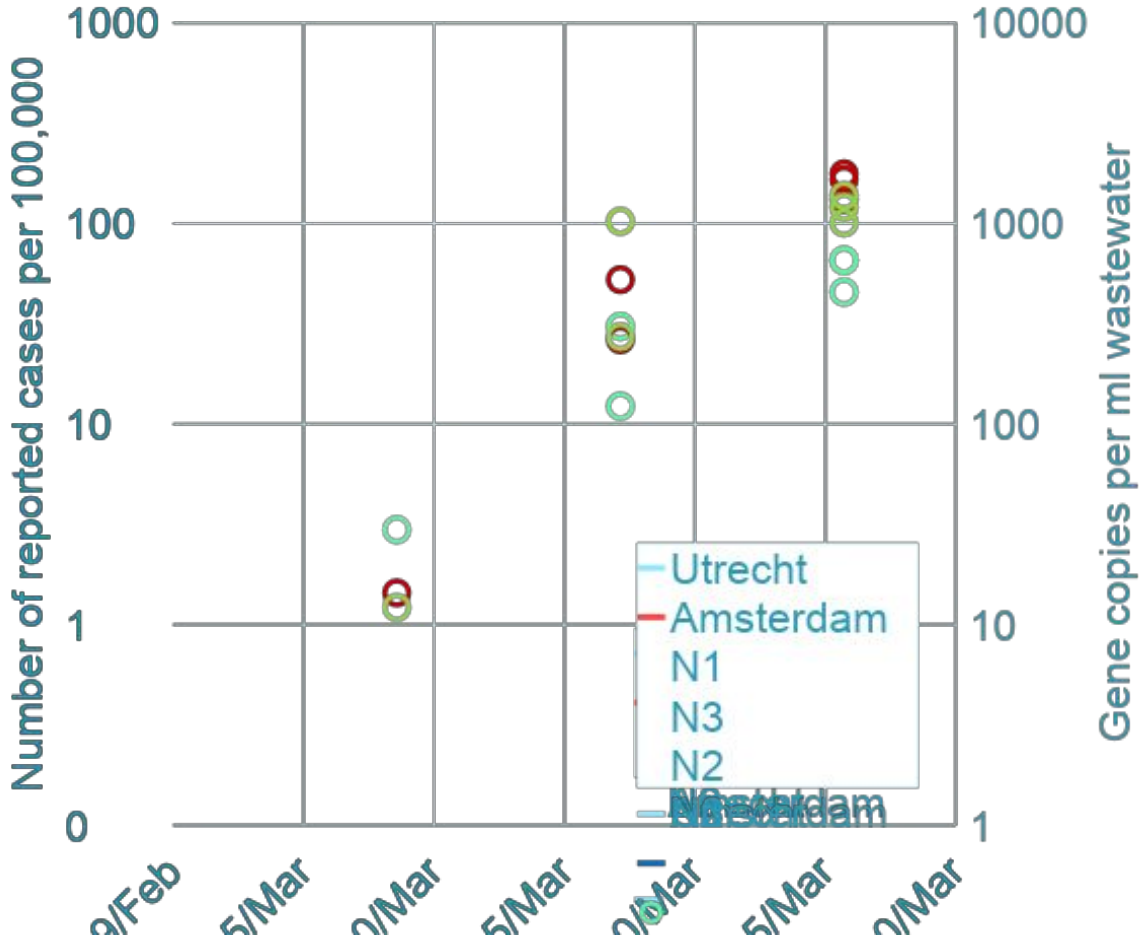
Concentration and purification of SARS-CoV-2 from sewage

Extraction of virus RNA

RT-qPCR against 4 targets (CDC N1, N2, N3; Corman ea 2020 E)
Concentration and RT-PCR controls

Sewage surveillance at WWTP in the Netherlands

- Clear increase in reported cases coincides with increase in concentration in wastewater
- Two other WWTP: virus detected in wastewater 6 days before first reported case
- Now national surveillance (RIVM)



Location of institutes (planning) sewage surveillance of COVID-19

How could we use these data?

Trends in virus circulation in communities?

- Trends/changes: early warning virus circulation starts?
  - Yes: appears to be sensitive and fast enough
- Trends/changes: early warning virus circulation increases again as we move out of lockdown?
  - Maybe: how far does RNA signal drop as prevalence in community drops?
  - Correlation with health surveillance datasets: virus/disease/antibody surveillance of the community?
  - What level of RNA signal rise or drop is informative?

Health risk to workers?

- No epidemiological signals SARS1, SARS2
- No case reports SARS1, SARS2
- What we detected ≠ infectious virus
- Are SARS-CoV 2 shed in stool infectious?
  - Limited evidence indicates: not very
- Survival in wastewater?
  - Virus is not robust in wastewater
  - Limited evidence SARS1: 2d 20°C, 2w 4°C
  - Limited evidence: not/low in effluent

- Advice: standard personal protection is safe

Photo credit: Broadbent

Health risk downstream?

