



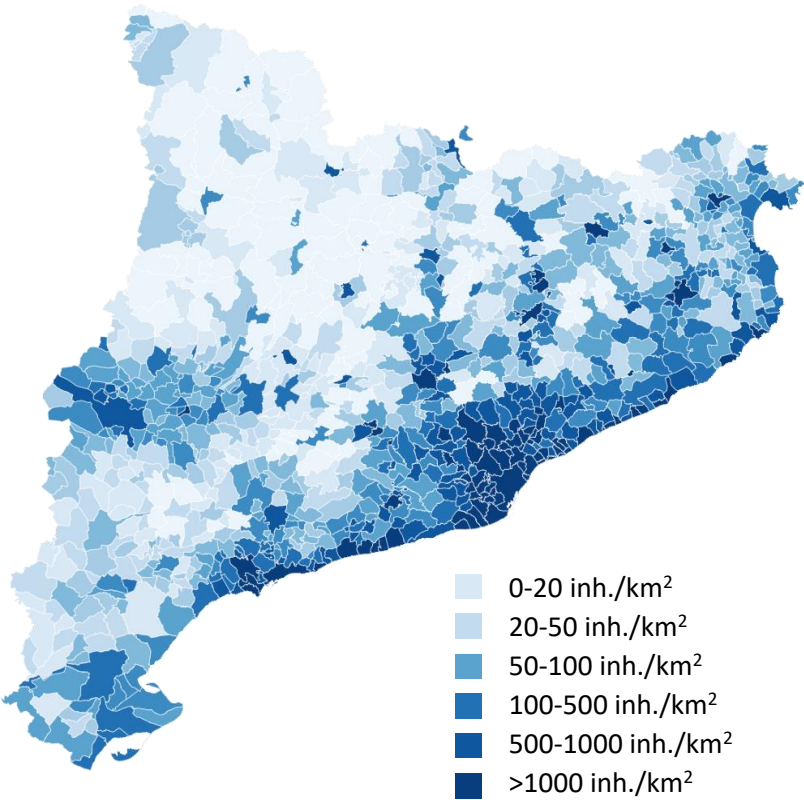
## Drawing the future of the Catalan sewage surveillance program: towards an integrated public health perspective

