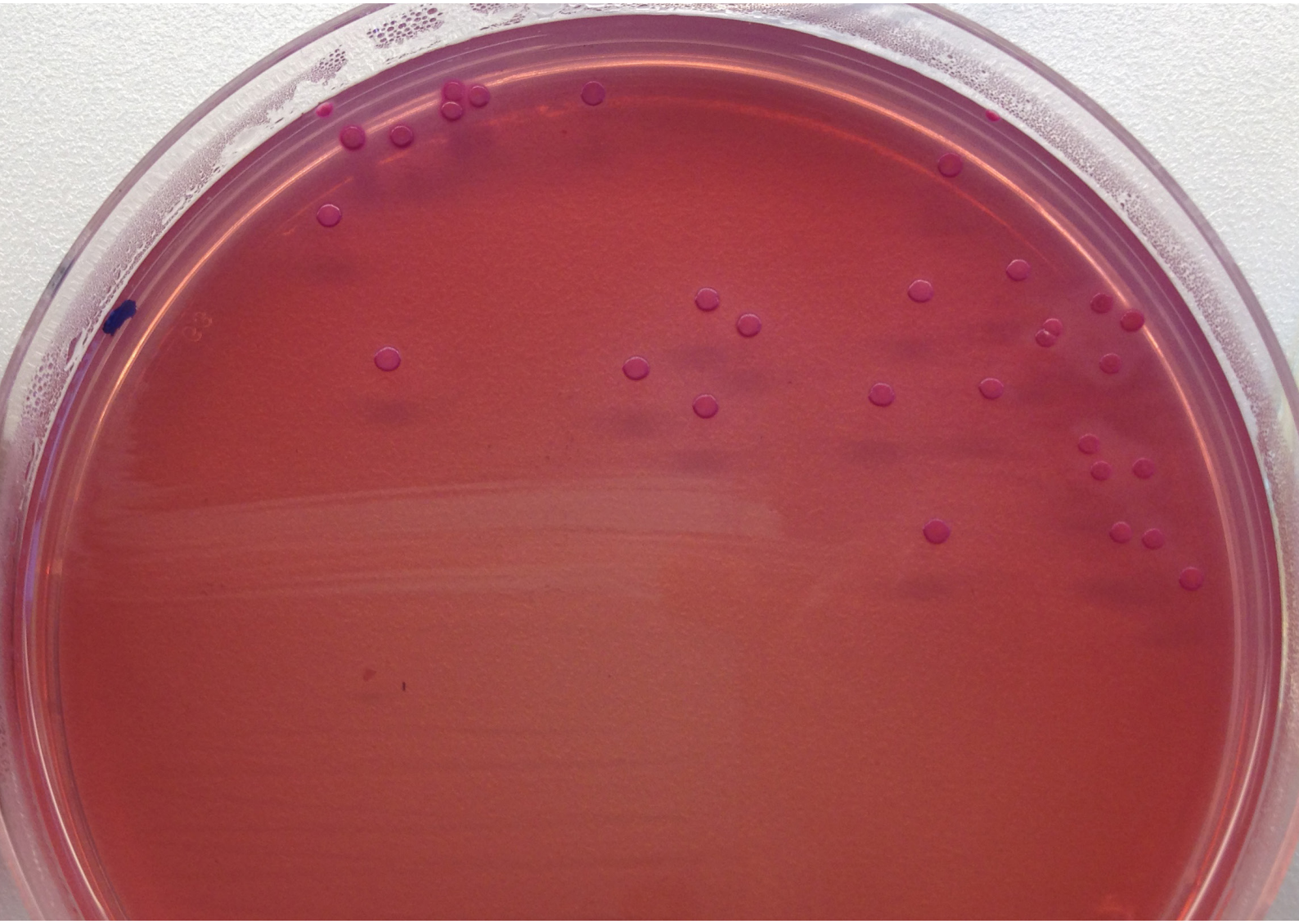
National Food Institute
Technical University of Denmark

The 6th EURL-AR PROFICIENCY TEST ON SELECTIVE ISOLATION OF E. COLI WITH PRESUMPTIVE ESBL OR AMPC PHENOTYPES FROM MEAT OR CAECAL SAMPLES - 2020



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European Union Reference Laboratory -
Antimicrobial Resistance

THE 6th EURL-AR PROFICIENCY TEST ON SELECTIVE ISOLATION OF *E. COLI* WITH PRESUMPTIVE ESBL OR AMPC PHENOTYPES FROM MEAT OR CAECAL SAMPLES – 2020

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1. Introduction

This report describes and summarises results from the sixth matrix-based proficiency test conducted by The National Food Institute (DTU Food) as the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR) as an External Quality Assurance System (EQAS). This proficiency test focuses on selective isolation of extended spectrum beta-lactamase (ESBL) and AmpC-producing *E. coli* from meat and caecal samples of animal origin and antimicrobial susceptibility testing (AST) of the isolated *E. coli*. In addition, the proficiency test includes optional isolation of carbapenemases and OXA-48-producing *E. coli*.

Extended spectrum beta-lactamase (ESBL) and AmpC-producing *E. coli* continue to spread in food producing animals. In 2013, the European Commission (EC) decided to include the isolation of ESBL and AmpC-producing *E. coli* as mandatory parts of the EU monitoring and this started during 2015. The screening includes matrix samples consisting of either meat or caecal samples of animal origin in the EU Member States (MS) and affiliated countries according to a common protocol defined by the EC and validated by the EURL-AR (EURL-AR, 2019).

In 2016, the EQAS was extended to include carbapenemase and/or OXA-48-producing *E. coli*, thereby including the optional isolation of these using the EURL-AR selective isolation protocol on agar plates suitable for isolation of carbapenemase-producing *E. coli* (EURL-AR, 2019). This will be made mandatory with the new decision from 2021.

Similar to the previous EURL-AR matrix based EQAS', the aim of this specific EQAS was to i) monitor the capacity of the National Reference Laboratories (NRL-AR) for isolation, identification and AST of ESBL/AmpC or carbapenemase-producing *E. coli,* ii) identify laboratories which may need assistance to improve their performance in isolation and AST of *E. coli* from matrices, and iii) identify potential problems or focus areas for future training and research.

In reading this report, the following important considerations should be taken into account:

1) Expected results were generated by performing Minimum Inhibitory Concentration (MIC) determination for all test strains prior to selection of strains and MIC's were confirmed upon selection of strains at the Technical University of Denmark, National Food Institute (DTU Food). The genetic basis for resistance was known, as all the selected test strains had been whole-genome sequenced (WGS). The MIC determination was repeated after preparation of the matrix samples of meat and caecal, which revealed a risk for deviating phenotypic results and unclear phenotypes (See section 3.1).

2) No thresholds have been set in advance to evaluate the acceptance of the performance of the participating laboratories and therefore the results will not be classified as above or below a threshold, but will be evaluated case by case.

3) Evaluation of a result as 'deviating from the expected interpretation' should be carefully analysed in a self-evaluation performed by the participant, including considerations of corrective actions in the laboratory. Note that since methods used for MIC determination has limitations, it is not considered a mistake to obtain a one level dilution difference in the MIC of a specific antimicrobial when testing the same strains. If, however, the expected MIC is close to the breakpoint value for categorising the strain as susceptible or resistant, one two-fold dilution difference (which is acceptable) may result in two different interpretations, i.e. the same strain

can be categorized as susceptible and resistant. This result will be evaluated as correct in one case, but incorrect when the evaluation is based on AST interpretations. In the organization of the EQAS, we try to avoid these situations by choosing test strains with MIC values distant from the cut-offs for resistance, which is not always feasible for all strains and all antimicrobials. Therefore, the EURL-AR network unanimously established in 2008 that if there are less than 75% correct results for a specific strain/antimicrobial combination, the reasons for this situation must be further examined and, on selected occasions explained in details case by case, these results may subsequently be omitted from the evaluation report.

The data in this report is presented with laboratory codes. A laboratory code is known only by the individual laboratory, whereas the entire list of laboratories and their codes is confidential and known only by relevant representatives of the EURL-AR and the EU Commission. All conclusions are public.

This sixth matrix EQAS was organized by the EURL-AR at the National Food Institute (DTU Food), Kgs. Lyngby, Denmark. The report was approved in its draft version by a technical advisory group composed by competent representatives from all NRL-ARs, who meets annually at the EURL-AR workshop, and no substantial changes were made in this final report.

2. Materials and Methods

2.1 Participants in EQAS 2020

A pre-notification (App. 1), announcing the matrix EQAS 2020, was distributed on the 7th of October 2020 by e-mail to the designated NRLs including all EU countries and Iceland, Norway and Switzerland. In total 37 laboratories participated in the matrix EQAS (App. 2) involving one NRL from each of 28 MS (two from two countries, analysing meat and caecal sample in different laboratories), and from Iceland, Norway, and Serbia, plus additional laboratories. As results from only one laboratory per country are included in this report, 33 laboratory results from 31 countries are described. The exception was the two countries, who has different laboratories enrolled for handling meat and caecal samples, and therefore had two different NRLs enrolled.

Furthermore, one additional laboratory from each of Malta, the Netherlands, Spain and United Kingdom participated. These were invited based on their participation in previous EQAS iterations and/or affiliation to the EU network and provided results but were not included further in the report. Participants from non-EU MS were charged a fee for participation whereas participation was free of charge for EU MS, but each laboratory was expected to cover expenses associated with the analyses.

2.2 Preparation of samples

Eight samples were prepared and dispatched for isolation of ESBL, AmpC or carbapenemase-producing *E. coli*, including identification, and antimicrobial susceptibility testing (AST) of the obtained isolates. The samples included five chicken meat and three chicken caecal samples and were prepared either by spiking with test strains or unmodified.

The meat used to prepare the samples was minced chicken meat of Danish origin (raised, slaughtered and packed in Denmark) acquired in local supermarkets (four different batches were bought in sufficient amount for covering both the pre-tests and preparation of the samples). The

meat was pretested using the official method for selective isolation of *E. coli* producing ESBL, AmpC or carbapenemases to ensure the batch used was negative for those and contained some background flora. A batch fulfilling these criteria was chosen for preparation of aliquots of 25 g of meat that were either used directly as blank samples or spiked as follows.

The test isolates used in the spiking of meat samples within the EQAS matrix 2020 were prepared in advance and sub-cultured the day before sample preparation. For the sample preparation and standardization of the spiking, suspensions equal to McFarland 0.5 were prepared in saline tubes with the relevant isolates to contain about 10^8 CFU/mL, as confirmed by viable counts of serial dilutions on Luria Bertani (LB) agar plates. The standardized suspensions were further diluted in ten-fold dilutions and the meat samples (25 g) were spiked with 25 µl of the chosen dilutions. The spiking dilutions were chosen based on the results obtained in the previous matrix EQAS'. The final inoculum found in the samples in this EQAS was expected to be approx. 10^3 CFU/g meat, for the samples EURL-M-6.2, M-6.3, M-6.4 and M-6.5. The sample M-6.1 was spiked as mentioned above, however with a susceptible *E. coli* strain (ATCC 25922) and therefore expected to be negative.

One slaughterhouse provided on October 16th four batches of 50 chicken caecal samples from different flocks. These samples were pooled per flock and tested using the official selective isolation protocol for ESBL, AmpC and carbapenemase-producing *E. coli*.

One ESBL-negative caecal batch was chosen for preparation of the matrix caecal samples for the EQAS strains. Thereby 1 g aliquots of pooled caecal content was spiked with 10 µl of a dilution containing 10^6 CFU/ml, causing an expected spiking level of 10^4 CFU/g for the samples M-6.6, M-6.7 and M-6.8. In previous year's Matrix EQAS', it had in some cases proven difficult for the inoculum bacteria to remain viable in the caecal samples. This was the reason for inoculation of all three caecal sample sets with ESBL, AmpC or carbapenemase-producing *E. coli.*

The minimal inhibitory concentrations (MIC) of selected antimicrobials were determined using broth microdilution method both for the strains used for spiking during the preparation work and for the isolates obtained in the homogeneity testing after sample preparation to generate expected results (App. 3).

For follow-up on the stability of the inoculum in the matrix samples after shipping, repeated testing of isolation of test strains was performed on sets the eight samples in four time points after shipment (during two weeks). In this period, the meat and caecal samples were kept at 4°C, to mimic the conditions in the shipment parcel.

2.3 Isolation and identification of ESBL, AmpC or carbapenemase producing *E. coli* from meat and caecal samples

The official protocols for selective isolation and identification of the ESBL, AmpC and/or carbapenemase-producing *E. coli* isolates contained in the samples were available on the EURL website, http://www.eurl-ar.eu (App. 4). For the confirmation of *E. coli* isolates, different methods were allowed as these are not specified in the legislation (EU Commission implementing decision on the monitoring and reporting antimicrobial resistance in zoonotic and commensal bacteria 2013/652/EU). The description of the method used for selective isolation of presumptive ESBL, AmpC or carbapenemase-producing *E. coli* as well as species identification was requested as part of the methods sheet to be completed in the database upload system.

