Wastewater-based epidemiology in Wales

COVID-19 and beyond

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Wastewater operations and research team

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We also acknowledge the support from all our collabrators

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RESEARCH ARTICLE

Rapid Assessment of SARS-CoV-2 Variant-Associated Mutations in Wastewater Using Real-Time RT-PCR

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ABSTRACT Within months of the COVID-19 pandemic being declared on March 20, 2020, novel, more infectious variants of SARS-CoV-2 began to be detected in geospatially distinct regions of the world. With international travel being a lead cause of

Wastewater monitoring in the UK for COVID-19

- Four separate wastewater programmes were operated in the UK in response to the pandemic, across the devolved Governments and by the UK Government in England

- Health is one of the devolved responsibilities in Wales, Scotland and Northern Ireland

Northern Ireland Executive

HM Government

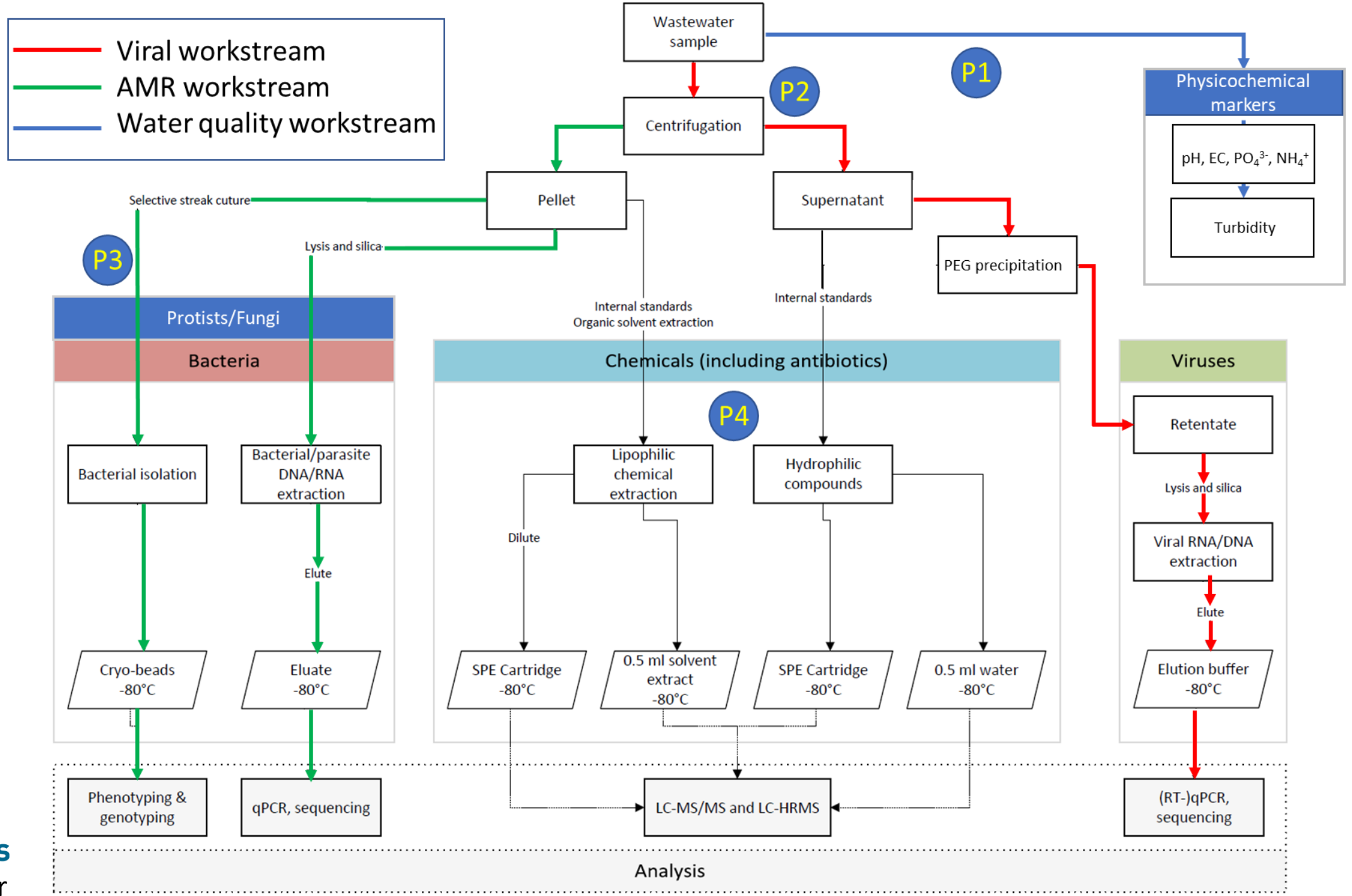
Scottish Government
Riaghaltas na h-Alba

Llywodraeth Cymru
Welsh Government

Wastewater monitoring in Wales

- Wales undertakes a comprehensive wastewater monitoring programme across **47 municipal WwTW.**
- 5 days-a-week, 24-hour composites of influent (and some effluents).
- ~75% of Welsh population covered (2.4m people covered). PE values range from 419 to 612,000.
- Sites chosen based on geography and population density.
- Monitoring COVID-19, Influenza, Norovirus, RSV, Enterovirus, Polio and antibiotic resistant genes (ARGs). Policy relevant questions where we can give answers.
- Pilot trials (pharmaceuticals, protozoal pathogens, culturable AMR).
- Running for > 2 years (some sites since March 2020).

Different sampling approaches used in Wales



Cefas

D. Walker

Weekly reporting of COVID-19 to Welsh Government

Since the last report, SARS-CoV-2 viral load has increased across the country.
The signal increased in 11 regions, decreased in 2 regions, and remained level in 1 region.
Please note flow data is not available from July 11th onwards, consequently data normalisation is based on chemical markers only.

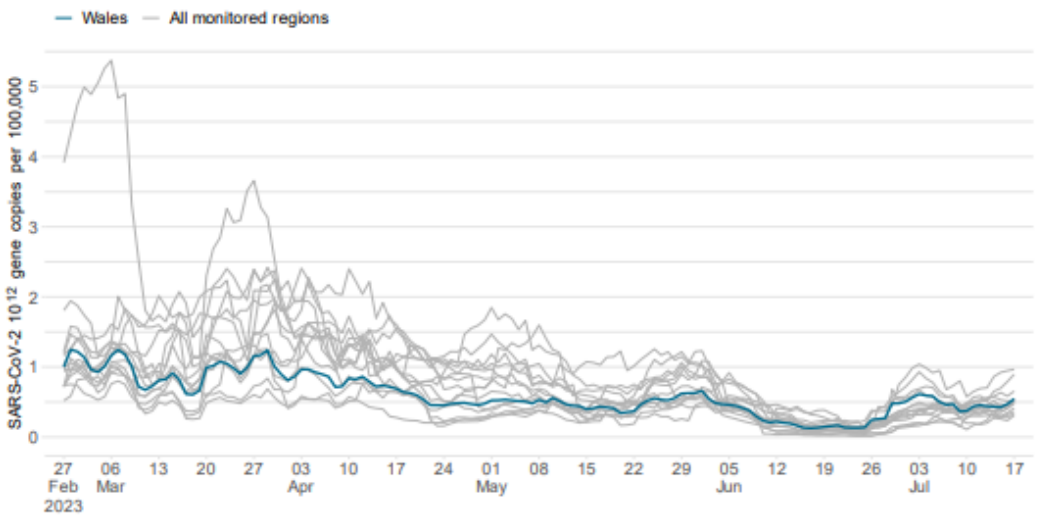


Figure 2 - National (blue lines) and Regions (grey lines) Rolling Mean SARS-CoV-2 gc/day per 100k

