7.3 Pseudomonas aeruginosa

Pseudomonas aeruginosa is a non-fermentative Gram-negative rod and the most important human pathogen in this group of bacteria. *P. aeruginosa* is one of the leading causes of nosocomial respiratory tract infections and is also found in hospital-acquired urinary tract, wound and bloodstream infections. It is a feared pathogen, especially in burn units. Mucoid strains frequently infect cystic fibrosis patients and are very difficult to eradicate. The main community-acquired infections caused by *P. aeruginosa* in immunocompetent hosts are external otitis (swimmer's ear) and sinusitis.

P. aeruginosa is intrinsically resistant to amoxicillin, amoxicillin-clavulanic acid, first- and second-generation cephalosporins, cefixime, cefpodoxime, ceftriaxone, ertapenem, as well as tetracyclines, including tigecycline and trimethoprim-sulfamethoxazole. Quinolones are among the rare orally given antibiotics which retain activity against *P. aeruginosa*. Following increasing resistance rates between 2010 and 2015 for all antibiotics, non-susceptibility rates stabilized or even slightly decreased thereafter Decreasing resistance trends between 2016 and 2018 were observed in the EU/EEA for aminoglycosides, ceftazidime, piperacillin-tazobactam and carbapenems, while resistance to fluoroquinolones remained stable during this period [2]. In Switzerland in 2019, non-susceptibility rates were around 13% for carbapenems, around 10% for piperacillin-tazobactam, around 9% for aminoglycosides and ciprofloxacin, and were lowest for ceftazidime and cefepime (8%). These rates are mostly lower than those observed in neighboring countries such as France and Italy. Swiss regional data are given in Table 7. e, data on co-resistance in Table 7. f and Figure 7. g.

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Table 7. e: Non-susceptibility rates of invasive *Pseudomonas aeruginosa* isolates in humans in 2019.

Pseudomonas aeruginosa											2019
	West		North–East		South		Total			Trend	
Antimicrobial	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**95% CI**	**4y**	**10y**
Piperacillin-tazobactam	132	15.9%	362	7.7%	35	14.3%	529	10.2%	8.9–11.5	–	–
Ceftazidime	110	12.7%	386	6.2%	35	8.6%	531	7.7%	6.5–8.9	–	↑
Cefepime	132	12.1%	376	6.9%	35	8.6%	543	8.3%	7.1–9.5	↑	↑
Carbapenem[1]	132	20.5%	384	10.7%	35	11.4%	551	13.1%	11.7–14.5	–	↑
Aminoglycosides	132	7.6%	385	10.1%	35	0.0%	552	8.9%	7.7–10.1	–	↑
Ciprofloxacin	131	10.7%	385	8.6%	35	11.4%	551	9.3%	8.1–10.5	–	–

[1] Carbapenems: imipenem, meropenem

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).

Table 7. f: Non-susceptibility combinations in invasive *P. aeruginosa* isolates in humans in 2019. Only isolates tested against all five antibiotics or antibiotic groups (piperacillin-tazobactam, cefepime, carbapenems, aminoglycosides, ciprofloxacin) were considered (n = 515/554 [93.0%]).

