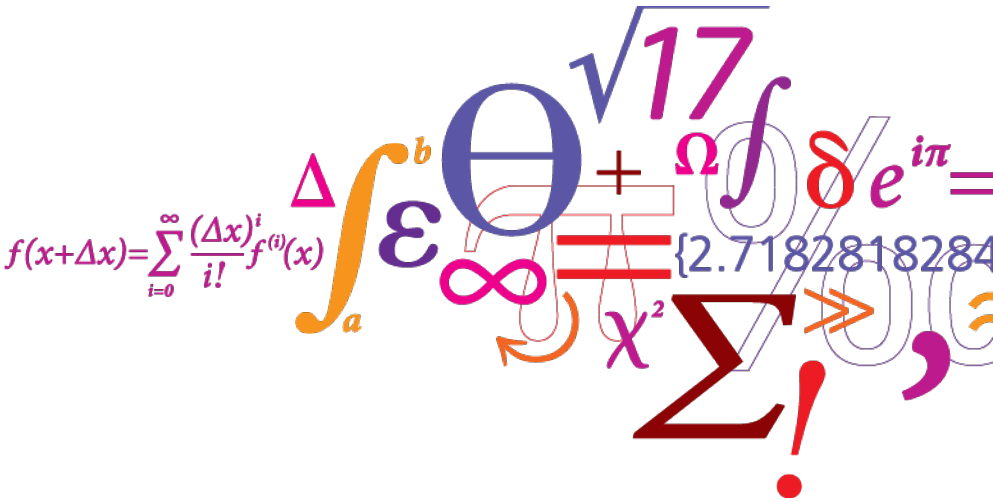
Results from the MIC survey 2017

Jette Sejer Kjeldgaard



DTU Food
National Food Institute

Purpose of the MIC Survey

- The survey was set up to **evaluate the reading of MIC results** for antimicrobial susceptibility testing (AST) of *E. coli, Salmonella, Enterococcus* and *Campylobacter*, routinely performed in the NRL's.

- The aim is to **identify problematic areas in the reading of MIC values** that can lead to deviations in the reporting of AST results.

Set-up

The MIC survey contained 45 images of MIC panels:

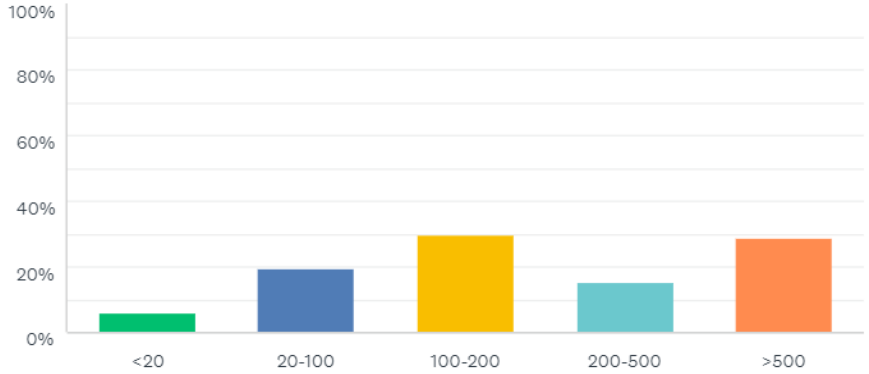
- EUVSEC Escherichia coli (x10)
- EUVSEC2 Escherichia coli (x5)
- EUVSEC Salmonella (x10)
- EUVSEC2 Salmonella (x5)
- EUVENC Enterococcus faecium (x5)
- EUVENC Enterococcus faecalis (x5)
- EUCAMP2 Campylobacter (x5)

- Suggest only to reply to the panel you normally work with

Background information

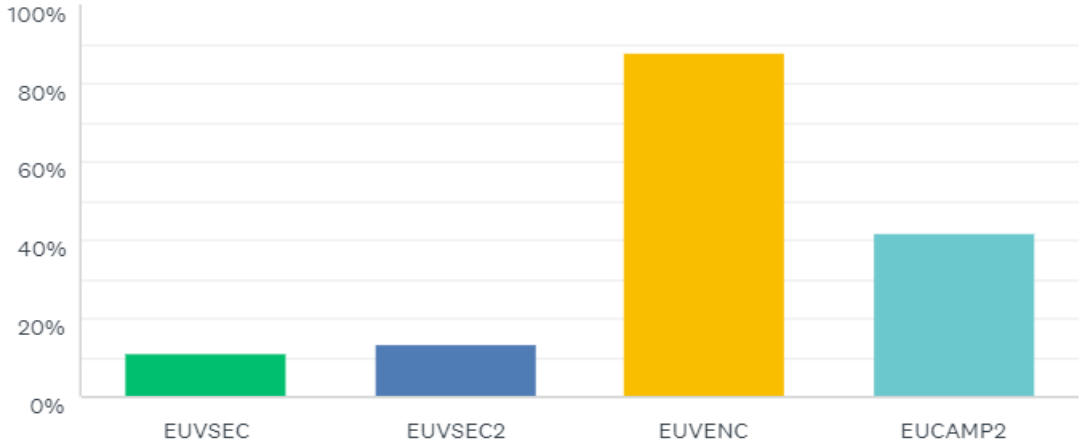
How many AST results do you approximately read annually? (No. of isolates)

Answered: 117 Skipped: 0

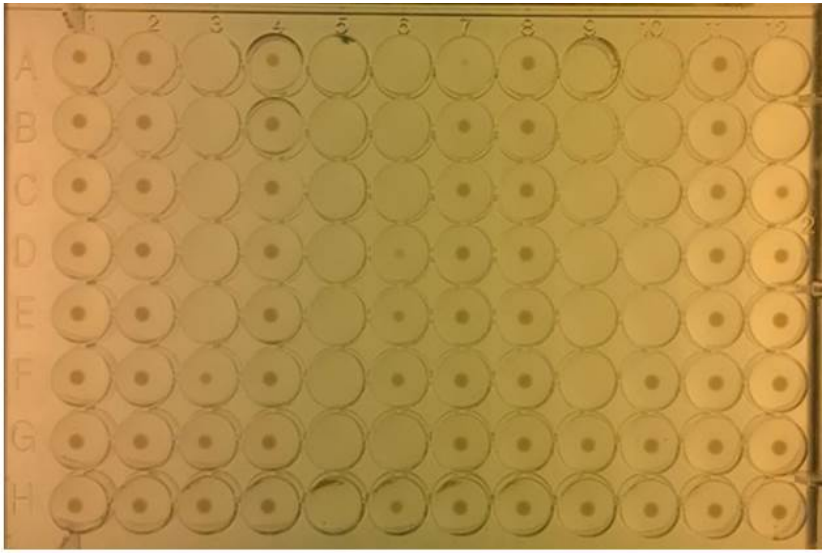


Are there some panels that you never or only rarely read?

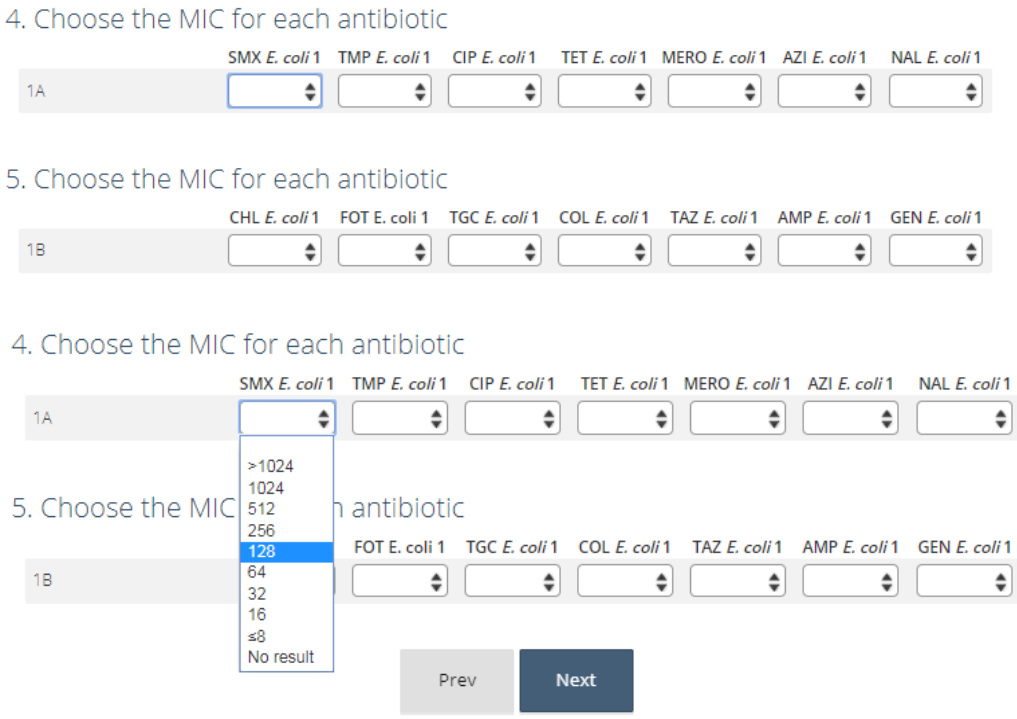
Answered: 98 Skipped: 19



Set-up 2



	1	2	3	4	5	6	7	8	9	10	11	12
A	SMX 1024	TMP 32	CIP 8	TET 64	MERO 16	AZI 64	NAL 128	CHL 128	TGC 8	COL 16	AMP 64	GEN 32
B	SMX 512	TMP 16	CIP 4	TET 32	MERO 8	AZI 32	NAL 64	CHL 64	TGC 4	COL 8	AMP 32	GEN 16
C	SMX 256	TMP 8	CIP 2	TET 16	MERO 4	AZI 16	NAL 32	CHL 32	TGC 2	COL 4	AMP 16	GEN 8
D	SMX 128	TMP 4	CIP 1	TET 8	MERO 2	AZI 8	NAL 16	CHL 16	TGC 1	COL 2	AMP 8	GEN 4
E	SMX 64	TMP 2	CIP 0.5	TET 4	MERO 1	AZI 4	NAL 8	CHL 8	TGC 0.5	COL 1	AMP 4	GEN 2
F	SMX 32	TMP 1	CIP 0.25	TET 2	MERO 0.5	AZI 2	NAL 4	FOT 1	TGC 0.25	TAZ 2	AMP 2	GEN 1
G	SMX 16	TMP 0.5	CIP 0.12	CIP 0.03	MERO 0.25	MERO 0.06	FOT 4	FOT 0.5	TAZ 8	TAZ 1	AMP 1	GEN 0.5
H	SMX 8	TMP 0.25	CIP 0.06	CIP 0.015	MERO 0.12	MERO 0.03	FOT 2	FOT 0.25	TAZ 4	TAZ 0.5	POS CON	POS CON