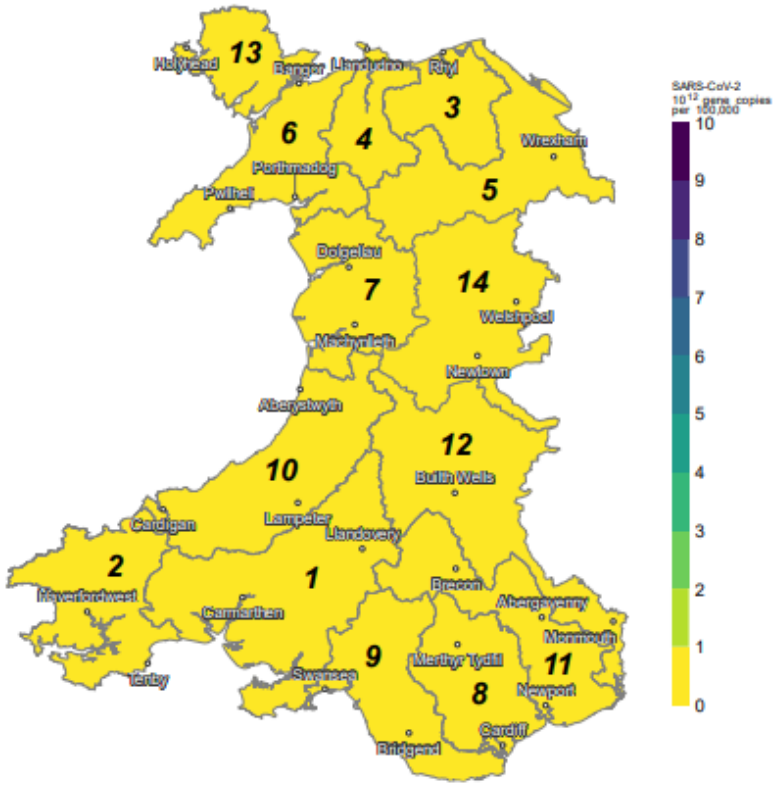
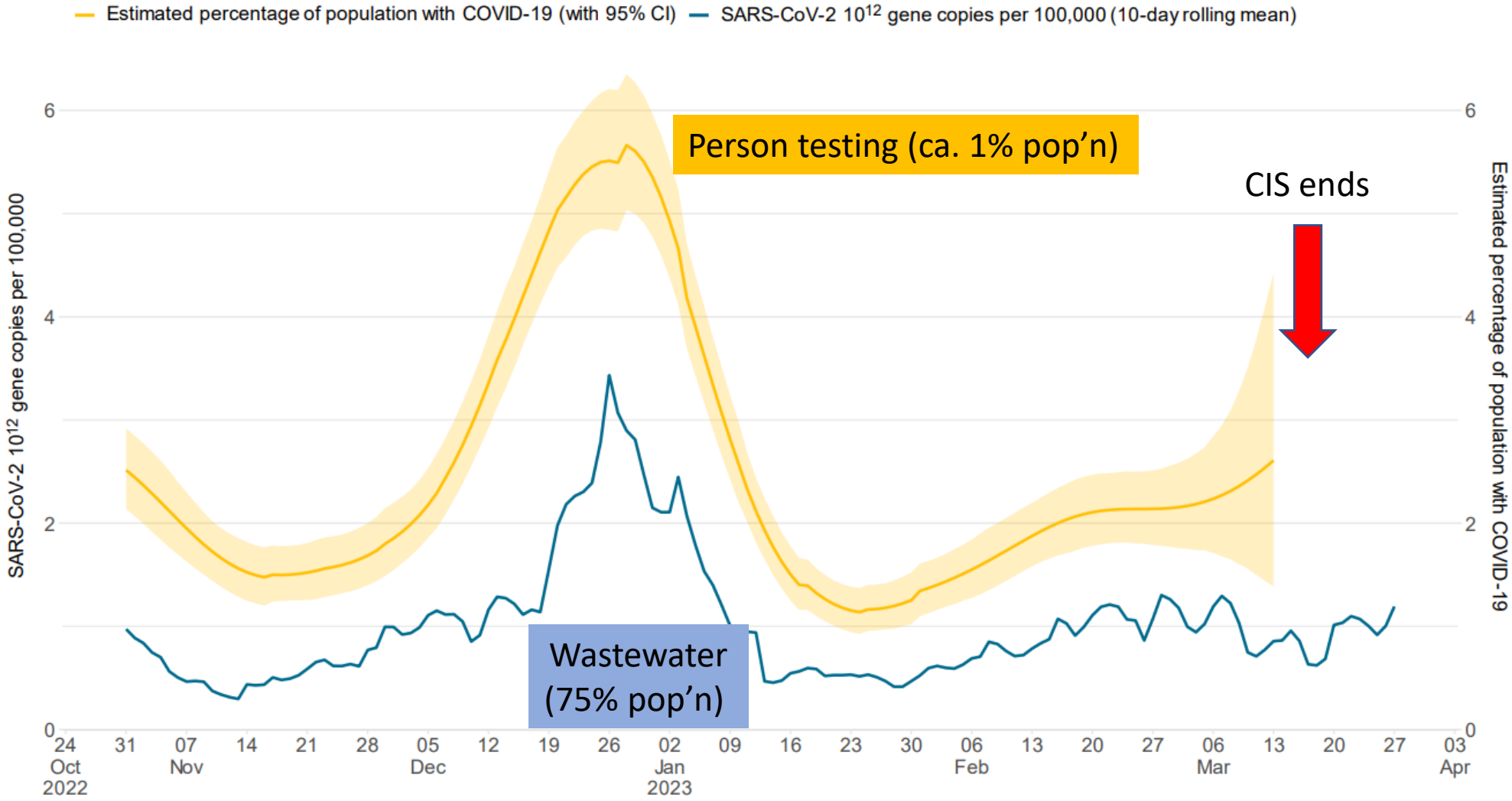
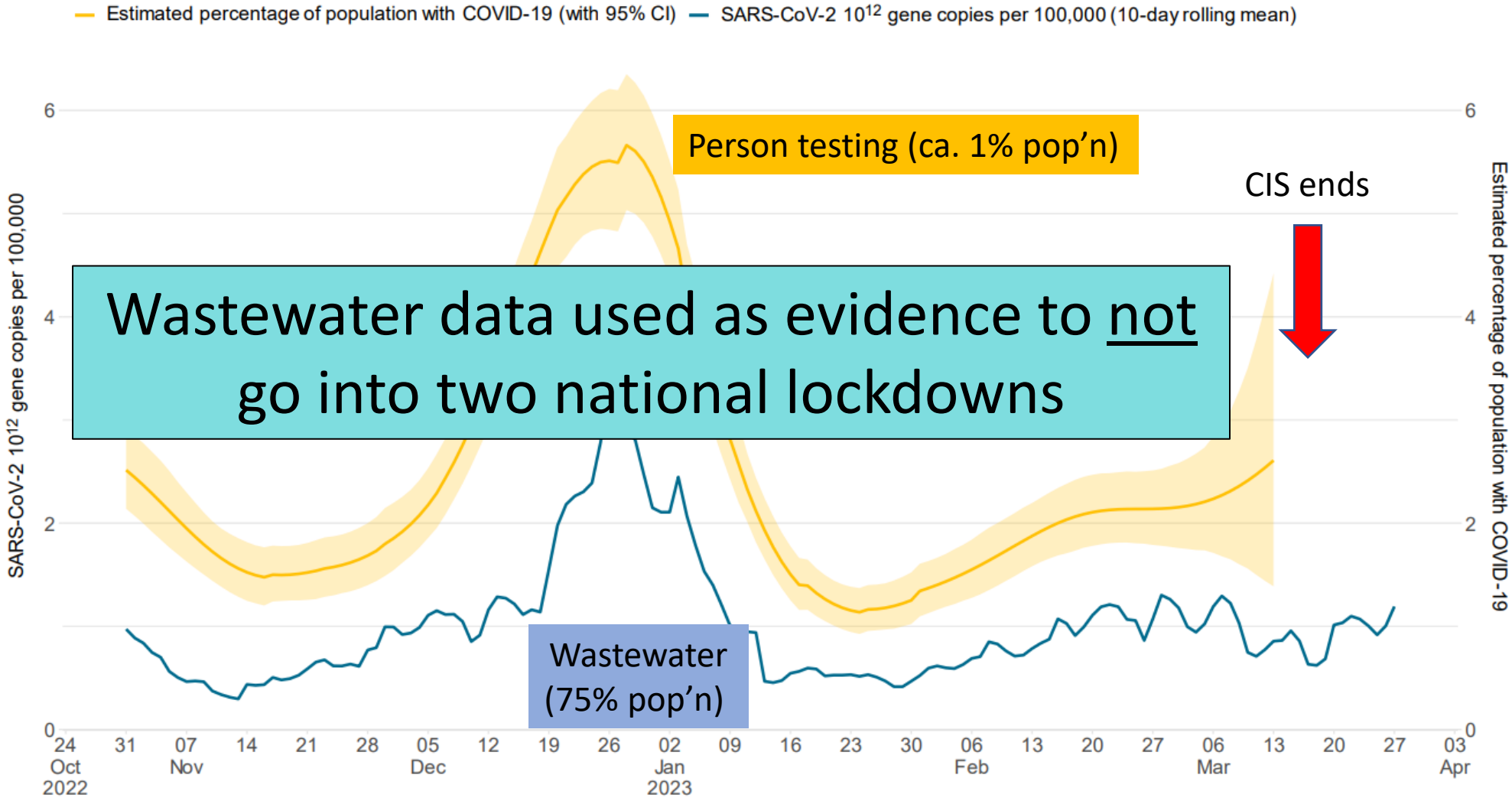


