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The impact of large changes to human populations on the presence of ESBL-producing *Enterobacteriaceae* in a wastewater treatment plant

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Introduction: Wastewater treatment plants (WWTP) could be a crucial point in the spread of Extended Spectrum Beta Lactamase (ESBL)-producing *Enterobacteriaceae* in the environment. *bla*CTX-M groups (1, 2, 8/25, 9), *bla*SHV, *bla*TEM and *bla*OXA enzymes have rapidly become the most important ESBL, with increase in many countries during the last decade. Large changes to human populations due to different social and climatic events could exacerbate this issue.

Objectives: Bangor is a small city, with a very high proportion of its population being students, many of whom are international. The aim of this work was to compare the presence of ESBL-producing faecal coliforms bacteria in Bangor's WWTP before and after the week of students' arrival to the city ("welcome week").

Methods: Over a five-week period (two weeks before students' arrival and three weeks after), water samples were collected twice a week, from the influent, primary sedimentation tank, aeration tank and treated sewage throughout the WWTP that serves Bangor city. Counts of *E. coli* and other faecal coliforms (OFCs) were performed on selective (primary UTI) agar and then isolates were confirmed by biochemical and PCR tests. ESBL producers

were screened by combination disc method and identified genes by multiplex PCR.

Results: The mean counts of *E. coli* and OFCs before welcome week were higher than after. This is probably due to dilution factor by heavy rainfall that occurred subsequent to student arrival. Treatment by the WWTP eliminated 98.8-99.2% of total *E. coli* and OFCs, respectively. Of the *E. coli* isolated, a greater proportion was ESBL-producing before welcome week (4.3%) than after (2.0%). However, there was effectively no difference in the proportion of ESBL-producing OFCs recovered before or after welcome week (10.3% and 10.9%, respectively). In the *E. coli*, genotyping found that *bla*CTX-M group 1 was the most common enzyme-producing gene in both periods. However, the most frequently detected ESBL gene among OFCs was *bla*TEM and then *bla*SHV before welcome week, while *bla*SHV and then *bla*TEM predominated thereafter.

Conclusions: Treatment of wastewater significantly reduced counts of faecal indicator bacteria from the influent to effluent stages. In this study, large population changes were not found to affect the presence of ESBL at WWTP.

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