Table 1. Panel of antimicrobials recommended for susceptibility testing of bacteria included in this EQAS 2020 component

Escherichia coli EUVSEC	*Escherichia coli* EUVSEC2
Ampicillin, AMP	Cefepime, FEP
Azithromycin, AZI	Cefotaxime + clavulanic acid (F/C)
Cefotaxime, FOT	Cefotaxime, FOT
Ceftazidime, TAZ	Cefoxitin, FOX
Chloramphenicol, CHL	Ceftazidime, TAZ
Ciprofloxacin, CIP	Ceftazidime+ clavulanic acid (T/C)
Colistin, COL	Ertapenem, ETP
Gentamicin, GEN	Imipenem, IMI
Meropenem, MERO	Meropenem, MERO
Nalidixic acid, NAL	Temocillin, TRM
Sulfamethoxazole, SMX	
Tetracycline, TET	
Tigecycline, TGC	

2.4 Antimicrobial susceptibility testing

The panels of antimicrobials recommended for AST in this proficiency test are those included in the EU Commission implementing decision on the monitoring and reporting Antimicrobial resistance in zoonotic and commensal bacteria 2013/652/EU (Table 1).

Guidelines for performing the antimicrobial susceptibility testing using dilution methods were set according to the Clinical and Laboratory Standards Institute (CLSI) document – M7 (2018) "Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard - 11th Edition"" and whenever commercial methods were used, the guidelines of the manufacturer were followed.

MIC results were interpreted by using EUCAST epidemiological cut-off values (www.eucast.org), as included in the regulation referred above or as recommended by EFSA and described in the EQAS protocol (App. 4). Results of the ESBL confirmatory testing were interpreted according to the recommendations by EFSA and as referred in the regulation, using MIC testing on the second panel of antimicrobials, which is intended to be used every time a strain is found resistant to either cefotaxime, ceftazidime or meropenem.

2.5 Distribution

The meat samples were frozen at -80°C and kept at this temperature after preparation and until the time for shipment. The caecal samples were sent shortly after preparation, and therefore kept at 4°C until the time for shipment. At the day of shipment, the samples were tightly packed in thermos boxes with cooling elements, frozen at -80°C. The parcels contained the eight samples in tubes, and an additional tube contained a temperature logger to register the temperature at 15 min intervals during transport. Furthermore, the parcel contained a welcome letter with the login and password to the online database for the data upload and a labelled envelope for returning the temperature logger to the EURL-AR.

The protocol for the EQAS and the test forms

were available online on the EURL-AR website, http://www.eurl-ar.eu before launching this EQAS.

The thermo boxes used for the shipment of samples were enclosed in double pack containers and sent to the selected laboratories according to the International Air Transport Association (IATA) regulations as "Biological Substance category B" classified UN3373. The parcels were dispatched from DTU Food November 9th 2020.

2.6 Procedure

The laboratories were instructed to download the protocol and test forms (App. 4 and 5), from http://www.eurl-ar.eu and to process the samples following the EU protocol for selective isolation of presumptive ESBL, AmpC and/ carbapenemase producing *E. coli* from either meat or caecal samples, precisely as they would normally do for the EFSA monitoring. For the results collection the NRLs were instructed to upload of the data in the web based database, which was designed and prepared for this EQAS and opened after sample shipment and until the reporting deadline.

After completion of the tests, the laboratories were requested to enter the obtained results into the electronic sheet in the EURL-AR web based database through a secured individual login (App 5). The database was activated on the 21st of December 2020, and was closed January 31st 2021.

For the first part of the results of the selective isolation procedure for ESBL /AmpC and for carbapenemases, the results obtained from the isolation procedures samples were evaluated separately by defining the samples as positive if an isolate was obtained and positively identified as *E. coli*. Additionally, the results of susceptibility testing of the obtained isolates using both MIC panels were analysed separately in similar way as to the similarly to the *E. coli* AST EQAS, including the read values of MIC and their interpretations. As a conclusion of the susceptibility testing, the participants were asked to classify the isolates obtained according to the defined EFSA criteria for interpretation of ESBL/Ampc and/or carbapenemase producing isolates.

After the deadline, the qualitative results indicating if the samples were positive or negative for ESBL/AmpC, or carbapenemase-producing *E. coli* (OXA-48 and other), as well as the interpretations of the susceptibility tests results, and the conclusion on the observed *E. coli* phenotypes were evaluated against the expected results and scored as correct or incorrect. As no threshold is agreed the performance was evaluated case by case and not classified into acceptable or unacceptable based on the deviation percentage.

3. Results

Upon arrival of the parcels, the participants were requested to provide more information in a small introductory questionnaire on the database, including details on sample reception (measured temperature and date/time), the monitoring activities, and the methods used in their laboratory. The registration of the temperature was extracted and read to provide the temperature ranges along the shipment and at sample reception/opening. All but one samples were registered to be between -1°C and 4°C at arrival inferred from the temperature at opening time from the temperature logger registration and thereby all samples were expected to be in good conditions for testing at the time for opening of the parcels. The exception being one lab (#62) for which the shipping/custom handling of the parcel was delayed by 14 days, but luckily, this did not lead to deterioration of the samples.

Table 2. The overall performance of ESBL/AmpC isolation and identification, 2020.

Isolation of ESBL /AMPC from samples		Correctly classified samples	
Number of performed tests		Number of correct tests	
N	%	N	%
216	100	212	98.1
Number of expected negative tests		Number of correctly identified negative tests	
N	%	N	%
31	14.4	31	100
Number of expected positive tests		Number of correctly identified positive tests	
N	%	N	%
185	85.6	179	96.8

3.1 Data omitted from evaluation

One strain, M-6.6, with an expected carbapenem resistant phenotype, mediated by a VIM-1 gene, did not show a consistent carbapenemase phenotype for all participating laboratories. Overall, this strain was reported to have very wide variation in especially meropenem MIC (0.03 – 4 µg/mL) and ertapenem MIC (0.03 – 1 µg/mL). The MICs were tested twice by the EURL-AR after inoculation of the matrix samples, and the EURL-AR recorded 1 to 2 dilution steps differences, compared to the originally expected. Since this was a general problem, which affect both the AST results and the ESBL categorization, the M-6.6 strain was omitted from evaluation.

The meat and caecal matrices have a natural background of bacteria from the animal itself; there is a high possibility of presence of *E. coli* and other *Enterobacteriaceae*, which can even include ESBL producing bacteria, despite the pre-testing of both meat and caecal samples. This can affect the phenotypes obtained after re-isolation of the bacteria. Also, especially the caecal samples do not always support growth and viability of the inoculums. As such, a few deviations occurred, regarding the isolation of sample M-6.8 from the chicken caecal samples. Two laboratories (37 and 39) were not able to isolate *E. coli* from the sample M-6.8, which should contain an ESBL + AmpC positive *E. coli*. One additional lab (36) isolated an ESBL *E. coli* with an overall different phenotype, and by WGS analysis, this isolate was found to be completely unrelated to any of the originally inoculated strains, and thereby the strain M-6.8 was omitted for lab 36.

3.2 Overall results of selective isolation

The number of possible test results for ESBL/AmpC qualitative isolation considered for this report was 248 tests; eight samples from each of 31 countries. Due to the issues mentioned in previous section (3.1) and the resulting omission of data, the number of evaluated test results is 216 tests. These results are summarized in Table 2 and further discussed in section 3.4.

3.3 Methods used by EQAS-participants

In this trial, 33 participating NRL's reported

results for all the eight samples sent. Two laboratories reported only results for the meat samples (Labs, #38, and #41) and two laboratories reported only results for the caecal samples (Labs #32 and #58). All 33 participating laboratories, which have submitted results, participated in the ESBL and AmpC isolation and performed the identification and susceptibility testing of the respective isolates. Seven laboratories reported that they did not perform the optional carbapenemase selective isolation. The number of qualitative isolation tests results reported was variable, including results for three to eight samples, depending on how many samples were tested (four participants only tested meat or caecal sample while most others tested both), for the antimicrobial susceptibility test it depended on how many isolates were found and further tested in the MIC panels.

Information on the methods used for isolation, identification and typing was collected from the participants through the database. Most laboratories (n=32) reported that isolation had been performed following the exact procedures described in the protocol provided. One lab reported using a higher incubation temperature (44 ˚C). The species identification was performed using MALDI TOF (n=14), biochemical tests (n=12), or chromogenic media (n=8), and PCR using specific targets to confirm the ID (n=4). Additionally, some laboratories reported using second and third identification methods as supplement.

The broth microdilution testing was performed using the antimicrobials and ranges defined under the EU Commission regulation 652/2013 for testing the isolated and identified *E. coli* isolates using panel 1 (EUVSEC). Additional AST of the presumptive ESBL/AmpC and/or carbapenemase isolates was performed using panel 2 (EUVSEC2) if relevant and interpretation of the results according to the EFSA criteria for ESBL/AmpC and carbapenemase phenotypic classification.

3.4 ESBL /AmpC and carbapenemase producing *E. coli* isolation and identification

ESBL/AmpC

The total amount of test results was 216 tests for the ESBL/AmpC isolation qualitative results. All in all, 212 tests were assigned the correct ESBL/AmpC or carbapenemase phenotype, corresponding to 98 % correct results (Table 2 and 3). All of the 31 samples expected to be negative were correctly assigned. Regarding the 185 samples expected to be positive, all but six were correctly positive (96.8 %; hereof two were not isolated (in Lab #37 and #39) and four were not assigned the expected ESBL phenotype. The four deviations were observed by Lab #21 and #38 and two by Lab #45 (due to mix-up of strains). Unfortunately, one lab (#21) did not report panel 2 results for this particular isolate and therefore this could not be further elucidated.

Thus, the classification of ESBL/AmpC and carbapenemase phenotypes proved to be difficult, both due to occurrences of MIC for cefoxitin being close to the breakpoint, and due to lack of synergy. This is sought avoided by selection of strains with clear phenotypes, but despite focusing on this in the pre-testing of strains, the phenotypes happen to change after inoculation to matrices and re-isolation. Initially, in this round of samples, 48 out of 183 (26 %) ESBL/AmpC or carbapenemase positive samples were not assigned the expected phenotypes, and after assessment of the results, additional phenotypes were accepted for the strains M-6.2, M-6.7 and M-6.8 (See Table 3).

Other carbapenemases and OXA-48

The specific isolation of presumptive carbapenemase producing *E. coli* was performed by extending the protocol to include isolation on CARBA selective agar plates as described in the EURL-AR protocols. Seven labs did not perform the optional carbapenemase

Table 3 Deviations in ESBL /AmpC and carbapenemase phenotype identification

Strain	Expected phenotype*	Genetic basis	Deviations in %	Additional phenotype approved	Deviations in % after changed approval
M-6.1	Susceptible	-	0	None	0
M-6.2	ESBL + AmpC	TEM52C; AmpC mut	54.8	AmpC-phenotype	0
M-6.3	ESBL	CTX-M-1	6.5	None	6.5
M-6.4	ESBL	SHV12	3.2	None	3.2
M-6.5	Carbapenemase	NDM-4	0	None	0
M-6.6	Carbapenemase	VIM-1	19.4	Omitted	19.4
M-6.7	ESBL	CTX-M-15	45.2	ESBL+AmpC-phenotype	0
M-6.8	ESBL + AmpC	CMY2; blaCTX-M-1	50	AmpC-phenotype	3.6

*Expected phenotype based on both susceptibility testing and genomic analysis

selective isolation, but defined results based on the findings in the ESBL/AmpC selective method and AST results.

There were no problems in isolating the carbapenemase producing *E. coli*, since the selected strains were able to grow on the ESBL selective media. For the majority of laboratories, who did isolate carbapenemase producing *E. coli,* the plates were chosen by the laboratories as the protocol defines that any suitable plates for selective isolation of carbapenemase- and OXA-48-producing *E. coli* may be used. Most participants declared the use of the chromogenic agar ChromID CARBA and ChromID OXA or CARBA Smart combination plates (as reported by ten and eight participants, respectively). Some participants did not report the brand or specific type of plates being used for this purpose, but report that the EURL-AR protocol was followed.

