HADEA SERVICE CONTRACT 20197409

Provision of EU networking and support for public health reference laboratory functions for antimicrobial resistance in *Salmonella* species and *Campylobacter* species in human samples

FWD AMR·
RefLabCap

TODAY

STATENS SERUM INSTITUT

EU protocol for harmonised monitoring of antimicrobial resistance in human Salmonella and Campylobacter isolates.

EUCAST protocols, guidelines, clinical/epidemiological breakpoints, interpretation and website.

EQA-AST 6

Jeppe Boel
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EUROPEAN CENTRE FOR DISEASE PREVENTION AND CONTROL - ECDC

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- Has a mandate to gather and analyse data and information on emerging public health threats
- The collection antimicrobial resistance (AMR) data is included as part of the European Surveillance System (TESSy) through several networks:
- EARS-Net (S. pneumoniae, S aureus, E. faecalis, E. faecium, E. coli, Klebsiella pneumoniae, P. aeruginosa, and Acinetobacter spp.).
- • HAI-Net collects data on AMR in selected pathogens associated with healthcare-associated infections.
- • ESAC-Net collects data on the consumption of antimicrobial agents in humans.
- **• FWD-Net collects data on AMR in Salmonella spp., Campylobacter spp. and Shiga toxin/verocytotoxin-producing Escherichia coli (STEC/VTEC)**

AMR MONITORING - ZOONOSES IN ANIMALS AND FOOD

- Directive 2003/99/EC requires Member States to monitor and report comparable data on AMR in zoonoses and zoonotic agents in food-producing animals and food

- Commission Implementing Decision (EU) 2020/1729 of 17 November 2020 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria

COMMON ECDC – EFSA REPORT

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Read the report

Publication

The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2019–2020

Technical report - 29 Mar 2022

Data on antimicrobial resistance (AMR) in zoonotic and indicator bacteria from humans, animals and food are collected annually by the EU Member States (MSs), jointly analysed by the EFSA and the ECDC and reported in a yearly EU Summary Report.

The European Union Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2019–2020 - EN - [PDF-67.39 MB]

Antimicrobial consumption | Antimicrobial resistance | Antimicrobial stewardship |

EU HARMONIZED PROTOCOL FOR AMR TESTING OF SALMONELLA AND CAMPYLOBACTER

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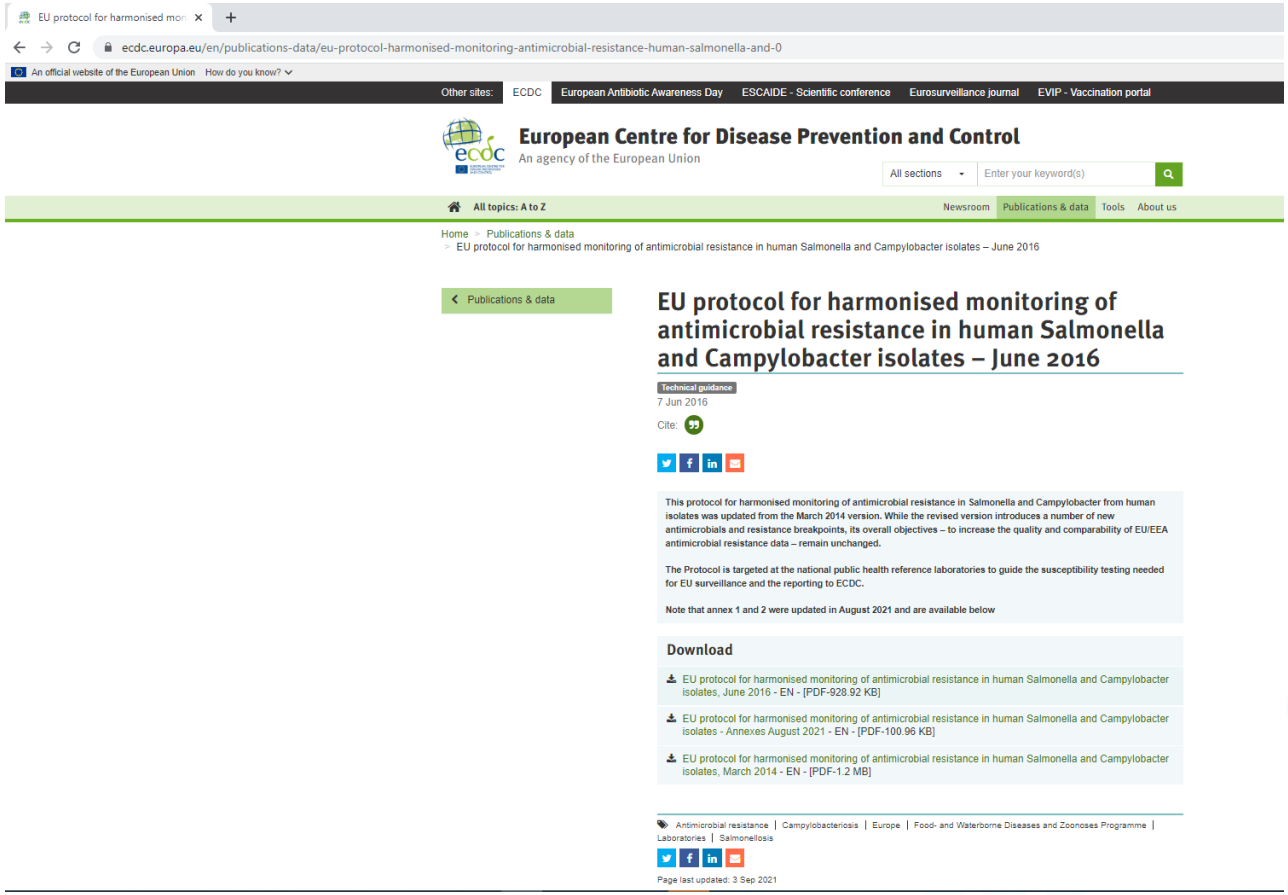

https://www.ecdc.europa.eu/en/publications-data/eu-protocol-harmonised-monitoring-antimicrobial-resistance-human-salmonella-and-0

HARMONIZED EU PROTOCOL FOR DOWNLOAD

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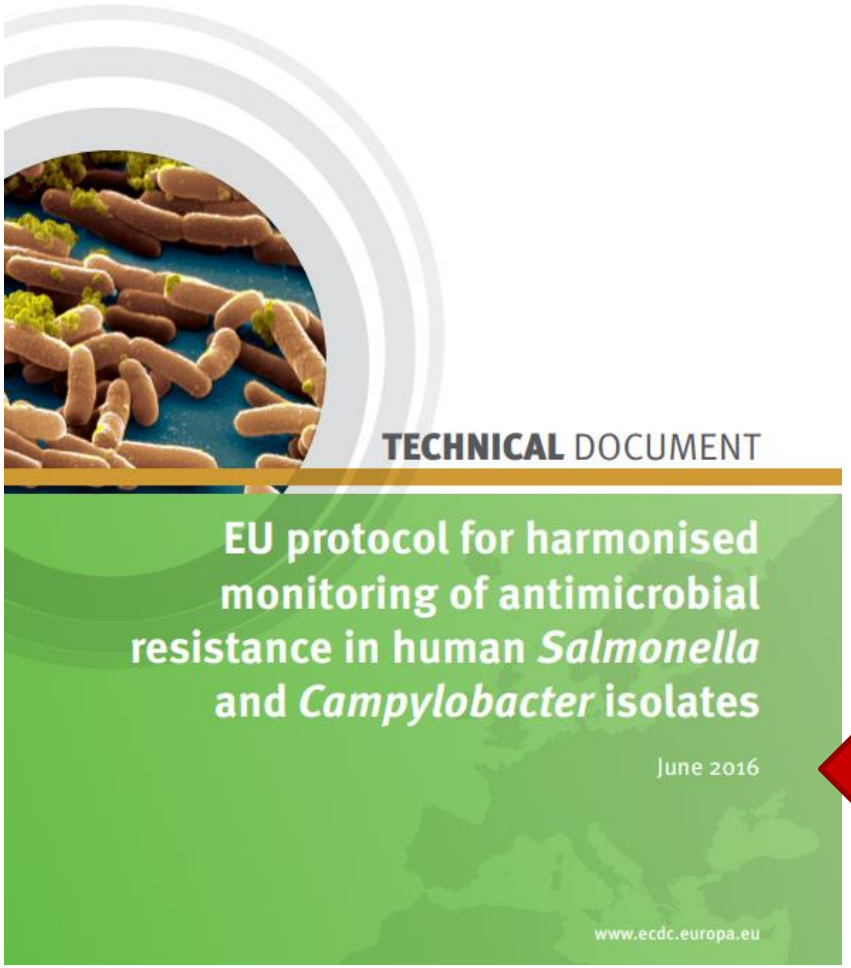
Note that annex 1 and 2 were updated in August 2021 and are available below

Download

- EU protocol for harmonised monitoring of antimicrobial resistance in human Salmonella and Campylobacter isolates, June 2016 - EN - [PDF-928.92 KB]
- EU protocol for harmonised monitoring of antimicrobial resistance in human Salmonella and Campylobacter isolates - Annexes August 2021 - EN - [PDF-100.96 KB]
- EU protocol for harmonised monitoring of antimicrobial resistance in human Salmonella and Campylobacter isolates, March 2014 - EN - [PDF-1.2 MB]

EU PROTOCOL FOR HARMONIZED AMR TESTING



"The content of this report was developed at three expert workshops arranged by ECDC. The report was sent for consultation to the Food- and Waterborne Diseases and Zoonoses network."

