

Resistance patterns in multiresistant Enterobacteriaceae: Data from the German Antibiotic Resistance Surveillance System (ARS) from 2008-2010



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Introduction

Multiresistant gramnegative bacteria have emerged as a serious public health problem worldwide requiring consistent and intensified surveillance efforts. Data from ARS, the German Antibiotic Resistance Surveillance system are presented.

Material and Methods

ARS is a voluntary laboratory based surveillance system collecting resistance data of all clinical pathogens and sample types. Data are transmitted electronically to the central data-base of the national public health institute (Robert Koch Institute). The development of single susceptibility-rates and of resistance patterns of *Escherichia coli* (*E. coli*), and *Klebsiella pneumoniae* (*K. pneumoniae*) from 2008 to 2010 is presented.

Material and Methods

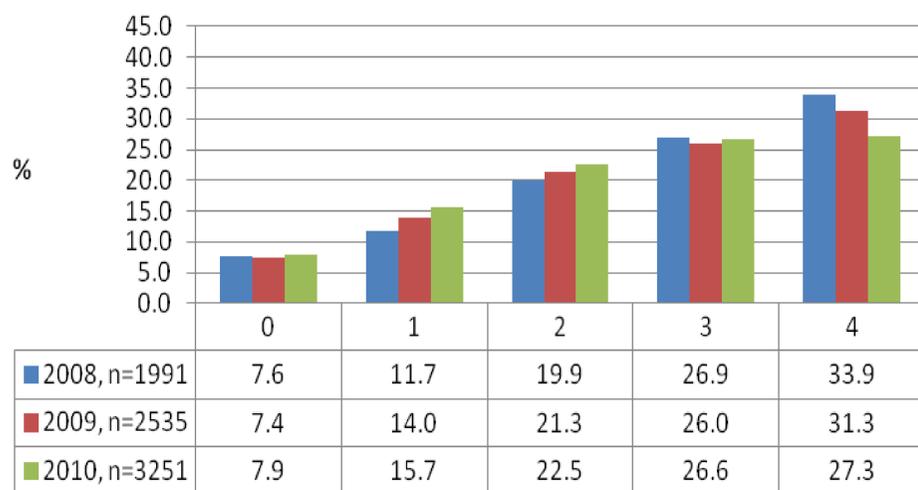
The panel of antibiotics and antibiotic classes used for the estimation of resistance patterns comprises aminopenicillins*, aminopenicillins/Betalactamase-Inhibitor, piperacillin*, piperacillin/tazobactam, 3rd generation-cephalosporins, ciprofloxacin, trimetoprim/sulfamethoxazol, tetracyclines, aminoglycosides. For analysis, only those isolates, which have been tested simultaneously against all of these antibiotics/antibiotic classes have been included. Cefotaxim (CTX)-non-susceptible isolates have been categorized in isolates without any further non-susceptibility and in isolates with one, two, three and four simultaneous non-susceptibilities against antibiotic classes other than betalactams. For all analyses only data from hospitals participating over the whole time period have been considered. Copy-strains and screening samples have been excluded.
*not in *K. pneumoniae*

Results

Single resistances: In hospital care, susceptibility testing was performed in more than 24,000 *E. coli*-isolates and more than 4500 *K. pneumoniae* isolates in each year. From 2008 to 2010, non-susceptibility against cefotaxim (CTX) in *E. coli* rose from 6.9% to 9.3% ($p < 0.001$) and in *K. pneumoniae* from 10.4% to 11.4% ($p = 0.05$). In the observed time period, non-susceptibility against carbapenems remained under 1%.

Resistance patterns: In both species the most frequent resistance pattern was full susceptibility. In 2010 the percentage was twice as high in *K. pneumoniae* (64.2%) as compared to *E. coli* (32.7%). Resistance patterns of CTX-non-susceptible *E. coli*- and *K. pneumoniae*-isolates are presented in Figure 1-2, showing the occurrence of simultaneous non-susceptibility against other antibiotics/antibiotic classes (ciprofloxacin, trimetoprim/sulfamethoxazol, aminoglycosides, tetracyclines) over time.