3.5 Antimicrobial susceptibility testing

A total of 4,440 AST results were submitted and 4,392 (98.9 %) of these were correct. The 33 laboratories uploaded a variable number of results, depending on the samples found positive and isolates tested in one or both panels, ranging from 48 to 144 test results per participant. Of the 48 deviations detected, 14 were caused by one-dilution MIC differences, which in some cases (for FEP and TGC) resulted in a different susceptible/resistant interpretation, which is still regarded as acceptable deviations, but will nonetheless appear on the list of deviations (Appendix 8). Further, 23 deviations were caused by a mix-up of isolates by one lab (#45) and 12 deviations were caused by errors in reporting of resistant/susceptible interpretation or other errors in reporting.

The analysis per laboratory identified 15 laboratories with no deviations, while others had deviation percentages ranging from 0.7 % to 16 %. (Figure 1). As the performance on the AST depends on the isolation and identification procedures, no threshold was set for acceptance as the capacity for performing AST of *E. coli* is analysed more accurately in the *E. coli* AST EQAS. Additional feedback and follow-up has been performed with the laboratories reporting most deviations. In the analysis of deviations per antimicrobial, it was observed that the highest deviation percentage was found for cefoxitin (FOX; 7.1%)(Figure 2), but the majority of these (85 %) were caused by the one-dilution MIC differences, and can thereby be disregarded. Further, some deviations were observed for FOT (1.1%) and the combination of FOT+ clavulanic acid (2.7%; F/C), but the MIC values reported indicates a mix up between FOT and F/C MIC results. Otherwise, there were generally only few deviations (<5) per antimicrobial (Figure 2).

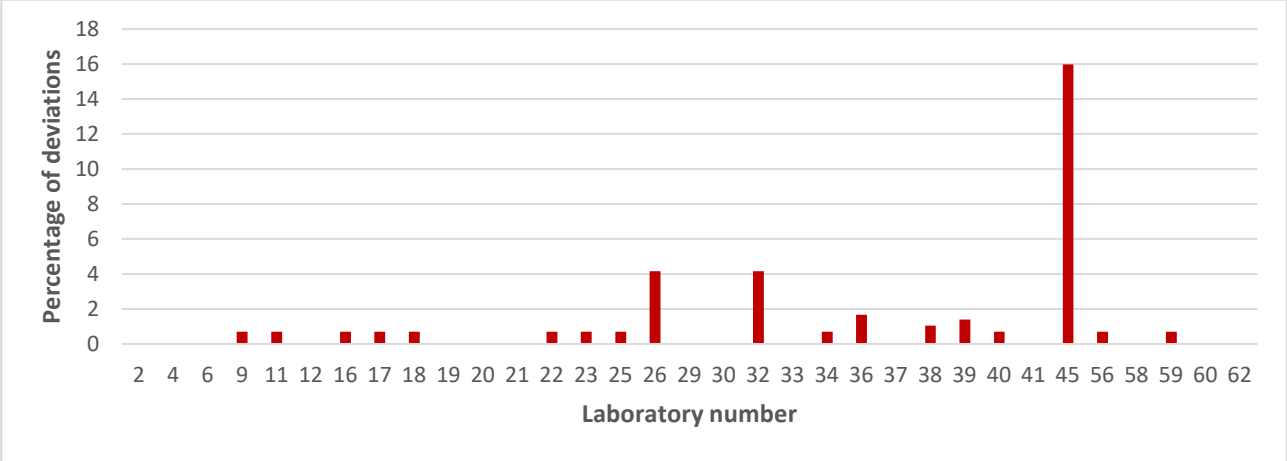

Figure 1. Percentages of deviations in antimicrobial susceptibility testing per participating laboratory

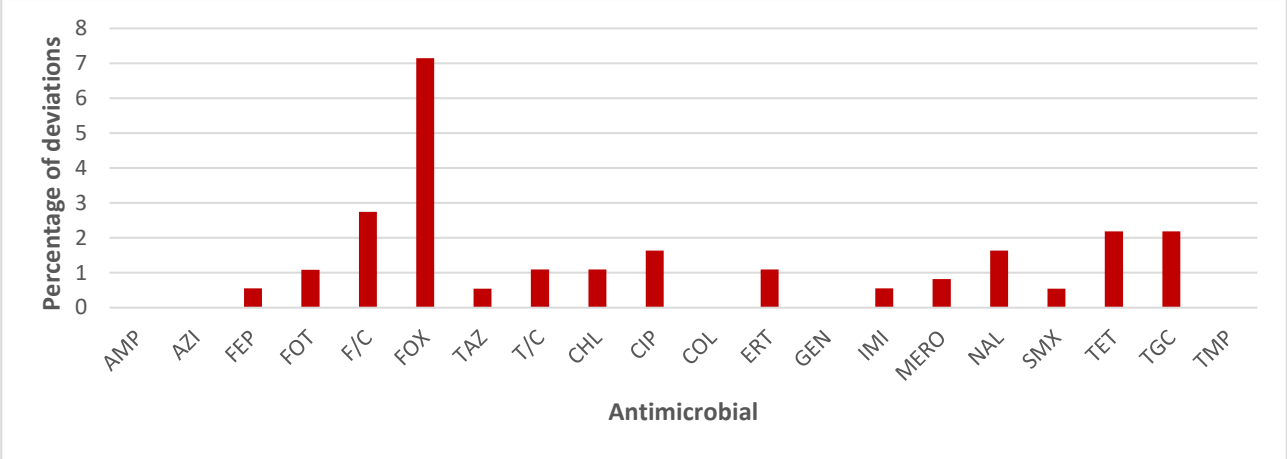

Figure 2. Percentages of deviations of AST results per antimicrobial in EQAS matrix 2020

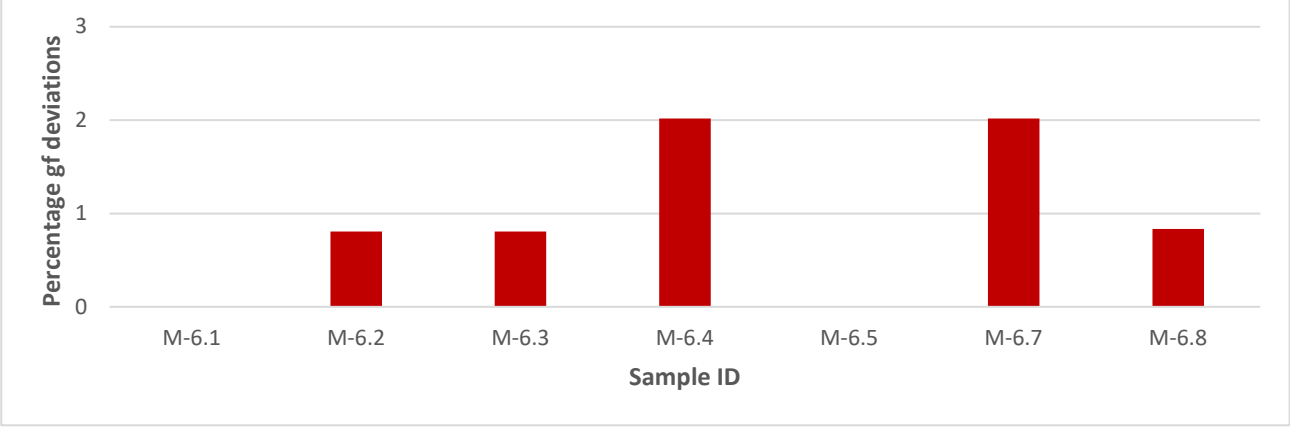

Figure 3. Percentages of AST deviations per sample in EQAS matrix 2020

The analysis of deviations per matrix sample indicates that the highest levels of deviations (15 deviations; 2.0 %) were observed for sample M-6.4 (meat) and M-6.7 (caecal). All other samples had deviation levels below 1 % (Figure 3).

3.6 ESBL/AmpC and carbapenemase phenotypic testing conclusions

Five chicken meat samples (M-6.1 – M-6.5) were included in this matrix EQAS. The sample M-6.2 contained an isolate expressing ESBL + AmpC phenotype by TEM52C and mutations in the AmpC promoter region; sample M-6.3 and M-6.4 contained strains with ESBL genes CTX-M-1 and SHV-12, respectively, whereas M-6.5 contained an NDM-4 gene, expressing carbapenemase phenotype. The last sample, M-6.1, was spiked with a susceptible strain of *E. coli* (Table 3).

Due to previous years' difficulties with survival of inoculum in caecal samples, all three caecal samples were spiked with resistant *E. coli.* M-6.6 contained an isolate expressing carbapenemase by VIM-1, whereas M-6.7 contained an ESBL, mediated by CTX-M-15 and M-6.8 contained an ESBL + AmpC with both CTX-M-1 and CMY2 genes. Unfortunately, the strain M-6.6 did not express a consistent level of carbapenemase activity, and was omitted from evaluation. Still, there were two caecal samples with ESBL/AmpC *E. coli* for evaluation in this report.

Overall, there were many difficulties with the differentiating between ESBL and AmpC phenotypes, as these were not in all cases as clear as expected The M-6.2 ESBL + AmpC did in more than half of the isolates not show synergy with clavulanic acid, and thereby only AmpC phenotype. The M-6.7 ESBL had in approx. 45 % of reports elevated cefoxitin MIC and hence an additional AmpC phenotype. Finally, M-6.8, which genotypically is ESBL + AmpC were in 50 % of reports not showing clavulanic acid synergy, and thereby only AmpC phenotype. Thus, due to the high number of deviations in the ESBL/AmpC phenotypes, additional phenotypes had to be accepted. Hereafter, only four deviations were reported. Two of these were caused by mix-up of strains, and the remaining two by variation in the cefoxitin MIC.

The strain M-6.8 appeared to be less viable compared to other inocula, and were not recovered in two labs. Additionally, one lab isolated a non-related *E. coli* (determined by WGS analysis), which had gained the CTX-M-1 gene, and thereby expressed ESBL. This single isolate was omitted from evaluation.

4. Discussion

4.1 ESBL and AmpC and carbapenemase-producing *E. coli* isolation and identification

The 2020 EURL-AR matrix EQAS trial was the sixth of its kind on samples of animal origin since the first round of this EQAS in 2015. Some challenges continue to be present; e.g. selection of test strains with abilities to survive in caecal samples, and adequate testing and selection of meat and caecal samples with a low level of background bacteria and absence of ESBL contamination. In this round, one test strain (M-6.8) was not successfully recovered by three laboratories, and four of the seven inoculated resistant *E. coli* did not completely maintain the expected phenotype after recovery from meat or caecal matrix samples. As the screening of matrix material only serves to reveal possible ESBL/AmpC/carbapenemase contamination per batch and a rough estimation of the level of background bacteria, it is practically impossible to avoid having generic *Enterobacteriaceae* or *E. coli* and sometimes even ESBL bacteria in some parts of the meat matrix. Though, this was less of a problem this year, compared to pervious rounds of the matrix EQAS. The main problem in the 2020 round was the inconsistent phenotypes, hindering the clear distinguishing between the ESBL/AmpC/carbapenemase phenotypes. This was causing omission of one carbapenemase producing test strain, which exhibited a variation in MIC of up to eight different concentrations for MERO and ETP, and a necessity for accepting additional phenotypes for three ESBL and ESBL + AmpC strains, due to variations in the FOX MIC just around the resistant/susceptible breakpoint.

In general, the ESBL/AmpC and carbapenemase *E. coli* isolation was very successful, with only three cases of failed recovery from a caecal sample (M-6.8). Regarding the laboratories that do not selectively isolate carbapenemase producing *E. coli*, they were still able to isolate and characterise these strains, based on the ESBL media and the MIC results. A list of deviations in ESBL phenotype interpretations is available in Appendix 8.

4.2 Antimicrobial susceptibility testing

It is in general a problem, when the expected MIC values are close to the breakpoint between susceptible and resistant. Although +/- one MIC level deviation is accepted, it is problematic when it changes the susceptible/resistant interpretation. Thus, it can be difficult to select test strains with clear phenotypes, expected to survive in the matrix, without making compromises on this point. This issue gave rise to the majority of AST deviations, especially for cefoxitin.

The remaining results, however, were generally very precise, but with an unusual high proportion of deviations that is more related to the sample and data handling and results interpretation, than to the performance and reading of MIC. This involved that 48 % of the deviations were related to mix of strains, and 25 % of deviations were related to errors in reporting of resistant/susceptible interpretation or other errors in reporting, like mixing up results of FOT and TAZ with F/C and T/Z, respectively. Overall, this could to some extent be explained by changes in the laboratory routines, caused by the restrictions and partial lock-downs that many of the laboratories were facing in late 2020. A full list of deviations in AST results is available in Appendix 8.

This year, 15 laboratories had no deviations in AST results, which in general shows an improvement over the years. But this is also

reflecting on the complications occurring with the unpredictable variations in phenotypes, that have a high impact on the overall results.