**Laura Guerrero-Latorre**  
Environmental Health Service  
Public Health Agency of Catalonia

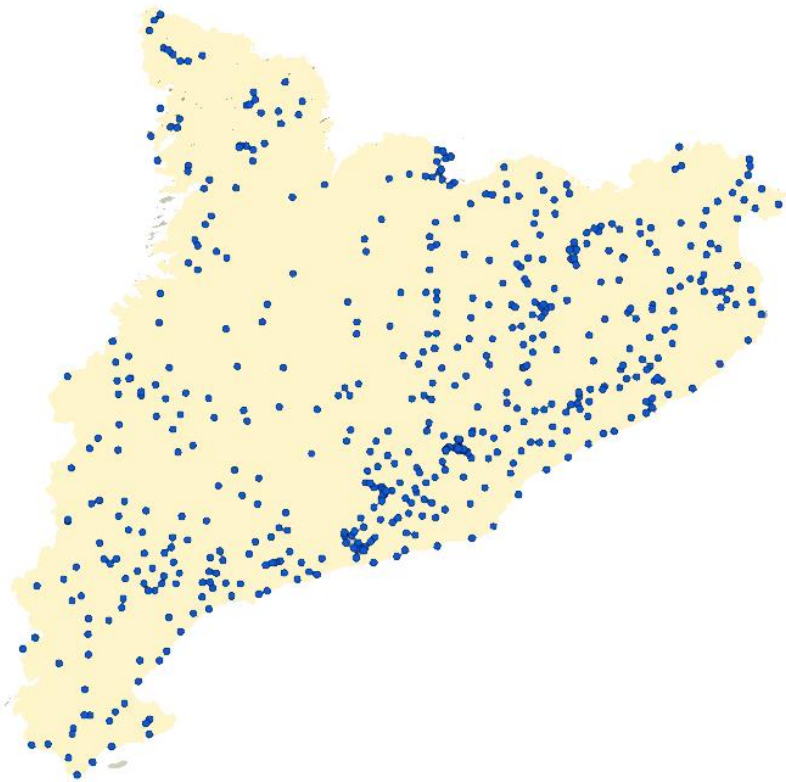
17th November 2023, Frankfurt



# Catalunya



7,56 Million inhabitants

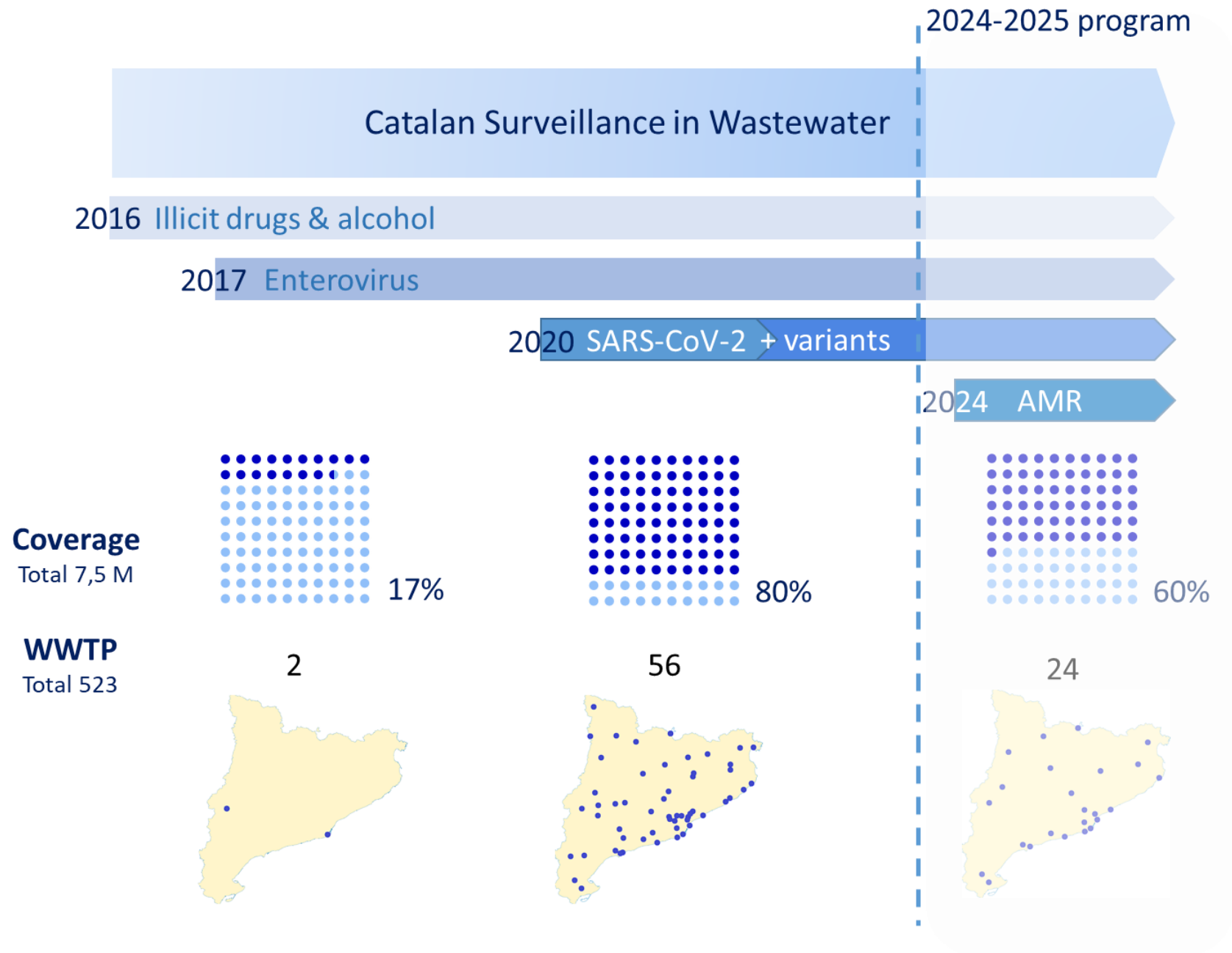


523 WWTP (98% sanitation)



9 Health Regions

# Timeline



# Illicit Drugs, Alcohol and Sedatives

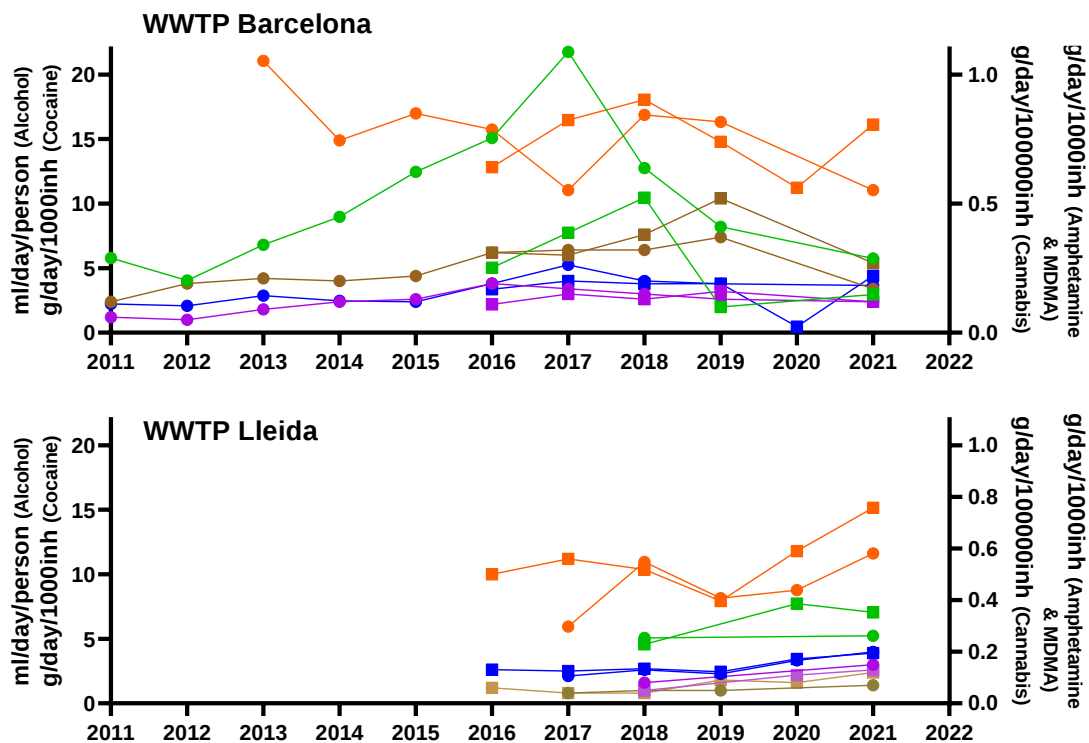
Program **started in 2011** (ScoreNetwork), 2016 within ASPCAT