Resistance patterns of 3. gen-Ceph-non-susceptible *E. coli*



Resistance patterns of 3. gen-Ceph-non-susceptible *K. pneumoniae*

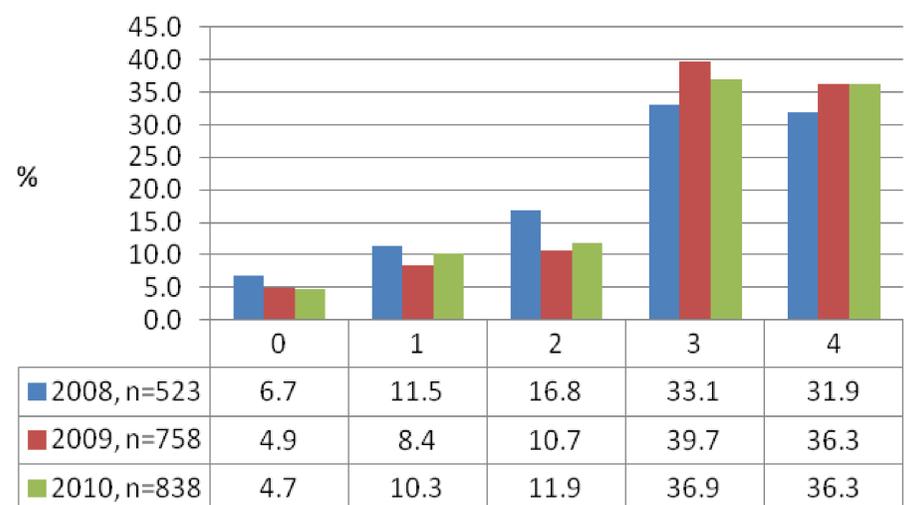


Figure 1 and 2: Occurrence of resistance patterns of CTX-non-susceptible *E. coli*- and *K. pneumoniae*-isolates from 2008 to 2010. Categorisation of isolates by number of simultaneous resistances to other antibiotic classes (ciprofloxacin, trimetoprim/sulfamethoxazol, aminoglycosides, tetracyclines)

The majority of CTX-non-susceptible *E. coli*- and *K. pneumoniae*-isolates exhibit non-susceptibility against ≥ 3 antibiotic classes other than betalactams. From 2008 to 2010 CTX-non-susceptible *E. coli*-isolates with simultaneous non-susceptibility against ≥ 3 additional antibiotic classes sank from 61% to 54% in favour to isolates exhibiting non-susceptibility against ≤ 2 additional antibiotic classes (39% versus 49%). Vice versa, the percentage of CTX-non-susceptible *K. pneumoniae*-isolates with combined non-susceptibility against ≥ 3 additional antibiotic classes increased from 65% to 73% at the expense of isolates expressing co-non-susceptibility to ≥ 2 antibiotic classes (35% versus 27%). The rising degree of multiresistance in CTX-non-susceptible *K. pneumoniae* is primarily due to an increase in aminoglycoside-containing resistance patterns (56% versus 74%). In CTX-non-susceptible isolates of both species the most frequent resistance pattern includes simultaneous non-susceptibility against fluoroquinolones, aminoglycosides, trimetoprim/sulfamethoxazol and tetracyclines.

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Conclusions

In the observed time period, resistance patterns of CTX-non-susceptible *E. coli* and *K. pneumoniae*-isolates develop into different directions. While in CTX-non-susceptible *E. coli* simultaneous non-susceptibility to other antibiotic classes sank, CTX-non-susceptible *K. pneumoniae* show a trend to more resistant isolates. The analysis of resistance patterns provides a deeper insight into strain characteristics and allows a more differentiated tracing of the development of antibiotic resistance.