Thus, the challenges met were not unexpected, as working with isolates in a matrix is likely to cause problems like retrieving the right isolates from the samples, or that changes could have occurred in the isolate composition in the samples or the isolate characteristics (conjugation, or plasmid losses). Some of the deviating results were further caused by MIC results close to breakpoint, and this should carefully be considered when selecting the strains for spiking samples. Thus, some of the deviations seem to derive from either mix of samples or by wrong interpretation of a correct MIC.

4.3 ESBL /AmpC and carbapenemase phenotypic testing conclusions

As what regards to the final conclusions for the AST testing and phenotypic confirmation, the conclusions depends heavily on the isolation process, thus some of the deviations might be related to the isolation of strains that have different characteristics. Thus, the primary AST results, used for classification of ESBL, AmpC, carbapenemases or other phenotypes were generally very good, and overall correctly interpreted. But, in situations where participants compared the phenotype with the genotype, there have been some challenges, as these were not compatible for all strains. Thus, it is still important that participants interpret the results based on phenotype, as is the evaluation of results.

4.4 Performance in AST of the quality control strains

Antimicrobial susceptibility test results for the quality control strain was evaluated based on the CLSI quality control ranges (Appendix 6).

4.4.1 *Escherichia coli* ATCC 25922

It was the first time, the *E. coli* ATCC 25922 QC strain was included in the reporting of the EQAS results for the present EQAS. All the 33 participants tested *E. coli* ATCC 25922 by MIC determination and reported a total of 792 test results, of which 98.7 % were within the acceptable range (Table 4; Appendix 6). The majority of deviations (7 of 10) was reported by one lab (# 26), which reported MIC values of a resistant isolate instead of the *E. coli* ATCC 25922. Further, two deviations were caused by reporting non-existing MIC values (erroneous reporting) and the final deviation seem to be the only true deviation, with a report of a trimethoprim MIC one-step dilution value below the accepted range.

Table 4 Antimicrobial susceptibility testing of *Escherichia coli* ATCC 25922 by MIC determination

Antimicrobial	Proportion outside of range		Below accept. range	Above accept. range
Ampicillin	0/33	0%	–	–
Cefotaxime	1/63	1.6%	–	1
Ceftazidime	2/63	3.2%	–	2
Chloramphenicol	2/33	6%	2	–
Ciprofloxacin	1/33	3%	–	1
Colistin	0/33	0%	–	–
Gentamicin	0/33	0%	–	–
Meropenem	1/63	1.6%	–	1
Nalidixic acid	0/33	0%	–	–
Sulfamethoxazole	0/33	0%	–	–
Tetracycline	0/33	0%	–	–
Tigecycline	1/33	3%	–	1
Trimethoprim	2/33	6%	1	1
Cefepime	0/33	0%	–	–
Cefoxitin	0/33	0%	–	
Ertapenem	0/30	0%	–	–
Imipenem	0/30	0%	–	–

Further details on test results of quality control strains are reported in Appendix 7.

5. Conclusion

In general, the results of this matrix EQAS demonstrate that most participating labs have well established methods to isolate ESBL/ AmpC and carbapenemase-carrying strains from meat or caecal samples, despite the difficult nature of the matrices.

The susceptibility testing results were in general very satisfactory, with only few deviations. Thus, there are still some preventable deviations, including mix of strains and wrong interpretation of susceptible or resistant phenotypes, which seems to be more prevalent this year than previous years. This has also been noted in other EURL-AR activities, and it is likely that the somewhat troublesome times in the autumn of 2020, with Covid19 lockdowns and restrictions leading to changing in routines and staff has played a role in this.

6. References

EC 652/2013- COMMISSION IMPLEMENTING DECISION of 12 November 2013 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria.

7. Appendices

Appendix 1. Pre-notification EURL-AR EQAS matrix 2020
Appendix 2. List of participants
Appendix 3. Test strains and reference values (MIC in mg/L)
Appendix 4. Protocol EQAS matrix 2020
Appendix 5. Examples of Test forms EQAS matrix 2020
Appendix 6. QC ranges *E. coli* ATCC25922
Appendix 7. Reference strain results (MIC in mg/L) - *E. coli* ATCC 25922
Appendix 8. List of deviations

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2020

DTU Food
National Food Institute

EURL-AR EQAS pre-notification

G00-06-001/23.06.2017

EQAS 2020 FOR SELECTIVE ISOLATION OF *E. COLI* WITH PRESUMPTIVE ESBL, AMPC PHENOTYPES OR CARBAPENEMASES FROM MEAT OR CAECAL SAMPLES

The EURL-AR announces the launch of another EQAS on matrix samples, providing the opportunity for proficiency testing, which is considered an essential tool for the generation of reliable laboratory results of consistently good quality.

This EQAS consists of testing of eight samples for selective isolation of ESBL, AmpC or carbapenemase-presumptive *E. coli*. Additionally, which is new for this EQAS, quality control (QC) strains *E. coli* ATCC 25922 and *A. baumannii* 2012-70-100-69 will be included, and these will be distributed to participants on request.

This EQAS is targeted NRL's on antimicrobial resistance involved in the monitoring according to the EU Commission decision 652/2013 and specifically processing meat and/or caecal samples in the specific monitoring for ESBL implemented in 2015. You may contact the EQAS-Coordinator if you wish to inform of changes in relation to your level of participation in compared to previous years. Participation is free of charge for all above-mentioned designated laboratories.

TO AVOID DELAY IN SHIPPING THE ISOLATES TO YOUR LABORATORY

The content of the parcel is categorized as "UN3373, Biological Substance Category B". Eight samples which might contain ESBL, AmpC or carbapenemase-producing *E. coli* included in a matrix of chicken meat and/or chicken caecal will be shipped. Please provide the EQAS coordinator with documents or other information that can simplify customs procedures. We kindly ask you to send this information already at this stage.

TIMELINE FOR RESULTS TO BE RETURNED TO THE NATIONAL FOOD INSTITUTE

Shipment of isolates and protocol: The isolates are expected to be shipped in November 2020. The protocol for this proficiency test is available for download from the website (https://www.eurl-ar.eu/protocols.aspx).

Submission of results: Results must be submitted to the National Food Institute **no later than 11 December 2020** via the password-protected webtool. Upon reaching the deadline, each participating laboratory is kindly asked to enter the password-protected website once again to download an automatically generated evaluation report.

EQAS report: A report summarising and comparing results from all participants will be issued. In the report, laboratories will be presented coded, which ensures full anonymity. The EURL-AR and the EU Commission, only, will have access to un-coded results. The report will be publicly available.

Next EQAS: The next EURL-AR EQAS planned by the EURL-AR will be on antimicrobial susceptibility testing of *E. coli*, *Staphylococcus* and *Enterococcus* which will be carried out in 2021.

Please contact me if you have comments or questions regarding the EQAS.

Sincerely,

Jette Kjeldgaard, EURL-AR EQAS-Coordinator

Meat	Caecal	Institute	Country
x	x	Austrian Agency for Health and Food Safety	Austria
x	x	Institute of Public Health	Belgium
x	x	National Diagnostic and Research Veterinary Institute	Bulgaria
x	x	Croatian Veterinary Institut	Croatia
x	x	Veterinary Services	Cyprus
x	x	State Veterinary Institute Praha	Czech Republic
x	x	Danish Veterinary and Food Administration	Denmark
x	x	Estonian Veterinary and Food Laboratory	Estonia
x	x	Finnish Food Safety Authority EVIRA	Finland
x	x	Agence nationale de sécurité sanitaire alimentation, environnement, travail	France
x	x	Federal Institute for Risk Assessment	Germany
x	x	Veterinary Laboratory of Chalkida	Greece
x	x	Central Agricultural Office Veterinary Diagnostic Directorate	Hungary
x	x	Institute For Experimental Pathology, University of Iceland, KELDUR	Iceland
x	x	Central Veterinary Research Laboratory	Ireland
x	x	Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana	Italy
x	x	Institute of Food Safety, Animal Health and Environment BIOR	Latvia
x	x	National Food and Veterinary Risk Assessment Institute	Lithuania
x	x	Laboratoire de Medecine Vétérinaire	Luxembourg
x	x	Public Health Laboratory	Malta
x	x	National Veterinary Laboratory*	Malta
x	x	Wageningen Bioveterinary Research (WBVR)	Netherlands
x	x	The Netherlands Food and Consumer Product Safety Authority*	Netherlands
x	x	Veterinærinstituttet	Norway
x	x	National Veterinary Research Institute	Poland
x	x	Instituto Nacional de Investigação Agrária e Veterinária	Portugal
	x	Institute for Diagnosis and Animal Health	Romania
x		Institute for Hygiene and Veterinary Public Health	Romania
x	x	Scientific Veterinary Institute (Novi Sad)	Serbia
x	x	State Veterinary and Food Institute (SVFI)	Slovakia
x	x	National Veterinary Institute	Slovenia
	x	Laboratorio Central de Veterinaria	Spain
x		Centro Nacional de Alimentación (AECOSAN)	Spain
x	x	Foodborne Zoonoses and Antimicrobial Resistance Unit (ZTA)*	Spain
x	x	National Veterinary Institute, SVA	Sweden
	x	Agri-Food and Biosciences Institute*	United Kingdom
x	x	Animal Plant Helath Agency	United Kingdom

Designated NRL-AR by the compentent authority of the member state

Non-NRL-AR enrolled by the EURL-AR

Not a Member State of the EU

* Submitted results were not included in the current report (one dataset per country, only)

Panel 1

Strain	SMX	TMP	CIP	TET	MERO	AZI	NAL	CHL	FOT	TGC	COL	TAZ	AMP	GEN	ESBL prediction
EURL-M-6.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Susceptible
EURL-M-6.2	>1024	0.5	8	64	≤0.03	8	>128	128	>4	≤0.25	≤1	>8	>64	1	ESBL + AmpC
EURL-M-6.3	>1024	0.5	>8	>64	≤0.03	4	>128	≤8	>4	≤0.25	≤1	4	>64	≤0.5	ESBL
EURL-M-6.4	≤8	≤0.25	2	>64	≤0.03	4	>128	≤8	>4	≤0.25	≤1	>8	>64	1	ESBL
EURL-M-6.5	>1024	>32	0.03	≤2	>16	8	<=4	16	>4	≤0.25	≤1	>8	>64	1	Carbapenem
EURL-M-6.6	>1024	≤0.25	≤0.015	≤2	0.25	8	<=4	≤8	>4	≤0.25	≤1	>8	>64	4	Carbapenem
EURL-M-6.7	>1024	0.5	>8	>64	≤0.03	16	>128	≤8	>4	0.5	≤1	8	>64	≤0.5	ESBL
EURL-M-6.8	>1024	≤0.25	≤0.015	≤2	≤0.03	4	<=4	≤8	>4	≤0.25	≤1	8	>64	≤0.5	ESBL + AmpC

Interpretation

Strain	SMX	TMP	CIP	TET	MERO	AZI	NAL	CHL	FOT	TGC	COL	TAZ	AMP	GEN	ESBL prediction
EURL-M-6.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Susceptible
EURL-M-6.2	R	S	R	R	S	S	R	R	R	S	S	R	R	S	ESBL + AmpC
EURL-M-6.3	R	S	R	R	S	S	R	S	R	S	S	R	R	S	ESBL
EURL-M-6.4	S	S	R	R	S	S	R	S	R	S	S	R	R	S	ESBL
EURL-M-6.5	R	S	S	S		S	S	S	R	S	S	R	R	S	Carbapenem
EURL-M-6.6	R	S	S	S	R	S	S	S	R	S	S	R	R	R	Carbapenem
EURL-M-6.7	R	S	R	R	S	S	R	S	R	S	S	R	R	S	ESBL
EURL-M-6.8	R	S	S	S	S	S	S	S	R	S	S	R	R	S	ESBL + AmpC

Panel 2

Strain	FOX	ETP	IMI	MERO	TAZ	FEP	FOT+CL	TAZ+CL	FOT	TRM	ESBL prediction	Gene
EURL-M-6.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Susceptible	-
EURL-M-6.2	32	0.03	0.25	≤0.03	16	2	1/4	2/4	16	16	ESBL + AmpC	TEM52C; mutation C42T
EURL-M-6.3	16	≤0.015	≤0.12	≤0.03	4	16	≤0.06/4	0.25/4	64	8	ESBL	blaCTX-M-1
EURL-M-6.4	4	≤0.015	≤0.12	≤0.03	16	0.5	≤0.06/4	≤0.12/4	4	4	ESBL	blaSHV12
EURL-M-6.5	>64	>2	16	>16	>128	>32	>64/4	>128/4	>64	64	Carbapenem	NDM-4
EURL-M-6.6	64	0.25	4	0.25	128	16	64	128	64	64	Carbapenem	VIM-1
EURL-M-6.7	16	≤0.015	≤0.12	≤0.03	8	16	0.12/4	0.25/4	>64	8	ESBL	CTX-M-15
EURL-M-6.8	64	0.03	≤0.12	≤0.03	8	8	8/4	4/4	64	4	ESBL + AmpC	blaCMY2; blaCTX-M-1