Figure 3 - National Heat Map showing Regional Mean SARS-CoV-2 gc/day per 100k

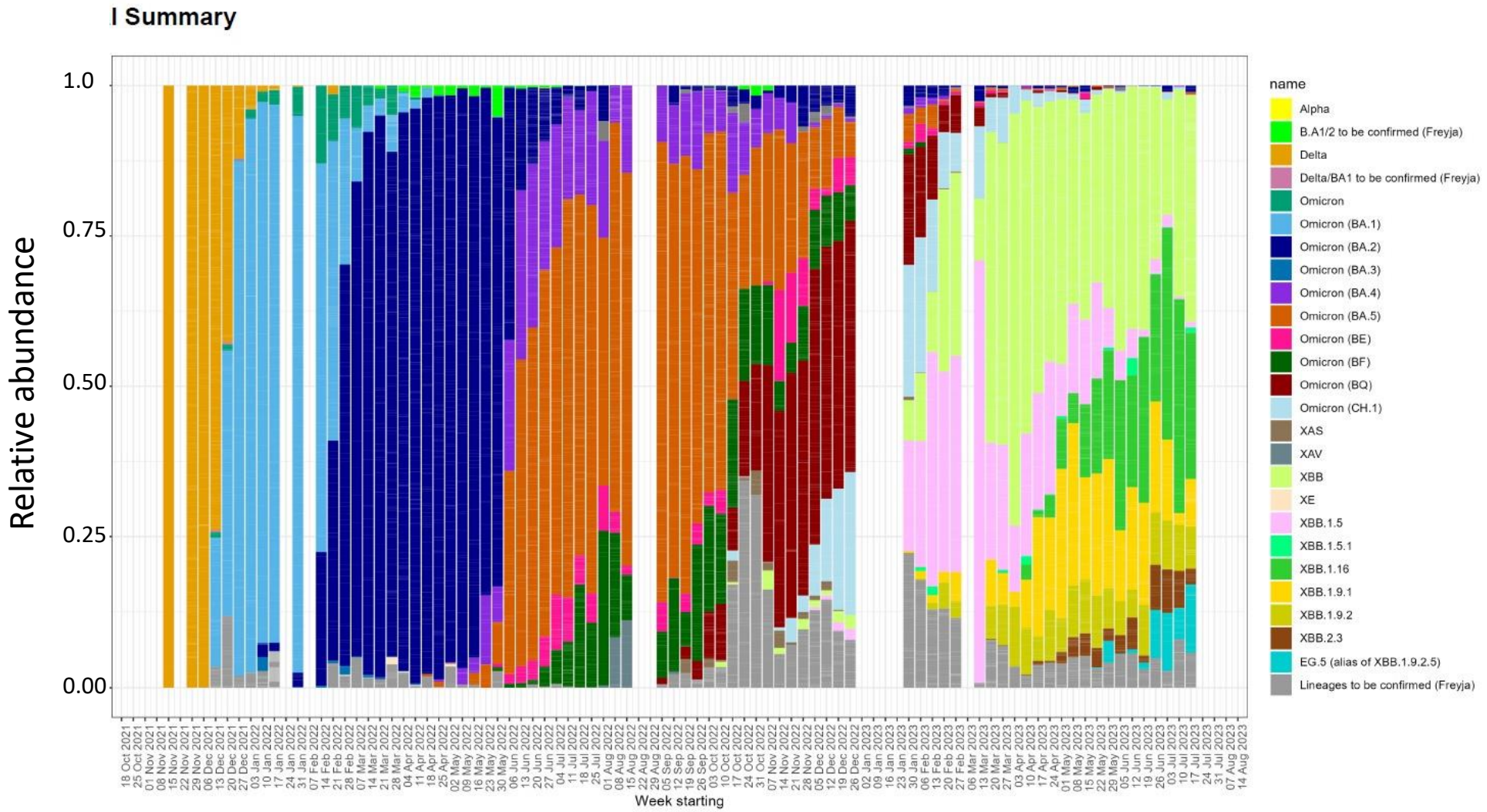
Wastewater vs. COVID-19 Infection Survey in Wales



