



Applicability of wastewater-based epidemiology for respiratory diseases beyond COVID-19

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WBE – Welsh programme

- Since September 2020
- 47 treatment sites – raw sewage (5/week)
- 10 hospitals (4/week)
- Seven viral targets



WBE – Welsh programme

Methodology

0. Basic chemical analysis

1. PEG precipitation

2. NulciSense RNA/DNA extraction

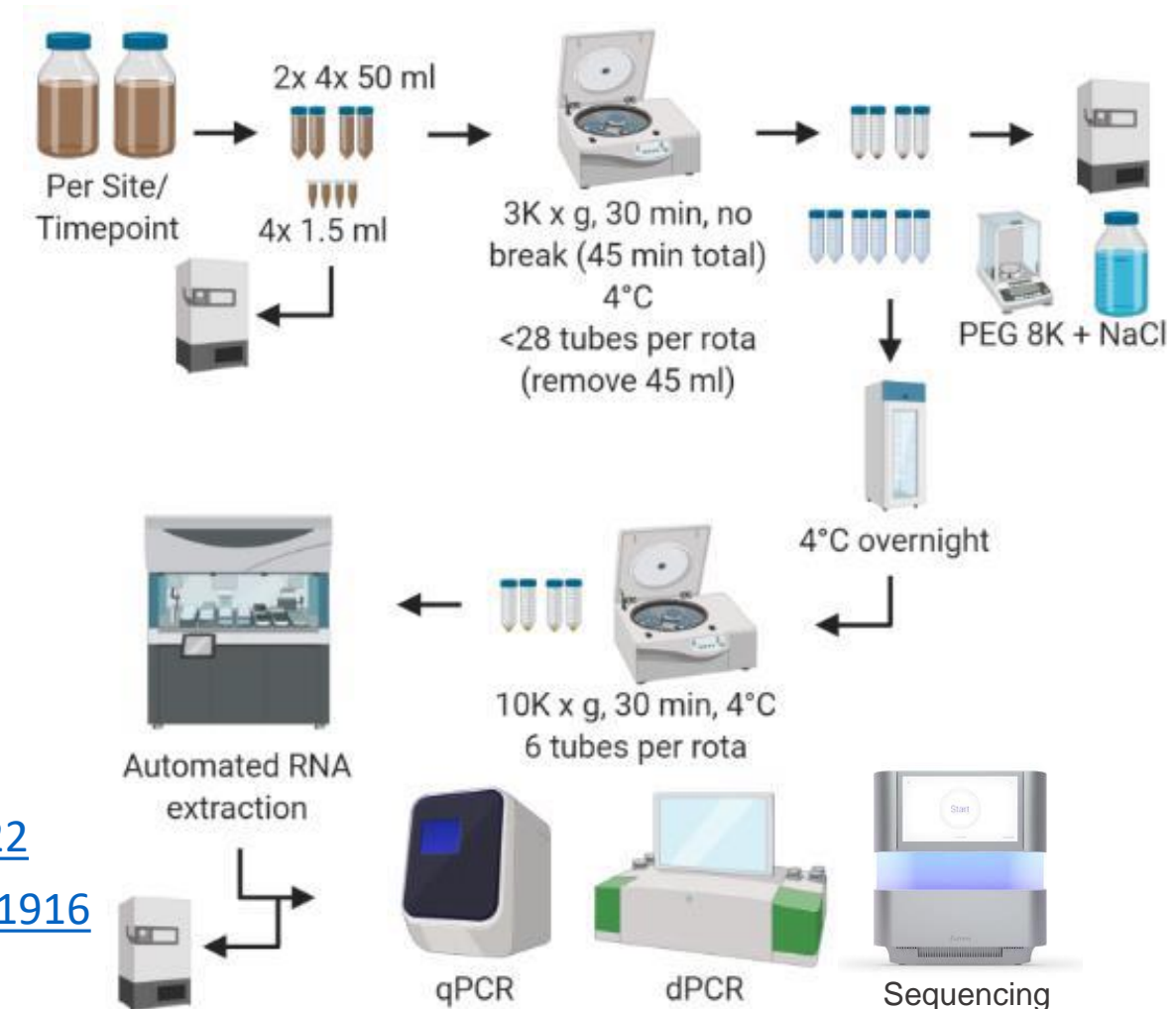
3. qPCR/Sequencing

4. Sample archive

Farkas et al, 2022 <https://doi.org/10.1128/spectrum.01102-22>

Kevill et al, 2022 <https://doi.org/10.1016/j.scitotenv.2021.151916>

Farkas et al, 2020 <https://doi.org/10.3390/mps4010017>



WBE for SARS-CoV-2

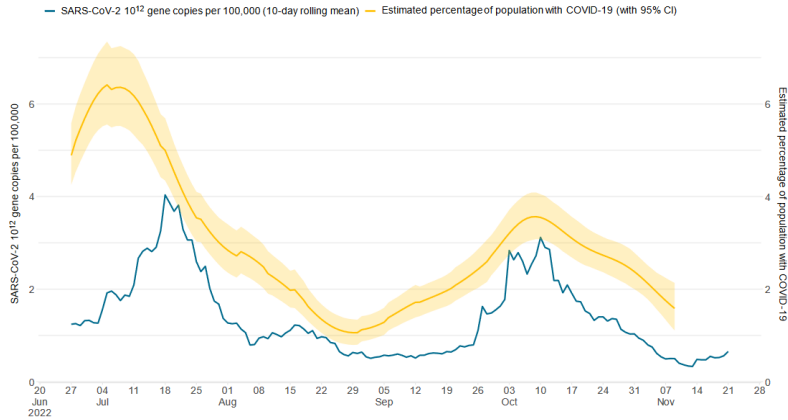


Figure 47 – ONS CIS vs Wastewater National Mean (SARS-CoV-2 gc/day per 100k)

