

Antibiotics in city sewage linked to resistance gene levels – hospitals as key contributors

Prevalence of antibiotics and antibiotic-resistance genes (ARGs) in a sewage system

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INTRO

- Pharmaceuticals released into wastewater vary within a city.
- Local sources of antibiotic and ARG dissemination overlooked.
- In-sewer emission hotspot identification at city-scale desired.

METHODS

- Sewer hotspot profiling
- 10 diverse locations
- 2 years
- 23 antibiotics
- 5 ARGs

CONCLUSIONS

- Hospitals can have a predominant role in ARG presence and dissemination.
- Emission hotspots identification and prioritization can help lower pollution.
- Targeted emission reduction strategies by local authorities is encouraged.

RESULTS

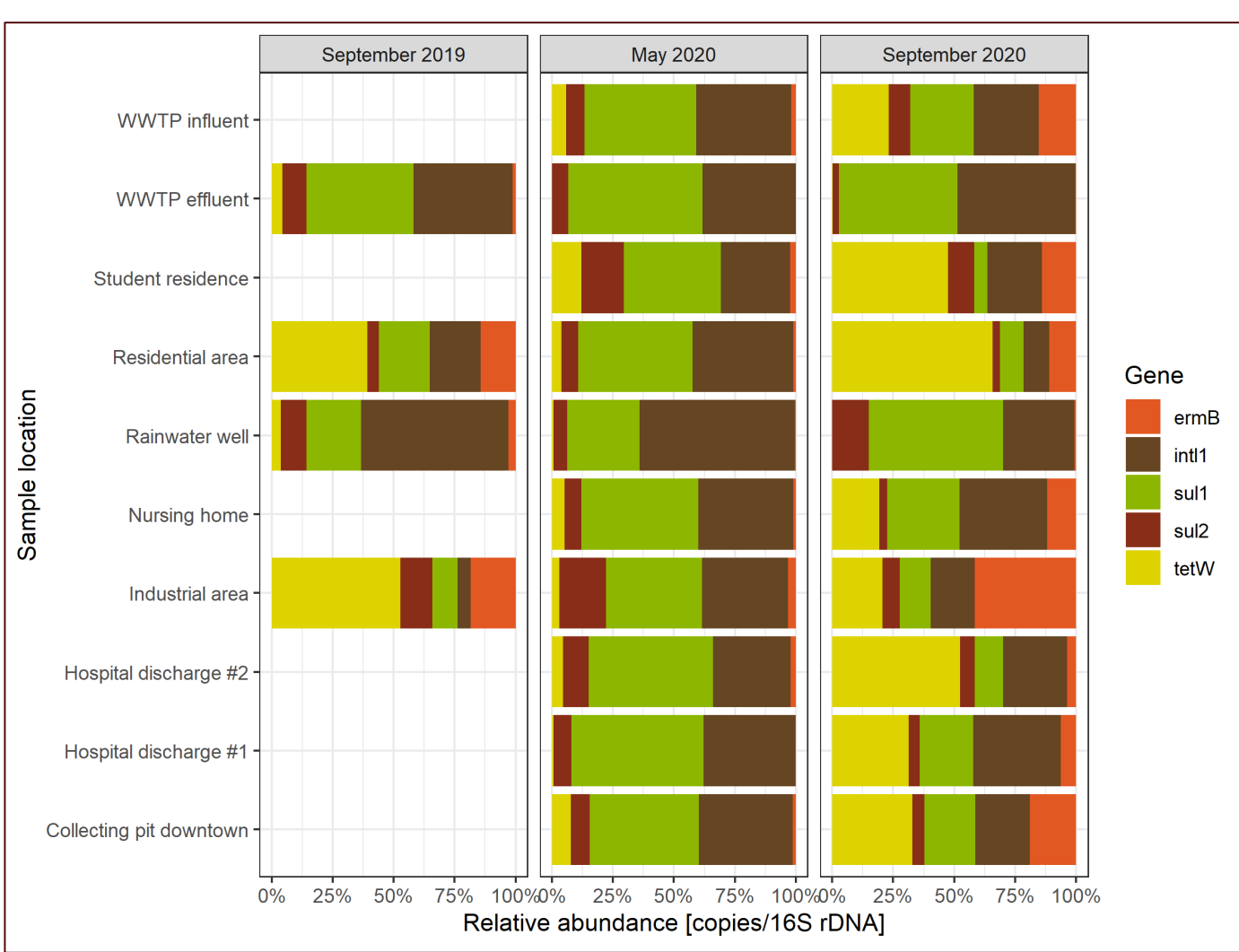


Figure 1. Relative gene abundance.

