




3 June 2020



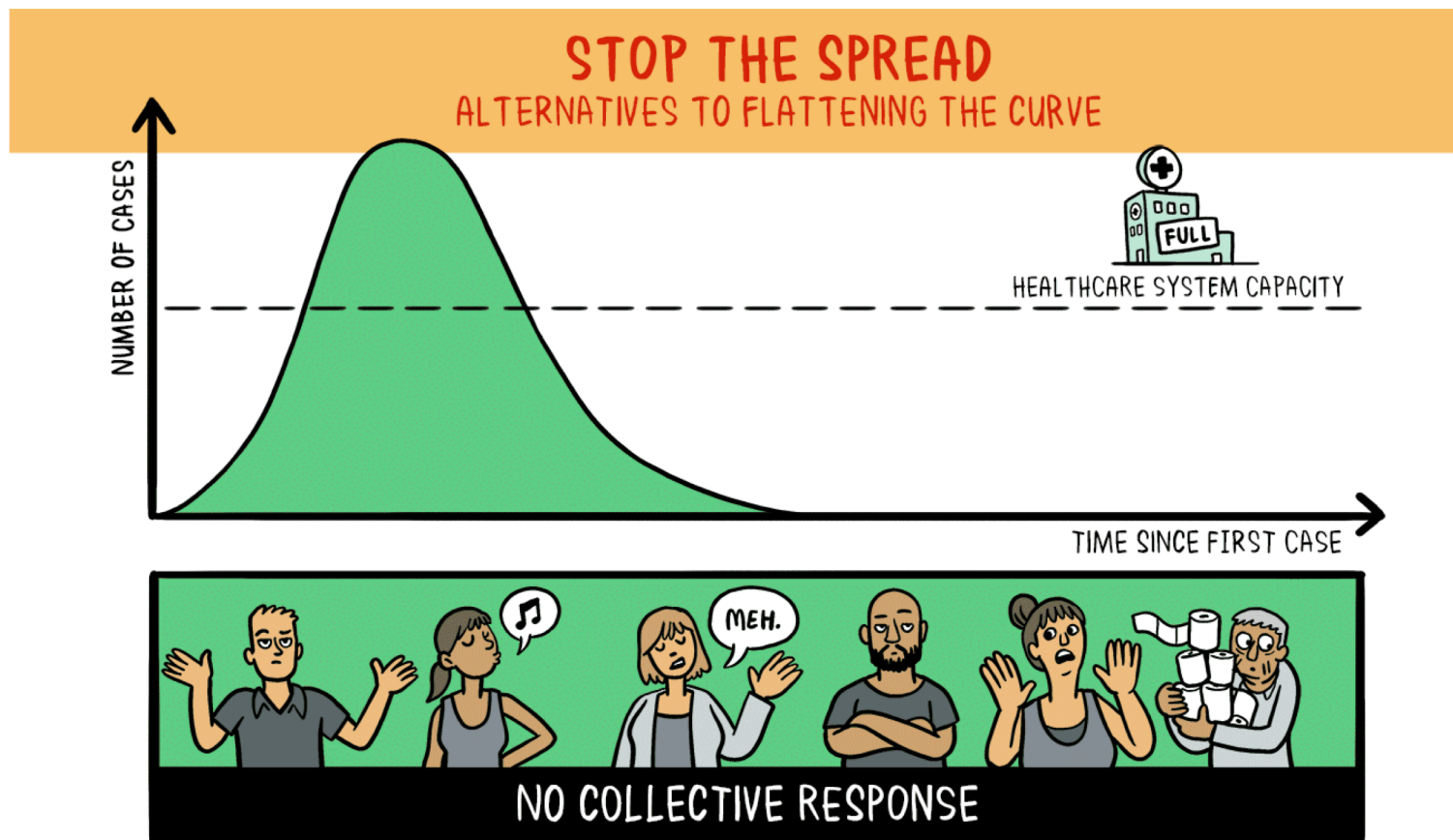
Sewage surveillance of COVID-19

Dr Frederic Béen

Prof Gertjan Medema

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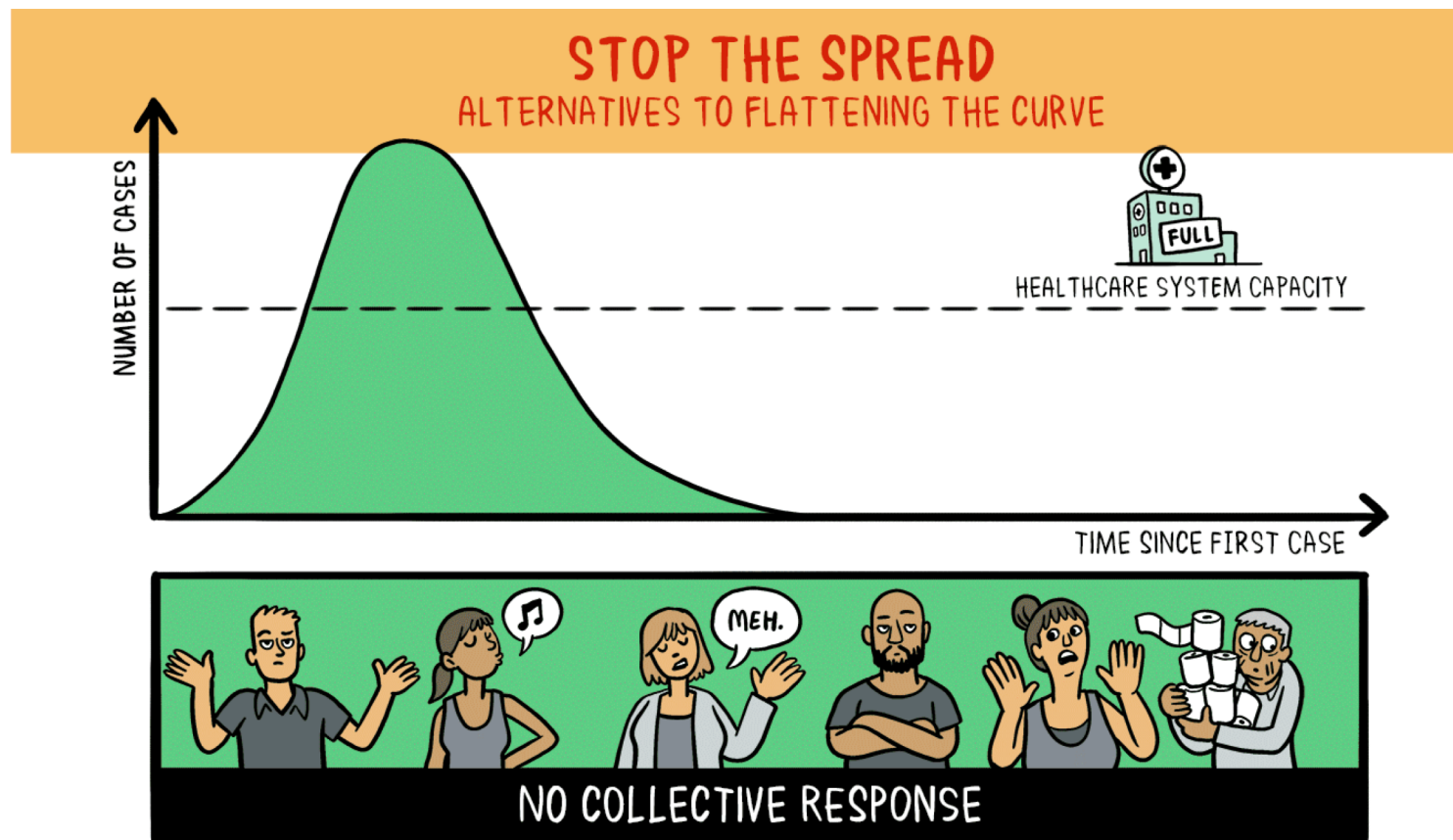
Objective of COVID-19 measures: don't overwhelm healthcare



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HOLLINGSWORTH (THE LANCET, 2020), @DREWAHARRIS & @SPLETTE CC-BY-SA

Why surveillance? COVID-19 trends



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Sewage surveillance for other viruses

Poliovirus

- absence of virus circulation in (unvaccinated) population
- early warning outbreaks
- 'herd monitoring': only 0.1-1% paralysis