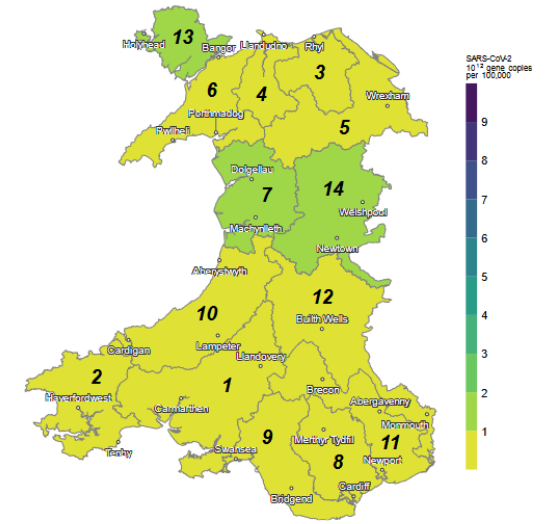
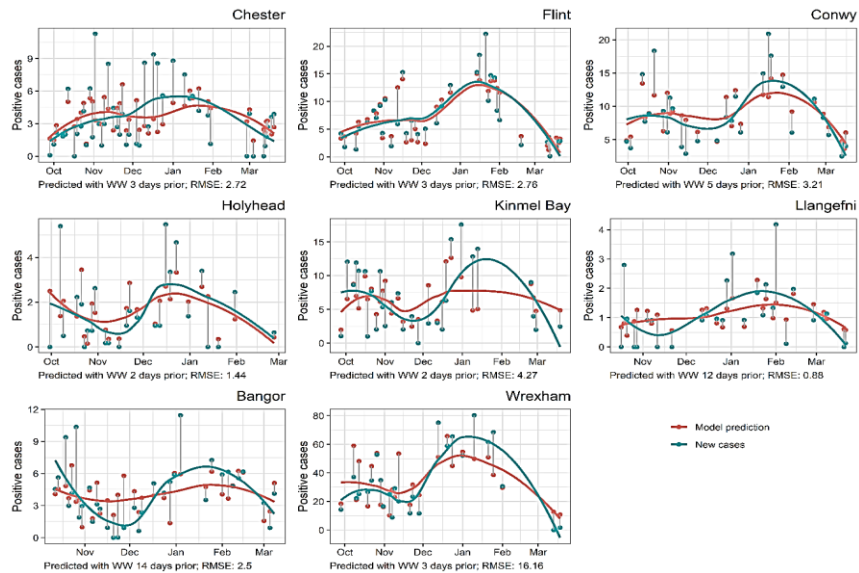
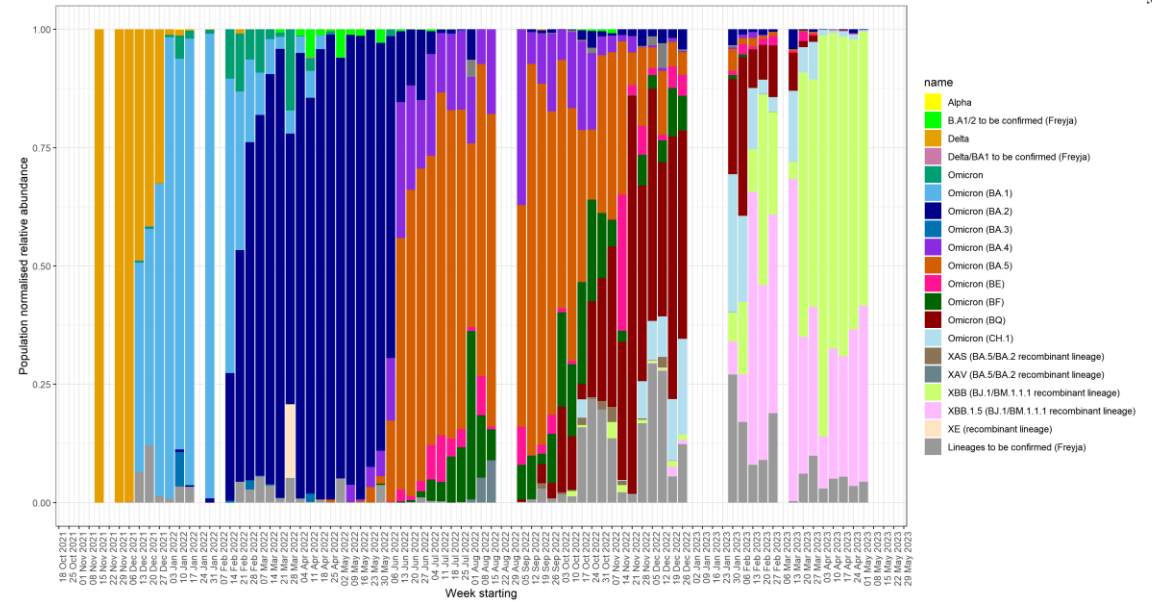


Figure 3 - National Heat Map showing Regional Mean SARS-CoV-2 gc/day per 100k



Weekly reports:

<https://www.gov.wales/sites/default/files/publications/2023-05/wastewater-monitoring-11-may-2023.pdf>

WBE feasibility for influenza and RSV

- Virus detection

- qPCR

- Assay needs regular updating due to high mutation rates →← assay reproducibility
 - Inclusion of flu vaccine?
 - Inclusion of animal strains?

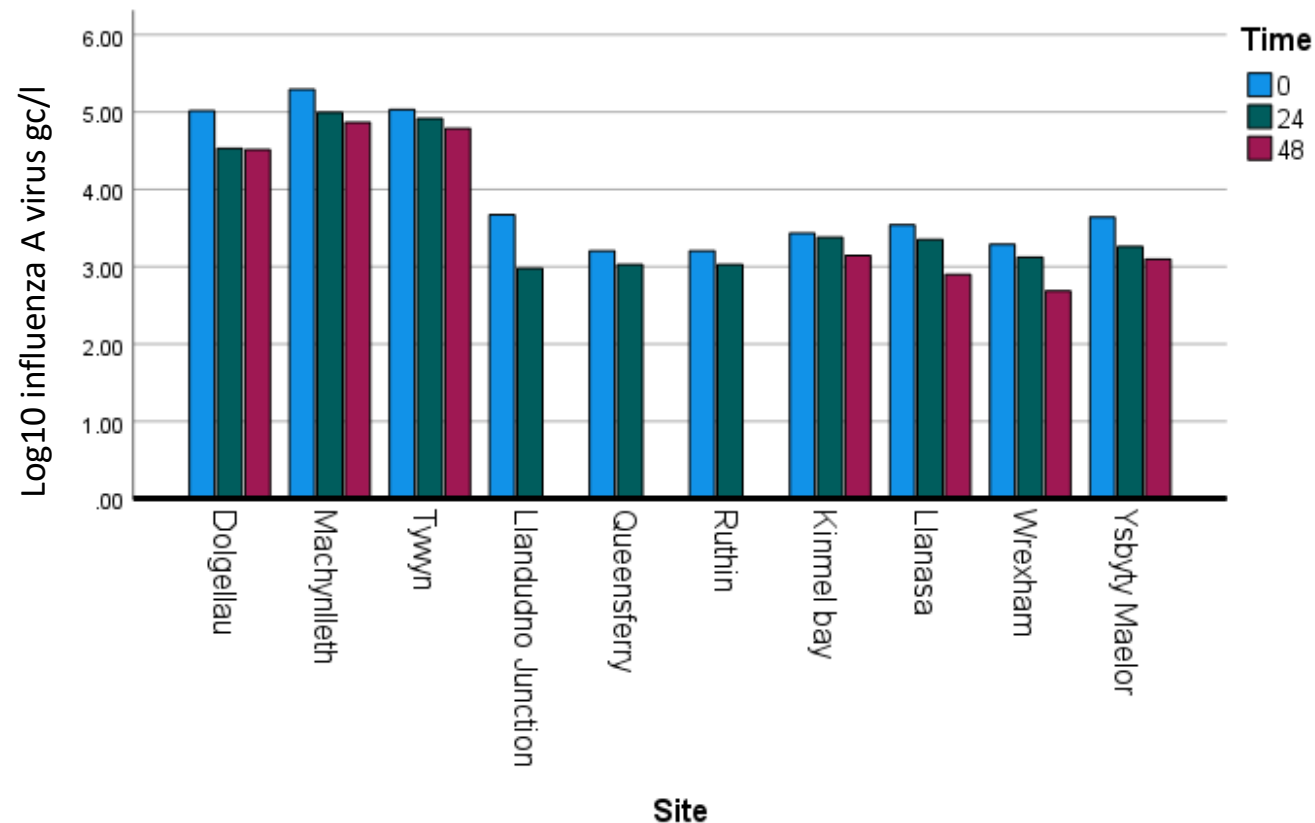
- Sequencing

- RVOP panel, Illumina
 - CleanPlex Respiratory Virus Research Panel, Paragon Genomics
 - Amplicon sequencing