A total of 530 tests

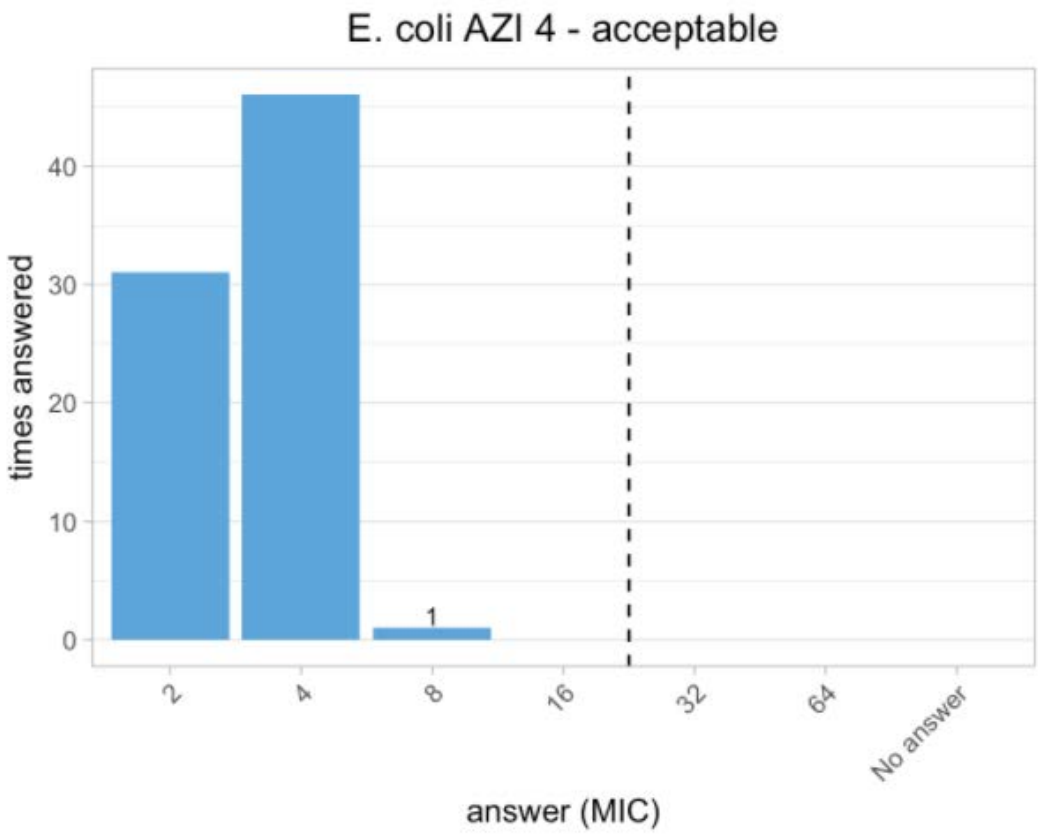
Approx. 117 participants

Data treatment

Not all deviations are equally important

Timo Röder

The MIC rules for an AST novice



Most common answer

= expected result

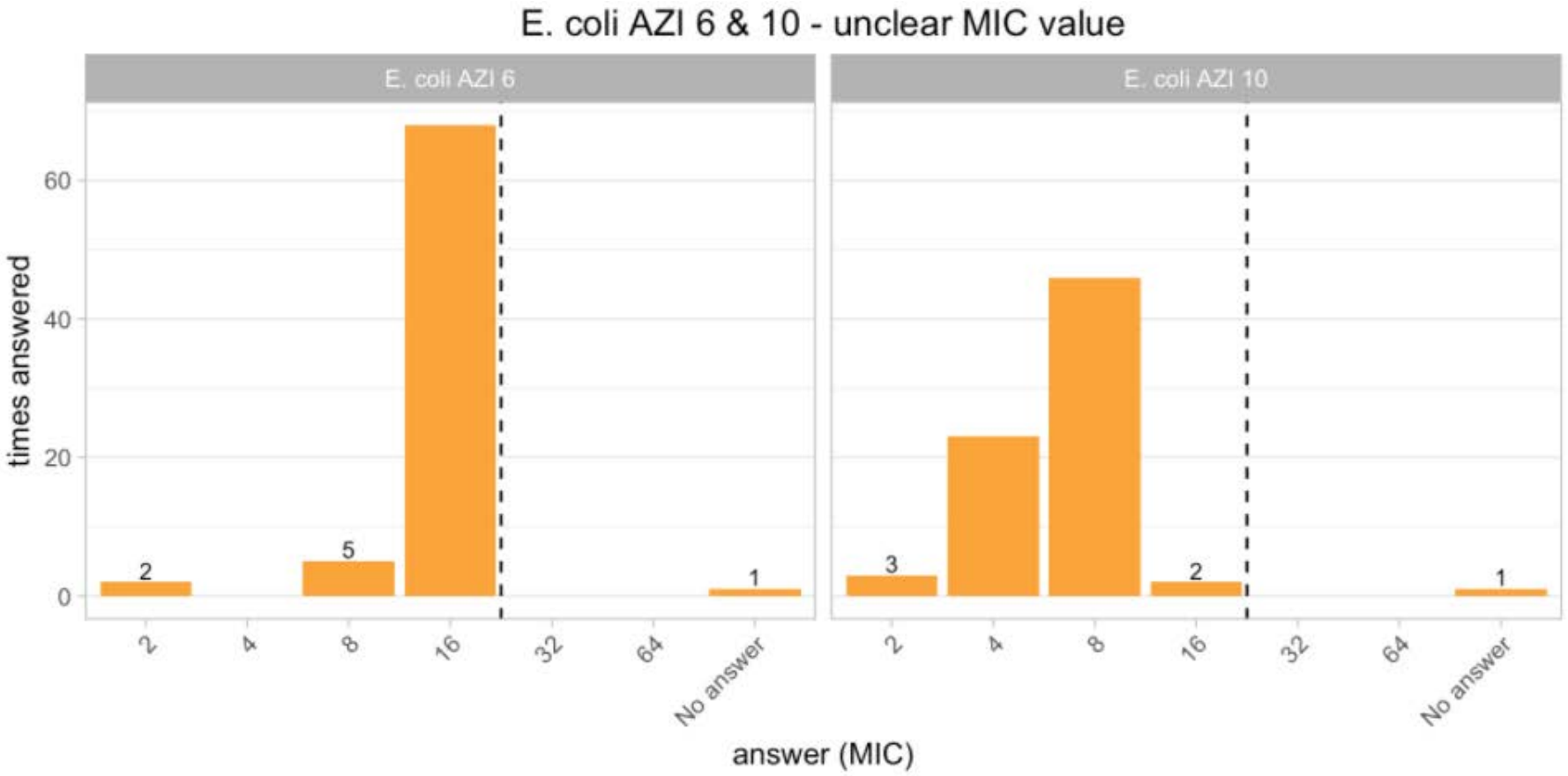
Three classifications of results

-Acceptable

-Unclear MIC

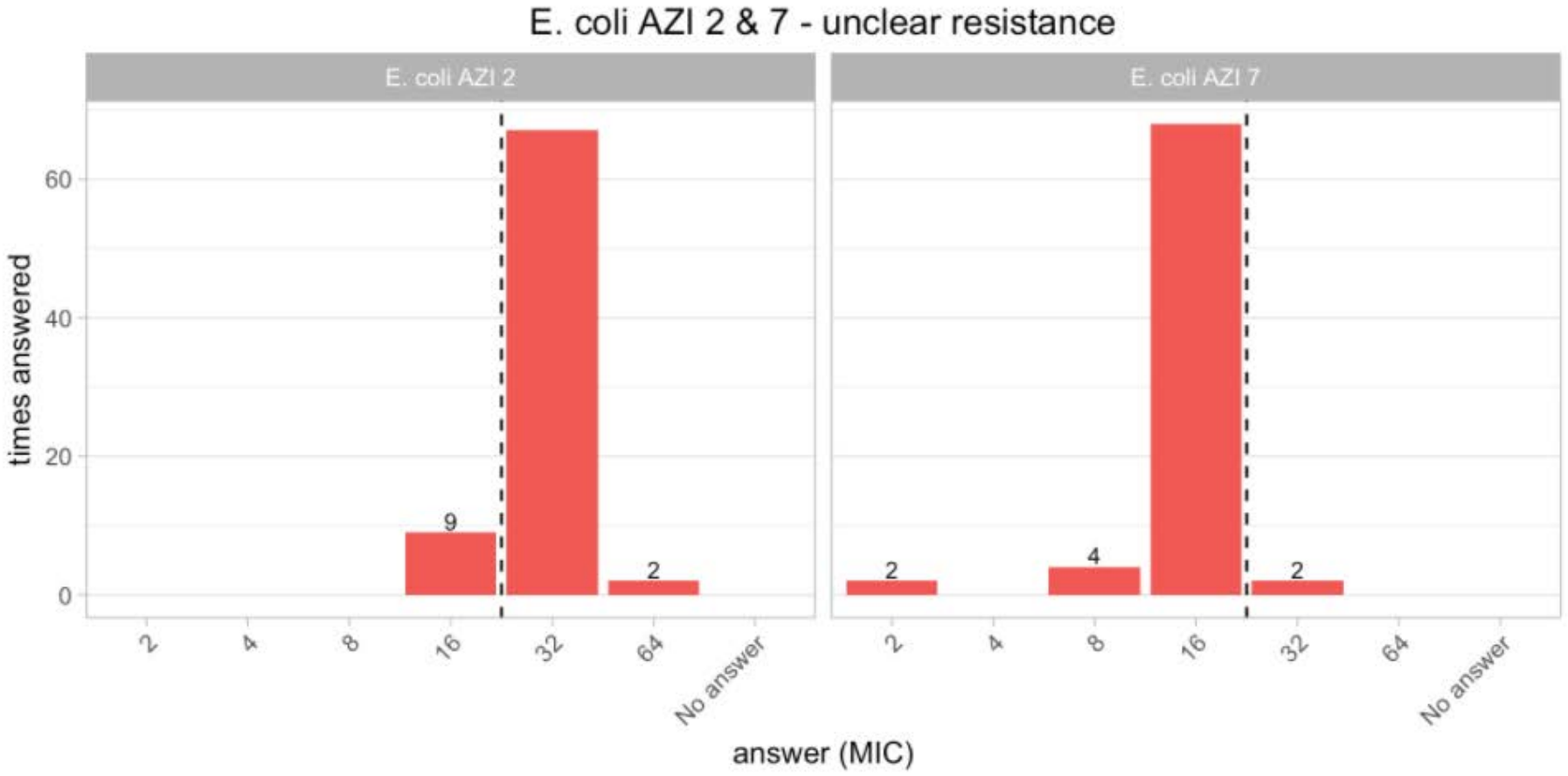
-Unclear resistance

Classification: Unclear MIC



Deviations but S/R interpretation is correct