EU SURVEILLANCE OBJECTIVES (1)

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- a) To monitor, in human clinical isolates, trends in the occurrence of resistance to antimicrobial agents **relevant for treatment of human** Salmonella and Campylobacter infections, including comparison with food/animal isolates
- b) To monitor, in human clinical isolates, trends in the occurrence of resistance to **other antimicrobial agents** of public and animal health importance, including comparison with food/animal isolates
- c) To monitor, in human clinical isolates, the prevalence of ESBL, plasmid-encoded Ambler class C βlactamases (pAmpC) and carbapenemase phenotypes
- d) To use antimicrobial resistance patterns to characterise human clinical isolates, i.e. as an epidemiological marker, to **support identification of** outbreaks and related cases

EU SURVEILLANCE OBJECTIVES (2)

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- d) To use antimicrobial resistance patterns to characterise human clinical isolates, i.e. as an epidemiological marker, to **support identification of** outbreaks and related cases
- e) To identify and monitor, in human clinical isolates, genetic determinants of resistance that are important for public health e.g. to aid recognition of epidemic cross-border spread of multi-drug resistant Salmonella strains
- f) To monitor, in human clinical isolates, trends in the occurrence of resistance to antimicrobial agents that may be needed for **future therapeutic** use

Data should be reported quantitatively (mm or mg/l)

REQUIREMENTS FOR SURVEILLANCE

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- No specific requirements for the extent of surveillance/monitoring are defined in the EU harmonized protocol
- One of the tasks for the FVD AMR-RefLabCap project is to propose minimum requirements for national AMR surveillance

ANTIMICROBIALS FOR HUMAN SALMONELLA ISOLATES (1)

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Class	Name (abbreviation*)	Surveillance objectives	Comments
First priority			
Aminoglycosides	Gentamicin (GEN)	b, d	
Aminopenicillins	Ampicillin (AMP)	a, b, d	
Amphenicols	Chloramphenicol (CHL)	a, d	
Carbapenems	Meropenem (MEM)	a, b, c, d, e	EUCAST recommend meropenem as it offers the best compromise between sensitivity and specificity in terms of detecting carbapenemase-producers
Cephalosporins	Cefotaxime (CTX)	a, b, c, d, e	May be insensitive for detection of ceftazidimase-type ESBLs
	Ceftazidime (CAZ)	a, b, c, d, e	Added to increase sensitivity of screening for full range of ESBL with diverse substrate specificities
Dihydrofolate reductase inhibitors	Trimethoprim (TMP)	d	Value as an epidemiological marker, e.g. in the resistance pattern ASuT common among *S.* Typhimurium.
Macrolides	Azithromycin (AZM)	f	May be considered as a last resort drug for invasive salmonellosis.

ANTIMICROBIALS FOR HUMAN SALMONELLA ISOLATES (2)

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Class	Name (abbreviation*)	Surveillance objectives	Comments
First priority			
Polymyxins	Colistin (COL)	b	Last-resort drug in human medicine and extensively used in animal medicine. Plasmid-mediated resistance detected in *E. coli* and *Salmonella* in Europe in 2015. Its chemical properties however cause unreliable results with dilution and render it impossible to test with disk diffusion. Please follow the dilution method agreed between CLSI and EUCAST [10]. Note: Any laboratory that wants to report an isolate as resistant to colistin must get the result confirmed at a reference laboratory that is up to date with the latest method developments for testing of colistin.
Quinolones	Ciprofloxacin (CIP)/pefloxacin (PEF)	a, b, c, d, e	Preferably test ciprofloxacin with broad MIC range. For disk diffusion, EUCAST recommend screening with pefloxacin [11] since ciprofloxacin is poor at detecting low-level fluoroquinolone resistance in *Salmonella* spp. with this method and nalidixic acid is often not detecting plasmid-mediated fluoroquinolone resistance [12]. Only for isolates having the *aac(6')-Ib-cr* gene, pefloxacin does not work well.
Sulphonamides	Sulfamethoxazole (SMX)	d	Value as an epidemiological marker, e.g. in the resistance pattern ASuT common among *S.* Typhimurium. No ECOFF available however due to methodological problems and little harmonisation between disk manufacturers.
Tetracyclines	Tetracycline (TCY)	b, d	Used both in veterinary and human medicine.
	Tigecycline (TGC)	f	

OPTIONAL ANTIMICROBIALS FOR HUMAN SALMONELLA ISOLATES

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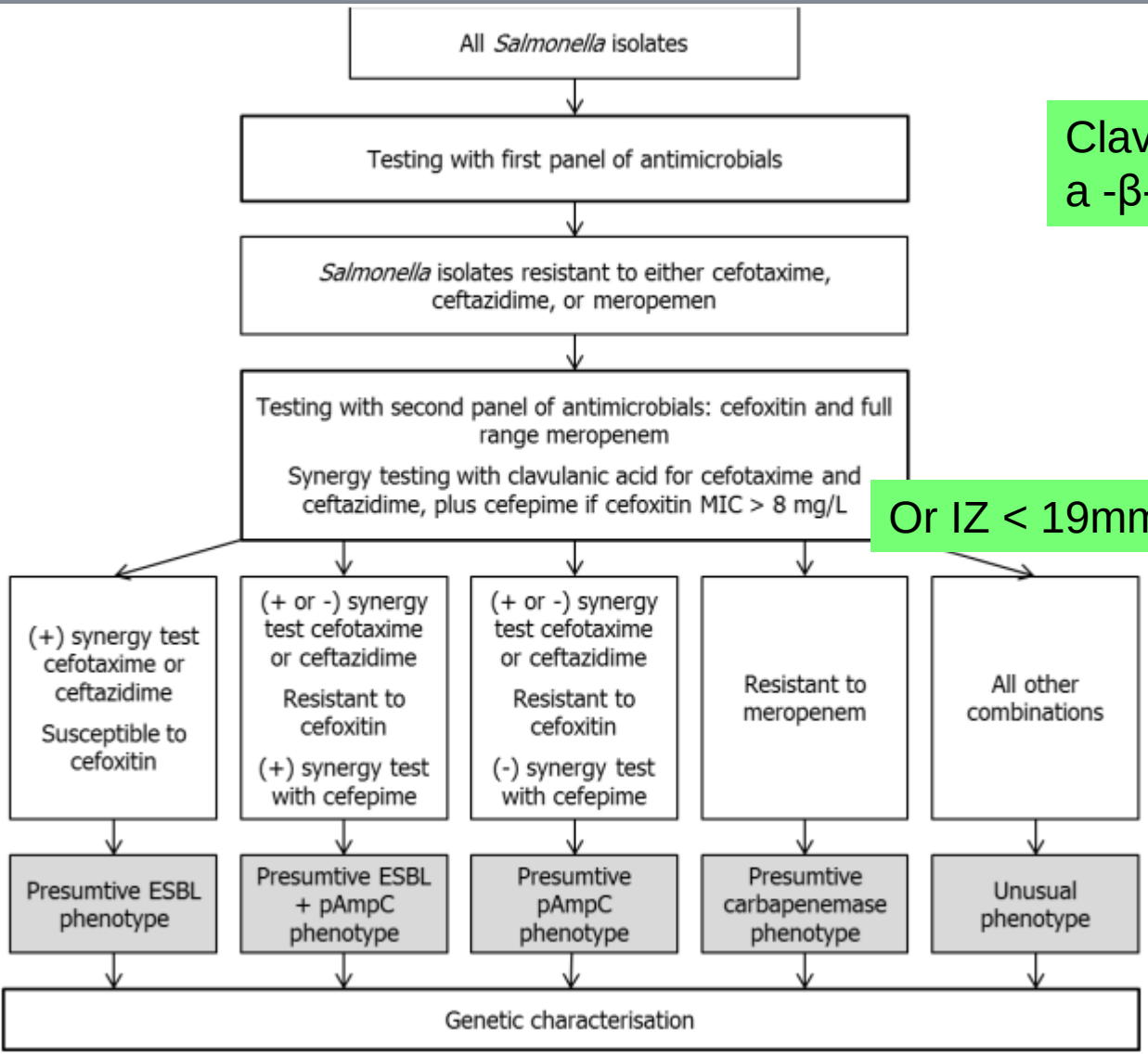
Optional			
Aminopenicillins	Amoxicillin (AMX)		Alternative for testing and reporting if AMP not tested.
Carbapenems	Ertapenem (ETP)		Many human laboratories test for ertapenem so should be possible to report.
Cephalosporins	Ceftriaxone (CRO)	a, b, c, d, e	Alternative for cefotaxime with disk diffusion method as has similar spectrum of activity.
Combination drugs	Trimethoprim + sulfamethoxazole (co-trimoxazole) (SXT)		No need to test if the substances are tested separately.
Quinolones	Nalidixic acid (NAL)		For laboratories using disk diffusion, nalidixic acid (NAL) can be tested in addition to pefloxacin for easier identification of QRDR mutations (*gyr* and *par*) since such mutations may result in clinical treatment failure (Le Hello, Institut Pasteur Paris, personal communication, Sep 2015).