Twice a year sampling (**7-day campaing**, autum & spring)

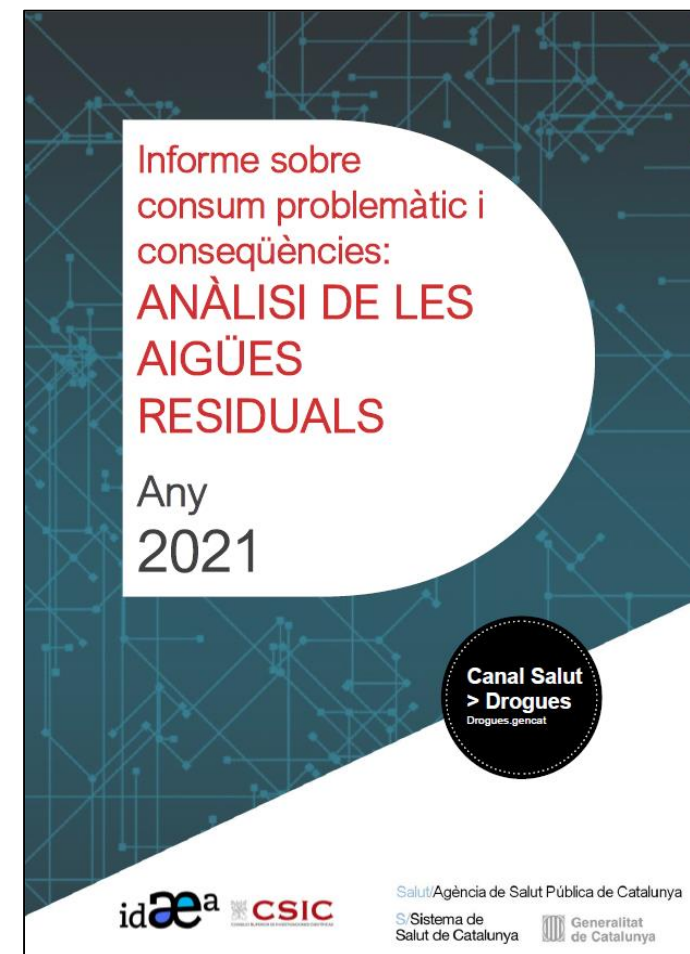
**2 WWTP** : El Prat del Llobregat (1.000.000 inhabitants)

Lleida (300.000 inhabitants)

Results expressed in **consumption per day** (flow, metabolism, population, etc...)



Alcohol Spring    Autumn  
Cocaine Spring    Autumn  
Amphetamine Spring    Autumn  
MDMA Spring    Autumn  
Cannabis Spring    Autumn



# Enterovirus

Program **started in may 2017**

**Monthly** sampling

**1 WWTP** : El Prat del Llobregat (1.000.000 inhabitants)

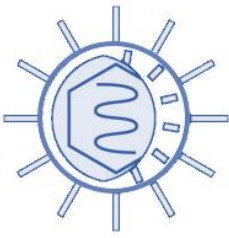
Enterovirus analysis allows us to:

- **Monitor poliovirus:** cVDPV neither WPV have not been detected
- **Detect** the circulation of **neurological strains** (such as A71).

Sewage surveillance integrated into the **Poliomyelitis Eradication Plan**

## Objectives

1. Maintain the acute **flaccid paralysis surveillance** system in under 15 years in order to meet the quality requirements established by the WHO
2. Maintain **sewage surveillance** to detect the presence of wild and/or vaccinated polioviruses



## Protocol per a la Vigilància de les Paràlisis Flàccides Agudes en menors de 15 anys

### Pla d'erradicació de la Poliomièlitis

(Enquesta epidemiològica actualitzada juny 2023)

