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Use of passive samplers as sewage surveillance tool

Monitoring a hepatitis A outbreak at a school in Amsterdam, the Netherlands

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ACADEMISCHE WERKPLAATS PUBLIEKEGEZONDHEID
REGIO NOORD-HOLLAND EN FLEVOLAND



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Use of passive samplers as sewage surveillance tool to monitor a hepatitis A outbreak at a school in Amsterdam, the Netherlands, Oct 2022 - March 2023

Maarten de Jong [1], Maarten F Schim van der Loeff [2 3], Rémy Schilperoort [4], Harry Vennema [5], Charlie van der Weijden [2], Jeroen Langeveld [4], Matthijs Welkers [2 6], Maria Prins [2 3], Ana Maria de Roda Husman [5], Ewout Fanoy [2], Gertjan Medema [7]

Affiliations – collapse

Affiliations

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Hepatitis A outbreak - Amsterdam, Netherlands

- October 2022: 3 hep A cases notified to Public Health Service (GGD)
- All cases attended the same primary school
- Not vaccinated and recently returned from hepatitis A endemic country

Silent transmission?

- No feces of other children at the school was collected
  - no standard procedure in outbreak protocol
  - vaccination campaign was prioritized
  - communication with school was difficult

=> Wastewater surveillance?



Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/scitotenv

Capturing the SARS-CoV-2 infection pyramid within the municipality of Rotterdam using longitudinal sewage surveillance

Miranda de Graaf [a,b,1,*], Jeroen Langeveld [c,h,1], Johan Post [c,1], Christian Carrizosa [d,i], Eelco Franz [d], Ray W. Izquierdo-Lara [a], Goffe Elsinga [e], Leo Heijnen [e], Frederic Been [e], Janko van Beek [a], Remy Schilperoort [c], Rianne Vriend [f], Ewout Fanoy [f], Evelien I.T. de Schepper [g], Marion P.G. Koopmans [a,b,2], Gertjan Medema [b,e,h,2]



Sampling washing machine water to detect scabies (*Sarcoptes scabiei*)

G. Sips[1@], W. Stolk [1,2], M. de Jong[3], R. Schilperoort[4], P. Bijkerk[1*], A. Tjon-A-Tsien[1], M. de Graaf[2], J. Langeveld[4,5], E. Fanoy[3,#], G. Medema[5,6]

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International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Local wastewater monitoring as a complementary tool in a mumps outbreak investigation in the Netherlands: A proof-of-concept study

Maja Joosten [1,#], Aart C. Dijkstra [1,#,*], Maarten de Jong [2], Remy P.S. Schilperoort [3], Jeroen Langeveld [3], Marlous Prins [4], Gregorius J. Sips [4], Ewout Fanoy [5], Miranda de Graaf [6], Gertjan Medema [7], Loes Jaspers [1]

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[5] Municipal Health Service Utrecht (GGD regio Utrecht), Department of Infectious Diseases, the Netherlands
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[7] Microbial Water Quality & Health, KWR Water Research Institute, Nieuwegein, the Netherlands

An observational study protocol on wastewater measurements and diaper culture to estimate antimicrobial resistance in long-term care facilities for people with intellectual disabilities: The GIRAF-MIC study protocol

S. Hidad[1,2], S.C. de Greeff[1], F. de Haan[1], R. Schilperoort[3], G.L. Leusink[2], A. Timen[1,2], H. Schmitt[1]*

1 Centre for Infectious Disease Control, National Institute for Public Health and the Environment, Bilthoven, the Netherlands, **2** Department of Primary and Community Care, Radboud University Medical Center, Nijmegen, the Netherlands, **3** Partners4UrbanWater, Nijmegen, the Netherlands



