

# EARS-NET EQA 2023 Österreich

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# EARS-Net EQA



- EQA (External Quality Assessment) organisiert durch European Antimicrobial Resistance Surveillance Network (EARS-Net)
- EARS-Net Surveillance of AMR (Antimicrobial Resistance) in der EU (siehe AURES für Ö, ECDC)
- Performance und Vergleichbarkeit der Testergebnisse zwischen Laboren und Ländern
  - Verlässlichkeit der Laborergebnisse
  - Qualität
- konkrete Ziele EQA
  - Qualität der Speziesidentifikation
  - Genauigkeit der qualitativen Resistenztestungen

# EARS-Net EQA 2023 Austria

- 871 Labore von 30 EU/EEA Ländern teilgenommen
- 37 Labore in Österreich teilgenommen
- 6 Isolate zur Speziesidentifizierung, Resistenztestung
  - *E. coli*, *K. pneumoniae* (2x), *Acinetobacter baumannii*, *E. faecalis*, *E. faecium*
- Technischen Universität Dänemarks (Technical University of Denmark, National Food Institute (DTU Food))



# EARS-Net EQA 2023

- phänotypische Empfindlichkeitstestung (DTU FOOD): Boullion-Mikrodilution u/o Agardiffusion
- 3 Referenzlabore: Konsensus/ Bestätigung
  - EUCAST Development Laboratory, Uppsala, Schweden
  - Microbiological Diagnostic Unit Public Health Laboratory, The Doherty Institute, Australia
  - Antimicrobial Resistance Research Center, National Institute of Infectious Diseases, Japan
- Ganzgenomsequenzierung: Resistenzgene, chromosomale Punktmutationen (DTU FOOD) (ResFinder v4.1, AMRFinderPlus and CARD RGI)
- Antibiotika → EARS-Net
- Speziesidentifikation und Empfindlichkeitstestung nach Routinemethoden (automatisierte Systeme, Boullion-Mikrodilution, Agardilution, Agardiffusion, Gradienten-Diffusionstest)
- EUCAST v13.0; R, I, S

# Scoring Empfindlichkeitstestung

Bewertung jeder Drug-Bug-Kombinationen

Bewertung Kategorie S/I/R, Zusatzanagbe MHK/HH

→ Grad der Schwierigkeit

– **leicht**

- erwartete MHK  $\geq 2$  Verdünnungsstufen entfernt vom BP
- außerhalb der ATU
- BP unverändert

– **schwer:**

- ATU
- $< 2$  Verdünnungsstufen vom BP entfernt
- kürzlich geänderter BP

→ Schwere des Fehlers

- **Very Major Error (VME):** statt R als S/I ausgeben
- **Major Error (ME):** statt S/I als R ausgeben
- **No Error**

# Scoring System: Empfindlichkeitstestung

**Table 7. Exercise scoring system for reported AST results in the 2023 EARS-Net EQA**

		Difficulty of result and expected interpretation					
		Easy			Difficult		
		R	I	S	R	I	S
Obtained interpretation	R	1	-3 (ME)	-3 (ME)	4	0 (ME)	0 (ME)
	I	-4 (VME)	1	-1	-1 (VME)	4	2
	S	-4 (VME)	-1	1	-1 (VME)	2	4
	Not reported	-	-	-	-	-	-

Note: R: resistant, I: susceptible, increased exposure, S: susceptible, standard dosing regimen; VME: very major error, ME: major error; - : no data.

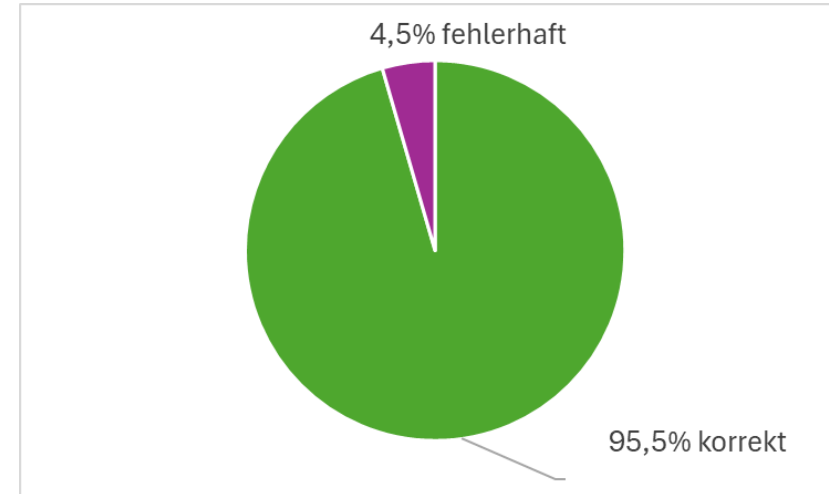
# Ergebnisse Speziesdifferenzierung

222/ 222 (100.0%) korrekt

Austria	Expected species	No. of labs submitting data with interpretation	No. of labs reporting correct species identification	% of labs reporting correct species identification
Strain ID				
2023 EARS-Net 1	<i>Escherichia coli</i>	37	37	100.0
2023 EARS-Net 2	<i>Klebsiella pneumoniae</i>	37	37	100.0
2023 EARS-Net 3	<i>Enterococcus faecalis</i>	37	37	100.0
2023 EARS-Net 4	<i>Klebsiella pneumoniae</i>	37	37	100.0
2023 EARS-Net 5	<i>Acinetobacter baumannii</i>	37	37	100.0
2023 EARS-Net 6	<i>Enterococcus faecium</i>	37	37	100.0

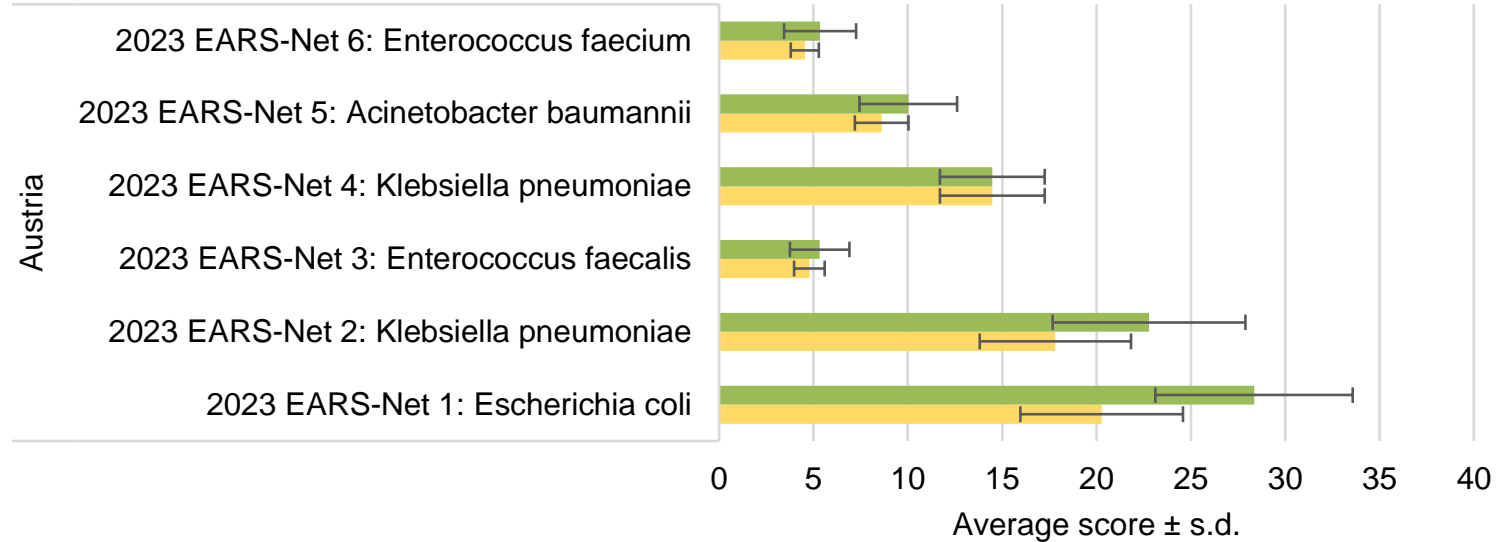
# Ergebnisse der Empfindlichkeitstestung

- 74 verschiedene Drug-Bug-Kombinationen
- Maximal Score 98
- 2 360 von 2 738 möglichen Ergebnissen
- 2 254 (95.5%) korrekte Interpretation (Average Score  $70.5 \pm 13.1$ )





# Empfindlichkeitstestung Ergebnisse



■ Average (+/- s.d.) maximum possible score for results submitted by participating laboratories

■ Average (+/- s.d.) reported score for results submitted by participating laboratories

# Methoden

Austria	Total		
Method	No. of AST performed	% of total AST performed	% correct interpretation
Agar dilution	10	0.4	100.0
Automated system	905	38.3	96.0
Broth microdilution	97	4.1	96.9
Disk/Tablet diffusion	1,078	45.7	95.6
Gradient test	268	11.4	92.5
Other	2	0.1	100.0
<b>Total</b>	<b>2,360</b>	<b>100.0</b>	<b>95.5</b>



