

# **INTRINSIC RESISTANCE AND EXCEPTIONAL RESISTANCE PHENOTYPES OF BACTERIAL PATHOGENS**

[adapted from “EUCAST Expert Rules: Intrinsic Resistance and Exceptional Phenotypes” version 3.1 (September 26th 2016)]

**NATIONAL ANTIBIOGRAM COMMITTEE**

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# TABLE 1: INTRINSIC RESISTANCE IN *ENTEROBACTERALES* (PART 1)

These bacteria are intrinsically resistant to penicillin G, oxacillin, glycopeptides, daptomycin, linezolid, fusidic acid, macrolides<sup>1</sup>.

	Ampicillin, amoxicillin	Amoxicillin-clavulanate	Ticarcillin	1st gen. cephalosporin	Cefoxitin	Cefuroxime	Tetracycline	Tigecycline	Colistin	Fosfomycin	Nitrofurantoin
<i>Citrobacter koseri</i> <sup>2</sup> , <i>Citrobacter amalonaticus</i> <sup>2</sup>	R		R								
<i>Citrobacter freundii</i> complex <sup>3</sup>	R	R		R	R						
<i>Enterobacter aerogenes</i>	R	R		R	R						
<i>Enterobacter cloacae</i> complex <sup>4</sup>	R	R		R	R						
<i>Hafnia alvei</i>	R	R		R	R			R			
<i>Klebsiella</i> spp.	R		R								

1. Azithromycin is clinically effective for the treatment of infections due to *Salmonella* spp. (typhoid fever) and *Shigella* spp.
2. Also includes *Citrobacter sedlakii*, *Citrobacter farmeri*, *Citrobacter rodentium*.
3. Also includes *Citrobacter braakii*, *Citrobacter murlinae*, *Citrobacter werkmanii*, *Citrobacter youngae*.
4. Mainly includes *Enterobacter cloacae*, *Enterobacter asburiae*, *Enterobacter kobei*, *Enterobacter ludwigii*, *Enterobacter hormaechei*.
5. Includes cefazolin, cefalexin, cefadroxil and cefalothin.

# TABLE 1: INTRINSIC RESISTANCE IN *ENTEROBACTERALES* (PART 2)

These bacteria are intrinsically resistant to penicillin G, oxacillin, glycopeptides, daptomycin, linezolid, fusidic acid, macrolides<sup>1</sup>.

	Ampicillin, amoxicillin	Amoxicillin-clavulanate	Ticarcillin	1st generation cephalosporin	Cefoxitin	Cefuroxime	Tetracycline	Tigecycline	Colistin	Fosfomycin	Nitrofurantoin
<i>Morganella morganii</i>	R	R		R		R	R	R	R		R
<i>Proteus mirabilis</i>						R	R	R			R
<i>Proteus vulgaris</i> , <i>Proteus penneri</i>	R			R		R	R	R	R		R
<i>Providencia rettgeri</i>	R	R		R		R	R	R			R
<i>Providencia stuartii</i>	R	R		R		R	R	R			R
<i>Raoultella</i> spp.	R		R								
<i>Serratia marcescens</i> <sup>6</sup>	R	R		R	R	R		R			R
<i>Yersinia enterocolitica</i>	R	R	R	R	R						
<i>Yersinia pseudotuberculosis</i>								R			

1. Azithromycin is clinically effective for the treatment of infections due to *Salmonella* spp. (typhoid fever) and *Shigella* spp.
5. Includes cefazolin, cefalexin, cefadroxil and cefalothin.
6. Intrinsically resistant to tetracycline and doxycycline, but not to minocycline and tigecycline.

# TABLE 2: INTRINSIC RESISTANCE IN GRAMNEGATIVE NON FERMENTERS

These bacteria are intrinsically resistant to penicillin G, oxacillin, glycopeptides, daptomycin, linezolid, fusidic acid, rifampicin, macrolides.

	Ampicillin, amoxicillin	Amoxicillin-clavulanate	Ticarcillin, piperacillin	Ticarcillin-clavulanate	Piperacillin-tazobactam	Temocillin	1st and 2nd gen. ceph.	Cefotaxime, ceftioaxone	Ceftazidime, ceftazidime	Aztreonam	Ertapenem	Imipenem	Ciprofloxacin	Aminoglycosides	Trimethoprim-sulfamethoxazole	Fosfomycin	Tetracycline	Tigecycline	Colistin
<i>Acinetobacter</i> spp. <sup>1,2,3</sup>	R	R				R	R	R		R	R				R	R			
<i>Achromobacter xylosoxidans</i>	R	R				R	R	R		R	R								
<i>Burkholderia cepacia</i> complex	R	R	R	R	R		R	R	R	R	R	R	R	R	R				R
<i>Elizabethkingia meningoseptica</i>	R	R	R	R		R	R	R	R	R	R	R	R						R
<i>Ochrobactrum anthropi</i>	R	R	R	R	R	R	R	R	R	R	R	R							
<i>Pseudomonas aeruginosa</i>	R	R				R	R	R		R				R		R	R		
<i>Stenotrophomonas maltophilia</i> <sup>2,3</sup>	R	R	R			R	R	R		R	R	R		R		R	R		