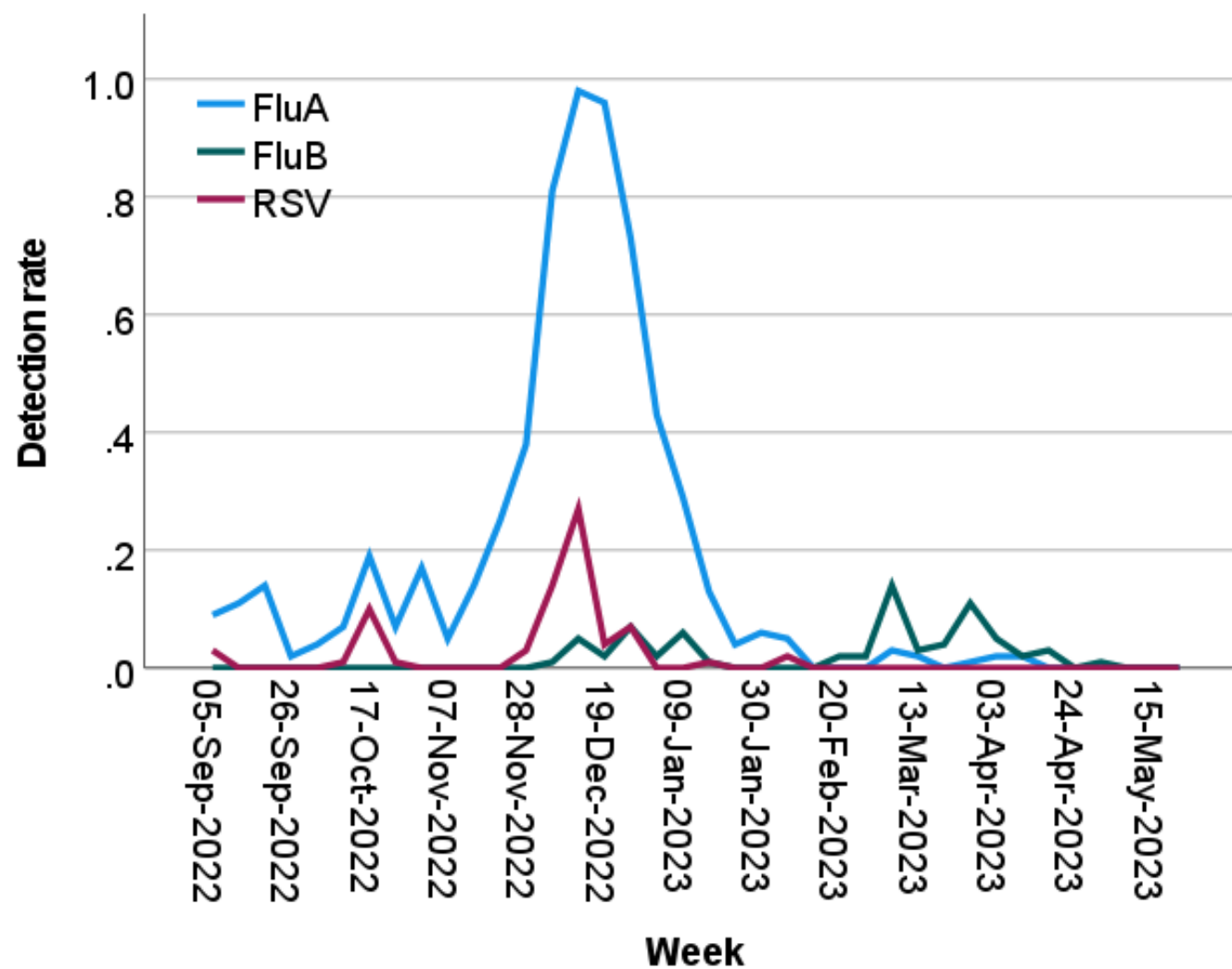
WBE feasibility for influenza

- Virus decay rates in wastewater – spiking experiment

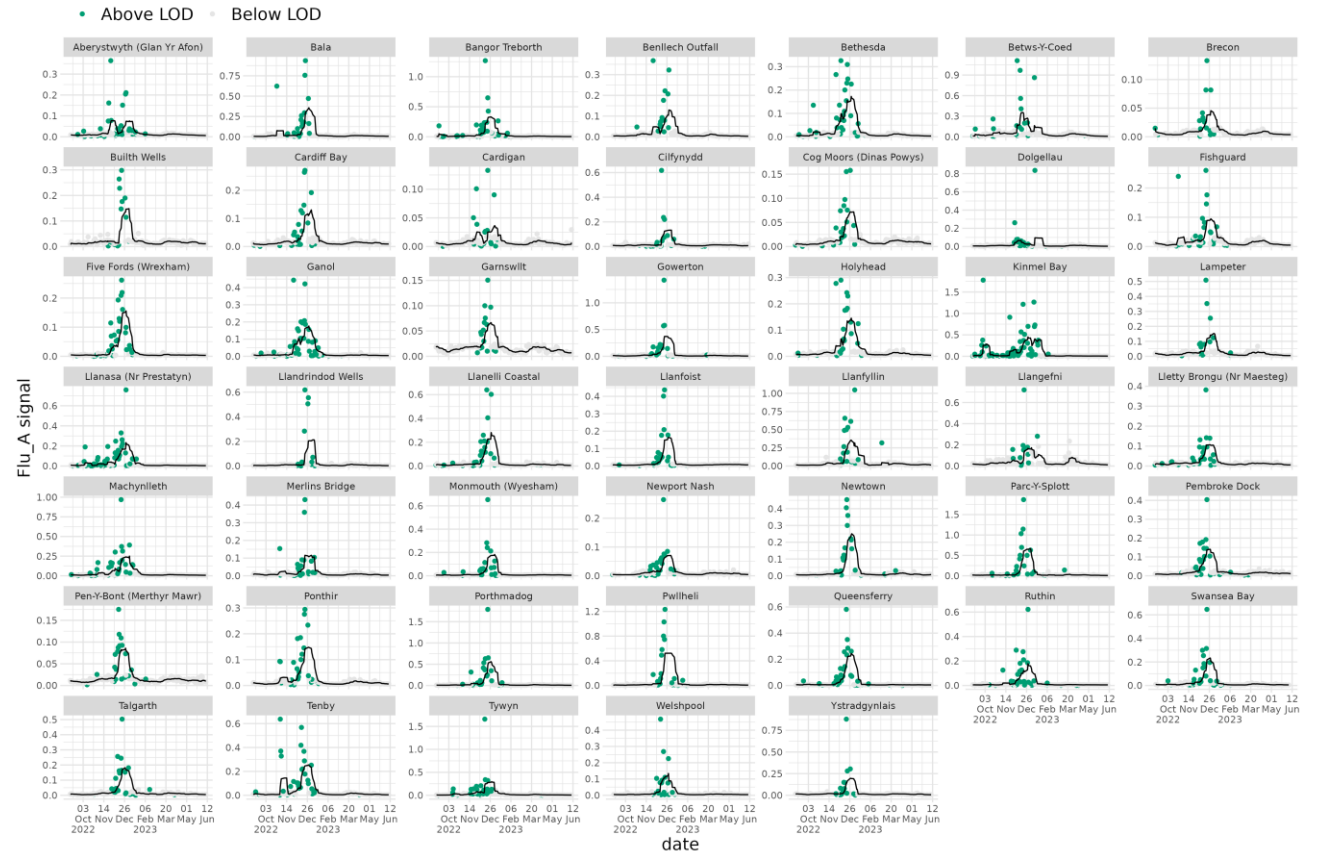