Wastewater vs. COVID-19 Infection Survey in Wales



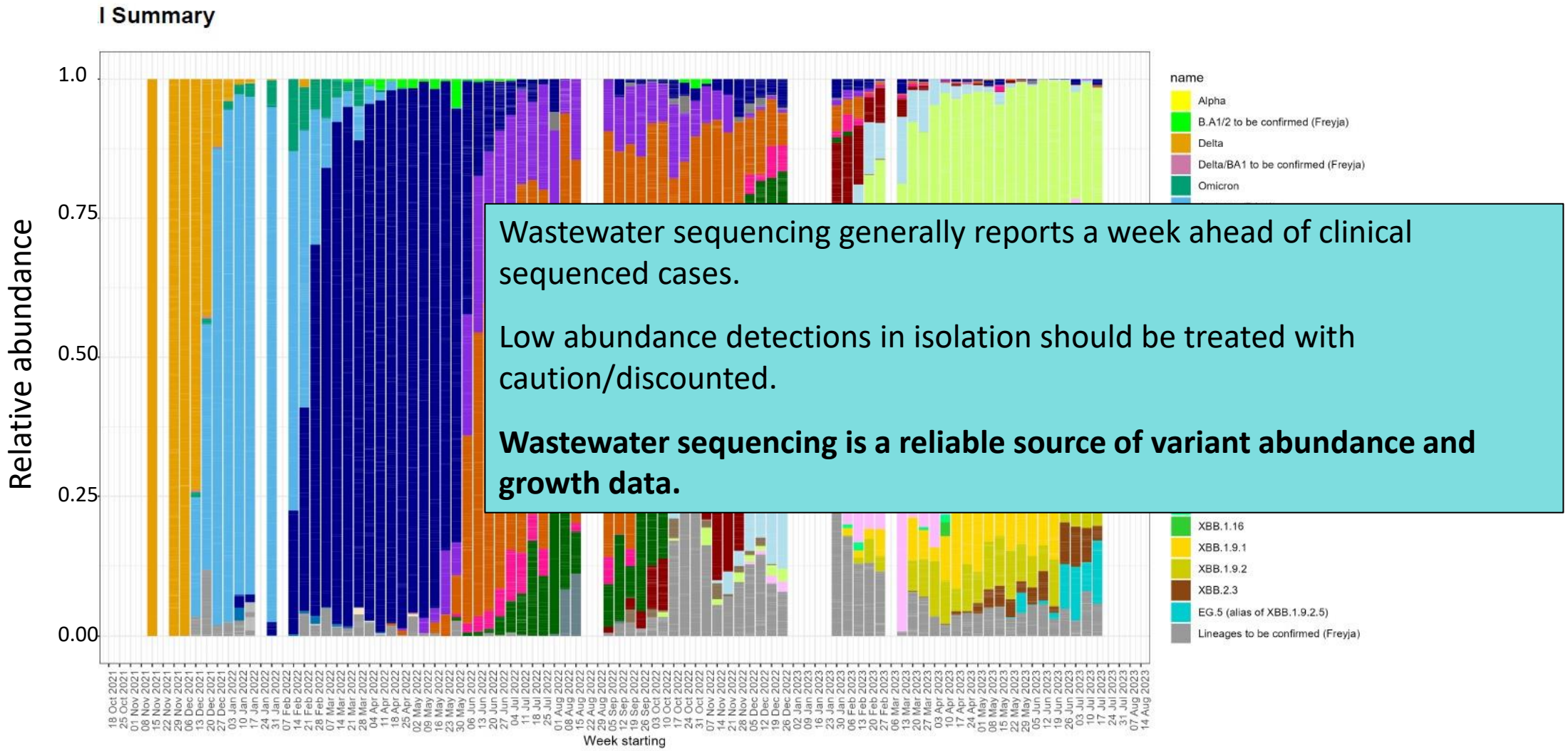
Variants of SARS-CoV-2 mapped weekly



NoV 2021

July 2023

Variants of SARS-CoV-2 mapped weekly



Wastewater sequencing generally reports a week ahead of clinical sequenced cases.

Low abundance detections in isolation should be treated with caution/discounted.

Wastewater sequencing is a reliable source of variant abundance and growth data.

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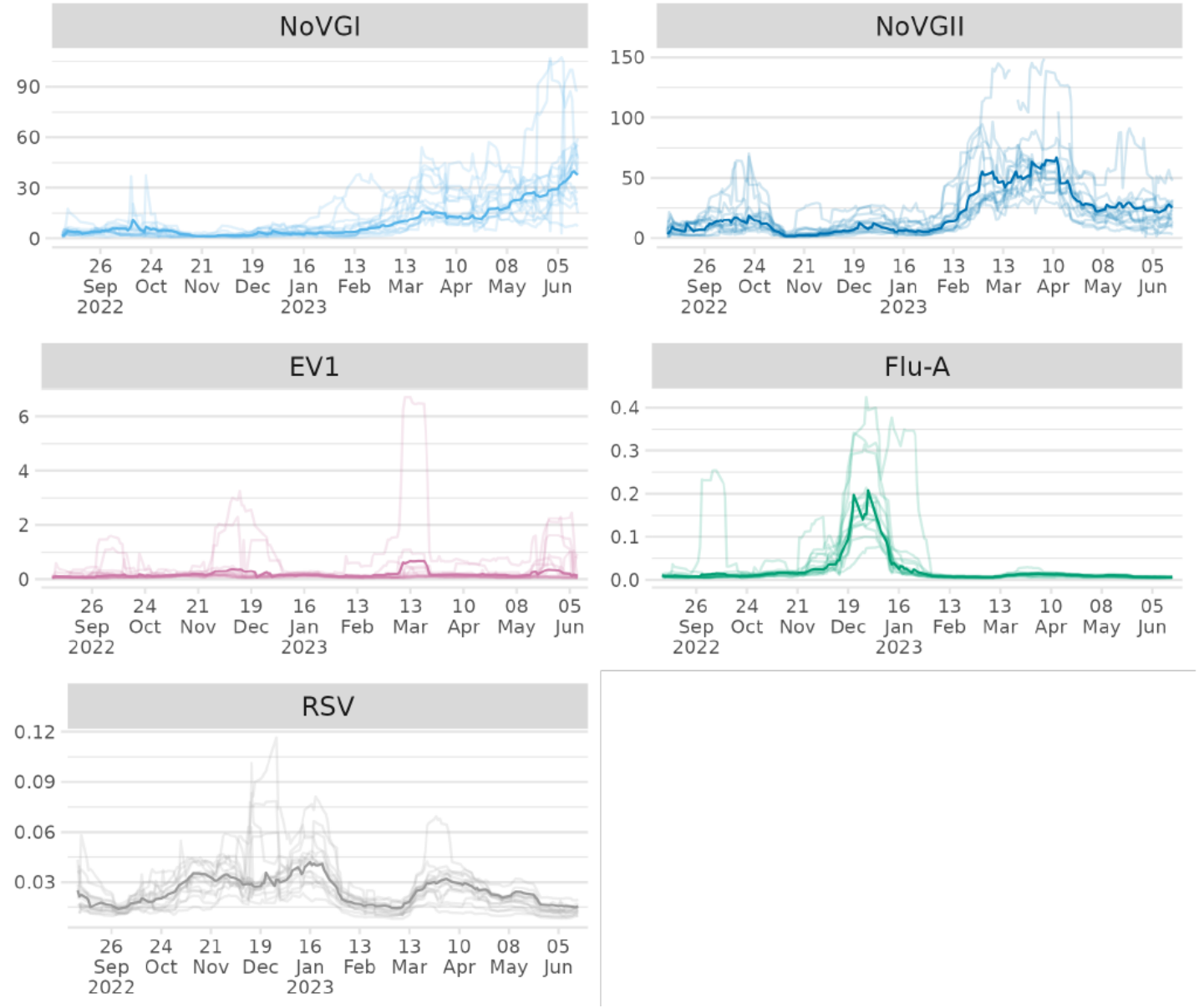
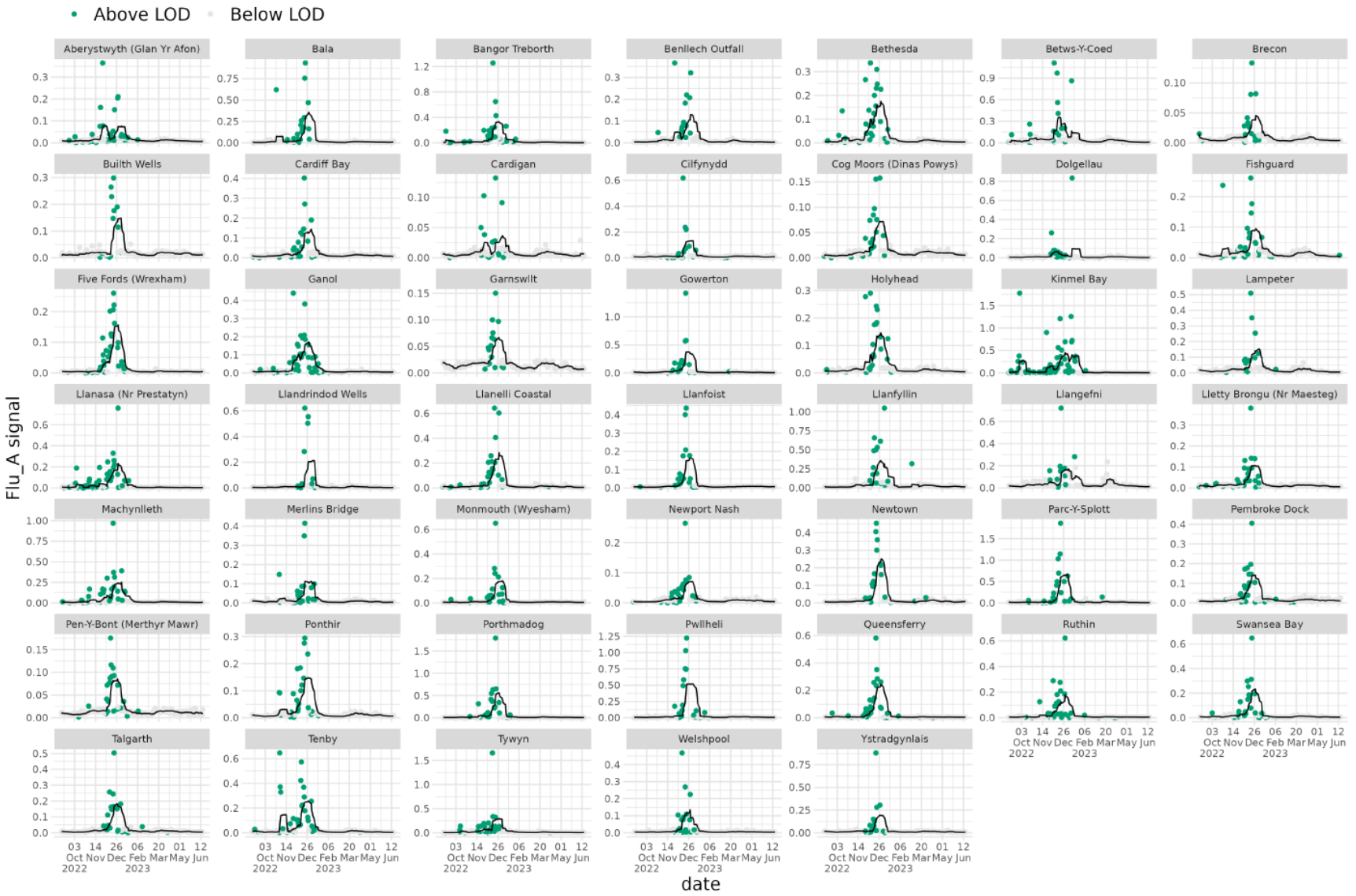
Expanding the public health wastewater portfolio in Wales

