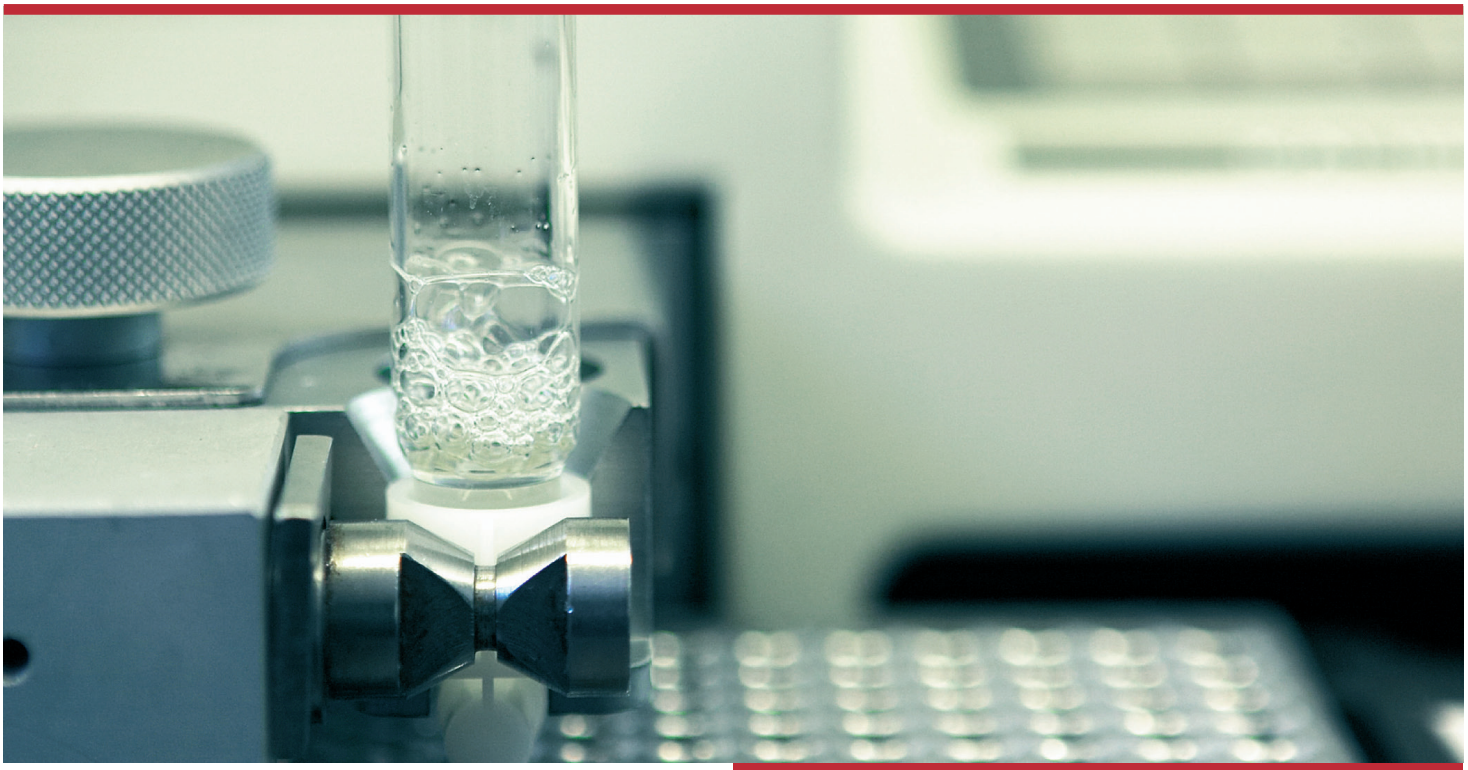
The 20th EURL-AR Proficiency Test - Enterococci, Staphylococci and *E. coli* 2016



Valeria Bortolaia
Susanne Karlsmose Pedersen
Louise Roer
Lina Cavaco
Rene S. Hendriksen
Frank M. Aarestrup

DANAK
PT Reg.nr. 516

FDA

Community Reference Laboratory Antimicrobial Resistance

DTU Food
National Food Institute

THE 20TH EURL-AR Proficiency Test Enterococci, Staphylococci and *Escherichia coli* - 2016

1. edition, August 2017

Photo: Mikkel Adsbøl
ISBN: 978-87-93565-09-8

The report is available at
www.food.dtu.dk

National Food Institute
Technical University of Denmark
Kemitorvet
Building 202
DK-2800 Kgs. Lyngby

Index

1. Introduction

This report describes the results of the 20th proficiency test organised by the Technical University of Denmark, National Food Institute (DTU-FOOD) as the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). This proficiency test focuses on antimicrobial susceptibility testing (AST) of enterococci, staphylococci and *Escherichia coli.* It is the tenth External Quality Assurance System (EQAS) conducted for AST of these microorganisms.

The aim of this EQAS is to: i) monitor the quality of AST results produced by National Reference Laboratories (NRL-AR), ii) identify laboratories which may need assistance to improve their performance in AST, and iii) determine possible topics for future research and collaboration.

When reading this report, please consider:

1) Expected results were generated by performing Minimum Inhibitory Concentration (MIC) determination on two occasions at DTU-FOOD. These results were verified by the United States Food and Drug Administration (FDA), Centre for Veterinary Medicine. Finally, MIC determination was performed at DTU-FOOD after preparation of the agar stab cultures to be shipped to participants to confirm that the vials contained the correct strains with the expected MIC values.

2) The evaluation is based on interpretation of MIC values in agreement with the method reported in Decision 2013/652/EU for testing of *E. coli* and enterococci. For AST of staphylococci, it is recommended to implement the most recent recommendations from EFSA. Participants were requested to apply the same method used when generating AST results to be reported to EFSA. This request was made to ensure compliance with the main objective of this EQAS "to assess and improve the comparability of antimicrobial susceptibility data reported to EFSA by the different NRLs", as stated in the protocol (Appendix 4).

3) Only results obtained by MIC determination methods were allowed in this EQAS to comply with Decision 2013/652/EU. Thus, the set-up of the database for reporting results did not allow upload of disk diffusion results.

4) Laboratory performance is considered acceptable if there are < 5% deviations from expected results, as previously agreed by the EURL-AR network.

Evaluation of a result as "deviating from the expected interpretation" should be carefully analysed in a self-evaluation procedure performed by individual participants when the EQAS trial results are disclosed. MIC determination methods have limitations in reproducibility, thus a one-fold dilution difference in the MIC of a specific antimicrobial could occur even when testing the same strain. If the expected MIC is close to the breakpoint value for categorising the strain as susceptible or resistant, a one-fold dilution difference may result in different interpretations. Since this report evaluates the interpretations of MIC values, some participants may find their results classified as wrong even though the actual MIC measured is only one-fold dilution different from the expected MIC. In these cases (hereafter defined "one-fold dilution issues"), the participants should be confident about the good quality of their AST performance. At the EURL-AR, we strive to select test strains with MIC values distant from the breakpoints for resistance to avoid these ambiguous situations, though this is not always feasible for all strains and antimicrobial combinations. For this reason, the EURL-AR network unanimously established in 2008 that, if there are less than 75% correct results for a specific strain/antimicrobial

combination, these results may be subtracted from the evaluation report after a case by case evaluation to be detailed in the report.

This report is approved in its final version by a technical advisory group composed by competent representatives from all NRLs who meet yearly at the EURL-AR workshop.

All conclusions presented in this report are publicly available. However, participating laboratories are identified by codes and each code is known only by the corresponding laboratory. The full list of laboratory codes is confidential information known only by relevant representatives of the EURL-AR and the EU Commission.

The EURL-AR is accredited by DANAK as provider of proficiency testing (accreditation no. 516); working with zoonotic pathogens and indicator organisms as bacterial isolates (identification, serotyping and antimicrobial susceptibility testing).

2. Materials and Methods

2.1 Participants in EQAS 2016

A pre-notification to announce the EQAS 2016 on AST of enterococci, staphylococci and *E. coli* was sent by e-mail on the 8th March 2016 to the designated NRL-AR in the network (Appendix 1) and to eight additional laboratories (Denmark, Iceland, Norway, Serbia, Spain, Switzerland, the Netherlands, Turkey and United Kingdom) invited to participate based on participation to previous EQAS iterations and/or affiliation to the EU network.

Participating laboratories represented all 28 EU Member States (MS) and three non-MS (Iceland, Norway, and Switzerland; Appendix 2 and Figure 1). Only one set of data per MS is included in this report.

2.2 Strains

The eight enterococci, eight staphylococci and eight *E. coli* included in this EQAS were selected among the DTU-FOOD strain collection based on available MIC data. For quality assurance purposes, one strain per each bacterial species has been included in all

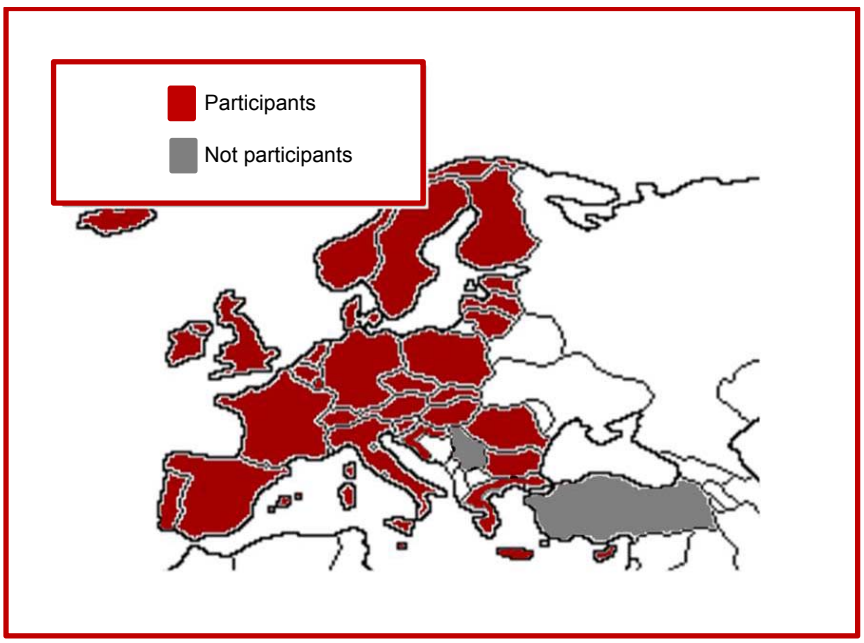


Figure 1. Countries participating in the EURL-AR EQAS on antimicrobial susceptibility testing of enterococci, staphylococci and/or *Escherichia coli*, 2016

Table 1. Panels of antimicrobials for antimicrobial susceptibility testing included in this EURL-AR EQAS 2016 component

Enterococci	Staphylococci	*Escherichia coli* 1st panel	*Escherichia coli* 2nd panel
Ampicillin, AMP	Cefoxitin, FOX	Ampicillin, AMP	Cefepime, FEP
Chloramphenicol, CHL	Chloramphenicol, CHL	Azithromycin, AZI	Cefotaxime + clavulanic acid (F/C)
Ciprofloxacin, CIP	Ciprofloxacin, CIP	Cefotaxime, FOT	Cefotaxime, FOT
Daptomycin, DAP	Clindamycin, CLN	Ceftazidime, TAZ	Cefoxitin, FOX
Erythromycin, ERY	Erythromycin, ERY	Chloramphenicol, CHL	Ceftazidime, TAZ
Gentamicin, GEN	Gentamicin, GEN	Ciprofloxacin, CIP	Ceftazidime+ clavulanic acid (T/C)
Linezolid, LZD	Linezolid, LZD	Colistin, COL	Ertapenem, ETP
Quinupristin-dalfopristin (Synercid), SYN	Mupirocin, MUP	Gentamicin, GEN	Imipenem, IMI
Teicoplanin, TEI	Quinupristin-dalfopristin (Synercid), SYN	Meropenem, MERO	Meropenem, MERO
Tetracycline, TET	Sulfamethoxazole, SMX	Nalidixic acid, NAL	Temocillin, TRM
Tigecycline, TGC	Sulfamethoxazole+Trimethoprim, SXT	Sulfamethoxazole, SMX	
Vancomycin, VAN	Tetracycline, TET	Tetracycline, TET	
	Tiamulin, TIA	Tigecycline, TGC	
	Trimethoprim, TMP	Trimethoprim, TMP	
	Vancomycin, VAN		

EQAS iterations performed to date to represent an internal control.

Expected MIC values (Appendix 3) for this EQAS were generated by using Sensititre panels (Trek Diagnostic Systems) at DTU-FOOD and further verified by the U.S. FDA. Results could not be verified by FDA for: ampicillin and teicoplanin (enterococci); colistin, ertapenem, meropenem, temocillin and tigecycline (*E. coli*); and sulfamethoxazole, tiamulin and trimethoprim (staphylococci). MICs were further determined at DTU-FOOD after production of agar stab cultures to confirm expected values prior to shipment and to ensure homogeneity of the test cultures at the DTU-FOOD laboratory.

Reference strains *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213 and *E. coli* ATCC 25922 were provided to new participants with instructions to store and maintain them for quality assurance purposes and future EQAS trials. The expected quality control ranges for the reference strains were retrieved from Clinical and Laboratory Standards Institute (CLSI) in documents VET01 A4 (2013) / M100-S26 (2016) (App. 5).

2.3 Antimicrobials

The panels of antimicrobials recommended for AST in this trial are listed in Table 1.

These antimicrobials represent those defined by the Commission Implementing Decision 2013/652/EU for *E. coli* and enterococci, and those most recently recommended by EFSA for staphylococci.

2.4 Distribution

The bacterial strains were dispatched as agar stab cultures on 28th June 2016. These

bacterial cultures were shipped in double pack containers (class UN 6.2) as UN3373, biological substances category B according to the International Air Transport Association (IATA) regulations.

2.5 Procedure

The participants were recommended to keep the agar stab cultures refrigerated until performance of AST. Protocols and all relevant information were uploaded on the EURL-AR website (http://www.eurl-ar.eu) thus being available at any time (Appendix 4). Guidelines for performing AST were set according to the CLSI document – M7-A10 (2015) "Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard - 10th Edition". Manufacturer's guidelines had to be followed when commercial methods were used.

Instructions for interpretation of AST results adhered to those specified in the Commission Implementing Decision 2013/652/EU, and were provided in the protocol (Appendix 4b: Tables 1, 2 and 3). Participants were invited to categorise the strains as resistant or susceptible using EUCAST epidemiological cut-off (ECOFF) values (www.eucast.org). For interpretation of the results of the *E. coli* 2nd panel (to be tested when a strain displayed resistance to cefotaxime, ceftazidime and/or meropenem in the *E. coli* 1st panel) participants were invited to adhere to recommendations by EFSA (Appendix 4b).

The EURL-AR is aware that there are two types of criteria for interpretation of MIC results: clinical breakpoints and ECOFF values. The terms 'susceptible', 'intermediate' and 'resistant' should be used for classification made in relation to the therapeutic application of antimicrobial agents, whereas bacteria should be reported as 'wild-type' or 'non-wild-type' when reporting data relative to ECOFF values (Schwarz et al., 2010). To simplify the interpretation of results, we maintain the terms susceptible and resistant throughout this report even when referring to wild-type and non-wild-type strains.

All participants were invited to enter the obtained results into an electronic record sheet at the EURL-AR web-based database designed for this trial. Participants were also encouraged to complete an evaluation form available on the EURL-AR database with the aim to improve future EQAS trials.

The database could be accessed through a secured individual login and password.

The database was closed on 5th September 2015.

After this date, the participants were invited to login again to retrieve an individual database-generated evaluation report.

3. Results and Discussion

In this report, results from 28, 27 and 31 laboratories for enterococci, staphylococci and *E. coli* were evaluated, respectively. The participants were invited to report MIC values and categorisation as resistant or susceptible for each strain/antimicrobial combination. Only the categorisation was evaluated, whereas the MIC values were used as supplementary information.

3.1 Results excluded from the report

The following strain/antimicrobial combinations resulted in > 25% deviations from expected results: ENT-10.7/chloramphenicol, ST-10.4/ciprofloxacin, ST-10.8/ciprofloxacin and EC-10.8/ertapenem. In agreement with the decision by the EURL-AR network these results were carefully evaluated.

For ENT-10.7/chloramphenicol, 27 laboratories reported MIC values but only 26 reported interpretation. This strain had an expected interpretation as ”R” based on an expected MIC value of 64 mg/L. Ten laboratories reported this strain as ”R” (MIC = 64 mg/L) whereas 16 laboratories reported this strains as ”S” (MIC = 32 mg/L). One laboratory obtained a MIC = 32 mg/L but did not report interpretation. The result close to breakpoint caused 61% deviations, thus was omitted from the analysis in the report.

For ST-10.4/ciprofloxacin, 25 laboratories reported results. This strain had an expected interpretation as ”R” based on an expected MIC value of 2 mg/L. Eleven laboratories reported this strain as ”S” (with MIC = 1 mg/L). The result close to breakpoint caused 44% deviations, thus was omitted from the analysis in the report.

For ST-10.8/ciprofloxacin, 25 laboratories reported results. This strain had an expected interpretation as ”S” based on an expected MIC = 1 mg/L. Ten laboratories reported this strain as ”R”. Eight laboratories reported MIC = 2 mg/L, one laboratory reported MIC > 1 mg/L, and one laboratory reported MIC > 8 mg/L. Whereas this last measurement is likely to represent an AST performance problem, 36% deviations were due to “one-step dilution” issues in presence of an expected result closed to breakpoint, and thus this strain/antimicrobial combination was omitted from the analysis in the report.

For EC-10.8/ertapenem, 30 and 29 participants uploaded MIC values and interpretation, respectively. This strain had an expected interpretation as ”R” based on an expected MIC value of 0.12 mg/L. Twelve laboratories reported this strain as ”R” based on: MIC = 0.12 mg/L in ten laboratories; MIC = 0.25 mg/L in one laboratory; and MIC = 0.03 mg/L in one laboratory (of note, this last interpretation deviates from EUCAST ECOFF). Seventeen laboratories reported this strains as ”S” based on: MIC = 0.06 mg/L in 15 laboratories, MIC = 0.03 mg/L in one laboratory and MIC ≤ 0.015 mg/L in one laboratory. One additional laboratory obtained a MIC = 0.06 mg/L but did not report interpretation. Overall, 59% reported results deviated from expected ones, and 88% of these deviations were caused by the expected result close to breakpoint. Therefore, this strain/antimicrobial combination was omitted from the analysis in the report.

Exclusion of these results is based on the fact that deviations caused by “one-fold dilution issues” cannot be considered representative of the ability of the laboratories to perform AST.

3.2 Overall performance

The percentage of results in agreement with those expected ranged from 95.2% (strain ST-10.6) to 100% (strains ENT-10.1, ST-10.1 and EC-10.7) (Table 2). The *E. coli* trial yielded the highest percentage of correct results (99.2%), tightly followed both by the enterococci trial (98.7%) and by the staphylococci trial (98.4%). The percentage of deviations from the expected results appears to be very low and stable, with only minor fluctuations, for enterococci and *Escherichia coli* since 2013, and for staphylococci since 2014 (Figure 2). The results for the internal control strains appear to be stable for enterococci and *E. coli* since 2014, whereas notable improvements in the results of the internal control *S. aureus* strain were observed compared to previous years (Figure 2). The list of deviations is reported in Appendices 8a, 8b and 8c.

Table 2. Number of total and correct (%) antimicrobial susceptibility tests (AST) performed in the EURL-AR EQAS 2016

Strain*	No. AST	No. correct	% correct	Strain*	No. AST	No. correct	% correct	Strain*	No. AST	No. correct	% correct
ENT10.1	310	310	100%	ST10.1	357	357	100%	EC10.1	651	645	99.1%
ENT10.2	299	296	98.9%	ST10.2	357	353	98.9%	EC10.2	651	649	99.7%
ENT10.3	322	321	99.7%	ST10.3	357	356	99.7%	EC10.3	649	640	98.6%
ENT10.4	300	297	99.0%	ST10.4	330	326	98.7%	EC10.4	650	646	99.4%
ENT10.5	322	315	97.8%	ST10.5	357	351	98.3%	EC10.5	651	648	99.5%
ENT10.6	302	296	98.0%	ST10.6	355	338	95.2%	EC10.6	434	430	99.1%
ENT10.7	265	261	98.4%	ST10.7	356	352	98.9%	EC10.7	434	434	100.0%
ENT10.8	308	301	97.7%	ST10.8	330	320	97.0%	EC10.8	620	612	98.7%

*ENT, enterococci; ST, staphylococci; EC, *Escherichia coli*.

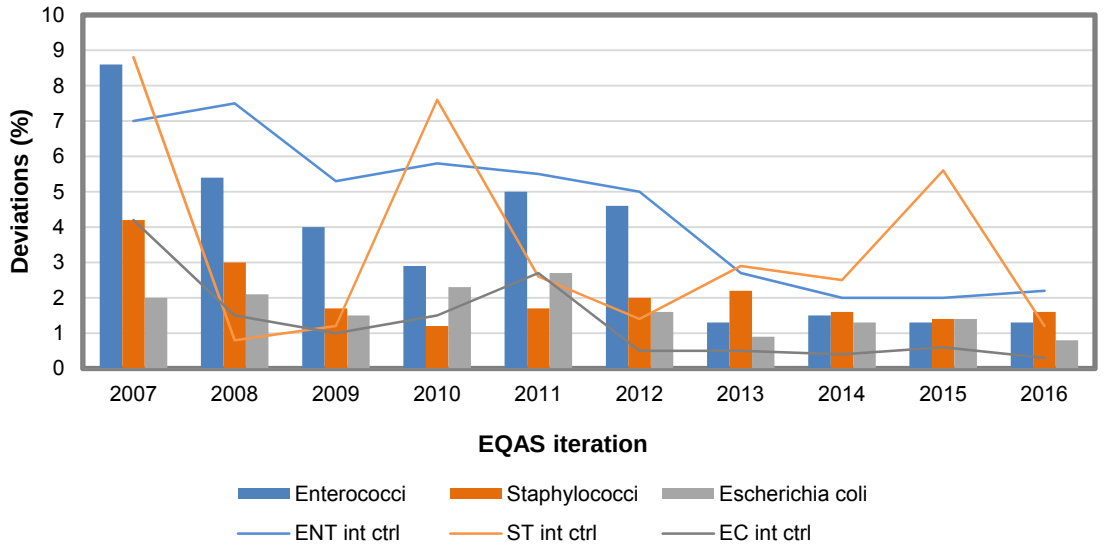


Figure 2. Overall deviations (%) from expected results by EQAS iteration. ENT, enterococci; ST, staphylococci; EC, *Escherichia coli*; int ctrl, internal control.

3.2.1 Enterococci

Twenty-eight laboratories (from 25 MS and three non-EU countries) approved results for the enterococci trial.

At the EURL-AR workshop 2016, it was unanimously decided that reporting interpretation of quinupristin/dalfopristin MIC values for *E. faecalis* should not be considered a deviation although this species is intrinsically resistant to such antimicrobial. Thus, results are considered correct both when interpretation is not reported and when interpretation is R. An interpretation as S for the quinupristin/dalfopristin-*E. faecalis* combination is a deviation. No results deviating from those expected were observed for ENT-10.1. For the

remaining strains, deviations ranged from 0.3% for ENT-10.3 to 2.8% for ENT-10.8 (Figure 3). Although several cases of disagreement in interpretation (*i.e.* the participant uploaded a MIC value in agreement with the expected but interpreted it differently from what recommended in the protocol) were observed, as well as "one-fold dilution issues" (especially for strain ENT-10.8), true performance problems appeared evident especially for ENT-10.2, ENT-10.6 and ENT-10.7.

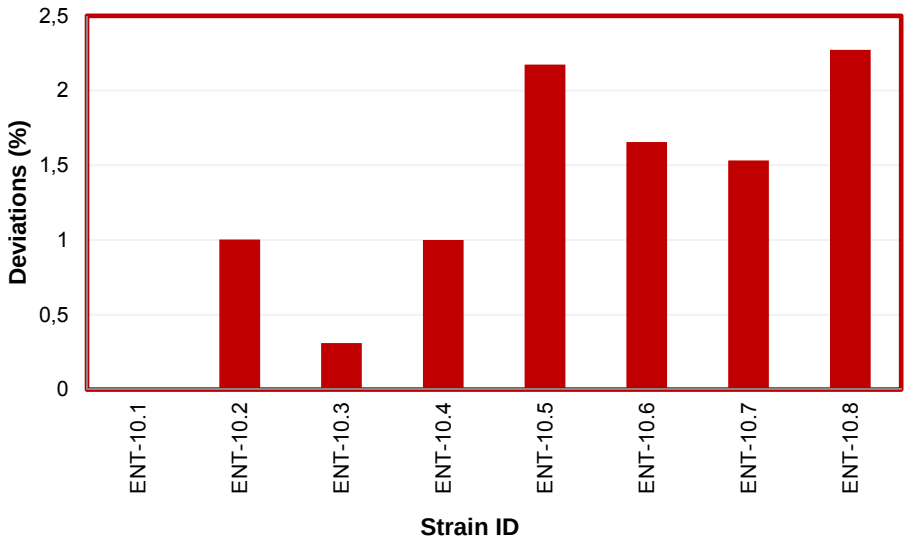


Figure 3. Deviations (%) from expected interpretation of AST result for each *Enterococcus* sp. strain, EURL-AR EQAS 2016.