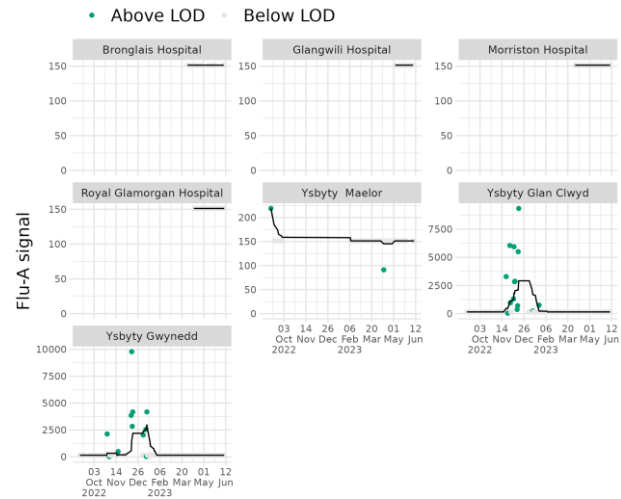
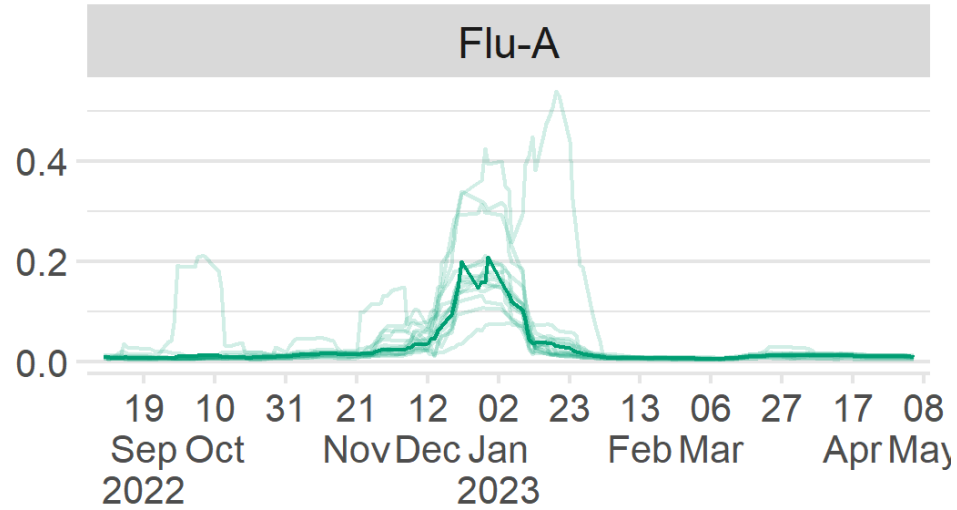


Influenza virus is stable in wastewater for one day, however, longer storage may affect viral recovery in some samples.