Strain	FOX	ETP	IMI	MERO	TAZ	FEP	FOT+CL	TAZ+CL	FOT	TRM	ESBL conclusion	Gene
EURL-M-6.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	Susceptible	
EURL-M-6.2	R	S	S	S	R	R	R	R	R	NA	ESBL + AmpC	TEM52C; mutation C42T
EURL-M-6.3	R	S	S	S	R	R	S	S	R	NA	ESBL	blaCTX-M-1
EURL-M-6.4	S	S	S	S	R	R	S	S	R	NA	ESBL	blaSHV12
EURL-M-6.5	R	R	R	R	R	R	R	R	R	NA	Carbapenem	NDM-4
EURL-M-6.6	R	R	R	S	R	R	R	R	R	NA	Carbapenem	VIM-1
EURL-M-6.7	R	S	S	R	R	R	S	S	R	NA	ESBL	CTX-M-15
EURL-M-6.8	R	S	S	R	R	R	R	R	R	NA	ESBL + AmpC	blaCMY2; blaCTX-M-1

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2020

DTU Food
National Food Institute

PROTOCOL

for selective isolation of presumptive ESBL-, AmpC- and carbapenemase-producing *Escherichia coli* from meat and caecal samples (Matrix EQAS)

Table of contents

1 INTRODUCTION

The organisation and implementation of an External Quality Assurance System (EQAS) on selective isolation of presumptive extended spectrum beta-lactamase (ESBL)-, AmpC- or carbapenemase-producing *E. coli* is among the tasks of the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR), and will include the selective isolation procedures and antimicrobial susceptibility testing (AST) of obtained isolates of eight samples of either meat or caecal content. In 2020, these eight samples will include five 25-g samples of chicken meat and three 1-g samples of chicken caecal content. These samples may contain *E. coli* presumptive of producing either ESBL-, AmpC- or carbapenemase-enzymes.

It is expected that the participating laboratories apply the same analysis procedures used in the monitoring, described by the regulation EC/652/2013, and perform the selective isolation following the by EU recommended methods, published on the EURL-AR website www.eurl-ar.eu.

2 OBJECTIVES

This EQAS aims to assess and, if necessary, to improve the quality of results obtained in the selective isolation of presumptive ESBL-, AmpC- or carbapenemase-producing isolates from meat and caecal samples. Further objectives are to evaluate and improve the comparability of surveillance data on ESBL-, AmpC- or carbapenemase -producing *E. coli* reported to EFSA by different laboratories.

Appendix 3. Test strains and reference

3 OUTLINE OF THE EQAS

3.1 Shipping, receipt and storage of samples

In November 2020, the National Reference Laboratories for Antimicrobial Resistance (NRL-AR) will receive a parcel containing eight samples from the National Food Institute. All strains used in the spiking of samples belong to UN3373, Biological substance, category B. Participants should expect that ESBL-, AmpC- and/or carbapenemase-enzymes producing strains will be included in some of the sample matrices.

The samples will be spiked matrices of either chicken meat or chicken caecal content and will be distributed already weighed and ready to be tested, in tubes labelled from 6.1 to 6.8. Hereof 6.1 to 6.5 being samples of meat (each 25 g) and 6.6 to 6.8 being samples of caecal content (each 1 g).

The matrix samples will be shipped on November 9th in chilled state in separate tubes and contained in a cooling box with a temperature logging devices and cooling elements.

Upon arrival, it is very important to open the parcel as soon as possible and proceed to the analysis (following the normal procedures for sample testing in the monitoring).

It is required that participants

- **when opening the parcel, note the date and exact time at opening (this data is very important to follow the temperature data checks)**
- **proceed to sample analysis immediately after opening the parcel**
- **register the date for start of analysis for each sample**
- **collect the temperature logging device (small discoid device located in a bag inserted in a labelled tube, located inside the parcel);** open the tube and take out the bag with the device inside. Place this bag with the device in the labelled bubble envelope provided and return it to the EURL-AR as soon as possible. Please note that you will have to arrange for stamps/postage (the post systems differ from country to country, why this cannot be arranged and paid from the EURL-AR in advance).

3.2 QC reference strains

Include the *E. coli* ATCC25922 and *Acinetobacter baumannii* (2012-70-100-69) reference strains in the MIC testing, and report results of these together with the isolates obtained from the EQAS samples. Note that, for the testing of the *E. coli* ATCC25922 reference strain, the two compounds, sulfamethoxazole and sulfisoxazole, are regarded as comparable, i.e. the obtained MIC-value from the testing of sulfamethoxazole will be evaluated against the acceptance range listed in CLSI M100 for sulfisoxazole.

3.3 Selective isolation of ESBL, AmpC or carbapenemase producing *E. coli* from the samples

The samples provided in each parcel are weighed beforehand and therefore no further weighing is required. Proceed immediately to the first enrichment step by adding the sample to the necessary volume of media (225 ml of Buffered Peptone water for the meat samples and 9 ml for the caecal samples) as referred in the official EURL-AR protocols. **Results should be produced according to the laboratory's routine procedures for antimicrobial susceptibility testing by MIC determination.** All the following procedures should follow the methods used in the monitoring for ESBL and AmpC *E. coli* according to the EC/652/2013 regulation. If any changes are introduced to the official protocols, these changes should be described with details in the online database on the methods upload page. The participants are responsible for assuring the validity of the plates and therefore the protocol for "Validation of selective MacConkey agar plates supplemented with 1 mg/L cefotaxime for monitoring of ESBL and AmpC producing *E. coli* in meat and animals" should be run beforehand, as stated on the EURL-AR webpage (see http://eurl-ar.eu/233-protocols.htm).

Optionally, the participants may perform the additional plating for isolation of carbapenemase-producing *E. coli* from the samples, following the official protocols and plating on suitable agar plates. Similarly, the agar plates used for the carbapenemase isolation should be validated using the protocol for "Validation of selective and indicative agar plates for monitoring of carbapenemase-producing *E. coli*".

The officially recommended protocols are found on the EURL-AR webpage (http://eurl-ar.eu/233-protocols.htm):

- Follow the protocol for meat when testing samples 6.1 to 6.5
- Follow the protocol for caecal content when testing samples 6.6 to 6.8

As referred in these protocols, the isolates obtained from isolation procedure should be identified as *E. coli* using the procedures for *E. coli* species identification applied at the participant's laboratory for the specific monitoring of ESBL- and AmpC-producing *E.coli*.

Please store the isolates obtained in the isolation procedure and document the whole process as well as all the findings in each step.

As part of the results submission, you will be requested to describe the findings along the enrichment process and selective isolation including growth in the media, isolation of suspected

colonies, species identification results and finally regarding the finding (or not) of presumptive *E. coli* isolates harbouring one of the selected resistances (this result will be evaluated in relation to the expected result as a qualitative result) (see details in the Test Form).

3.4 Antimicrobial susceptibility testing

If the sample is deemed positive for ESBL- , AmpC- or carbapenemase -producing *E. coli*, one *E. coli* isolate per sample should be taken further and tested for susceptibility to antimicrobials as stated in the EU regulation (antimicrobials listed in Tables 1 and 2 in this document). Only one *E.coli* isolate is expected to be tested for AST and these results will be evaluated in the database comparing to expected results. Appendix 3. Tet strains and

AST results to be reported should be from:

- A presumptive carbapenemase positive isolate (from the CARBA or OXA-48 selective plates), if this optional part was performed and a presumptive carbapenemase positive *E. coli* isolate was detected.
- An ESBL- or AmpC-presumptive isolate (if you do not have a carbapenemase positive isolate or if you did not perform the optional plating) if an ESBL- or AmpC-presumptive isolate was detected.

The testing should be performed using the same method as implemented in your laboratory for performing AST when monitoring for EFSA according to the regulation EC/652/2013 (using the two-step approach, i.e. both testing panels) and applying the interpretative criteria listed below.

Table 1. Antimicrobials recommended for AST of *Escherichia coli* and interpretative criteria according to table 1 in Commission Implementing Decision 2013/652/EU

Antimicrobials for *E. coli*	MIC (mg/L) **R is >**
Ampicillin, AMP	8
Azithromycin, AZI	16*
Cefotaxime, FOT	0.25
Ceftazidime, TAZ	0.5
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	0.064
Colistin, COL	2
Gentamicin, GEN	2
Meropenem, MERO	0.125
Nalidixic acid, NAL	16
Sulfamethoxazole, SMX	64
Tetracycline, TET	8
Tigecycline, TGC	0.5
Trimethoprim, TMP	2

* Tentative ECOFF

Plasmid-mediated quinolone resistance

When performing AST of *E. coli*, the interpretative criteria listed in Table 1 for results obtained by MIC-determination should allow detection of plasmid-mediated quinolone-resistant test strains.

Beta-lactam resistance

Confirmatory testing for ESBL production is mandatory on all strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) and should be performed by testing the second panel of antimicrobials (Table 2).

Table 2. Antimicrobials recommended for additional AST of *Escherichia coli* resistant to cefotaxime, ceftazidime or meropenem and interpretative criteria according to Table 4 in Commission Implementing Decision 2013/652/EU.

Antimicrobials for *E. coli*	MIC (mg/L) **R is >**
Cefepime, FEP	0.125
Cefotaxime, FOT	0.25
Cefotaxime + clavulanic acid (F/C)	**0.25**
Cefoxitin, FOX	8
Ceftazidime, TAZ	0.5
Ceftazidime+ clavulanic acid (T/C)	**0.5**
Ertapenem, ETP	0.064*
Imipenem, IMI	0.5
Meropenem, MERO	0.125
Temocillin, TRM	>32*

*Tentative ECOFF

Confirmatory test for ESBL production requires use of both cefotaxime (FOT) and ceftazidime (TAZ) alone and in combination with a β-lactamase inhibitor (clavulanic acid). Synergy is defined either as i) a ≥ 3 twofold concentration decrease in an MIC for either antimicrobial agent tested in combination with clavulanic acid vs. the MIC of the agent when tested alone (MIC FOT : FOT/CL or TAZ : TAZ/CL ratio ≥ 8) (CLSI M100 Table 3A, Tests for ESBLs). The presence of synergy indicates ESBL production.

Confirmatory test for carbapenemase production requires the testing of meropenem (MERO).

Detection of AmpC-type beta-lactamases can be performed by testing the bacterium for susceptibility to cefoxitin (FOX). Resistance to FOX could indicate the presence of an AmpC-type beta-lactamase.

The classification of the phenotypic results should be based on the most recent EFSA recommendations (EURL-AR Workshop 2016; https://www.eurl-

ar.eu/CustomerData/Files/Folders/3-workshop-kgs-lyngby-april2016/25_efsa-eusr-amr-workflow-and-criteria-for-esbl-ampc-carbapenemase-phenotypes.pdf and in the appendix to this protocol).

4 REPORTING OF RESULTS AND EVALUATION

Test forms are available for recording your results before you enter them into the web tool.

4.1 General recommendations for data upload

We recommend reading carefully the description reported in paragraph 5 before entering your results in the web database. **Results must be submitted no later than 11th, December, 2020.** After the deadline when all participants have uploaded results, you will be able to login to the database once again, and to view and print an automatically generated report evaluating your results. Results in agreement with the expected interpretation are categorised as 'correct', while results deviating from the expected interpretation are categorised as 'incorrect'.

If you experience difficulties in entering your results, please contact us directly.

All results will be summarized in a report which will be publicly available. The data in the report will be presented with laboratory codes. A laboratory code is known to the individual laboratory, whereas the complete list of laboratories and their codes is confidential and known only to the EURL-AR and the EU Commission. All conclusions will be public.

If you have questions, please do not hesitate to contact the EQAS Coordinator:

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National Food Institute
Technical University of Denmark
Kemitorvet, Building 204,

DK-2800 Lyngby

Denmark

Tel: +45 3588 6269

E-mail: jetk@food.dtu.dk

5 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE

The 'guideline for submission of results via webtool' is available for download directly from the EURL-AR website (https://www.eurl-ar.eu/eqas.aspx).

Access the webtool using this address: https://amr-eqas.dtu.dk. Please follow the guideline carefully and **remember to access the webtool via an 'incognito' website**.

When you submit your results, remember to have by your side the completed test forms.

Do not hesitate to contact us if you experience difficulties with the webtool.

