

PL-11

Surveillance of communicable diseases and antimicrobial resistance through wastewater-based epidemiology: experiences in the Sicilian Region

C.M. Maida (1,2), G. Andolina (2), A. Russo (2), M.R. Tricoli (2), G. Randazzo (2), R. Li Muli (2), A. Previti (2), V. Guzzetta (2), G. Sferlazza (2), W. Mazzucco (1,2), G. Graziano (2), C. Costantino (1,2), F. Tramuto (1,2)

(1) Dipartimento Scienze per la Promozione della Salute, Materno Infantile, Medicina Interna e Specialistica d'Eccellenza, Università degli Studi di Palermo; (2) U.O.C. Epidemiologia Clinica con Registro Tumori, A.O.U.P. "P. Giaccone", Palermo, Italy

Background. Wastewater-Based Epidemiology (WBE) is an innovative public health surveillance approach that analyses wastewater to monitor infectious agents and antimicrobial resistance (AMR) determinants at population level. In Sicily, WBE has progressively developed through poliovirus surveillance and expanded during the COVID-19 pandemic, creating opportunities for integrated environmental surveillance.

Materials and Methods. The Sicilian surveillance network included multiple sampling sites, including Palermo, Catania, Messina, Siracusa, Trapani and Ragusa, linked to laboratories participating in the surveillance system coordinated by the Italian National Institute of Health (ISS). SARS-CoV-2 monitoring involved collaboration among universities, healthcare institutions, laboratories and water service providers, within the framework of European Commission Recommendation (EU) 2021/472. Further activities included participation in 2023 National Centre for Disease Prevention and Control (CCM) project investigating respiratory viruses in wastewater. Preliminary correlations between wastewater measurements and clinical surveillance indicators were assessed for respiratory syncytial virus (hRSV) and influenza viruses. The regional network was also considered for extension to AMR surveillance, in line with the Italian National Action Plan on Antimicrobial Resistance 2022–2025 (PNCAR).

Results. During the COVID-19 pandemic, the regional network covered approximately 29.6% of Sicily's population. Preliminary findings from CCM project involving the University of Palermo showed positive correlations between wastewater and clinical surveillance indicators for hRSV/A ($r = 0.513$; $p < 0.05$), hRSV/B ($r = 0.637$; $p < 0.05$) and influenza A ($r = 0.607$; $p < 0.05$). For influenza B, the correlation was weak and negative ($r = -0.213$), without statistical significance ($p > 0.05$). The regional network reportedly covers 1,482,120 population equivalents, representing 29.6% of the regional population, and could provide a basis for monitoring antibiotic resistance genes (ARGs).

Conclusions. The Sicilian experience highlights WBE's potential as an integrated regional surveillance infrastructure for infectious diseases and AMR determinants. Positive correlations for selected respiratory viruses support further evaluation of wastewater monitoring as a complement to clinical surveillance, although predictive performance and temporal relationships require validation. Future priorities include standardised procedures, sustained monitoring, quality assurance and integration of environmental, clinical and epidemiological data. Detection of ARGs should be interpreted cautiously, as it does not independently establish viable resistant pathogens or clinically expressed resistance.

References. 1. European Commission. Commission Recommendation (EU) 2021/472 of 17 March 2021 on a common approach to establish a systematic surveillance of SARS-CoV-2 and its variants in wastewaters in the EU. Official Journal of the European Union. 2021;L98:3–8. Testo ufficiale EUR-Lex. 2. Parkins MD, Lee BE, Acosta N, et al. Wastewater-based surveillance as a tool for public health action: SARS-CoV-2 and beyond. Clinical Microbiology Reviews. 2024. DOI: 10.1128/cmr.00103-22. Clinical Microbiology Reviews 3. Combating antibiotic resistance using wastewater surveillance: Significance, applications, challenges, and future directions. Science of the Total Environment 2024;908:168056. DOI: 10.1016/j.scitotenv.2023.168056