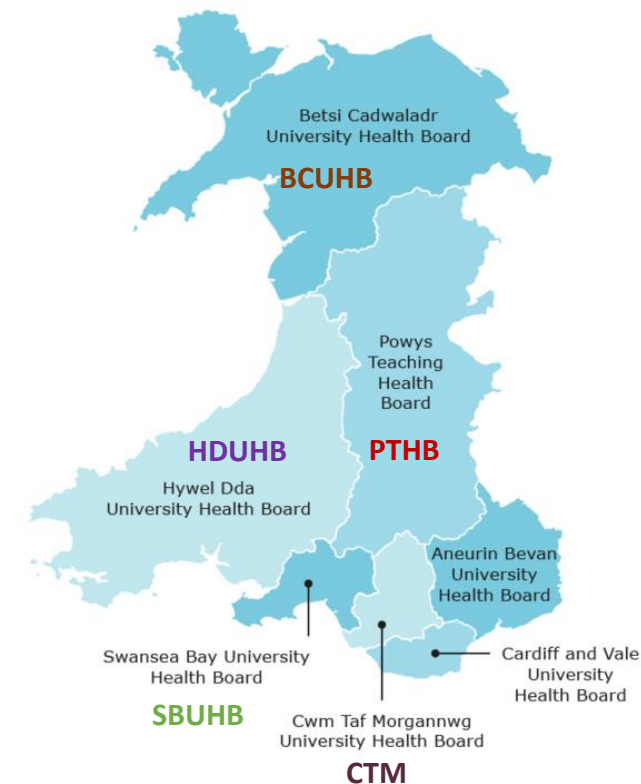
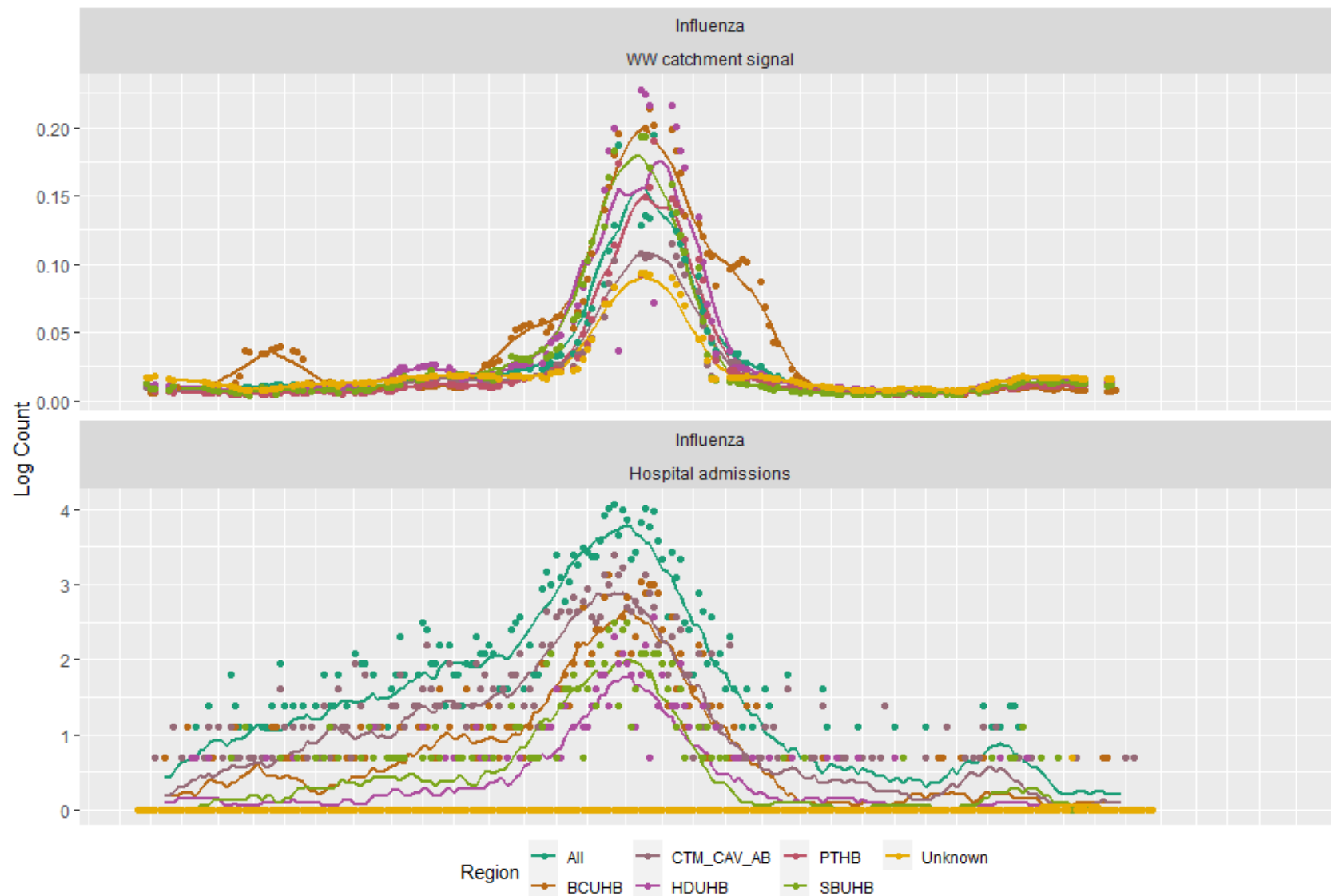
WBE for influenza and RSV in Wales



WBE for influenza A virus



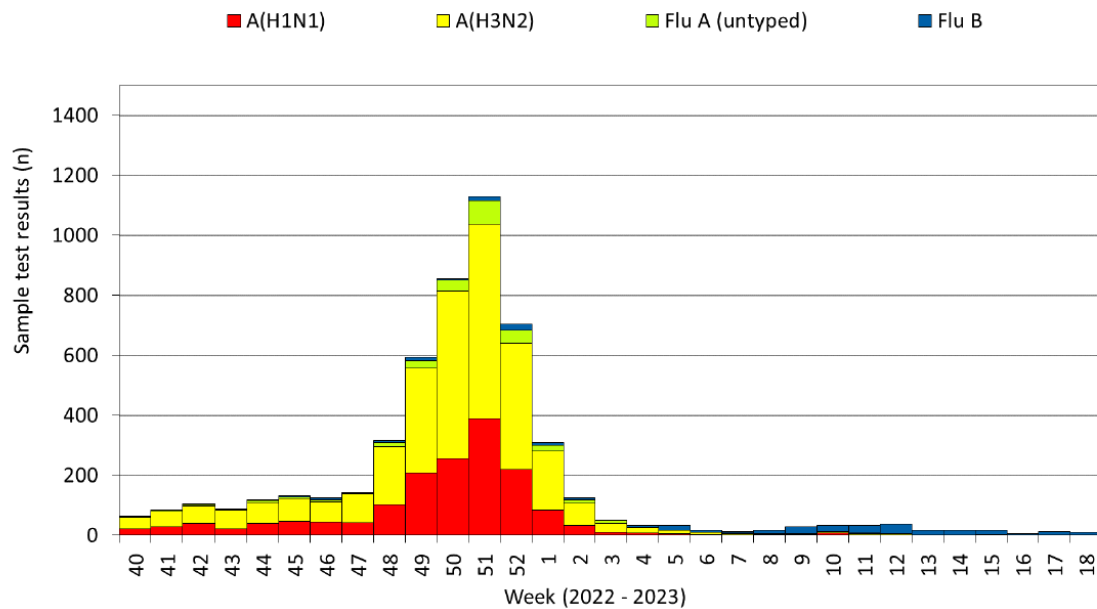
WBE for influenza A virus



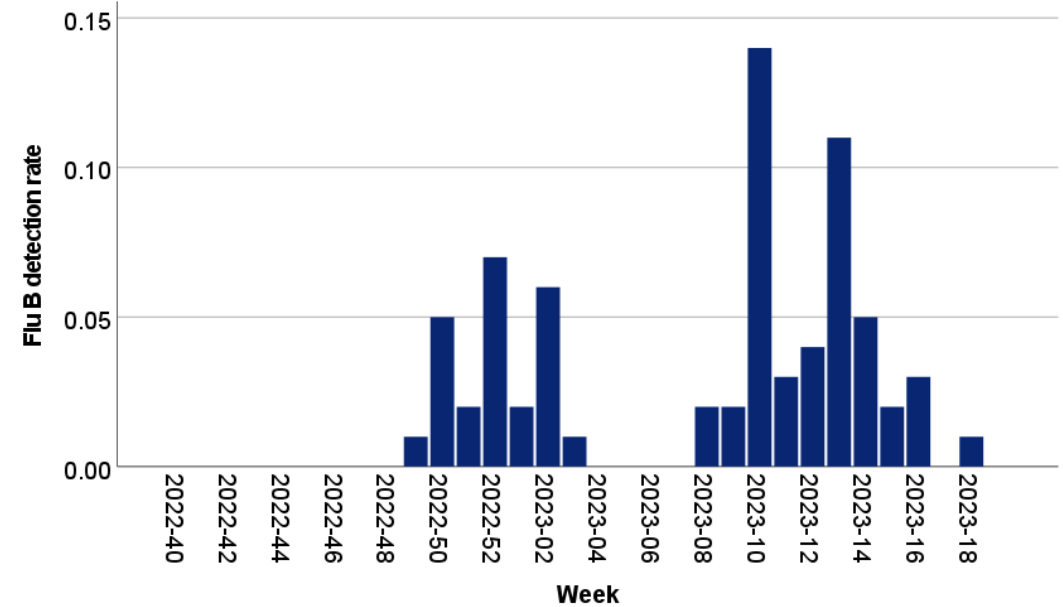
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WBE for influenza B virus