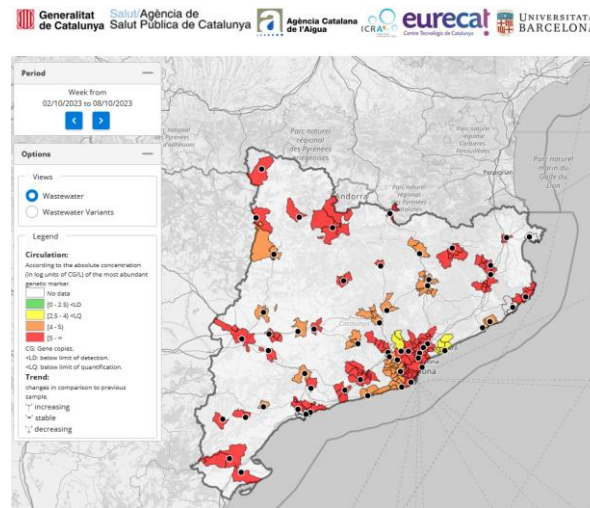
Octubre 2021

# SARS-CoV-2 Viral loads

Program started in July 2020

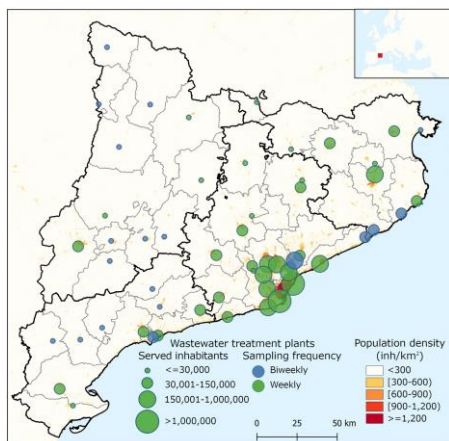
Weekly sampling (36 WWTPs) / fortnightly (18 WWTPs)

56 WWTP covering 6.000.000 inhabitants (80%),  $\geq 1$  WWTP/county



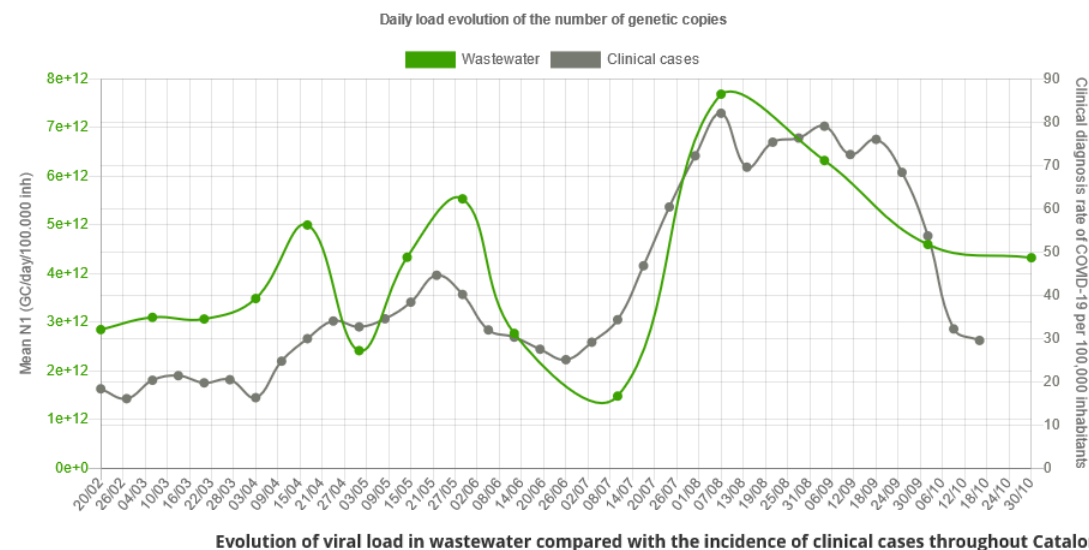
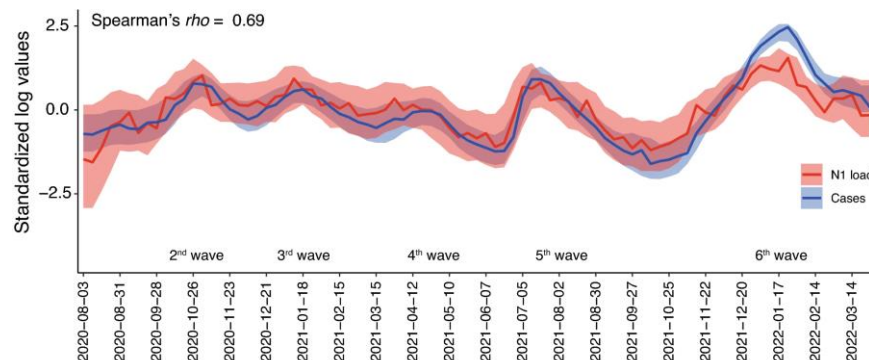
<http://sarsaigua.icra.cat>