EUCAST CLINICAL BREAKPOINTS AND EPIDEMIOLOGICAL CUT-OFF VALUES FOR THE PRIORITY LIST OF ANTIMICROBIALS TO BE TESTED FOR SALMONELLA ENTERICA AS OF 31 AUGUST 2021

STATENS SERUM INSTITUT

Antimicrobial	Criteria based on MIC dilution (mg/L)			Recommended concentration range[1] (mg/L) (number of wells)	Criteria based on disk diffusion (mm)			Disk load (µg)
	S≤	R>	NWT>		S≥	R<	NWT<	
First priority								
Ampicillin (AMP)	8.0	8.0	4.0	1-32 (6)	14	14	18	10
Azithromycin (AZM)	ND	ND	16	2-64 (6)	ND	ND	12	15
Cefotaxime (CTX)	1.0	2.0 (1.0)[2]	0.5	0.25-4 (5), 0.25-64 (9)[3]	20	17 (21)[2]	20	5
Ceftazidime (CAZ)	1.0[2]	4.0 (1.0)[2]	2.0	0.25-8 (6), 0.25-128 (10)[3]	22[3]	19	20	10
Chlorampenicol (CHL)	8.0	8.0	16.0	8-64 (4)	17	17	19	30
Ciprofloxacin (CIP)	0.06	0.06	0.064	0.015-8 (10)	NA	NA	NA	NA
Colistin (COL)	2.0	2.0	NA	1-16 (5)	NA	NA	NA	NA
Gentamicin (GEN)	2.0	2.0	2.0	0.5-16 (6)	17	17	17	10
Meropenem (MEM)	2.0	8.0	0.06 (0.125)[2]	0.03-16 (10)	22	16	27 (28)[2]	10
Pefloxacin	NA	NA	NA	NA	24	24	24	5
Sulfamethoxazole (SMX)	ND	ND	ND	8-512 (7)	ND	ND	ND	100
Tetracycline (TCY)	ND	ND	8.0	2-32 (5)	ND	ND	17	30
Tigecycline (TGC)	ND	ND	ND	0.25-8 (6)	ND	ND	16	15
Trimethoprim (TMP)	4.0	4.0	2.0	0.25-16 (7)	15	15	23	5
Second level testing ESBL-producers								
Cefepime (FEP)	1.0	4.0	ND		27	24	ND	30
Cefoxitin (FOX)	ND	ND	8.0[2]	0.5-64 (8)	19	19[2]	21	30
Optional								
Amoxicillin (AMX)	8.0	8.0	4.0		ND	ND	ND	10
Ceftriaxone (CRO)	1.0	2.0 (1.0)[2]	0.25		25	22 (23)[2]	ND	30
Ertapenem (ETP)	0.5	0.5	ND (0.125)[2]	0.015-2 (8)	25	25[3]	ND	10
Nalidixic acid (NAL)	ND	ND	8.0	4-64 (5)	ND	ND	16	30
Trimethoprim-sulfamethoxazole (SXT)	2.0	4.0	ND		14	11	22	1.25-23.75

SCHEMATIC VIEW OF THE PROPOSED PHENOTYPIC TESTING FOR DETECTION AND CONFIRMATION OF ESBL-, ACQUIRED AMPC, AND CARBAPENEMASE-PRODUCING SALMONELLA SPP.



Clavulanic acids works as a -β-lactamase inhibitor

Or IZ < 19mm

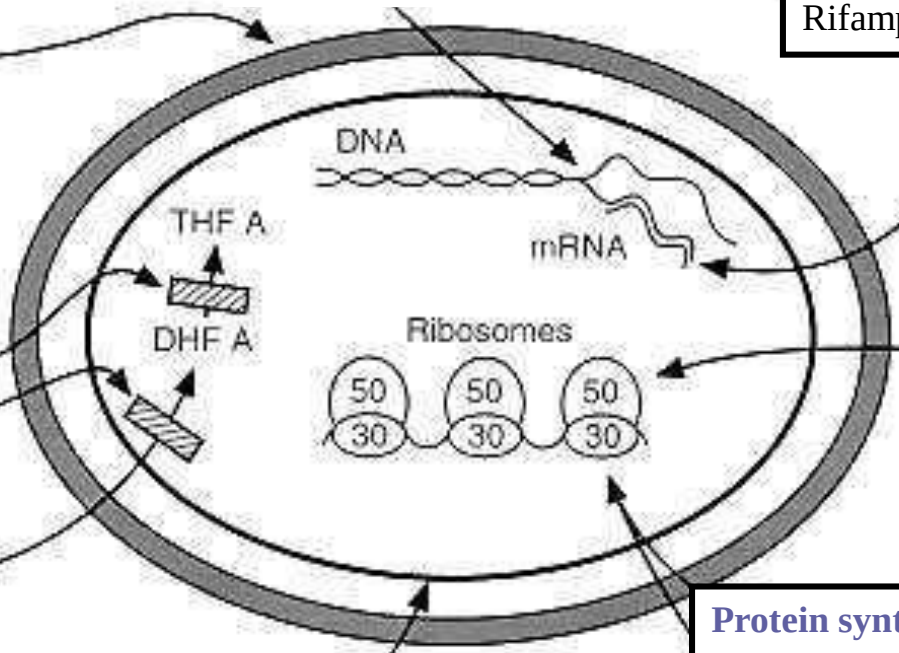
Positive synergy test:
IZ > 5 mm
MIC ratio >8

Antibiotics

Cell wall synthesis
β-lactams:
Penicillin
Cephalosporins
Monobaktams
Carbapenems

DNA replication
Fluoquinolones
Metronidazole

RNA-polymerase
Rifampicin



Protein syntese Inhibitors (50s)
Macrolides
chloramphenikol
Clindamycin

Anti metabolittes
Sulfonamides
Trimethroprim

Protein syntese Inhibitors (30s)
Tetracyclines
Aminoglykocides
Fucidinic acid

Cell membrane
Polymyxin
Amphotericin

Mechanisms of antibiotics

- Bacteriostatic

Stops growth of the infectious agent but does not kill it

The immune system has to kill the bug

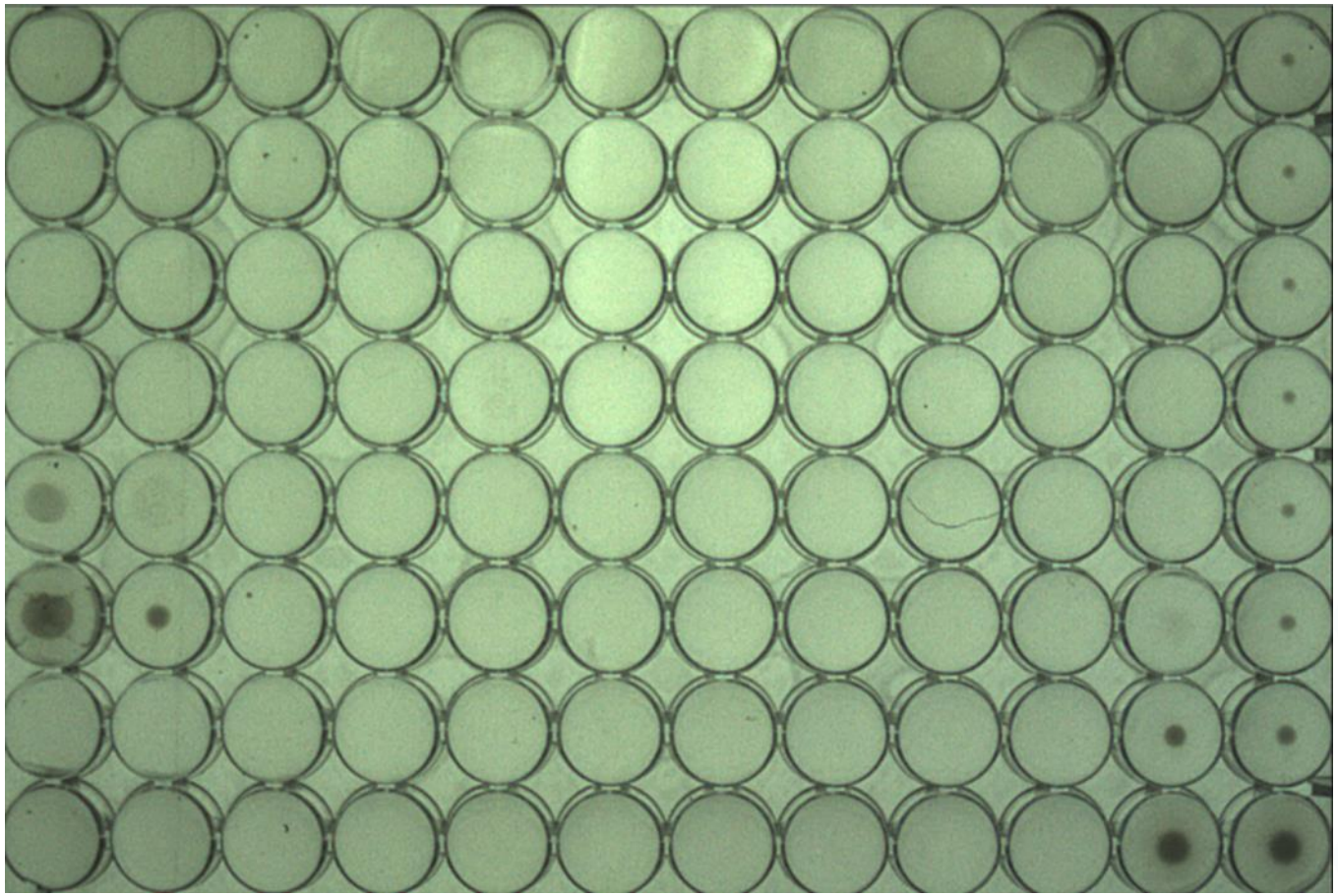
- Bactericidal

Actively kills the infectious agent (some only growing bacteria)

Bacteriostatic antibiotic classes

- **Tetracyclines**
- **Aminoglycosides** (Gentamicin, Apramycin, Neomycin, Spectinomycin, Streptomycin)
- **Sulphonamides** (Sulphamethoxazole)
- **Macrolides** (Erythromycin)
- **Amphenicols** (Chlorphenicol, Florphenicol)
- **Trimethoprim**

E. COLI ATCC 25922 ON EUVSEC3



Bactericidal antibiotics classes

Beta-lactams

- **Penicillins** (ampicillin, methicillin)
- **Cephalosporins** (Cefotaxime, Ceftazidime, Ceftiofur)
- **Monobactams** (Aztreonam)
- **Carbapenems** (Imipenem, Meropenem, Ertapenem)
- **Quinolones** (Nalidixan)
- **Fluoroquinolones** (Ciprofloxacin)
- **Polymoxins** (Colistin)

What is antimicrobial resistance I?