Onderwerpen Over RIVM Publicaties International Contact Agenda Mijn RIVM

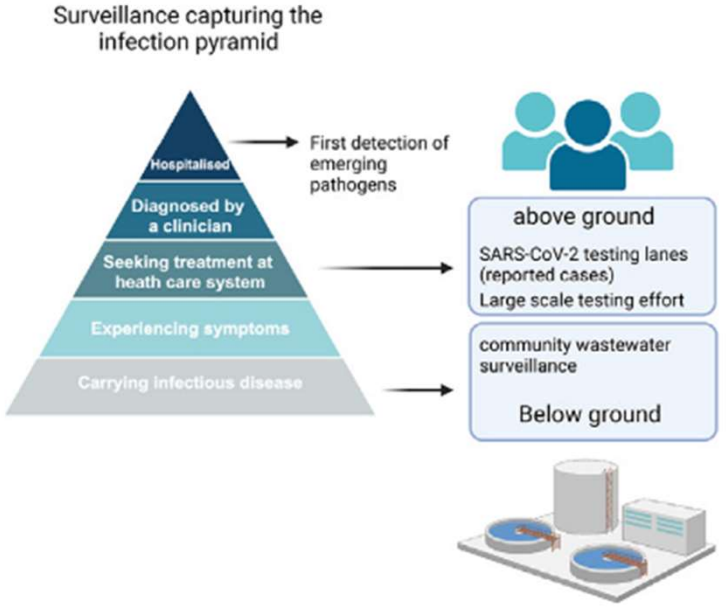
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Zomerse influenza A-uitbraak in Rotterdams verpleeghuis leidde tot 'diepgaand' multidisciplinair onderzoek

+ many non-health parameters

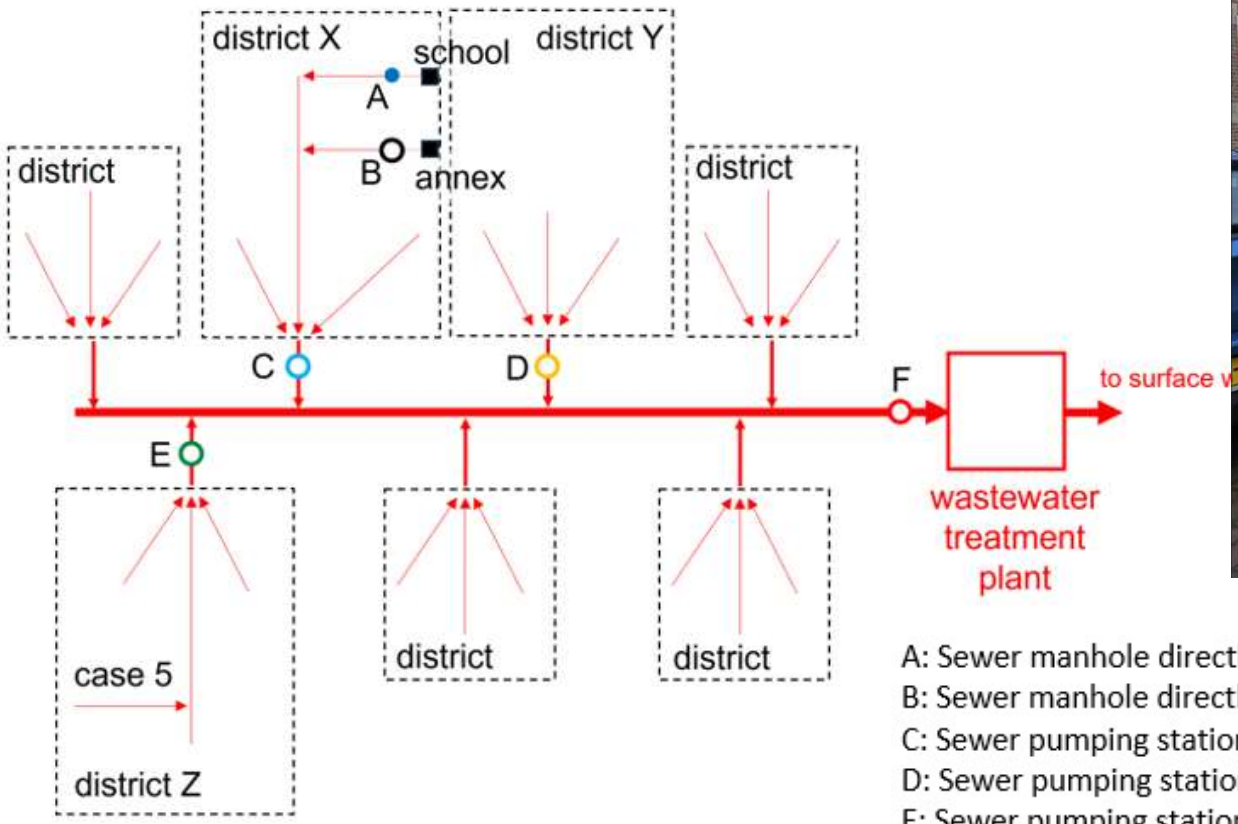
Pilot wastewater surveillance for hepatitis A