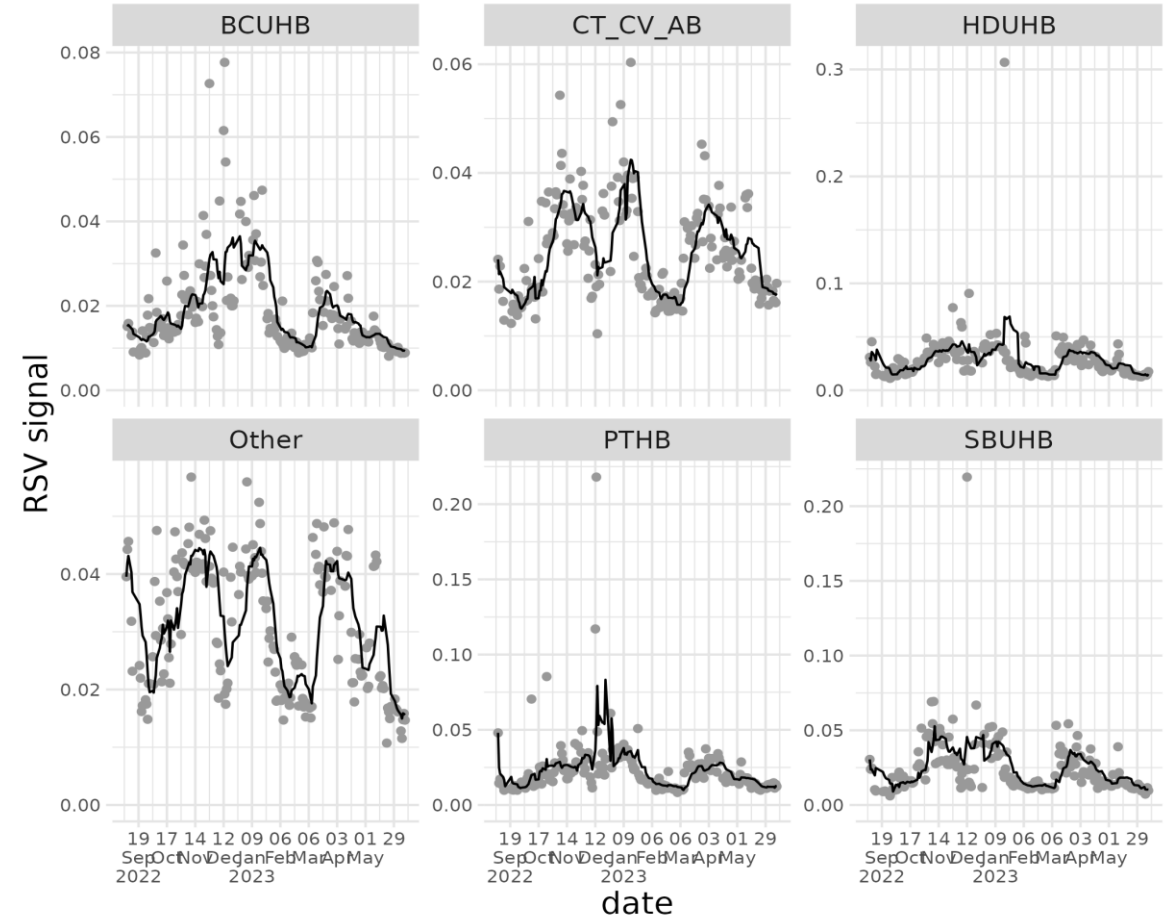
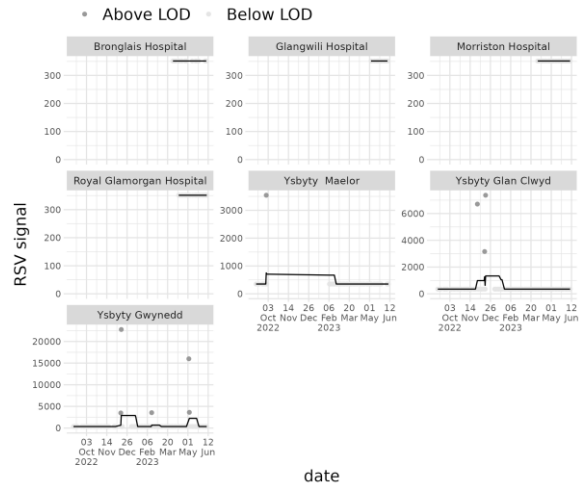
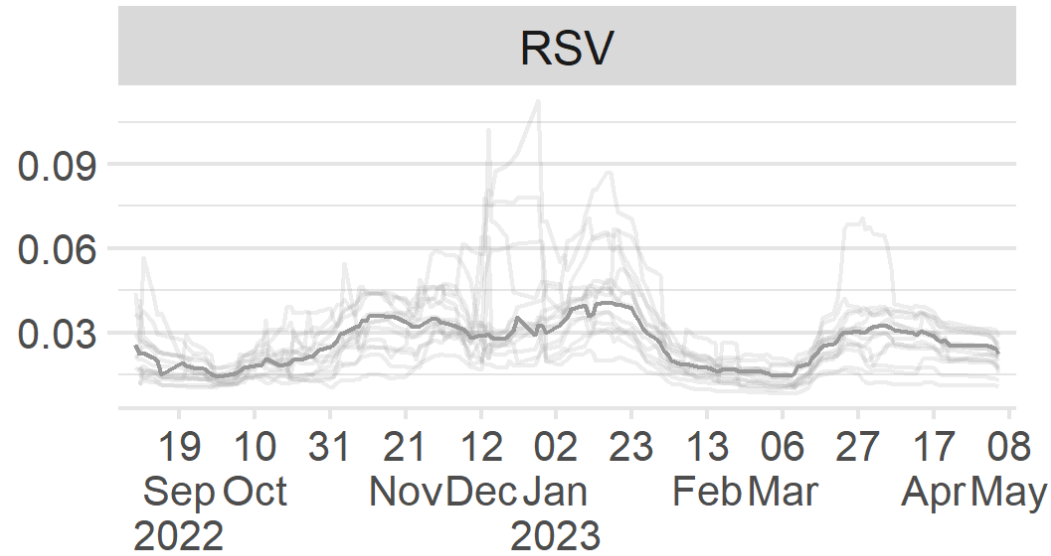
Figure 6. Flu subtypes based on specimens submitted for virological testing by sentinel GPs and community pharmacies, hospital patients, and non-sentinel GPs, as of 07/05/2023 by week of sample collection, Week 40 2022 to Week 18 2023.



