The increasing levels of antimicrobial resistance (AMR) pose the greatest problem in contemporary medicine. Originally, multidrug-resistant bacteria (MDRB) were identified mostly in hospitals, where lengthened hospitalization and extensive levels of antibiotic treatment contributed to the antibiotic-resistant bacteria (ARB) selection and the distribution of highly drug-resistant strains. In hospitals, up to one-third of patients receive antibiotic therapy every day and consequently, hospitals may be important centers for the development and spread of ARB and antibiotic resistance genes (ARGs). Hospital wastewater is one of the main routes of AMR spread from medical facilities to the natural environment. A large combination of clinical important ARB and ARGs is excreted through the faces and urine of patients and reaches liquid wastes. The risk potential of HWW is heightened by the fact that hospitals use last-resort antibiotics more frequently and resistance profiles of bacteria isolated from HWW might be different when compared to other organisms. Therefore hospitals and HWW are thought to be the main ecological niches for the selection, accumulation, and dissemination of antibiotic-resistant bacteria, which may reach the urban sewerage system and finally, with treated effluent, be released by WWTPs into the environment. In response to the AMR crisis, the researchers and medical communities challenge to study the spread of AMR among different environmental niches and selecting the critical points of monitoring and interventions to familiarize adequate strategies and action. This highlights the importance of performing interconnecting studies in different disciplines and environments, all in the context of the One Health concept.

Discharge of HWW to the municipal sewage system contributes to its continuous enrichment with considerable chemical and biological pollution. Hospital wastewater can enrich wastewater in municipal sewage system with high concentrations of antibiotics and bacteria with much higher antibiotic resistance potential compared to municipal wastewater. The release of untreated HWW might be posing a risk to the environment and human health, therefore many studies are investigating the release and direct influence of HWW into the environment or communal sewage system. Disinfection seems to be an essential element of hospital wastewater treatment. Disinfection directly affects the spread of pathogenic microorganisms. It can be carried out by physical and chemical methods. Disinfection based on the use of chlorine compounds is the cheapest and most popular method in Poland. The disinfection processes may inactivate or completely damage ARB generating increased extracellular DNA in the wastewater environment. However, the integral portions of bacterial DNA could still confer resistance genes, that may be furthered transferred to municipal wastewater bacterial populations by transformation and /or transduction. ARGs seem to be the more difficult to remove component of hospital wastewater and more dangerous in the perspective of spreading drug resistance. Antibiotic resistance genes are easily detected even when all vegetative forms of bacteria are killed during the disinfection process.

The project aims to completely understand the metagenome of hospital wastewater and to determine the effect of chemical disinfection (chlorination) on changes in the metagenome of hospital wastewater. The research will identify differences in the composition of metagenomes of wastewater discharged from various medical facilities. The results will indicate whether hospital wastewater is a reservoir of ARGs and groups of microorganisms with an increased hazardous and importance status. The research will help to better understand the nature and threats posed by hospital wastewater and its disinfection. The results could increase the significance of hospital wastewater analysis as an alternative program to monitor specific microbial resistance mechanisms within individual medical units, regions or countries.