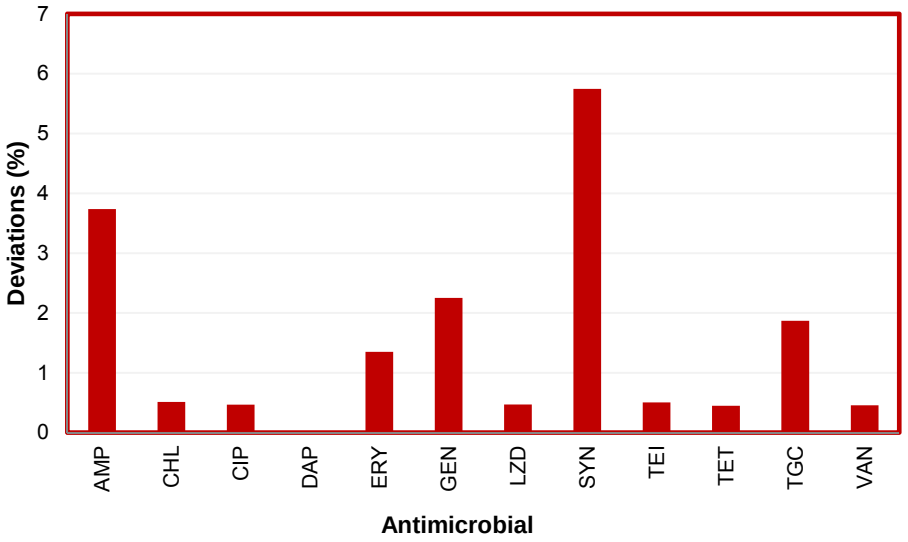


Figure 4. Deviations (%) from expected interpretation of AST results for each antimicrobial. Enterococci component of the EURL-AR EQAS 2016. AMP, ampicillin; CHL, chloramphenicol; CIP, ciprofloxacin; DAP, daptomycin; ERY, erythromycin; GEN, gentamicin; LZD, linezolid; SYN, quinupristin/dalfopristin (synercid); TEI, teicoplanin; TET, tetracycline; TGC, tigecycline; VAN, vancomycin.

Deviations from expected results were obtained for all antimicrobials except daptomycin (Figure 4). The antimicrobials that resulted in highest percentages of deviations were quinupristin-dalfopristin (5.7%), ampicillin (3.7%), and gentamicin (2.2 %). Analysis of these deviations revealed that problems were not linked to poor test performance for ampicillin. For ampicillin most (7/8, 87%) deviations were due to expected MIC value close to breakpoint for resistance (“one-fold dilution issues”) for strains

ENT-10.5 and ENT-10.8. Ampicillin deviations were obtained by eight laboratories. Regarding quinupristin-dalfopristin deviations, five deviations were obtained by three laboratories and all except one represented "one-fold dilution issues" or different interpretation of MIC values otherwise obtained as expected. Regarding gentamicin deviations, the five deviations observed were true wrong results obtained by two laboratories.

An overview of obtained and expected results is reported in Appendix 7a.

Enterococci species identification

Participants were requested to identify the enterococci species as a mandatory component. The test strains were five *E. faecalis* (ENT-10.1, ENT-10.2, ENT-10.4, ENT-10.6 and ENT-10.7) and three *E. faecium* (ENT-10.3, ENT-10.5, ENT-10.8). Species identification results were uploaded by all participants with the exception of Lab #38 who did not report results for any of the strains and Lab #41 who did not report results for ENT-10.7 and ENT-10.8. Two out of 214 (0.9%) results were in disagreement with those expected. This was caused by one participant (Lab #59) reporting a wrong identification of strains ENT-10.7 and ENT-10.8.

3.2.2 Staphylococci

Twenty-seven laboratories (from 24 MS and three non-MS) uploaded results for the staphylococci trial.

No results deviating from those expected were observed for ST-10.1. For the remaining strains, deviations ranged from 0.3% in ST-10.3 to 4.8% in ST-10.6 (Figure 5). For each strain, at least half of the deviations obtained suggested AST performance issues.

The antimicrobials that resulted in highest percentages of deviations were sulfamethoxazole-trimethoprim (21.2%), quinupristin-dalfopristin (4.4%) and tiamulin (3.3%) (Figure 6). For sulfamethoxazole/trimethoprim, seven deviations in three strains were obtained by four laboratories out of 33 results reported in total (for all strains and by all laboratories). Of note, only those four laboratories submitted results for sulfamethoxazole/trimethoprim. Three deviations were "one-fold dilution issues". In three cases no MIC values were reported, but interpretation was uploaded and it was in disagreement with that expected. The remaining deviation might represent a MIC reading issue. For quinupristin/dalfopristin (synercid), eight deviations in four strains were obtained by six laboratories out of 183 results reported for all strains and from all laboratories. Three deviations (three strains/two laboratories) represented true incongruences from expected results whereas the remaining five deviations were "one-fold dilution issues". For tiamulin, six deviations in three strains were reported by five laboratories, with three deviations from three laboratories representing "one-fold dilution issues" and the remaining deviations suggesting performance issues.

An overview of obtained and expected results is reported in Appendix 7b.

Methicillin-resistant *S. aureus*

Participants were requested to identify the presence/absence of methicillin resistance as a mandatory component. The test strains included five methicillin-resistant *S. aureus* (MRSA; ST-10.1, ST-10.2, ST-10.4, ST-10.5, ST-10.6) and three methicillin-susceptible *S. aureus* (MSSA; ST-10.3, ST-10.7, ST-10.8). All participants submitted MRSA/MSSA results. Two out of 216 (0.9%) results were in disagreement with those expected. This was caused by one participant (Lab #40) reporting a wrong methicillin resistance phenotype for strains ST-10.6 and ST-10.8.

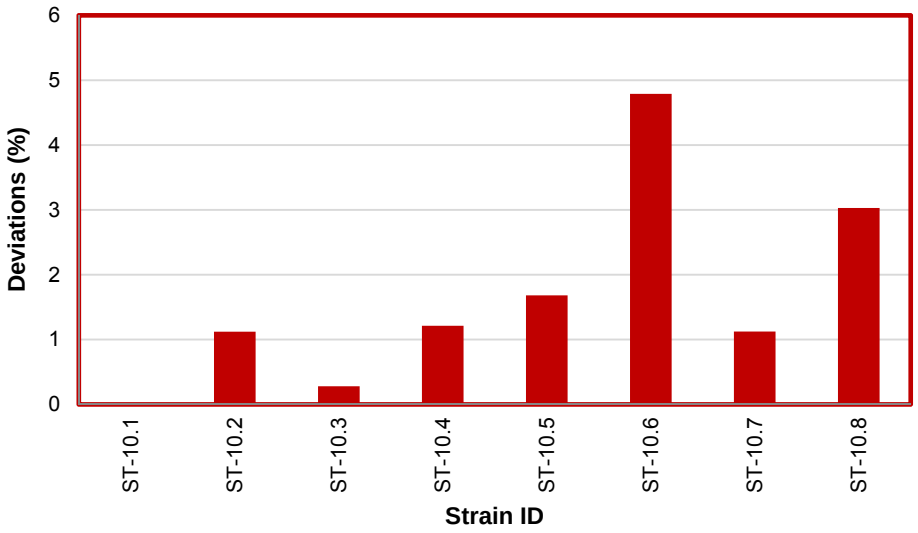


Figure 5. Deviations (%) from expected interpretation of AST results for each *Staphylococcus aureus* strain, EURL-AR EQAS 2016.

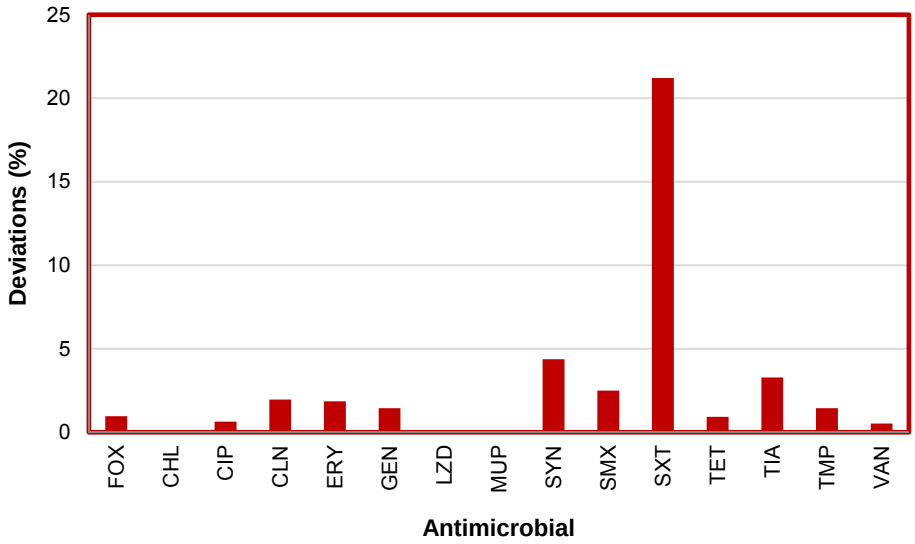


Figure 6. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Staphylococcus aureus* component of the EURL-AR EQAS 2016. CHL, chloramphenicol; CIP, ciprofloxacin; CLN, clindamycin; ERY, erythromycin; FOX, cefoxitin; GEN, gentamicin; LZD, linezolid; MUP, mupirocin; SYN, quinupristin/dalfopristin (synercid); SMX, sulfamethoxazole; SXT, sulfamethoxazole-trimethoprim; TET, tetracycline; TIA, tiamulin; TMP, trimethoprim; VAN, vancomycin.

3.2.3 *Escherichia coli*

Thirty-one laboratories (from 28 MS and three non-MS) uploaded results for the *E. coli* trial.

No results deviating from those expected were observed for EC-10.7. For the remaining strains, deviations from expected results ranged

from 0.3 % for EC-10.2 to 1.4% for EC-10.3 (Figure 7). For each strain, at least half of the deviations obtained represented "one-fold dilution issues" or different interpretation of MIC values, with the exception of deviations in EC-10.6 and EC-10.8 which suggested performance problems.

No deviations from expected results were obtained when testing susceptibility to ampicillin, imipenem, meropenem, gentamicin and nalidixic acid (Figure 8). The antimicrobials that resulted in highest percentages of deviations were cefepime (4.3 %), sulfamethoxazole (2.4 %), and colistin and trimethoprim (both with 1.6 % deviations) (Figure 8). Eight cefepime deviations were obtained by four laboratories. Analysis of cefepime deviations revealed that most of them (5/8, 62.5%) were due either to interpretation of MIC values different from the recommend protocol or "one-fold dilution issues", whereas the remaining three were likely to represent performance issue. Four colistin deviations were obtained by three laboratories. Three of them (75%) represented "one-fold dilution issues" and only one suggested performance problems. For sulfamethoxazole, six deviations in two strains were obtained by four laboratories, whereas for trimethoprim, four deviations in two strains were obtained by four laboratories. For these antimicrobials, results appeared to be true deviations possibly linked to the fact that those MICs might be difficult to define.

An overview of obtained and expected results is reported in Appendix 7c.

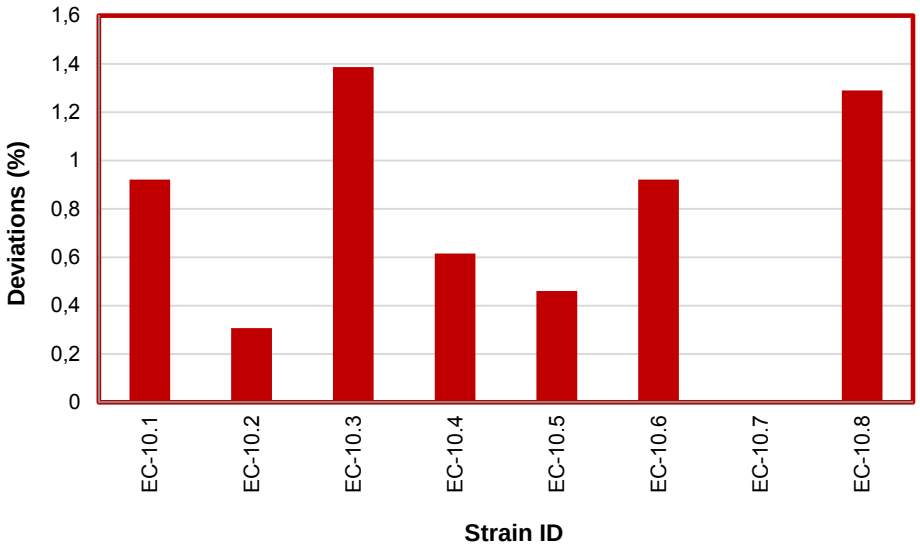


Figure 7. Deviations (%) from expected interpretation of AST results for each *Escherichia coli* strain, EURL-AR EQAS 2016.

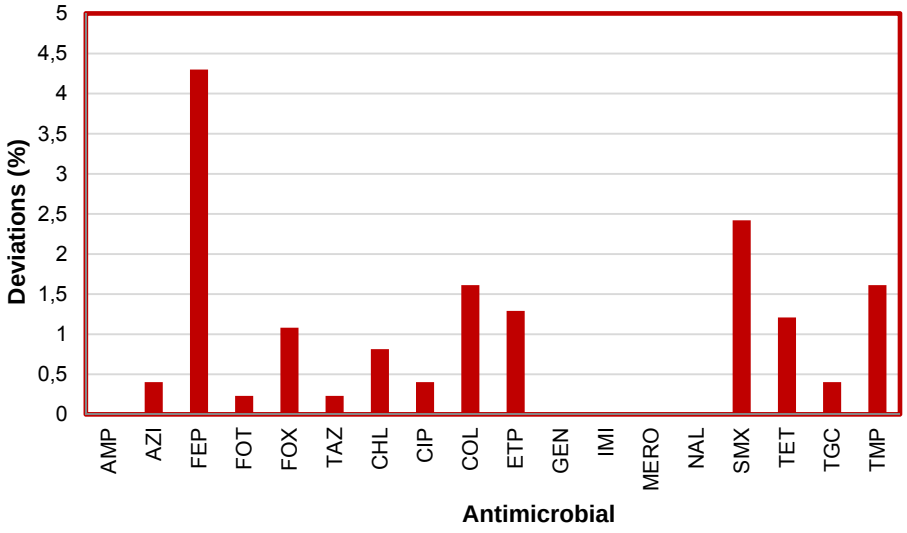


Figure 8. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Escherichia coli* component of the EURL-AR EQAS 2016. AMP, ampicillin; AZI, azithromycin; FEP, cefepime; FOT, cefotaxime; TAZ, ceftazidime; CHL, chloramphenicol; CIP, ciprofloxacin; COL, colistin; ETP, ertapenem; GEN, gentamicin; IMI, imipenem; MERO, meropenem; NAL, nalidixic acid; SMX, sulfamethoxazole; TET, tetracycline; TGC tigecycline; TMP trimethoprim

Beta-lactamase-producing *E. coli*

Participants were requested to detect the production of beta-lactamases and classify the beta-lactam resistance phenotype into Extended-Spectrum Beta-Lactamase (ESBL)/AmpC/carbapenemase production as a mandatory component.

Guidelines for interpretation of the beta-lactam resistance phenotype were specified in the protocol (Appendix 4b) and were in agreement with the latest recommendations by EFSA.

In this EQAS, EC-10.2, EC-10.3 and EC-10.4 were ESBL producers; EC-10.1 and EC-10.8 were AmpC beta-lactamase producers and EC-10.5 was a carbapenemase producer. The remaining strains (EC-10.6 and EC-10.7) did not produce any beta-lactamase.

All 31 participants uploaded results for this part of the *E. coli* trial. No wrong detection of ESBL/AmpC/carbapenemase-producing *E. coli* was observed, though deviations from correct classification of the phenotype of some of the strains were reported for seven (23%) laboratories, probably due to the fact that the criteria for categorisation of beta-lactam resistance were not clear to some participants (Figure 9). Six laboratories classified EC-10.1 as "Presumptive ESBL+AmpC" instead of "Presumptive AmpC". This strain produced CMY-2 and TEM-1 beta-lactamase.

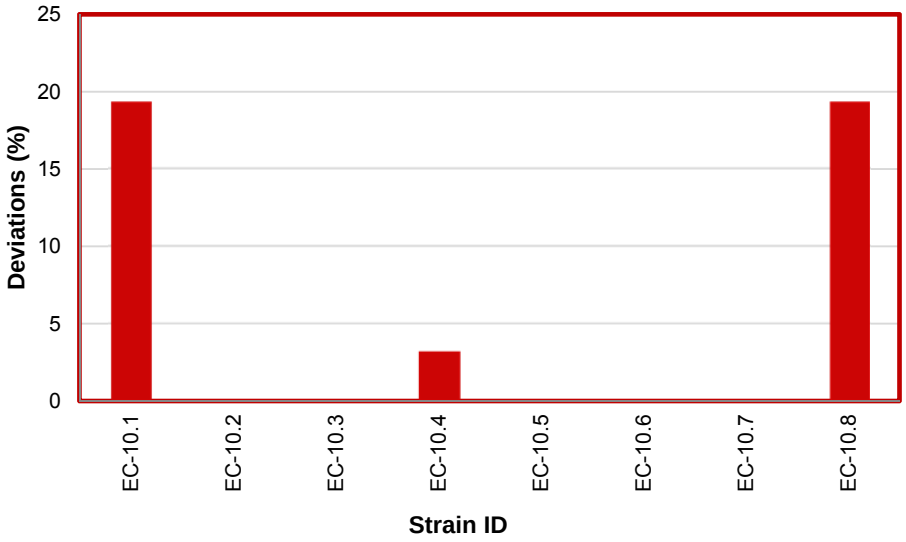


Figure 9. Deviations (%) in classification of beta-lactam resistance phenotype for each *Escherichia coli* strain, EURL-AR EQAS 2016.

The same six laboratories had problems also in interpretation of beta-lactam resistance of EC-10.8: five and one laboratories reported this strain as "Presumptive ESBL+AmpC" and "Other phenotype", respectively, instead of "Presumptive AmpC". This strain produced CMY-2 beta-lactamase.

One laboratory classified EC-10.4 as "Presumptive ESBL+AmpC" instead of "Presumptive ESBL" probably linked to erroneous detection/reporting of cefoxitin resistance. This strain produced SHV-12 beta-lactamase.

EC-10.2, EC-10.3and EC-10.5 producing CTX-M-1, SHV-12 and VIM-1 beta-lactamases were correctly classified by all participants.

3.3 Performance by individual laboratories

The figures 10, 11 and 12 illustrate the percentage of deviations that each laboratory obtained in the three MIC determination/interpretation trials.

3.3.1 Enterococci

Seventeen laboratories (61%) reported results in full agreement with those expected (Figure 10).

Nine laboratories had between 1% and 4.2% deviations (Figure 10). Of these, seven laboratories obtained deviations due to “one-fold dilution issues” or to interpretation of the MIC values (obtained as expected) different from the protocol. This suggests no problems in AST performance in these laboratories, though reasons for interpreting MIC values differently from what indicated in the protocol are unclear and will be followed-up. The remaining two laboratories obtained deviations partly due to “one-fold dilution issues” and partly due to true deviations such as vancomycin and teicoplanin MIC different from the expected in one strain (Lab #42), and ciprofloxacin MIC different from the expected in one strain (Lab #39), which suggest some performance issues.

Two laboratories had percentages of deviations (11% and 7%) above the threshold for acceptable laboratory performance (5%) (Figure 10). Lab #40 had nine deviations in five strains. All but one (which was a “one-fold dilution issue”) likely represent performance/reading problems.
Lab #45 had six deviations in four strains. Half of them were ”one-fold dilution issues”, and two might indicate problems in gentamicin susceptibility testing. Follow-up with these laboratories is ongoing.

Deviations from expected results obtained by each participant in the enterococci trial are reported in Appendix 8a.

3.3.2 Staphylococci

Fifteen laboratories (55%) reported results in full agreement with those expected (Figure 11).

Nine laboratories obtained between 0.9% and 3.4% deviations (Figure 11). All deviations obtained by these laboratories represented either “one-fold dilution issues” or problems in defining the MICs of sulfamethoxazole or sulfamethoxazole/trimethoprim. Thus, although reassuring of the overall good AST performance of these laboratories, these results reveal that reading MICs of sulfamethoxazole or sulfamethoxazole/trimethoprim for staphylococci present challenges that need to be addressed.

Three laboratories had percentages of deviations (12.7%, and 7.2% for two laboratories) above the threshold for acceptable laboratory performance (5%) (Figure 11).
Lab #40 had 14 deviations in three strains and identified the issue just after the EQAS deadline by realising that most (93%) of the deviations were due to a switch of two strains. This represents a serious strain management issue but not a MIC determination problem.
Lab #17 had eight deviations in two strains. Also in this case the participant followed-up soon after the EQAS deadline and sent the strains back to the EURL-AR for confirmatory testing. AST by the EURL-AR confirmed the participant’s results, thus also in this case there seemed to be no problem in performance of MIC determination. Whole genome sequencing is ongoing to determine if there was loss of resistance genes at some point during shipment/storage. Notably, no other participant experienced this issue.
Lab #45 had eight deviations in four strains. Two deviations were ”one-fold dilution issues”, whereas the remaining might suggest problems in AST of staphylococci. Lab #45 obtained > 5% deviations also in the enterococci trial, which

might indicate a general problem when testing Gram-positive bacteria.

Deviations from expected results obtained by each participant in the staphylococci trial are reported in Appendix 8b.

3.3.3 *Escherichia coli*

Fourteen laboratories (45%) reported results in full agreement with those expected (Figure 12).

Ten laboratories (32%) had 0.6% deviations representing one deviation per laboratory (Figure 12). Five of these deviations were “one-fold dilution issues” or interpretation of the MIC values (obtained as expected) different from the protocol. The remaining deviations indicate issues in testing/reporting susceptibility to cefoxitin, tetracycline, tigecycline and trimethoprim in different strains.

Three laboratories (10%) obtained 1.3% deviations representing two deviations per laboratory (Figure 12). Three of these deviations were “one-fold dilution issues” or interpretation of the MIC values (obtained as expected) different from the protocol. The remaining deviations indicate issues in testing/reporting susceptibility to sulfamethoxazole and tetracycline in different strains.

One laboratory (3%) obtained 4 deviations (Figure 12) of which one represented a possible colistin susceptibility testing issue, whereas the remaining were “one-fold dilution issues”.

One laboratory (3%) obtained 5 deviations (Figure 12) which were all indicative of issues in performance of azithromycin, cefepime and sulfamethoxazole susceptibility testing.

Finally, one laboratory (3%) obtained eight deviations (Figure 12) thus being on the threshold for acceptable laboratory performance. Three deviations were linked to interpretation of the cefepime MIC values (obtained as expected) different from the protocol, whereas the remaining deviations suggested issues in performance of sulfamethoxazole and trimethoprim susceptibility testing.

3.4 Performance in AST of the quality control strains

Antimicrobial susceptibility test results for the quality control strains were evaluated based on the CLSI quality control ranges (Appendix 5).

3.4.1 *Enterococcus faecalis* ATCC 29212

Of the 28 participants in the enterococci trial, 27 performed AST of *E. faecalis* ATCC 29212 by MIC determination reporting a total of 288 test results, of which four (1.4%) were outside the acceptable range (Table 3). These deviations were obtained by two laboratories: one had three deviations that might represent performance issues whereas the other most likely performed a typo in entering the results on the database.

3.4.2 *Staphylococcus aureus* ATCC 29213

Of the 27 participants in the staphylococci trial, 24 performed AST of *S. aureus* ATCC 29213 by MIC determination reporting a total of 254 test results, which were all (100%) within the acceptable range (Table 4).

3.4.3 *Escherichia coli* ATCC 25922

Of the 31 participants in the *E. coli* trial, 30 tested *E. coli* ATCC 25922 by MIC determination on panel 1 reporting a total of 389 test results, of which four (1%) were outside the acceptable range (Table 5).

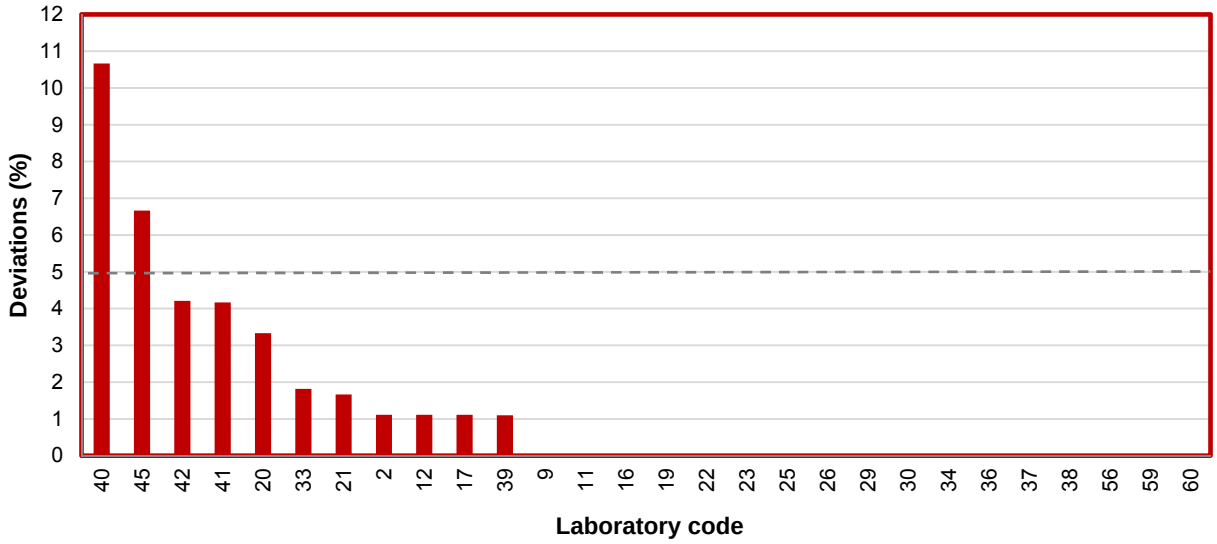


Figure 10. Deviations (%) by participating laboratory in the enterococci trial, EURL-AR EQAS 2016. The dashed line indicates the threshold (5%) for acceptable laboratory performance.