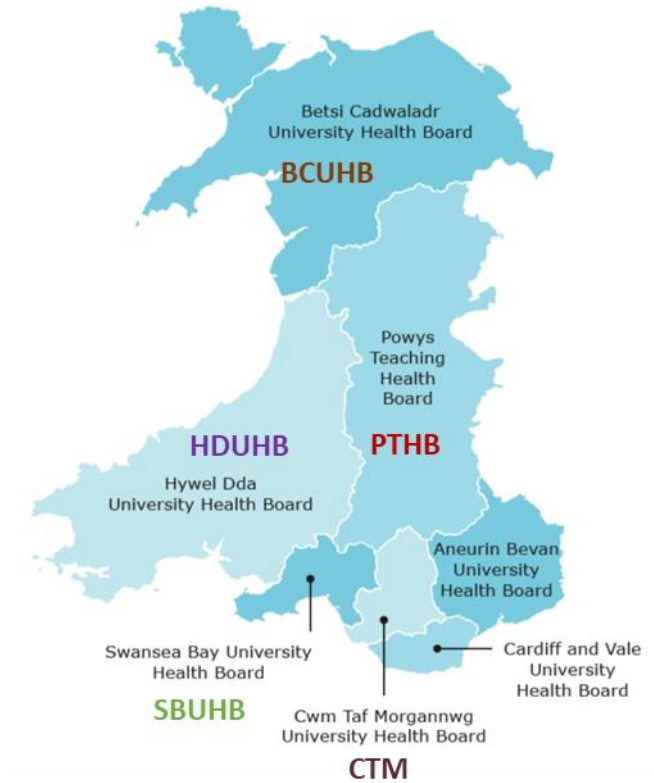
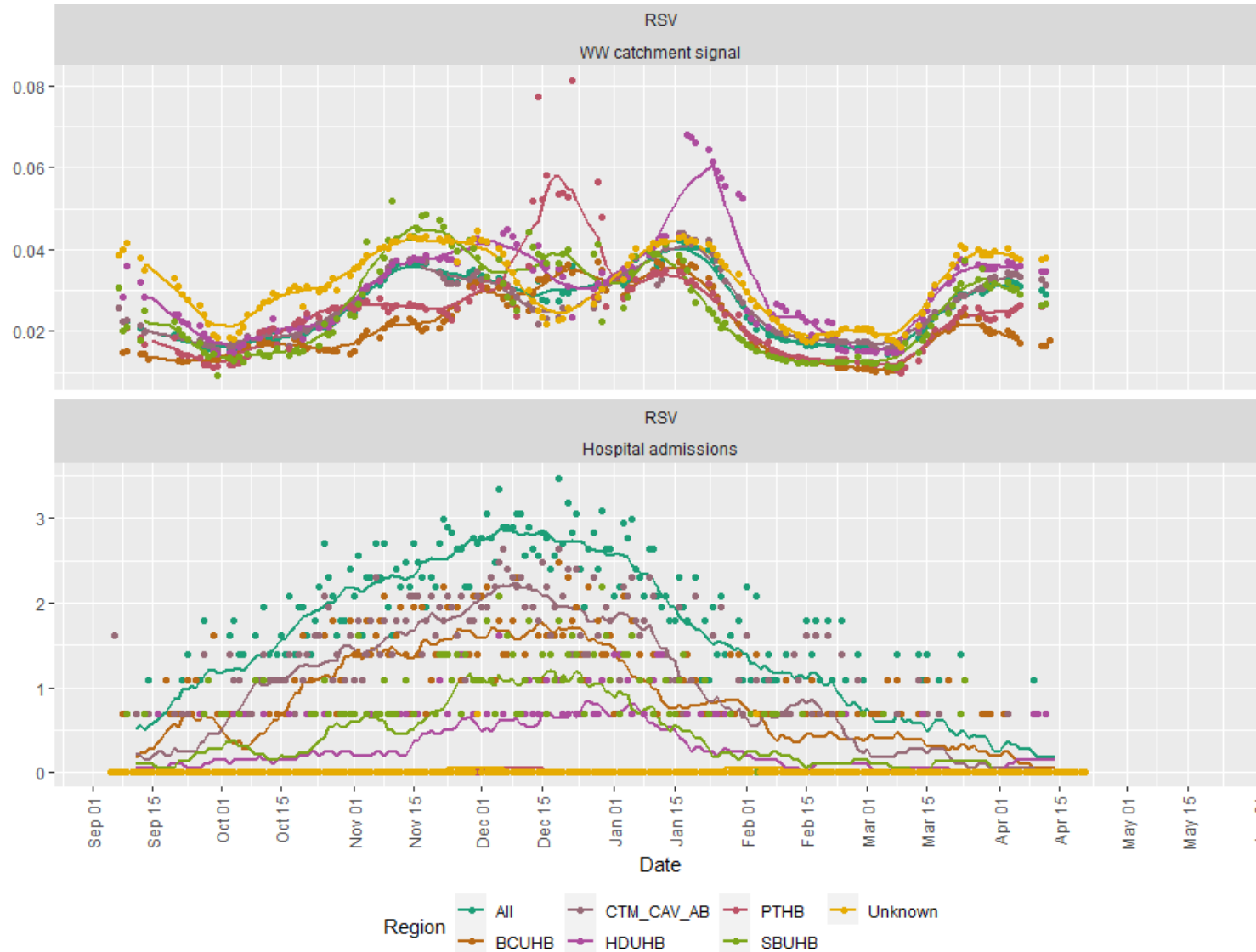
Wastewater data