- Hepatitis A detectable in wastewater?
- Downstream schools building(s) and in broader area?
- Can we find a (below ground) match with known (above ground) cases?



De Graaf *et al*, 2023

Monitoring plan





A: Sewer manhole directly downstream school
B: Sewer manhole directly downstream annex building
C: Sewer pumping station district X
D: Sewer pumping station district Y
E: Sewer pumping station district Z
F: Wastewater treatment plant (influent)

How to sample wastewater?



How to sample wastewater?

1. Grab sample (‘snapshot’)





How to sample wastewater?

2. Automated sampler (‘composite sample’)



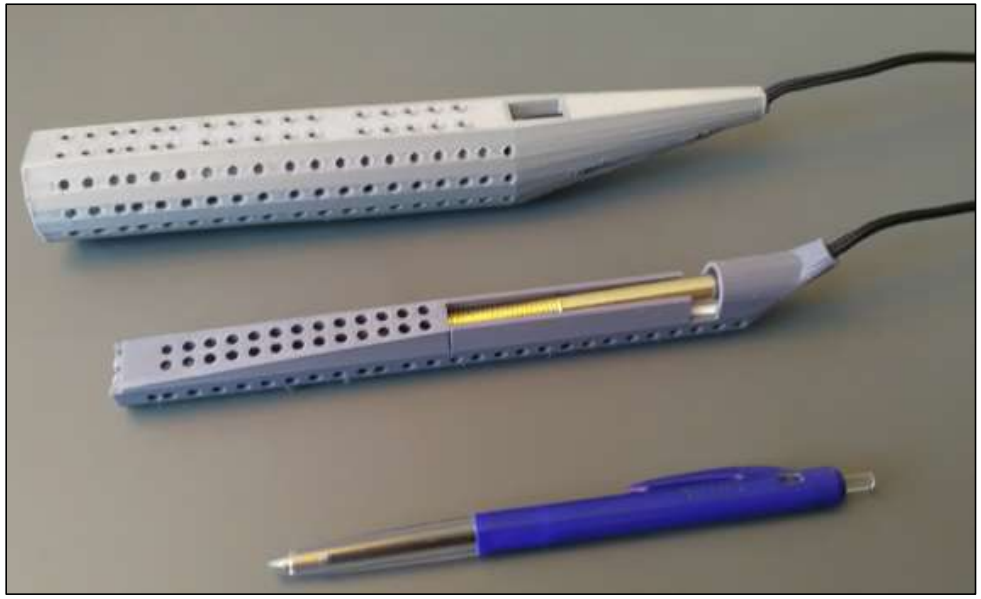




How to sample wastewater?



3. Passive sampler
   - 3D-printed casing
   - absorption materials: cotton q-tips, filter paper, wound gauze
   - 48h-72h in sewer





Passive sampling

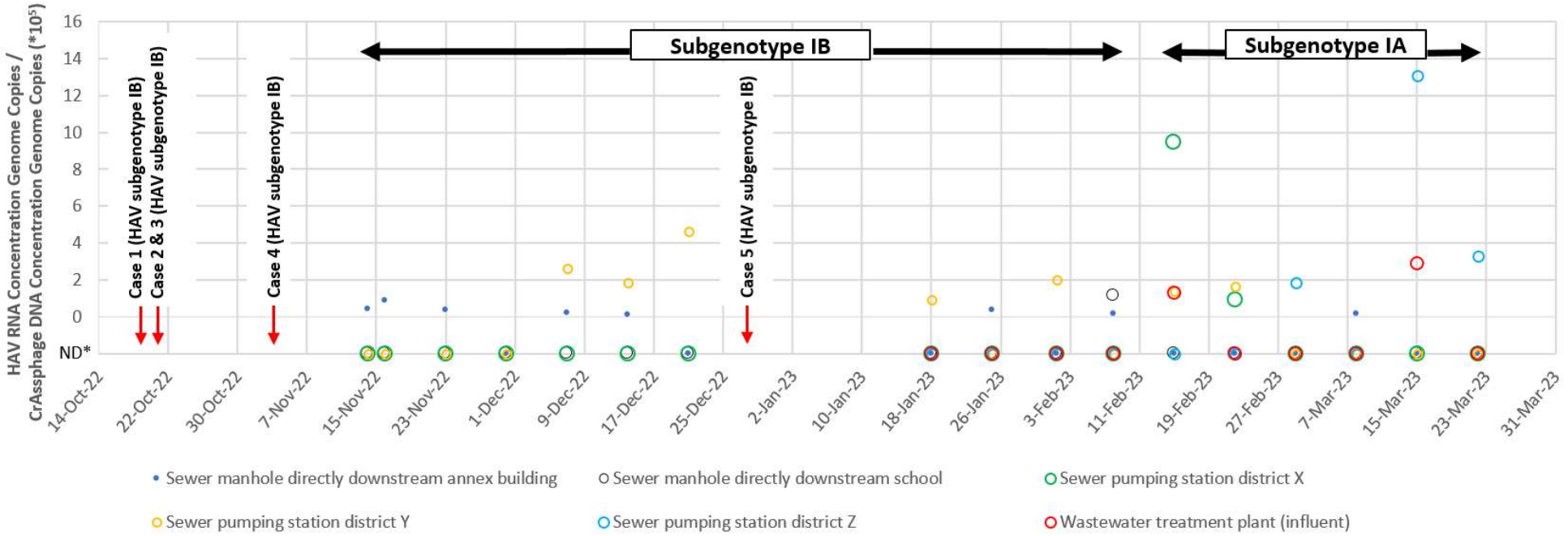
Very small scale possible (individual buildings)



example of nursing home



Results



- 22/88 positive for HAV (25%)
- Nov ‘22 - Feb ‘23: subgenotype IB, matches feces samples
- Feb ’23 - Mar ‘23: subgenotype IA, no known cases

Discussion - conclusions

Successful first time use of passive samplers to detect hepatitis A in sewage for outbreak monitoring and to link to diagnosed cases