## 2023 EARS-Net 1: *Escherichia coli*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amoxicillin	R	<i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Ampicillin	R	<i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Amoxicillin-clavulanic acid****	R	<i>bla</i> <sub>OXA-1</sub>
Piperacillin-tazobactam****	R	<i>bla</i> <sub>OXA-1</sub>
Cefotaxime	R	<i>bla</i> <sub>CTX-M-15</sub>
Ceftazidime	I	<i>bla</i> <sub>CTX-M-15</sub>
Ceftriaxone	R	<i>bla</i> <sub>CTX-M-15</sub>
Cefepime	S	<i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Meropenem	S	
Ertapenem	S	
Imipenem	S	
Ciprofloxacin	R	<i>aac</i> (6')-Ib-cr, <i>gyrA</i> S83L, <i>gyrA</i> D87N, <i>parC</i> S80I, <i>parC</i> E84V, <i>parE</i> I529L
Levofloxacin	R	<i>aac</i> (6')-Ib-cr, <i>gyrA</i> S83L, <i>gyrA</i> D87N, <i>parC</i> S80I, <i>parC</i> E84V, <i>parE</i> I529L
Moxifloxacin	R	<i>aac</i> (6')-Ib-cr, <i>gyrA</i> S83L, <i>gyrA</i> D87N, <i>parC</i> S80I, <i>parC</i> E84V, <i>parE</i> I529L
Ofloxacin	R	<i>aac</i> (6')-Ib-cr, <i>gyrA</i> S83L, <i>gyrA</i> D87N, <i>parC</i> S80I, <i>parC</i> E84V, <i>parE</i> I529L
Tigecycline	S	
Tobramycin	R	<i>aac</i> (6')-Ib-cr
Amikacin	S	<i>aac</i> (6')-Ib-cr
Gentamicin	S	
Colistin	S	

- *bla*<sub>CTX-M-15</sub> = ESBL
- *aac*(6')-Ib-cr = Aminoglykosid modifizierendes Enzym
- 9/37 haben alle AB getestet
- schwer:
  - PIP/TAZ
  - CAZ
  - FEP
  - AK

# EARS-Net 1: *Escherichia coli*

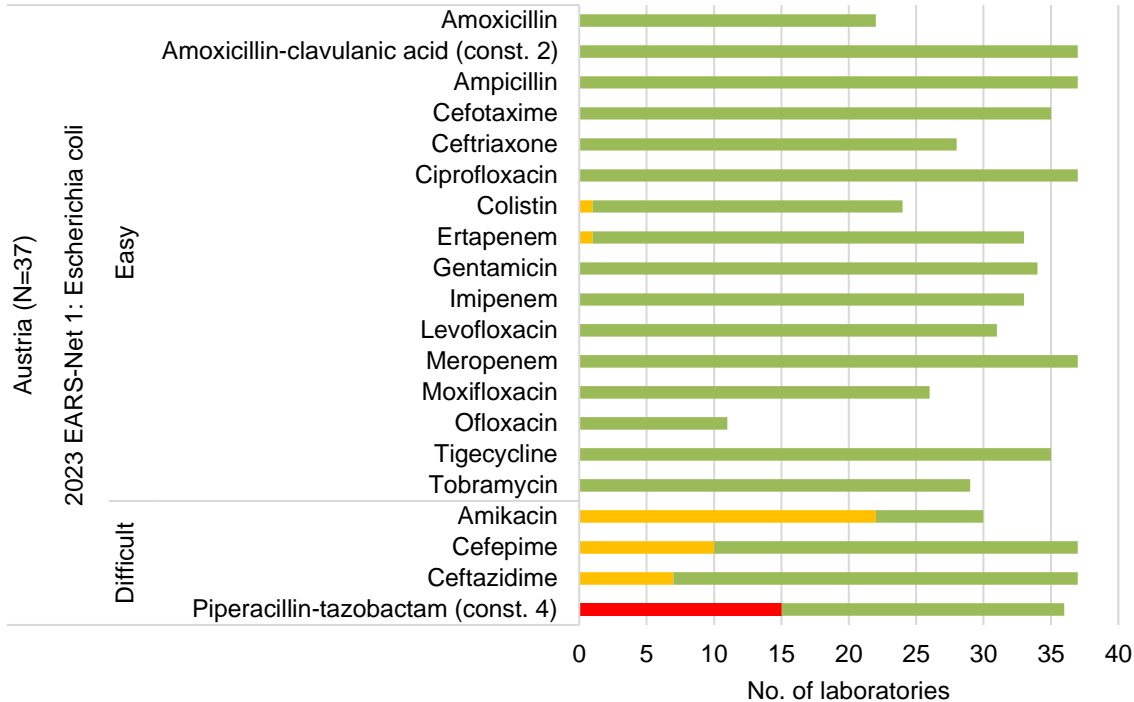
- derselbe Stamm wie 2022
- NEU 2023: 2 Abweichungen im Vgl. zu 2022
  - PIP/TAZ 2023 MHK 16/4 mg/L = R  
(2022 MHK= 8/4 mg/L = S)
  - Amikacin 2023 MHK= 8mg/L = S  
(2022 MHK = >8 mg/L = R)
- Variabilität des Stammes
- Vergleich 2022 mit 2023 Cefepim:  
ME von 20% → 17% ↓
- 27/37 Laboren 2022/2023  
mindestens einen VME/ME

# EARS-Net 1: *E. coli*



Ordens  
klinikum  
Linz

Barmherzige  
Schwestern  
Elisabethinen



■ VME ■ ME ■ No error

91,1% korrekt  
6,5% ME  
2,4% VME  
VME PIP/TAZ

# ***EARS-Net 1: E. coli***

- 5/37 alle Ergebnisse richtig
- 3/37 exzellent ( $\geq 95\%$ )
- 14/37 sehr gut (90%-94%)
- 8/37 gut (85%-89%)
- 5/37 zufriedenstellend (80%- 84%)
- 2/ 37  $< 80\%$

