

## 7.2 *Klebsiella pneumoniae*

**Table 7. c:** Non-susceptibility rates of invasive *Klebsiella pneumoniae* isolates in humans in 2019.

<i>Klebsiella pneumoniae</i>										2019	
Antimicrobials	West		North–East		South		Total			Trend	
	n	%	n	%	n	%	n	%	95% CI	4y	10y
Amoxicillin-clavulanic acid	284	19	851	13.5	64	9.4	1,199	14.6	13.6–15.6	–	–
Piperacillin-tazobactam	284	17.3	807	9.7	64	6.2	1,155	11.3	10.4–12.2	–	↑
Cephalosporin, 2nd gen.	210	15.7	704	18	64	15.6	978	17.4	16.2–18.6	–	–
Cephalosporin, 3rd/4th gen.	284	12	854	7.1	64	10.9	1,202	8.5	7.7–9.3	–	↑
Carbapenems	285	0.7	851	0.2	64	1.6	1,200	0.4	0.2–0.6	–	–
Aminoglycosides	281	8.2	852	3.2	64	6.2	1,197	4.5	3.9–5.1	–	–
Trimethoprim-sulfamethoxazole	284	16.5	777	10.6	64	14.1	1,125	12.3	11.3–13.3	–	–
Fluoroquinolones <sup>1</sup>	284	14.1	854	8.7	64	9.4	1,202	10	9.1–10.9	–	↑

<sup>1</sup> Fluoroquinolones: ciprofloxacin, norfloxacin, ofloxacin

West (GE, NE, VD, JU, FR), South (TI), North–East (other cantons) according to linguistic regions.

95% confidence intervals (CI) were calculated by the Wilson score method, calculations of trends were performed by logistic regression.

Trends were modelled with logistic regressions. Arrows represent a significant effect ( $p < 0.05$ ) of the year on the correspondent outcome (increase, decrease).

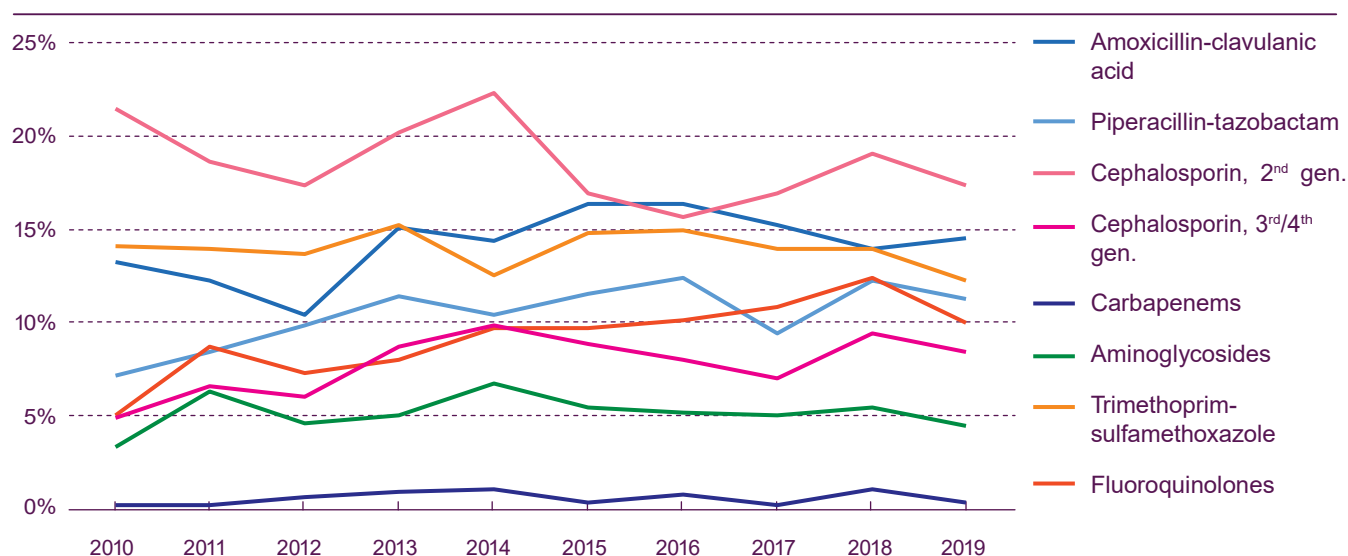
*Klebsiella* spp. are frequent colonizers of the gastrointestinal tract. Although they may also occur in the outpatient setting, they are more frequently found in the hospital setting, affecting patients with an impaired immune system. Most common sites of infection are the urinary tract and the lung (pneumonia). In contrast to *E. coli*, they are intrinsically resistant to aminopenicillins.