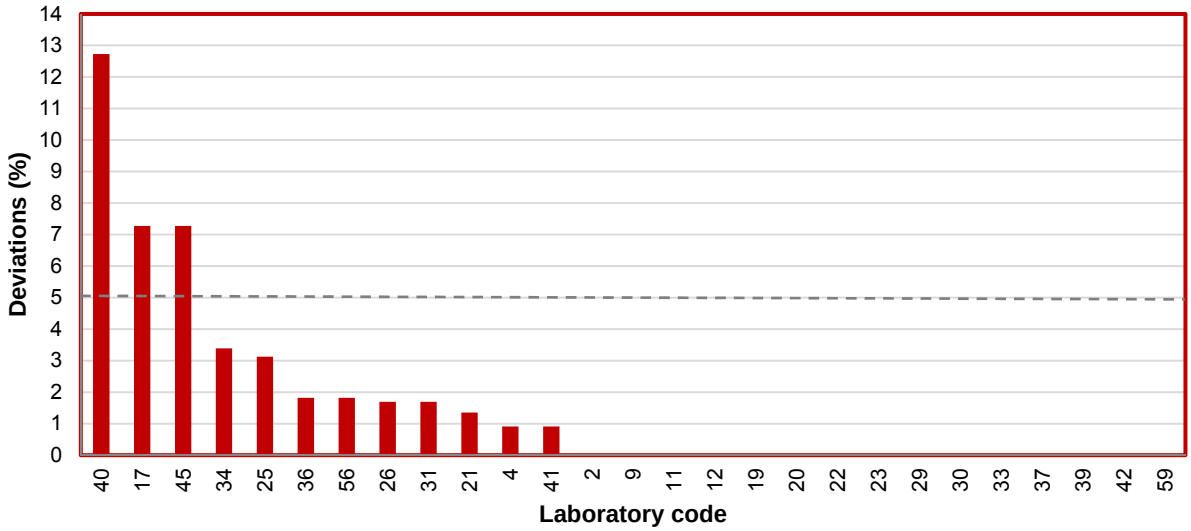


Figure 11. Deviations (%) by participating laboratory in the staphylococci trial, EURL-AR EQAS 2016. The dashed line indicates the threshold (5%) for acceptable laboratory performance.

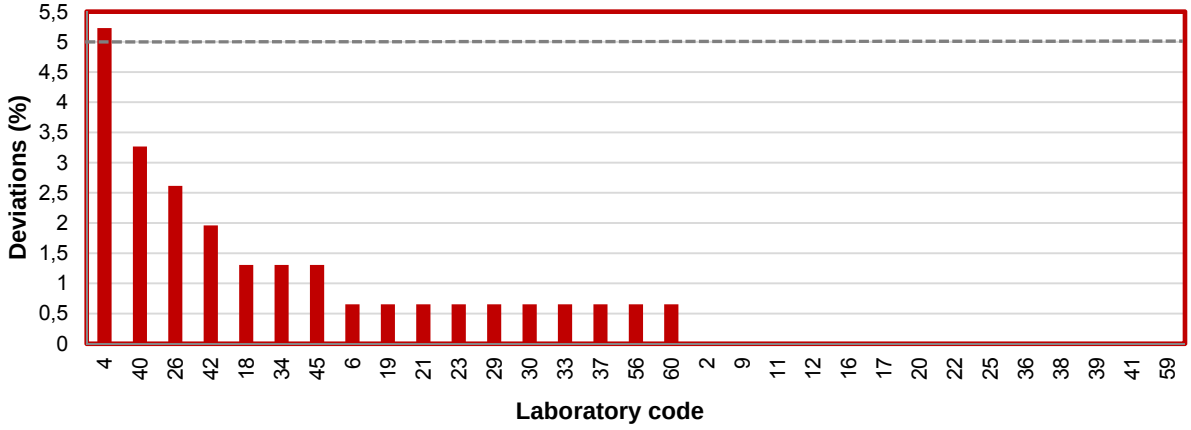


Figure 12. Deviations (%) by participating laboratory in the *Escherichia coli* trial, EURL-AR EQAS 2016. The dashed line indicates the threshold (5%) for acceptable laboratory performance.

These deviations were obtained by four laboratories measuring MIC of trimethoprim one step below the acceptable range and one laboratory measuring MIC of sulfamethoxazole one step above the acceptable range (Table 5). *E. coli* ATCC 25922 was tested for susceptibility to antimicrobials in panel 2 by 28 laboratories reporting 193 test results all (100%) within the acceptable range (Table 5).

Further details on test results of quality control strains are reported in Appendix 6.

Table 3. Antimicrobial susceptibility testing of *Enterococcus faecalis* ATCC 29212 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Ampicillin	0/26 (0%)	–	–
Chloramphenicol	0/27 (0%)	–	–
Ciprofloxacin	1/26 (3.8%)	1 step	
Daptomycin	1/25 (4)	2 steps	
Erythromycin	0/27 (0%)	–	–
Gentamicin	0/26 (0%)	–	–
Linezolid	0/27 (0%)	–	–
Quinu/dalfopristin	0/0	–	–
Teicoplanin	0/24 (0%)	–	–
Tetracycline	0/27 (0%)	–	–
Tigecycline	2/26 (7.7%)	–	1 step (1) typo (1)
Vancomycin	0/27 (0%)	–	–

Table 4. Antimicrobial susceptibility testing of *Staphylococcus aureus* ATCC 29213 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Cefoxitin	0/23 (0%)	–	–
Chloramphenicol	0/23 (0%)	–	–
Ciprofloxacin	0/23 (0%)	–	–
Clindamycin	0/23 (0%)	–	–
Erythromycin	0/24 (0%)	–	–
Gentamicin	0/23 (0%)	–	–
Linezolid	0/22 (0%)	–	–
Mupirocin	no range	–	–
Quinu/dalfopristin	0/0	–	–
Sulfamethoxazole	0/22 (0%)	–	–
Sulfa/Trimethoprim	0/2 (0%)	–	–
Tetracycline	0/24 (0%)	–	–
Tiamulin	no range	–	–
Trimethoprim	0/23 (0%)	–	–
Vancomycin	0/22 (0%)	–	–

4. Conclusions

This report presented the result of the EURL-AR EQAS 2016 for *E. coli*, enterococci and staphylococci. This proficiency test evaluated the performance in i) MIC determination and interpretation, ii) enterococci species identification and iii) detection of relevant phenotypes such as methicillin resistance in *S. aureus* and beta-lactam resistance mediated by ESBL/AmpC/carbapenemase in *E. coli*.

Participants invited to this EQAS were NRL-AR from each MS and additional laboratories affiliated to the EURL-AR network including laboratories from non-MS and laboratories other than NRL-AR in MS.

Results from NRL-AR and from one laboratory per non-MS were analysed in this report, leading to a total of 28 (25 MS and 3 non-MS), 27 (24 MS and 3 non-MS) and 31 (28 MS and 3 non-MS) sets of results analysed for enterococci, staphylococci and *E. coli*, respectively.

In the MIC determination and interpretation component, two, three and none laboratories obtained more than 5% deviations in the enterococci, staphylococci and *E. coli* trial, respectively. Communication between the EURL-AR and these underperforming laboratories is ongoing to assess the causes of the high percentages of deviations and to identify possible troubleshooting procedures. One case was peculiar, since the EURL-AR confirmed the participant's results – in disagreement with those expected – upon re-testing of the EQAS strains sent back from the participant. In this case, the high percentage of deviations is not linked to AST performance but likely to loss of resistance genes. WGS is ongoing to try to solve this issue. The fact that no other participant experienced a similar problem adds to the odd case.

Table 5. Antimicrobial susceptibility testing of *Escherichia coli* ATCC 25922 by MIC determination.

Antimicrobial	Proportion outside of range	Below accept. range	Above accept. range
Ampicillin	0/30 (0%)	–	–
Azithromycin	no range	–	–
Cefotaxime	0/29 (0%)	–	–
Ceftazidime	0/30 (0%)	–	–
Chloramphenicol	0/30 (0%)	–	–
Ciprofloxacin	0/30 (0%)	–	–
Colistin	0/30 (0%)	–	–
Gentamicin	0/30 (0%)	–	–
Meropenem	0/30 (0%)	–	–
Nalidixic acid	0/30 (0%)	–	–
Sulfamethoxazole	1/30 (3.3%)	–	1 step
Tetracycline	0/30 (0%)	–	–
Tigecycline	0/30 (0%)	–	–
Trimethoprim	3/30 (10%)	1 step	–
Cefepime	0/28 (0%)	–	–
Cefotaxime	0/28 (0%)	–	–
Cefotaxime/clavulanic acid	no range	–	–
Cefoxitin	0/28 (0%)	–	–
Ceftazidime	0/28 (0%)	–	–
Ceftazidime/clavulanic acid	no range	–	–
Ertapenem	0/28 (0%)	–	–
Imipenem	0/28 (0%)	–	–
Meropenem	0/28 (0%)	–	–
Temocillin	no range	–	–

For all participants obtaining deviations, although a notable proportion of deviations was due to "one-fold dilutions issues" (which are unavoidable with the used methods and do not indicate AST performance problems), improvements can still be pursued. Deviations due to different interpretation of the same MIC values were detected, which could easily be avoided. Issues related to strain management as well as MIC reading occurred too, and correction of these errors require internal troubleshooting that might differ in the different NRLs, and the EURL-AR is available for assistance if requested.

Overall, performance in the MIC determinations and interpretation component was consistent with that observed in recent EQAS iterations.

Enterococci species identification was performed correctly by all laboratories except

one, and in addition one laboratory did not perform this component. Though the results are overall excellent, assistance to those two laboratories will be offered.

Detection of methicillin resistance in *S. aureus* was correctly performed by all laboratories except one. The reason for the deviation was detected by the participant immediately after the EQAS deadline, and such self-evaluation represents a first important step to avoid that the same problem recurs in the future.

Detection of ESBL/AmpC/carbapenemase production in *E. coli* was correctly performed by all laboratories, though interpretation of the phenotype was challenging for some of them. This might be linked to the newly adopted criteria for classification of beta-lactam resistance phenotypes in this EQAS iteration. Communication with those participants was performed to clarify the classification scheme.

Colistin resistance in *E. coli*, a phenotype that acquired notable importance recently, was overall correctly detected, though some challenges when resistance mechanisms mediated a MIC just above the breakpoint for resistance were observed. Thus, one strain was incorrectly categorised as susceptible by two (out of 31; 6%) participants and one participant incorrectly classified as susceptible both colistin-resistant strains included in this EQAS. Colistin susceptibility testing is undoubtedly challenging, and all necessary QC procedures should be implemented to ensure valid results. Such QC procedures are periodically updated by EUCAST and publicly available (www.eucast.org). Laboratories in the network are welcome to ask the EURL-AR for assistance on this issue.

Finally, the EURL-AR welcomes suggestions for improvement of future EQAS trials and invites the network to contribute with ideas for newsletters and for training needs, with the overall goal to continuously improve the knowledge and skills of the laboratories involved in the AMR monitoring.

5. References

EFSA, Technical specifications on the harmonised monitoring and reporting of antimicrobial resistance in *Salmonella*, *Campylobacter* and indicator *Escherichia coli* and *Enterococcus* spp. bacteria transmitted through food. EFSA Journal 2012;10(6):2742 [64 pp.].

European Commission, 2013/652/EU: Commission Implementing Decision of 12 November 2013 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria

Schwarz S, Silley P, Simjee S, Woodford N, van DE, Johnson AP & Gaastra W. (2010) Editorial: assessing the antimicrobial susceptibility of bacteria obtained from animals. J Antimicrob Chemother 65: 601-604.

Appendix 1

DTU Food
National Food Institute

European Union Reference Laboratory Antimicrobial Resistance

G00-06-001/01.12.2014

EURL-AR EQAS pre-notification

EQAS 2016 FOR *E. COLI*, STAPHYLOCOCCI AND ENTEROCOCCI

The EURL-AR announces the launch of another EQAS, thus 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 antimicrobial susceptibility testing of eight *E. coli* isolates, eight staphylococci and eight enterococci isolates. Additionally, quality control (QC) strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224) and *S. aureus* ATCC 29213 (CCM 4223) (for MIC) will be distributed to new participants.

This EQAS is specifically for NRL's on antimicrobial resistance. Laboratories designated to be NRL-AR do not need to sign-up to participate but are automatically regarded as participants. You may contact the EQAS-Coordinator if you wish to inform of changes in relation to your level of participation in previous years. The EURL-AR will be able to cover the expenses for one parcel, only, per EU Member State. Therefore, countries with more than one laboratory registered on the EURL-AR contact-list will be contacted directly to confirm which laboratory will be included for participation free of charge.

The invitation to participate in the proficiency test is extended to additional participants from official NRLs and participants from laboratories which are involved in the network but are not designated NRLs (cost for participation will be 100 euro).

TO AVOID DELAY IN SHIPPING THE ISOLATES TO YOUR LABORATORY
The content of the parcel is "UN3373, Biological Substance Category B. Eight *E. coli*, eight staphylococci, eight enterococci and for new participants also the QC strains mentioned above. Please provide the EQAS coordinator with documents or other information that can simplify customs procedures (e.g. specific text that should be written on the proforma invoice). To avoid delays, 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 will be shipped in *June* 2016. The protocol for this proficiency test will be available for download from the website (www.eurl-ar.eu).

Submission of results: Results must be submitted to the National Food Institute **no later than *September, 2nd, 2016***, via the password-protected website.
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 that we will have is on antimicrobial susceptibility testing of *Salmonella* and *Campylobacter* and a new EQAS on isolation of ESBL and ampC –producing *E.coli* from samples which are both expected to be carried out in *October, 2016.*
Please contact me if you have comments or questions regarding the EQAS.

Sincerely,
Susanne Karlsmose Pedersen,
EURL-AR

EU Reference Laboratory, Antimicrobial Resistance, Søltofts Plads, Building 221, DK-2800 Kgs. Lyngby, Denmark.
Phone: + 45 3588 6601, Fax: + 45 3588 6341, e-mail: suska@food.dtu.dk

Appendix 2

Participants to the EURL-AR EQAS 2016

Institute	Country	*E. coli*	Ent	Staph
Austrian Agency for Health and Food Safety	Austria	x	x	x
Institute of Public Health	Belgium	x	no	x
Nacional Diagnostic and Research Veterinary Institute	Bulgaria	x	x	x
Croatian Veterinary Institut	Croatia	x	x	x
Veterinary Services	Cyprus	x	no	no
State Veterinary Institute Praha	Czech Republic	x	x	x
Danish Veterinary and Food Administration	Denmark	x	x	no
Estonian Veterinary and Food Laboratory	Estonia	x	x	x
Finnish Food Safety Authority EVIRA	Finland	x	x	x
Agence nationale de sécurité sanitaire ANSES - Fougères	France	x	x	no
Federal Institute for Risk Assessment	Germany	x	x	x
Veterinary Laboratory of Chalkis	Greece	x	no	no
Central Agricultural Office Veterinary Diagnostic Directorate	Hungary	x	x	x
University of Iceland	Iceland	x	x	x
Central Veterinary Research Laboratory	Ireland	x	x	x
Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana	Italy	x	x	x
Institute of Food Safety, Animal Health and Enviroment "BIOR"	Latvia	x	x	x
National Food and Veterinary Risk Assessment Institute	Lithuania	x	x	x
Laboratoire national de Santé	Luxembourg	x	x	x
Veterinary Services	Malta	x	no	no
Public Health Laboratory	Malta	x	x	x
Central Veterinary Institute of Wageningen UR	Netherlands	x	x	x
Food and Consumer Product Safety Authority (VWA)	Netherlands	x	x	x
Veterinærinstituttet	Norway	x	x	x
National Veterinary Research Institute	Poland	x	x	x
Laboratorio National de Investigacáo Veterinaria	Portugal	x	x	x
Institute for Diagnosis and Animal Health	Romania	x	x	x
Institute for Hygiene and Veterinary Public Health	Romania	x	x	x
State Veterinary and Food Institute (SVFI)	Slovakia	x	x	x
National Veterinary Institute	Slovenia	x	x	x
Laboratorio Central de Sanidad, Animal de Algete	Spain	x	x	no
Laboratorio Central de Sanidad, Animal de Santa Fe	Spain	no	no	x
VISAVET Health Surveillance Center, Complutense University	Spain	x	x	x
Agencia Espanola de Seguridad Alimentria y Nutricion	Spain	x	x	no
National Veterinary Institute, SVA	Sweden	x	x	x
Vetsuisse faculty Bern, Institute of veterinary bacteriology	Switzerland	x	x	x
The Veterinary Laboratory Agency	United Kingdom	x	x	x

Color code	
NRLs	
non- NRL enrolled for EQAS or extra NRL enrolled	
not EU-member state	

Appendix 3a

Expected MIC values

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 10.1	*Enterococcus faecalis*	2.0	0.25	<=0.5	1.0	8.0	1.0	>128.0	>1024.0	2.0	16.0	64.0	2.0
EURL ENT 10.2	*Enterococcus faecalis*	4.0	0.25	<=0.5	1.0	8.0	1.0	<=1.0	<=8.0	2.0	16.0	<=1.0	4.0
EURL ENT 10.3	*Enterococcus faecium*	1.0	0.06	>64.0	4.0	16.0	1.0	>128.0	<=8.0	2.0	8.0	64.0	>128
EURL ENT 10.4	*Enterococcus faecalis*	1.0	0.25	<=0.5	1.0	128.0	1.0	>128.0	256	2.0	32	128.0	<=1.0
EURL ENT 10.5	*Enterococcus faecium*	1.0	0.12	64.0	4.0	8.0	0.5	2.0	<=8.0	2.0	4.0	64.0	>128.0
EURL ENT 10.6	*Enterococcus faecalis*	2	0.25	<=0.5	1.0	128.0	1.0	>128.0	>1024.0	2.0	32.0	128.0	2.0
EURL ENT 10.7	*Enterococcus faecalis*	2	0.12	<=0.5	1	64	2	>128	<=8.0	8	16	128	2
EURL ENT 10.8	*Enterococcus faecium*	1.0	0.12	<=0.5	4.0	8.0	2.0	>128.0	<=8.0	2.0	4.0	64.0	<=1.0

Expected interpretation

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 10.1	*Enterococcus faecalis*	S	S	S	S	S	S	R	R	S	NA	R	S
EURL ENT 10.2	*Enterococcus faecalis*	S	S	S	S	S	S	S	S	S	NA	S	S
EURL ENT 10.3	*Enterococcus faecium*	S	S	R	S	S	S	R	S	S	R	R	R
EURL ENT 10.4	*Enterococcus faecalis*	S	S	S	S	R	S	R	R	S	NA	R	S
EURL ENT 10.5	*Enterococcus faecium*	S	S	R	S	S	S	S	S	S	S	R	R
EURL ENT 10.6	*Enterococcus faecalis*	S	S	S	S	R	S	R	R	S	NA	R	S
EURL ENT 10.7	*Enterococcus faecalis*	S	S	S	S	R	S	R	S	R	NA	R	S
EURL ENT 10.8	*Enterococcus faecium*	S	S	S	S	S	S	R	S	S	S	R	S

Abbreviations

DAP, daptomycin
TIG, tigecycline
TEI, teicoplanin
AMP, ampicillin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
GEN, gentamicin
LZD, linezolid
Q-D, quinupristin-dalfopristin (synercid)
TET, tetracycline
VAN, vancomycin
R, resistant
S, susceptible
NA, not applicable

Color legend

resistant
susceptible

Appendix 3b

Expected MIC values

Strain ID	Species	Antimicrobial														
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX**	GEN	SMX	TET	TIA	TMP	SXT
EURL ST 10.1	*Staphylococcus aureus*	<=1.0	8.0	2.0	0.064	12	8.0	0.25	>16.0	16.0	<=0.25	64.0	>32.0	>32.0	>32.0	0.5
EURL ST 10.2	*Staphylococcus aureus*	<=1.0	8.0	2.0	0.064	16	8.0	0.25	>16.0	16.0	0.5	<=32.0	>32.0	>32.0	>32.0	0.5
EURL ST 10.3	*Staphylococcus aureus*	<=1.0	<=0.5	2.0	0.064	0.125	8	0.25	0.5	4	<=0.25	<=32.0	<=0.5	1	1	<=0.25
EURL ST 10.4	*Staphylococcus aureus*	<=1.0	<=0.5	2.0	0.094	0.125	8.0	2.0	<=0.25	8.0	>16.0	>512.0	32.0	0.5	1.0	<=0.25
EURL ST 10.5	*Staphylococcus aureus*	<=1.0	1.0	2.0	0.064	>256	8.0	0.5	>16.0	32.0	0.5	128.0	>32.0	0.5	>32.0	2.0
EURL ST 10.6	*Staphylococcus aureus*	<=1.0	2.0	2.0	0.064	>256	8.0	>8.0	>16.0	8.0	16.0	<=32.0	>32.0	4.0	>32.0	1.0
EURL ST 10.7	*Staphylococcus aureus*	<=1.0	<=0.5	2.0	0.094	0.125	8.0	0.25	0.5	4.0	<=0.25	64.0	<=0.5	0.5	2.0	<=0.25
EURL ST 10.8	*Staphylococcus aureus*	<=1.0	<=0.5	2.0	0.064	0.094	8.0	1	0.5	4.0	0.5	64.0	>32.0	1.0	>32	1.0

Expected interpretation

Strain ID	Species	Antimicrobial															MRSA*	Gene detected
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX	GEN	SMX	TET	TIA	TMP	SXT		
EURL ST 10.1	*Staphylococcus aureus*	S	R	S	S	R	S	S	R	R	S	S	R	R	R	S	positive	*mecA*
EURL ST 10.2	*Staphylococcus aureus*	S	R	S	S	R	S	S	R	R	S	S	R	R	R	S	positive	*mecA*
EURL ST 10.3	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	negative	NA
EURL ST 10.4	*Staphylococcus aureus*	S	S	S	S	S	S	R	S	R	R	R	R	S	S	S	positive	*mecA*
EURL ST 10.5	*Staphylococcus aureus*	S	S	S	S	R	S	S	R	R	S	S	R	S	R	R	positive	*mecA*
EURL ST 10.6	*Staphylococcus aureus*	S	R	S	S	R	S	R	R	R	R	S	R	R	R	R	positive	*mecA*
EURL ST 10.7	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	negative	NA
EURL ST 10.8	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	S	S	S	R	S	R	R	negative	NA

Abbreviations

VAN, vancomycin
Q-D, quinupristin-dalfopristin (synercid)
LZD, linezolid
MUP, muprocin
CLN, clindamycin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
FOX, cefoxitin
GEN, gentamicin
SMX, sulphamethoxazole
TET, tetracycline
TIA, tiamulin
TMP, trimethoprim
SXT, sulphamethoxazole+trimethoprim
R, resistant
S, susceptible
NA, not applicable

Color legend

resistant
susceptible

*the interpretation for MRSA is "positive" or "negative"

Appendix 3c - Panel 1

Expected MIC values

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 10.1	*Escherichia coli*	>64.0	<=0.03	8.0	<=8.0	>8.0	>8.0	>4.0	1.0	>128.0	>1024.0	>64.0	>32.0	8.0	0.5
EURL EC 10.2	*Escherichia coli*	>64.0	<=0.03	<=1.0	<=8.0	<=0.015	4.0	>4.0	<=0.5	<=4.0	<=8.0	<=2.0	<=0.25	8.0	<=0.25
EURL EC 10.3	*Escherichia coli*	>64	<=0.03	4.0	32.0	<=0.015	>8.0	4.0	1.0	<=4.0	>1024.0	64.0	<=0.25	4.0	0.5
EURL EC 10.4	*Escherichia coli*	>64.0	<=0.03	<=1.0	32.0	<=0.015	8.0	2.0	1.0	<=4.0	>1024.0	64.0	<=0.25	4.0	0.5
EURL EC 10.5	*Escherichia coli*	>64.0	4.0	<=1.0	<=8.0	0.03	>8.0	>4.0	2.0	<=4.0	16.0	<=2.0	<=0.25	4.0	<=0.25
EURL EC 10.6	*Escherichia coli*	>64.0	<=0.03	<=1.0	<=8.0	0.25	<=0.5	<=0.25	1.0	<=4.0	>1024.0	64.0	>32.0	4.0	0.5
EURL EC 10.7	*Escherichia coli*	2.0	<=0.03	<=1.0	<=8.0	<=0.015	<=0.5	<=0.25	<=0.5	<=4.0	16.0	<=2.0	<=0.25	4.0	<=0.25
EURL EC 10.8	*Escherichia coli*	>64.0	0.06	<=1.0	<=8.0	0.03	>8.0	>4.0	1.0	<=4.0	32	4.0	<=0.25	4.0	<=0.25