Resistance patterns	Number of isolates	% of total
Fully susceptible	**377**	**73.2%**
Single resistance (to indicated antimicrobial group)		
Total (all single resistance types)	**76**	**14.7%**
Piperacillin-tazobactam	12	2.3%
Ciprofloxacin	14	2.7%
Cefepime	1	0.2%
Carbapenems	26	5.0%
Aminoglycosides	23	4.5%
Resistance to two antimicrobial groups		
Total (all two-group combinations)	**29**	**5.7%**
Piperacillin-tazobactam + ciprofloxacin	2	0.4%
Cefepime + piperacillin-tazobactam	7	1.3%
Carbapenems + piperacillin-tazobactam	4	0.8%
Carbapenems + ciprofloxacin	8	1.6%
Cefepime + carbapenems	2	0.4%
Aminoglycosides + piperacillin-tazobactam	1	0.2%
Aminoglycosides + cefepime	3	0.6%
Aminoglycosides + carbapenems	2	0.4%
Resistance to three antimicrobial groups		
Total (all three-group combinations)	**16**	**3.2%**
Cefepime + piperacillin-tazobactam + ciprofloxacin	3	0.6%
Carbapenems + piperacillin-tazobactam + ciprofloxacin	1	0.2%
Cefepime + carbapenems + piperacillin-tazobactam	4	0.8%
Cefepime + carbapenems + ciprofloxacin	1	0.2%
Aminoglycosides + piperacillin-tazobactam + ciprofloxacin	1	0.2%
Aminoglycosides + cefepime + piperacillin-tazobactam	2	0.4%
Aminoglycosides + cefepime + ciprofloxacin	1	0.2%
Aminoglycosides + carbapenems + ciprofloxacin	1	0.2%
Aminoglycosides + cefepime + carbapenems	2	0.4%
Resistance to four antimicrobial groups		
Total (all four-group combinations)	**10**	**1.9%**
Cefepime + carbapenems + piperacillin-tazobactam + ciprofloxacin	7	1.3%
Aminoglycosides + carbapenems + piperacillin-tazobactam + ciprofloxacin	1	0.2%
Aminoglycosides + cefepime + carbapenems + piperacillin-tazobactam	1	0.2%
Aminoglycosides + cefepime + carbapenems + ciprofloxacin	1	0.2%
Resistance to five antimicrobial groups		
Total (all five-group combinations)	**7**	**1.3%**
Aminoglycosides + cefepime + carbapenems + piperacillin-tazobactam + ciprofloxacin	7	1.3%

Figure 7. f: Non-susceptibility rates of invasive *Pseudomonas aeruginosa* isolates in humans from 2010 to 2019.

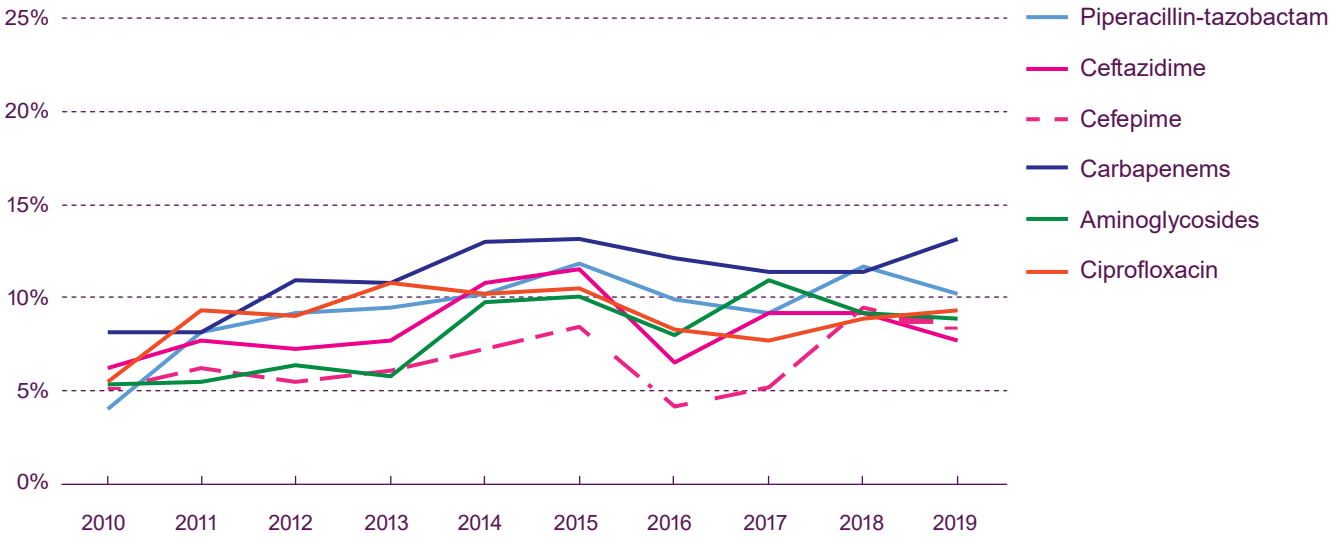

Figure 7. g: Multiresistance in invasive *Pseudomonas aeruginosa* isolates in humans between 2010 and 2019 (for details refer to Table 7. f).