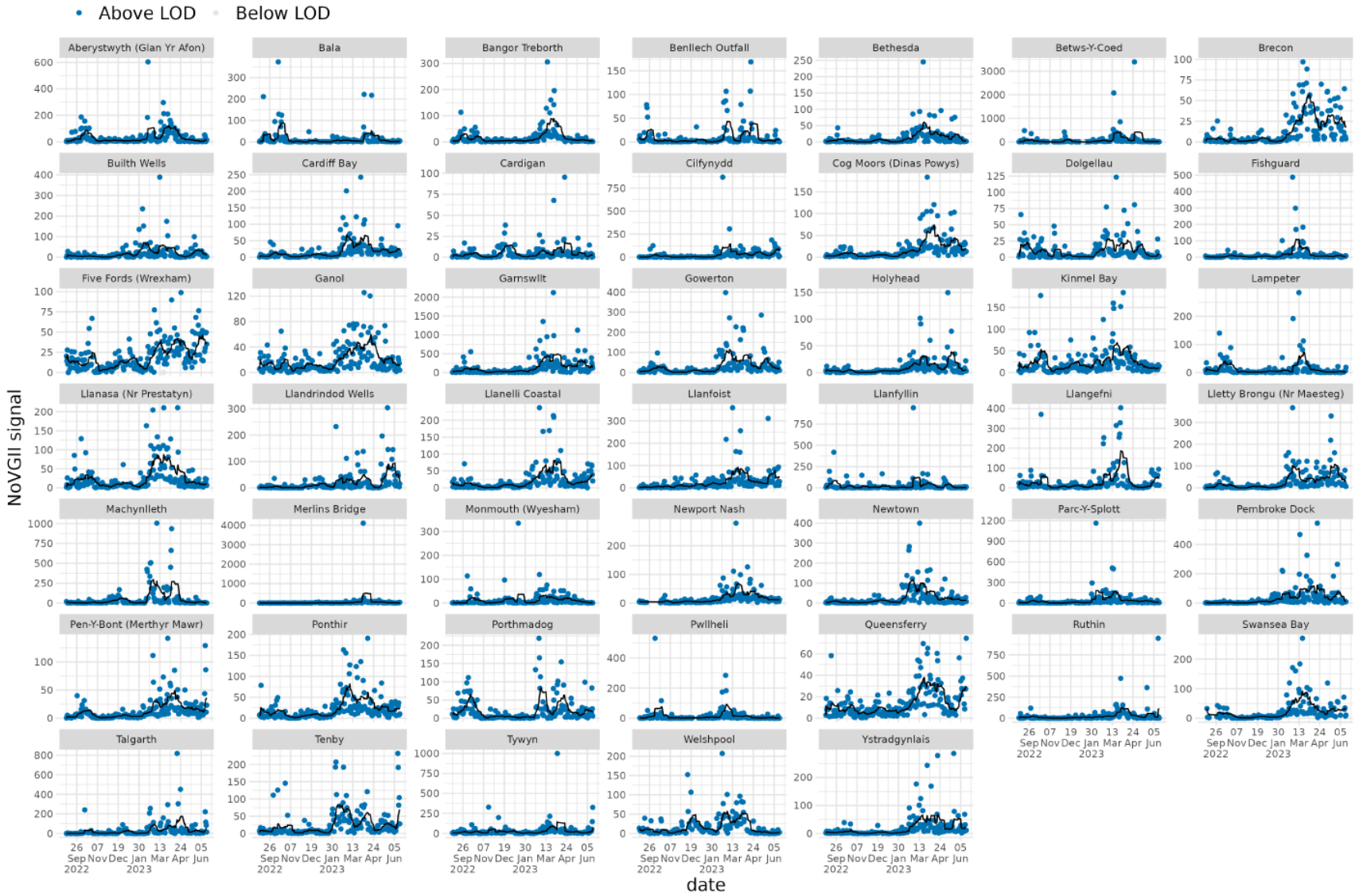
Deetection of other viruses in wastewater