1. Includes *Acinetobacter baumannii*, *Acinetobacter pittii*, *Acinetobacter nosocomialis*, *Acinetobacter calcoaceticus* complex.
2. Intrinsically resistant to tetracycline and doxycycline, but not to minocycline and tigecycline.
3. Resistant to trimethoprim alone, But susceptible to trimethoprim-sulfamethoxazole,

# TABLE 3: INTRINSIC RESISTANCE IN OTHER GRAMNEGATIVE BACTERIA

These bacteria are naturally resistant to oxacillin, glycopeptides, lincosamides, daptomycin, linezolid.

	Macrolides	Trimethoprim	Colistin	Nalidixic acid	1st gen. ceph.	2nd to 4th gen. ceph.
<i>Haemophilus influenzae</i> <sup>1</sup>	R				R	
<i>Moraxella catarrhalis</i>		R				
<i>Neisseria spp.</i>		R				
<i>Neisseria meningitidis</i>		R	R			
<i>Neisseria gonorrhoeae</i>		R	R			
<i>Campylobacter jejuni, Campylobacter coli</i>		R			R	R
<i>Campylobacter coli</i>		R			R	R
<i>Campylobacter fetus</i>		R		R	R	R
<i>Helicobacter pylori</i>		R	R	R		

1. *Haemophilus influenzae* is naturally resistant to macrolides with 16 C atom cycles (spiramycin, josamycin, midecamycin).

# TABLE 4: INTRINSIC RESISTANCE IN GRAM POSITIVE BACTERIA (PART 1)

These bacteria are naturally resistant to ceftazidime, aztreonam, temocillin, colistin, nalidixic acid.

		1st to 3rd gen. cephalosporins	Ceftazidime	Aminoglycosides	Macrolides	Clindamycin	Quinupristin-Dalfopristin	Vancomycin	Teicoplanin	Fosfomycin	Novobiocin	Fusidic acid	Cotrimoxazole
<i>Staphylococcus saprophyticus</i>		R							R	R	R		
<i>Staphylococcus cohnii</i> , <i>Staphylococcus xylosus</i>		R							R				
<i>Staphylococcus capitis</i>		R							R				
Other coagulase negative staphylococci		R											
<i>Staphylococcus aureus</i>		R											
<i>Listeria monocytogenes</i>	R	R			R				R				
<i>Corynebacterium urealyticum</i> , <i>Corynebacterium jeikeium</i>	R	R	R	R	R				R			R	
<i>Bacillus cereus</i>	R	R											
<i>Leuconostoc</i> , <i>Pediococcus</i>							R	R					
<i>Lactobacillus</i> spp. ( <i>L. casei</i> , <i>L. casei</i> var. <i>ramnosus</i> )							R	R					
<i>Clostridium innocuum</i> , <i>Clostridium ramosum</i>							R						

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# TABLE 4: INTRINSIC RESISTANCE IN GRAM POSITIVE BACTERIA (PART 2)

These bacteria are naturally resistant to ceftazidime, aztreonam, temocillin, colistin, nalidixic acid.

		1st to 3rd gen. cephalosporins, cefepime	Ceftazidime	Aminoglycosides	Macrolides	Clindamycin	Quinupristin-Dalfopristin	Vancomycin	Teicoplanin	Fosfomycin	Novobiocin	Fusidic acid	Cotrimoxazole
<i>Streptococcus</i> spp. <sup>1</sup>		R	R								R		
<i>Enterococcus faecalis</i> <sup>1,2</sup>	R	R	R	R	R	R					R	R	
<i>Enterococcus faecium</i> <sup>1,2</sup>	R	R	R	R							R	R	
<i>Enterococcus gallinarum</i> <sup>1,2</sup> , <i>Enterococcus casseliflavus</i> <sup>1,2</sup>	R	R	R	R	R	R	R				R	R	

1. Low resistance rates to aminoglycosides. Combinations of aminoglycosides with cell wall inhibitors (betalactams, glycopeptides) are bactericidal and synergistic against isolates that are susceptible to betalactams and do not display high level resistance to aminoglycosides (gentamicin, amikacin).
2. Naturally resistant to sulfonamides and susceptible only to trimethoprim. The clinical efficacy of cotrimoxazole is controversial and should best be avoided in case of severe infection.