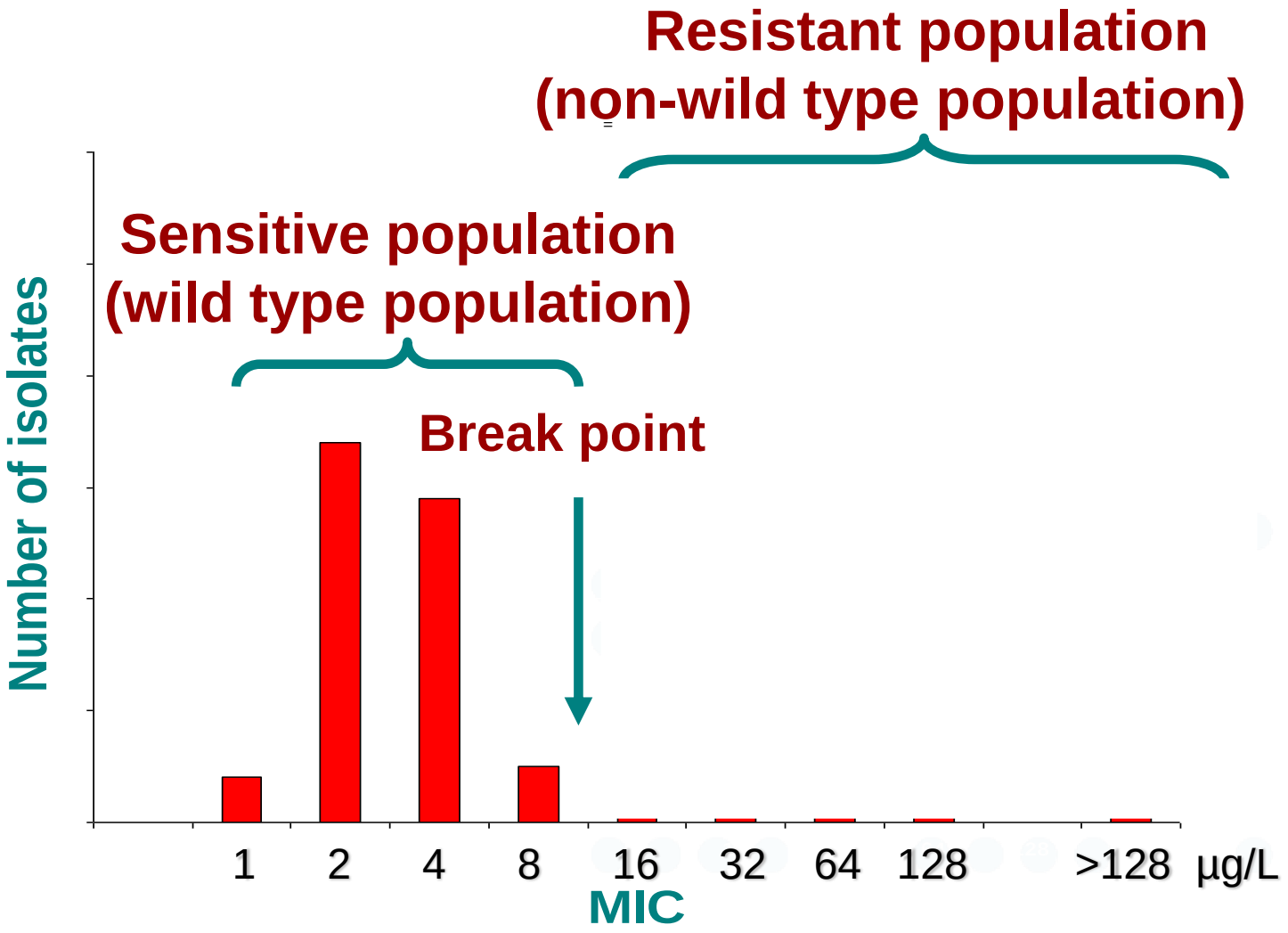
The ability of a microorganism to survive at a given concentration of an antimicrobial agent at which the wild type population of the microorganism would be killed

This is called the
“epidemiological/microbiological breakpoint”.

EUCAST* defines epidemiological breakpoints – ECOFFs

*European Committee on Antimicrobial Susceptibility Testing

Population distribution



MIC > Breakpoint → Resistant (R > 8 or R ≥ 16)

What is antimicrobial resistance II?

The ability of a microorganism to survive treatment with a clinical concentration of an antimicrobial agent in the body.

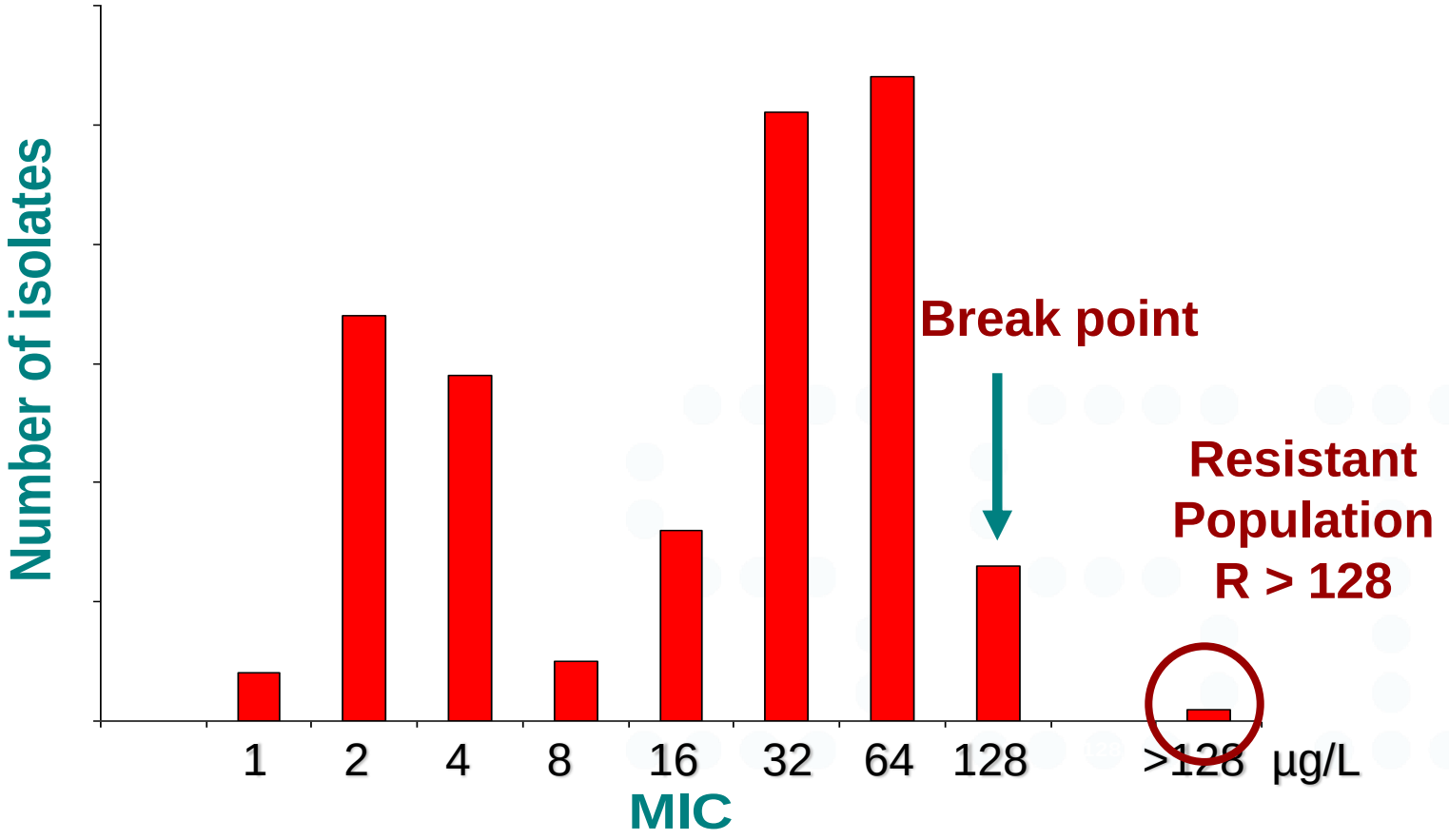
This is called the
“Clinical breakpoint”.

EUCAST and CLSI* is defining the clinical breakpoints**.**

* Clinical Laboratory Standards Institute)

Population distribution

Drug concentration in infection site: 128 µg/L



MIC > Breakpoint → Resistant (R > 128)

EUCAST DISTRIBUTIONS

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mic.eucast.org/search/?search%5Bmethod%5D=mic&search%5Bantibiotic%5D=-1&search%5Bspecies%5D=431&search%5Bdisk_content%5D=-1&search%5Blimit%5D=50

MIC EUCAST Login

Antimicrobial wild type distributions of microorganisms

Mic distributions include collated data from multiple sources, geographical areas and time periods and can never be used to infer rates of resistance

Search database

Method MIC Disk diffusion

Antimicrobial Antimicrobial ...