Expected interpretation

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 10.1	*Escherichia coli*	R	S	R	S	R	R	R	S	R	R	R	R	S	S
EURL EC 10.2	*Escherichia coli*	R	S	S	S	S	R	R	S	S	S	S	S	S	S
EURL EC 10.3	*Escherichia coli*	R	S	R	R	S	R	R	S	S	R	R	S	S	S
EURL EC 10.4	*Escherichia coli*	R	S	S	R	S	R	R	S	S	R	R	S	S	S
EURL EC 10.5	*Escherichia coli*	R	R	S	S	S	R	R	S	S	S	S	S	S	S
EURL EC 10.6	*Escherichia coli*	R	S	S	S	R	S	S	S	S	R	R	R	S	S
EURL EC 10.7	*Escherichia coli*	S	S	S	S	S	S	S	S	S	S	S	S	S	S
EURL EC 10.8	*Escherichia coli*	R	S	S	S	S	R	R	S	S	S	S	S	S	S

Abbreviations

AMP, ampicillin
MER, meropenem
COL, colistin
CHL, chloramphenicol
CIP, ciprofloxacin
TAZ, ceftazidime
FOT, cefotaxime
GEN, gentamicin
NAL, nalidixic acid
SMX, sulphamethoxazole
TET, tetracycline
TMP, trimethoprim
AZT, azithromycin
TIG, tigecycline
R, resistant
S, susceptible

Color legend

resistant
susceptible

Appendix 3c - Panel 2

Expected MIC values

Strain ID	Species	Antimicrobial									
		FOX	TAZ	TAZ+CL	FOT	FOT+CL	FEP	MER	IMI	ETP	TRM
EURL EC 10.1	*Escherichia coli*	64	16	8/4	8	8/4	0.25	<=0.03	0.25	0.06	8
EURL EC 10.2	*Escherichia coli*	4	2	<=0.12/4	64	<=0.06/4	16	<=0.03	<=0.12	<=0.015	4
EURL EC 10.3	*Escherichia coli*	4	8	<=0.12/4	2	<=0.06/4	0.25	<=0.03	0.25	<=0.015	4
EURL EC 10.4	*Escherichia coli*	2	8	<=0.12/4	2	<=0.06/4	0.25	<=0.03	<=0.12	<=0.015	4
EURL EC 10.5	*Escherichia coli*	64	>128	128/4	>64	>64/4	32	4	4	0.5	64
EURL EC 10.6	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
EURL EC 10.7	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
EURL EC 10.8	*Escherichia coli*	64	8	8/4	16	8/4	0.25	<=0.03	0.25	0.12	8

Expected interpretation

Strain ID	Species	Antimicrobial										Presumptive mechanism mediating beta-lactam resistance					
		FOX	TAZ	TAZ+CL*	FOT	FOT+CL*	FEP	MER	IMI	ETP	TRM**	ESBL	AmpC	ESBL+AmpC	Carbapenemase	Other	None
EURL EC 10.1	*Escherichia coli*	R	R	no synergy	R	no synergy	R	S	S	S	NA	no	yes	no	no	no	no
EURL EC 10.2	*Escherichia coli*	S	R	synergy	R	synergy	R	S	S	S	NA	yes	no	no	no	no	no
EURL EC 10.3	*Escherichia coli*	S	R	synergy	R	synergy	R	S	S	S	NA	yes	no	no	no	no	no
EURL EC 10.4	*Escherichia coli*	S	R	synergy	R	synergy	R	S	S	S	NA	yes	no	no	no	no	no
EURL EC 10.5	*Escherichia coli*	R	R	no synergy	R	no synergy	R	R	R	R	NA	no	no	no	yes	no	no
EURL EC 10.6	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	no	no	no	no	no	yes
EURL EC 10.7	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	no	no	no	no	no	yes
EURL EC 10.8	*Escherichia coli*	R	R	no synergy	R	no synergy	R	S	S	R	NA	no	yes	no	no	yes	no

Abbreviations

FOX, cefoxitin
TAZ, ceftazidime
TAZ+CL, ceftazidime+clavulanic acid
FOT, cefotaxime
FOT+CL, cefotaxime+clavulanic acid
FEP, cefepime
MER, meropenem
IMI, imipenem
ETP, ertapenem
TRM, temocillin
R, resistant
S, susceptible
NA, not applicable

*interpretation of TAZ+CL and FOT+CL is SYNERGY or NO SYNERGY

**interpretation for temocillin is not available, so participants should be requested to upload only the MIC value

Color legend

resistant
susceptible

Appendix 4a, page 1 of 1

National Food Institute

G00-06-001/01.12.2014

EURL-AR External Quality Assurance System (EQAS) 2016:

-*Escherichia coli*, staphylococci and enterococci

Id: «Lab_no_»
«Name»
«Institute__»
«Country»

Lyngby, 21st June 2016

Dear

Please find enclosed the bacterial strains for the EURL-AR EQAS 2016. Upon arrival to your laboratory, the strains should be stored in a dark place at 4°C for stabs, and in a dark and cool place for freeze-dried strains.

On the EURL-AR-website (www.eurl-ar.eu) the following documents relevant for the EURL-AR EQAS are available:

- Protocol for *E. coli*, staphylococci and enterococci including test forms
- Instructions for Opening and Reviving Lyophilised Cultures
- Subculture and Maintenance of Quality Control Strains

We ask you to examine the eight *E. coli, enterococci and S. aureus* strains that we send to you by performing antimicrobial susceptibility testing. In the protocol you can find detailed description of the procedures to follow. Additionally, you can find a description of the procedure to enter your results into the interactive web database. For accessing the database, you need this username and password:

Your username: «Username»

Your password: «Password»

Please keep this document
Your username and password will not appear in other documents

Results should be entered in the database no later than **2nd September 2016.** Please acknowledge receipt of this parcel immediately upon arrival (to vabo@food.dtu.dk) and do not hesitate to contact me for further information.

Yours sincerely,

Valeria Bortolaia

Technical University of Denmark
National Food Institute
Kemitorvet
Building 204
DK-2800 Kgs. Lyngby
Denmark
Tel +45 35 88 70 00
Dir. +45 35 88 62 69
Fax +45 35 88 63 41
vabo@food.dtu.dk
www.food.dtu.dk

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

PROTOCOL

For antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

1 INTRODUCTION

The organisation and implementation of an External Quality Assurance System (EQAS) on antimicrobial susceptibility testing (AST) of *E. coli*, enterococci and staphylococci is among the tasks of the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). The EC/Ent/Staph EQAS 2016 will include AST of eight *Escherichia coli*, eight enterococci and eight staphylococci strains and AST of reference strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224), and *S. aureus* ATCC 29213 (CCM 4223).

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

The above-mentioned reference strains are included in the parcel only for new participants of the EQAS who did not receive them previously. The reference strains are original CERTIFIED cultures provided free of charge, and should be used for future internal quality control for antimicrobial susceptibility testing in your laboratory. The reference strains will not be included in the years to come. Therefore, please take proper care of these strains. Handle and maintain them as suggested in the manual 'Subculture and Maintenance of QC Strains' available on the EURL-AR website (see www.eurl-ar.eu).

Various aspects of the proficiency test scheme may from time to time be subcontracted. When subcontracting occurs it is placed with a competent subcontractor and the National Food Institute is responsible to the scheme participants for the subcontractor's work.

2 OBJECTIVES

This EQAS aims to support laboratories to assess and, if necessary, to improve the quality of results obtained by AST of pathogens of food- and animal-origin, with special regard to *E. coli*, enterococci and staphylococci. Further objectives are to evaluate and improve the comparability of surveillance data on antimicrobial susceptibility of *E. coli*, enterococci and staphylococci reported to EFSA by different laboratories.

3 OUTLINE OF THE EC/ENT/STAPH EQAS 2016

Shipping, receipt and storage of strains

In June 2016, the National Reference Laboratories for Antimicrobial Resistance (NRL-AR) will receive a parcel containing eight *E. coli*, eight enterococci and eight staphylococci strains from the DTU National Food Institute. This parcel will also contain reference strains, but only for participants who did not receive them previously.
All strains belong to UN3373, Biological substance, category B. Extended-spectrum beta-lactamase (ESBL)-producing strains as well as carbapenemase-producing strains and methicillin-resistant *Staphylococcus aureus* (MRSA) will be included in the selected material.
The reference strains are shipped lyophilised, while the test strains are stab cultures. On arrival, the stab cultures must be subcultured, and all cultures should be adequately stored until testing. A suggested procedure for reconstitution of the lyophilised reference strains is presented below.

Suggested procedure for reconstitution of the lyophilised reference strains

Please refer to the document 'Instructions for opening and reviving lyophilised cultures' reported on the EURL-AR-website (see www.eurl-ar.eu).

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

Antimicrobial susceptibility testing

The strains should be tested for susceptibility to the antimicrobials listed in Tables 1, 2 and 3, using the method implemented in your laboratory for performing monitoring for EFSA and applying the interpretative criteria listed below.

Participants should perform minimum inhibitory concentration (MIC) determination using the methods stated in the Commission Implementing Decision 2013/652/EU. For staphylococci, MIC methods should be used as well, according to the EFSA recommendations and the antimicrobials to test are those stated under the EFSA technical specifications (see Table 3). For interpretation of the results, use the cut-off values listed in Tables 1, 2, 3 and 4 in this document. These values (except where indicated) represent the current epidemiological cut-off values developed by EUCAST (www.eucast.org), and allow categorisation of bacterial isolates into two categories: resistant or susceptible. A categorisation as intermediate is not accepted**.**

Participants will not be allowed to use disk diffusion as the current regulation and recommendations only focus on MIC testing.

3.1.1 *E. coli*

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 (µg/mL) **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
** EUCAST.org

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

Plasmid-mediated quinolone resistance

When performing antimicrobial susceptibility testing 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 tests for ESBL production are mandatory on all strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem and should be performed by testing the second panel of antimicrobials (Table 2 in this document corresponding to Table 4 in Commission Implementing Decision 2013/652/EU).

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 (µg/mL) **R is >**
Cefepime, FEP	0.125
Cefotaxime, FOT	0.25
Cefotaxime + clavulanic acid (F/C)	Not applicable
Cefoxitin, FOX	8
Ceftazidime, TAZ	0.5
Ceftazidime+ clavulanic acid (T/C)	Not applicable
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).

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

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, http://www.crl-ar.eu/data/images/ws_april-2016/f11_efsa_criteria.pdf and in the appendix to this protocol).

3.1.2 Enterococci

Table 3. Antimicrobials recommended for AST of *Enterococcus* spp. and interpretative criteria according to table 3 in Commission Implementing Decision 2013/652/EU

Antimicrobials for enterococci	MIC (µg/mL) **R is >** *E. faecium*	MIC (µg/mL) **R is >** *E. faecalis*
Ampicillin, AMP	4	4
Chloramphenicol, CHL	32	32
Ciprofloxacin, CIP	4	4
Daptomycin, DAP	4	4
Erythromycin, ERY	4	4
Gentamicin, GEN	32	32
Linezolid, LZD	4	4
Quinupristin-dalfopristin (Synercid), SYN	4*	Not applicable
Teicoplanin, TEI	2	2
Tetracycline, TET	4	4
Tigecycline, TGC	0.25	0.25
Vancomycin, VAN	4	4

*DANMAP 2009 (www.danmap.org)

Identification of *Enterococcus* spp.
Species identification of enterococci must be performed by the NRLs using in-house methods or adopting the protocol available on the EURL-AR website under: www.eurl-ar.eu/233-protocols.htm.

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

3.1.3 Staphylococci

Table 4. Antimicrobials recommended for AST of *Staphylococcus aureus* and interpretative criteria according to EFSA technical specifications (EFSA Journal 2012;10(10):2897)

Antimicrobials for *S. aureus*	MIC (µg/mL) **R is >**
Cefoxitin, FOX	4
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	1
Clindamycin, CLN	0.25
Erythromycin, ERY	1
Gentamicin, GEN	2
Linezolid, LZD	4
Mupirocin, MUP	1
Quinupristin-dalfopristin (Synercid), SYN	1
Sulfamethoxazole, SMX	128
Sulfamethoxazole+Trimethoprim, SXT	0.5
Tetracycline, TET	1
Tiamulin, TIA	2
Trimethoprim, TMP	2
Vancomycin, VAN	2

Identification of MRSA

Confirmation of *mec*A and/or *mecC* presence is mandatory in this EQAS. For this purpose, you are recommended to use the PCR method protocol recommended by the EURL-AR (www.eurl-ar.eu/233-protocols.htm) and upload the result as 'positive' or 'negative'.

4 REPORTING OF RESULTS AND EVALUATION

Please write your results in the test forms, and enter your results into the interactive web database. In addition, we kindly ask you to report in the database the tested MIC range for the staphylococci tests (for this organism only, as it is not included the Commission Implementing Decision 2013/652/EU). Finally, if **you did not use the cut-off values recommended in the protocol for interpretation of *Staphylococcus* AST results**, please report the breakpoints used in the database.

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

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 September 2nd, 2016.** 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 summarised 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:

Susanne Karlsmose Pedersen
National Food Institute
Technical University of Denmark
Søltofts Plads, Building 221, DK-2800 Lyngby

Denmark

Tel: +45 3588 6601
Fax: +45 3588 6341

E-mail: suska@food.dtu.dk

5 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE

Please read carefully this paragraph before entering the web page.
Remember that you need by your side the completed test forms and the breakpoint values you used.

Enter the EURL-AR EQAS 2016 start web page (http://eurl-ar.food.dtu.dk), write your username and password in lower-cases and press enter. Your username and password are indicated in the letter accompanying your strains. Do not hesitate to contact us if you experience problems with the login.

You can browse back and forth by using the Home or back keys, but please remember to save your inputs before.

Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

European Union Reference Laboratory Antimicrobial Resistance

5.1 AST of *E. coli*, enterococci and staphylococci

Click on either "*E. coli*", "enterococci" or "staphylococci" for input of test results based on the results you are going to upload.

Click on "Start of Data Entry - Methods and Breakpoints".

In the next page, you can navigate among fields with the Tab-key and the mouse.

Complete the fields related to the method used for antimicrobial susceptibility testing and the brand of MIC trays, etc.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

In the data entry pages, enter the obtained values and the interpretation (R, resistant or S, susceptible) for each *E. coli*, enterococcus and staphylococcus strain.

For *E. coli* strains, remember to report also the results for the ESBL detection tests.
For *S. aureus* strains, remember to report also the results for presence/absence of methicillin resistance.

If you did not test for susceptibility to a given antimicrobial, please leave the field empty.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

When uploading data on the reference strains, please enter MIC values in µg/ml. Remember to use the operator keys to show symbols like "equal to", etc.

Click on "save".

Review the input pages by browsing through the pages and make corrections if necessary. Remember to save a page if you make corrections. If you press home to leave a page without saving changes, you will see an error screen. In this case, click on "save" to save your results, browse back to the page and then continue.

Please complete the evaluation form.

Before approving your input, please be sure that you have filled in all the relevant fields because YOU CAN ONLY APPROVE ONCE! The approval blocks your data entry in the interactive database.

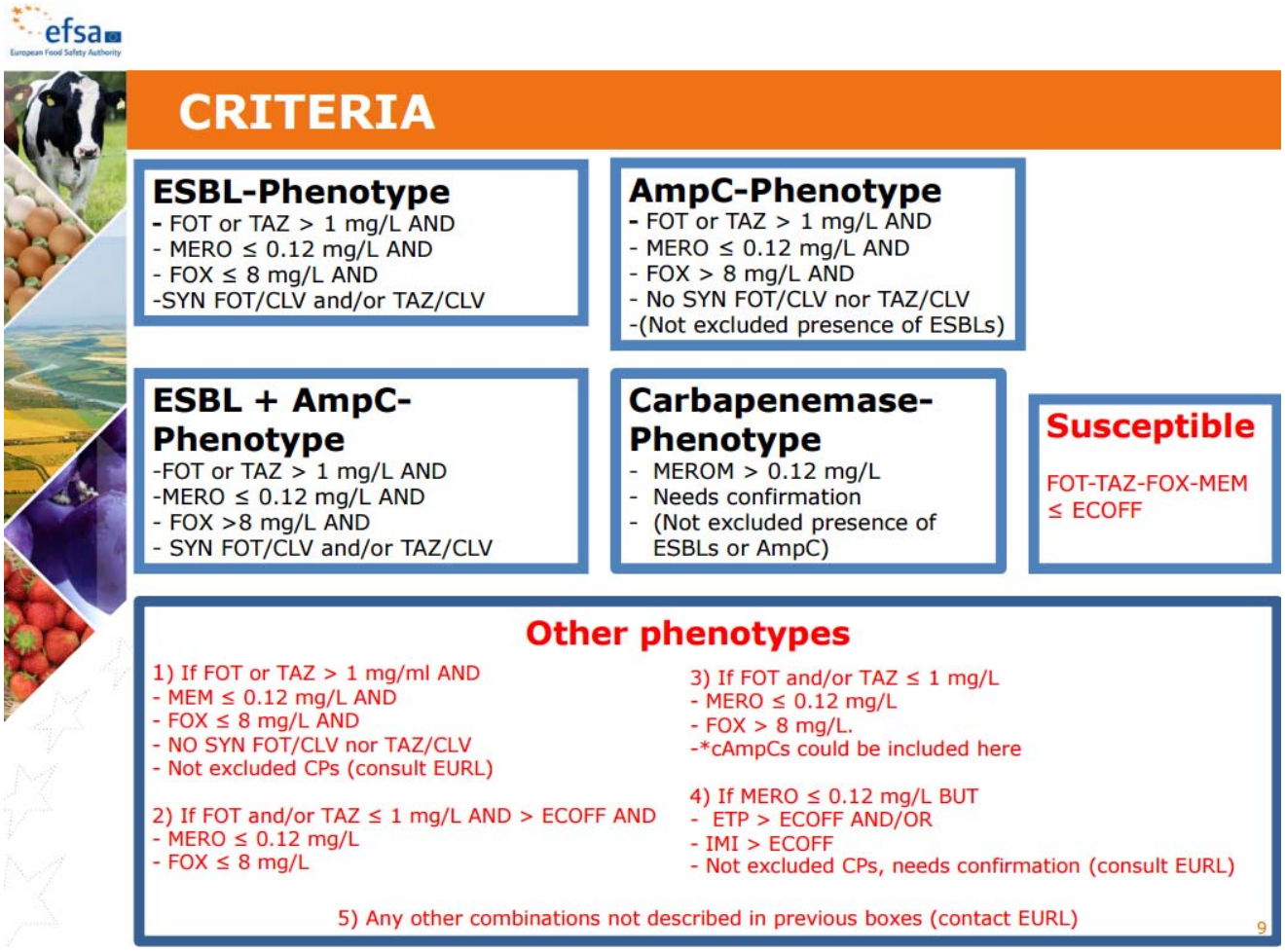
Appendix 4b

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

APPENDIX

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



Please refer to the full presentation at http://www.crl-ar.eu/data/images/ws_april-2016/f11_efsa_criteria.pdf

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

Antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

TEST FORMS

Name:
Name of laboratory:
Name of institute:
City:
Country:
E-mail:
Fax:

Comments:

Technical University of Denmark

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS METHODS - Enterococci

Which method did you use for antimicrobial susceptibility testing of enterococci in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution
Brand**:**

How many *Enterococcus* spp. isolates does your laboratory annually isolate:

How many *Enterococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS METHODS - Staphylococci

Which method did you use for antimicrobial susceptibility testing of staphylococci in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution
Brand**:**

How many *Staphylococcus* spp. isolates does your laboratory annually isolate:
How many *Staphylococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:
Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

Antimicrobial	General information The relevant information in the four columns below should be reported			
	Test-range for MIC (µg/ml)	Resistant (µg/ml)	Intermediate (µg/ml)	Susceptible (µg/ml)
Cefoxitin, FOX		≤		≥
Chloramphenicol, CHL		≤		≥
Ciprofloxacin, CIP		≤		≥
Clindamycin, CLN		≤		≥
Erythromycin, ERY		≤		≥
Gentamicin, GEN		≤		≥
Linezolid, LZD		≤		≥
Mupirocin, MUP		≤		≥
Quin.-Dalf. (Synercid), SYN		≤		≥
Sulfamethoxazole, SMX		≤		≥
Sulfamethoxazole + trimethoprim, SXT		≤		≥
Tetracycline, TET		≤		≥
Tiamulin (TIA)		≤		≥
Trimethoprim, TMP		≤		≥
Vancomycin, VAN		≤		≥

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS METHODS – *Escherichia coli*

Which method did you use for antimicrobial susceptibility testing of *E. coli* in this EQAS:

☐ MIC – Microtitre
☐ MIC – Agar dilution

Brand**:**

Incubation conditions: °C/ h

How many *E. coli* isolates does your laboratory annually isolate:

How many *E. coli* isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.1 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.2 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.3 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.4 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.5 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.6 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.7 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 10.8 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Enterococci

Antimicrobial susceptibility testing of reference strain *Enterococcus faecalis* ATCC 29212

Antimicrobial	MIC-value (µg/ml)
Ampicillin, AMP	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Daptomycin, DAP	
Erythromycin, ERY	
Gentamicin, GEN	
Linezolid, LZD	
Quinupristin-Dalfopristin (Synercid), SYN	
Teicoplanin, TEI	
Tetracycline, TET	
Tigecycline, TIG	
Vancomycin, VAN	

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.1	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.2	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.3	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.4	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.5	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.6	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.7	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 10.8	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Quinu-dalfopristin (Synercid), SYN			
	Sulfamethoxazole, SMX			
	Sulfamethoxazole+Trimethoprim, SXT			
	Tetracycline, TET			
	Tiamulin, TIA			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM - Staphylococci

Antimicrobial susceptibility testing of reference strain *S. aureus* ATCC 29213 (MIC)

Antimicrobial	MIC-value (µg/ml)
Cefoxitin, FOX	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Clindamycin, CLN	
Erythromycin, ERY	
Gentamicin, GEN	
Linezolid, LZD	
Mupirocin, MUP	
Quinupristin-dalfopristin (Synercid), SYN	
Sulfamethoxazole, SMX	
Sulfamethoxazole + trimethoprim, SXT	
Tetracycline, TET	
Tiamulin, TIA	
Trimethoprim, TMP	
Vancomycin, VAN	

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.1	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.1	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.2	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.2	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC10.3	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.3	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Technical University of Denmark DTU

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.4	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.4	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.5	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.5	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.6	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.6	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.7	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.7	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.8	Ampicillin, AMP			
	Azithromycin, AZT			
	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			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) or meropenem (MERO) should be included for testing in the second panel confirmatory tests for ESBL or carbapenemase production. See further description of confirmatory tests in the protocol section '*3.1.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 10.8	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

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

Comments (include optional genotype or other results):

Appendix 4c

EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2016

DTU Food
National Food Institute

TEST FORM – *E. coli*

Antimicrobial susceptibility testing of reference strain *E. coli* ATCC 25922

	Antimicrobial	MIC-value (µg/ml)
1st panel	Ampicillin, AMP	
	Azithromycin, AZT	
	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	
2nd panel	Cefepime, FEP	
	Cefotaxime, FOT	
	Cefotaxime + clavulanic acid (F/C)	
	Cefoxitin, FOX	
	Ceftazidime, TAZ	
	Ceftazidime+ clavulanic acid (T/C)	
	Ertapenem, ETP	
	Imipenem, IMI	
	Meropenem, MERO	
	Temocillin, TRM	

Appendix 4d

DTU Fødevareinstituttet
KVALITETSSIKRING

INSTRUCTIONS FOR OPENING AND REVIVING LYOPHILISED CULTURES

Instructions adjusted from Czech Collection of Microorganisms (CCM) document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz.

Lyophilised cultures are supplied in vacuum-sealed ampoules. Care should be taken in opening the ampoule. All instructions given below should be followed closely to ensure the safety of the person who opens the ampoule and to prevent contamination of the culture.

a. Check the number of the culture on the label inside the ampoule
b. Make a file cut on the ampoule near the middle of the plug (see Figure 1)
c. Disinfect the ampoule with alcohol-dampened gauze or alcohol-dampened cotton wool from just below the plug to the pointed end
d. Apply a red-hot glass rod to the file cut to crack the glass and allow air to enter slowly into the ampoule
e. Remove the pointed end of the ampoule into disinfectant
f. Add about 0.3 ml appropriate broth to the dried suspension using a sterile Pasteur pipette and mix carefully to avoid creating aerosols. Transfer the contents to one or more suitable solid and /or liquid media
g. Incubate the inoculated medium at appropriate conditions for several days
h. Autoclave or disinfect effectively the used Pasteur pipette, the plug and all the remains of the original ampoule before discarding

Notes:

- Cultures should be grown on media and under conditions as recommended in the CCM catalogue (see http://www.sci.muni.cz)
- Cultures may need at least one subculturing before they can be optimally used in experiments
- Unopened ampoules should be kept in a dark and cool place!

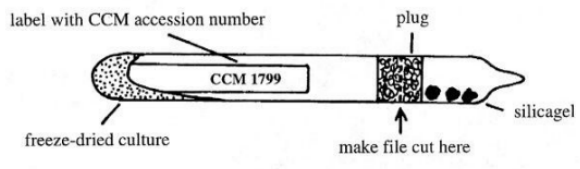


Figure 1: from CCM document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz

Appendix 4e

DTU Fødevareinstituttet
KVALITETSSIKRING

DTU

SUBCULTURE AND MAINTENANCE OF QUALITY CONTROL STRAINS

1.1 Purpose

Improper storage and repeated subculturing of bacteria can produce alterations in antimicrobial susceptibility test results. The Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) has published a guideline for Quality Control (QC) stock culture maintenance to ensure consistent antimicrobial susceptibility test results.