scientific reports



## OPEN The Catalan Surveillance Network of SARS-CoV-2 in Sewage: design, implementation, and performance

Laure Guerrero-Latorre<sup>1,2,3,4</sup>, Neus Collado<sup>1,2,3,4</sup>, Nerea Abasolo<sup>1</sup>, Gabriel Anzaldí<sup>4</sup>, Silvia Bofill-Mas<sup>5</sup>, Albert Bosch<sup>1,2</sup>, Lluís Bosch<sup>1,2</sup>, Silvia Busquets<sup>1,2</sup>, Antoni Caimari<sup>6</sup>, Núria Canela<sup>7</sup>, Albert Carcereny<sup>8,9</sup>, Carme Chacón<sup>3</sup>, Pilar Ciruela<sup>3</sup>, Irene Corbella<sup>3</sup>, Xavier Domingo<sup>4</sup>, Xavier Escoté<sup>10</sup>, Yaimara Espiñeira<sup>4</sup>, Eva Forés<sup>4</sup>, Isabel Gandullo-Sarró<sup>11</sup>, David García-Pedemonte<sup>12</sup>, Rosina Girones<sup>4</sup>, Susana Guix<sup>4,7</sup>, Ayalkibet Hundersá, Marta Itarte<sup>4</sup>, Roger Marín-Casadó<sup>10</sup>, Anna Martínez<sup>3</sup>, Sandra Martínez-Puchol<sup>1</sup>, Anna Mas-Capdevila<sup>10</sup>, Cristina Mejías-Molina<sup>4</sup>, Marc Moliner i Rafà<sup>11</sup>, Antoni Munné<sup>11</sup>, Rosa Maria Pintó<sup>4,7</sup>, Josep Pueyo-Ros<sup>1,2</sup>, Jordi Robusté-Cartró<sup>12</sup>, Marta Rusiñol<sup>12</sup>, Robert Sanfeliu<sup>4</sup>, Joan Teichenné<sup>10</sup>, Helena Torrell<sup>13</sup>, Lluís Corominas<sup>1,2</sup> & Carles M. Borrego<sup>1,13,14</sup>

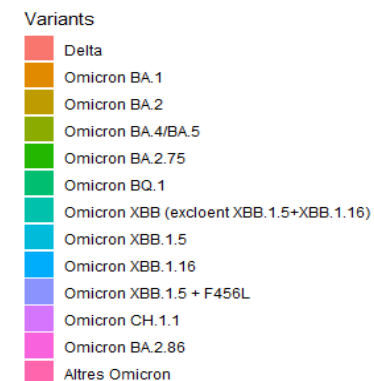
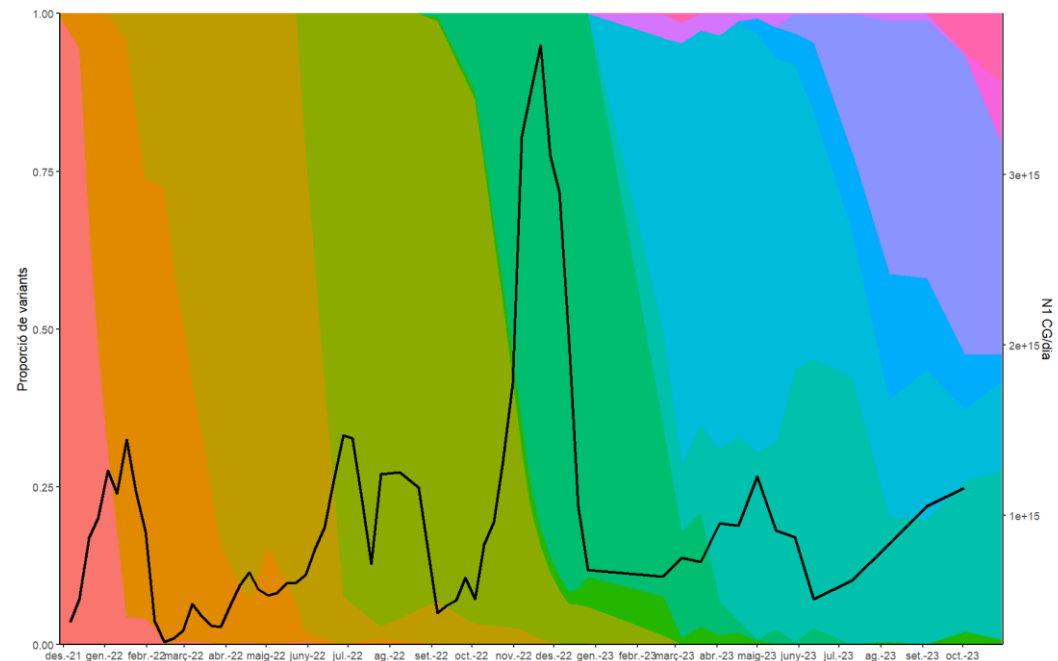


From June 2023: **monthly** sampling

→ geometric mean N1 values from all WWTPs in order to compare viral loads with clinical incidence