Species Salmonella enterica

Elements per page 50

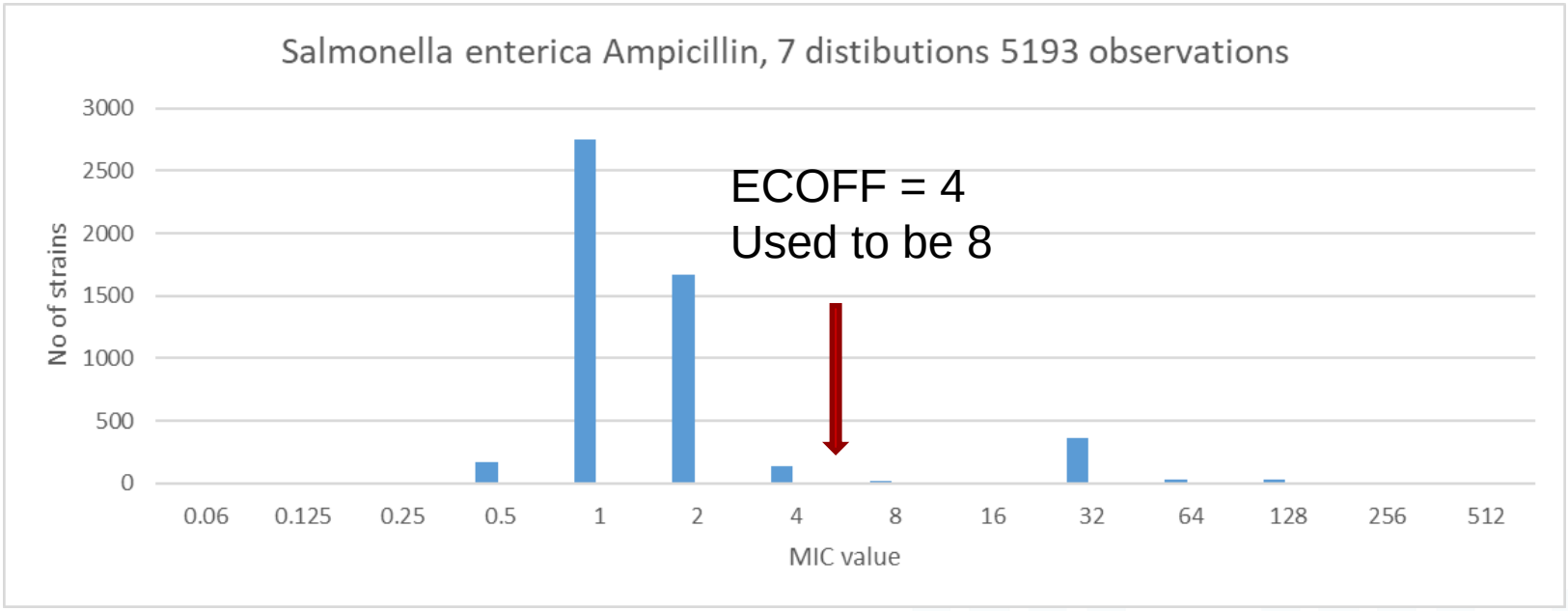
MIC distributions for Salmonella enterica, 2022-05-15

Species: Salmonella enterica (Method: MIC)

	0.002	0.004	0.008	0.016	0.03	0.06	0.125	0.25	0.5	1	2	4	8	16	32	64	128	256	512	Distributions	Observations	(T)ECOFF	Confidence interval
Amikacin	0	0	0	0	0	0	0	1	2358	9523	3498	376	26	0	1	0	1	0	0	3	15784	(4)	1 - 16
Amoxicillin	0	0	0	0	0	0	0	6	2418	5791	207	6	4	2	14	1148	553	0	0	6	10149	4	1 - 2
Ampicillin	0	0	0	0	0	0	0	12	172	2752	1673	137	16	11	360	32	28	0	0	7	5193	4	1 - 4
Apramycin	0	0	0	0	0	0	0	0	0	2	2	14	97	48	3	0	0	0	0	1	166	-	
Azithromycin	0	0	0	0	0	0	2	2	14	116	3672	13721	2577	176	19	0	0	0	0	7	20299	16	4 - 16
Aztreonam	0	0	0	0	12	37	18	3	1	0	0	0	0	0	0	0	0	0	0	2	71	-	
Cefalothin	0	0	0	0	0	0	0	0	3	4	1954	2554	603	162	57	13	10	0	0	4	5360	(16)	
Cefazolin	0	0	0	0	0	0	0	0	4	88	87	38	2	0	0	0	0	0	0	5	219	4	1 - 4
Cefepime	0	0	0	2	38	234	63	33	18	3	2	5	2	0	0	0	0	0	0	4	400	(0.25)	0.06 - 0.25
Cefixime	0	0	0	0	0	0	19	15	1	2	0	0	0	0	0	0	0	0	0	1	37	-	

[Antimicrobial wild type distributions]

SALMONELLA ENTERICA AMP MIC DISTRIBUTION



Data from EUCAST
2022-05-12

EUCAST CLINICAL BREAKPOINTS: NEW DEFINITIONS OF S, I AND R FROM 2019

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- S - Susceptible, standard dosing regimen: A microorganism is categorised as "Susceptible, standard dosing regimen", when there is a high likelihood of therapeutic success using a standard dosing regimen of the agent.
- I - Susceptible, increased exposure*: A microorganism is categorised as "Susceptible, Increased exposure*" when there is a high likelihood of therapeutic success because exposure to the agent is increased by adjusting the dosing regimen or by its concentration at the site of infection.
- R - Resistant: A microorganism is categorised as "Resistant" when there is a high likelihood of therapeutic failure even when there is increased exposure.
- ATU: The Area of Technical Uncertainty

EUCAST CLINICAL BREAKPOINTS AND EPIDEMIOLOGICAL CUT-OFF VALUES FOR THE PRIORITY LIST OF ANTIMICROBIALS TO BE TESTED FOR SALMONELLA ENTERICA AS OF 31 AUGUST 2021

STATENS SERUM INSTITUT

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Colistin (COL)	2.0	2.0	NA	1-16 (5)	NA	NA	NA	NA
Gentamicin (GEN)	2.0	2.0	2.0	0.5-16 (6)	17	17	17	10
Meropenem (MEM)	2.0	8.0	0.06 (0.125)[2]	0.03-16 (10)	22	16	27 (28)[2]	10
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Sulfamethoxazole (SMX)	ND	ND	ND	8-512 (7)	ND	ND	ND	100
Tetracycline (TCY)	ND	ND	8.0	2-32 (5)	ND	ND	17	30
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Second level testing ESBL-producers								
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Cefoxitin (FOX)	ND	ND	8.0[2]	0.5-64 (8)	19	19[2]	21	30
Optional								
Amoxicillin (AMX)	8.0	8.0	4.0		ND	ND	ND	10
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Nalidixic acid (NAL)	ND	ND	8.0	4-64 (5)	ND	ND	16	30
Trimethoprim-sulfamethoxazole (SXT)	2.0	4.0	ND		14	11	22	1.25-23.75

HOW DO WE MEASURE ANTIMICROBIAL SUSCEPTIBILITY *IN VITRO*?

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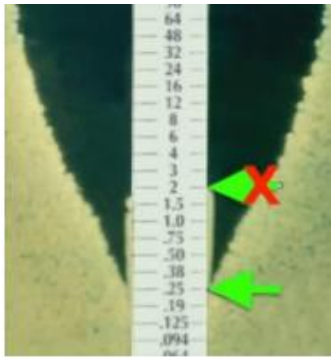
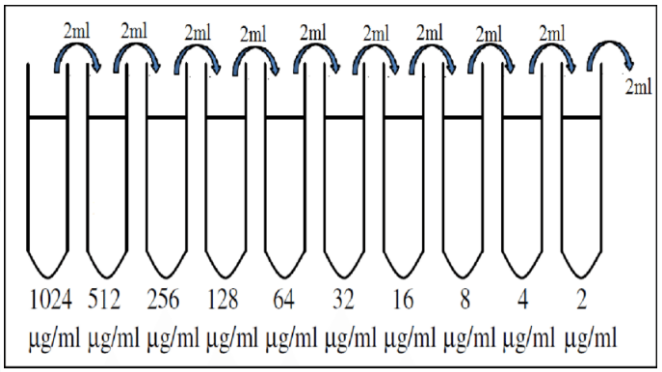
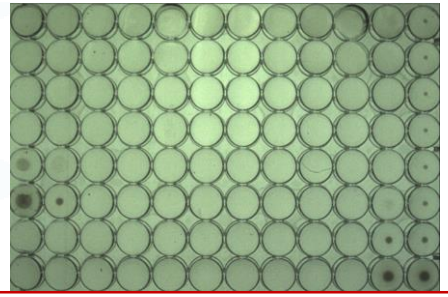
Phenotypic methods



- Agar diffusion method
  - Disks (tablet) mm
  - Gradient strips quantitative

- Dilution methods (quantitative)
  - Liquid media
  - MicroBrothDilution
  - Solid media





“OPEN” AST TESTING METHODS

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- Dilution methods - minimum inhibitory concentration (MIC) is determined (mg/L) is considered the **gold standard** for AST by EUCAST

ICS › 11 › 11.100 › 11.100.20

ISO 20776-1:2019

Susceptibility testing of infectious agents and evaluation of performance of antimicrobial susceptibility test devices — Part 1: Broth micro-dilution reference method for testing the in vitro activity of antimicrobial agents against rapidly growing aerobic bacteria involved in infectious diseases

- Disk diffusion – inhibition zones in mm - according to EUCAST guidelines v10 (1 January 2022)

AST TESTING WITH PROPRIETARY METHODS

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- Gradient strips (MIC) – according to EUCAST and producer – should be validated

- Other methods, e.g. Trek sensititre, Vitek should be validated

Validation protocol:

ICS › 11 › 11.100 › 11.100.20

ISO 20776-2:2021

Clinical laboratory testing and in vitro diagnostic test systems — Susceptibility testing of infectious agents and evaluation of performance of antimicrobial susceptibility test devices — Part 2: Evaluation of performance of antimicrobial susceptibility test devices against reference broth micro-dilution

LINKS TO EUCAST

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- **Website** EUCAST: EUCAST
- **Disk diffusion methodology** EUCAST: Disk diffusion methodology
- **Broth microdilution reading guide** EUCAST: MIC determination
- **QC tables** EUCASTQuality: Control
- **Breakpoint table**
  - EUCAST: Clinical breakpoints and dosing of antibiotics
  - V. 12 v_12.0_Breakpoint_Tables.xlsx (live.com)
- **ECOFFS** EUCAST: MIC and zone distributions and ECOFFs
- **Warnings** EUCAST: Warnings!
- **Instruction videos** Instruction videos

ECDC – EQA6-AST, 2020 – phenotypic part

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Aims:

- support the implementation of the harmonized EU AST protocol for *Salmonella* and *Campylobacter*
- assess the quality of the AST data obtained using MIC and/or DD methods in NPHRLs across Europe
- evaluation of serotyping of Salmonella

Objectives:

- identify common laboratory problem(s)
- assess the overall comparability of routinely collected AST results from European NPHRLs

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EQA6-AST for *Salmonella*

- Participants - Laboratories in the FWD-Net
- Laboratories were asked to follow the harmonised EU AST protocol whenever possible

  - Eight strains for AST testing
  - Five mandatory antimicrobials:

    Ampicillin, Cefotaxime, Meropenem, Cipro/Pefloxacin, Tetracycline
  - Possible to report ESBL-, acquired AmpC-, and carbapenemase status of the test strains – both pheno- and genotypes
  - Possible to report serotyping results

Selection of Salmonella test strains

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- Represented commonly reported human strains in the EU/EEA
- Were stable during the testing period in the organising laboratory
- Expected MIC and DD results were established by the EQA provider following the harmonized EU AST protocol
- DD results established using disks from Oxoid by EQA provider
- MIC values established using the micro-broth dilution based MIC system from TREK diagnostic systems© from Thermo Scientific by EQA provider

Data analysis

- Test results were compared to the expected results
  - *Salmonella*: MIC results within +/- one dilution difference and DD results within +/- 3 mm difference were evaluated as correct
- MIC results that were not in the relevant concentration range for comparison with expected results were not evaluated (ND)
- Qualitative results interpreted using EUCAST ECOFF and clinical breakpoints

Salmonella

25 EU/EEA countries

- 16 reported disk diffusion results
- 17 reported MIC results - broth dilution or gradient strip

Salmonella test strains EQA6 AST

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Strain	Serotype	Microbiological resistance profile (NWT)*	Genotype, selected resistance genes
EQA_AST.S20.0001	Chester	CHL, CIP, COL, PEF, SMX, TCY, TMP	
EQA_AST.S20.0002	Dublin	AMP, AZM, COL, SMX, TCY	
EQA_AST.S20.0003	Stanley	AMP, AZM, CHL, CIP, GEN, PEF, SMX, TMP	
EQA_AST.S20.0004	Infantis	AMP, CEP, CAZ, CTX, FOX, CHL, CIP, GEN, PEF, NAL, SMX, TCY, TMP	blaCTX_M_65
EQA_AST.S20.0005	Rissen	AMP, CEP, CTX, CAZ, CHL, CIP, GEN, NAL, PEF, SMX, TEM, TCY	*blaCTX_M_55*
EQA_AST.S20.0006	Typhimurium	AMP, CEP, CTX, CHL, CIP, GEN, PEF, SMP, TCY, TMP	*mcr_9, blaCTX_M_9*
EQA_AST.S20.0007	Enteritidis	AMP, CHL, CIP, PEF, NAL, TCY	
EQA_AST.S20.0008	Heidelberg	AMP, AZM, CEP, CTX, CAZ, CHL, CIP, PEF, SMP, TCY, TMP	*blaCTX_M_123*

* AMP: ampicillin, AZM: Azithromycin, CEP: cefipime, CAZ: Ceftazidime, CHL: chloramphenicol, CIP: ciprofloxacin, COL: colistin, CTX: cefotaxime, FOX: cefoxitin, PEF: peflocacin, MEM: meropenem, NAL: nalidixic acid, TCY: tetracycline, TMP: trimethoprim

EQA6-AST SALMONELLA – OVERALL RESULTS

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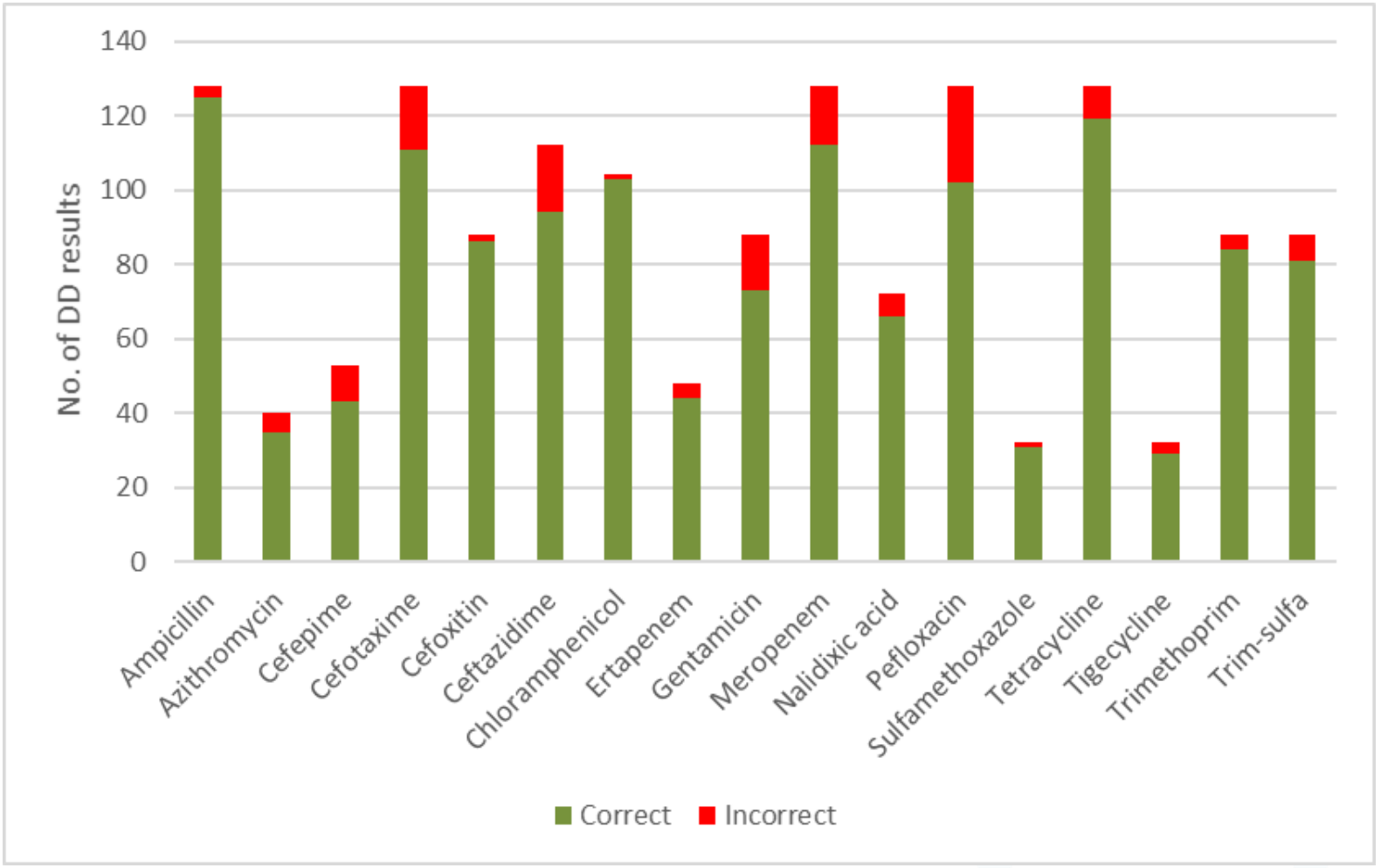
DD and MIC results evaluated against expected quantitative and expected qualitative results using ECOFF's and clinical breakpoints

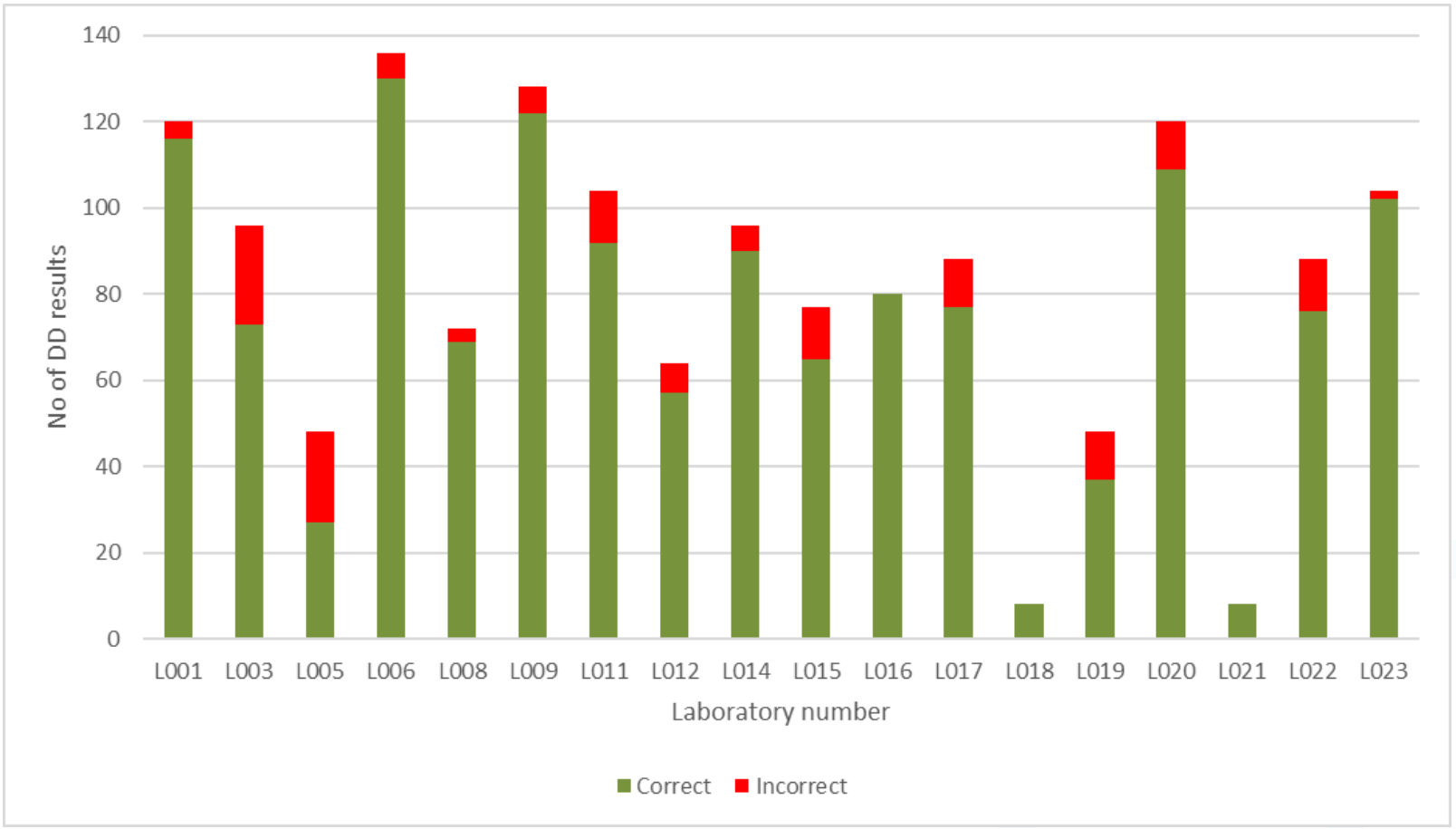
Results by DD assay	All antimicrobials	Mandatory	Optional
Expected value	1338/1485 (90%)	569/640 (89%)	769/845 (91%)
ECOFF	1204/1264 (95%)	616/640 (96%)	588/624 (94%)
Clinical breakpoints	1138/1181 (96%)	503/512 (98%)	635/669 (95%)
NA (No breakpoints)	221/304	0/128	221/176
Excluded	48	0	48
total	1533		
Results by MIC determination	**All antimicrobials**	**Mandatory**	**Optional**
Expected value	1240/1329 (93%)	433/458 (95%)	807/871 (93%)
ECOFF	1353/1440 (94%)	498/511 (97%)	855/929 (92%)
Clinical breakpoints	911/973 (94%)	399/407 (98%)	512/566 (90%)
NA (No breakpoints)	0/467	0/104	0/363
ND	111	53	58
Excluded	29	24	6
Total	1469		