# EARS-Net 1: *E. coli*



Antimicrobial	Expected interpretation
Amoxicillin	R
Ampicillin	R
Amoxicillin-clavulanic acid****	R
Piperacillin-tazobactam****	R
Cefotaxime	R
Ceftazidime	I
Ceftriaxone	R
Cefepime	S
Meropenem	S
Ertapenem	S
Imipenem	S
Ciprofloxacin	R
Levofloxacin	R
Moxifloxacin	R
Ofloxacin	R
Tigecycline	S
Tobramycin	R
Amikacin	S
Gentamicin	S
Colistin	S

- VME (PIP/TAZ) 41,7%,
- ME (Amikacin) 73,3%
- ME (Cefepim) 27%
- ME (Cefazidim) 18,9%

Methoden unabhängig

Ursache:

- Methodenvariation
- systematischer oder zufälliger Fehler
- unterschiedl. Expression Resistenzgene

# EARS-Net 2 *Klebsiella pneumoniae*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amikacin	S	aac(6')-Ia
Amoxicillin-clavulanic acid***	R	<i>bla</i> <sub>VEB-1</sub> , <i>bla</i> <sub>SHV-11</sub>
Cefepime	I	<i>bla</i> <sub>VEB-1</sub> , <i>bla</i> <sub>SHV-11</sub>
Cefotaxime	R	<i>bla</i> <sub>VEB-1</sub> , <i>bla</i> <sub>SHV-11</sub>
Ceftazidime	R	<i>bla</i> <sub>VEB-1</sub> , <i>bla</i> <sub>SHV-11</sub>
Ceftriaxone	R	<i>bla</i> <sub>SHV-11</sub>
Ciprofloxacin	S	
Colistin	S	
Ertapenem	R	
Gentamicin	R	ant(2'')-Ia
Imipenem	S	
Levofloxacin	S	
Meropenem	S	
Moxifloxacin	S	
Ofloxacin	S	
Piperacillin-tazobactam***	R	<i>bla</i> <sub>VEB-1</sub> , <i>bla</i> <sub>SHV-11</sub> , <i>bla</i> <sub>OXA-10</sub>
Tobramycin	R	aac(6')-Ia, ant(2'')-Ia

- *bla*<sub>VEB-1</sub> ESBL
- *bla*<sub>SHV-11</sub> Broad Spectrum
- ant(2'')-Ia, aac(6')Ia = Aminoglykosid modifizierende Enzyme
- additional: ompK36 A217S, ompK37 I70M, ompK37 I128M potentially associated with carbapenem resistance
- 8/37 alle Antibiotika ausgetestet