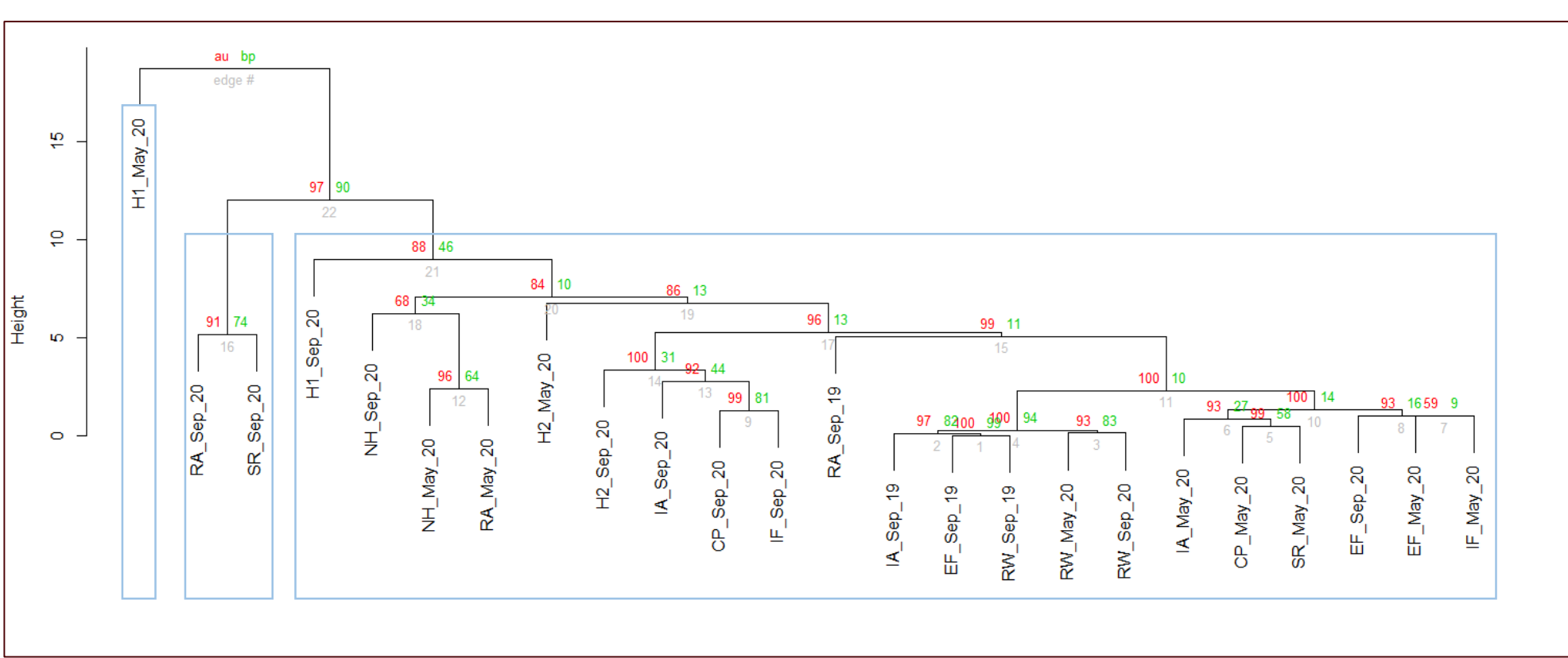


Figure 2. Sewer profiling. Hierarchical clustering of locations according to their profile similarity based on antibiotic selective pressure and antibiotic-resistance gene relative abundance. Blue squares depict the most distant and distinct clusters. Location codes: H1, main hospital outlet; RA, residential area; SR, student residence; NH, nursing home; H2, side outlet hospital; IA, industrial area; CP, collection pit city center; IF, WWTP influent; RW, rainwater pit; EF, WWTP effluent.

Table 1. Overview of sampling locations and campaigns. P = pre-screening campaign. C1 = first target campaign. C2 = second target campaign.

Location	Code	Sampling campaign
Nursing home	NH	C1, C2
Collecting pit	CP	C1, C2
Student residence	SR	C1, C2
Residential area	RA	P ^a , C1, C2
Rainwater pit	RW	P ^a , C1, C2
Industrial area	IA	P ^a , C1, C2
Hospital #1	H1	C1, C2 ^c
Hospital #2	H2	C1, C2
WWTP influent	IF	C1, C2
WWTP effluent	EF	P ^a , C1, C2

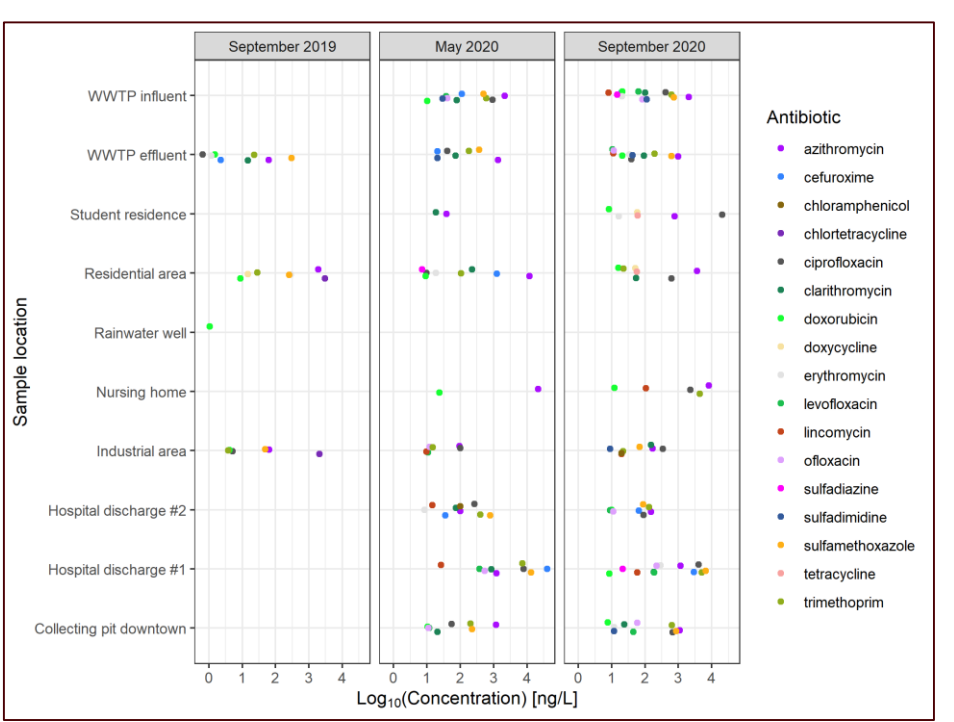


Figure 3. Measured antibiotic concentrations.