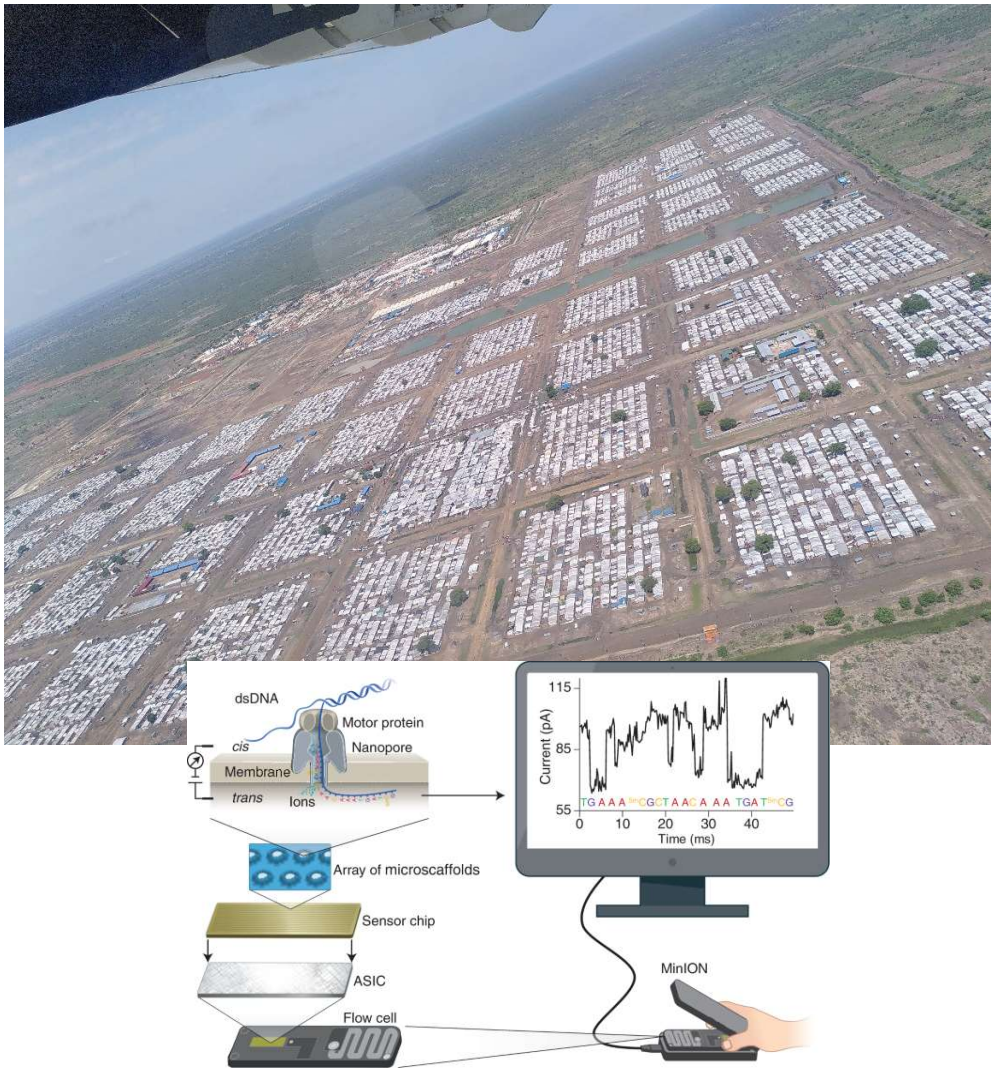
- Sewage surveillance detected both recognized and unrecognized HAV infections and documented the disappearance of HAV circulation over time, despite only limited implementation of control measures
- Sewage surveillance proved a practical second-best alternative to individual stool sampling, enabling population-level monitoring of HAV circulation and shedding dynamics when collection of fecal samples was considered unfeasible. However, unlike individual testing, it does not identify who is shedding virus and therefore cannot support targeted interventions such as household contact tracing or ring vaccination

Passive sampler-based sewage monitoring is a promising tool to guide public health response during hepatitis A and other (asymptomatic) outbreaks

Future plans

- Employment passive samplers in low-resource settings
- Doctors without Borders
  - e.g. refugee camps (photo: South Sudan)

- Combining passive samplers with portable on-demand diagnostic tools (Nanopore MinIon Technology)



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Ethical framework

https://www.rivm.nl/weblog/IB/ontwikkeling-van-waardenkompas-voor-toepassing-van-rioolwatersurveillance-bij-infectieziektebestrijding-IB0526