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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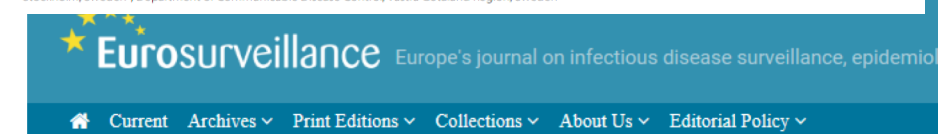
⁵ Global Polioymyelitis Eradication Initiative, WHO, Geneva, Switzerland



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

Maria Hellmér,^a Nicklas Paxéus,^b Lars Magnus,^c Lucica Enache,^b Birgitta Arnholm,^d Annette Johansson,^b Tomas Bergström,^a Heléne Norder^{a,c}

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Research article

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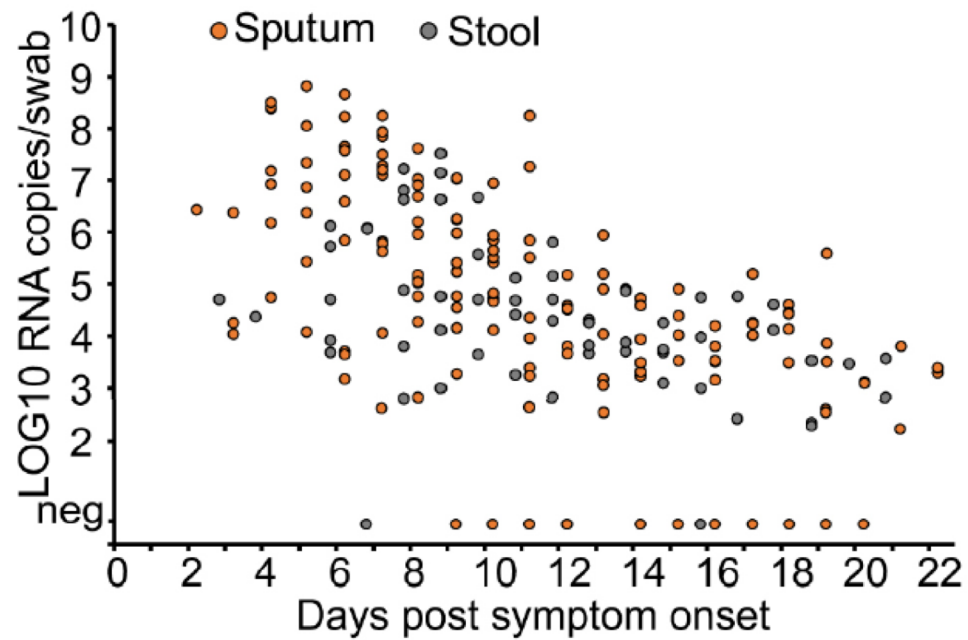
Monitoring human enteric viruses in wastewater and relevance to infections encountered in the clinical setting: a one-year experiment in central France, 2014 to 2015 |