Salmonella: 1485 quantitative DD results - antimicrobials



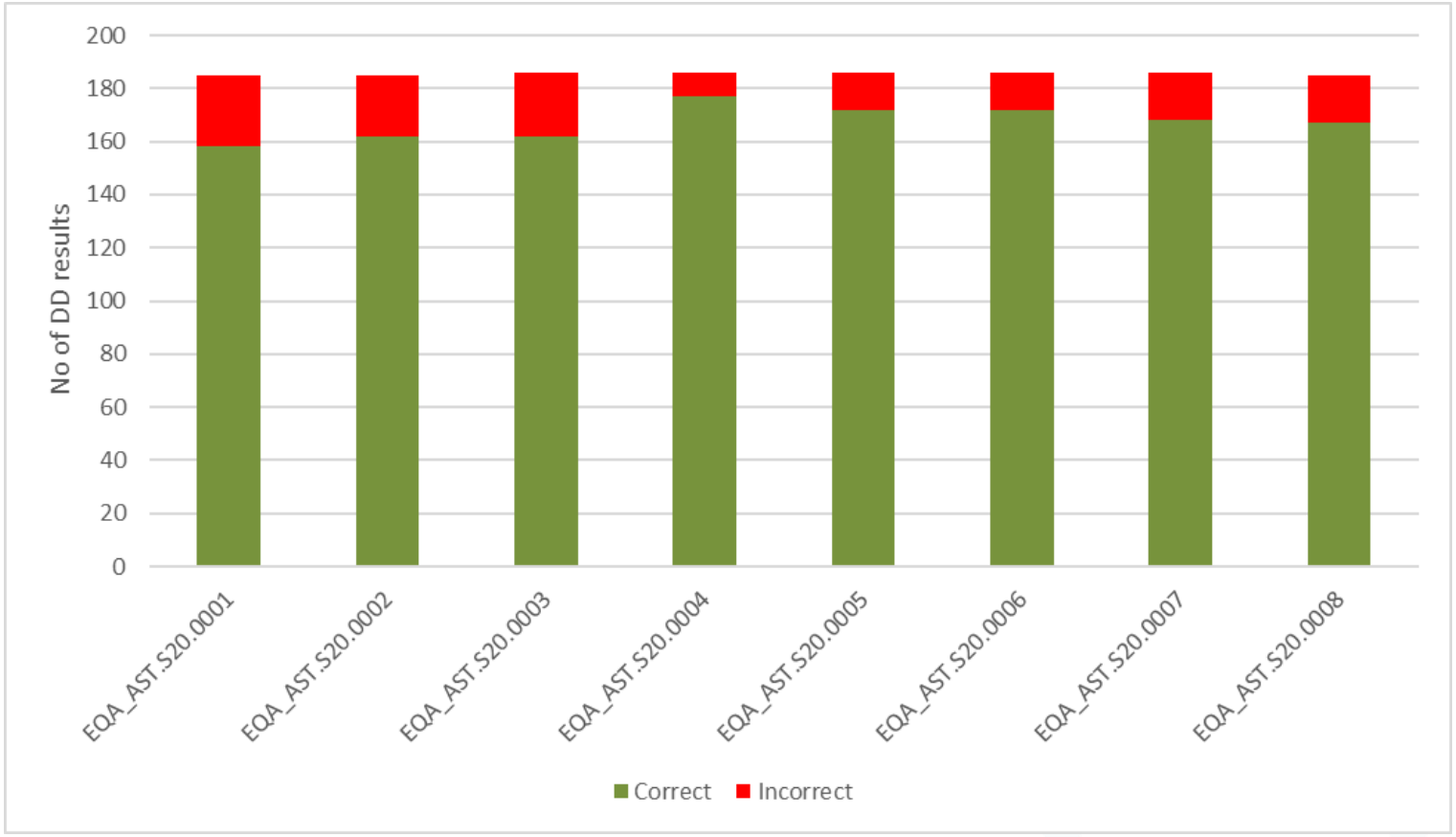
1338/1485 = 90% correct DD results

*Salmonella:*1485 quantitative results DD – laboratory
All antimicrobials



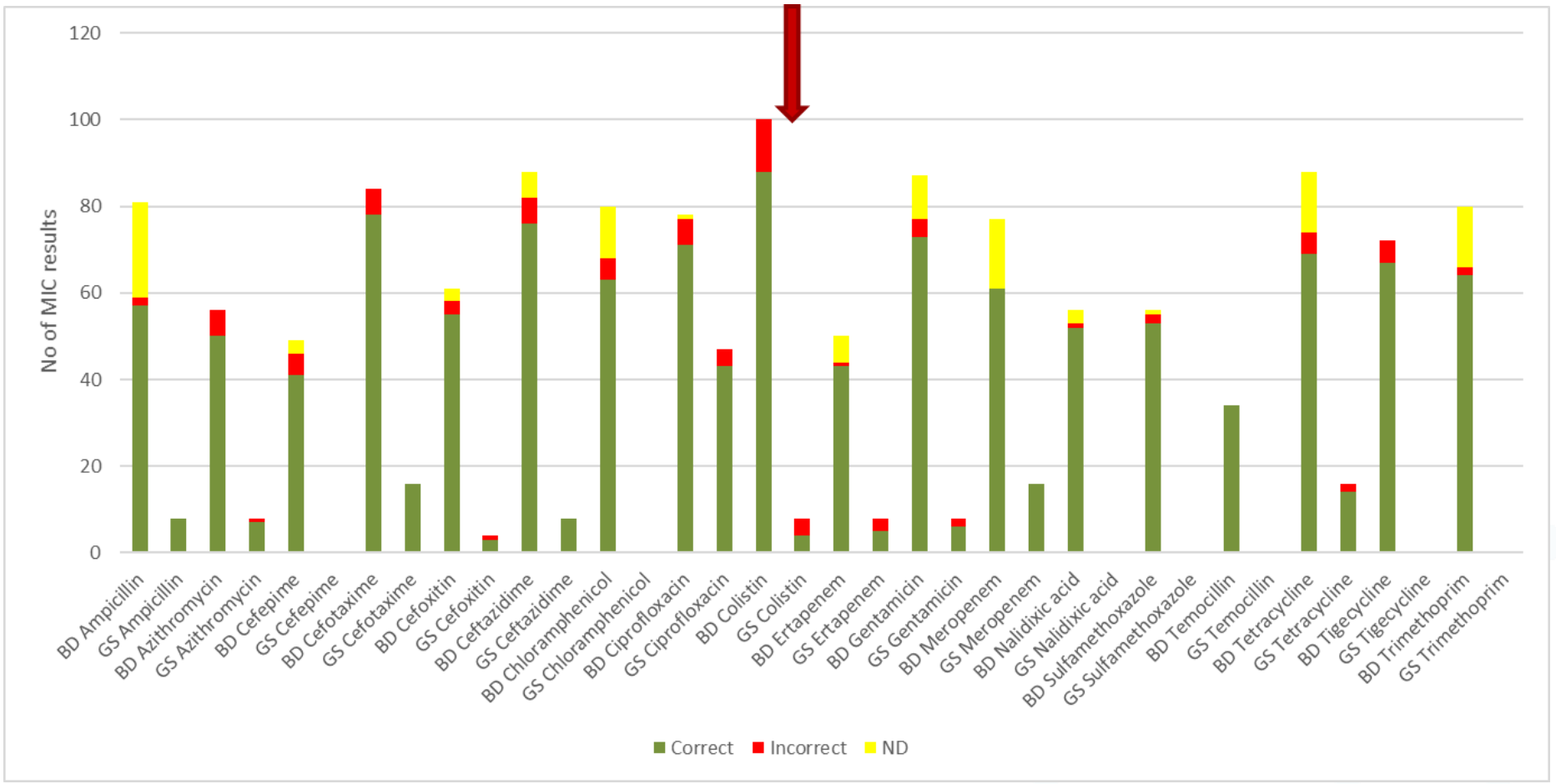
1338/1485 = 90% correct DD results

*Salmonella:*1485 quantitative DD results for test strains All antimicrobials



1338/1485 = 90% correct DD results

Salmonella: 1440 quantitative MIC results – antimicrobials and methods



BD: Broth dilution methods
GS: Gradient strip methods

Overall 93% of evaluated MIC results correct
Most ND-results: correct ECOFF interpretation