# SARS-CoV-2 Variants

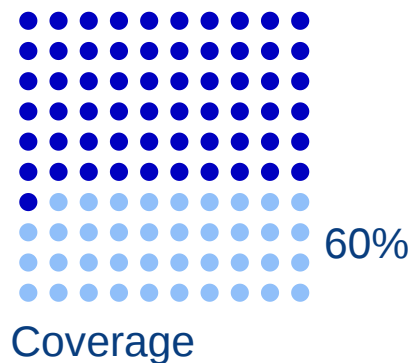
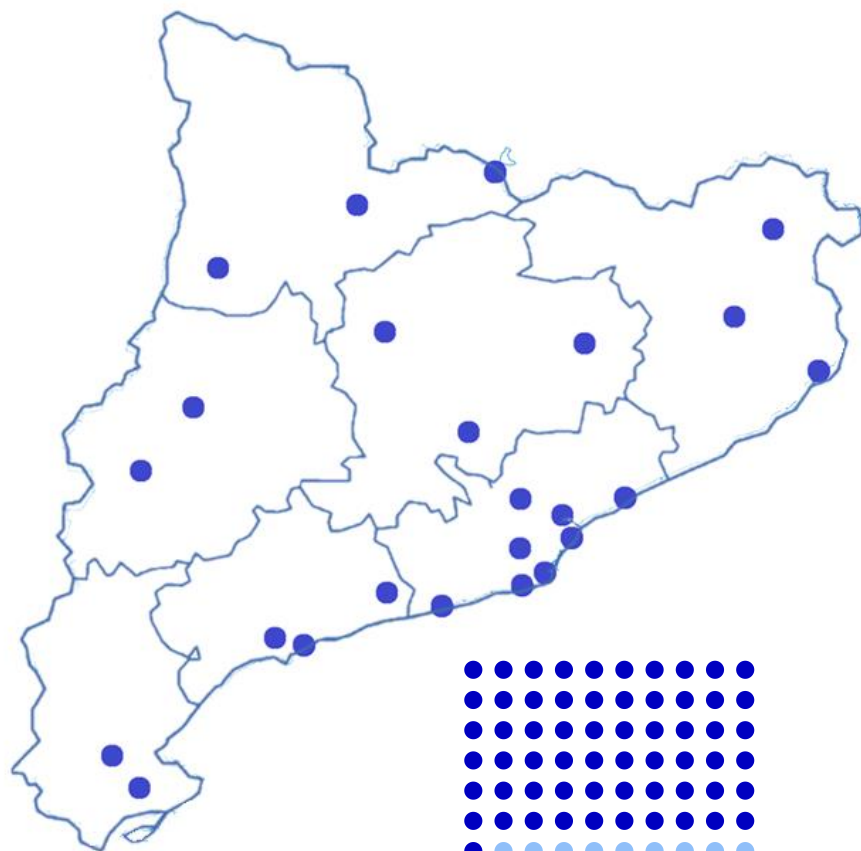
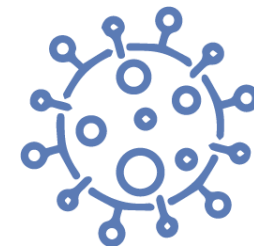
Program started in Nov 2021



Results available in  
<http://sarsaigua.icra.cat/variants>



# 2024-2025 program SARS-CoV-2 & variants



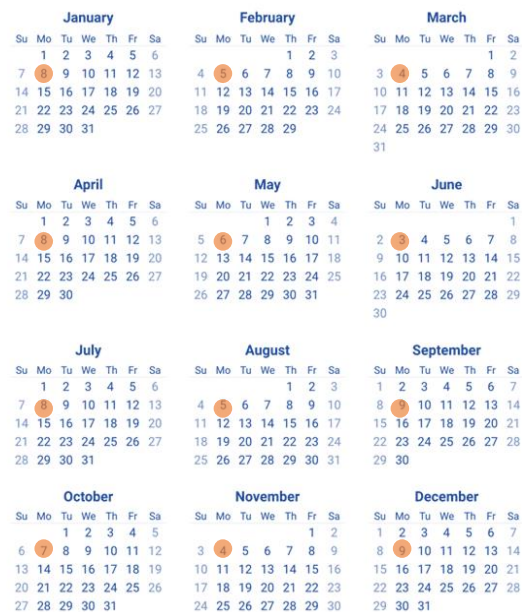
## Sampling facts

24 WWTPs

4,56 Million inhabitants

9/9 Health Regions

Monthly Sampling



Calendar

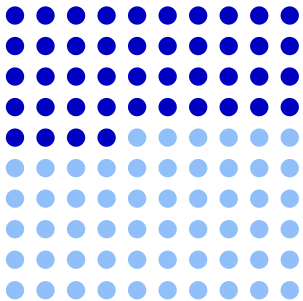
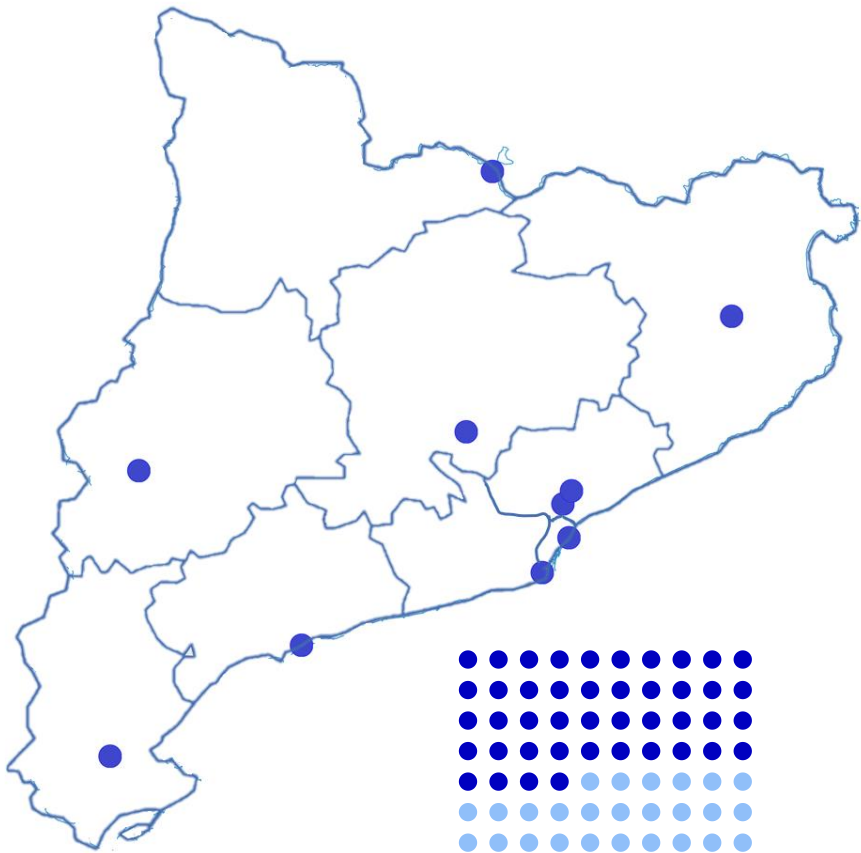
## Analytical methods

