Association Between Antimicrobial Resistance in Escherichia coli Isolates from Food Animals and Blood Stream Isolates from Humans in Europe: An Ecological Study

Background: In addition to medical antimicrobial usage, the use of antimicrobials in food animals contributes to the occurrence of resistance among some bacterial species isolated from infections in humans. Recently, several studies have indicated that a large proportion of Escherichia coli causing infections in humans, especially those resistant to antimicrobials, have an animal origin.

Methods: We analyzed the correlation between the prevalence of antimicrobial resistance in E. coli isolates from blood stream infections in humans and in E. coli isolates from poultry, pigs, and cattle between 2005 and 2008 for 11 countries, using available surveillance data. We also assessed the correlation between human antimicrobial usage and the occurrence of resistance in E. coli isolates from blood stream infections.

Results: Strong and significant correlations between prevalences of resistance to ampicillin ($r=0.94$), aminoglycosides ($r=0.72$), third-generation cephalosporins ($r=0.76$), and fluoroquinolones ($r=0.68$) were observed for human and poultry E. coli isolates. Similar significant correlations were observed for ampicillin ($r=0.91$), aminoglycosides ($r=0.73$), and fluoroquinolone resistance ($r=0.74$) in pig and human isolates. In cattle isolates, only ampicillin resistance ($r=0.72$) was significantly correlated to human isolates. When usage of antimicrobials in humans was analyzed with antimicrobial resistance among human isolates, only correlations between fluoroquinolones ($r=0.90$) and third-generation cephalosporins ($r=0.75$) were significant.

Conclusions: Resistance in E. coli isolates from food animals (especially poultry and pigs) was highly correlated with resistance in isolates from humans. This supports the hypothesis that a large proportion of resistant E. coli isolates causing blood stream infections in people may be derived from food sources.