Flu showed a consistent national picture

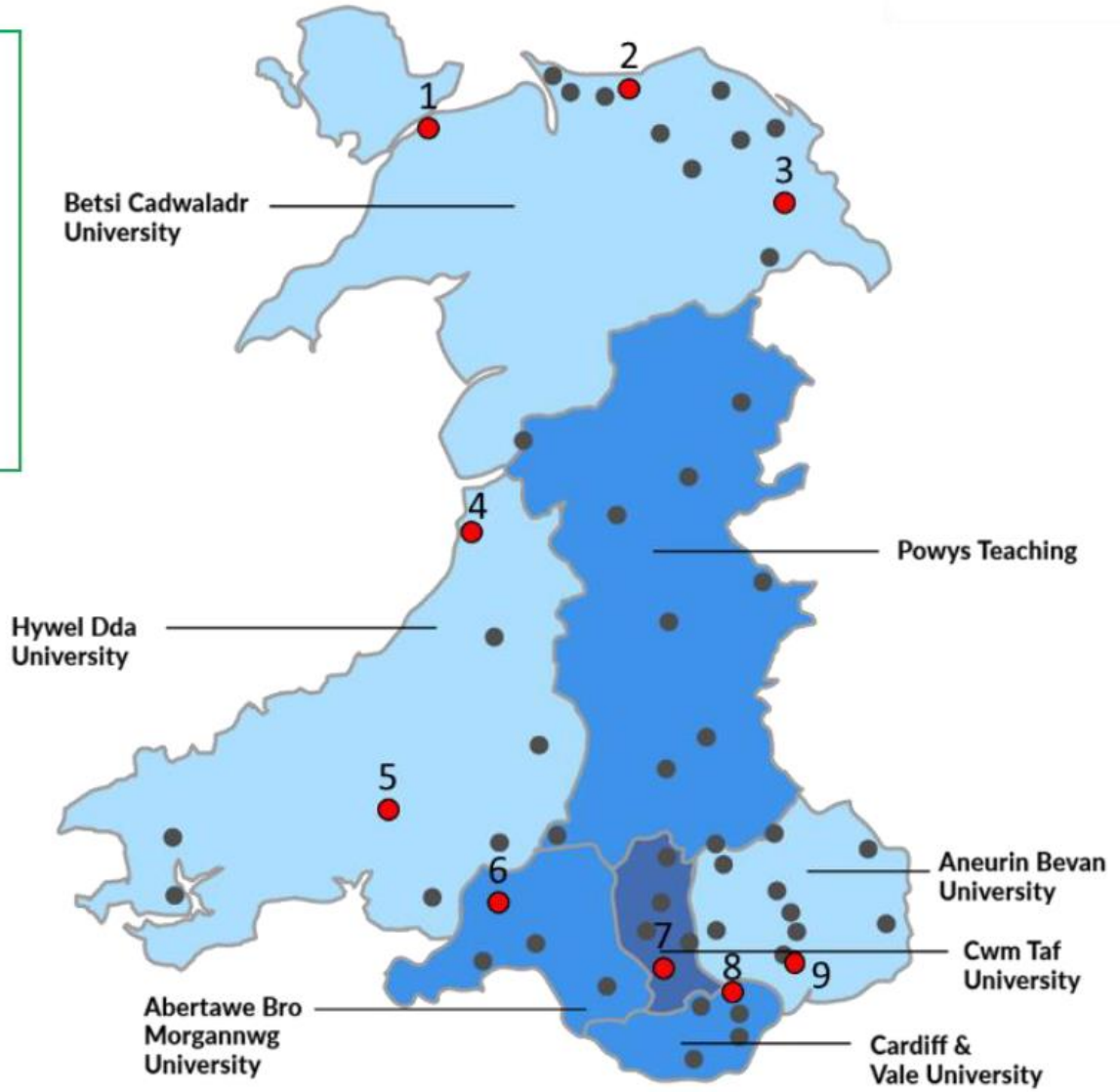


Norovirus showed more localised outbreaks



Sampling hospital wastewater in Wales

1. Ysbyty Gwynedd
2. Ysbyty Glan Clwyd
3. Wrexham Maelor Hospital
4. Bronglais General Hospital
5. Glangwili General Hospital
6. Morriston Hospital
7. Royal Glamorgan Hospital
8. University Hospital Wales
9. Royal Gwent Hospital



Open Access Research

BMJ Open

To close or not to close? Analysis of 4 year's data from national surveillance of norovirus outbreaks in hospitals in England

John P Harris,[1,2] Goutam K Adak,[1,2] Sarah J O'Brien[2]

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► Prepublication history and additional material for this paper is available online. To

ABSTRACT

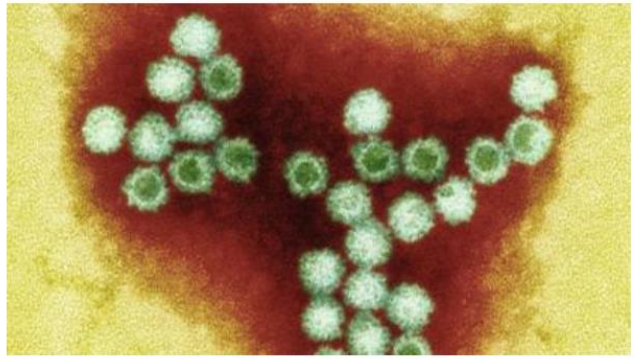
Objective: To assess the impact of ward or bay closures, specifically, whether prompt closure of an affected ward shortens the duration of norovirus outbreaks and the resulting disruption in hospitals.

Design: Analysis of summary data from hospitals on outbreaks of norovirus from 2009 to 2012.

Methods: Using a large outbreak surveillance dataset, we examined the duration of outbreaks, duration of disruption, ward closures, the number of patients and staff affected and the number of lost bed-days, as functions of the timing of closure. We conducted Quasi-Poisson regression analyses to assess the effect

Strengths and limitations of this study

- A large standardised data set for analysis.
- This analysis provides a baseline should infection control strategies move away from whole-ward closures as the new guidelines suggest.
- A weakness is that analysis was carried out on summary data collected on outbreaks from a national web-based reporting scheme, which makes it difficult to unpick some of the questions around the ward characteristics which influence differences in the outcomes.

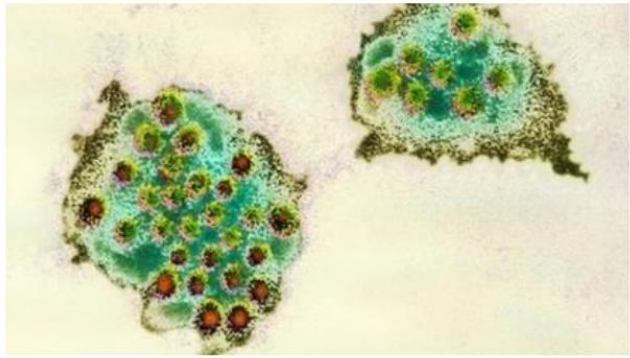


Norovirus vomiting bug hits five north Wales hospitals

The diarrhoea and vomiting bug norovirus spreads to five hospitals across north Wales, with 31 patients falling ill and admission restrictions at eight wards.