RT-qPCR N1 & N2/IP4

Sequencing Spike gene

*Flexibility in choosing sampling locations and frequencies, all within the constraints of budget availability*

# 2024-2025 program    Illicit drugs, alcohol & sedatives



43%

Coverage

## Sampling facts

10 WWTPs

3,3 Million inhabitants

9/9 Health Regions

Twice-year Sampling

| January                                                                                                                 | February                                                                                                                | March                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Su Mo Tu We Th Fr Sa<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | Su Mo Tu We Th Fr Sa<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 29       | Su Mo Tu We Th Fr Sa<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30<br>31 |
| April                                                                                                                   | May                                                                                                                     | June                                                                                                                       |
| Su Mo Tu We Th Fr Sa<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30    | Su Mo Tu We Th Fr Sa<br>1 2 3 4<br>5 6 7 8 9 10 11<br>12 13 14 15 16 17 18<br>19 20 21 22 23 24 25<br>26 27 28 29 30 31 | Su Mo Tu We Th Fr Sa<br>1<br>2 3 4 5 6 7 8<br>9 10 11 12 13 14 15<br>16 17 18 19 20 21 22<br>23 24 25 26 27 28 29<br>30    |
| July                                                                                                                    | August                                                                                                                  | September                                                                                                                  |
| Su Mo Tu We Th Fr Sa<br>1 2 3 4 5 6<br>7 8 9 10 11 12 13<br>14 15 16 17 18 19 20<br>21 22 23 24 25 26 27<br>28 29 30 31 | Su Mo Tu We Th Fr Sa<br>1 2 3<br>4 5 6 7 8 9 10<br>11 12 13 14 15 16 17<br>18 19 20 21 22 23 24<br>25 26 27 28 29 30 31 | Su Mo Tu We Th Fr Sa<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30       |
| October                                                                                                                 | November                                                                                                                | December                                                                                                                   |
| Su Mo Tu We Th Fr Sa<br>1 2 3 4 5<br>6 7 8 9 10 11 12<br>13 14 15 16 17 18 19<br>20 21 22 23 24 25 26<br>27 28 29 30 31 | Su Mo Tu We Th Fr Sa<br>1 2<br>3 4 5 6 7 8 9<br>10 11 12 13 14 15 16<br>17 18 19 20 21 22 23<br>24 25 26 27 28 29 30    | Su Mo Tu We Th Fr Sa<br>1 2 3 4 5 6 7<br>8 9 10 11 12 13 14<br>15 16 17 18 19 20 21<br>22 23 24 25 26 27 28<br>29 30 31    |

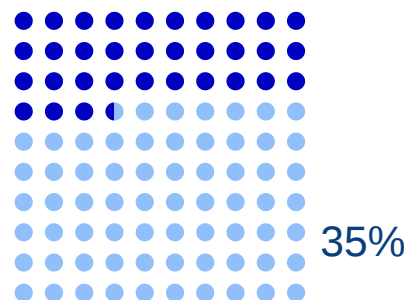
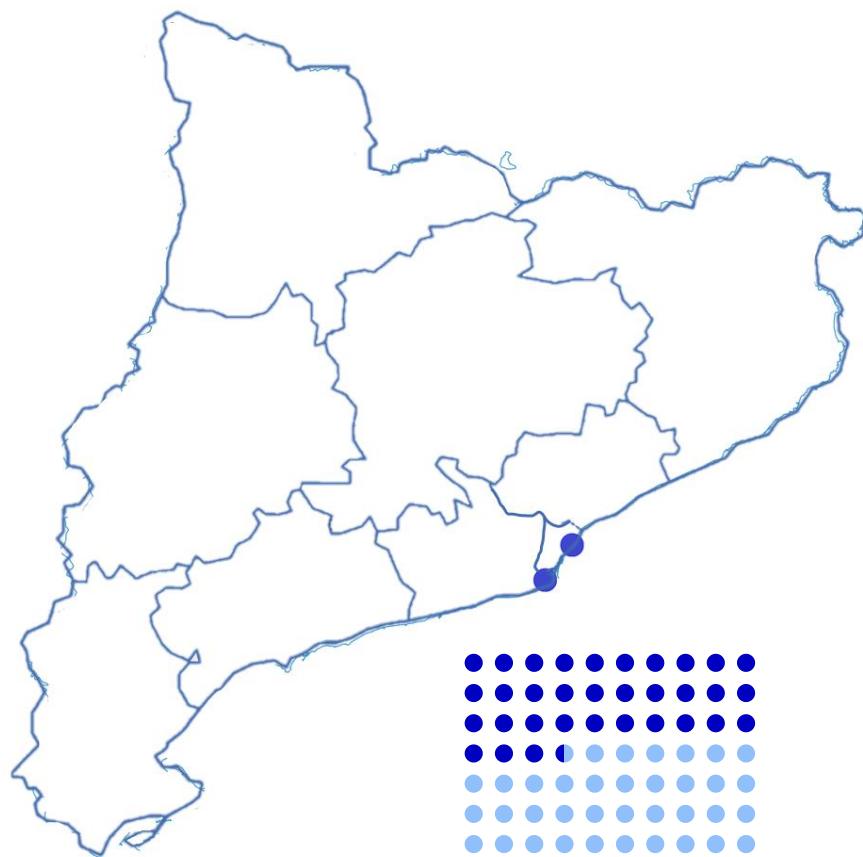
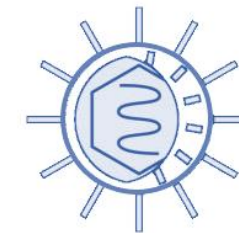
Calendar