WBE for RSV



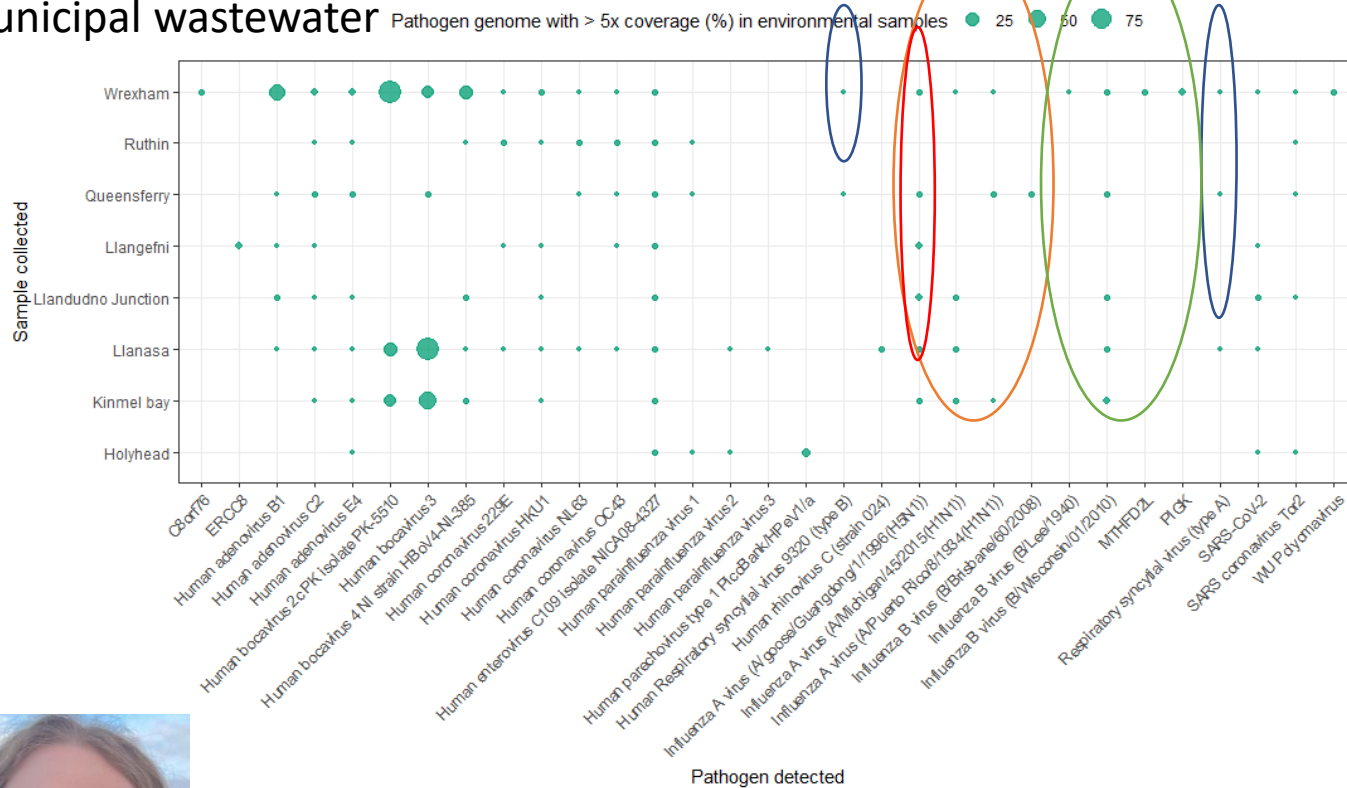
WBE for RSV



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Sequence analysis - RVOP

Municipal wastewater



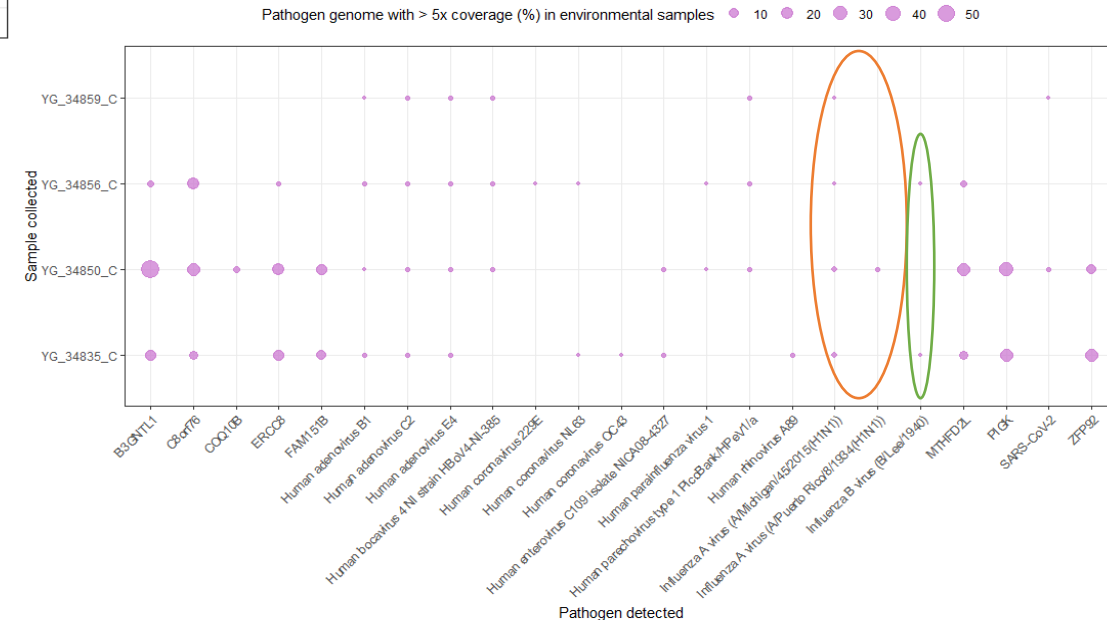
RSV

Influenza A virus

H5N1

Influenza B virus

Hospital wastewater



Dr Rachel Williams

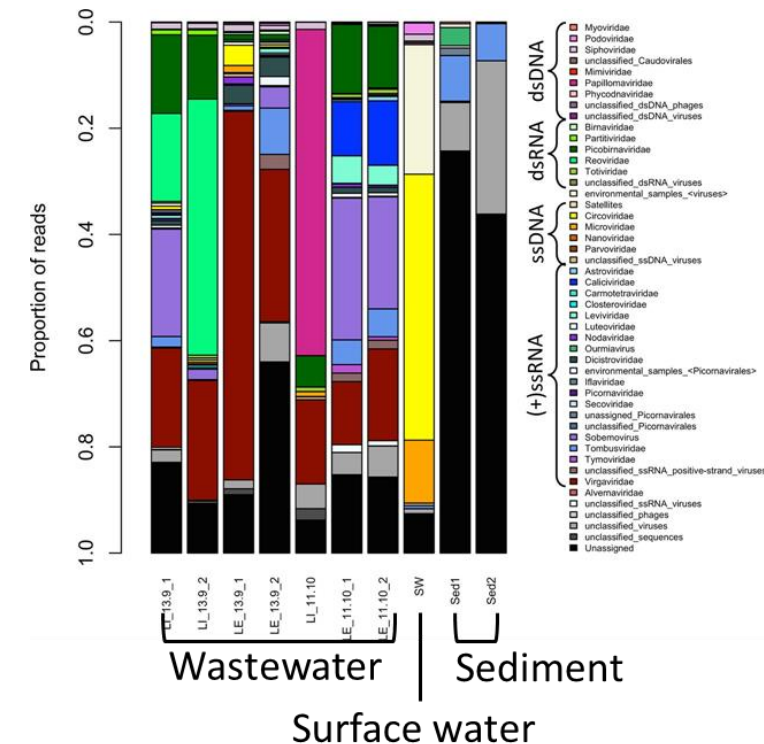
Poster #

Conclusions

- The most relevant respiratory viruses may be monitored in municipal wastewater for WBE applications
- Timely sampling and sample process should be established
- Careful assay development and constant update are required for sensitive quantitative data
- Respiratory virus sequencing approaches to be optimised

Further work

- Inclusion of other clinically relevant viruses and other pathogens (AMR, Cryptosporidium, etc.)
- Application of metaviromes to explore yet unknown viruses
- One Health approach: effect of wastewater contamination on animals and the environment



Acknowledgement



Poster presentation:

Dr Alvaro Delgado

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Partners:

