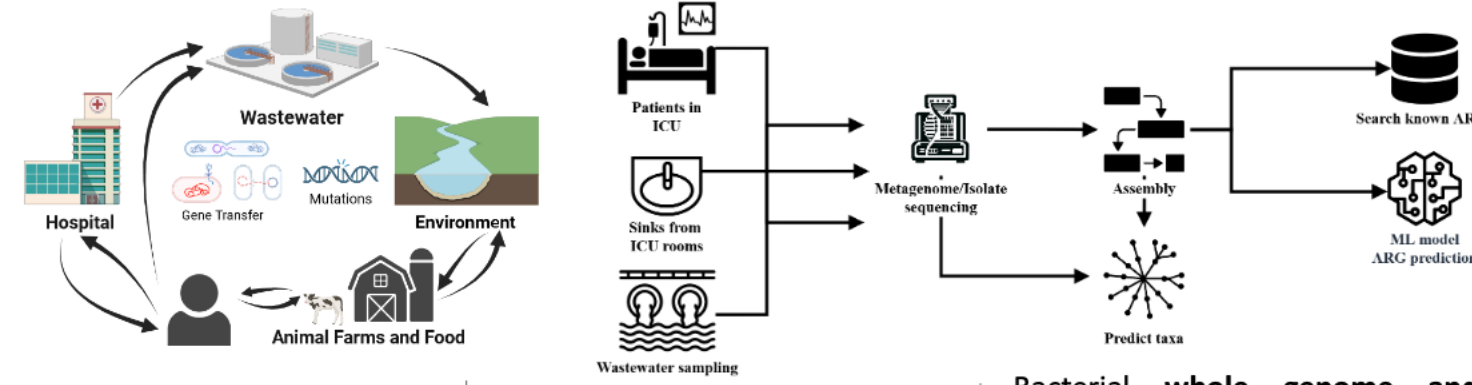


# From patients to hospital wastewater tracing antimicrobial resistance in a health-care setting

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A better understanding of environmental transmission of **antibiotic resistance genes (ARG)** is required, to control the spread of MDR bacteria in hospitals.

This pilot study is aiming to **characterize ARG transmission within a tertiary-care hospital** and to evaluate the utility of **wastewater as an indicator of ARG landscape** within the hospital.



Carbapenemase-producing **Klebsiella pneumoniae** isolates from:

- 6 patients in ICU
- 10 ICU sinks
- 2 wastewater isolates.

**Metagenomic samples from:**

- 10 sinks in two ICUs
- 24-hour composite wastewater sample from the hospital building's outlet.

Bacterial **whole genome and metagenomic sequencing** was used to evaluate the transmission of ARG from patients through sinks to hospital wastewater.

Sequence assemblies were analyzed using Resistance Gene Identifier (RGI) combined with the Comprehensive Antibiotic Resistance Database (CARD) and a DeepARG (ML)

## Results

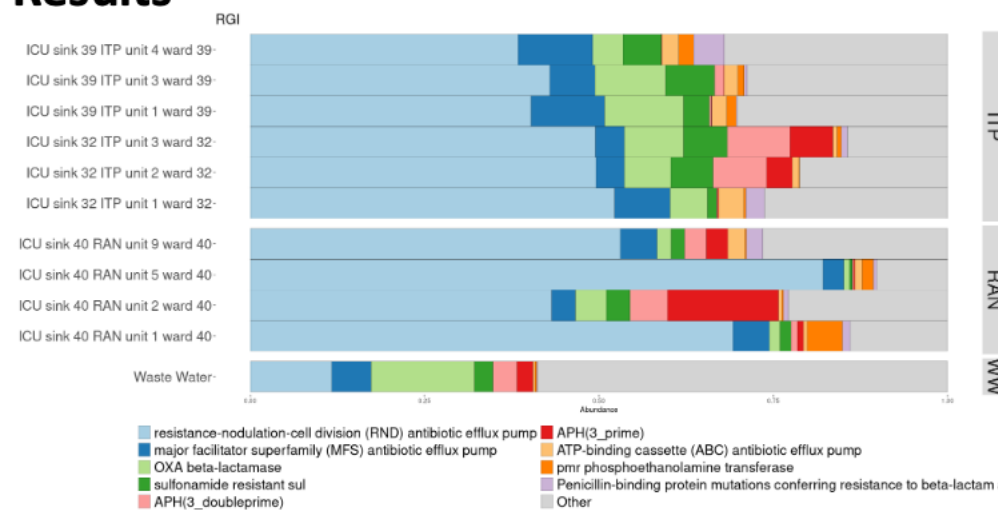


Figure showing top 10 relative abundances of ARG found in intensive care unit (ICU) sink metagenomes and waste water

- 118 genes that confer resistance antimicrobials found in metagenome
- DeepARG model revealed a more extensive range of ARG (4.92-fold increase).
- 94% of ARG coding sequences identified in isolate genomes had corresponding sequences in the metagenomic reads
- 66 ARG genes identified in WGS data. 24 were detected in all isolate samples, 32 in at least three isolates.
- Resistance to carbapenem found in 15 ARGs, with 6 found in all isolates.

## Conclusions

1. **Overlapping ARG sequences** indicates that it is possible to trace ARG between patients and hospital environment, and wastewater could be used as a coarse indicator of the overall ARG landscape in the hospital.
2. Both **detection methods showed similar patterns** in hospital-associated metagenomes.
3. differences in the total number of identified ARG suggest that **ML-based approaches** might provide researchers with the means to detect emerging resistance mechanisms.
4. We plan to continue this study and validate these findings by performing more extensive sampling to provide a more detailed hospital AMR landscape and evaluate the trends over time.



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