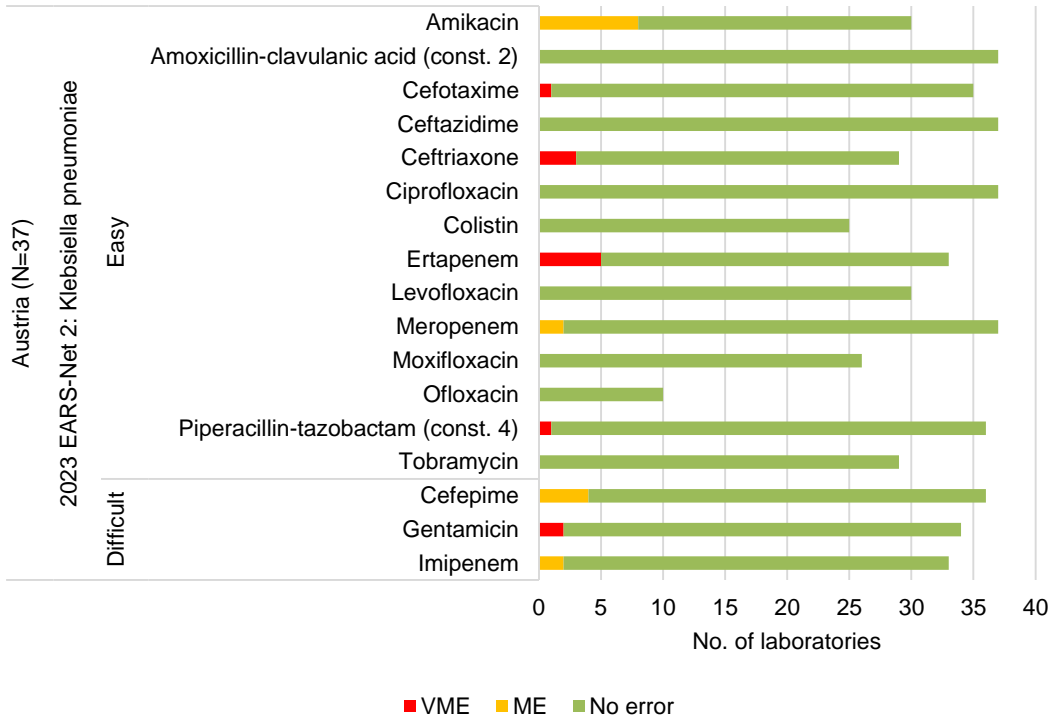


# EARS-Net 2 *Klebsiella pneumoniae*



Ordens  
klinikum  
Linz

Barmherzige  
Schwestern  
Elisabethinen



94,8% korrekt

3% (16) ME

2,2% (12) VME für

- Cefotaxim
- Ceftriaxon
- Ertapenem
- Gentamicin
- PIP/Taz

## EARS-Net 2 *K. pneumoniae*

- 16/37 alle Ergebnisse richtig
- 14/37 sehr gut (90%-94%)
- 5/37 gut (85%-89%)
- 1/37 zufriedenstellend (80%- 84%)
- 1/37 < 80%

# EARS-Net 2 *K. pneumoniae*

## VME

- Ertapenem (15,2%): autom., Agardiff., Gradient.
- Ceftriaxon (10,3%): Agardiff., Gradiententest
- Cefotaxim (2,9%): Gradiententest
- PIP/TAZ (2,8%): autom.

VME: Gentamicin (5,9%): Agardiffusion

ME: Amikacin (26,7%): autom., Agardiff., Gradient.

→ **leicht:** systematischer, zufälliger Fehler, unterschiedl. Expression der Resistenzgene

→ **schwer:** Methodenvariation, systematischer, zufälliger Fehler

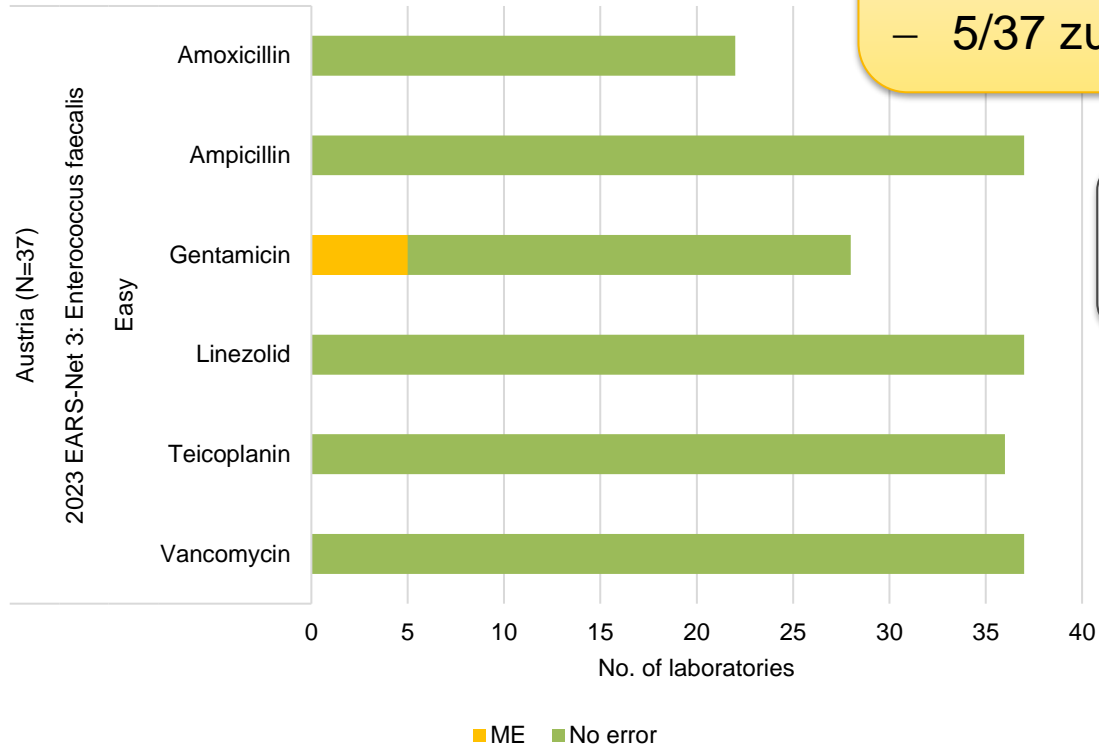
→ **leicht:** systematischer, zufälliger Fehler

# EARS-Net 3: *Enterococcus faecalis*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amoxicillin	S	
Ampicillin	S	
Gentamicin (test for HLAR)	S	
Linezolid	R	optrA
Teicoplanin	S	
Vancomycin	S	

- 19/37 alle 6 Antibiotika getestet
- optrA (Plasmid)
- alle Substanzen Schwierigkeitsgrad „leicht“

# EARS-Net 3: *E. faecalis*



- 97,5 % korrekt
- 2,5% ME
- 32/37 korrekt (100%)
- 5/37 zufriedenstellend (80%- 84%)

ME: Gentamicin (17,5%):  
Methodenunabhängig

- systematischer, zufälliger Fehler
- Fehlinterpretation: HLAR negativ = S (s. EQA Protokoll)