1.2 References

M100-S24, January 2014 (Performance Standards for Antimicrobial Susceptibility Testing)

M7-A9, January 2012 (Methods for Dilution Antimicrobial Susceptibility Test for Bacteria That Grow Aerobically; Approved Standard)

1.3 Definition of Terms

Reference Culture: A reference culture is a microorganism preparation that is acquired from a culture type collection.

Reference Stock Culture: A reference stock culture is a microorganism preparation that is derived from a reference culture. Guidelines and standards outline how reference stock cultures must be processed and stored.

Working Stock Cultures: A working stock culture is growth derived from a reference stock culture. Guidelines and standards outline how working stock cultures must be processed and how often they can be subcultured.

Subcultures (Passages): A subculture is simply the transfer of established microorganism growth on media to fresh media. The subsequent growth on the fresh media constitutes a subculture or passage. Growing a reference culture or reference stock culture from its preserved status (frozen or lyophilized) is not a subculture. The preserved microorganism is not in a stage of established growth until it is thawed or hydrated and grown for the first time

1.4 Important Considerations

- Do not use disc diffusion strains for MIC determination.
- Obtain QC strains from a reliable source such as ATCC
- CLSI requires that QC be performed either on the same day or weekly (only after 30 day QC validation)
- Any changes in materials or procedure must be validated with QC before implemented
- For example: Agar and broth methods may give different QC ranges for drugs such as glycopeptides, aminoglycosides and macrolides
- Periodically perform colony counts to check the inoculum preparation procedure

Appendix 4e

DTU Fødevareinstituttet
KVALITETSSIKRING

DTU

- Ideally, test values should be in the middle of the acceptable range
- Graphing QC data points over time can help identify changes in data helpful for troubleshooting problems

1.5 Storage of Reference Strains

Preparation of stock cultures

- Use a suitable stabilizer such as 50% fetal calf serum in broth, 10-15% glycerol in tryptic soy broth, defibrinated sheep blood or skim milk to prepare multiple aliquots.
- Store at -20°C, -70°C or liquid nitrogen. (Alternatively, freeze dry.)
- Before using rejuvenated strains for QC, subculture to check for purity and viability.

Working cultures

- Set up on agar slants with appropriate medium, store at 4-8°C and subculture weekly.
- Replace the working strain with a stock culture at least monthly.
- If a change in the organisms inherent susceptibility occurs, obtain a fresh stock culture or a new strain from a reference culture collection e.g. ATCC.

1.6 Frequency of Testing

Weekly vs. daily testing

Weekly testing is possible if the lab can demonstrate satisfactory performance with daily testing as follows:

- Documentation showing reference strain results from 30 consecutive test days were within the acceptable range.
- For each antimicrobial/organism combination, no more than 3 out of 30 MIC values may be outside the acceptable range.

When the above are fulfilled, each quality control strain may be tested once a week and whenever any reagent component is changed.

Corrective Actions

If an MIC is outside the range in weekly testing, corrective action is required as follows:

- Repeat the test if there is an obvious error e.g. wrong strain or incubation conditions used
- If there is no obvious error, return to daily control testing

The problem is considered resolved only after the reference strain is tested for 5 consecutive days and each drug/organism result is within specification on each day.

If the problem cannot be resolved, continue daily testing until the errors are identified.

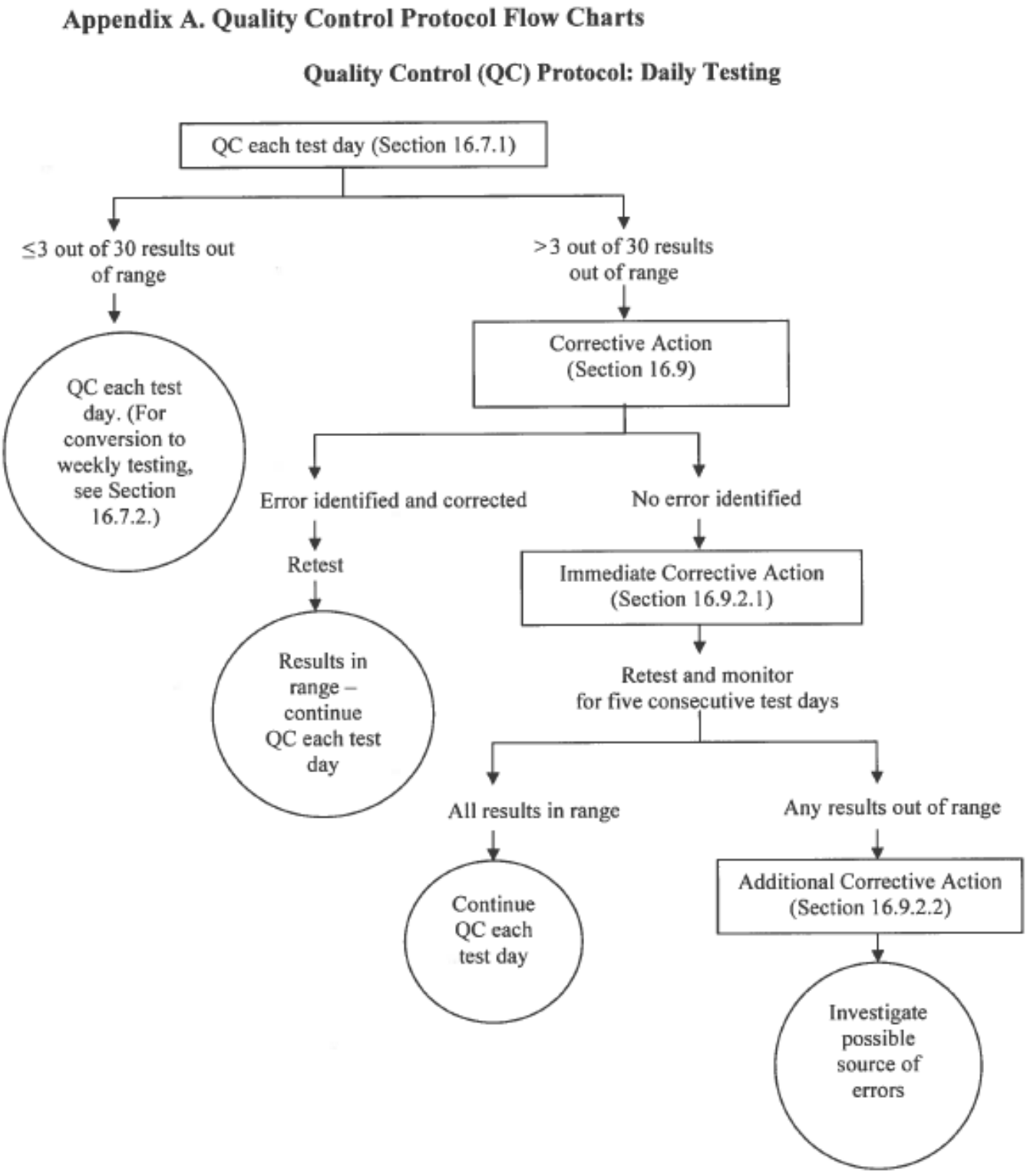
Repeat the 30 days validation before resuming weekly testing.

Appendix 4e

DTU Fødevareinstituttet
KVALITETSSIKRING

DTU

DAILY MIC QC CHART



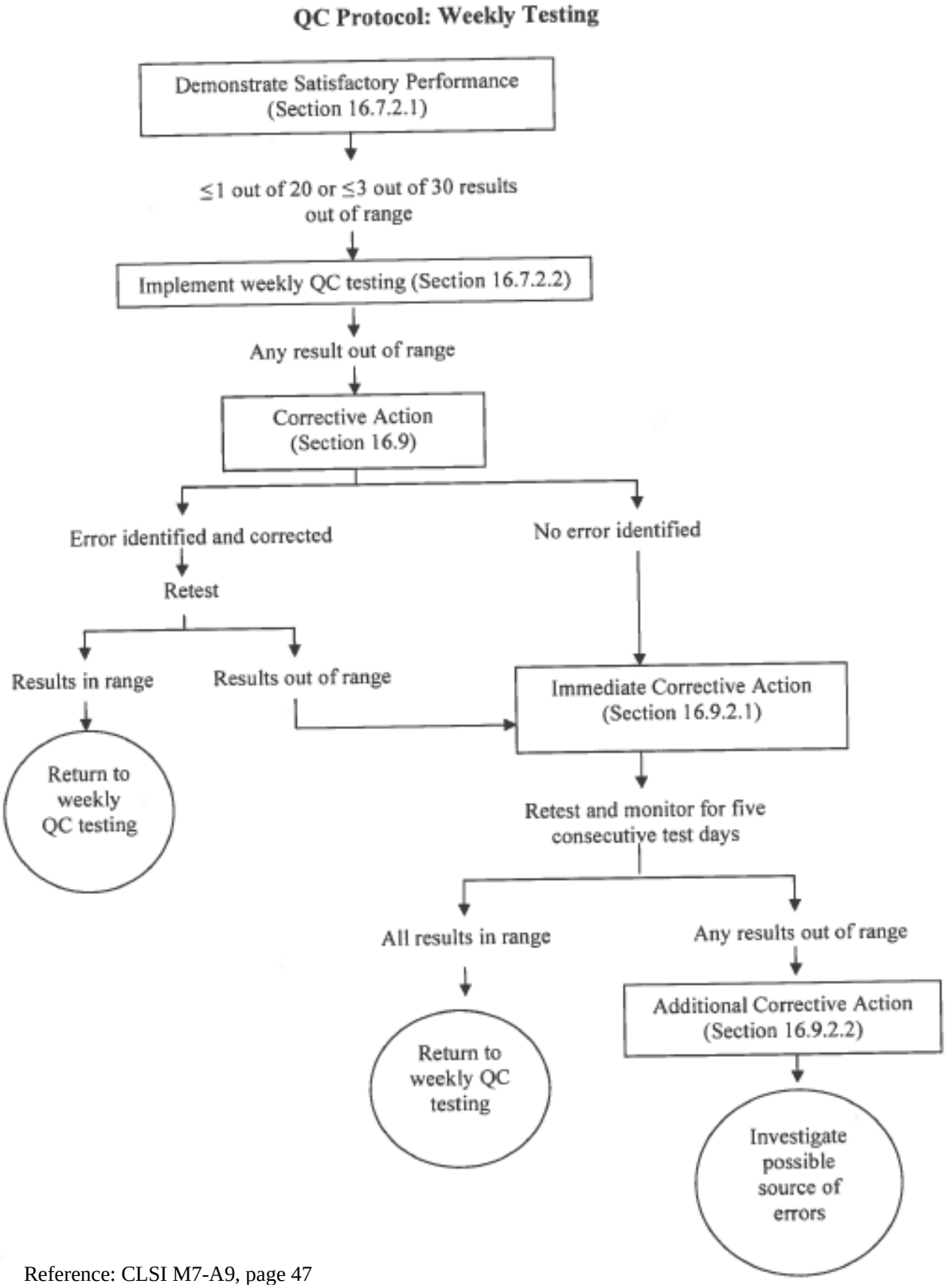
Reference: CLSI M7-A9, page 46

Appendix 4e

DTU Fødevareinstituttet
KVALITETSSIKRING

DTU

Appendix A. (Continued)



Reference: CLSI M7-A9, page 47

Appendix 5

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 1

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	2	8
Azithromycin	AZI	NA	NA
Cefotaxime	FOT	0.03	0.12
Ceftazidime	TAZ	0.06	0.5
Chloramphenicol	CHL	2	8
Ciprofloxacin	CIP	0.004	0.015
Colistin	COL	0.25	2
Gentamicin	GEN	0.25	1
Meropenem	MER	0.008	0.06
Nalidixic acid	NAL	1	4
Sulfamethoxazole	SMX	8	32
Tetracycline	TET	0.5	2
Tigecycline	TGC	0.03	0.25
Trimethoprim	TMP	0.5	2

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 2

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefepime	FEP	0.015	0.12
Cefotaxime/clavulanic acid	F/C	NA	na
Cefotaxime	FOT	0.03	0.12
Cefoxitin	FOX	2	8
Ceftazidime	TAZ	0.06	0.5
Ceftazidime/clavulanic acid	T/C	NA	NA
Ertapenem	ETP	0.004	0.015
Imipenem	IMI	0.06	0.25
Meropenem	MER	0.008	0.06
Temocillin	TRM	NA	NA

Legend

NA, not available

Appendix 5

Quality control ranges - *Staphylococcus aureus* ATCC 29213

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefoxitin	FOX	1	4
Chloramphenicol	CHL	2	16
Ciprofloxacin	CIP	0.12	0.5
Clindamycin	CLN	0.06	0.25
Erythromycin	ERY	0.25	1
Gentamicin	GEN	0.12	1
Linezolid	LZD	1	4
Mupirocin	MUP	NA	NA
Quinupristin-dalfopristin	SYN	0.25	1
Sulfamethoxazole	SMX	32	128
Sulfamethoxazole-trimethoprim	SXT	0	0.5
Tetracycline	TET	0.12	1
Tiamulin	TIA	NA	NA
Trimethoprim	TMP	1	4
Vancomycin	VAN	0.5	2

Quality control ranges - *Enterococcus faecalis* ATCC 29212

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	0.5	2
Chloramphenicol	CHL	4	16
Ciprofloxacin	CIP	0.25	2
Daptomycin	DAP	1*	4*
Erythromycin	ERY	1	4
Gentamicin	GEN	4	16
Linezolid	LZD	1	4
Quinupristin-dalfopristin	SYN	2	8
Teicoplanin	TEI	0.25	1
Tetracycline	TET	8	32
Tigecycline	TGC	0.03	0.12
Vancomycin	VAN	1	4

Legend

*when medium is supplemented with calcium to a final concentration of 50 µg/ml

NA, not available

Appendix 6a

***Enterococcus faecalis* ATCC 29212 results**

Lab. code	Antimicrobial	Operator	Read_value	Min Value	Max Value	Score
2	Ampicillin	=	1	0.5	2	1
2	Chloramphenicol	=	8	4	16	1
2	Ciprofloxacin	=	0.5	0.25	2	1
2	Daptomycin	=	2	1	4	1
2	Erythromycin	=	2	1	4	1
2	Gentamicin	=	16	4	16	1
2	Linezolid	=	2	1	4	1
2	Teicoplanin	<=	0.5	0.25	1	1
2	Tetracycline	=	32	8	32	1
2	Tigecycline	=	0.12	0.03	0.12	1
2	Vancomycin	=	4	1	4	1
9	Ampicillin	=	1	0.5	2	1
9	Chloramphenicol	=	8	4	16	1
9	Ciprofloxacin	=	0.5	0.25	2	1
9	Daptomycin	=	2	1	4	1
9	Erythromycin	=	2	1	4	1
9	Gentamicin	<=	8	4	16	1
9	Linezolid	=	2	1	4	1
9	Teicoplanin	<=	0.5	0.25	1	1
9	Tetracycline	=	16	8	32	1
9	Tigecycline	=	0.06	0.03	0.12	1
9	Vancomycin	=	2	1	4	1
11	Ampicillin	<=	0.5	0.5	2	1
11	Chloramphenicol	=	8	4	16	1
11	Ciprofloxacin	=	1	0.25	2	1
11	Daptomycin	=	1	1	4	1
11	Erythromycin	=	2	1	4	1
11	Gentamicin	=	16	4	16	1
11	Linezolid	=	2	1	4	1
11	Teicoplanin	<=	0.5	0.25	1	1
11	Tetracycline	=	16	8	32	1
11	Tigecycline	=	0.12	0.03	0.12	1
11	Vancomycin	=	4	1	4	1
12	Ampicillin	=	1	0.5	2	1
12	Chloramphenicol	<=	4	4	16	1
12	Ciprofloxacin	=	1	0.25	2	1
12	Daptomycin	=	2	1	4	1
12	Erythromycin	=	2	1	4	1
12	Gentamicin	<=	8	4	16	1
12	Linezolid	=	2	1	4	1
12	Teicoplanin	<=	0.5	0.25	1	1
12	Tetracycline	=	32	8	32	1
12	Tigecycline	=	0.12	0.03	0.12	1
12	Vancomycin	=	2	1	4	1
16	Ampicillin	=	1	0.5	2	1
16	Chloramphenicol	=	8	4	16	1
16	Ciprofloxacin	=	1	0.25	2	1
16	Daptomycin	=	2	1	4	1

Appendix 6a

16	Erythromycin	=	2	1	4	1
16	Gentamicin	=	16	4	16	1
16	Linezolid	=	2	1	4	1
16	Teicoplanin	<=	0.5	0.25	1	1
16	Tetracycline	=	32	8	32	1
16	Tigecycline	=	0.12	0.03	0.12	1
16	Vancomycin	=	2	1	4	1
17	Ampicillin	=	1	0.5	2	1
17	Chloramphenicol	=	8	4	16	1
17	Ciprofloxacin	=	1	0.25	2	1
17	Daptomycin	=	2	1	4	1
17	Erythromycin	=	2	1	4	1
17	Gentamicin	=	16	4	16	1
17	Linezolid	=	2	1	4	1
17	Teicoplanin	<=	0.5	0.25	1	1
17	Tetracycline	=	32	8	32	1
17	Tigecycline	=	0.12	0.03	0.12	1
17	Vancomycin	=	4	1	4	1
19	Ampicillin	=	1	0.5	2	1
19	Chloramphenicol	=	8	4	16	1
19	Ciprofloxacin	=	0.5	0.25	2	1
19	Daptomycin	=	2	1	4	1
19	Erythromycin	=	2	1	4	1
19	Gentamicin	=	16	4	16	1
19	Linezolid	=	2	1	4	1
19	Teicoplanin	<=	0.5	0.25	1	1
19	Tetracycline	=	32	8	32	1
19	Tigecycline	=	0.12	0.03	0.12	1
19	Vancomycin	=	2	1	4	1
20	Ampicillin	=	1	0.5	2	1
20	Chloramphenicol	=	8	4	16	1
20	Ciprofloxacin	=	1	0.25	2	1
20	Daptomycin	=	4	1	4	1
20	Erythromycin	=	2	1	4	1
20	Gentamicin	<=	8	4	16	1
20	Linezolid	=	2	1	4	1
20	Teicoplanin	<=	0.5	0.25	1	1
20	Tetracycline	=	16	8	32	1
20	Tigecycline	=	0.12	0.03	0.12	1
20	Vancomycin	=	4	1	4	1
22	Ampicillin	=	1	0.5	2	1
22	Chloramphenicol	=	8	4	16	1
22	Ciprofloxacin	=	0.25	0.25	2	1
22	Daptomycin	=	2	1	4	1
22	Erythromycin	=	2	1	4	1
22	Gentamicin	<=	8	4	16	1
22	Linezolid	=	2	1	4	1
22	Tetracycline	=	16	8	32	1
22	Tigecycline	=	0.06	0.03	0.12	1
22	Vancomycin	=	2	1	4	1

Appendix 6a

23	Ampicillin	<=	0.5	0.5	2	1
23	Chloramphenicol	<=	4	4	16	1
23	Ciprofloxacin	=	0.5	0.25	2	1
23	Daptomycin	=	1	1	4	1
23	Erythromycin	=	2	1	4	1
23	Gentamicin	<=	8	4	16	1
23	Linezolid	=	1	1	4	1
23	Teicoplanin	<=	0.5	0.25	1	1
23	Tetracycline	=	16	8	32	1
23	Tigecycline	=	0.06	0.03	0.12	1
23	Vancomycin	<=	1	1	4	1
25	Ampicillin	=	1	0.5	2	1
25	Chloramphenicol	=	8	4	16	1
25	Ciprofloxacin	=	1	0.25	2	1
25	Daptomycin	=	2	1	4	1
25	Erythromycin	<=	2	1	4	1
25	Gentamicin	=	16	4	16	1
25	Linezolid	=	2	1	4	1
25	Teicoplanin	<=	0.5	0.25	1	1
25	Tetracycline	=	32	8	32	1
25	Tigecycline	=	0.12	0.03	0.12	1
25	Vancomycin	=	4	1	4	1
26	Ampicillin	=	1	0.5	2	1
26	Chloramphenicol	<=	4	4	16	1
26	Ciprofloxacin	=	1	0.25	2	1
26	Daptomycin	=	4	1	4	1
26	Erythromycin	=	2	1	4	1
26	Gentamicin	<=	8	4	16	1
26	Linezolid	=	2	1	4	1
26	Teicoplanin	<=	0.5	0.25	1	1
26	Tetracycline	=	16	8	32	1
26	Tigecycline	=	0.12	0.03	0.12	1
26	Vancomycin	<=	1	1	4	1
29	Ampicillin	=	0.5	0.5	2	1
29	Chloramphenicol	=	8	4	16	1
29	Ciprofloxacin	=	2	0.25	2	1
29	Daptomycin	=	4	1	4	1
29	Erythromycin	=	4	1	4	1
29	Gentamicin	=	8	4	16	1
29	Linezolid	=	2	1	4	1
29	Teicoplanin	=	1	0.25	1	1
29	Tetracycline	=	16	8	32	1
29	Tigecycline	=	0.03	0.03	0.12	1
29	Vancomycin	=	4	1	4	1
30	Ampicillin	=	2	0.5	2	1
30	Chloramphenicol	=	4	4	16	1
30	Ciprofloxacin	=	1	0.25	2	1
30	Daptomycin	=	1	1	4	1
30	Erythromycin	=	2	1	4	1
30	Gentamicin	<=	8	4	16	1

Appendix 6a

30	Linezolid	=	2	1	4	1
30	Teicoplanin	<=	0.5	0.25	1	1
30	Tetracycline	=	16	8	32	1
30	Tigecycline	=	0.12	0.03	0.12	1
30	Vancomycin	<=	1	1	4	1
33	Ampicillin	=	1	0.5	2	1
33	Chloramphenicol	=	4	4	16	1
33	Erythromycin	=	4	1	4	1
33	Gentamicin	=	4	4	16	1
33	Linezolid	=	2	1	4	1
33	Tetracycline	=	32	8	32	1
33	Vancomycin	=	2	1	4	1
34	Ampicillin	=	1	0.5	2	1
34	Chloramphenicol	=	8	4	16	1
34	Ciprofloxacin	=	0.5	0.25	2	1
34	Daptomycin	=	2	1	4	1
34	Erythromycin	=	4	1	4	1
34	Gentamicin	<=	8	4	16	1
34	Linezolid	=	2	1	4	1
34	Teicoplanin	<=	0.5	0.25	1	1
34	Tetracycline	=	32	8	32	1
34	Tigecycline	=	0.12	0.03	0.12	1
34	Vancomycin	<=	1	1	4	1
36	Ampicillin	-	1	0.5	2	1
36	Chloramphenicol	<=	4	4	16	1
36	Ciprofloxacin	-	0.5	0.25	2	1
36	Daptomycin	-	2	1	4	1
36	Erythromycin	-	2	1	4	1
36	Gentamicin	-	16	4	16	1
36	Linezolid	-	2	1	4	1
36	Teicoplanin	<=	0.5	0.25	1	1
36	Tetracycline	-	16	8	32	1
36	Tigecycline	-	0.12	0.03	0.12	1
36	Vancomycin	-	2	1	4	1
37	Ampicillin	=	1	0.5	2	1
37	Chloramphenicol	<=	8	4	16	1
37	Ciprofloxacin	=	1	0.25	2	1
37	Erythromycin	<=	1	1	4	1
37	Gentamicin	<=	8	4	16	1
37	Linezolid	=	2	1	4	1
37	Teicoplanin	<=	0.5	0.25	1	1
37	Tetracycline	=	16	8	32	1
37	Tigecycline	=	0.13	0.03	0.12	0
37	Vancomycin	=	4	1	4	1
38	Ampicillin	=	2	0.5	2	1
38	Chloramphenicol	=	8	4	16	1
38	Ciprofloxacin	=	0.5	0.25	2	1
38	Daptomycin	=	2	1	4	1
38	Erythromycin	<=	1	1	4	1
38	Gentamicin	<=	8	4	16	1

Appendix 6a

38	Linezolid	=	2	1	4	1
38	Teicoplanin	<=	0.5	0.25	1	1
38	Tetracycline	=	16	8	32	1
38	Tigecycline	=	0.06	0.03	0.12	1
38	Vancomycin	=	4	1	4	1
39	Ampicillin	<=	0.5	0.5	2	1
39	Chloramphenicol	-	8	4	16	1
39	Ciprofloxacin	-	0.25	0.25	2	1
39	Daptomycin	-	1	1	4	1
39	Erythromycin	-	2	1	4	1
39	Gentamicin	<=	8	4	16	1
39	Linezolid	-	2	1	4	1
39	Teicoplanin	<=	0.5	0.25	1	1
39	Tetracycline	-	16	8	32	1
39	Tigecycline	-	0.12	0.03	0.12	1
39	Vancomycin	-	2	1	4	1
40	Chloramphenicol	=	8	4	16	1
40	Ciprofloxacin	=	0.5	0.25	2	1
40	Daptomycin	=	1	1	4	1
40	Erythromycin	=	2	1	4	1
40	Linezolid	=	2	1	4	1
40	Tetracycline	=	8	8	32	1
40	Tigecycline	=	0.06	0.03	0.12	1
40	Vancomycin	=	2	1	4	1
41	Ampicillin	=	1	0.5	2	1
41	Chloramphenicol	=	8	4	16	1
41	Ciprofloxacin	=	0.25	0.25	2	1
41	Daptomycin	=	1	1	4	1
41	Erythromycin	<=	1	1	4	1
41	Gentamicin	<=	8	4	16	1
41	Linezolid	=	1	1	4	1
41	Teicoplanin	<=	0.5	0.25	1	1
41	Tetracycline	=	8	8	32	1
41	Tigecycline	=	0.06	0.03	0.12	1
41	Vancomycin	=	2	1	4	1
42	Ampicillin	=	2	0.5	2	1
42	Chloramphenicol	=	8	4	16	1
42	Ciprofloxacin	=	1	0.25	2	1
42	Daptomycin	=	2	1	4	1
42	Erythromycin	=	2	1	4	1
42	Gentamicin	<=	8	4	16	1
42	Linezolid	=	2	1	4	1
42	Teicoplanin	<=	0.5	0.25	1	1
42	Tetracycline	=	32	8	32	1
42	Tigecycline	=	0.06	0.03	0.12	1
42	Vancomycin	=	2	1	4	1
45	Ampicillin	=	2	0.5	2	1
45	Chloramphenicol	<=	4	4	16	1
45	Ciprofloxacin	<=	0.12	0.25	2	0
45	Daptomycin	<=	0.25	1	4	0

