Thames study: Rivers can be a source antibiotic resistance

February 13 2015

Image: USGS

Rivers and streams could be a major source of antibiotic resistance in the environment.

The discovery comes following a study on the Thames river by scientists at the University of Warwick's School of Life Sciences and the University of Exeter Medical School.

The study found that greater numbers of resistant bacteria exist close to some waste water treatment works, and that these plants are likely to be responsible for at least half of the increase observed.

Antimicrobial resistance is one of the largest threats to human health for a century, the researchers argue. Increasingly large amounts of

antibiotics are released into the environment through both human and agricultural use, with surface run off from farming activities (including fertiliser and animal slurry) washed straight into rivers after heavy rainfall.

Co-lead on the research, Professor Elizabeth Wellington of the University of Warwick, said:

"Antibiotic resistance naturally occurs in the environment, but we don't yet know how human and agricultural waste is affecting its development. We've found that waste water discharges effect resistance levels and that improvements in our treatment processes could hold the key to reducing the prevalence of resistant bacteria in the environment.

"We found antibiotic resistance in the group Enterobacteriaceae which includes gut bacteria and pathogens."

Published in Nature's *The ISME Journal*, the study has also shown that different types of waste water treatment plant release varying amounts of resistant bacteria. Professor Wellington explains:

We produced a model based on our data which showed that there was a big difference between secondary and tertiary activated sludge plant where the latter resulted in a predicted 100-fold decrease in resistance levels.

Study co-lead author, Dr William Gaze of the University of Exeter Medical School said:

"Our research has shed further light on links between environmental pollutants and antibiotic resistance. It has allowed us to uncover an association between a number of compounds - such as zinc, phosphorous and silicon - and antibiotic resistance. We think those bacteria that have

developed to survive in environments rich in metals may also possess antibiotic resistance mechanisms - highlighting the complexity of this global issue."

The researchers analysed water and sediment samples from 13 sites across the Thames river catchment and developed detailed models to predict the distribution of antibiotic resistant bacteria.

The team also found that several other factors affected the prevalence of antibiotic resistance, such as changes in rainfall and land cover. For example, heavy rainfall at a point surrounded by grassland raised resistance levels; whereas a heavy rainfall at a point surrounded by woodland reduced the levels seen.

The findings have allowed the research team to develop a robust model that will predict the level of antibiotic resistance in other catchments, without the need for detailed water sampling.

Increased levels of antibiotic resistance in the aquatic environment could lead to increased risk of human exposure. More research is required to fully understand the risk posed via this route and the possible implications for public health.

The study is published in the journal of the *International Society for Microbial Ecology*.

Provided by University of Warwick