Quality Control
of
Antimicrobial Susceptibility Test

routine quality control strains

Organism	Culture collection numbers	Characteristics
E. coli	ATCC 25922; NCTC 12241 CIP 7624; DSM 1103 CCUG 17620; CECT 434	Susceptible, wild-type
E. coli	ATCC 35218; NCTC 11954 CIP 102181; DSM 5923 CCUG 30600; CECT 943	TEM-1 β-lactamase producer
P. aeruginosa	ATCC 27853; NCTC 12903 CIP 76110; DSM 1117 CCUG 17619; CECT 108	Susceptible, wild-type
S. aureus	ATCC 29213; NCTC 12973 CIP 103429; DSM 2569 CCUG 15915; CECT 794	Weak β-lactamase producer
E. faecalis	ATCC 29212; NCTC 12697 CIP 103214; DSM 2570 CCUG 9997; CECT 795	Susceptible, wild-type

routine quality control strains

Organism	Culture collection numbers	Characteristics
S. pneumoniae	ATCC 49619; NCTC 12977 CIP 104340; DSM 11967 CCUG 33638	Reduced susceptibility to benzylpenicillin
H. influenzae	ATCC 49766; NCTC 12975 CIP 103570; DSM 11970 CCUG 29539	Susceptible, wild-type
Campylobacter jejuni	ATCC 33560; NCTC 11351 CIP 702; DSM 4688 CCUG 11284	Susceptible, wild-type

strains for detection of specific resistance mechanisms (extended QC)

Organism	Culture collection numbers	Characteristics
K. pneumoniae	ATCC 700603; NCTC 13368 CCUG 45421; CECT 7787	ESBL producer (SHV-18)
S. aureus	NCTC 12493	Oxacillin hetero-resistant, *mecA* positive
E. faecalis	ATCC 51299; NCTC 13379 CIP 104676; DSM 12956 CCUG 34289	High-level aminoglycoside resistant (HLAR) and vancomycin resistant (*vanB* positive)
H. influenzae	ATCC 49247; NCTC 12699 CIP 104604; DSM 9999 CCUG 26214	Reduced susceptibility to β-lactam agents due to PBP mutations (BLNAR)

Table 4A-1. Disk Diffusion QC Ranges for Nonfastidious Organisms and Antimicrobial Agents Excluding β-Lactam Combination Agents[a]

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Amikacin	30 µg	19–26	18–26	20–26
Ampicillin	10 µg	15–22	–	27–35
Azithromycin	15 µg	–	–	21–26
Azlocillin	75 µg	–	24–30	–
Aztreonam	30 µg	28–36	23–29	–
Carbenicillin	100 µg	23–29	18–24	–
Cefaclor	30 µg	23–27	–	27–31
Cefamandole	30 µg	26–32	–	26–34
Cefazolin	30 µg	21–27	–	29–35
Cefdinir	5 µg	24–28	–	25–32
Cefditoren	5 µg	22–28	–	20–28
Cefepime	30 µg	31–37	25–31	23–29
Cefetamet	10 µg	24–29	–	–
Cefiderocol	30 µg	25–31	22–31	–
Cefixime	5 µg	20–26	–	–
Cefmetazole	30 µg	26–32	–	25–34
Cefonicid	30 µg	25–29	–	22–28
Cefoperazone	75 µg	28–34	23–29	24–33
Cefotaxime	30 µg	29–35	18–22	25–31
Cefotetan	30 µg	28–34	–	17–23
Cefoxitin	30 µg	23–29	–	23–29
Cefpodoxime	10 µg	23–28	–	19–25
Cefprozil	30 µg	21–27	–	27–33
Ceftaroline	30 µg	26–34	–	26–35
Ceftazidime	30 µg	25–32	22–29	16–20
Ceftibuten	30 µg	27–35	–	–
Ceftizoxime	30 µg	30–36	12–17	27–35
Ceftobiprole	30 µg	30–36	24–30	26–34
Ceftriaxone	30 µg	29–35	17–23	22–28
Cefuroxime	30 µg	20–26	–	27–35
Cephalothin	30 µg	15–21	–	29–37
Chloramphenicol	30 µg	21–27	–	19–26
Cinoxacin	100 µg	26–32	–	–

Table 4A-1. (Continued)