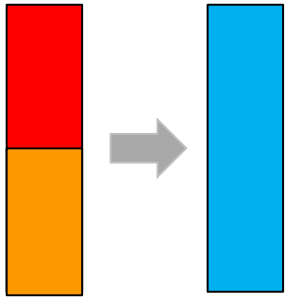
Classification: Unclear resistance

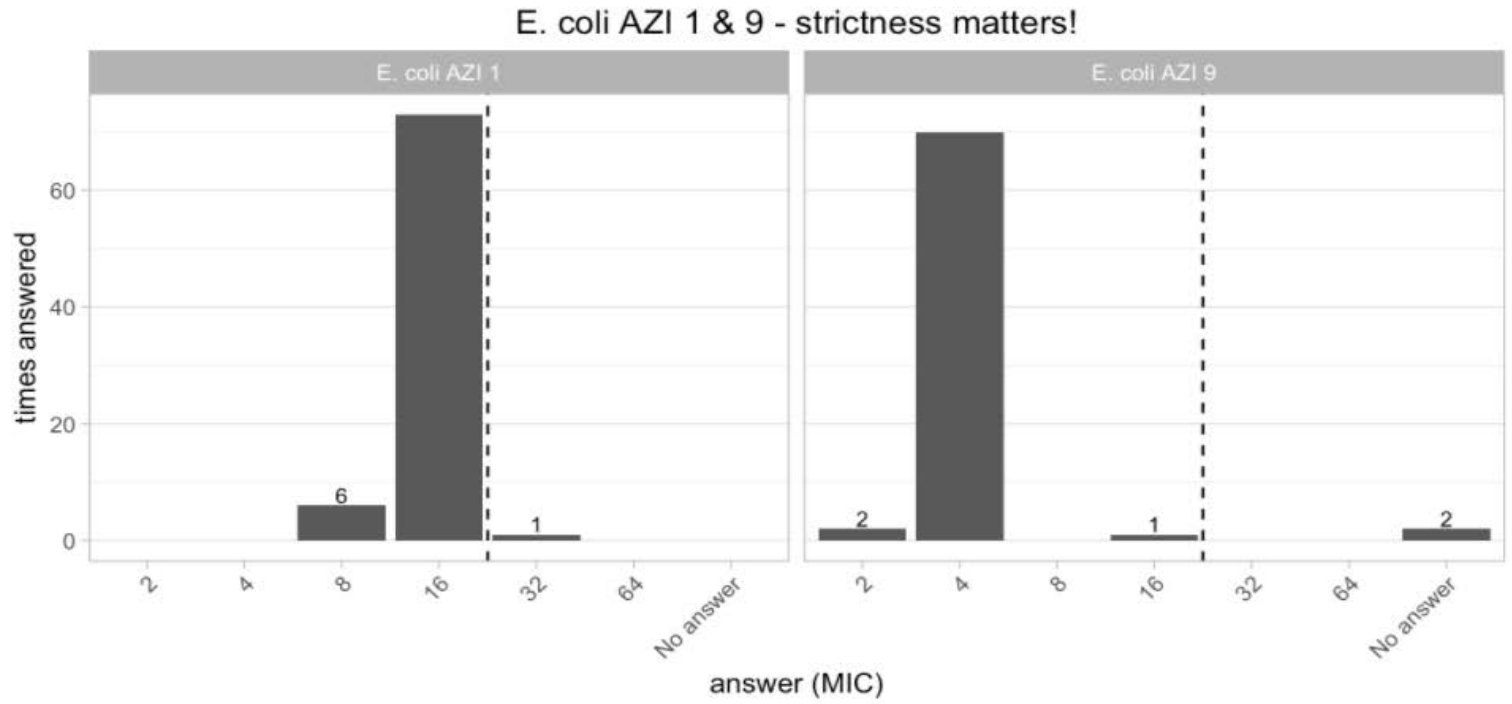


Deviations and S/R interpretation is wrong

Accidental errors

- It's a long survey
- What if we accept **a single deviating?**

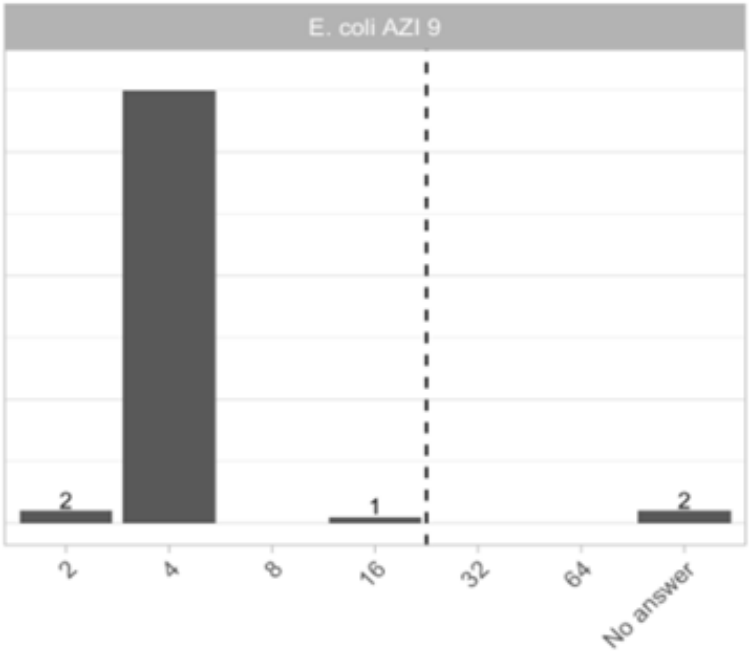


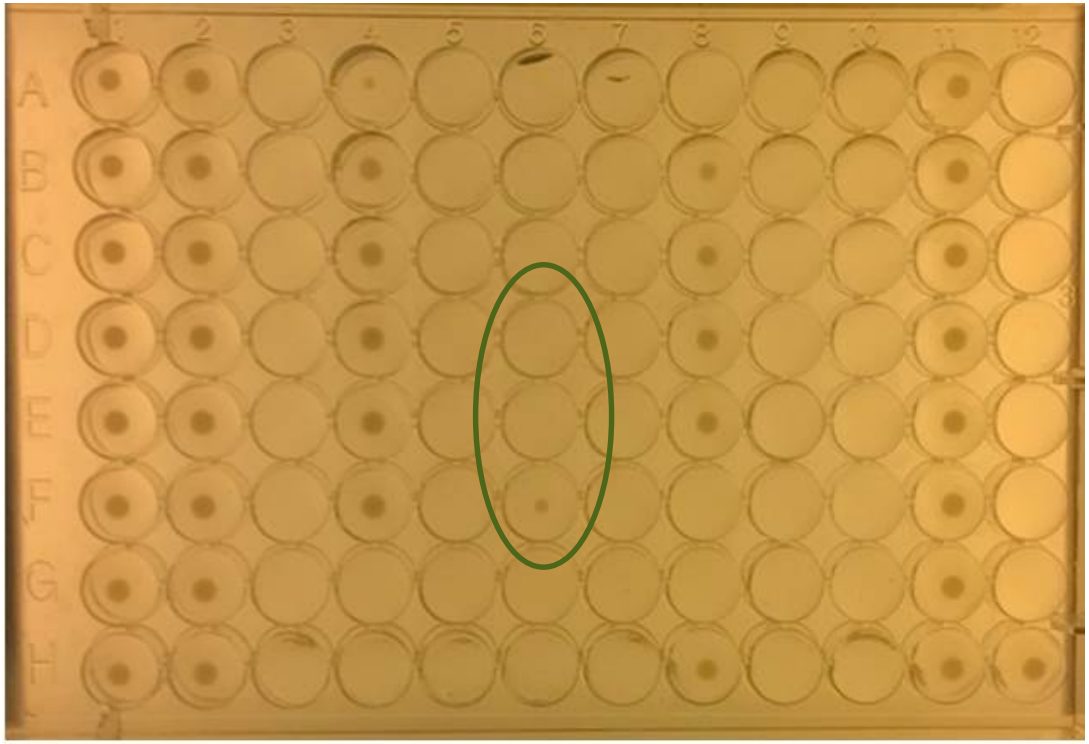


threshold for flagging	acceptable	unclear MIC value	unclear resistance
≥2 ambiguous answers	492	19	19
one ambiguous answer	396	46	88