In this report, we only present the data on *K. pneumoniae*, which is the most frequent species of the genus *Klebsiella* isolated from human clinical isolates. As in *E. coli*, increasing resistance to 3rd/4th generation cephalosporins was a main issue between 2004 (1.3%) and 2014 (9.9%). Since then, it has remained stable or has even decreased slightly to 8.5% in 2019, which compares favorably with the EU/EEA average of 31.7% in 2018. However, stabilization of this increas-

ing resistance trend was also observed in EU/EEA states between 2016 and 2018 [2]. The same trend with maximal non-susceptibility rates in 2014 was observed for 2nd generation cephalosporins and aminoglycosides, with a maximum in 2016 for amoxicillin-clavulanic acid and trimethoprim-sulfamethoxazole and with a maximum in 2018 for fluoroquinolones. No significant trends were observed for carbapenem resistance, which is still below 1% in Switzerland, and therefore much lower than the mean EU/EEA rate of 7.5% in 2018.

However, there are considerable differences between different Swiss regions (Table 7. c), with higher non-susceptibility rates in Western Switzerland for most antibiotics, including 3rd/4th generation cephalosporins. Carbapenem non-susceptibility is highest in southern Switzerland (1.6%), mirroring but still much lower than the carbapenem resistance rate observed in Italy in that species (26.8% in 2018). More details concerning carbapenemase-producing Enterobacterales are summarized in chapter 13. Interestingly- several *K. pneumoniae* isolates that produce a carbapenemase and that co-produce a 16 S rRNA methylase conferring pandrug resistance to aminoglycosides and/or that are resistant to colistin have been reported throughout Switzerland. Their identification raises the spectrum of truly pandrug resistant *K. pneumoniae*. Co-resistance is frequent, details are shown in Table 7. d and Figure 7. e.

**Figure 7. d:** Non-susceptibility rates in invasive *Klebsiella pneumoniae* isolates in humans from 2010 to 2019.



**Table 7. d:** Non-susceptibility combinations in invasive *K. pneumoniae* isolates in humans in 2019. Only isolates tested against all four antibiotic groups (third-generation cephalosporins, carbapenems, aminoglycosides, fluoroquinolones) were considered (n = 1194/1203 [99.3%]).

Resistance patterns	Number of isolates	% of total
Fully susceptible	1,040	87.1%
<b>Single resistance (to indicated antimicrobial group)</b>		
<b>Total (all single resistance types)</b>	<b>73</b>	<b>6.1%</b>
Fluroquinolones	40	3.4%
Third-generation cephalosporins	28	2.3%
Aminoglycosides	5	0.4%
<b>Resistance to two antimicrobial groups</b>		
<b>Total (all two-group combinations)</b>	<b>38</b>	<b>3.2%</b>
Third-generation cephalosporins + fluoroquinolones	30	2.5%
Aminoglycosides + fluoroquinolones	7	0.6%
Aminoglycosides + third-generation cephalosporins	1	0.1%
<b>Resistance to three antimicrobial groups</b>		
<b>Total (all three-group combinations)</b>	<b>41</b>	<b>3.4%</b>
Carbapenems + third-generation cephalosporins + fluoroquinolones	2	0.2%
Aminoglycosides + third-generation cephalosporins + fluoroquinolones	39	3.2%
<b>Resistance to four antimicrobial groups</b>		
<b>Total (all four-group combinations)</b>	<b>2</b>	<b>0.2%</b>
Aminoglycosides + carbapenems + third-generation cephalosporins + fluoroquinolones	2	0.2%

**Figure 7. e:** Multiresistance in invasive *K. pneumoniae* isolates in humans from 2010 to 2019 (for details refer to Table 7. d).