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Ciprofloxacin	5 µg	29–38	25–33	22–30
Clarithromycin	15 µg	–	–	26–32
Clinafloxacin	5 µg	31–40	27–35	28–37
Clindamycin[c]	2 µg	–	–	24–30
Colistin	10 µg	11–17	11–17	–
Delafloxacin[d]	5 µg	28–35	23–29	32–40
Dirithromycin	15 µg	–	–	18–26
Doripenem	10 µg	27–35	28–35	33–42
Doxycycline	30 µg	18–24	–	23–29
Enoxacin	10 µg	28–36	22–28	22–28
Eravacycline	20 µg	16–23	–	19–26
Ertapenem	10 µg	29–36	13–21	24–31
Erythromycin[c]	15 µg	–	–	22–30
Faropenem	5 µg	20–26	–	27–34
Fleroxacin	5 µg	28–34	12–20	21–27
Fosfomycin[e]	200 µg	22–30	–	25–33
Fusidic acid	10 µg	–	–	24–32
Garenoxacin	5 µg	28–35	19–25	30–36
Gatifloxacin	5 µg	30–37	20–28	27–33
Gemifloxacin	5 µg	29–36	19–25	27–33
Gentamicin[f]	10 µg	19–26	17–23	19–27
Gepotidacin	10 µg	18–26	–	23–29
Grepafloxacin	5 µg	28–36	20–27	26–31
Iclaprim	5 µg	14–22	–	25–33
Imipenem[g]	10 µg	26–32	20–28	–
Kanamycin	30 µg	17–25	–	19–26
Lefamulin	20 µg	–	–	26–32
Levofloxacin	5 µg	29–37	19–26	25–30
Levonadifloxacin	10 µg	27–33[d]	17–23[d]	32–39[d]
Linezolid	30 µg	–	–	25–32[h]
Lomefloxacin	10 µg	27–33	22–28	23–29
Loracarbef	30 µg	23–29	–	23–31
Mecillinam	10 µg	24–30	–	–

Table 4A-1. (Continued)

Antimicrobial Agent	Disk Content	Disk Diffusion QC Ranges, mm		
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923
Meropenem	10 µg	28–35	27–33	29–37
Minocycline	30 µg	19–25	–	25–30
Moxalactam	30 µg	28–35	17–25	18–24
Moxifloxacin	5 µg	28–35	17–25	28–35
Nafcillin	1 µg	–	–	16–22
Nafithromycin	15 µg	–	–	25–31[d]
Nalidixic acid	30 µg	22–28	–	–
Netilmicin	30 µg	22–30	17–23	22–31
Nitrofurantoin	300 µg	20–25	–	18–22
Norfloxacin	**10 µg**	**28–35**	**22–29**	**17–28**
Ofloxacin	5 µg	29–33	17–21	24–28
Omadacycline	30 µg	22–28	–	22–30
Oxacillin	1 µg	–	–	18–24
Pefloxacin	5 µg	25–33	–	–
Penicillin	10 units	–	–	26–37
Piperacillin	100 µg	24–30	25–33	–
Plazomicin	30 µg	21–27	15–21	19–25
Polymyxin B	300 units	13–19	14–18	–
Quinupristin-dalfopristin	15 µg	–	–	21–28
Razupenem	10 µg	21–26	–	–[i]
Rifampin	5 µg	8–10	–	26–34
Solithromycin	15 µg	–	–	22–30
Sparfloxacin	5 µg	30–38	21–29	27–33
Streptomycin[f]	10 µg	12–20	–	14–22
Sulfisoxazole[j]	250 µg or 300 µg	15–23	–	24–34
Sulopenem	**2 µg**	**24–30[d]**	**–**	**–**
Tebipenem[g]	10 µg	30–37	20–26	–
Tedizolid[k]	**2** µg	–	–	**18–24[h]**
Teicoplanin	30 µg	–	–	15–21
Telithromycin	15 µg	–	–	24–30
Tetracycline	30 µg	18–25	–	24–30
Ticarcillin	75 µg	24–30	21–27	–
Tigecycline	15 µg	20–27	9–13	20–25
Tobramycin	10 µg	18–26	20–26	19–29
Trimethoprim[j]	5 µg	21–28	–	19–26
Trimethoprim-sulfamethoxazole[j]	1.25/23.75 µg	23–29	–	24–32
Trospectomycin	30 µg	10–16	–	15–20
Trovafloxacin	10 µg	29–36	21–27	29–35
Ulifloxacin (prulifloxacin)[l]	5 µg	32–38	27–33	20–26
Vancomycin	30 µg	–	–	17–21

Abbreviations: ATCC®, American Type Culture Collection, QC, quality control.

Table 4A-2. Disk Diffusion QC Ranges for Nonfastidious Organisms and β-Lactam Combination Agents[a]