Appendix 6a

45	Erythromycin	<=	1	1	4	1
45	Gentamicin	<=	8	4	16	1
45	Linezolid	=	1	1	4	1
45	Teicoplanin	<=	0.5	0.25	1	1
45	Tetracycline	=	32	8	32	1
45	Tigecycline	=	0.25	0.03	0.12	0
45	Vancomycin	<=	1	1	4	1
56	Ampicillin	=	1	0.5	2	1
56	Chloramphenicol	=	8	4	16	1
56	Ciprofloxacin	=	0.5	0.25	2	1
56	Daptomycin	=	1	1	4	1
56	Erythromycin	=	2	1	4	1
56	Gentamicin	<=	8	4	16	1
56	Linezolid	=	1	1	4	1
56	Teicoplanin	<=	0.5	0.25	1	1
56	Tetracycline	=	16	8	32	1
56	Tigecycline	=	0.06	0.03	0.12	1
56	Vancomycin	<=	1	1	4	1
59	Ampicillin	=	2	0.5	2	1
59	Chloramphenicol	=	8	4	16	1
59	Ciprofloxacin	=	0.5	0.25	2	1
59	Daptomycin	=	1	1	4	1
59	Erythromycin	=	2	1	4	1
59	Gentamicin	=	16	4	16	1
59	Linezolid	=	2	1	4	1
59	Teicoplanin	<=	0.5	0.25	1	1
59	Tetracycline	=	32	8	32	1
59	Tigecycline	=	0.12	0.03	0.12	1
59	Vancomycin	=	2	1	4	1
60	Ampicillin	=	1	0.5	2	1
60	Chloramphenicol	=	8	4	16	1
60	Ciprofloxacin	=	1	0.25	2	1
60	Daptomycin	=	2	1	4	1
60	Erythromycin	=	2	1	4	1
60	Gentamicin	<=	8	4	16	1
60	Linezolid	=	2	1	4	1
60	Teicoplanin	<=	0.5	0.25	1	1
60	Tetracycline	=	16	8	32	1
60	Tigecycline	=	0.12	0.03	0.12	1
60	Vancomycin	=	4	1	4	1

Appendix 6b

***Staphylococcus aureus* ATCC 29213 results**

Lab. code	Antimicrobial	Operator	Read_value	Min Value	Max Value	Score
2	Cefoxitin	=	4	1	4	1
2	Chloramphenicol	=	8	2	16	1
2	Ciprofloxacin	<=	0.25	0.12	0.5	1
2	Clindamycin	<=	0.12	0.06	0.25	1
2	Erythromycin	<=	0.25	0.25	1	1
2	Gentamicin	<=	1	0.12	1	1
2	Linezolid	=	2	1	4	1
2	Sulfamethoxazole	<=	64	32	128	1
2	Tetracycline	<=	0.5	0.12	1	1
2	Trimethoprim	<=	2	1	4	1
2	Vancomycin	<=	1	0.5	2	1
9	Cefoxitin	=	2	1	4	1
9	Chloramphenicol	<=	4	2	16	1
9	Ciprofloxacin	<=	0.25	0.12	0.5	1
9	Clindamycin	<=	0.12	0.06	0.25	1
9	Erythromycin	<=	0.5	0.25	1	1
9	Gentamicin	<=	1	0.12	1	1
9	Linezolid	=	2	1	4	1
9	Sulfamethoxazole	<=	64	32	128	1
9	Tetracycline	<=	0.5	0.12	1	1
9	Trimethoprim	<=	2	1	4	1
9	Vancomycin	<=	1	0.5	2	1
11	Cefoxitin	=	4	1	4	1
11	Chloramphenicol	=	8	2	16	1
11	Ciprofloxacin	=	0.5	0.12	0.5	1
11	Clindamycin	=	0.25	0.06	0.25	1
11	Erythromycin	=	0.5	0.25	1	1
11	Gentamicin	<=	1	0.12	1	1
11	Linezolid	=	2	1	4	1
11	Sulfamethoxazole	<=	64	32	128	1
11	Tetracycline	=	1	0.12	1	1
11	Trimethoprim	<=	2	1	4	1
11	Vancomycin	<=	1	0.5	2	1
12	Cefoxitin	=	4	1	4	1
12	Chloramphenicol	=	8	2	16	1
12	Ciprofloxacin	<=	0.25	0.12	0.5	1
12	Clindamycin	<=	0.12	0.06	0.25	1
12	Erythromycin	=	0.5	0.25	1	1
12	Gentamicin	<=	1	0.12	1	1
12	Linezolid	=	2	1	4	1
12	Sulfamethoxazole	<=	64	32	128	1
12	Tetracycline	<=	0.5	0.12	1	1
12	Trimethoprim	<=	2	1	4	1
12	Vancomycin	<=	1	0.5	2	1
17	Cefoxitin	=	4	1	4	1
17	Chloramphenicol	=	16	2	16	1
17	Ciprofloxacin	=	0.5	0.12	0.5	1
17	Clindamycin	=	0.25	0.06	0.25	1

Appendix 6b

17	Erythromycin	=	1	0.25	1	1
17	Gentamicin	<=	1	0.12	1	1
17	Linezolid	=	4	1	4	1
17	Sulfamethoxazole	<=	64	32	128	1
17	Tetracycline	=	1	0.12	1	1
17	Trimethoprim	=	4	1	4	1
17	Vancomycin	<=	1	0.5	2	1
19	Cefoxitin	=	2	1	4	1
19	Chloramphenicol	=	8	2	16	1
19	Ciprofloxacin	<=	0.25	0.12	0.5	1
19	Clindamycin	<=	0.12	0.06	0.25	1
19	Erythromycin	=	0.5	0.25	1	1
19	Gentamicin	<=	1	0.12	1	1
19	Linezolid	=	2	1	4	1
19	Sulfamethoxazole	<=	64	32	128	1
19	Tetracycline	<=	0.5	0.12	1	1
19	Trimethoprim	<=	2	1	4	1
19	Vancomycin	<=	1	0.5	2	1
20	Cefoxitin	=	4	1	4	1
20	Chloramphenicol	=	16	2	16	1
20	Ciprofloxacin	=	0.5	0.12	0.5	1
20	Clindamycin	<=	0.12	0.06	0.25	1
20	Erythromycin	=	0.5	0.25	1	1
20	Gentamicin	<=	1	0.12	1	1
20	Linezolid	=	4	1	4	1
20	Sulfamethoxazole	<=	64	32	128	1
20	Tetracycline	<=	0.5	0.12	1	1
20	Trimethoprim	=	4	1	4	1
20	Vancomycin	<=	1	0.5	2	1
22	Cefoxitin	=	4	1	4	1
22	Chloramphenicol	=	8	2	16	1
22	Ciprofloxacin	<=	0.25	0.12	0.5	1
22	Clindamycin	<=	0.12	0.06	0.25	1
22	Erythromycin	<=	0.25	0.25	1	1
22	Gentamicin	<=	1	0.12	1	1
22	Linezolid	=	2	1	4	1
22	Sulfamethoxazole	<=	64	32	128	1
22	Tetracycline	<=	0.5	0.12	1	1
22	Trimethoprim	<=	2	1	4	1
22	Vancomycin	<=	1	0.5	2	1
23	Cefoxitin	=	4	1	4	1
23	Chloramphenicol	=	8	2	16	1
23	Ciprofloxacin	<=	0.25	0.12	0.5	1
23	Clindamycin	<=	0.12	0.06	0.25	1
23	Erythromycin	=	0.5	0.25	1	1
23	Gentamicin	<=	1	0.12	1	1
23	Linezolid	=	2	1	4	1
23	Sulfamethoxazole	<=	64	32	128	1
23	Tetracycline	<=	0.5	0.12	1	1
23	Trimethoprim	<=	2	1	4	1

Appendix 6b

23	Vancomycin	<=	1	0.5	2	1
25	Clindamycin	=	0.12	0.06	0.25	1
25	Erythromycin	=	0.5	0.25	1	1
25	Sulfamethoxazole-Trimethoprim	<=	0.12	0	0.5	1
25	Tetracycline	=	0.5	0.12	1	1
26	Cefoxitin	=	4	1	4	1
26	Chloramphenicol	=	8	2	16	1
26	Ciprofloxacin	=	0.5	0.12	0.5	1
26	Clindamycin	<=	0.12	0.06	0.25	1
26	Erythromycin	=	0.5	0.25	1	1
26	Gentamicin	<=	1	0.12	1	1
26	Linezolid	=	4	1	4	1
26	Sulfamethoxazole	<=	64	32	128	1
26	Sulfamethoxazole-Trimethoprim	=	0.5	0	0.5	1
26	Tetracycline	<=	0.5	0.12	1	1
26	Trimethoprim	<=	2	1	4	1
26	Vancomycin	<=	1	0.5	2	1
29	Cefoxitin	-	4	1	4	1
29	Chloramphenicol	-	4	2	16	1
29	Ciprofloxacin	-	0.5	0.12	0.5	1
29	Clindamycin	-	0.25	0.06	0.25	1
29	Erythromycin	-	0.5	0.25	1	1
29	Gentamicin	-	0.5	0.12	1	1
29	Linezolid	-	1	1	4	1
29	Sulfamethoxazole	-	64	32	128	1
29	Tetracycline	-	0.25	0.12	1	1
29	Trimethoprim	-	2	1	4	1
29	Vancomycin	-	0.5	0.5	2	1
30	Cefoxitin	=	4	1	4	1
30	Chloramphenicol	<=	4	2	16	1
30	Ciprofloxacin	<=	0.25	0.12	0.5	1
30	Clindamycin	<=	0.12	0.06	0.25	1
30	Erythromycin	<=	0.25	0.25	1	1
30	Gentamicin	<=	1	0.12	1	1
30	Linezolid	=	2	1	4	1
30	Sulfamethoxazole	<=	64	32	128	1
30	Tetracycline	<=	0.5	0.12	1	1
30	Trimethoprim	<=	2	1	4	1
30	Vancomycin	<=	1	0.5	2	1
33	Cefoxitin	=	2	1	4	1
33	Chloramphenicol	=	8	2	16	1
33	Ciprofloxacin	=	0.25	0.12	0.5	1
33	Clindamycin	<=	0.25	0.06	0.25	1
33	Erythromycin	=	0.5	0.25	1	1
33	Gentamicin	<=	0.5	0.12	1	1
33	Tetracycline	<=	0.5	0.12	1	1
33	Trimethoprim	=	2	1	4	1
34	Cefoxitin	=	4	1	4	1
34	Chloramphenicol	<=	4	2	16	1
34	Ciprofloxacin	<=	0.25	0.12	0.5	1

Appendix 6b

34	Clindamycin	<=	0.12	0.06	0.25	1
34	Erythromycin	=	0.5	0.25	1	1
34	Gentamicin	<=	1	0.12	1	1
34	Linezolid	<=	1	1	4	1
34	Sulfamethoxazole	<=	64	32	128	1
34	Tetracycline	<=	0.5	0.12	1	1
34	Trimethoprim	<=	2	1	4	1
34	Vancomycin	<=	1	0.5	2	1
36	Cefoxitin	-	4	1	4	1
36	Chloramphenicol	-	8	2	16	1
36	Ciprofloxacin	<=	0.25	0.12	0.5	1
36	Clindamycin	<=	0.12	0.06	0.25	1
36	Erythromycin	-	0.5	0.25	1	1
36	Gentamicin	<=	1	0.12	1	1
36	Linezolid	-	2	1	4	1
36	Sulfamethoxazole	<=	64	32	128	1
36	Tetracycline	<=	0.5	0.12	1	1
36	Trimethoprim	<=	2	1	4	1
36	Vancomycin	<=	1	0.5	2	1
37	Cefoxitin	=	4	1	4	1
37	Chloramphenicol	=	8	2	16	1
37	Ciprofloxacin	=	0.25	0.12	0.5	1
37	Erythromycin	=	0.25	0.25	1	1
37	Gentamicin	=	0.25	0.12	1	1
37	Linezolid	=	2	1	4	1
37	Sulfamethoxazole	=	32	32	128	1
37	Tetracycline	=	1	0.12	1	1
37	Trimethoprim	=	1	1	4	1
37	Vancomycin	<=	1	0.5	2	1
39	Cefoxitin	-	2	1	4	1
39	Chloramphenicol	-	8	2	16	1
39	Ciprofloxacin	-	0.5	0.12	0.5	1
39	Clindamycin	-	0.25	0.06	0.25	1
39	Erythromycin	-	1	0.25	1	1
39	Gentamicin	<=	1	0.12	1	1
39	Linezolid	-	2	1	4	1
39	Sulfamethoxazole	<=	64	32	128	1
39	Tetracycline	<=	0.5	0.12	1	1
39	Trimethoprim	-	2	1	4	1
39	Vancomycin	<=	1	0.5	2	1
40	Cefoxitin	=	1	1	4	1
40	Chloramphenicol	=	8	2	16	1
40	Ciprofloxacin	=	0.25	0.12	0.5	1
40	Clindamycin	=	0.25	0.06	0.25	1
40	Erythromycin	=	0.5	0.25	1	1
40	Gentamicin	=	1	0.12	1	1
40	Linezolid	=	2	1	4	1
40	Sulfamethoxazole	=	64	32	128	1
40	Tetracycline	=	1	0.12	1	1
40	Trimethoprim	=	1	1	4	1

Appendix 6b

40	Vancomycin	=	1	0.5	2	1
41	Cefoxitin	=	1	1	4	1
41	Chloramphenicol	=	8	2	16	1
41	Ciprofloxacin	<=	0.25	0.12	0.5	1
41	Clindamycin	=	0.25	0.06	0.25	1
41	Erythromycin	=	0.5	0.25	1	1
41	Gentamicin	<=	1	0.12	1	1
41	Linezolid	=	2	1	4	1
41	Sulfamethoxazole	<=	64	32	128	1
41	Tetracycline	<=	0.5	0.12	1	1
41	Trimethoprim	<=	2	1	4	1
41	Vancomycin	<=	1	0.5	2	1
42	Cefoxitin	=	4	1	4	1
42	Chloramphenicol	=	8	2	16	1
42	Ciprofloxacin	<=	0.25	0.12	0.5	1
42	Clindamycin	<=	0.12	0.06	0.25	1
42	Erythromycin	=	0.5	0.25	1	1
42	Gentamicin	<=	1	0.12	1	1
42	Linezolid	=	2	1	4	1
42	Sulfamethoxazole	<=	64	32	128	1
42	Tetracycline	<=	0.5	0.12	1	1
42	Trimethoprim	<=	2	1	4	1
42	Vancomycin	<=	1	0.5	2	1
45	Cefoxitin	=	4	1	4	1
45	Chloramphenicol	=	8	2	16	1
45	Ciprofloxacin	=	0.5	0.12	0.5	1
45	Clindamycin	<=	0.12	0.06	0.25	1
45	Erythromycin	=	0.5	0.25	1	1
45	Gentamicin	<=	1	0.12	1	1
45	Linezolid	=	2	1	4	1
45	Sulfamethoxazole	=	128	32	128	1
45	Tetracycline	=	1	0.12	1	1
45	Trimethoprim	<=	2	1	4	1
45	Vancomycin	<=	1	0.5	2	1
56	Cefoxitin	=	1	1	4	1
56	Chloramphenicol	=	8	2	16	1
56	Ciprofloxacin	<=	0.25	0.12	0.5	1
56	Clindamycin	<=	0.12	0.06	0.25	1
56	Erythromycin	=	0.5	0.25	1	1
56	Gentamicin	<=	1	0.12	1	1
56	Linezolid	=	2	1	4	1
56	Sulfamethoxazole	<=	64	32	128	1
56	Tetracycline	<=	0.5	0.12	1	1
56	Trimethoprim	<=	2	1	4	1
56	Vancomycin	<=	1	0.5	2	1
59	Cefoxitin	=	4	1	4	1
59	Chloramphenicol	=	8	2	16	1
59	Ciprofloxacin	<=	0.25	0.12	0.5	1
59	Clindamycin	<=	0.12	0.06	0.25	1
59	Erythromycin	=	0.5	0.25	1	1

Appendix 6b

59	Gentamicin	<=	1	0.12	1	1
59	Linezolid	=	2	1	4	1
59	Sulfamethoxazole	<=	64	32	128	1
59	Tetracycline	<=	0.5	0.12	1	1
59	Trimethoprim	<=	2	1	4	1
59	Vancomycin	<=	1	0.5	2	1

Appendix 6c

***Escherichia coli* ATCC 25922 results**

Lab. Code	Panel	Antimicrobial	Operator	Read_value	Min Value	Max Value	Score
2	1	Ampicillin	=	4	2.0	8.0	1
2	1	Cefotaxime	<=	0.25	0.03	0.12	1
2	1	Ceftazidime	<=	0.5	0.06	0.5	1
2	1	Chloramphenicol	<=	8	2.0	8.0	1
2	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
2	1	Colistin	<=	1	0.25	2.0	1
2	1	Gentamicin	<=	0.5	0.25	1.0	1
2	1	Meropenem	<=	0.03	0.008	0.06	1
2	1	Nalidixic acid	<=	4	1.0	4.0	1
2	1	Sulfamethoxazole	=	32	8.0	32.0	1
2	1	Tetracycline	<=	2	0.5	2.0	1
2	1	Tigecycline	<=	0.25	0.03	0.25	1
2	1	Trimethoprim	=	1	0.5	2.0	1
2	2	Cefepime	<=	0.06	0.015	0.12	1
2	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
2	2	Cefoxitin	=	4	2.0	8.0	1
2	2	Ceftazidime	<=	0.25	0.06	0.5	1
2	2	Ertapenem	<=	0.015	0.004	0.015	1
2	2	Imipenem	<=	0.12	0.06	0.25	1
2	2	Meropenem	<=	0.03	0.008	0.06	1
4	1	Ampicillin	=	8	2.0	8.0	1
4	1	Cefotaxime	<=	0.25	0.03	0.12	1
4	1	Ceftazidime	<=	0.5	0.06	0.5	1
4	1	Chloramphenicol	<=	8	2.0	8.0	1
4	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
4	1	Colistin	<=	1	0.25	2.0	1
4	1	Gentamicin	<=	0.5	0.25	1.0	1
4	1	Meropenem	<=	0.03	0.008	0.06	1
4	1	Nalidixic acid	<=	4	1.0	4.0	1
4	1	Sulfamethoxazole	=	16	8.0	32.0	1
4	1	Tetracycline	<=	2	0.5	2.0	1
4	1	Tigecycline	<=	0.25	0.03	0.25	1
4	1	Trimethoprim	=	0.5	0.5	2.0	1
4	2	Cefepime	<=	0.06	0.015	0.12	1
4	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
4	2	Cefoxitin	=	4	2.0	8.0	1
4	2	Ceftazidime	<=	0.25	0.06	0.5	1
4	2	Ertapenem	<=	0.015	0.004	0.015	1
4	2	Imipenem	<=	0.12	0.06	0.25	1
4	2	Meropenem	<=	0.03	0.008	0.06	1
6	1	Ampicillin	=	4	2.0	8.0	1
6	1	Cefotaxime	<=	0.25	0.03	0.12	1
6	1	Ceftazidime	<=	0.5	0.06	0.5	1
6	1	Chloramphenicol	<=	8	2.0	8.0	1
6	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
6	1	Colistin	<=	1	0.25	2.0	1
6	1	Gentamicin	<=	0.5	0.25	1.0	1
6	1	Meropenem	<=	0.03	0.008	0.06	1

Appendix 6c

6	1	Nalidixic acid	<=	4	1.0	4.0	1
6	1	Sulfamethoxazole	=	16	8.0	32.0	1
6	1	Tetracycline	<=	2	0.5	2.0	1
6	1	Tigecycline	<=	0.25	0.03	0.25	1
6	1	Trimethoprim	<=	0.25	0.5	2.0	0
6	2	Cefepime	<=	0.06	0.015	0.12	1
6	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
6	2	Cefoxitin	=	2	2.0	8.0	1
6	2	Ceftazidime	<=	0.25	0.06	0.5	1
6	2	Ertapenem	<=	0.015	0.004	0.015	1
6	2	Imipenem	=	0.25	0.06	0.25	1
6	2	Meropenem	<=	0.03	0.008	0.06	1
9	1	Ampicillin	=	4	2.0	8.0	1
9	1	Ceftazidime	<=	0.5	0.06	0.5	1
9	1	Chloramphenicol	<=	8	2.0	8.0	1
9	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
9	1	Colistin	<=	1	0.25	2.0	1
9	1	Gentamicin	<=	0.5	0.25	1.0	1
9	1	Meropenem	<=	0.03	0.008	0.06	1
9	1	Nalidixic acid	<=	4	1.0	4.0	1
9	1	Sulfamethoxazole	=	16	8.0	32.0	1
9	1	Tetracycline	<=	2	0.5	2.0	1
9	1	Tigecycline	<=	0.25	0.03	0.25	1
9	1	Trimethoprim	=	1	0.5	2.0	1
9	2	Cefepime	=	0.06	0.015	0.12	1
9	2	Cefoxitin	=	4	2.0	8.0	1
9	2	Ceftazidime	<=	0.25	0.06	0.5	1
9	2	Ertapenem	<=	0.015	0.004	0.015	1
9	2	Imipenem	<=	0.12	0.06	0.25	1
9	2	Meropenem	<=	0.03	0.008	0.06	1
11	1	Ampicillin	=	4	2.0	8.0	1
11	1	Cefotaxime	<=	0.25	0.03	0.12	1
11	1	Ceftazidime	<=	0.5	0.06	0.5	1
11	1	Chloramphenicol	<=	8	2.0	8.0	1
11	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
11	1	Colistin	<=	1	0.25	2.0	1
11	1	Gentamicin	=	1	0.25	1.0	1
11	1	Meropenem	<=	0.03	0.008	0.06	1
11	1	Nalidixic acid	<=	4	1.0	4.0	1
11	1	Sulfamethoxazole	=	16	8.0	32.0	1
11	1	Tetracycline	<=	2	0.5	2.0	1
11	1	Tigecycline	<=	0.25	0.03	0.25	1
11	1	Trimethoprim	=	0.25	0.5	2.0	0
11	2	Cefepime	<=	0.06	0.015	0.12	1
11	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
11	2	Cefoxitin	=	4	2.0	8.0	1
11	2	Ceftazidime	<=	0.25	0.06	0.5	1
11	2	Ertapenem	<=	0.015	0.004	0.015	1
11	2	Imipenem	<=	0.12	0.06	0.25	1
11	2	Meropenem	<=	0.03	0.008	0.06	1

Appendix 6c

12	1	Ampicillin	=	4	2.0	8.0	1
12	1	Cefotaxime	<=	0.25	0.03	0.12	1
12	1	Ceftazidime	<=	0.5	0.06	0.5	1
12	1	Chloramphenicol	<=	8	2.0	8.0	1
12	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
12	1	Colistin	<=	1	0.25	2.0	1
12	1	Gentamicin	<=	0.5	0.25	1.0	1
12	1	Meropenem	<=	0.03	0.008	0.06	1
12	1	Nalidixic acid	<=	4	1.0	4.0	1
12	1	Sulfamethoxazole	=	32	8.0	32.0	1
12	1	Tetracycline	<=	2	0.5	2.0	1
12	1	Tigecycline	<=	0.25	0.03	0.25	1
12	1	Trimethoprim	=	0.5	0.5	2.0	1
12	2	Cefepime	<=	0.06	0.015	0.12	1
12	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
12	2	Cefoxitin	=	4	2.0	8.0	1
12	2	Ceftazidime	<=	0.25	0.06	0.5	1
12	2	Ertapenem	<=	0.015	0.004	0.015	1
12	2	Imipenem	<=	0.12	0.06	0.25	1
12	2	Meropenem	<=	0.03	0.008	0.06	1
16	1	Ampicillin	=	4	2.0	8.0	1
16	1	Cefotaxime	<=	0.25	0.03	0.12	1
16	1	Ceftazidime	<=	0.5	0.06	0.5	1
16	1	Chloramphenicol	<=	8	2.0	8.0	1
16	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
16	1	Colistin	<=	1	0.25	2.0	1
16	1	Gentamicin	<=	0.5	0.25	1.0	1
16	1	Meropenem	<=	0.03	0.008	0.06	1
16	1	Nalidixic acid	<=	4	1.0	4.0	1
16	1	Sulfamethoxazole	=	32	8.0	32.0	1
16	1	Tetracycline	<=	2	0.5	2.0	1
16	1	Tigecycline	<=	0.25	0.03	0.25	1
16	1	Trimethoprim	=	0.5	0.5	2.0	1
16	2	Cefepime	<=	0.06	0.015	0.12	1
16	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
16	2	Cefoxitin	=	4	2.0	8.0	1
16	2	Ceftazidime	<=	0.25	0.06	0.5	1
16	2	Ertapenem	<=	0.015	0.004	0.015	1
16	2	Imipenem	<=	0.12	0.06	0.25	1
16	2	Meropenem	<=	0.03	0.008	0.06	1
17	1	Ampicillin	=	4	2.0	8.0	1
17	1	Cefotaxime	<=	0.25	0.03	0.12	1
17	1	Ceftazidime	<=	0.5	0.06	0.5	1
17	1	Chloramphenicol	<=	8	2.0	8.0	1
17	1	Ciprofloxacin	<=	0.15	0.004	0.015	1
17	1	Colistin	<=	1	0.25	2.0	1
17	1	Gentamicin	<=	0.5	0.25	1.0	1
17	1	Meropenem	<=	0.03	0.008	0.06	1
17	1	Nalidixic acid	<=	4	1.0	4.0	1
17	1	Sulfamethoxazole	=	16	8.0	32.0	1