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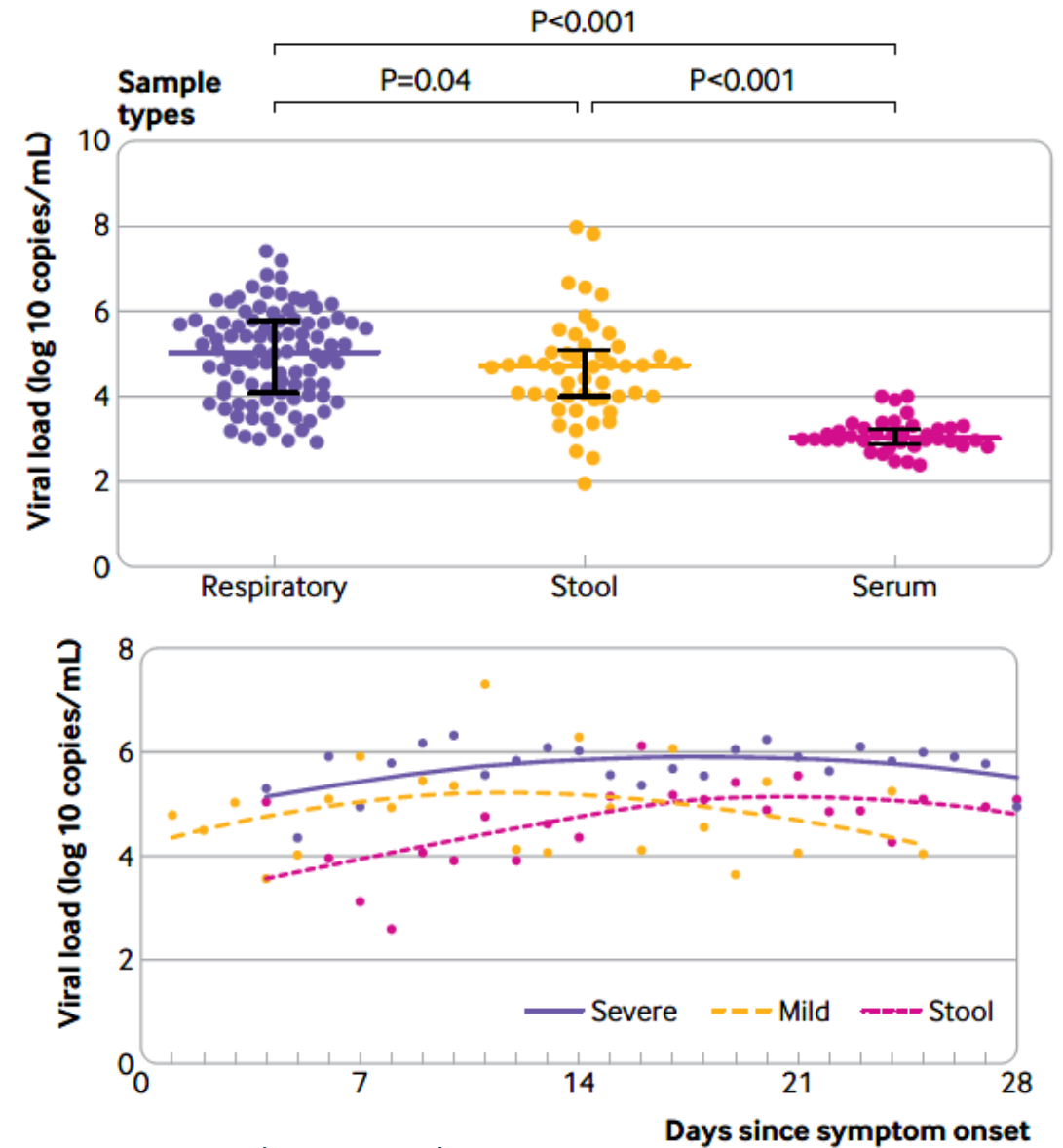
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Maxime Bisseux^{1,2}, Jonathan Colombet¹, Audrey Mirand^{1,2}, Anne-Marie Roque-Afonso³, Florence Abravanel⁴, Jacques Izopet⁴, Christine Archimbaud^{1,2}, Hélène Peigue-Lafeuille^{1,2}, Didier Debroas¹, Jean-Luc Bailly¹, Cécile Henquell^{1,2}