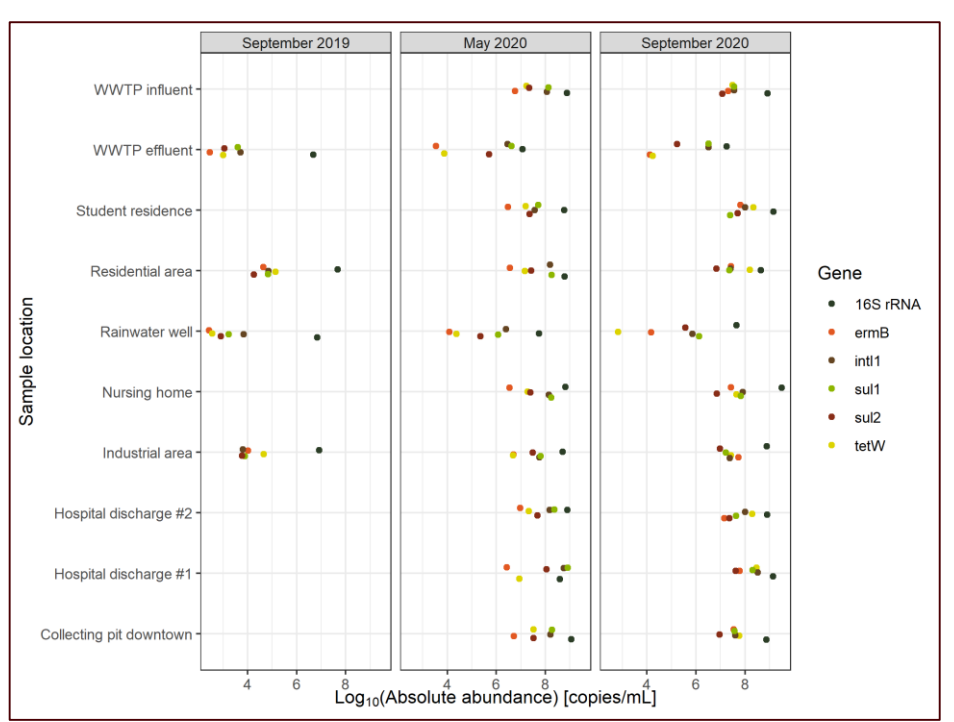


Figure 4. Measured gene abundance.

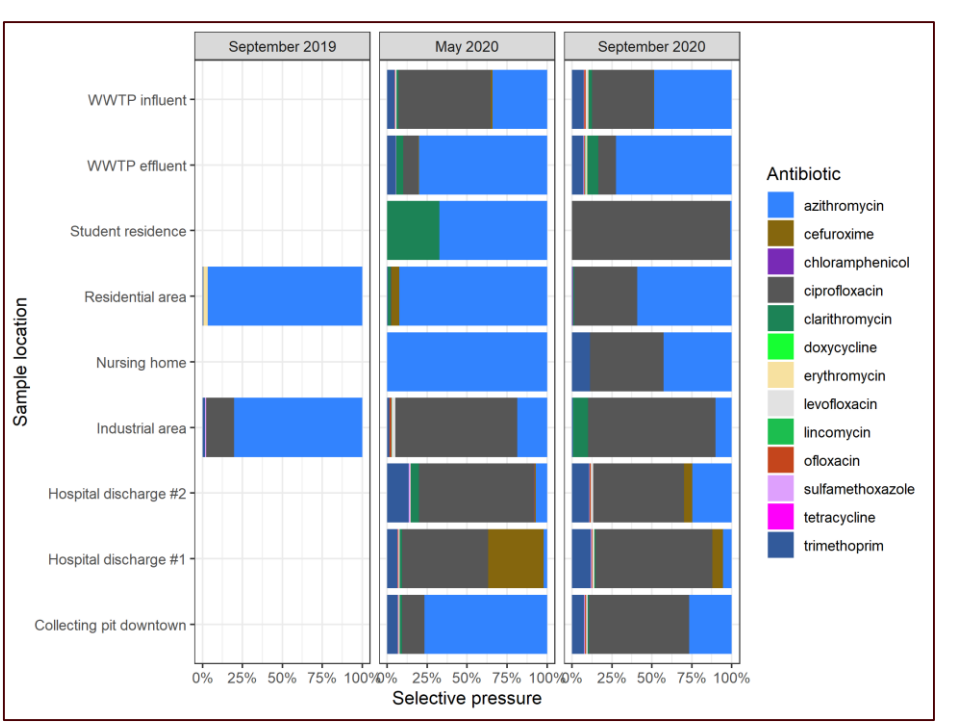


Figure 5. Antibiotic selective pressures.