Appendix 6c

17	1	Tetracycline	<=	2	0.5	2.0	1
17	1	Tigecycline	<=	0.25	0.03	0.25	1
17	1	Trimethoprim	=	0.5	0.5	2.0	1
17	2	Cefepime	<=	0.06	0.015	0.12	1
17	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
17	2	Cefoxitin	=	4	2.0	8.0	1
17	2	Ceftazidime	<=	0.25	0.06	0.5	1
17	2	Ertapenem	<=	0.015	0.004	0.015	1
17	2	Imipenem	=	0.25	0.06	0.25	1
17	2	Meropenem	<=	0.03	0.008	0.06	1
18	1	Ampicillin	=	2	2.0	8.0	1
18	1	Cefotaxime	<=	0.25	0.03	0.12	1
18	1	Ceftazidime	<=	0.5	0.06	0.5	1
18	1	Chloramphenicol	<=	8	2.0	8.0	1
18	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
18	1	Colistin	<=	1	0.25	2.0	1
18	1	Gentamicin	<=	0.5	0.25	1.0	1
18	1	Meropenem	<=	0.03	0.008	0.06	1
18	1	Nalidixic acid	<=	4	1.0	4.0	1
18	1	Sulfamethoxazole	=	16	8.0	32.0	1
18	1	Tetracycline	<=	2	0.5	2.0	1
18	1	Tigecycline	<=	0.25	0.03	0.25	1
18	1	Trimethoprim	=	1	0.5	2.0	1
18	2	Cefepime	<=	0.06	0.015	0.12	1
18	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
18	2	Cefoxitin	=	4	2.0	8.0	1
18	2	Ceftazidime	<=	0.25	0.06	0.5	1
18	2	Ertapenem	<=	0.015	0.004	0.015	1
18	2	Imipenem	<=	0.12	0.06	0.25	1
18	2	Meropenem	<=	0.03	0.008	0.06	1
19	1	Ampicillin	=	4	2.0	8.0	1
19	1	Cefotaxime	<=	0.25	0.03	0.12	1
19	1	Ceftazidime	<=	0.5	0.06	0.5	1
19	1	Chloramphenicol	<=	8	2.0	8.0	1
19	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
19	1	Colistin	<=	1	0.25	2.0	1
19	1	Gentamicin	<=	0.5	0.25	1.0	1
19	1	Meropenem	<=	0.03	0.008	0.06	1
19	1	Nalidixic acid	<=	4	1.0	4.0	1
19	1	Sulfamethoxazole	=	32	8.0	32.0	1
19	1	Tetracycline	<=	2	0.5	2.0	1
19	1	Tigecycline	<=	0.25	0.03	0.25	1
19	1	Trimethoprim	=	0.5	0.5	2.0	1
19	2	Cefepime	<=	0.06	0.015	0.12	1
19	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
19	2	Cefoxitin	=	4	2.0	8.0	1
19	2	Ceftazidime	<=	0.25	0.06	0.5	1
19	2	Ertapenem	<=	0.015	0.004	0.015	1
19	2	Imipenem	<=	0.12	0.06	0.25	1
19	2	Meropenem	<=	0.03	0.008	0.06	1

Appendix 6c

20	1	Ampicillin	=	4	2.0	8.0	1
20	1	Cefotaxime	<=	0.25	0.03	0.12	1
20	1	Ceftazidime	<=	0.5	0.06	0.5	1
20	1	Chloramphenicol	<=	8	2.0	8.0	1
20	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
20	1	Colistin	<=	1	0.25	2.0	1
20	1	Gentamicin	<=	0.5	0.25	1.0	1
20	1	Meropenem	<=	0.03	0.008	0.06	1
20	1	Nalidixic acid	<=	4	1.0	4.0	1
20	1	Sulfamethoxazole	=	16	8.0	32.0	1
20	1	Tetracycline	<=	2	0.5	2.0	1
20	1	Tigecycline	<=	0.25	0.03	0.25	1
20	1	Trimethoprim	=	0.5	0.5	2.0	1
20	2	Cefepime	<=	0.06	0.015	0.12	1
20	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
20	2	Cefoxitin	=	4	2.0	8.0	1
20	2	Ceftazidime	<=	0.25	0.06	0.5	1
20	2	Ertapenem	<=	0.015	0.004	0.015	1
20	2	Imipenem	<=	0.12	0.06	0.25	1
20	2	Meropenem	<=	0.03	0.008	0.06	1
22	1	Ampicillin	=	2	2.0	8.0	1
22	1	Cefotaxime	<=	0.25	0.03	0.12	1
22	1	Ceftazidime	<=	0.5	0.06	0.5	1
22	1	Chloramphenicol	<=	8	2.0	8.0	1
22	1	Ciprofloxacin	<=	0.03	0.004	0.015	1
22	1	Colistin	<=	1	0.25	2.0	1
22	1	Gentamicin	<=	0.5	0.25	1.0	1
22	1	Meropenem	<=	0.03	0.008	0.06	1
22	1	Nalidixic acid	<=	4	1.0	4.0	1
22	1	Sulfamethoxazole	=	16	8.0	32.0	1
22	1	Tetracycline	<=	2	0.5	2.0	1
22	1	Tigecycline	<=	0.25	0.03	0.25	1
22	1	Trimethoprim	=	0.5	0.5	2.0	1
22	2	Cefepime	<=	0.06	0.015	0.12	1
22	2	Cefoxitin	=	2	2.0	8.0	1
22	2	Ceftazidime	<=	0.25	0.06	0.5	1
22	2	Ertapenem	<=	0.015	0.004	0.015	1
22	2	Imipenem	<=	0.12	0.06	0.25	1
22	2	Meropenem	<=	0.03	0.008	0.06	1
23	1	Ampicillin	=	2	2.0	8.0	1
23	1	Cefotaxime	<=	0.25	0.03	0.12	1
23	1	Ceftazidime	<=	0.5	0.06	0.5	1
23	1	Chloramphenicol	<=	8	2.0	8.0	1
23	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
23	1	Colistin	<=	1	0.25	2.0	1
23	1	Gentamicin	<=	0.5	0.25	1.0	1
23	1	Meropenem	<=	0.03	0.008	0.06	1
23	1	Nalidixic acid	<=	4	1.0	4.0	1
23	1	Sulfamethoxazole	=	16	8.0	32.0	1
23	1	Tetracycline	<=	2	0.5	2.0	1

Appendix 6c

23	1	Tigecycline	<=	0.25	0.03	0.25	1
23	1	Trimethoprim	=	0.5	0.5	2.0	1
23	2	Cefepime	<=	0.06	0.015	0.12	1
23	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
23	2	Cefoxitin	=	2	2.0	8.0	1
23	2	Ceftazidime	<=	0.25	0.06	0.5	1
23	2	Ertapenem	<=	0.015	0.004	0.015	1
23	2	Imipenem	=	0.25	0.06	0.25	1
23	2	Meropenem	<=	0.03	0.008	0.06	1
25	1	Ampicillin	=	8	2.0	8.0	1
25	1	Cefotaxime	<=	0.25	0.03	0.12	1
25	1	Ceftazidime	<=	0.5	0.06	0.5	1
25	1	Chloramphenicol	<=	8	2.0	8.0	1
25	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
25	1	Colistin	<=	1	0.25	2.0	1
25	1	Gentamicin	<=	0.5	0.25	1.0	1
25	1	Meropenem	<=	0.03	0.008	0.06	1
25	1	Nalidixic acid	<=	4	1.0	4.0	1
25	1	Sulfamethoxazole	<=	8	8.0	32.0	1
25	1	Tetracycline	<=	2	0.5	2.0	1
25	1	Tigecycline	<=	0.25	0.03	0.25	1
25	1	Trimethoprim	=	0.5	0.5	2.0	1
25	2	Cefepime	<=	0.06	0.015	0.12	1
25	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
25	2	Cefoxitin	=	4	2.0	8.0	1
25	2	Ceftazidime	<=	0.25	0.06	0.5	1
25	2	Ertapenem	<=	0.015	0.004	0.015	1
25	2	Imipenem	<=	0.12	0.06	0.25	1
25	2	Meropenem	<=	0.03	0.008	0.06	1
26	1	Ampicillin	=	2	2.0	8.0	1
26	1	Cefotaxime	<=	0.25	0.03	0.12	1
26	1	Ceftazidime	<=	0.5	0.06	0.5	1
26	1	Chloramphenicol	<=	8	2.0	8.0	1
26	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
26	1	Colistin	<=	1	0.25	2.0	1
26	1	Gentamicin	=	1	0.25	1.0	1
26	1	Meropenem	<=	0.03	0.008	0.06	1
26	1	Nalidixic acid	<=	4	1.0	4.0	1
26	1	Sulfamethoxazole	<=	8	8.0	32.0	1
26	1	Tetracycline	<=	8	0.5	2.0	1
26	1	Tigecycline	<=	0.25	0.03	0.25	1
26	1	Trimethoprim	=	0.5	0.5	2.0	1
29	1	Ampicillin	=	4	2.0	8.0	1
29	1	Cefotaxime	=	0.12	0.03	0.12	1
29	1	Ceftazidime	=	0.25	0.06	0.5	1
29	1	Chloramphenicol	=	8	2.0	8.0	1
29	1	Ciprofloxacin	=	0.015	0.004	0.015	1
29	1	Colistin	=	1	0.25	2.0	1
29	1	Gentamicin	=	1	0.25	1.0	1
29	1	Meropenem	=	0.06	0.008	0.06	1

Appendix 6c

29	1	Nalidixic acid	=	2	1.0	4.0	1
29	1	Sulfamethoxazole	=	32	8.0	32.0	1
29	1	Tetracycline	=	2	0.5	2.0	1
29	1	Tigecycline	=	0.25	0.03	0.25	1
29	1	Trimethoprim	=	1	0.5	2.0	1
29	2	Cefepime	=	0.12	0.015	0.12	1
29	2	Cefoxitin	=	4	2.0	8.0	1
29	2	Ceftazidime	=	0.25	0.06	0.5	1
29	2	Ertapenem	=	0.015	0.004	0.015	1
29	2	Imipenem	=	0.25	0.06	0.25	1
29	2	Meropenem	=	0.06	0.008	0.06	1
30	1	Ampicillin	=	4	2.0	8.0	1
30	1	Cefotaxime	<=	0.25	0.03	0.12	1
30	1	Ceftazidime	<=	0.5	0.06	0.5	1
30	1	Chloramphenicol	<=	8	2.0	8.0	1
30	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
30	1	Colistin	<=	1	0.25	2.0	1
30	1	Gentamicin	<=	0.5	0.25	1.0	1
30	1	Meropenem	<=	0.03	0.008	0.06	1
30	1	Nalidixic acid	<=	4	1.0	4.0	1
30	1	Sulfamethoxazole	=	16	8.0	32.0	1
30	1	Tetracycline	<=	2	0.5	2.0	1
30	1	Tigecycline	<=	0.25	0.03	0.25	1
30	1	Trimethoprim	=	0.5	0.5	2.0	1
30	2	Cefepime	<=	0.06	0.015	0.12	1
30	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
30	2	Cefoxitin	=	2	2.0	8.0	1
30	2	Ceftazidime	<=	0.25	0.06	0.5	1
30	2	Ertapenem	<=	0.015	0.004	0.015	1
30	2	Imipenem	<=	0.12	0.06	0.25	1
30	2	Meropenem	<=	0.03	0.008	0.06	1
33	1	Ampicillin	=	2	2.0	8.0	1
33	1	Cefotaxime	<=	0.25	0.03	0.12	1
33	1	Ceftazidime	<=	0.5	0.06	0.5	1
33	1	Chloramphenicol	<=	8	2.0	8.0	1
33	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
33	1	Colistin	<=	1	0.25	2.0	1
33	1	Gentamicin	<=	0.5	0.25	1.0	1
33	1	Meropenem	<=	0.03	0.008	0.06	1
33	1	Nalidixic acid	<=	4	1.0	4.0	1
33	1	Sulfamethoxazole	=	32	8.0	32.0	1
33	1	Tetracycline	<=	2	0.5	2.0	1
33	1	Tigecycline	<=	0.25	0.03	0.25	1
33	1	Trimethoprim	=	0.5	0.5	2.0	1
33	2	Cefepime	<=	0.06	0.015	0.12	1
33	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
33	2	Cefoxitin	=	4	2.0	8.0	1
33	2	Ceftazidime	<=	0.25	0.06	0.5	1
33	2	Ertapenem	<=	0.015	0.004	0.015	1
33	2	Imipenem	=	0.25	0.06	0.25	1

Appendix 6c

33	2	Meropenem	<=	0.03	0.008	0.06	1
34	1	Ampicillin	=	4	2.0	8.0	1
34	1	Cefotaxime	<=	0.25	0.03	0.12	1
34	1	Ceftazidime	<=	0.5	0.06	0.5	1
34	1	Chloramphenicol	<=	8	2.0	8.0	1
34	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
34	1	Colistin	<=	1	0.25	2.0	1
34	1	Gentamicin	<=	0.5	0.25	1.0	1
34	1	Meropenem	<=	0.03	0.008	0.06	1
34	1	Nalidixic acid	<=	4	1.0	4.0	1
34	1	Sulfamethoxazole	<=	8	8.0	32.0	1
34	1	Tetracycline	<=	2	0.5	2.0	1
34	1	Tigecycline	<=	0.25	0.03	0.25	1
34	1	Trimethoprim	=	0.5	0.5	2.0	1
34	2	Cefepime	<=	0.06	0.015	0.12	1
34	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
34	2	Cefoxitin	=	2	2.0	8.0	1
34	2	Ceftazidime	<=	0.25	0.06	0.5	1
34	2	Ertapenem	<=	0.015	0.004	0.015	1
34	2	Imipenem	<=	0.12	0.06	0.25	1
34	2	Meropenem	<=	0.03	0.008	0.06	1
36	1	Ampicillin	=	4	2.0	8.0	1
36	1	Cefotaxime	<=	0.25	0.03	0.12	1
36	1	Ceftazidime	<=	0.5	0.06	0.5	1
36	1	Chloramphenicol	<=	8	2.0	8.0	1
36	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
36	1	Colistin	<=	1	0.25	2.0	1
36	1	Gentamicin	<=	0.5	0.25	1.0	1
36	1	Meropenem	<=	0.03	0.008	0.06	1
36	1	Nalidixic acid	<=	4	1.0	4.0	1
36	1	Sulfamethoxazole	<=	8	8.0	32.0	1
36	1	Tetracycline	<=	2	0.5	2.0	1
36	1	Tigecycline	<=	0.25	0.03	0.25	1
36	1	Trimethoprim	=	0.5	0.5	2.0	1
36	2	Cefepime	<=	0.06	0.015	0.12	1
36	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
36	2	Cefoxitin	=	4	2.0	8.0	1
36	2	Ceftazidime	<=	0.25	0.06	0.5	1
36	2	Ertapenem	<=	0.015	0.004	0.015	1
36	2	Imipenem	<=	0.12	0.06	0.25	1
36	2	Meropenem	<=	0.03	0.008	0.06	1
37	1	Ampicillin	=	2	2.0	8.0	1
37	1	Cefotaxime	<=	0.25	0.03	0.12	1
37	1	Ceftazidime	<=	0.5	0.06	0.5	1
37	1	Chloramphenicol	<=	8	2.0	8.0	1
37	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
37	1	Colistin	<=	1	0.25	2.0	1
37	1	Gentamicin	<=	0.5	0.25	1.0	1
37	1	Meropenem	<=	0.03	0.008	0.06	1
37	1	Nalidixic acid	<=	4	1.0	4.0	1

Appendix 6c

37	1	Sulfamethoxazole	<=	8	8.0	32.0	1
37	1	Tetracycline	<=	2	0.5	2.0	1
37	1	Tigecycline	<=	0.25	0.03	0.25	1
37	1	Trimethoprim	=	0.5	0.5	2.0	1
37	2	Cefepime	<=	0.06	0.015	0.12	1
37	2	Cefotaxime/clavulanic acid	<=	0.25	0.03	0.12	1
37	2	Cefoxitin	=	4	2.0	8.0	1
37	2	Ceftazidime	<=	0.5	0.06	0.5	1
37	2	Ertapenem	<=	0.015	0.004	0.015	1
37	2	Imipenem	<=	0.125	0.06	0.25	1
37	2	Meropenem	<=	0.03	0.008	0.06	1
38	1	Ampicillin	=	8	2.0	8.0	1
38	1	Cefotaxime	<=	0.25	0.03	0.12	1
38	1	Ceftazidime	<=	0.5	0.06	0.5	1
38	1	Chloramphenicol	<=	8	2.0	8.0	1
38	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
38	1	Colistin	<=	1	0.25	2.0	1
38	1	Gentamicin	<=	0.5	0.25	1.0	1
38	1	Meropenem	<=	0.03	0.008	0.06	1
38	1	Nalidixic acid	<=	4	1.0	4.0	1
38	1	Sulfamethoxazole	=	16	8.0	32.0	1
38	1	Tetracycline	<=	2	0.5	2.0	1
38	1	Tigecycline	<=	0.25	0.03	0.25	1
38	1	Trimethoprim	=	1	0.5	2.0	1
38	2	Cefepime	<=	0.06	0.015	0.12	1
38	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
38	2	Cefoxitin	=	4	2.0	8.0	1
38	2	Ceftazidime	<=	0.25	0.06	0.5	1
38	2	Ertapenem	<=	0.015	0.004	0.015	1
38	2	Imipenem	<=	0.12	0.06	0.25	1
38	2	Meropenem	<=	0.03	0.008	0.06	1
39	1	Ampicillin	=	4	2.0	8.0	1
39	1	Cefotaxime	<=	0.25	0.03	0.12	1
39	1	Ceftazidime	<=	0.5	0.06	0.5	1
39	1	Chloramphenicol	<=	8	2.0	8.0	1
39	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
39	1	Colistin	<=	1	0.25	2.0	1
39	1	Gentamicin	<=	0.5	0.25	1.0	1
39	1	Meropenem	<=	0.03	0.008	0.06	1
39	1	Nalidixic acid	<=	4	1.0	4.0	1
39	1	Sulfamethoxazole	=	32	8.0	32.0	1
39	1	Tetracycline	<=	2	0.5	2.0	1
39	1	Tigecycline	<=	0.25	0.03	0.25	1
39	1	Trimethoprim	=	0.5	0.5	2.0	1
39	2	Cefepime	<=	0.06	0.015	0.12	1
39	2	Cefotaxime/clavulanic acid	=	0.06	0.03	0.12	1
39	2	Cefoxitin	=	2	2.0	8.0	1
39	2	Ceftazidime	<=	0.25	0.06	0.5	1
39	2	Ertapenem	<=	0.15	0.004	0.015	1
39	2	Imipenem	=	0.25	0.06	0.25	1

Appendix 6c

39	2	Meropenem	<=	0.03	0.008	0.06	1
40	1	Ampicillin	=	4	2.0	8.0	1
40	1	Cefotaxime	=	0.12	0.03	0.12	1
40	1	Ceftazidime	=	0.5	0.06	0.5	1
40	1	Chloramphenicol	=	8	2.0	8.0	1
40	1	Ciprofloxacin	=	0.015	0.004	0.015	1
40	1	Colistin	=	2	0.25	2.0	1
40	1	Gentamicin	=	0.5	0.25	1.0	1
40	1	Meropenem	=	0.06	0.008	0.06	1
40	1	Nalidixic acid	=	4	1.0	4.0	1
40	1	Sulfamethoxazole	=	16	8.0	32.0	1
40	1	Tetracycline	=	2	0.5	2.0	1
40	1	Tigecycline	=	0.25	0.03	0.25	1
40	1	Trimethoprim	=	0.5	0.5	2.0	1
40	2	Cefepime	=	0.12	0.015	0.12	1
40	2	Cefotaxime/clavulanic acid	=	0.06	0.03	0.12	1
40	2	Cefoxitin	=	4	2.0	8.0	1
40	2	Ceftazidime	=	0.5	0.06	0.5	1
40	2	Ertapenem	=	0.015	0.004	0.015	1
40	2	Imipenem	=	0.25	0.06	0.25	1
40	2	Meropenem	=	0.06	0.008	0.06	1
41	1	Ampicillin	=	4	2.0	8.0	1
41	1	Cefotaxime	<=	0.25	0.03	0.12	1
41	1	Ceftazidime	<=	0.5	0.06	0.5	1
41	1	Chloramphenicol	<=	8	2.0	8.0	1
41	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
41	1	Colistin	<=	1	0.25	2.0	1
41	1	Gentamicin	=	1	0.25	1.0	1
41	1	Meropenem	<=	0.03	0.008	0.06	1
41	1	Nalidixic acid	<=	4	1.0	4.0	1
41	1	Sulfamethoxazole	=	16	8.0	32.0	1
41	1	Tetracycline	<=	2	0.5	2.0	1
41	1	Tigecycline	<=	0.25	0.03	0.25	1
41	1	Trimethoprim	=	1	0.5	2.0	1
41	2	Cefepime	<=	0.06	0.015	0.12	1
41	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
41	2	Cefoxitin	=	2	2.0	8.0	1
41	2	Ceftazidime	<=	0.5	0.06	0.5	1
41	2	Ertapenem	<=	0.015	0.004	0.015	1
41	2	Imipenem	<=	0.12	0.06	0.25	1
41	2	Meropenem	<=	0.03	0.008	0.06	1
42	1	Ampicillin	=	8	2.0	8.0	1
42	1	Cefotaxime	<=	0.25	0.03	0.12	1
42	1	Ceftazidime	<=	0.5	0.06	0.5	1
42	1	Chloramphenicol	<=	8	2.0	8.0	1
42	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
42	1	Colistin	<=	1	0.25	2.0	1
42	1	Gentamicin	<=	0.5	0.25	1.0	1
42	1	Meropenem	<=	0.03	0.008	0.06	1
42	1	Nalidixic acid	<=	4	1.0	4.0	1

Appendix 6c

42	1	Sulfamethoxazole	=	64	8.0	32.0	0
42	1	Tetracycline	<=	2	0.5	2.0	1
42	1	Tigecycline	<=	0.25	0.03	0.25	1
42	1	Trimethoprim	=	2	0.5	2.0	1
42	2	Cefepime	<=	0.06	0.015	0.12	1
42	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
42	2	Cefoxitin	=	4	2.0	8.0	1
42	2	Ceftazidime	<=	0.25	0.06	0.5	1
42	2	Ertapenem	<=	0.015	0.004	0.015	1
42	2	Imipenem	<=	0.12	0.06	0.25	1
42	2	Meropenem	<=	0.03	0.008	0.06	1
45	1	Ampicillin	=	4	2.0	8.0	1
45	1	Cefotaxime	<=	0.25	0.03	0.12	1
45	1	Ceftazidime	<=	0.5	0.06	0.5	1
45	1	Chloramphenicol	<=	8	2.0	8.0	1
45	1	Ciprofloxacin	<=	0.016	0.004	0.015	1
45	1	Colistin	<=	1	0.25	2.0	1
45	1	Gentamicin	<=	0.5	0.25	1.0	1
45	1	Meropenem	<=	0.03	0.008	0.06	1
45	1	Nalidixic acid	<=	4	1.0	4.0	1
45	1	Sulfamethoxazole	=	32	8.0	32.0	1
45	1	Tetracycline	<=	2	0.5	2.0	1
45	1	Tigecycline	<=	0.25	0.03	0.25	1
45	1	Trimethoprim	=	1	0.5	2.0	1
45	2	Cefepime	<=	0.06	0.015	0.12	1
45	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
45	2	Cefoxitin	=	4	2.0	8.0	1
45	2	Ceftazidime	<=	0.25	0.06	0.5	1
45	2	Ertapenem	<=	0.016	0.004	0.015	1
45	2	Imipenem	<=	0.12	0.06	0.25	1
45	2	Meropenem	<=	0.03	0.008	0.06	1
56	1	Ampicillin	=	4	2.0	8.0	1
56	1	Cefotaxime	<=	0.25	0.03	0.12	1
56	1	Ceftazidime	<=	0.5	0.06	0.5	1
56	1	Chloramphenicol	<=	8	2.0	8.0	1
56	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
56	1	Colistin	<=	1	0.25	2.0	1
56	1	Gentamicin	<=	0.5	0.25	1.0	1
56	1	Meropenem	<=	0.03	0.008	0.06	1
56	1	Nalidixic acid	<=	4	1.0	4.0	1
56	1	Sulfamethoxazole	=	16	8.0	32.0	1
56	1	Tetracycline	<=	2	0.5	2.0	1
56	1	Tigecycline	<=	0.25	0.03	0.25	1
56	1	Trimethoprim	=	1	0.5	2.0	1
56	2	Cefepime	<=	0.06	0.015	0.12	1
56	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
56	2	Cefoxitin	=	8	2.0	8.0	1
56	2	Ceftazidime	<=	0.25	0.06	0.5	1
56	2	Ertapenem	<=	0.015	0.004	0.015	1
56	2	Imipenem	<=	0.12	0.06	0.25	1