Example I AZI

- Read the AZI MIC

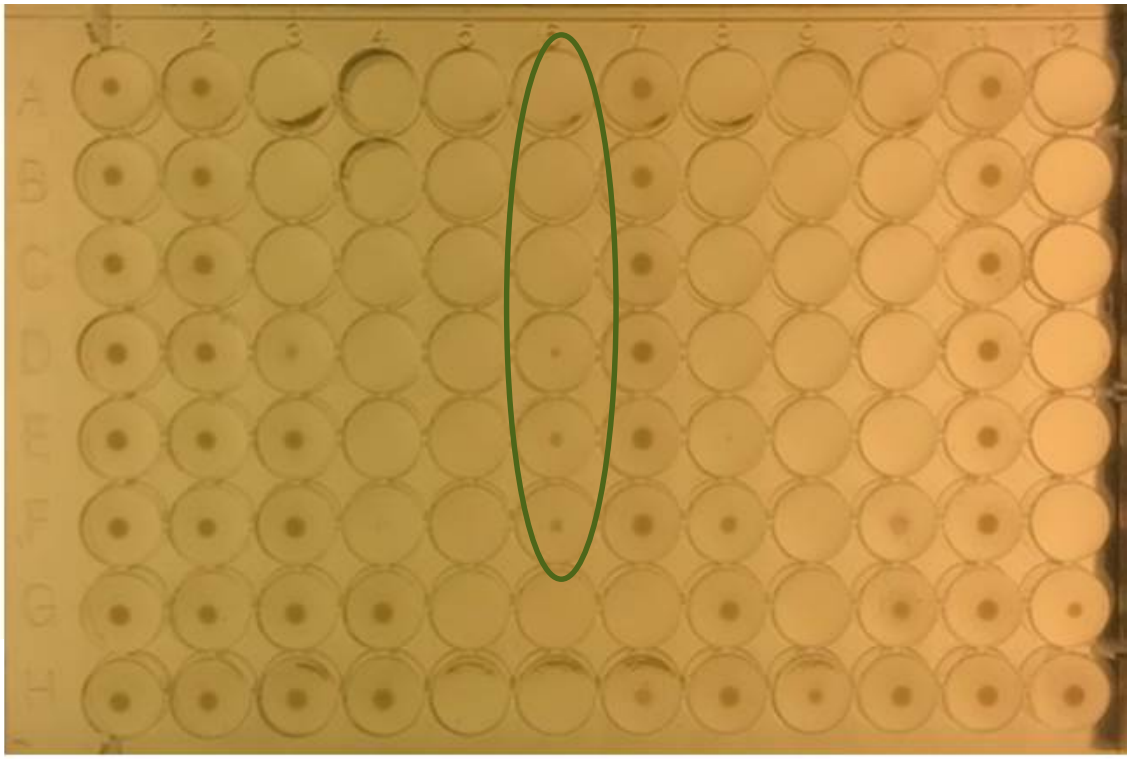


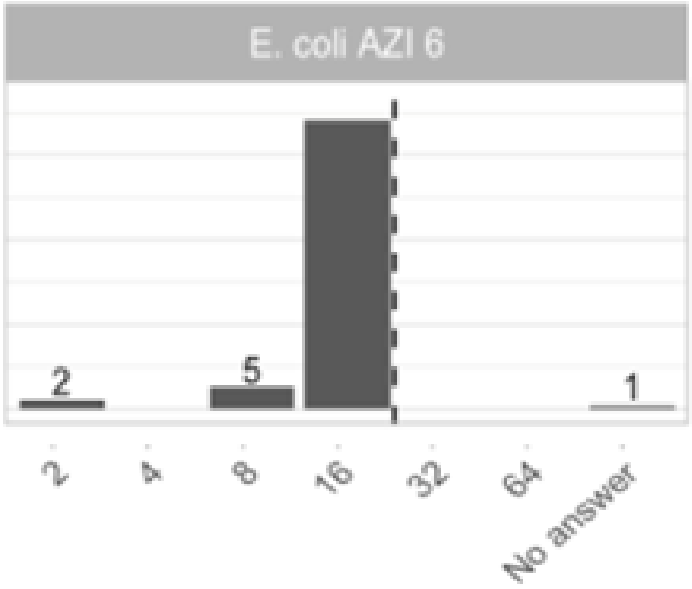


	1	2	3	4	5	6	7	8	9	10	11	12
A	SMX 1024	TMP 32	CIP 8	TET 64	MERO 16	AZI 64	NAL 128	CHL 128	TGC 8	COL 16	AMP 64	GEN 32
B	SMX 512	TMP 16	CIP 4	TET 32	MERO 8	AZI 32	NAL 64	CHL 64	TGC 4	COL 8	AMP 32	GEN 16
C	SMX 256	TMP 8	CIP 2	TET 16	MERO 4	AZI 16	NAL 32	CHL 32	TGC 2	COL 4	AMP 16	GEN 8
D	SMX 128	TMP 4	CIP 1	TET 8	MERO 2	AZI 8	NAL 16	CHL 16	TGC 1	COL 2	AMP 8	GEN 4
E	SMX 64	TMP 2	CIP 0.5	TET 4	MERO 1	AZI 4	NAL 8	CHL 8	TGC 0.5	COL 1	AMP 4	GEN 2
F	SMX 32	TMP 1	CIP 0.25	TET 2	MERO 0.5	AZI 2	NAL 4	FOT 1	TGC 0.25	TAZ 2	AMP 2	GEN 1
G	SMX 16	TMP 0.5	CIP 0.12	CIP 0.03	MERO 0.25	MERO 0.06	FOT 4	FOT 0.5	TAZ 8	TAZ 1	AMP 1	GEN 0.5
H	SMX 8	TMP 0.25	CIP 0.06	CIP 0.015	MERO 0.12	MERO 0.03	FOT 2	FOT 0.25	TAZ 4	TAZ 0.5	POS CON	POS CON

