

ABSTRACT

WEBINAR

WASTEWATER AS A SOURCE OF CARBAPENEM-RESISTANT E. COLI

March 23, 2016

Clinical studies have reported that the occurrence of carbapenem-resistant E. coli is on the rise. This is of concern because carbapenem antibiotics are typically reserved for treating infections caused by bacteria resistant to other classes of antibiotics. Current literature states that wastewater effluents serve as a reservoir of antibiotic resistant genes (ARGs). In this study, we sought to determine the occurrence of carbapenem-resistant E. coli in wastewater samples from seven geographically dispersed locations during the summer and winter seasons in the United States between 2012 and 2013. A total of 353 E.coli isolates were recovered using mFC agar supplemented with antibiotics. E. coli isolates were confirmed biochemically using BBL Crystal™. All isolates had MICs as determined by E-Test™ strip confirming intermediate or full resistance according to the CLSI 2012 guidelines to one or more of imipenem, ceftaxime, ceftazidime or ciprofloxacin. Phylogenetic grouping of the isolates was performed using a quadruplex PCR assay. PCR assays targeting 9 carbapenemase and extended-spectrum β-lactamase (ESBL) genes were performed against 88 isolates classified as nonsusceptible to imipenem. The resistance profiles of E. coli most prevalent in all samples combined was to ceftaxime (66%), followed by ciprofloxacin (65%), ceftazidime (60%) and imipenem (17%). Of 353 E. coli isolates, twenty three percent were nonsusceptible to imipenem, and resistant to ceftaxime and ceftazidime, meeting the Centers for Disease Control and Prevention's definition of Carbapenem Resistant Enterobacteriaceae (CRE). The prevalence of imipenem resistant E. coli per facility was greater in effluents from urban WWTP treating domestic waste (18%), than in effluents from rural plants treating a mixture of domestic and agricultural waste (8%). Phylogenetic groupings showed that, group D was the most prevalent (27%), followed by groups A (21%), B2 (20%), B1 (14%), F (11%), C (10%), and E (<1%). Global phylogenetic analyses have demonstrated that extraintestinal pathogenic E. coli (ExPEC) belong to groups B2 and D, which accounted for nearly half of the study isolates. 60% of E. coli isolates had positive PCR reactions for at least one ARG, and 27% were positive for 2 or more ARGs. This study demonstrates that occurrence of CRE E. coli are widespread in wastewaters in the US.