Before finally submitting your input for *E. coli*, *Salmonella* and *Campylobacter*, respectively, please ensure that you have filled in all the relevant fields as **you can only 'finally submit' once for each organism!** 'Final submit' blocks data entry.

⇨ About login to the webtool:

When first given access to login to the webtool, your **personal** loginID and password were sent to you by email. This is relevant for two email addresses connected to each NRL-AR (the EURL-AR defined a primary and a secondary contact).
Note that:

a) If the EURL-AR has only one contact person for an NRL, this person is registered both as primary and secondary contact. Should you like to add another person as the secondary contact, please contact jetk@food.dtu.dk
b) If your laboratory has two or more contact points on the EURL-AR contact list, two have been defined as the primary and secondary contact. Should you like to make changes to the primary and secondary contact or should you like more than the two persons to be able to access the webtool, please contact jetk@food.dtu.dk.

All participants registered with an account in the submission webtool will receive a separate email presenting the relevant personal username and password. The email will be sent by the time when the webtool has gone through internal quality control and has been approved for user access. The EQAS Coordinator will let all participants know when to look out for it.

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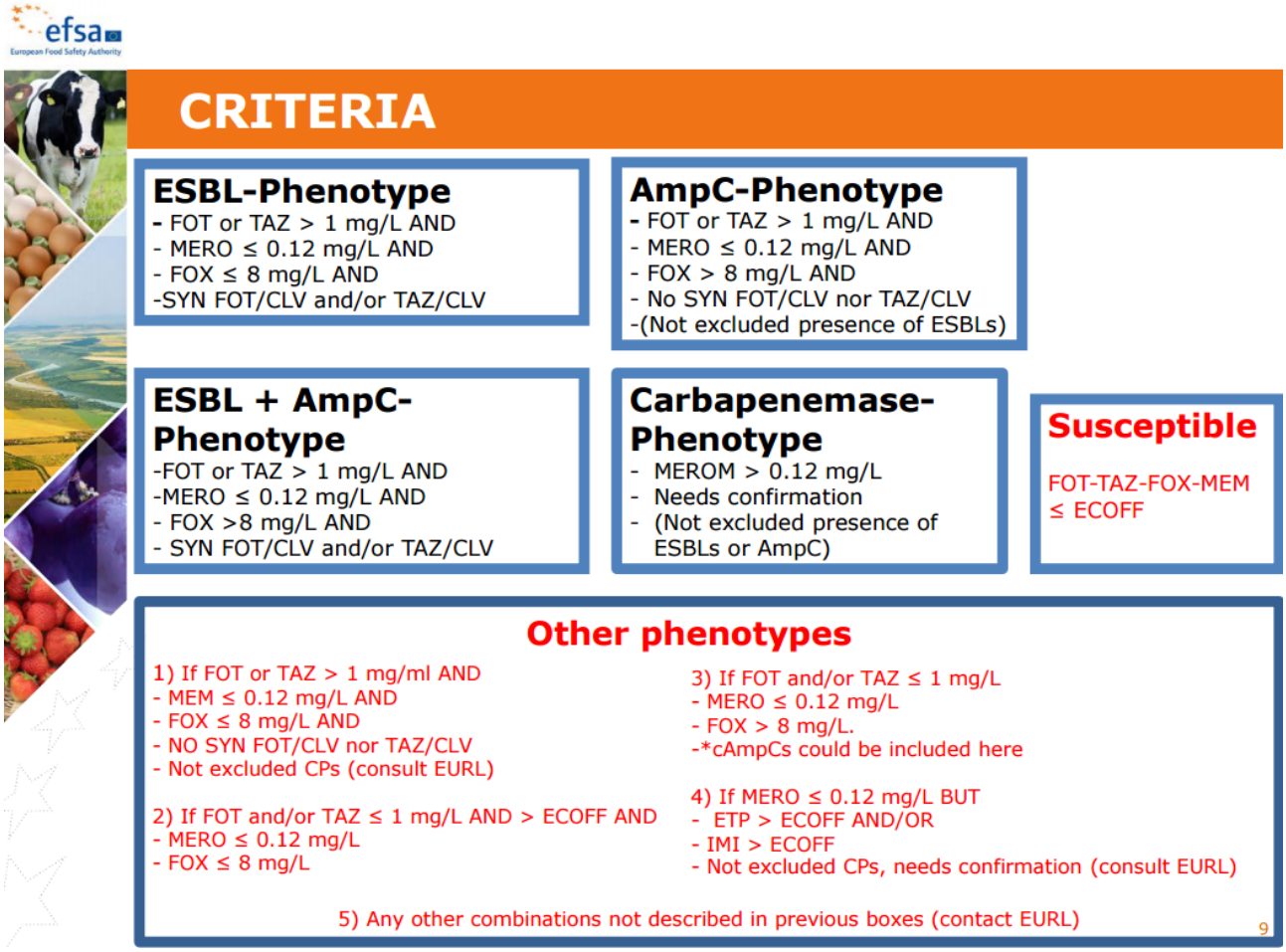
APPENDIX

Criteria for interpretation of *Escherichia coli*, panel 2 results



Please refer to: EFSA (European Food Safety Authority) and ECDC (European Centre for Disease Prevention and Control), 2020. The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2017/2018. EFSA Journal 2020;18 (3). https://doi.org/10.2903/j.efsa.2020.6007 (Annex A).

EU Reference Laboratory for Antimicrobial Resistance
Isolation of ESBL/AmpC- and carbapenemase-producers
External Quality Assurance System (Matrix EQAS) 2020

Test forms,

Isolation of ESBL/AmpC- and carbapenemase-producers from matrices

Username:
Contact person:

Country:
Date for filling in test forms:

SAMPLES

Reception date and exact time of opening the parcel of the proficiency test samples at the laboratory: (date and time is required)

Temperature of the contents of the parcel at arrival: °C

How many samples did your laboratory process in 2020 for monitoring of ESBL/AmpC-detection in relation to 2013/652/EU? (choose only one option)

- ☐ None
- ☐ less than 100
- ☐ 101-200
- ☐ 201-300
- ☐ 301-400
- ☐ 401- 1000
- ☐ more than 1000

Which kind of samples did your laboratory process in 2020 for monitoring of ESBL/AmpC-detection in relation to 2013/652/EU? (you may choose more than one option)

- ☐ None
- ☐ Caecal, chicken
- ☐ Meat, chicken
- ☐ other matrices, please specify:

Did you process samples for carbapenemase-selective isolation?

- ☐ Yes
- ☐ No

How many samples did your laboratory process in 2020 for monitoring of carbapenemases in relation to 2013/652/EU? (Choose only one option)

- ☐ None
- ☐ less than 100
- ☐ 101-200
- ☐ 201-300
- ☐ 301-400
- ☐ 401- 1000
- ☐ more than 1000

Which kind of samples did your laboratory process in 2020 for monitoring of carbapenemase-production in relation to 2013/652/EU? (you may choose more than one option)

- ☐ None
- ☐ caecal, chicken
- ☐ meat, chicken
- ☐ other matrices, please specify:

Any other comments:

METHODS

1- Method used for selective isolation of ESBL/AmpC in this EQAS:

Selective isolation procedure using the EURL recommended protocols that refer to the EU regulation 652/2013/EU

☐ The protocol was used without modifications (please jump to question 2)

☐ The protocol was used, however, the pre-enrichment was modified (please respond question 1.1)

☐ The protocol was used, however, the selective isolation procedures were modified (please respond question 1.2)

☐ The protocol was used, however, the incubation conditions in the selective plating were modified (please respond question 1.3)

1.1- If you modified the pre-enrichment, please indicate the differences introduced:

Different sample amount (weight) used for the enrichment procedure:
g in meat samples
g for caecal samples

Different volume of enrichment in the isolation step:
ml for meat samples
ml for caecal samples

Different pre-enrichment medium:
Different incubation conditions in pre-enrichment °C/ h;

Please justify these changes:

1.2- If you made changes in the selective isolation procedure:

Different sample amount (weight) used for the enrichment procedure:
g in meat samples
g for caecal samples

Different concentration of cefotaxime: mg/L
Different antimicrobial
Different medium
Please justify these changes:

1.3- If you used different incubation conditions in the selective plating, please indicate the conditions used: °C/ h;

Please justify these changes:

2- Method used for selective isolation of carbapenemase-producers (in case you run this method) in this EQAS:

Selective isolation procedure using the EURL recommended protocols for isolation of carbapenemase-producers:

- ☐ We did not perform carbapenemase selective isolation
- ☐ The protocol was used without modifications
- ☐ The protocol was modified

Plates used (brand/type)
Please justify these changes:

3- Method used for confirmation of *E. coli* species identification. Please indicate the primary *E. coli* identification method used (choose only one option; if you used more than one method, please explain in the comments field)

- ☐ PCR using published methods
- ☐ PCR using in-house method
- ☐ Biochemical tests
- ☐ MALDI-ToF
- ☐ DNA Sequencing
- ☐ Chromogenic media

Comments:

4- Method used for general antimicrobial susceptibility testing of the strains (choose only one option)

- ☐ Microbroth dilution test on EUVSEC panel
- ☐ Microbroth dilution test on another panel
- ☐ Agar dilution method
- ☐ E-test
- ☐ Disk diffusion test

5- Method used for phenotypic confirmatory testing of ESBL/AmpC (choose only one option)

- ☐ Microbroth dilution test on EUVSEC2 panel
- ☐ Microbroth dilution test on another panel
- ☐ Agar dilution method
- ☐ E-test
- ☐ Disk diffusion test

6- Additional comments. Please include here description and justification of your choice if you modified something in relation to the method defined in the EU regulation 2013/652/EU:

TEST FORM – SAMPLE 'EURL M-6.1'

Date the isolation procedure was started:

Please describe the results you have observed regarding this sample:

Visible growth in pre-enrichment:
Yes ☐/ No☐

Growth on ESBL/AmpC-selective plates:
Yes ☐ / No ☐

Please describe the growth observed on ESBL/AmpC-selective plates? (choose only one option)
☐ Mixed culture containing typical *E. coli* colonies
☐ Mixed culture without typical *E. coli* colonies
☐ Pure culture of typical *E. coli* colonies
☐ Pure culture without typical *E. coli* colonies
☐ No growth

Results of species identification: (choose only one option)
☐ No isolates tested (sample negative)
☐ Presumptive ESBL/AmpC isolate identified as *E. coli* (sample considered positive)
Comments:

Did you perform carbapenemase selective plating?
Yes ☐ / No ☐

Growth on CARBA-selective plates:
Yes ☐ / No ☐

Growth on OXA-48 selective plates:
Yes ☐ / No ☐

Results of species identification (isolates from carbapenemase selective plating): (choose only one option)
☐ No isolates tested (sample negative)
☐ Presumptive other carbapenemase isolate identified as *E. coli* (sample considered positive)
☐ Presumptive OXA-48 isolate identified as *E. coli* (sample considered positive)
Comments:

If you have found a presumptive carbapenemase positive isolate, please insert the results of antimicrobial susceptibility testing for the selected *E. coli* isolate, if you do not have a carbapenemase positive isolate and you have an ESBL presumptive isolate, please insert the results for this isolate (only one *E.coli* isolate is expected to be tested and these results will be evaluated in our database against the expected results).

Please confirm where the isolate tested for antimicrobial susceptibility originated from (compulsory):

☐ ESBL/ampC isolation on MacConkey with cefotaxime
☐ CARBA plate
☐ OXA-48 plate

Based on the results from the first AST panel, was the isolate found resistant to cefotaxime, ceftazidime or meropenem so that the second panel was tested?