Example II AZI

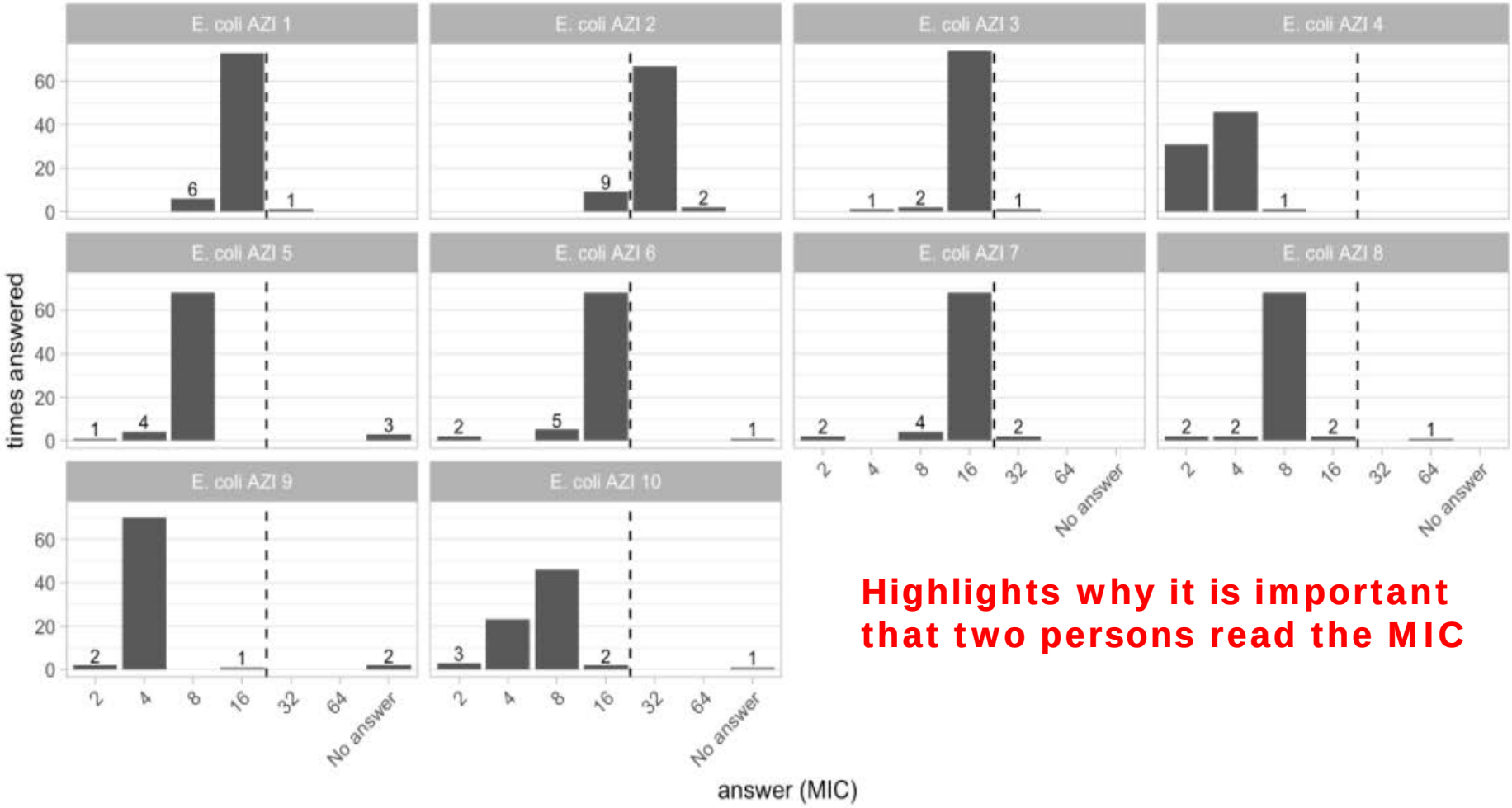
- Read the AZI MIC





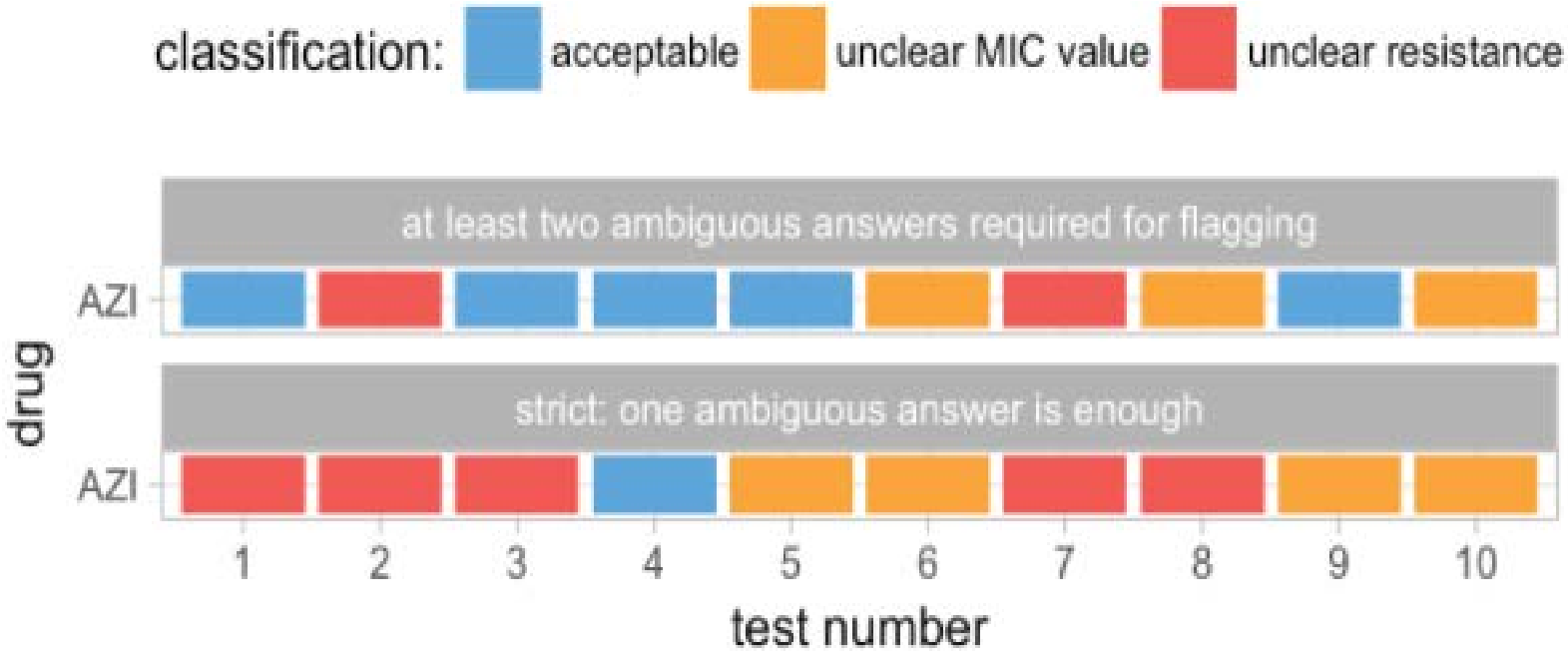
	1	2	3	4	5	6	7	8	9	10	11	12
A	SMX 1024	TMP 32	CIP 8	TET 64	MERO 16	AZI 64	NAL 128	CHL 128	TGC 8	COL 16	AMP 64	GEN 32
B	SMX 512	TMP 16	CIP 4	TET 32	MERO 8	AZI 32	NAL 64	CHL 64	TGC 4	COL 8	AMP 32	GEN 16
C	SMX 256	TMP 8	CIP 2	TET 16	MERO 4	AZI 16	NAL 32	CHL 32	TGC 2	COL 4	AMP 16	GEN 8
D	SMX 128	TMP 4	CIP 1	TET 8	MERO 2	AZI 8	NAL 16	CHL 16	TGC 1	COL 2	AMP 8	GEN 4
E	SMX 64	TMP 2	CIP 0.5	TET 4	MERO 1	AZI 4	NAL 8	CHL 8	TGC 0.5	COL 1	AMP 4	GEN 2
F	SMX 32	TMP 1	CIP 0.25	TET 2	MERO 0.5	AZI 2	NAL 4	FOT 1	TGC 0.25	TAZ 2	AMP 2	GEN 1
G	SMX 16	TMP 0.5	CIP 0.12	CIP 0.03	MERO 0.25	MERO 0.06	FOT 4	FOT 0.5	TAZ 8	TAZ 1	AMP 1	GEN 0.5
H	SMX 8	TMP 0.25	CIP 0.06	CIP 0.015	MERO 0.12	MERO 0.03	FOT 2	FOT 0.25	TAZ 4	TAZ 0.5	POS CON	POS CON