University Hospital Wales ward closed by norovirus

The hospital in Cardiff has urged people with symptoms of the illness not to visit the site.



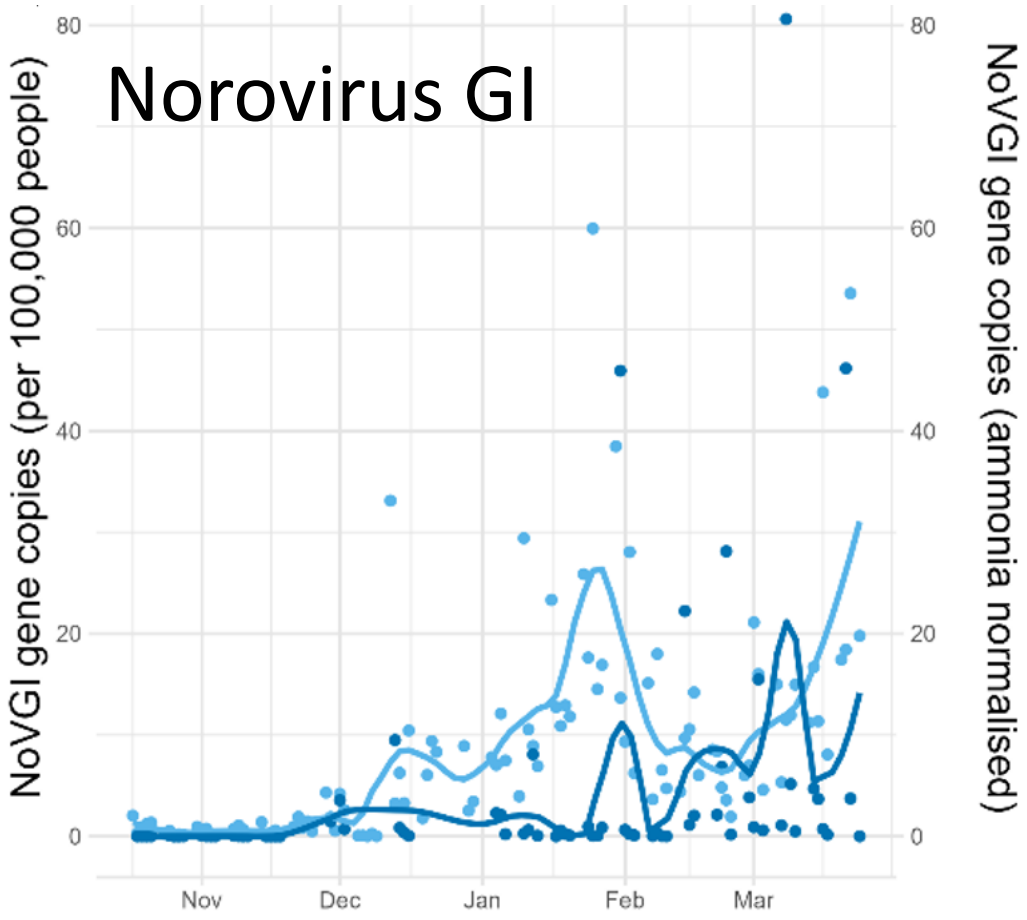
Norovirus: Warning as cases hit three south Wales' hospitals

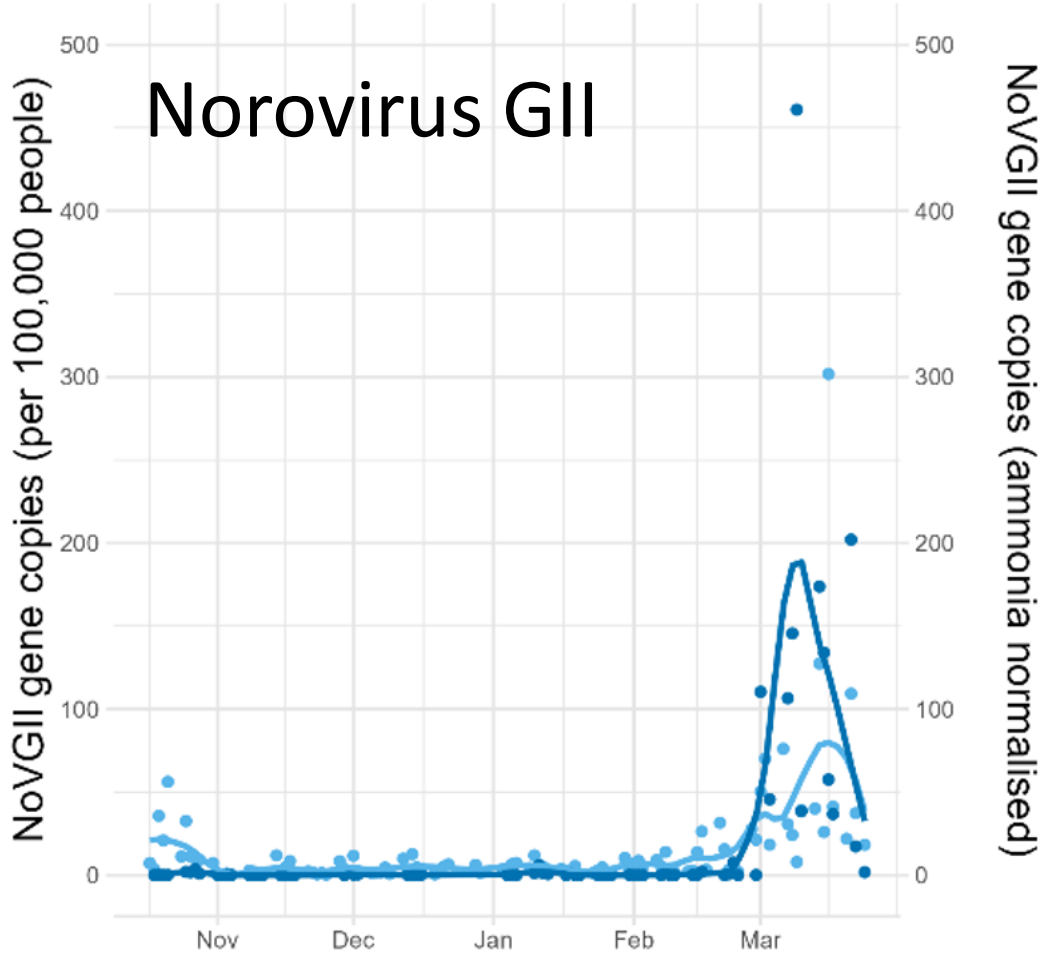
Eight wards are hit by a sickness bug at three hospitals, with managers warning all but urgent cases to stay away.

Does community wastewater provide an early warning system for Norovirus in hospitals?