SARS-CoV-2 shedding via stool



Woelfel et al 2020



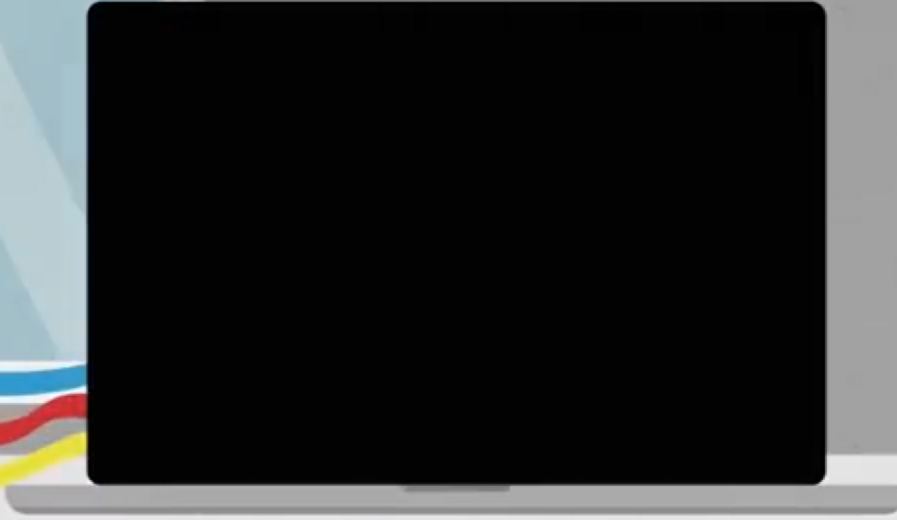
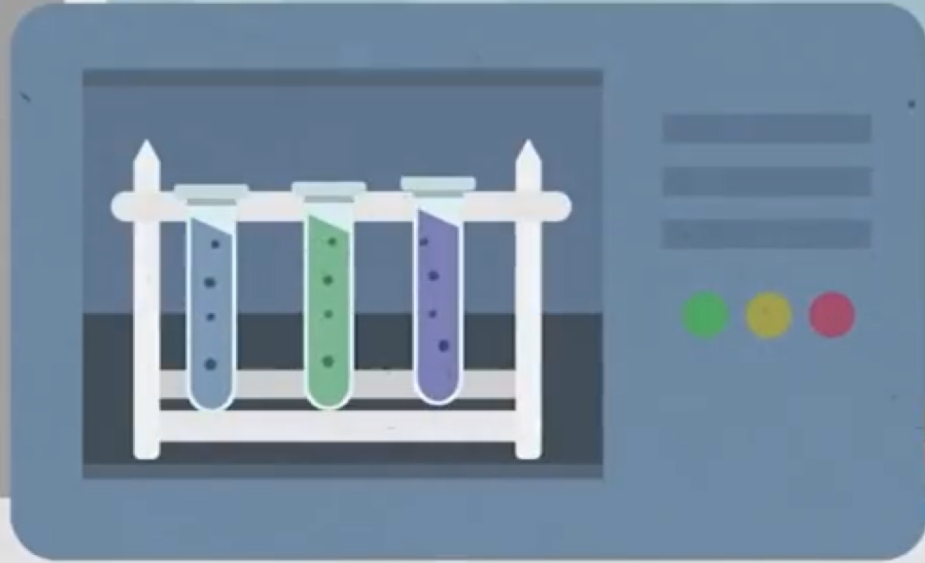
Zheng et al 2020



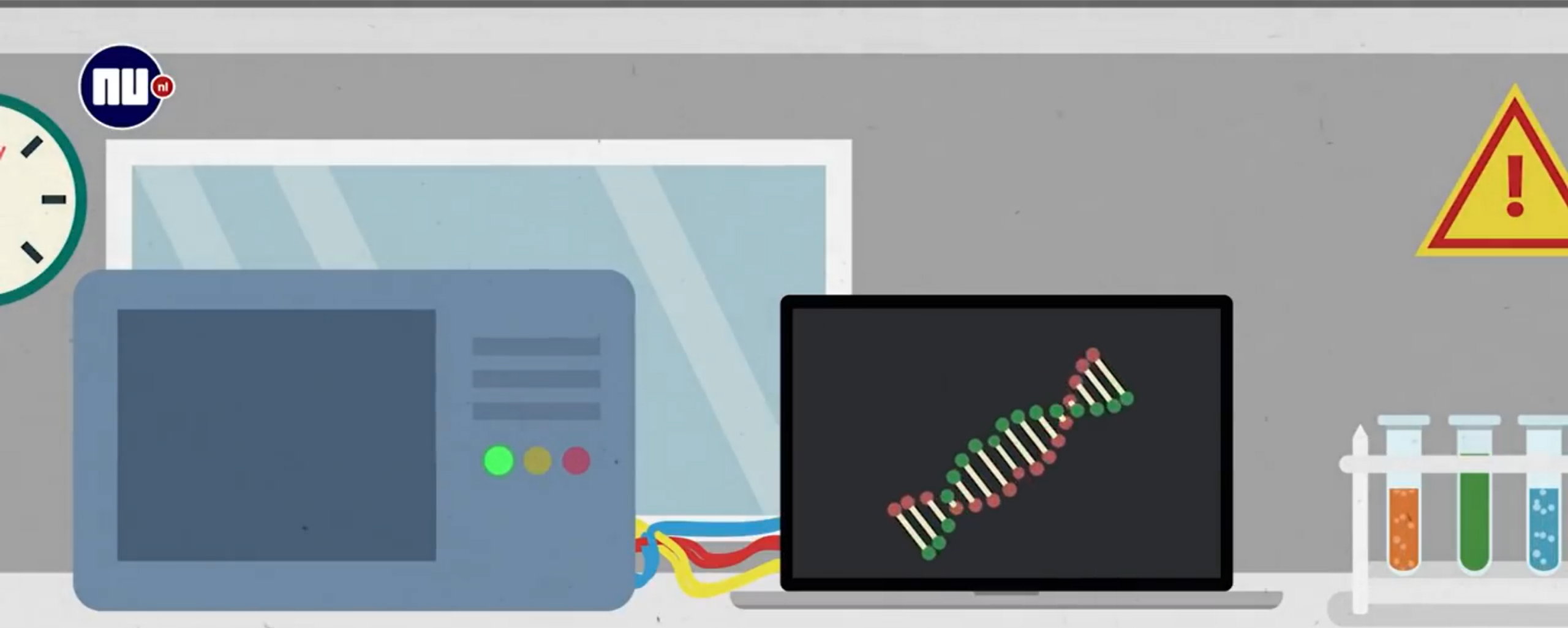
Images produced by
Wesley Oudijk for NU.nl



Sewage sampling at WWTP: one sample to monitor a million people
Is it sensitive enough? Is it an early warning signal?