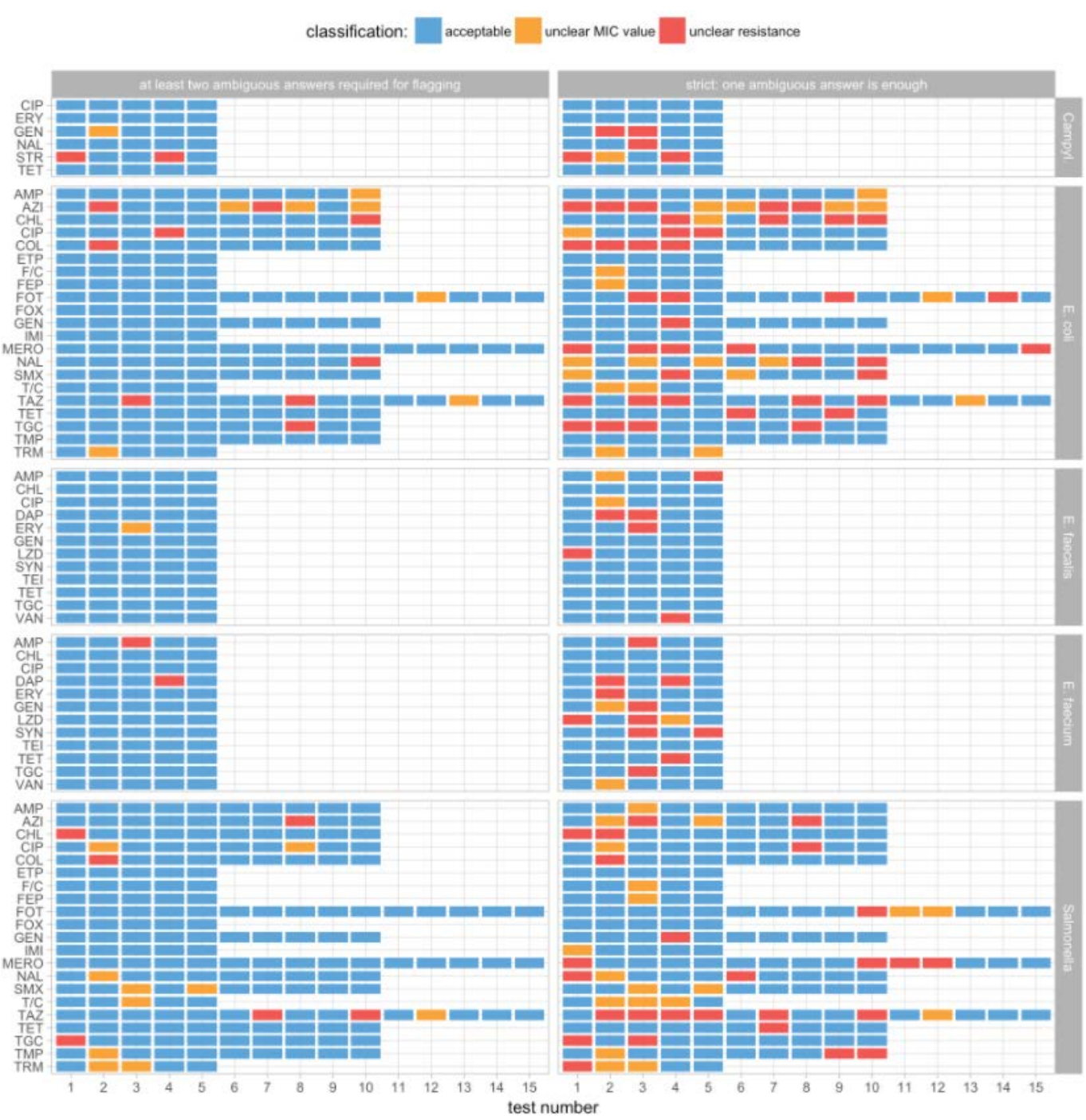
E. coli / AZI – all 10 strains



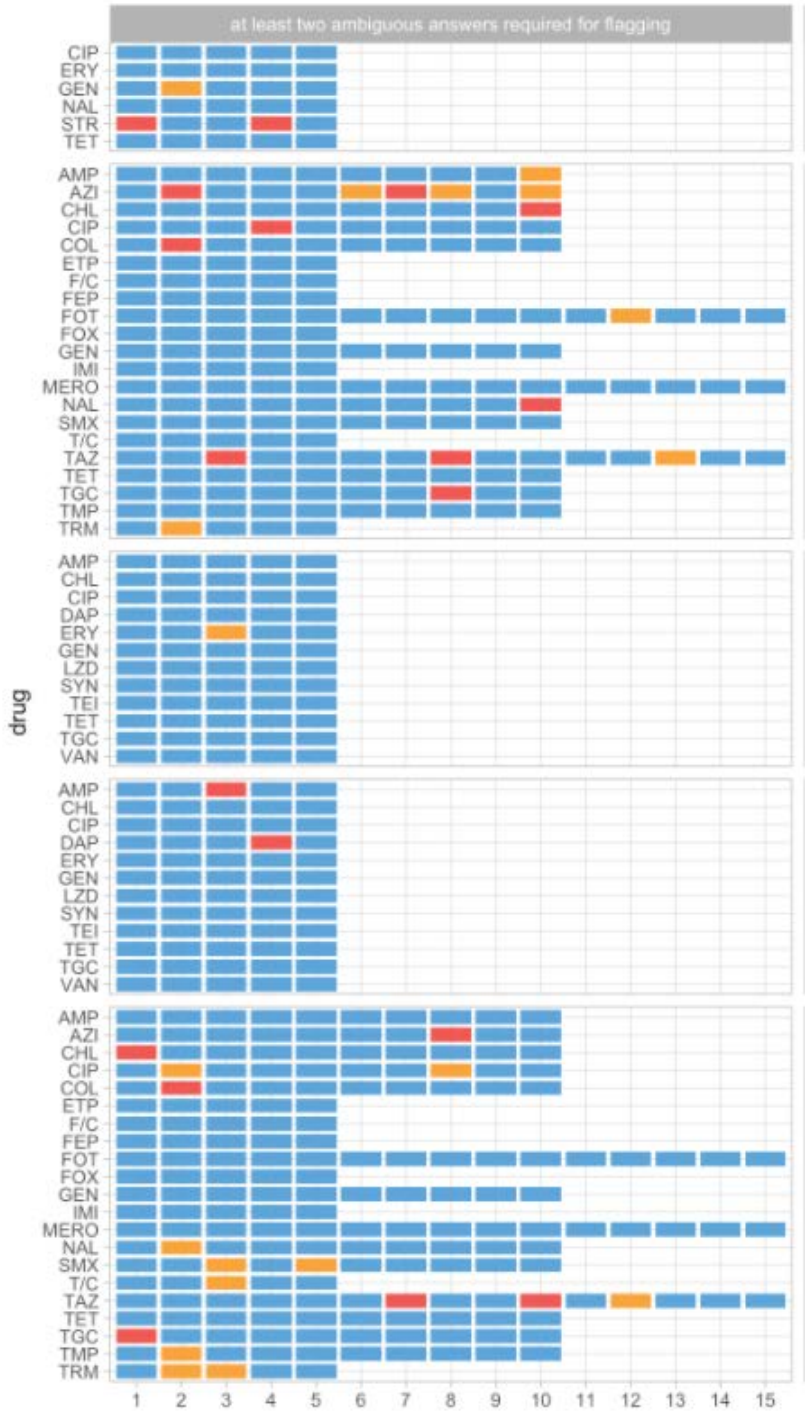
Highlights why it is important that two persons read the MIC

Strictness example – *E. coli* / AZI





06 April 2018



Campylobacter

(ca. 55 readings)

E. coli

E. faecalis

(ca. 45 readings)

E. faecium

Salmonella

06 April 2018

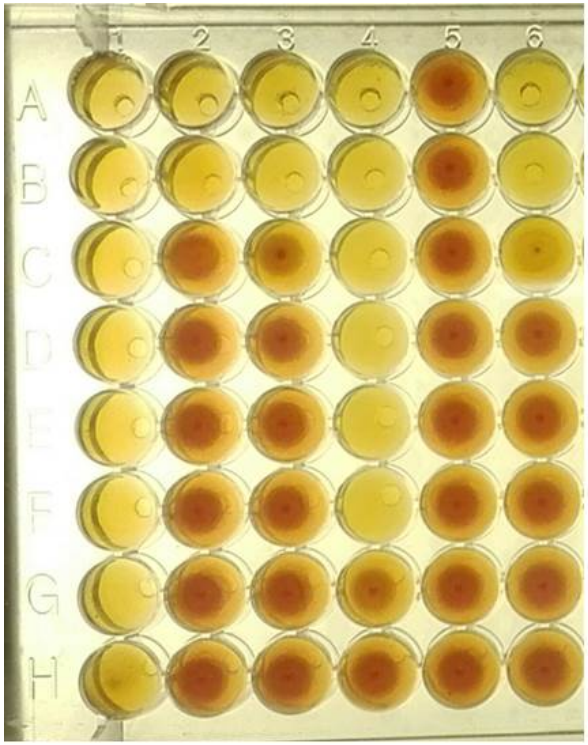
Example III Campy/STR

Read the STR MIC

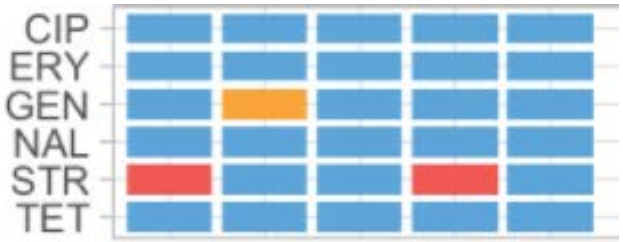
How much growth is required?

-Similar to POS CON?

-Any growth?



	1	2	3	4	5	6
A	ERY 128	CIP 16	TET 64	GEN 16	NAL 64	STR 16
B	ERY 64	CIP 8	TET 32	GEN 8	NAL 32	STR 8
C	ERY 32	CIP 4	TET 16	GEN 4	NAL 16	STR 4
D	ERY 16	CIP 2	TET 8	GEN 2	NAL 8	STR 2
E	ERY 8	CIP 1	TET 4	GEN 1	NAL 4	STR 1
F	ERY 4	CIP 0.5	TET 2	GEN 0.5	NAL 2	STR 0.5
G	ERY 2	CIP 0.25	TET 1	GEN 0.25	NAL 1	STR 0.25
H	ERY 1	CIP 0.12	TET 0.5	GEN 0.12	POS CON	POS CON

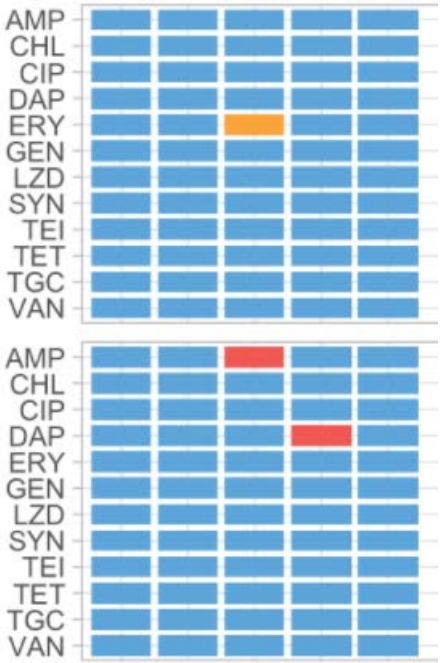


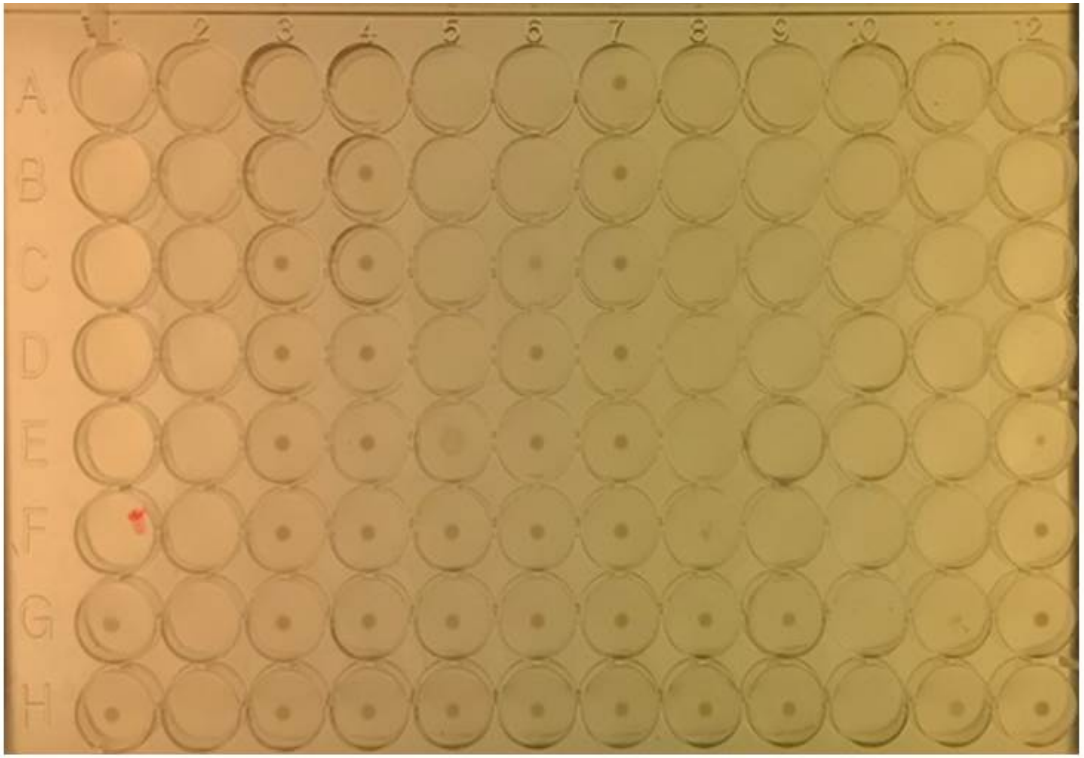
Example IV
Enterococcus

How much growth is required?

-Similar to POS CON?

-Any growth?