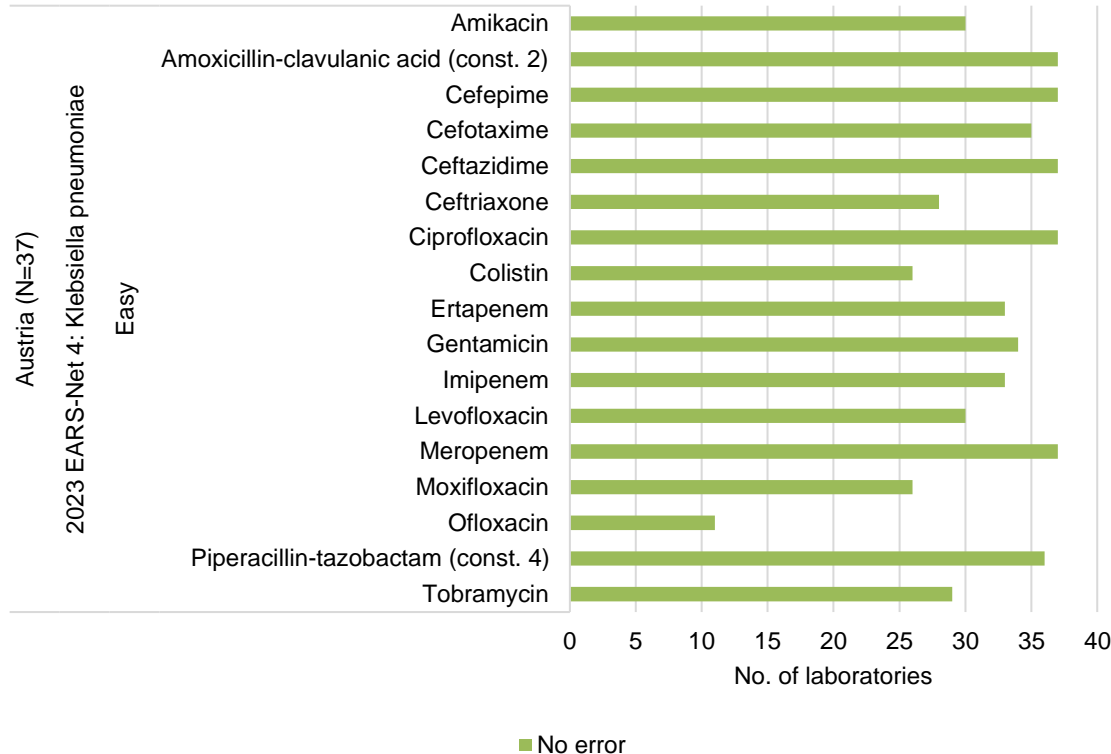


## EARS-Net 4: *Klebsiella pneumoniae*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amikacin	R	rmtB
Amoxicillin-clavulanic acid***	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>OXA-181</sub> , <i>bla</i> <sub>SHV-1</sub>
Cefepime	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>OXA-181</sub> , <i>bla</i> <sub>SHV-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Cefotaxime	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>SHV-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Ceftazidime	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>SHV-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Ceftriaxone	R	<i>bla</i> <sub>SHV-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Ciprofloxacin	R	<i>qnrS1</i> , <i>gyrA</i> D87N, <i>gyrA</i> S83F, <i>parC</i> E84K
Colistin	R	mgrB W20R
Ertapenem	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-181</sub>
Gentamicin	R	rmtB
Imipenem	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-181</sub>
Levofloxacin	R	<i>qnrS1</i> , <i>gyrA</i> D87N, <i>gyrA</i> S83F, <i>parC</i> E84K
Meropenem	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-181</sub>
Moxifloxacin	R	<i>qnrS1</i> , <i>gyrA</i> D87N, <i>gyrA</i> S83F, <i>parC</i> E84K
Ofloxacin	R	<i>qnrS1</i> , <i>gyrA</i> D87N, <i>gyrA</i> S83F, <i>parC</i> E84K
Piperacillin-tazobactam***	R	<i>bla</i> <sub>NDM-5</sub> , <i>bla</i> <sub>OXA-1</sub> , <i>bla</i> <sub>OXA-181</sub> , <i>bla</i> <sub>SHV-1</sub> , <i>bla</i> <sub>CTX-M-15</sub>
Tobramycin	R	rmtB

- *bla*<sub>NDM-5</sub> (MBL, Amb. B)
- *bla*<sub>OXA-181</sub> (OXA-48- like, Amb. D)
- *bla*<sub>CTX-M-15</sub> = ESBL
- mgrB W20R = Colistin R (chromosomal)
- Schwierigkeit: leicht