Community WWTP

Hospital wastewater



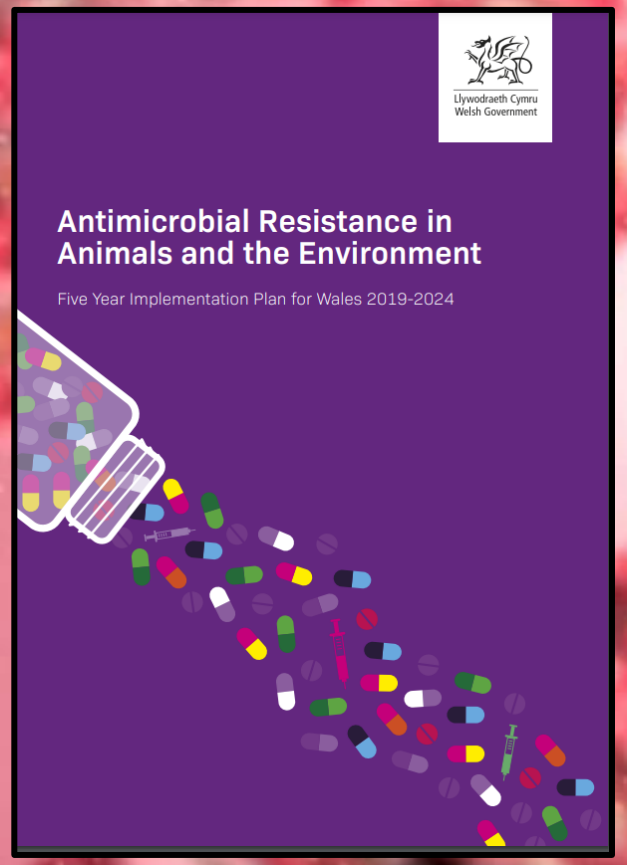


Different infoveillance approaches in Wales

Norovirus syndromic surveillance approach	Data accuracy	Sample size	Regional accuracy	Response time	Relative cost
Self-reporting apps	Low	High	Low	Fast	£
Internet searches	Low	High	Low	Fast	£
School/work absences	Medium	Medium	Medium	Medium	££
Over-the-counter medication sales	High	High	High	Medium	££
Tele-health advice calls	Low	Medium	Medium	Medium	£££
GP surgery visits	Low	Medium	Medium	Slow	££££

Norovirus syndromic surveillance approach	Data accuracy	Sample size	Regional accuracy	Response time	Relative cost
Prescription data	Low	Low	Medium	Slow	££
Urban wastewater surveillance	Medium	High	High	Fast	£££
Hospital wastewater surveillance	High	High	High	Fast	£££
Clinical testing	High	Low	High	Medium	£££££
'Event-based' testing of outbreaks/incidents	High	Low	High	Fast	££££
Emergency hospital admissons	High	Low	High	Fast	£££

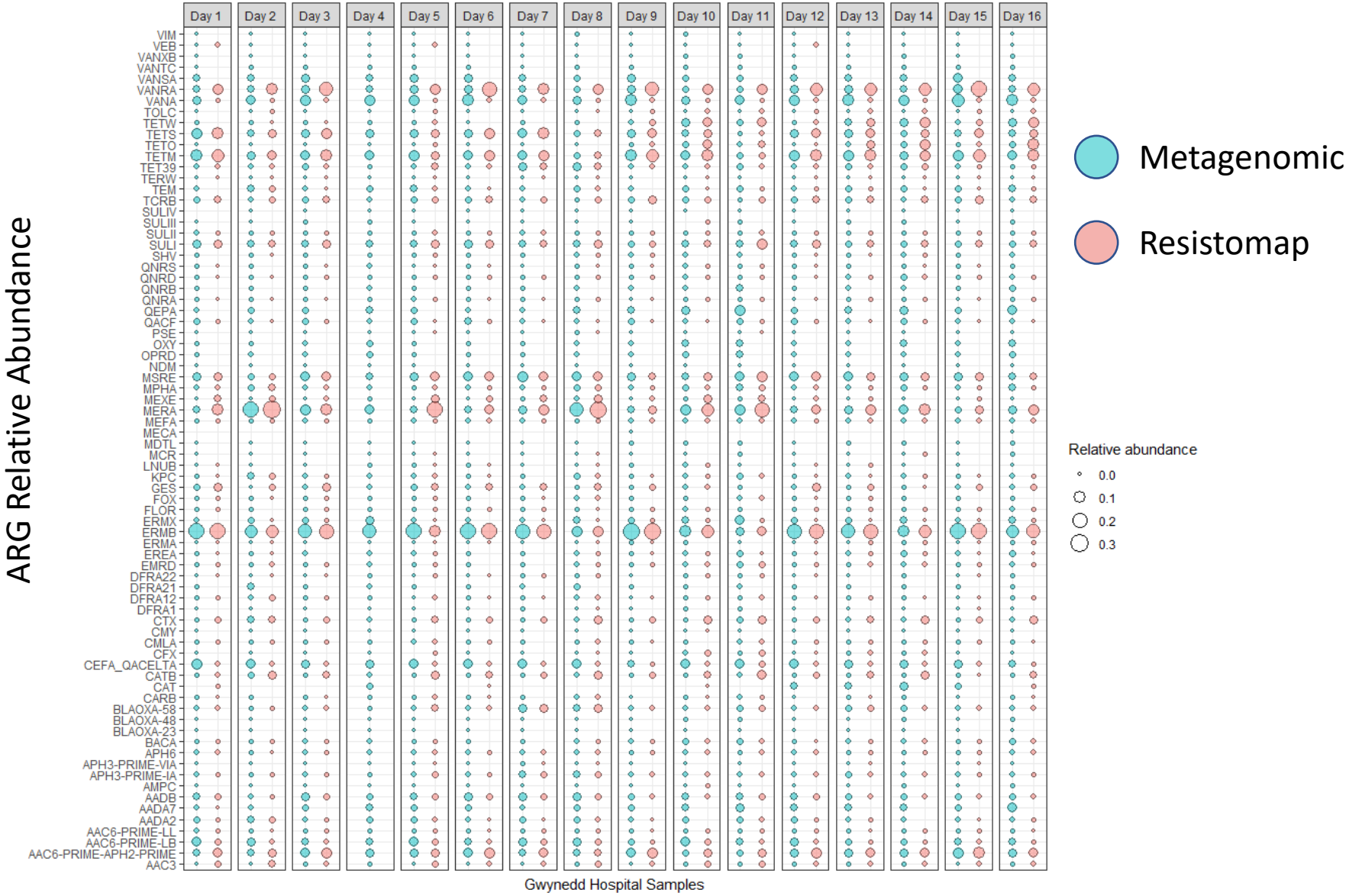
Key priority: We need to better integrate these data streams



Expanding into anti-microbial resistance to support Welsh policy

Can wastewater fulfil a gap in monitoring changes in AMR in Wales?

HT-qPCR vs. metagenomic approaches for AMR



Can AMR surveillance in wastewater help infection control in hospitals?

- Increased knowledge of the types/evolution of organisms involved
- Improved understanding of AMR movement between hospitals
- Linking hospital infections to those in the local community
- Estimate entry/exit rates of ARGs into hospitals
- Early warning system (if data produced in a timely way)
- Still need to work with clinical infection teams to best use the data
- Link to national and international databases
- Environmental exposure from wastewater (One Health)

Conclusions

- National WBE programme in Wales has been successfully running and reporting for >2 years.
- Long-term success down to being co-developed with Welsh Government and Dŵr Cymru.
- Wastewater SARS-CoV-2 variant and abundance data has impacted on policy decisions regarding COVID-19.
- Expanded to include a wide range of other targets (e.g. Norovirus, AMR).
- Profile and confidence of WBE as an intelligence source has increased since the reduction in mass testing and changes in population behaviour.
- Still work to be done to build confidence with health protection policy leads and public health professionals.
- Still need to combine with clinical data and other infoveillance data when reporting.