	1	2	3	4	5	6	7	8	9	10	11	12
A	VAN 128	TEI 64	SYN 64	TET 128	DAP 32	CIP 16	ERY 128	TGC 4	LZD 64	GEN 1024	AMP 64	CHL 128
B	VAN 64	TEI 32	SYN 32	TET 64	DAP 16	CIP 8	ERY 64	TGC 2	LZD 32	GEN 512	AMP 32	CHL 64
C	VAN 32	TEI 16	SYN 16	TET 32	DAP 8	CIP 4	ERY 32	TGC 1	LZD 16	GEN 256	AMP 16	CHL 32
D	VAN 16	TEI 8	SYN 8	TET 16	DAP 4	CIP 2	ERY 16	TGC 0.5	LZD 8	GEN 128	AMP 8	CHL 16
E	VAN 8	TEI 4	SYN 4	TET 8	DAP 2	CIP 1	ERY 8	TGC 0.25	LZD 4	GEN 64	AMP 4	CHL 8
F	VAN 4	TEI 2	SYN 2	TET 4	DAP 1	CIP 0.5	ERY 4	TGC 0.12	LZD 2	GEN 32	AMP 2	CHL 4
G	VAN 2	TEI 1	SYN 1	TET 2	DAP 0.5	CIP 0.25	ERY 2	TGC 0.06	LZD 1	GEN 16	AMP 1	POS CON
H	VAN 1	TEI 0.5	SYN 0.5	TET 1	DAP 0.25	CIP 0.12	ERY 1	TGC 0.03	LZD 0.5	GEN 8	AMP 0.5	POS CON

Answer option – No result

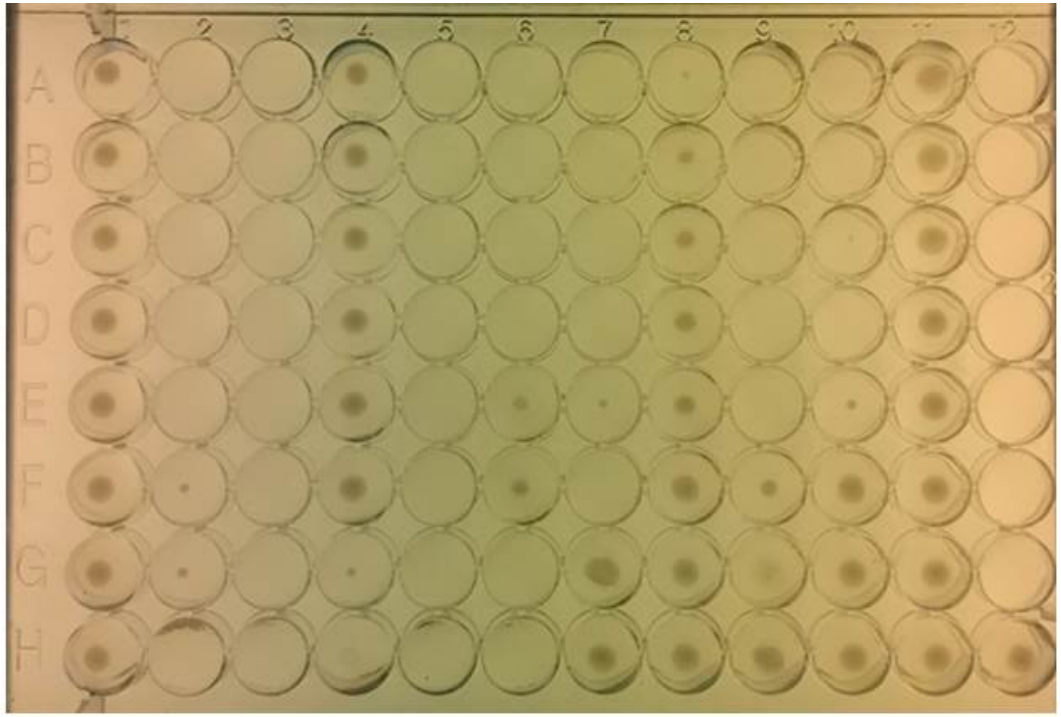
test	SurveyMonkey name	species	drug	total answers	"No result" answers	% "No result"
All	All	All	All	All	All	All
Salmonella NAL 2	S2A - NAL Salmonella 2	Salmonella	NAL	70	34	48.6
Salmonella TMP 2	S2A - TMP Salmonella 2	Salmonella	TMP	70	33	47.1
Salmonella TRM 2	S2-2B - TRM Salmonella 2	Salmonella	TRM	67	25	37.3
Salmonella CIP 2	S2A - CIP Salmonella 2	Salmonella	CIP	70	23	32.9
E. coli TAZ 13	2-3A - TAZ E. coli 3	E. coli	TAZ	74	22	29.7
Salmonella COL 2	S2B - COL Salmonella 2	Salmonella	COL	70	15	21.4

Salmonella2 panel 1

Example V
Salmonella2 panel 1

Please discuss

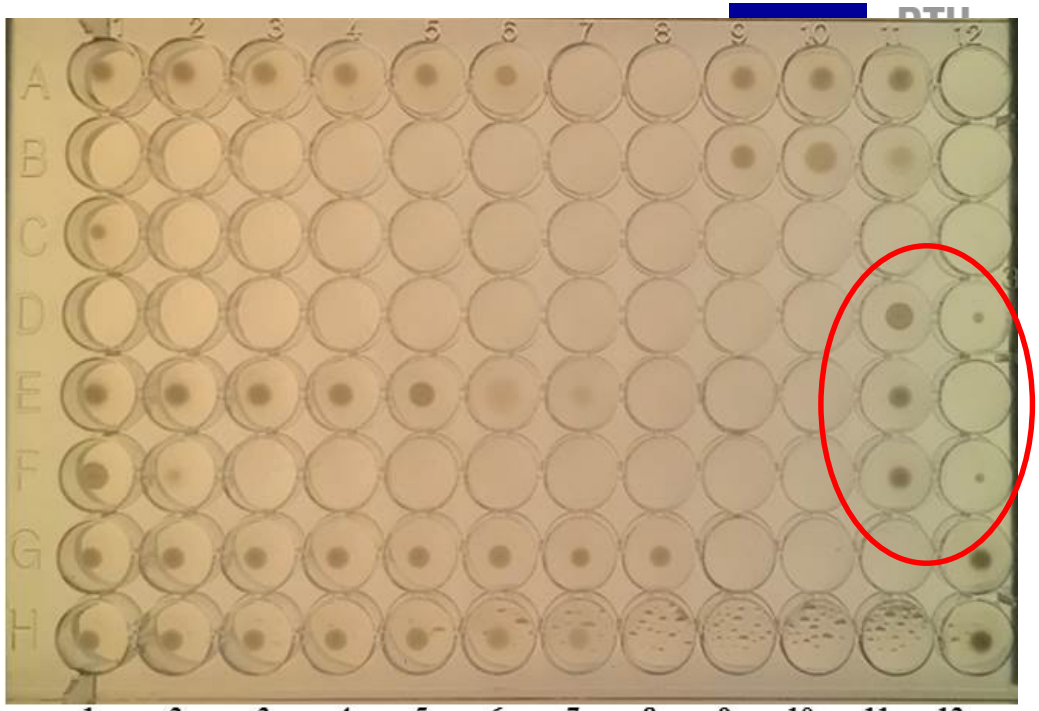
Skip for TMP, CIP, and NAL



	1	2	3	4	5	6	7	8	9	10	11	12
A	SMX 1024	TMP 32	CIP 8	TET 64	MERO 16	AZI 64	NAL 128	CHL 128	TGC 8	COL 16	AMP 64	GEN 32
B	SMX 512	TMP 16	CIP 4	TET 32	MERO 8	AZI 32	NAL 64	CHL 64	TGC 4	COL 8	AMP 32	GEN 16
C	SMX 256	TMP 8	CIP 2	TET 16	MERO 4	AZI 16	NAL 32	CHL 32	TGC 2	COL 4	AMP 16	GEN 8
D	SMX 128	TMP 4	CIP 1	TET 8	MERO 2	AZI 8	NAL 16	CHL 16	TGC 1	COL 2	AMP 8	GEN 4
E	SMX 64	TMP 2	CIP 0.5	TET 4	MERO 1	AZI 4	NAL 8	CHL 8	TGC 0.5	COL 1	AMP 4	GEN 2
F	SMX 32	TMP 1	CIP 0.25	TET 2	MERO 0.5	AZI 2	NAL 4	FOT 1	TGC 0.25	TAZ 2	AMP 2	GEN 1
G	SMX 16	TMP 0.5	CIP 0.12	CIP 0.03	MERO 0.25	MERO 0.06	FOT 4	FOT 0.5	TAZ 8	TAZ 1	AMP 1	GEN 0.5
H	SMX 8	TMP 0.25	CIP 0.06	CIP 0.015	MERO 0.12	MERO 0.03	FOT 2	FOT 0.25	TAZ 4	TAZ 0.5	POS CON	POS CON

Example VI Salmonella Skip

Read TRM MIC



	1	2	3	4	5	6	7	8	9	10	11	12
A	FOX 0.5	FOX 1	FOX 2	FOX 4	FOX 8	FOX 16	FOX 32	FOX 64	FOT 0.25	FOT 0.5	FOT 1	TRM 128
B	ETP 0.015	ETP 0.03	ETP 0.06	ETP 0.12	ETP 0.25	ETP 0.5	ETP 1	ETP 2	FOT 2	FOT 4	FOT 8	TRM 64
C	IMI 0.12	IMI 0.25	IMI 0.5	IMI 1	IMI 2	IMI 4	IMI 8	IMI 16	FOT 16	FOT 32	FOT 64	TRM 32
D	MERO 0.03	MERO 0.06	MERO 0.12	MERO 0.25	MERO 0.5	MERO 1	MERO 2	MERO 4	MERO 8	MERO 16	TRM 2	TRM 16
E	TAZ 0.25	TAZ 0.5	TAZ 1	TAZ 2	TAZ 4	TAZ 8	TAZ 16	TAZ 32	TAZ 64	TAZ 128	TRM 1	TRM 8
F	FEP 0.06	FEP 0.12	FEP 0.25	FEP 0.5	FEP 1	FEP 2	FEP 4	FEP 8	FEP 16	FEP 32	TRM 0.5	TRM 4
G	F/C 0.06/4	F/C 0.12/4	F/C 0.25/4	F/C 0.5/	F/C 1/4	F/C 2/4	F/C 4/4	F/C 8/4	F/C 16/4	F/C 32/4	F/C 64/4	POS CON
H	T/C 0.12/4	T/C 0.25/4	T/C 0.5/4	T/C 1/4	T/C 2/4	T/C 4/4	T/C 8/4	T/C 16/4	T/C 32/4	T/C 64/4	T/C 128/4	POS CON

CLSI M07, 11th Ed. Jan 2018

'When a single skipped well occurs in a microdilution test, read the highest MIC.