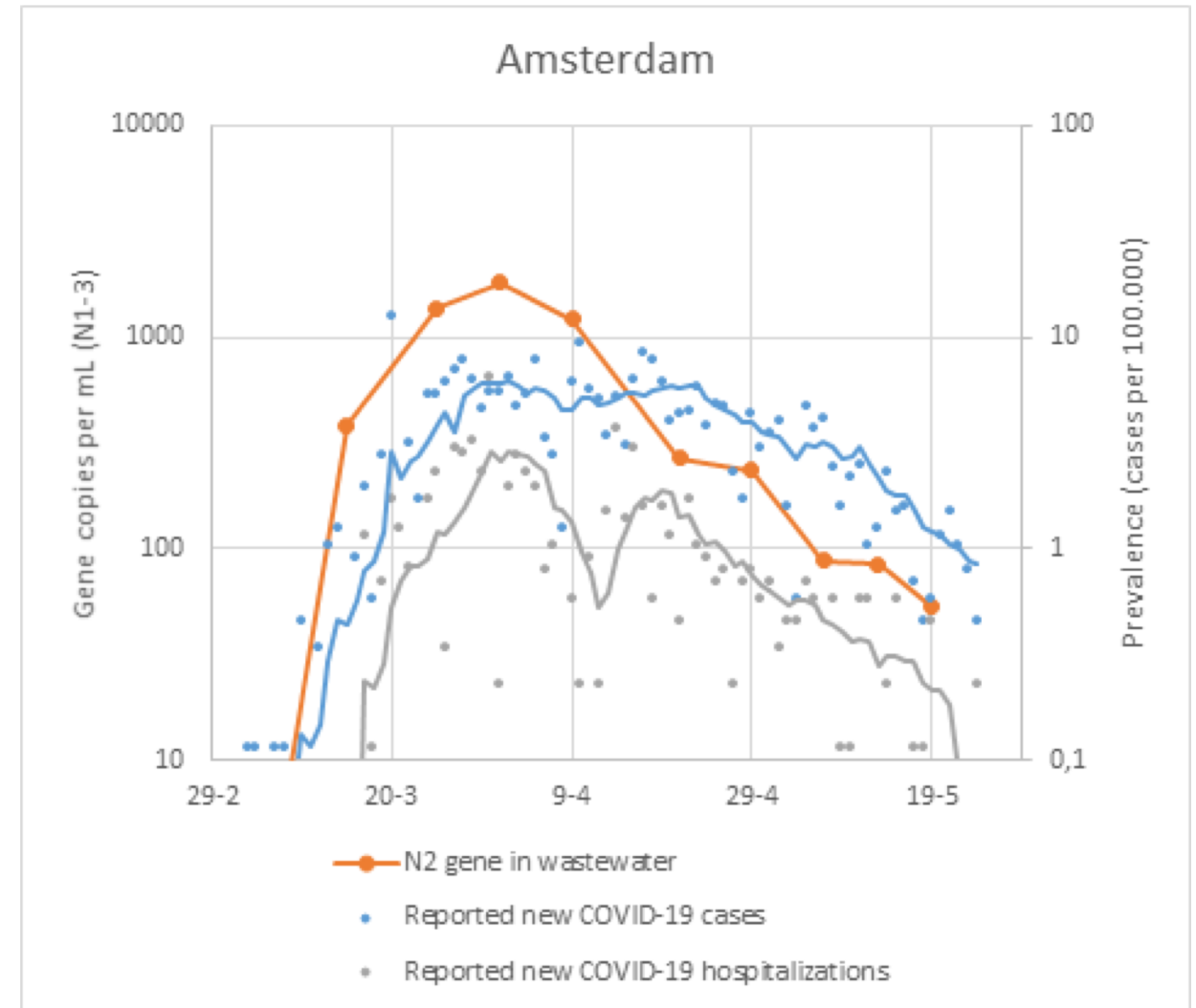
Concentration and purification of SARS-CoV-2 from sewage
Extraction of virus RNA



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

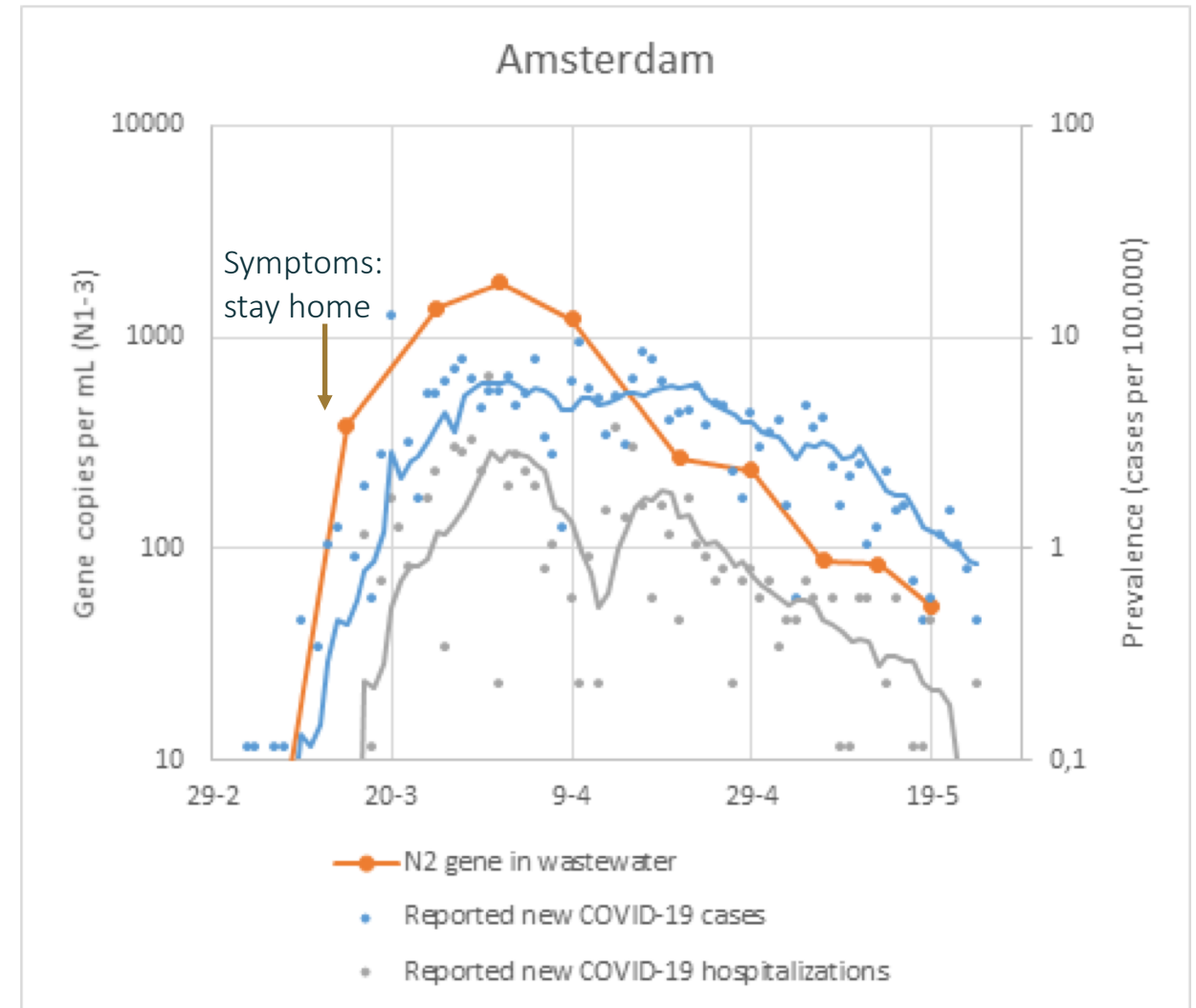
Sewage surveillance at WWTP in the Netherlands