Salmonella: 1440 quantitative MIC results – Laboratories
All antimicrobials

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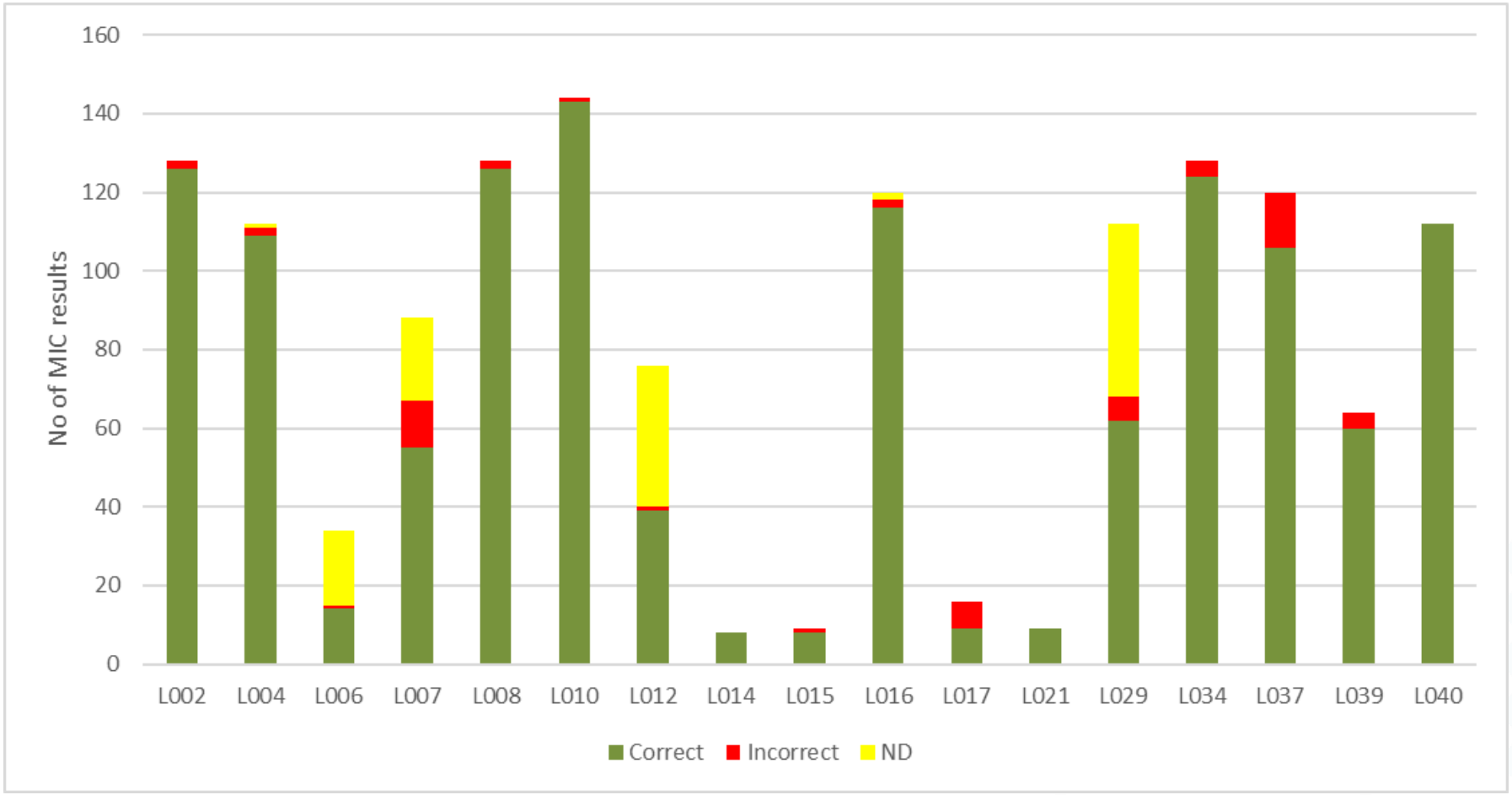
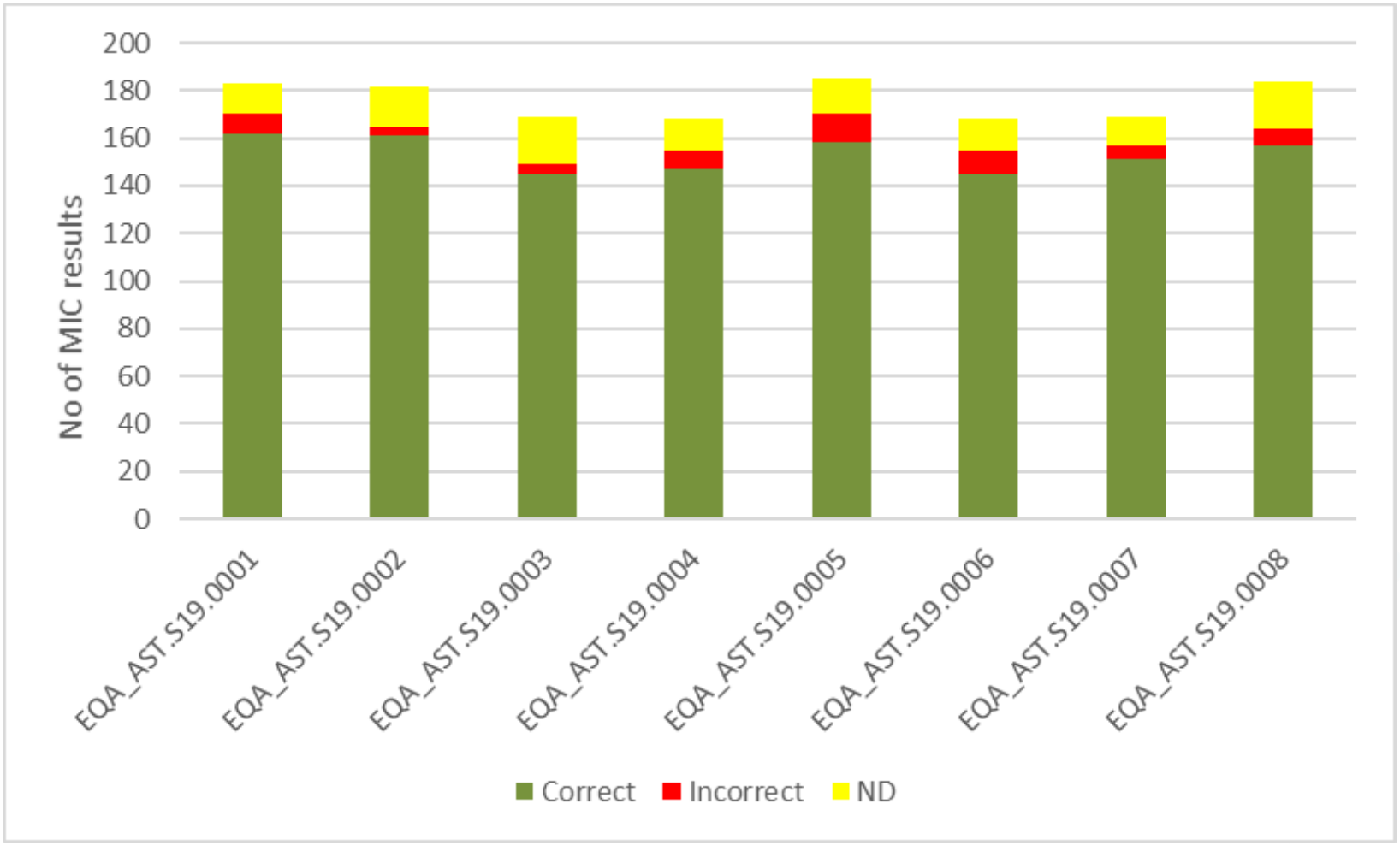


BD: Broth dilution methods
GS: Gradient strip methods

Overall 93% of evaluated MIC results correct
Most ND-results: correct ECOFF interpretation

Salmonella: 1440 quantitative MIC results – by strains
All antimicrobials



BD: Broth dilution methods
GS: Gradient strip methods

Overall 93% of evaluated MIC results correct
Most ND-results: correct ECOFF interpretation

Phenotypic prediction of ESBL-, acquired AmpC and carbapenemase-production

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Strain	Expected phenotype	Number of laboratories reporting phenotype	AmpC	ESBL	Carbapenemase	Carbapenemase, AmpC	ESBL, Carbapenemase	ESBL, AmpC	ESBL, AmpC, Carbapenemase
EQA_AST.S20.0001		2		2					
EQA_AST.S20.0002									
EQA_AST.S20.0003		1		1					
EQA_AST.S20.0004	ESBL	20		17				3	
EQA_AST.S20.0005	ESBL	20		19				1	
EQA_AST.S20.0006	ESBL	19		18				1	
EQA_AST.S20.0007		1		1					
EQA_AST.S20.0008	ESBL	19		18				1	
Total		82							

25 laboratories participated in the EQA

A few of the phenotypes could not entirely be justified from the reported data

SALMONELLA SEROTYPING RESULTS

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Strain	Serotype	Reported serotype		Incorrectly reported serotype
		Correct	Incorrect	
EQA_AST.S20.0001	Chester	19	1	Chartres
EQA_AST.S20.0002	Dublin	20		
EQA_AST.S20.0003	Stanley	19	1	Typhimurium
EQA_AST.S20.0004	Infantis	20		
EQA_AST.S20.0005	Rissen	19	1	Montevideo
EQA_AST.S20.0006	Typhimurium	19	1	Paratyphi B
EQA_AST.S20.0007	Enteritidis	20		
EQA_AST.S20.0008	Heidelberg	20		
Total		156	4	

Derived from WGS or based on slide agglutination

Conclusions *Salmonella* EQA6-AST

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- Good correspondence between expected and reported results
- Some laboratories deviated from the recommended testing range (MIC) and disk concentrations specified in the harmonized EU protocol.
- Some laboratories had issues with the results for the control strain ATCC 25922
- Colistin (MIC) results could be improved in some laboratories
- **Results indicate that it is possible to compare phenotypic DD and MIC AST Salmonella results from NPHRLs across Europe**

- **On this course you are going to work with the EQA7-AST strains**

Thank you for your attention !!