# EARS-Net 4: *Klebsiella pneumoniae*



100% korrekt  
keine VME  
keine ME

# EARS-Net 5: *Acinetobacter baumannii*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amikacin	R	
Ciprofloxacin	R	<i>gyrA</i> S81L, <i>parC</i> S84L, <i>parC</i> V104I, <i>parC</i> D105E
Colistin	S	
Gentamicin	R	<i>ant(2'')-Ia</i>
Imipenem	S	
Levofloxacin	R	<i>gyrA</i> S81L, <i>parC</i> S84L, <i>parC</i> V104I, <i>parC</i> D105E
Meropenem	S	
Tobramycin	R	<i>ant(2'')-Ia</i>

*Additional: ...,aph(3')-Ib, aph(3'')-Ib,  
aph(6)-Id,...*  
- *able to confer amikacin resistance  
(e.g., other aph(3') variants).*

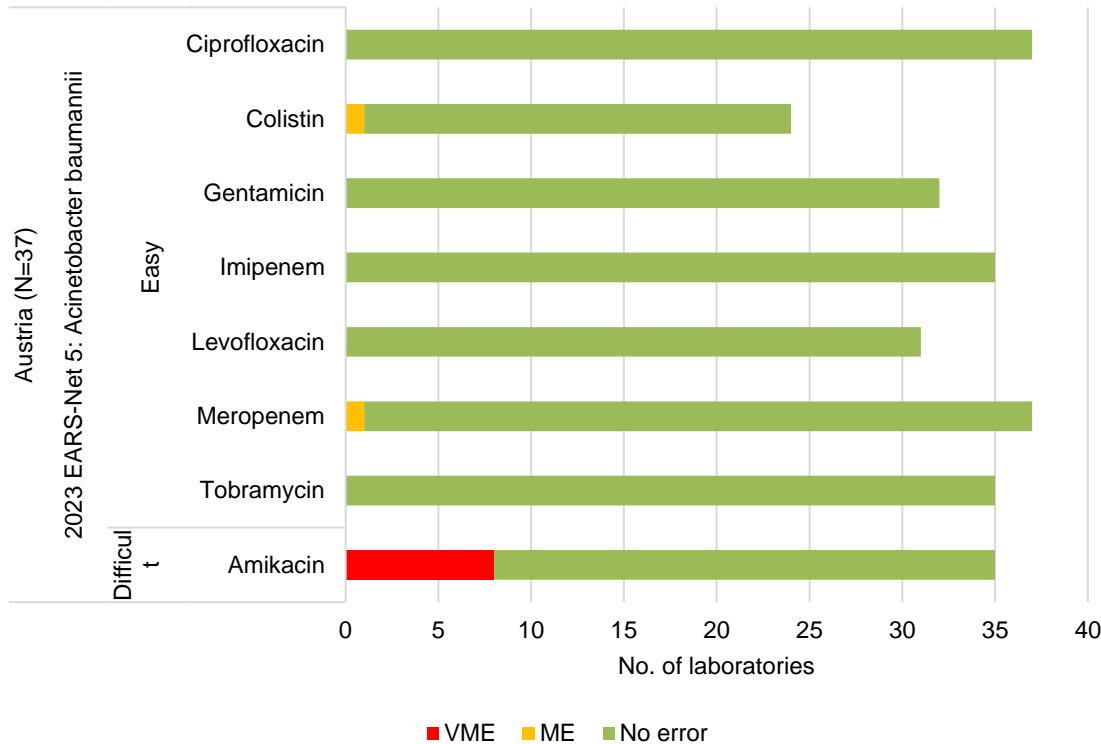


# EARS-Net 5: *A. baumannii*



Ordens  
klinikum  
Linz

Barmherzige  
Schwestern  
Elisabethinen



96,2% korrekt  
3% (8) VME  
0,8% (2) ME

VME Amikacin (22,9%):  
autom., Agardiff.,  
Gradient.

- Methodenvariation
- systematischer, zufälliger Fehler

## EARS-Net 5: *A. baumannii*

- 27/37 alle Ergebnisse richtig
- 8/37 gut (85%-89%)
- 1/37 zufriedenstellend (80%- 84%)
- 1/37 < 80%

# EARS-Net 6: *Enterococcus faecium*

Antimicrobial	Expected interpretation	(ARGs and PMs)**
Amoxicillin	R	PBP5-R
Ampicillin	R	PBP5-R
Gentamicin (test for HLAR)	S	
Linezolid	S	
Teicoplanin	S	
Vancomycin	R	VanHBX