- 5 cities: clear increase in reported cases coincides with increase in concentration in wastewater
- 5 cities: virus detected in wastewater before first hospitalizations. 1 city: virus detected in wastewater 6 days before first reported case



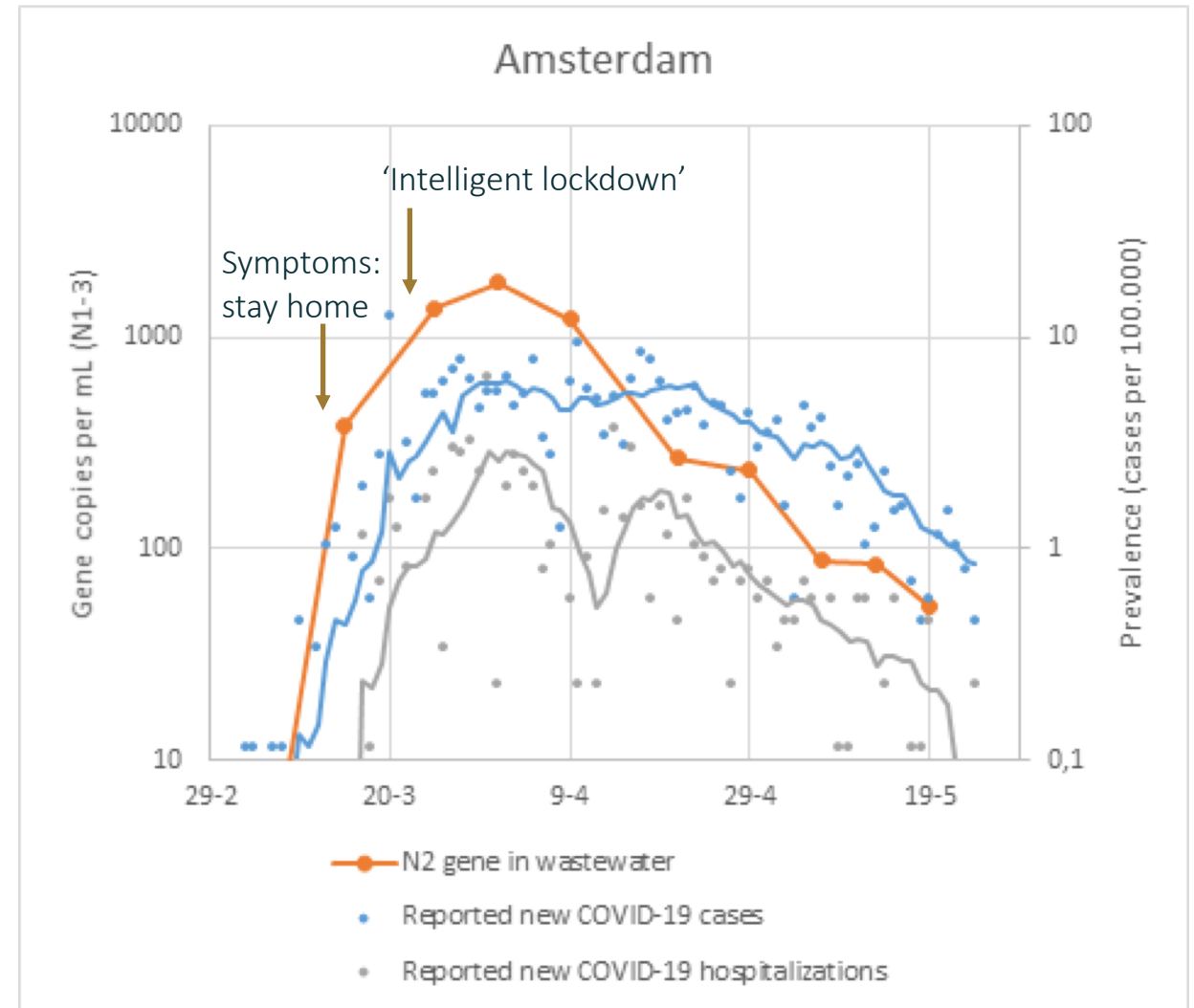
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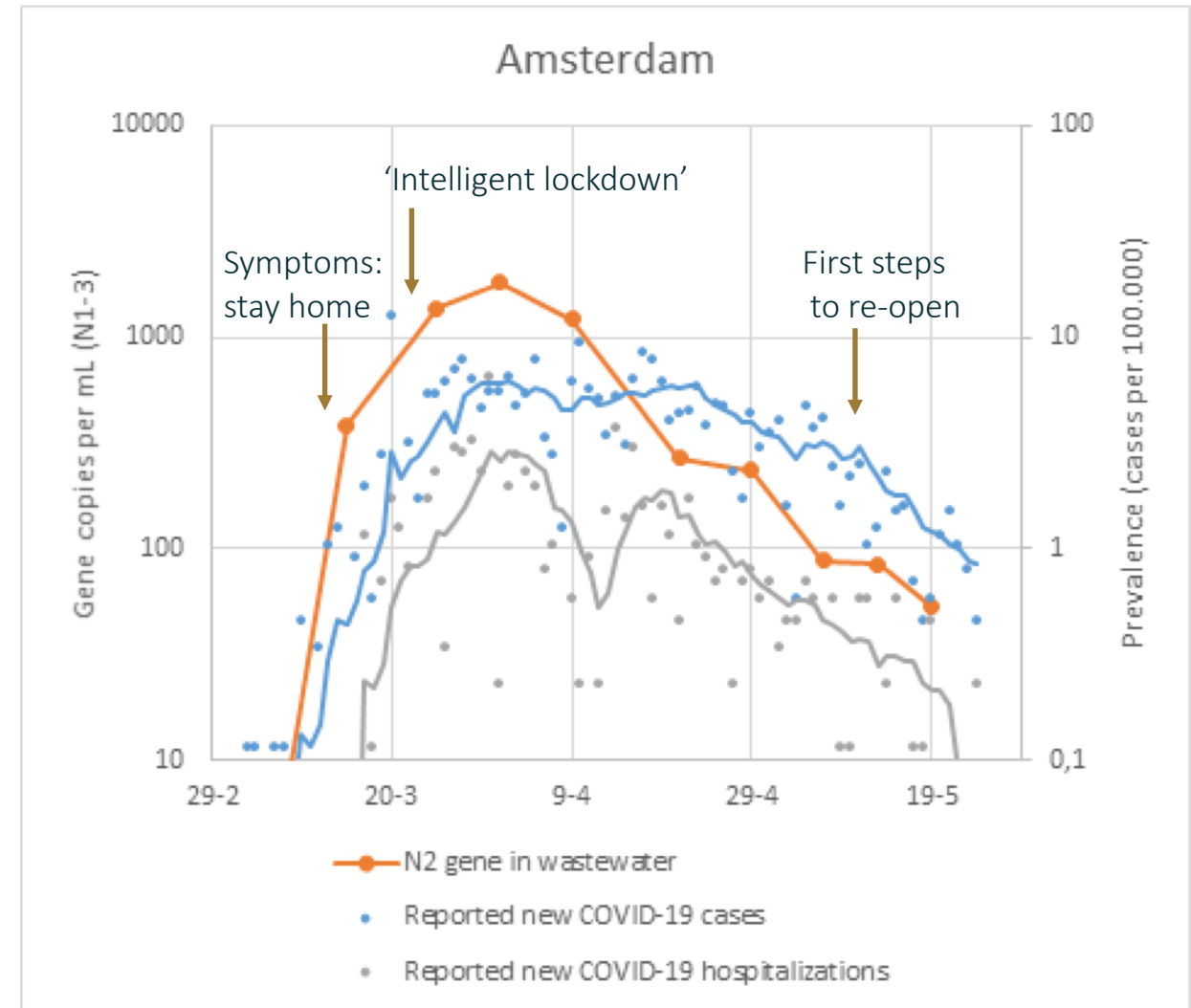
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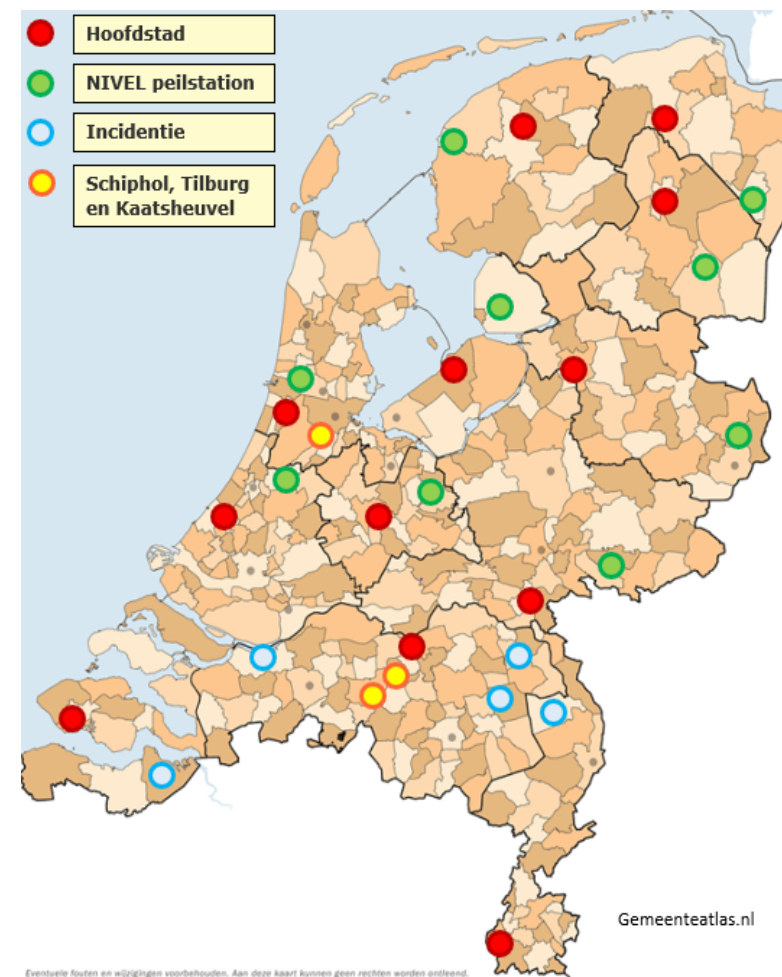
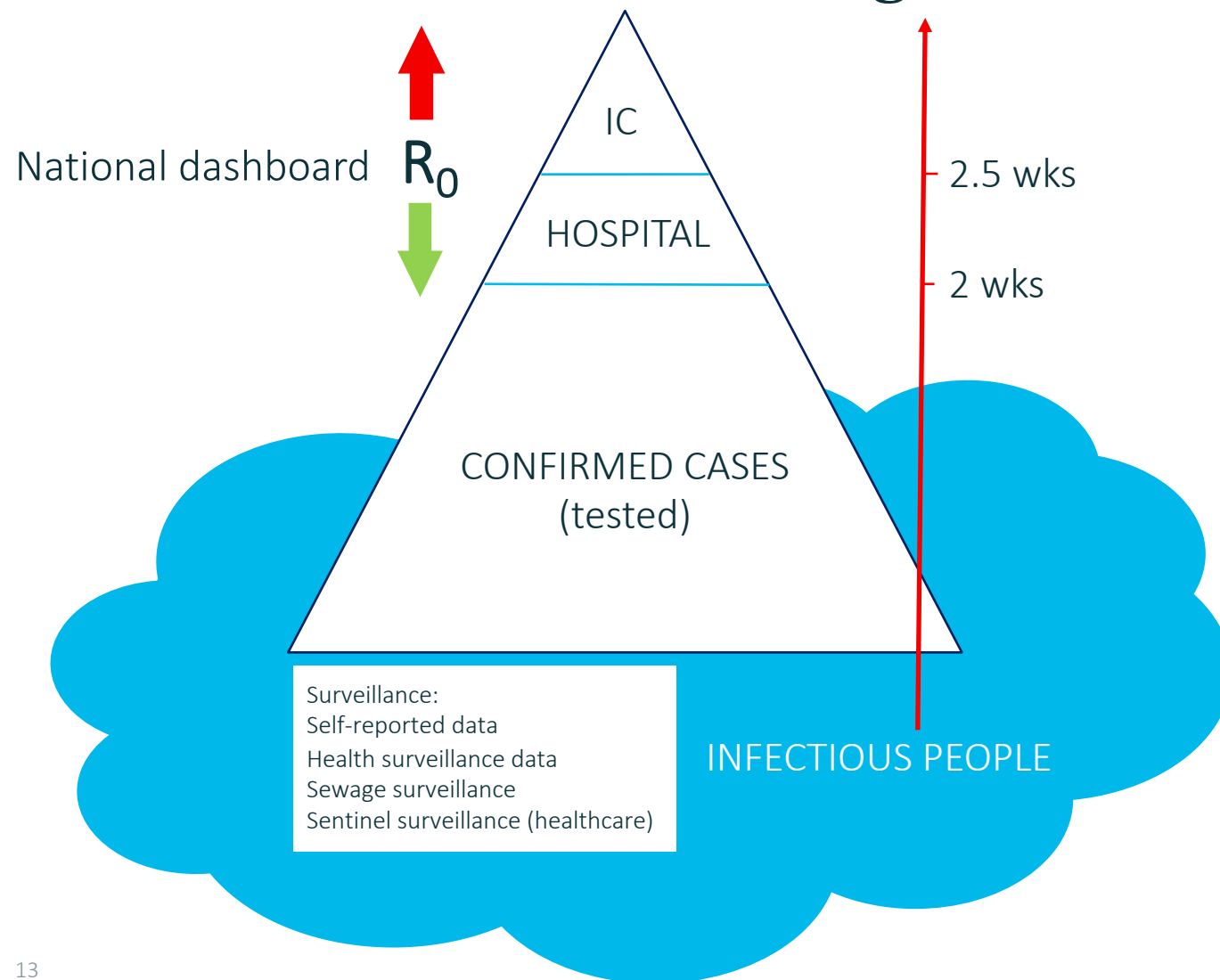


Sewage surveillance at WWTP in the Netherlands

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Netherlands: national sewage surveillance (RIVM)



Source: RIVM

How could we use these data?

Trends in virus circulation in communities as early warning

- 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?
 - Probably: how far does RNA signal drop as prevalence in community drops?
 - What level of RNA signal rise or drop is informative?
 - What frequency?
- Scale
 - Sentinel sites: larger cities

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



(Multi)National surveillance programs (scale)

Netherlands: national 29 (+8) cities weekly



Finland: national 28 cities weekly



Germany: national 20 cities daily



European Union: 100 city snapshot (feasibility study)



Global Water Pathogens Project: global data hub



Health risk to workers?

- No epidemiological signals SARS1, SARS2
- No case reports SARS1, SARS2
- What we detected \neq infectious virus
- Are SARS-CoV 2 shed in stool infectious?
 - Limited evidence indicates: not very
- Survival in wastewater?
 - First reports: no infectious SARS2 in sewage
 - Virus is not robust in wastewater
 - Limited evidence SARS1: 2d 20°C, 2w 4°C
 - Limited evidence: not/low in effluent
- SARS2 is not a game-changer for water and sanitation
- Advice: standard personal protection is safe





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With the help of:

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