- No epidemiological signals SARS1, SARS2
- No case reports SARS1, SARS2
- What we detected ≠ infectious virus
- Are SARS-CoV 2 shed in stool infectious?
  - Limited evidence indicates: not very
- Survival in water?
  - Wastewater? CSOs?
  - Virus is not robust in warm water
  - Beach safety checked with safety plan and faecal indicator bacteria
  - SARS-CoV-2 less robust than the other, known waterborne viruses (such as Norovirus).
  - Safely managed beaches = risks of faecal contamination managed = risk of SARS-CoV-2

Is drinking water safe?

- YES

- How can we say that?
- Because we know about other viruses…
- … that survive better in sewage and water…
- … are more resistant to disinfection…
- … and have confirmed that our drinking water supply systems can adequately remove/inactivate these


Photo credit: Jurisam







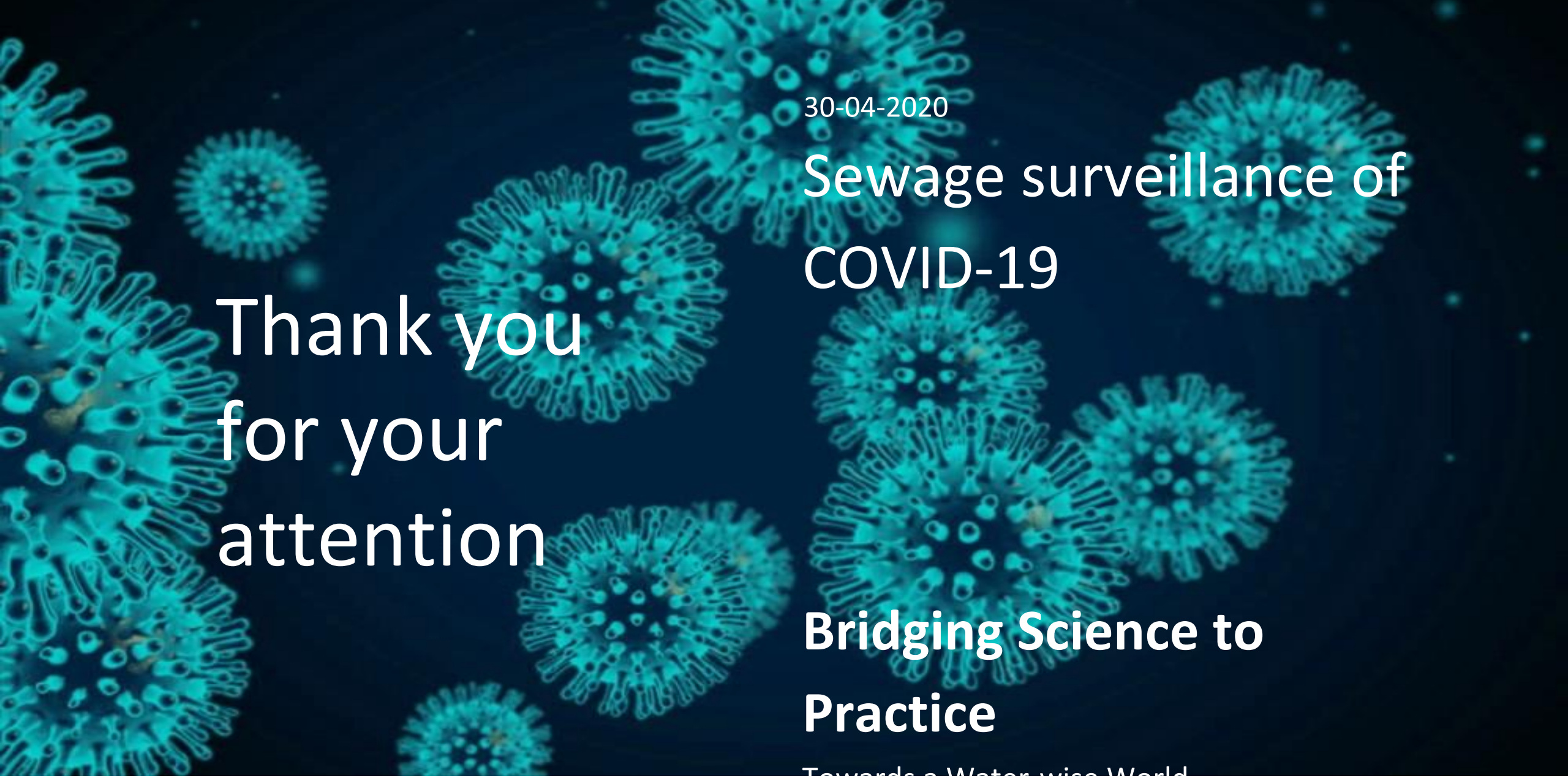






With the help of:

Dutch Water Authorities



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Thank you for your attention

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