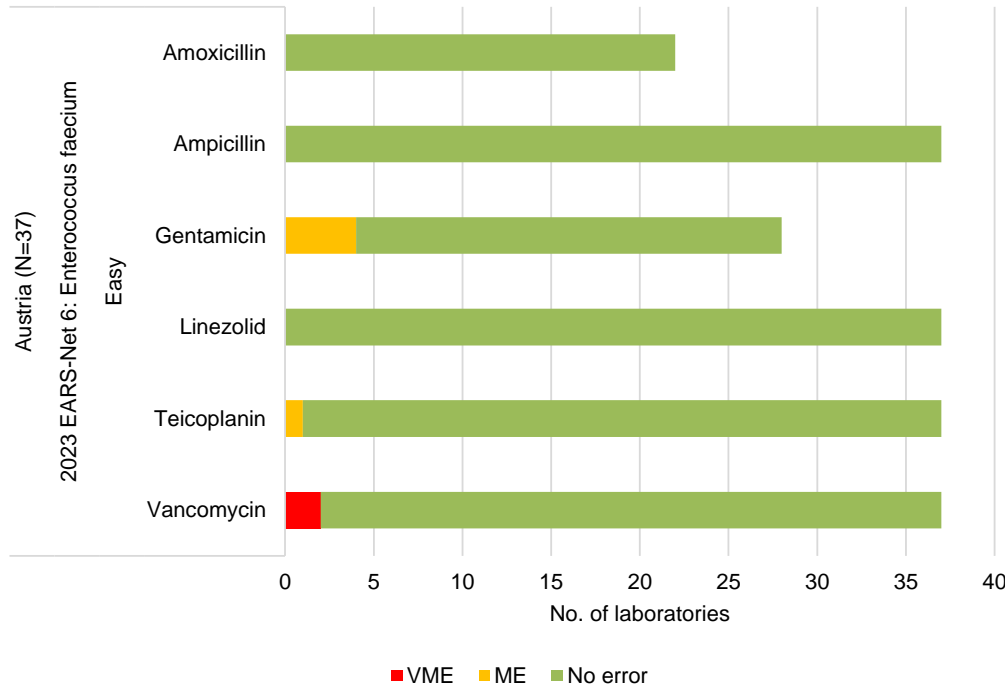
leicht

96,5% korrekt

1% (2) VME: Vancomycin

2,5% (5) ME

# EARS-Net 6: *Enterococcus faecium*



30/37 alles korrekt  
6/37 zufriedenstellend  
1/37 < 80%

VME: Vancomycin  
(5,4%) Agardiff.

- systematischer, zufälliger Fehler

ME Gentamicin  
(14,3%): automatisiert,  
Gradiententest

- System., zufälliger Fehler  
CAVE: Fehlinterpretation (no  
HLAR = S)



## *Enterococcus* spp.

### Expert Rules and Expected Phenotypes

For abbreviations and explanations of breakpoints, see the Notes sheet

In endocarditis, refer to national or international endocarditis guidelines for breakpoints for *E*

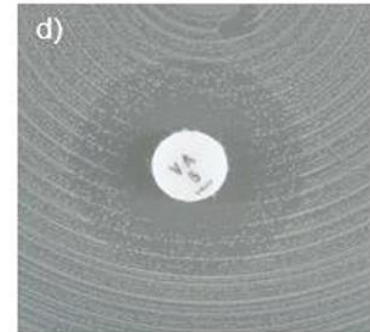
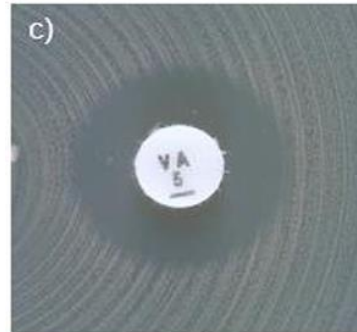
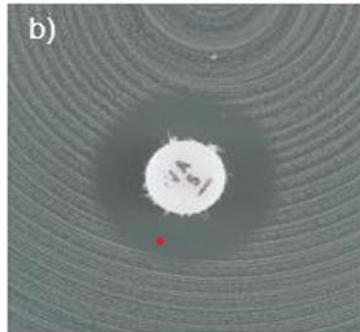
MIC determination (broth microdilution according to ISO standard 20776-1)

Medium: Cation-adjusted Mueller-Hinton broth

Inoculum:  $5 \times 10^5$  CFU/mL

Incubation: Sealed panels, air,  $35 \pm 1^\circ\text{C}$ ,  $18 \pm 2\text{h}$  (for glycopeptides 24h)

Reading: Unless otherwise stated, read MICs at the lowest concentration of the agent that completely



### Examples of inhibition zones for *Enterococcus* spp. with vancomycin.

a) Sharp zone edge **and** zone diameter  $\geq 12$  mm. Report susceptible.

b-d) Fuzzy zone edge or colonies within zone. Perform confirmatory testing with PCR or report resistant even if the zone diameter  $\geq 12$  mm.

# Empfehlungen



- Protokolle in Übereinstimmung mit EUCAST?
- richtige Kontrollstämme? Monitoring/ Kontrollmechanismen? Qualitätsmanagement?
- Methodenvariabilität zwischen verschiedenen Methoden
- Aminoglykosid-Testung/ Interpretation? Darstellung?
- Cephalosporin-, Carbapenemtestung Variabilität durch unterschiedliche Expression von  $\beta$ -Lactamasen, ggf. Bestätigung (CARBA-Net)
- Personalschulung

# Zusammenfassend

- 100% korrekte Speziesidentifizierung
- 2 253/ 2 360 (95,5%) exzellente Übereinstimmung
- 21/37 (56.8%) der Labore haben eine 95% Übereinstimmung erreicht