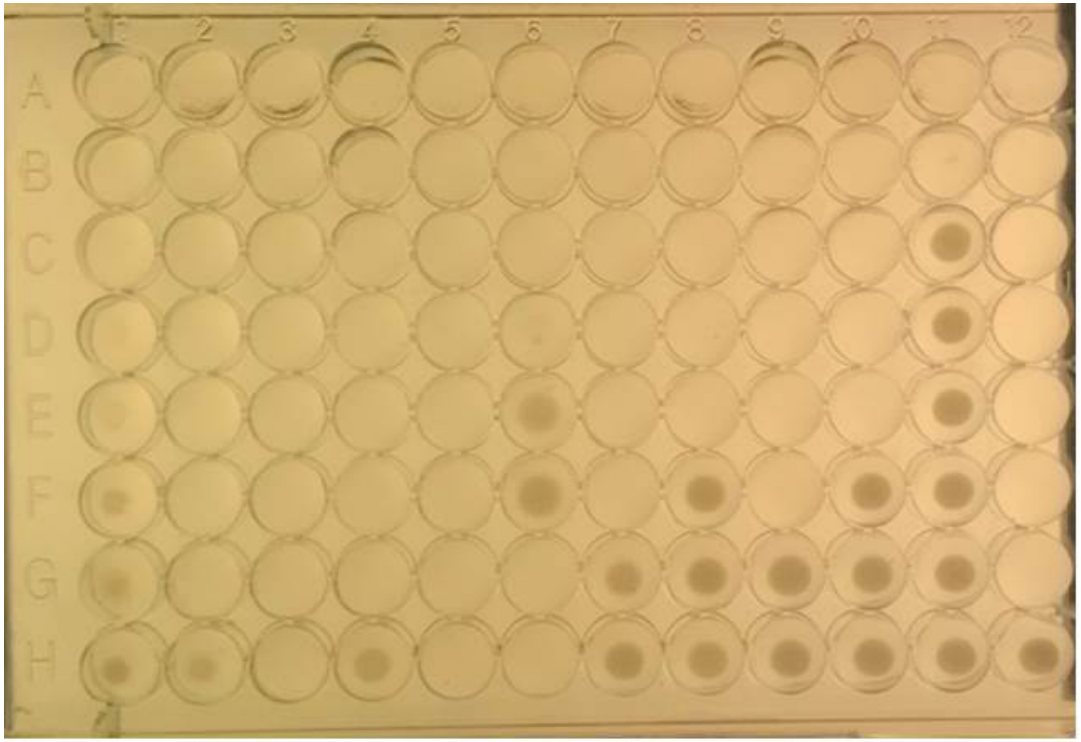
If skipped wells are observed across multiple concentrations of a single drug, do not report the results and repeat the test.'

Example VII SMX

Read the SMX MIC

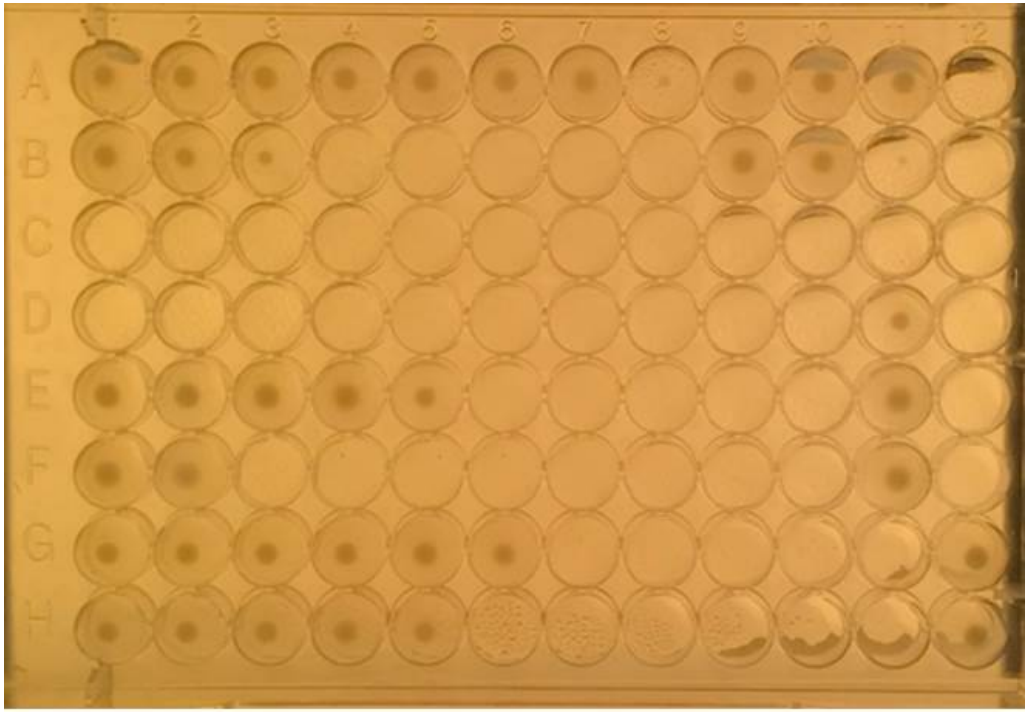
MIC results in survey:

≤8 - 256



	1	2	3	4	5	6	7	8	9	10	11	12
A	SMX 1024	TMP 32	CIP 8	TET 64	MERO 16	AZI 64	NAL 128	CHL 128	TGC 8	COL 16	AMP 64	GEN 32
B	SMX 512	TMP 16	CIP 4	TET 32	MERO 8	AZI 32	NAL 64	CHL 64	TGC 4	COL 8	AMP 32	GEN 16
C	SMX 256	TMP 8	CIP 2	TET 16	MERO 4	AZI 16	NAL 32	CHL 32	TGC 2	COL 4	AMP 16	GEN 8
D	SMX 128	TMP 4	CIP 1	TET 8	MERO 2	AZI 8	NAL 16	CHL 16	TGC 1	COL 2	AMP 8	GEN 4
E	SMX 64	TMP 2	CIP 0.5	TET 4	MERO 1	AZI 4	NAL 8	CHL 8	TGC 0.5	COL 1	AMP 4	GEN 2
F	SMX 32	TMP 1	CIP 0.25	TET 2	MERO 0.5	AZI 2	NAL 4	FOT 1	TGC 0.25	TAZ 2	AMP 2	GEN 1
G	SMX 16	TMP 0.5	CIP 0.12	CIP 0.03	MERO 0.25	MERO 0.06	FOT 4	FOT 0.5	TAZ 8	TAZ 1	AMP 1	GEN 0.5
H	SMX 8	TMP 0.25	CIP 0.06	CIP 0.015	MERO 0.12	MERO 0.03	FOT 2	FOT 0.25	TAZ 4	TAZ 0.5	POS CON	POS CON

Last example
E. coli FOX / FOT



	1	2	3	4	5	6	7	8	9	10	11	12
A	FOX 0.5	FOX 1	FOX 2	FOX 4	FOX 8	FOX 16	FOX 32	FOX 64	FOT 0.25	FOT 0.5	FOT 1	TRM 128
B	ETP 0.015	ETP 0.03	ETP 0.06	ETP 0.12	ETP 0.25	ETP 0.5	ETP 1	ETP 2	FOT 2	FOT 4	FOT 8	TRM 64
C	IMI 0.12	IMI 0.25	IMI 0.5	IMI 1	IMI 2	IMI 4	IMI 8	IMI 16	FOT 16	FOT 32	FOT 64	TRM 32
D	MERO 0.03	MERO 0.06	MERO 0.12	MERO 0.25	MERO 0.5	MERO 1	MERO 2	MERO 4	MERO 8	MERO 16	TRM 2	TRM 16
E	TAZ 0.25	TAZ 0.5	TAZ 1	TAZ 2	TAZ 4	TAZ 8	TAZ 16	TAZ 32	TAZ 64	TAZ 128	TRM 1	TRM 8
F	FEP 0.06	FEP 0.12	FEP 0.25	FEP 0.5	FEP 1	FEP 2	FEP 4	FEP 8	FEP 16	FEP 32	TRM 0.5	TRM 4
G	F/C 0.06/4	F/C 0.12/4	F/C 0.25/4	F/C 0.5/	F/C 1/4	F/C 2/4	F/C 4/4	F/C 8/4	F/C 16/4	F/C 32/4	F/C 64/4	POS CON
H	T/C 0.12/4	T/C 0.25/4	T/C 0.5/4	T/C 1/4	T/C 2/4	T/C 4/4	T/C 8/4	T/C 16/4	T/C 32/4	T/C 64/4	T/C 128/4	POS CON

Conclusions

- Overall very well performance
  - Dependent on the quality of the photos
- Deviations occur when
  - There is poor growth
  - There is less growth than in the positive control
    - Bacteriostatic antimicrobials
- Accidental deviations occur!

Great thanks to Timo!

Thank you for your attention

-And for spending hours of your time on the survey