Appendix 6c

56	2	Meropenem	<=	0.03	0.008	0.06	1
59	1	Ampicillin	=	4	2.0	8.0	1
59	1	Cefotaxime	<=	0.25	0.03	0.12	1
59	1	Ceftazidime	<=	0.5	0.06	0.5	1
59	1	Chloramphenicol	<=	8	2.0	8.0	1
59	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
59	1	Colistin	<=	1	0.25	2.0	1
59	1	Gentamicin	<=	0.5	0.25	1.0	1
59	1	Meropenem	<=	0.03	0.008	0.06	1
59	1	Nalidixic acid	<=	4	1.0	4.0	1
59	1	Sulfamethoxazole	=	32	8.0	32.0	1
59	1	Tetracycline	<=	2	0.5	2.0	1
59	1	Tigecycline	<=	0.25	0.03	0.25	1
59	1	Trimethoprim	=	0.5	0.5	2.0	1
59	2	Cefepime	<=	0.06	0.015	0.12	1
59	2	Cefotaxime/clavulanic acid	<=	0.06	0.03	0.12	1
59	2	Cefoxitin	=	2	2.0	8.0	1
59	2	Ceftazidime	<=	0.25	0.06	0.5	1
59	2	Ertapenem	<=	0.015	0.004	0.015	1
59	2	Imipenem	<=	0.12	0.06	0.25	1
59	2	Meropenem	<=	0.03	0.008	0.06	1
60	1	Ampicillin	=	4	2.0	8.0	1
60	1	Cefotaxime	<=	0.25	0.03	0.12	1
60	1	Ceftazidime	<=	0.5	0.06	0.5	1
60	1	Chloramphenicol	<=	8	2.0	8.0	1
60	1	Ciprofloxacin	<=	0.015	0.004	0.015	1
60	1	Colistin	<=	1	0.25	2.0	1
60	1	Gentamicin	<=	0.5	0.25	1.0	1
60	1	Meropenem	<=	0.03	0.008	0.06	1
60	1	Nalidixic acid	<=	4	1.0	4.0	1
60	1	Sulfamethoxazole	<=	8	8.0	32.0	1
60	1	Tetracycline	<=	2	0.5	2.0	1
60	1	Tigecycline	<=	0.25	0.03	0.25	1
60	1	Trimethoprim	<=	0.25	0.5	2.0	0

Appendix 7a

Enterococci - summary of results

Antimicrobial	EURL ENT-10.1		EURL ENT-10.2		EURL ENT-10.3		EURL ENT-10.4		EURL ENT-10.5		EURL ENT-10.6		EURL ENT-10.7		EURL ENT-10.8	
	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct
Ampicillin AMP	27	27	27	27	27	27	27	27	27	24	27	27	26	26	26	21
Chloramphenicol CHL	28	28	28	28	28	28	28	28	28	27	28	28	26	10	27	27
Ciprofloxacin CIP	27	27	27	27	27	27	27	27	27	27	27	26	26	26	26	26
Daptomycin DAP	25	25	25	25	25	25	25	25	25	25	25	25	24	24	24	24
Erythromycin ERY	28	28	28	27	28	28	28	28	28	27	28	28	27	27	27	26
Gentamicin GEN	28	28	28	27	28	28	28	27	28	28	28	26	27	26	27	27
Linezolid LZD	27	27	27	27	27	27	27	27	27	27	27	27	25	24	26	26
Quinopristin-dalfopristin (Synercid) SYN	22	22	22	22	24	23	22	22	24	22	23	22	21	21	22	21
Teicoplanin TEI	25	25	25	25	25	25	25	25	25	25	25	25	24	23	24	24
Tetracycline TET	28	28	28	27	28	28	28	28	28	28	28	28	27	27	27	27
Tigecycline TGC	27	27	27	27	27	27	27	25	27	27	27	25	26	26	26	26
Vancomycin VAN	27	27	27	27	28	28	28	28	28	28	28	28	27	26	26	26

Antimicrobial	EURL ENT-10.1		EURL ENT-10.2		EURL ENT-10.3		EURL ENT-10.4		EURL ENT-10.5		EURL ENT-10.6		EURL ENT-10.7		EURL ENT-10.8	
	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)
Ampicillin AMP	0	0	0	0	0	0	0	0	3	11,1	0	0	0	0	5	19,2
Chloramphenicol CHL	0	0	0	0	0	0	0	0	1	3,6	0	0	16	61,5	0	0
Ciprofloxacin CIP	0	0	0	0	0	0	0	0	0	0	1	3,7	0	0	0	0
Daptomycin DAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erythromycin ERY	0	0	1	3,6	0	0	0	0	1	3,6	0	0	0	0	1	3,7
Gentamicin GEN	0	0	1	3,6	0	0	1	3,6	0	0	2	7,1	1	3,7	0	0
Linezolid LZD	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0
Quinopristin-dalfopristin (Synercid) SYN	0	0	0	0	1	4,1	0	0	2	8,3	1	4,3	0	0	1	4,5
Teicoplanin TEI	0	0	0	0	0	0	0	0	0	0	0	0	1	4,1	0	0
Tetracycline TET	0	0	1	3,6	0	0	0	0	0	0	0	0	0	0	0	0
Tigecycline TGC	0	0	0	0	0	0	2	7,4	0	0	2	7,4	0	0	0	0
Vancomycin VAN	0	0	0	0	0	0	0	0	0	0	0	0	1	3,7	0	0

Excluded from the report (>25% deviations)

Appendix 7b

Staphylococci - summary of results 0

Antimicrobial	EURL ST-10.1		EURL ST-10.2		EURL ST-10.3		EURL ST-10.4		EURL ST-10.5		EURL ST-10.6		EURL ST-10.7		EURL ST-10.8	
	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct
Cefoxitin FOX	26	26	26	26	26	26	26	26	26	26	26	25	26	26	26	25
Chloramphenicol CHL	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Ciprofloxacin CIP	26	26	26	26	26	26	25	14	26	26	26	25	26	26	25	15
Clindamycin CLN	26	26	26	25	25	25	25	25	26	26	26	24	25	25	25	24
Erythromycin ERY	27	27	27	26	27	27	27	27	27	27	27	25	27	27	27	26
Gentamicin GEN	26	26	26	26	26	26	26	25	26	26	26	25	26	26	26	25
Linezolid LZD	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Mupirocin MUP	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
Quinopristin-dalfopristin (Synercid) SYN	23	23	23	22	23	23	23	23	23	21	22	18	23	23	23	22
Sulfamethoxazole SMX	25	25	25	25	25	25	25	24	25	23	25	25	25	23	25	25
Sulfamethoxazole-Trimethoprim SXT	4	4	4	4	5	5	4	4	4	2	4	3	4	4	4	0
Tetracycline TET	27	27	27	27	27	26	27	27	27	27	27	27	27	26	27	27
Tiamulin TIA	23	23	23	22	23	23	23	23	23	23	22	18	23	23	23	22
Trimethoprim TMP	26	26	26	26	26	26	26	25	26	26	26	25	26	25	26	26
Vancomycin VAN	24	24	24	24	24	24	24	23	24	24	24	24	24	24	24	24

Antimicrobial	EURL ST-10.1		EURL ST-10.2		EURL ST-10.3		EURL ST-10.4		EURL ST-10.5		EURL ST-10.6		EURL ST-10.7		EURL ST-10.8	
	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)
Cefoxitin FOX	0	0	0	0	0	0	0	0	0	0	1	3,8	0	0	1	3,8
Chloramphenicol CHL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ciprofloxacin CIP	0	0	0	0	0	0	11	44	0	0	1	3,8	0	0	10	40
Clindamycin CLN	0	0	1	3,8	0	0	0	0	0	0	2	7,7	0	0	1	4
Erythromycin ERY	0	0	1	3,7	0	0	0	0	0	0	2	7,4	0	0	1	3,7
Gentamicin GEN	0	0	0	0	0	0	1	3,8	0	0	1	3,8	0	0	1	3,8
Linezolid LZD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mupirocin MUP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Quinopristin-dalfopristin (Synercid) SYN	0	0	1	4,3	0	0	0	0	2	8,7	4	18,2	0	0	1	4,3
Sulfamethoxazole SMX	0	0	0	0	0	0	1	4	2	8	0	0	2	8	0	0
Sulfamethoxazole-Trimethoprim SXT	0	0	0	0	0	0	0	0	2	50	1	25	0	0	4	100
Tetracycline TET	0	0	0	0	1	3,7	0	0	0	0	0	0	1	3,7	0	0
Tiamulin TIA	0	0	1	4,3	0	0	0	0	0	0	4	18,2	0	0	1	4,3
Trimethoprim TMP	0	0	0	0	0	0	1	3,8	0	0	1	3,8	1	3,8	0	0
Vancomycin VAN	0	0	0	0	0	0	1	4,2	0	0	0	0	0	0	0	0

Appendix 7c

***Escherichia coli* - summary of results**

Antimicrobial	EURL EC-10.1		EURL EC-10.2		EURL EC-10.3		EURL EC-10.4		EURL EC-10.5		EURL EC-10.6		EURL EC-10.7		EURL EC-10.8	
	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct
Ampicillin AMP	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Azithromycin AZI	31	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Cefepime FEP	31	29	31	31	31	28	31	29	31	31	–	–	–	–	31	30
Cefotaxime FOT	62	62	62	62	62	62	62	62	62	62	31	30	31	31	62	62
Cefoxitin FOX	31	31	31	31	30	29	31	30	31	31	–	–	–	–	31	31
Ceftazidime TAZ	62	62	62	61	62	62	62	62	62	62	31	31	31	31	62	62
Chloramphenicol CHL	31	31	31	31	30	29	30	29	31	31	31	31	31	31	31	31
Ciprofloxacin CIP	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	30
Colistin COL	31	30	31	31	31	28	31	31	31	31	31	31	31	31	31	31
Ertapenem ETP	31	30	31	31	31	31	31	31	31	30	–	–	–	–	29	12
Gentamicin GEN	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Imipenem IMI	31	31	31	31	31	31	31	31	31	31	–	–	–	–	31	31
Meropenem MERO	62	62	62	62	62	62	62	62	62	62	31	31	31	31	62	62
Nalidixic acid NAL	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Sulfamethoxazole SMX	31	31	31	31	31	31	31	31	31	29	31	31	31	31	31	27
Tetracycline TET	31	31	31	30	31	30	31	31	31	31	31	31	31	31	31	30
Tigecycline TGC	31	30	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Trimethoprim TMP	31	31	31	31	31	31	31	31	31	31	31	28	31	31	31	30

Antimicrobial	EURL EC-10.1		EURL EC-10.2		EURL EC-10.3		EURL EC-10.4		EURL EC-10.5		EURL EC-10.6		EURL EC-10.7		EURL EC-10.8	
	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)
Ampicillin AMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Azithromycin AZI	1	3,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cefepime FEP	2	6,5	0	0	3	9,7	2	6,5	0	0	–	–	–	–	1	3,2
Cefotaxime FOT	0	0	0	0	0	0	0	0	0	0	1	3,2	0	0	0	0
Cefoxitin FOX	0	0	0	0	1	3,3	1	3,2	0	0	–	–	–	–	0	0
Ceftazidime TAZ	0	0	1	1,6	0	0	0	0	0	0	0	0	0	0	0	0
Chloramphenicol CHL	0	0	0	0	1	3,3	1	3,3	0	0	0	0	0	0	0	0
Ciprofloxacin CIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3,2
Colistin COL	1	3,2	0	0	3	9,7	0	0	0	0	0	0	0	0	0	0
Ertapenem ETP	1	3,2	0	0	0	0	0	0	1	3,2	–	–	–	–	17	58,6
Gentamicin GEN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Imipenem IMI	0	0	0	0	0	0	0	0	0	0	–	–	–	–	0	0
Meropenem MERO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nalidixic acid NAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfamethoxazole SMX	0	0	0	0	0	0	0	0	2	6,5	0	0	0	0	4	12,9
Tetracycline TET	0	0	1	3,2	1	3,2	0	0	0	0	0	0	0	0	1	3,2
Tigecycline TGC	1	3,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trimethoprim TMP	0	0	0	0	0	0	0	0	0	0	3	9,7	0	0	1	3,2

Excluded from the report (> 25% deviations)

Appendix 8a

Enterococci - deviations

Lab code	Strain_id	Antimicrobial	Read_value	Exp_val	Interp.	Exp_interp
2	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
2	EURL ENT-10.8	Ampicillin AMP	8	4	R	S
11	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
12	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
12	EURL ENT-10.8	Ampicillin AMP	8	4	R	S
17	EURL ENT-10.5	Ampicillin AMP	4	4	R	S
20	EURL ENT-10.5	Ampicillin AMP	8	4	R	S
20	EURL ENT-10.5	Quinopristin-dalfopristin (Synercid) SYN	4	4	R	S
20	EURL ENT-10.8	Quinopristin-dalfopristin (Synercid) SYN	4	4	R	S
21	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
21	EURL ENT-10.8	Erythromycin ERY	128	> 128	S	R
22	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
23	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
25	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
26	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
29	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
30	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
33	EURL ENT-10.8	Ampicillin AMP	8	4	R	S
34	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
36	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
39	EURL ENT-10.6	Ciprofloxacin CIP	8	1	R	S
40	EURL ENT-10.2	Erythromycin ERY	> 8	<= 1	R	S
40	EURL ENT-10.2	Gentamicin GEN	> 1024	<= 8	R	S
40	EURL ENT-10.2	Tetracycline TET	16	<= 1	R	S
40	EURL ENT-10.3	Quinopristin-dalfopristin (Synercid) SYN	4	8	S	R
40	EURL ENT-10.5	Chloramphenicol CHL	> 32	8	R	S
40	EURL ENT-10.5	Erythromycin ERY	> 8	2	R	S
40	EURL ENT-10.6	Gentamicin GEN	<= 128	> 1024	S	R
40	EURL ENT-10.6	Quinopristin-dalfopristin (Synercid) SYN	4	32	S	-
40	EURL ENT-10.7	Gentamicin GEN	256	<= 8	R	S
41	EURL ENT-10.4	Tigecycline TGC	= 0.5	= 0.25	R	S
41	EURL ENT-10.5	Ampicillin AMP	8	4	R	S
41	EURL ENT-10.6	Tigecycline TGC	= 0.5	= 0.25	R	S
42	EURL ENT-10.5	Quinopristin-dalfopristin (Synercid) SYN	8	4	R	S
42	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
42	EURL ENT-10.7	Teicoplanin TEI	64	<= 0.5	R	S
42	EURL ENT-10.7	Vancomycin VAN	> 128	2	R	S
42	EURL ENT-10.8	Ampicillin AMP	8	4	R	S
45	EURL ENT-10.4	Gentamicin GEN	32	256	S	R
45	EURL ENT-10.4	Tigecycline TGC	= 0.5	= 0.25	R	S
45	EURL ENT-10.6	Gentamicin GEN	32	> 1024	S	R
45	EURL ENT-10.6	Tigecycline TGC	1	= 0.25	R	S
45	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
45	EURL ENT-10.7	Linezolid LZD	4	8	S	R
45	EURL ENT-10.8	Ampicillin AMP	8	4	R	S
56	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R
60	EURL ENT-10.7	Chloramphenicol CHL	32	64	S	R

Excluded from final rude (> 25% deviations)

Appendix 8b

***Staphylococcus aureus* - deviations**

Lab. Code	Strain_id	Antibiotic_id	Read_value	Exp_val	Interp.	Exp_interp
2	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
4	EURL ST-10.5	Sulfamethoxazole SMX	> 512.0	128	R	S
4	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
11	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
12	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
17	EURL ST-10.2	Clindamycin CLN	<= 0.12	16	S	R
17	EURL ST-10.2	Erythromycin ERY	= 0.5	> 16	S	R
17	EURL ST-10.2	Quinopristin-dalfopristin (Synercid) SYN	<= 0.5	8	S	R
17	EURL ST-10.2	Tiamulin TIA	= 1.0	> 32	S	R
17	EURL ST-10.6	Clindamycin CLN	= 0.25	> 256	S	R
17	EURL ST-10.6	Erythromycin ERY	= 0.5	> 16	S	R
17	EURL ST-10.6	Quinopristin-dalfopristin (Synercid) SYN	= 1.0	2	S	R
17	EURL ST-10.6	Trimethoprim TMP	<= 2.0	> 32	S	R
19	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
20	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
21	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
21	EURL ST-10.4	Sulfamethoxazole SMX	= 128.0	> 512	S	R
25	EURL ST-10.8	Sulfamethoxazole-Trimethoprim SXT	= 0.5	1	S	R
26	EURL ST-10.5	Sulfamethoxazole-Trimethoprim SXT	= 0.5	1	S	R
26	EURL ST-10.8	Sulfamethoxazole-Trimethoprim SXT	= 0.25	1	S	R
29	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
30	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
31	EURL ST-10.6	Tiamulin TIA	<= 2.0	4	S	R
31	EURL ST-10.8	Ciprofloxacin CIP	> 1.0	1	R	S
31	EURL ST-10.8	Sulfamethoxazole-Trimethoprim SXT	<= 0.5	1	S	R
33	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
34	EURL ST-10.5	Quinopristin-dalfopristin (Synercid) SYN	> 2.0	1	R	S
34	EURL ST-10.5	Sulfamethoxazole-Trimethoprim SXT		1	S	R
34	EURL ST-10.6	Sulfamethoxazole-Trimethoprim SXT		1	S	R
34	EURL ST-10.8	Sulfamethoxazole-Trimethoprim SXT		1	S	R
36	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
36	EURL ST-10.6	Quinopristin-dalfopristin (Synercid) SYN	= 1.0	2	S	R
36	EURL ST-10.6	Tiamulin TIA	= 2.0	4	S	R
37	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
39	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
40	EURL ST-10.6	Cefoxitin FOX	= 4.0	8	S	R
40	EURL ST-10.6	Ciprofloxacin CIP	= 1.0	> 8	S	R
40	EURL ST-10.6	Clindamycin CLN	= 0.25	> 256	S	R
40	EURL ST-10.6	Erythromycin ERY	= 1.0	> 16	S	R
40	EURL ST-10.6	Gentamicin GEN	<= 1.0	16	S	R
40	EURL ST-10.6	Quinopristin-dalfopristin (Synercid) SYN	<= 0.5	2	S	R
40	EURL ST-10.6	Tiamulin TIA	= 1.0	4	S	R
40	EURL ST-10.7	Sulfamethoxazole SMX	= 256.0	64	R	S
40	EURL ST-10.8	Cefoxitin FOX	= 16.0	4	R	S
40	EURL ST-10.8	Ciprofloxacin CIP	> 8.0	1	R	S
40	EURL ST-10.8	Clindamycin CLN	> 4.0	= 0.094	R	S
40	EURL ST-10.8	Erythromycin ERY	> 8.0	= 0.5	R	S
40	EURL ST-10.8	Gentamicin GEN	> 16.0	= 0.5	R	S
40	EURL ST-10.8	Quinopristin-dalfopristin (Synercid) SYN	= 2.0	<= 0.5	R	S
40	EURL ST-10.8	Tiamulin TIA	> 4.0	1	R	S
41	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
41	EURL ST-10.4	Gentamicin GEN	= 2.0	> 16	S	R
42	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
42	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
45	EURL ST-10.3	Tetracycline TET	= 2.0	<= 0.5	R	S
45	EURL ST-10.4	Trimethoprim TMP	= 4.0	1	R	S
45	EURL ST-10.4	Vancomycin VAN	= 16.0	<= 1	R	S
45	EURL ST-10.5	Quinopristin-dalfopristin (Synercid) SYN	= 2.0	1	R	S
45	EURL ST-10.5	Sulfamethoxazole SMX	> 512.0	128	R	S
45	EURL ST-10.7	Sulfamethoxazole SMX	= 512.0	64	R	S
45	EURL ST-10.7	Tetracycline TET	= 2.0	<= 0.5	R	S
45	EURL ST-10.7	Trimethoprim TMP	= 4.0	2	R	S

Appendix 8b

45	EURL ST-10.8	Ciprofloxacin CIP	= 2.0	1	R	S
56	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R
56	EURL ST-10.6	Quinopristin-dalfopristin (Synercid) SYN	= 1.0	2	S	R
56	EURL ST-10.6	Tiamulin TIA	= 2.0	4	S	R
59	EURL ST-10.4	Ciprofloxacin CIP	= 1.0	2	S	R

Excluded from final report (> 25% deviations)

Appendix 8c

***Escherichia coli* - deviations**

Lab. code	Panel	Strain_id	Antibiotic_id	Read_value	Exp_val	Interp.	Exp_interp
2	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
4	2	EURL EC-10.1	Cefepime FEP	= 0.25	= 0.25	S	R
4	2	EURL EC-10.3	Cefepime FEP	= 0.06	= 0.25	S	R
4	2	EURL EC-10.4	Cefepime FEP	= 0.25	= 0.25	S	R
4	1	EURL EC-10.5	Sulfamethoxazole SMX	128	16	R	S
4	2	EURL EC-10.8	Cefepime FEP	= 0.25	= 0.25	S	R
4	1	EURL EC-10.8	Ciprofloxacin CIP	= 0.12	= 0.03	R	S
4	2	EURL EC-10.8	Ertapenem ETP	= 0.03	= 0.12	S	R
4	1	EURL EC-10.8	Sulfamethoxazole SMX	> 1024	32	R	S
4	1	EURL EC-10.8	Trimethoprim TMP	4	<= 0.25	R	S
6	2	EURL EC-10.4	Cefoxitin FOX	16	2	R	S
11	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
16	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
18	1	EURL EC-10.8	Sulfamethoxazole SMX	> 1024	32	R	S
18	1	EURL EC-10.8	Tetracycline TET	16	4	R	S
19	1	EURL EC-10.6	Trimethoprim TMP	<= 0.25	> 32	S	R
21	2	EURL EC-10.3	Cefepime FEP	= 0.5	= 0.25	S	R
22	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
23	2	EURL EC-10.1	Ertapenem ETP	= 0.12	= 0.06	R	S
25	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
26	1	EURL EC-10.1	Colistin COL	2	8	S	R
26	1	EURL EC-10.3	Chloramphenicol CHL	16	32	S	R
26	1	EURL EC-10.3	Colistin COL	2	4	S	R
26	1	EURL EC-10.4	Chloramphenicol CHL	16	32	S	R
26	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
29	1	EURL EC-10.3	Colistin COL	2	4	S	R
29	2	EURL EC-10.8	Ertapenem ETP	<= 0.06	= 0.12	S	R
30	1	EURL EC-10.2	Tetracycline TET	> 64	<= 2	R	S
30	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
33	1	EURL EC-10.6	Trimethoprim TMP	<= 0.25	> 32	S	R
33	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
34	2	EURL EC-10.1	Cefepime FEP	= 0.12	= 0.25	S	R
34	2	EURL EC-10.2	Ceftazidime TAZ	2	2	S	R
34	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
36	2	EURL EC-10.8	Ertapenem ETP	0.06	= 0.12	S	R
37	1	EURL EC-10.6	Cefotaxime FOT	<= 0.25	<= 0.25	R	S
39	2	EURL EC-10.8	Ertapenem ETP	0.06	= 0.12	S	R
40	1	EURL EC-10.1	Azithromycin AZI	32	8	R	S
40	2	EURL EC-10.3	Cefepime FEP	<= 0.06	= 0.25	S	R
40	2	EURL EC-10.4	Cefepime FEP	<= 0.06	= 0.25	S	R
40	1	EURL EC-10.5	Sulfamethoxazole SMX	> 1024	16	R	S
40	2	EURL EC-10.8	Ertapenem ETP	<= 0.015	= 0.12	S	R
40	1	EURL EC-10.8	Sulfamethoxazole SMX	256	32	R	S
42	1	EURL EC-10.3	Tetracycline TET	64	64	S	R
42	2	EURL EC-10.5	Ertapenem ETP	= 0.25	= 0.5	S	R
42	1	EURL EC-10.6	Trimethoprim TMP	= 0.5	> 32	S	R
42	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
45	2	EURL EC-10.3	Cefoxitin FOX	8	4	R	S
45	1	EURL EC-10.8	Sulfamethoxazole SMX	1024	32	R	S
56	1	EURL EC-10.3	Colistin COL	2	4	S	R
56	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
59	2	EURL EC-10.8	Ertapenem ETP	= 0.06	= 0.12	S	R
60	1	EURL EC-10.1	Tigecycline TGC	> 8	= 0.5	R	S

Excluded from final report (> 25% deviations)

National Food Institute
Technical University of Denmark
Kemitorvet
Building 202
DK-2800 Kgs. Lyngby

Tel. 35 88 70 00
Fax 35 88 70 01

www.food.dtu.dk

ISBN: 978-87-93565-09-8