## Analytical methods

Chromatography and Mass-Spectrometry

- Alcohol (Ethyl Sulfate)
- Cocaine (Benzoylecgonine, Cocaethylene)
- Ephedrine
- Amphetamine
- Methamphetamine
- MDMA: Methylenedioxyamphetamine
- Heroin (6-Monoacetyl morphine)
- Morphine
- Methadone (2-Ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine)
- LSD
- Ketamine
- Δ9-tetrahydrocannabinol (THC)
- Cannabinol (THCCOOH)
- Anxiolytics: Alprazolam, Diazepam, Lorazepam, Oxazepam, Temazepam)

# 2024-2025 program    Enterovirus



Coverage

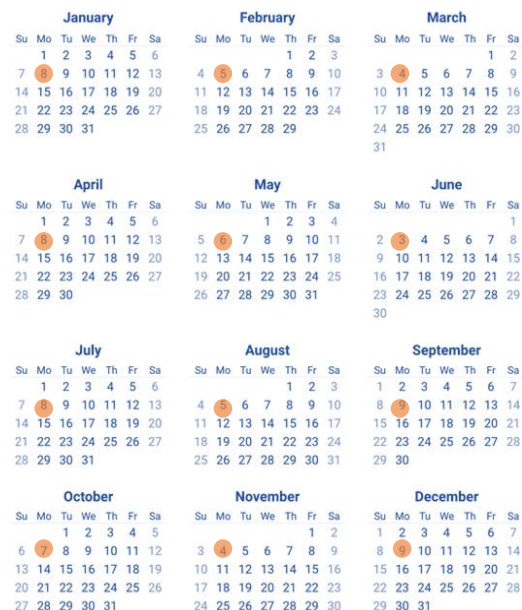
## Sampling facts

2 WWTPs

2,5 Million inhabitants

2/9 Health Regions

Monthly Sampling



Calendar

## Analytical methods

RT-qPCR Enterovirus

Sequencing positive PCRs

# 2024-2025 program Antimicrobial Resistant Microorganisms (AMR)



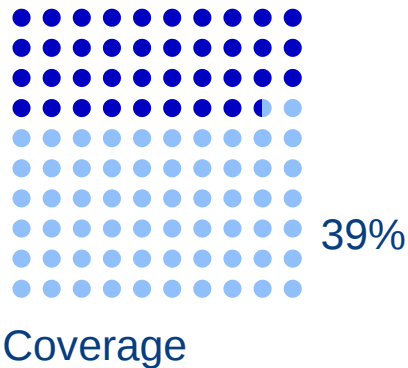
## Sampling facts

5 WWTPs inlet and outlet

+ 5 hospitals

5/9 Health Regions

Yearly Sampling



Calendar

## Analytical methods

Selective culture

- Extended-spectrum betalactamases Enterobacteria (Ent-BLEE)
- Carbapenem-resistant Enterobacteria (Ent-CRE)
- *Acinetobacter baumannii* carbapenem resistant (Acb-CRE)
- Vancomycin resistant enterococci
- *Pseudomonas sp./ Pseudomonas aeruginosa*

Metagenomics (resistome & mobilome)

# 2024-2025 program

## Integrated and customized programs

- Different sampling strategies
  - Inlet WWTP: epidemiological surveillance (for all markers)
  - Outlet WWTP: environmental risk assessment (for ARM)
  - Hospitals: emerging health risk (for ARM)
- Different frequencies: monthly, once a year, 7-day campaign
- Different methods: culture, chromatography, PCR, sequencing

## We have a plan, but we still have important concerns...

- How often we need to review the surveillance program design?
- What are the bases by which we should evaluate our programs?



# Thanks for your attention

Contact:



[salut.ambiental@gencat.cat](mailto:salut.ambiental@gencat.cat)

Institutions involved:



**Agència Catalana  
de l'Aigua**



UNIVERSITAT DE  
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**Salut/** Agència de Salut  
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**Generalitat  
de Catalunya**