Yes ☐ / No ☐

AST results

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (mg/L)	S / R
E. coli EURL M-6.1	Ampicillin, AMP			
	Azithromycin, AZI			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

Second *E. coli* AST panel (confirmatory testing for ESBL/AmpC/carbapenemase-production)

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (mg/L)	S / R
E. coli EURL M-6.1	Cefepime, FEP			
	Cefotaxime + clavulanic acid (F/C)			
	Cefotaxime, FOT			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Conclusions of confirmatory phenotypic testing: (choose only one option and please note that the final result will be evaluated by the database)

Interpretation of PANEL 2 results:

☐ Presumptive ESBL	☐ Presumptive AmpC	☐ Other phenotype
☐ Presumptive ESBL+ AmpC	☐ Presumptive carbapenemase	☐ Susceptible

Comments (include optional genotype or other results):

***Escherichia coli* ATCC 25922**

Panel	Antimicrobial	Abbreviation	Acceptable range	
			Min	Max
Panel 1	Ampicillin	AMP	2	8
Panel 1	Azithromycin	AZI	NA	NA
Panel 1	Cefotaxime	FOT	0,03	0,12
Panel 1	Ceftazidime	TAZ	0,06	0,5
Panel 1	Chloramphenicol	CHL	2	8
Panel 1	Ciprofloxacin	CIP	0,004	0,016
Panel 1	Colistin	COL	0,25	2
Panel 1	Gentamicin	GEN	0,25	1
Panel 1	Meropenem	MER	0,008	0,06
Panel 1	Nalidixic acid	NAL	1	4
Panel 1	Sulfamethoxazole	SMX	8	32
Panel 1	Tetracycline	TET	0,5	2
Panel 1	Tigecycline	TGC	0,03	0,25
Panel 1	Trimethoprim	TMP	0,5	2
Panel 2	Cefepime	FEP	0,016	0,12
Panel 2	Cefotaxime/clavulanic acid	F/C	NA	NA
Panel 2	Cefotaxime	FOT	0,03	0,12
Panel 2	Cefoxitin	FOX	2	8
Panel 2	Ceftazidime	TAZ	0,06	0,5
Panel 2	Ceftazidime/clavulanic acid	T/C	NA	NA
Panel 2	Ertapenem	ETP	0,004	0,016
Panel 2	Imipenem	IMI	0,06	0,25
Panel 2	Meropenem	MER	0,008	0,06
Panel 2	Temocillin	TRM	NA	NA

NA, not available

Lab Number	Strain	Panel	Antimicrobial	Operator to obtained value	Obtained value	Min Value	Max Value	Score
2	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
2	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
2	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
2	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
2	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
2	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
2	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
2	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
2	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
2	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
2	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
2	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
2	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
2	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
2	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
2	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
2	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
2	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
2	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
2	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
2	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
2	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
2	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
2	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
4	Escherichia coli ATCC25922	1	Ampicillin	=	8	2	8	1
4	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
4	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
4	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
4	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
4	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
4	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
4	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
4	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
4	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
4	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
4	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
4	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
4	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
4	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
4	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
4	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
4	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
4	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
4	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
4	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
4	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
4	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
4	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
6	Escherichia coli ATCC25922	1	Ampicillin	=	8	2	8	1

6	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
6	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
6	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
6	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
6	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
6	Escherichia coli ATCC25922	1	Colistin	=	2	0.25	2	1
6	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
6	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
6	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
6	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
6	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
6	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
6	Escherichia coli ATCC25922	1	Trimethoprim	=	1	0.5	2	1
6	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
6	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
6	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
6	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
6	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
6	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.5	0	0	
6	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
6	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
6	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
6	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
9	Escherichia coli ATCC25922	1	Ampicillin	=	8	2	8	1
9	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
9	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
9	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
9	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
9	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
9	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
9	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
9	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
9	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
9	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
9	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
9	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
9	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
9	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
9	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
9	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
9	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
9	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
9	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
9	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
9	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
9	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
9	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
11	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
11	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
11	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
11	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
11	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
11	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1

11	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
11	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
11	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
11	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
11	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
11	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
11	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
11	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
11	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
11	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
11	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
11	Escherichia coli ATCC25922	2	Cefoxitin	=	8	2	8	1
11	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.5	0.06	0.5	1
11	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
11	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
11	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
11	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
11	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
12	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
12	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
12	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
12	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
12	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
12	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
12	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
12	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
12	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
12	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
12	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
12	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
12	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
12	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
12	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
12	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
12	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
12	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
12	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
12	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
12	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
12	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
12	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
12	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
16	Escherichia coli ATCC25922	1	Ampicillin	=	8	2	8	1
16	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
16	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
16	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
16	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
16	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
16	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
16	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
16	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
16	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
16	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1

16	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
16	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
16	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
16	Escherichia coli ATCC25922	2	Cefepime	=	0.12	0.016	0.125	1
16	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
16	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
16	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
16	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
16	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
16	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
16	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
16	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
16	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
17	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
17	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
17	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
17	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
17	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
17	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
17	Escherichia coli ATCC25922	1	Colistin	=	2	0.25	2	1
17	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
17	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
17	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
17	Escherichia coli ATCC25922	1	Sulfamethoxazole	<=	8	8	32	1
17	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
17	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
17	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
17	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
17	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
17	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
17	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
17	Escherichia coli ATCC25922	2	Ceftazidime	=	0.5	0.06	0.5	1
17	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.5	0	0	
17	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
17	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
17	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
17	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
18	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
18	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
18	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
18	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
18	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
18	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
18	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
18	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
18	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
18	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
18	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
18	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
18	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
18	Escherichia coli ATCC25922	1	Trimethoprim	=	1	0.5	2	1
18	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
18	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1

18	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
18	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
18	Escherichia coli ATCC25922	2	Ceftazidime	=	0.5	0.06	0.5	1
18	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.5	0	0	
18	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
18	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
18	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
18	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
19	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
19	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
19	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
19	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
19	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
19	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
19	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
19	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
19	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
19	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
19	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
19	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
19	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
19	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
19	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
19	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
19	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
19	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
19	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
19	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
19	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
19	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
19	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
19	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
20	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
20	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
20	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
20	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
20	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
20	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
20	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
20	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
20	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
20	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
20	Escherichia coli ATCC25922	1	Sulfamethoxazole	<=	8	8	32	1
20	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
20	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
20	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
20	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
20	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
20	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
20	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
20	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
20	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
20	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1

20	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
20	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
20	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
21	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
21	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
21	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
21	Escherichia coli ATCC25922	1	Ceftazidime	<=	5	0.06	0.5	0
21	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
21	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
21	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
21	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
21	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
21	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
21	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
21	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
21	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
21	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
21	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
21	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
21	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
21	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
21	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
21	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
21	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
21	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
21	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
21	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
22	Escherichia coli ATCC25922	1	Ampicillin	=	2	2	8	1
22	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
22	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
22	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
22	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
22	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
22	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
22	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
22	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
22	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
22	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
22	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
22	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
22	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
22	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
22	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
22	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
22	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
22	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
22	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
22	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
22	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
22	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
22	Escherichia coli ATCC25922	2	Temocillin	=	4	0	0	
23	Escherichia coli ATCC25922	1	Ampicillin	=	2	2	8	1
23	Escherichia coli ATCC25922	1	Azithromycin	<=	2	0	0	

23	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
23	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
23	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
23	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
23	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
23	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
23	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
23	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
23	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
23	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
23	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
23	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
23	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
23	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
23	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
23	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
23	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
23	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
23	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
23	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
23	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
23	Escherichia coli ATCC25922	2	Temocillin	<=	0.5	0	0	
25	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
25	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
25	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
25	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
25	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
25	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
25	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
25	Escherichia coli ATCC25922	1	Gentamicin	=	1	0.25	1	1
25	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
25	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
25	Escherichia coli ATCC25922	1	Sulfamethoxazole	<=	8	8	32	1
25	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
25	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
25	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
25	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
25	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
25	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
25	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
25	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
25	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
25	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
25	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
25	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
25	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
26	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
26	Escherichia coli ATCC25922	1	Azithromycin	<=	0.25	0	0	
26	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.5	0.03	0.125	0
26	Escherichia coli ATCC25922	1	Ceftazidime	<=	8	0.06	0.5	0
26	Escherichia coli ATCC25922	1	Chloramphenicol	<=	0.015	2	8	0
26	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	1	0.004	0.016	0
26	Escherichia coli ATCC25922	1	Colistin	=	1	0.25	2	1

26	Escherichia coli ATCC25922	1	Gentamicin	<=	0.03	0.25	1	1
26	Escherichia coli ATCC25922	1	Meropenem	<=	4	0.008	0.06	0
26	Escherichia coli ATCC25922	1	Nalidixic acid	<=	2	1	4	1
26	Escherichia coli ATCC25922	1	Sulfamethoxazole	<=	0.25	8	32	1
26	Escherichia coli ATCC25922	1	Tetracycline	=	0.5	0.5	2	1
26	Escherichia coli ATCC25922	1	Tigecycline	=	4	0.03	0.25	0
26	Escherichia coli ATCC25922	1	Trimethoprim	=	16	0.5	2	0
26	Escherichia coli ATCC25922	2	Cefepime	=		0.016	0.125	
26	Escherichia coli ATCC25922	2	Cefotaxime	=		0.03	0.125	
26	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=		0	0	
26	Escherichia coli ATCC25922	2	Cefoxitin	=		2	8	
26	Escherichia coli ATCC25922	2	Ceftazidime	=		0.06	0.5	
26	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=		0	0	
26	Escherichia coli ATCC25922	2	Ertapenem	=		0.004	0.016	
26	Escherichia coli ATCC25922	2	Imipenem	=		0.06	0.25	
26	Escherichia coli ATCC25922	2	Meropenem	=		0.008	0.06	
26	Escherichia coli ATCC25922	2	Temocillin	=		0	0	
29	Escherichia coli ATCC25922	1	Ampicillin	=	8	2	8	1
29	Escherichia coli ATCC25922	1	Azithromycin	=		0	0	
29	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
29	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
29	Escherichia coli ATCC25922	1	Chloramphenicol	=	8	2	8	1
29	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
29	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
29	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
29	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
29	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
29	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
29	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
29	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
29	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
29	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
29	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
29	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=		0	0	
29	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
29	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
29	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=		0	0	
29	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
29	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
29	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
29	Escherichia coli ATCC25922	2	Temocillin	=		0	0	
30	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
30	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
30	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
30	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
30	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
30	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
30	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
30	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
30	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
30	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
30	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
30	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1

30	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
30	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
30	Escherichia coli ATCC25922	2	Cefepime	=	0.12	0.016	0.125	1
30	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
30	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
30	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
30	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
30	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
30	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
30	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
30	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
30	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
32	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
32	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
32	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
32	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
32	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
32	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
32	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
32	Escherichia coli ATCC25922	1	Gentamicin	=	1	0.25	1	1
32	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
32	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
32	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
32	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
32	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
32	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
32	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
32	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
32	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=	0.12	0	0	
32	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
32	Escherichia coli ATCC25922	2	Ceftazidime	=	0.5	0.06	0.5	1
32	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
32	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
32	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
32	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
32	Escherichia coli ATCC25922	2	Temocillin	=	32	0	0	
33	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
33	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
33	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
33	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
33	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
33	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
33	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
33	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
33	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
33	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
33	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
33	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
33	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
33	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
33	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
33	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
33	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	

33	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
33	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
33	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
33	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
33	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
33	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
33	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
34	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
34	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
34	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
34	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
34	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
34	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
34	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
34	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
34	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
34	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
34	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
34	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
34	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
34	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
34	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
34	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
34	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
34	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
34	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
34	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
34	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
34	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
34	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
34	Escherichia coli ATCC25922	2	Temocillin	=	8	0	0	
36	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
36	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
36	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
36	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
36	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
36	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
36	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
36	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
36	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
36	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
36	Escherichia coli ATCC25922	1	Sulfamethoxazole	<=	8	8	32	1
36	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
36	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
36	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
36	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
36	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
36	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
36	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
36	Escherichia coli ATCC25922	2	Ceftazidime	=	0.5	0.06	0.5	1
36	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
36	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
36	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1

36	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
36	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
37	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
37	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
37	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
37	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
37	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
37	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
37	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
37	Escherichia coli ATCC25922	1	Gentamicin	=	1	0.25	1	1
37	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
37	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
37	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
37	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
37	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
37	Escherichia coli ATCC25922	1	Trimethoprim	=	1	0.5	2	1
37	Escherichia coli ATCC25922	2	Cefepime	=		0.016	0.125	
37	Escherichia coli ATCC25922	2	Cefotaxime	=		0.03	0.125	
37	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=		0	0	
37	Escherichia coli ATCC25922	2	Cefoxitin	=		2	8	
37	Escherichia coli ATCC25922	2	Ceftazidime	=		0.06	0.5	
37	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=		0	0	
37	Escherichia coli ATCC25922	2	Ertapenem	=		0.004	0.016	
37	Escherichia coli ATCC25922	2	Imipenem	=		0.06	0.25	
37	Escherichia coli ATCC25922	2	Meropenem	=		0.008	0.06	
37	Escherichia coli ATCC25922	2	Temocillin	=		0	0	
38	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
38	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
38	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
38	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
38	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
38	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
38	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
38	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
38	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
38	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
38	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
38	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
38	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
38	Escherichia coli ATCC25922	1	Trimethoprim	=	2	0.5	2	1
38	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
38	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
38	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
38	Escherichia coli ATCC25922	2	Cefoxitin	=	8	2	8	1
38	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
38	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
38	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
38	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
38	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
38	Escherichia coli ATCC25922	2	Temocillin	=	64	0	0	
39	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
39	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
39	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1