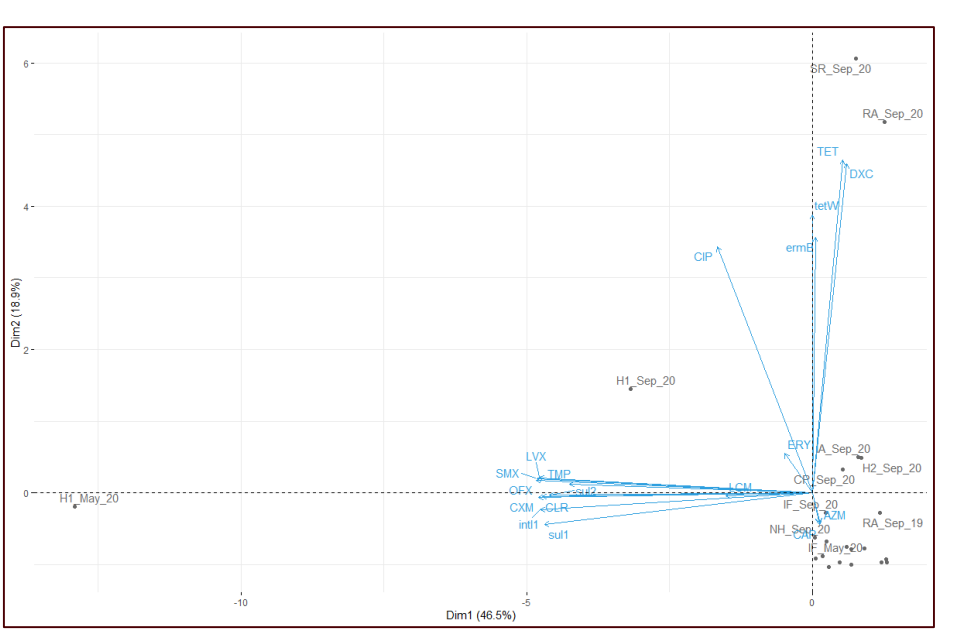


Figure 6. Sewer location profiles and determinants.

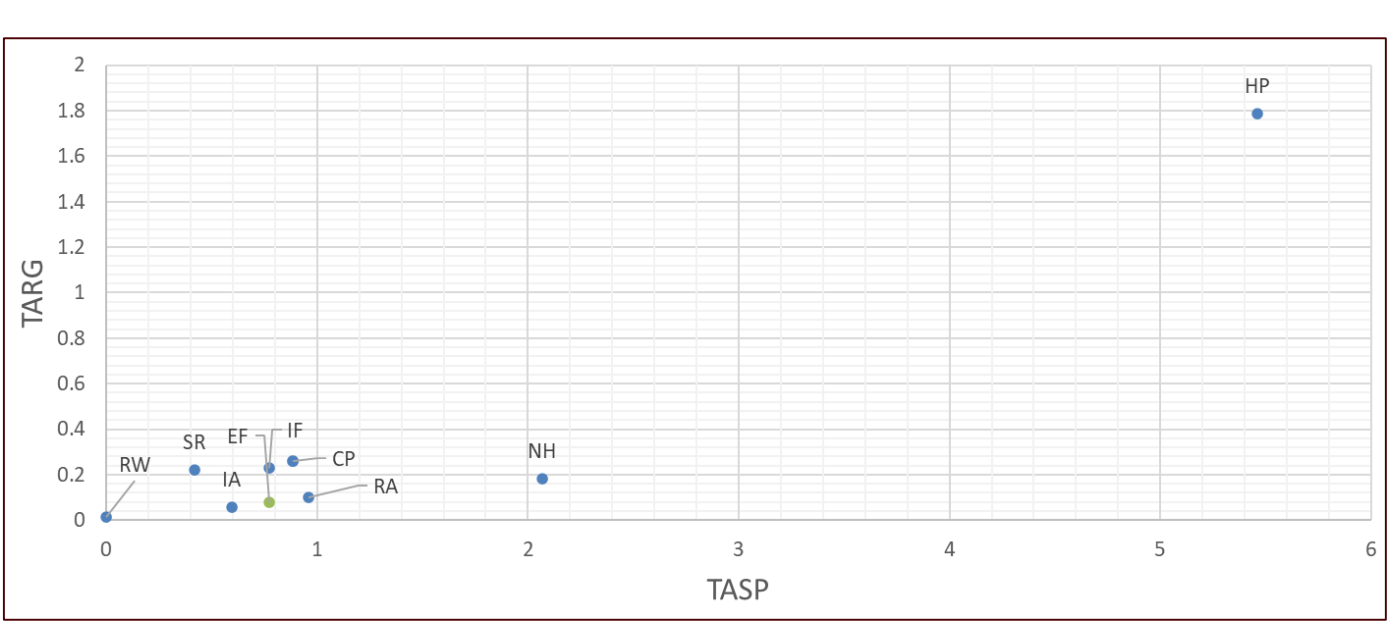


Figure 7. Excretion-based total antibiotic selective pressure (TASP) and total relative resistance-gene abundance (TARG) estimates.