39	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
39	Escherichia coli ATCC25922	1	Chloramphenicol	=	8	2	8	1
39	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
39	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
39	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
39	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
39	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
39	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
39	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
39	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
39	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
39	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
39	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
39	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
39	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
39	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
39	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.5	0	0	
39	Escherichia coli ATCC25922	2	Ertapenem	=	0.015	0.004	0.016	1
39	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
39	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
39	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
40	Escherichia coli ATCC25922	1	Ampicillin	=	2	2	8	1
40	Escherichia coli ATCC25922	1	Azithromycin	=	2	0	0	
40	Escherichia coli ATCC25922	1	Cefotaxime	=	0.12	0.03	0.125	1
40	Escherichia coli ATCC25922	1	Ceftazidime	=	0.5	0.06	0.5	1
40	Escherichia coli ATCC25922	1	Chloramphenicol	=	8	2	8	1
40	Escherichia coli ATCC25922	1	Ciprofloxacin	=	0.015	0.004	0.016	1
40	Escherichia coli ATCC25922	1	Colistin	=	1	0.25	2	1
40	Escherichia coli ATCC25922	1	Gentamicin	=	0.5	0.25	1	1
40	Escherichia coli ATCC25922	1	Meropenem	=	0.03	0.008	0.06	1
40	Escherichia coli ATCC25922	1	Nalidixic acid	=	4	1	4	1
40	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
40	Escherichia coli ATCC25922	1	Tetracycline	=	2	0.5	2	1
40	Escherichia coli ATCC25922	1	Tigecycline	=	0.25	0.03	0.25	1
40	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
40	Escherichia coli ATCC25922	2	Cefepime	=	0.06	0.016	0.125	1
40	Escherichia coli ATCC25922	2	Cefotaxime	=	0.12	0.03	0.125	1
40	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=		0	0	
40	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
40	Escherichia coli ATCC25922	2	Ceftazidime	=	0.5	0.06	0.5	1
40	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=		0	0	
40	Escherichia coli ATCC25922	2	Ertapenem	=	0.015	0.004	0.016	1
40	Escherichia coli ATCC25922	2	Imipenem	=	0.12	0.06	0.25	1
40	Escherichia coli ATCC25922	2	Meropenem	=	0.03	0.008	0.06	1
40	Escherichia coli ATCC25922	2	Temocillin	=	4	0	0	
41	Escherichia coli ATCC25922	1	Ampicillin	=	2	2	8	1
41	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
41	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
41	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
41	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
41	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
41	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
41	Escherichia coli ATCC25922	1	Gentamicin	=	1	0.25	1	1

41	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
41	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
41	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
41	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
41	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
41	Escherichia coli ATCC25922	1	Trimethoprim	<=	0.25	0.5	2	0
41	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
41	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
41	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
41	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
41	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.5	0.06	0.5	1
41	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
41	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
41	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
41	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
41	Escherichia coli ATCC25922	2	Temocillin	=	1	0	0	
45	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
45	Escherichia coli ATCC25922	1	Azithromycin	<=	2	0	0	
45	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
45	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
45	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
45	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
45	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
45	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
45	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
45	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
45	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
45	Escherichia coli ATCC25922	1	Tetracycline	=	2	0.5	2	1
45	Escherichia coli ATCC25922	1	Tigecycline	=	0.25	0.03	0.25	1
45	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
45	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
45	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
45	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
45	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
45	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
45	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
45	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
45	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
45	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
45	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
56	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
56	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
56	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
56	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
56	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
56	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
56	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
56	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
56	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
56	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
56	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
56	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
56	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1

56	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
56	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
56	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
56	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
56	Escherichia coli ATCC25922	2	Cefoxitin	=	2	2	8	1
56	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
56	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
56	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
56	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
56	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
56	Escherichia coli ATCC25922	2	Temocillin	=	2	0	0	
58	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
58	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
58	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
58	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
58	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
58	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
58	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
58	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
58	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
58	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
58	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
58	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
58	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
58	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
58	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
58	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
58	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
58	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
58	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
58	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
58	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
58	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
58	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
58	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	
59	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
59	Escherichia coli ATCC25922	1	Azithromycin	=	8	0	0	
59	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
59	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
59	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
59	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
59	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
59	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
59	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
59	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
59	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	32	8	32	1
59	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
59	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
59	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
59	Escherichia coli ATCC25922	2	Cefepime	=		0.016	0.125	
59	Escherichia coli ATCC25922	2	Cefotaxime	=		0.03	0.125	
59	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	=		0	0	
59	Escherichia coli ATCC25922	2	Cefoxitin	=		2	8	

59	Escherichia coli ATCC25922	2	Ceftazidime	=		0.06	0.5	
59	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=		0	0	
59	Escherichia coli ATCC25922	2	Ertapenem	=		0.004	0.016	
59	Escherichia coli ATCC25922	2	Imipenem	=		0.06	0.25	
59	Escherichia coli ATCC25922	2	Meropenem	=		0.008	0.06	
59	Escherichia coli ATCC25922	2	Temocillin	=		0	0	
60	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
60	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
60	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
60	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
60	Escherichia coli ATCC25922	1	Chloramphenicol	<=	8	2	8	1
60	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
60	Escherichia coli ATCC25922	1	Colistin	=	2	0.25	2	1
60	Escherichia coli ATCC25922	1	Gentamicin	<=	0.5	0.25	1	1
60	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
60	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
60	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
60	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
60	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
60	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
60	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
60	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
60	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
60	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
60	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
60	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	=	0.25	0	0	
60	Escherichia coli ATCC25922	2	Ertapenem	<=	0.016	0.004	0.016	1
60	Escherichia coli ATCC25922	2	Imipenem	=	0.25	0.06	0.25	1
60	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1
60	Escherichia coli ATCC25922	2	Temocillin	=	32	0	0	
62	Escherichia coli ATCC25922	1	Ampicillin	=	4	2	8	1
62	Escherichia coli ATCC25922	1	Azithromycin	=	4	0	0	
62	Escherichia coli ATCC25922	1	Cefotaxime	<=	0.25	0.03	0.125	1
62	Escherichia coli ATCC25922	1	Ceftazidime	<=	0.5	0.06	0.5	1
62	Escherichia coli ATCC25922	1	Chloramphenicol	<=	0.8	2	8	0
62	Escherichia coli ATCC25922	1	Ciprofloxacin	<=	0.015	0.004	0.016	1
62	Escherichia coli ATCC25922	1	Colistin	<=	1	0.25	2	1
62	Escherichia coli ATCC25922	1	Gentamicin	=	0.5	0.25	1	1
62	Escherichia coli ATCC25922	1	Meropenem	<=	0.03	0.008	0.06	1
62	Escherichia coli ATCC25922	1	Nalidixic acid	<=	4	1	4	1
62	Escherichia coli ATCC25922	1	Sulfamethoxazole	=	16	8	32	1
62	Escherichia coli ATCC25922	1	Tetracycline	<=	2	0.5	2	1
62	Escherichia coli ATCC25922	1	Tigecycline	<=	0.25	0.03	0.25	1
62	Escherichia coli ATCC25922	1	Trimethoprim	=	0.5	0.5	2	1
62	Escherichia coli ATCC25922	2	Cefepime	<=	0.06	0.016	0.125	1
62	Escherichia coli ATCC25922	2	Cefotaxime	<=	0.25	0.03	0.125	1
62	Escherichia coli ATCC25922	2	Cefotaxime/clavulanic acid	<=	0.06	0	0	
62	Escherichia coli ATCC25922	2	Cefoxitin	=	4	2	8	1
62	Escherichia coli ATCC25922	2	Ceftazidime	<=	0.25	0.06	0.5	1
62	Escherichia coli ATCC25922	2	Ceftazidime/clavulanic acid	<=	0.12	0	0	
62	Escherichia coli ATCC25922	2	Ertapenem	<=	0.015	0.004	0.016	1
62	Escherichia coli ATCC25922	2	Imipenem	<=	0.12	0.06	0.25	1
62	Escherichia coli ATCC25922	2	Meropenem	<=	0.03	0.008	0.06	1

62	Escherichia coli ATCC25922	2	Temocillin	=	16	0	0	

Lab Refkey	Strain	Obtained value	Expected value	Score
37	EURL-M-6.8	No growth	AmpC-phenotype, ESBL+AmpC-phenotype	
39	EURL-M-6.8	No growth	AmpC-phenotype, ESBL+AmpC-phenotype	
38	EURL-M-6.3	ESBL+AmpC-phenotype	ESBL-phenotype	0
45	EURL-M-6.3	ESBL+AmpC-phenotype	ESBL-phenotype	0
45	EURL-M-6.4	Carbapenemase-phenotype	ESBL-phenotype	0
21	EURL-M-6.8	ESBL-phenotype	AmpC-phenotype, ESBL+AmpC-phenotype	0

Lab Refkey	Strain	Panel	Antimicrobial	Operator t	Obt value	Operator t	Exp value	Obt Interpr	Exp interpr	Score
9	EURL-M-6.7	1	Meropenem	<=	0.03	<=	0.03	R	S	0
11	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
16	EURL-M-6.7	1	Tigecycline	=	1	=	0.5	R	S	0
17	EURL-M-6.8	2	Cefoxitin	=	64	=	64	S	R	0
18	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
22	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
23	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
25	EURL-M-6.3	1	Cefotaxime	>	4	>	4	S	R	0
26	EURL-M-6.3	2	Cefotaxime	=	0.12	=	64	S	R	0
26	EURL-M-6.4	2	Cefotaxime	<=	0.06	=	4	S	R	0
26	EURL-M-6.7	2	Cefotaxime	=	0.12	>	64	S	R	0
26	EURL-M-6.3	2	Cefotaxime/clavulanic acid	>	64	<=	0.06	R	S	0
26	EURL-M-6.4	2	Cefotaxime/clavulanic acid	=	8	<=	0.06	R	S	0
26	EURL-M-6.7	2	Cefotaxime/clavulanic acid	>	64	=	0.12	R	S	0
32	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
32	EURL-M-6.8	2	Ertapenem	=	0.03	=	0.03	R	S	0
34	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
36	EURL-M-6.2	2	Cefotaxime/clavulanic acid	=	1	=	1	S	R	0
36	EURL-M-6.2	2	Ceftazidime/clavulanic acid	=	2	=	2	S	R	0
38	EURL-M-6.3	2	Cefoxitin	=	16	=	8	R	S	0
39	EURL-M-6.4	2	Cefepime	=	0.5	=	0.5	S	R	0
39	EURL-M-6.7	1	Tigecycline	=	1	=	0.5	R	S	0
40	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
45	EURL-M-6.4	2	Cefotaxime/clavulanic acid	>	64	<=	0.06	R	S	0
45	EURL-M-6.3	2	Cefoxitin	=	16	=	8	R	S	0
45	EURL-M-6.4	2	Cefoxitin	=	32	=	4	R	S	0
45	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
45	EURL-M-6.4	2	Ceftazidime/clavulanic acid	=	64	<=	0.12	R	S	0
45	EURL-M-6.2	1	Chloramphenicol	<=	8	=	128	S	R	0
45	EURL-M-6.8	1	Chloramphenicol	=	128	<=	8	R	S	0
45	EURL-M-6.2	1	Ciprofloxacin	<=	0.15	=	8	S	R	0
45	EURL-M-6.4	1	Ciprofloxacin	<=	0.015	=	2	S	R	0
45	EURL-M-6.8	1	Ciprofloxacin	>	8	<=	0.015	R	S	0
45	EURL-M-6.4	2	Ertapenem	=	0.5	<=	0.015	R	S	0
45	EURL-M-6.4	2	Imipenem	=	4	<=	0.12	R	S	0
45	EURL-M-6.4	1	Meropenem	=	2	<=	0.03	R	S	0
45	EURL-M-6.4	2	Meropenem	=	2	<=	0.03	R	S	0
45	EURL-M-6.2	1	Nalidixic acid	<=	4	>	128	S	R	0
45	EURL-M-6.4	1	Nalidixic acid	<=	4	>	128	S	R	0
45	EURL-M-6.8	1	Nalidixic acid	>	128	<=	4	R	S	0
45	EURL-M-6.4	1	Sulfamethoxazole	>	1024	<=	8	R	S	0
45	EURL-M-6.2	1	Tetracycline	=	4	=	64	S	R	0
45	EURL-M-6.4	1	Tetracycline	<=	2	>	64	S	R	0
45	EURL-M-6.8	1	Tetracycline	=	64	<=	2	R	S	0
45	EURL-M-6.3	1	Tigecycline	=	1	<=	0.25	R	S	0
45	EURL-M-6.7	1	Tigecycline	=	1	=	0.5	R	S	0
56	EURL-M-6.7	2	Cefoxitin	=	8	=	16	S	R	0
59	EURL-M-6.4	1	Tetracycline	<=	0.25	>	64	S	R	0

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