Antimicrobial Agent	Disk Content	QC Organisms and Characteristics								
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923	*Escherichia coli* ATCC® 35218[c,d]	*Klebsiella pneumoniae* ATCC® 700603[c,d]	*Escherichia coli* NCTC 13353[c,d]	*Klebsiella pneumoniae* ATCC® BAA-1705™[c,d]	*Klebsiella pneumoniae* ATCC® BAA-2814™	*Acinetobacter baumannii* NCTC 13304[c,d]
		β-lactamase negative	Inducible AmpC	β-lactamase negative, *mecA* negative	TEM-1	SHV-18 OXA-2 Mutations in OmpK35 and OmpK37 TEM-1	CTX-M-15	KPC-2 SHV	KPC-3 SHV-11 TEM-1	OXA-27
		Zone Diameter QC Ranges, mm								
Amoxicillin-clavulanate (2:1)	20/10 µg	18–24	–	28–36	17–22	–	–	–	–	–
Ampicillin	10 µg	15–22	–	27–35	6	–	–	–	–	–
Ampicillin-sulbactam (2:1)	10/10 µg	19–24	–	29–37	13–19	–	–	–	–	–
Aztreonam	30 µg	28–36	23–29	–	31–38	10–16	–	–	–	–
Aztreonam-avibactam	30/20 µg	32–38	24–30	–	31–38	26–32[e]	–	–	–	–
Cefepime	30 µg	31–37	25–31	23–29	**31–37**	23–29	6–15[f]	–	–	6–16[f]
Cefepime-enmetazobactam[e]	**30/20 µg**	**32–38**	**26–32**	**–**	**32–38**	**26–32**	**27–33**	**–**	**–**	**–**
Cefepime-taniborbactam	**30/20 µg**	**31–37**	**25–31**	**–**	**31–37**	**24–31**	**24–30**	**22–27**	**–**	**–**
Cefepime-tazobactam	30/20 µg	32–37	27–31	24–30	–	25–30[e]	27–31	–	–	–
Cefepime-zidebactam	30/30 µg	33–40	29–35	–	–	28–34	29–35	–	–	19–25
Cefotaxime	30 µg	29–35	18–22	25–31	–	17–25	–	–	–	–
Cefpodoxime	10 µg	23–28	–	19–25	–	9–16	–	–	–	–
Ceftaroline	30 µg	26–34	–	26–35	–	–	–	–	–	–
Ceftaroline-avibactam	30/15 µg	27–34	17–26	25–34	27–35	21–27[e]	–	–	–	–
Ceftazidime	30 µg	25–32	22–29	16–20	–	10–18	–	–	–	–
Ceftazidime-avibactam	30/20 µg	27–35	25–31	16–22	28–35	21–27[e]	–	–	–	–
Ceftolozane-tazobactam	30/10 µg	24–32	25–31	10–18	25–31	17–25	–	–	–	–
Ceftriaxone	30 µg	29–35	17–23	22–28	–	16–24	–	–	–	–
Imipenem	10 µg	**26–32**	**20–28**	–	–	25–33	–	11–22	6–14	–
Imipenem-relebactam[e,g]	10/25 µg	27–33	26–31	–	–	26–32	–	23–29	22–28	–
Meropenem[f]	10 µg	28–35	27–33	29–37	–	–	–	11–18[e]	6[e]	–

Table 4A-2. (Continued)

Antimicrobial Agent	Disk Content	QC Organisms and Characteristics								
		Escherichia coli ATCC®[b] 25922	*Pseudomonas aeruginosa* ATCC® 27853	*Staphylococcus aureus* ATCC® 25923	*Escherichia coli* ATCC® 35218[c,d]	*Klebsiella pneumoniae* ATCC® 700603[c,d]	*Escherichia coli* NCTC 13353[c,d]	*Klebsiella pneumoniae* ATCC® BAA-1705™[c,d]	*Klebsiella pneumoniae* ATCC® BAA-2814™	*Acinetobacter baumannii* NCTC 13304[c,d]
		β-lactamase negative	Inducible AmpC	β-lactamase negative, *mecA* negative	TEM-1	SHV-18 OXA-2 Mutations in OmpK35 and OmpK37 TEM-1	CTX-M-15	KPC-2 SHV	KPC-3 SHV-11 TEM-1	OXA-27
		Zone Diameter QC Ranges, mm								
Meropenem-vaborbactam[g]	20/10 µg	31–37	29–35	32–38	–	29–35	–	21–27	16–20	–
Piperacillin	100 µg	24–30	25–33	–	12–18	–	–	–	–	–
Piperacillin-tazobactam	100/10 µg	24–30	25–33	27–36	24–30	–	–	–	–	–
Sulbactam-durlobactam	**10/10** µg	**26–32**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**24–30**
Ticarcillin	75 µg	24–30	21–27	–	6	–	–	–	–	–
Ticarcillin-clavulanate	75/10 µg	24–30	20–28	29–37	21–25	–	–	–	–	–

Abbreviations: ATCC®, American Type Culture Collection; MIC, minimal inhibitory concentration; N/A, not applicable; NCTC, National Collection of Type Cultures; QC, quality control.

QC strain selection codes: QC strain is recommended for routine QC.
Test one of these agents by a disk diffusion or MIC method to confirm the integrity of the respective QC strain.[c,d]

Frequency of Quality Control Testing

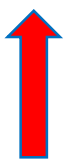
Monitor the overall performance of the test system using the QC limits by testing the appropriate QC strains **each day** the test is performed or, if satisfactory performance is documented test the QC strains **weekly**.

The weekly QC testing option is not applicable when disk diffusion tests are performed less than once a week. QC testing should be performed each test day for disk diffusion tests performed less than once a week.

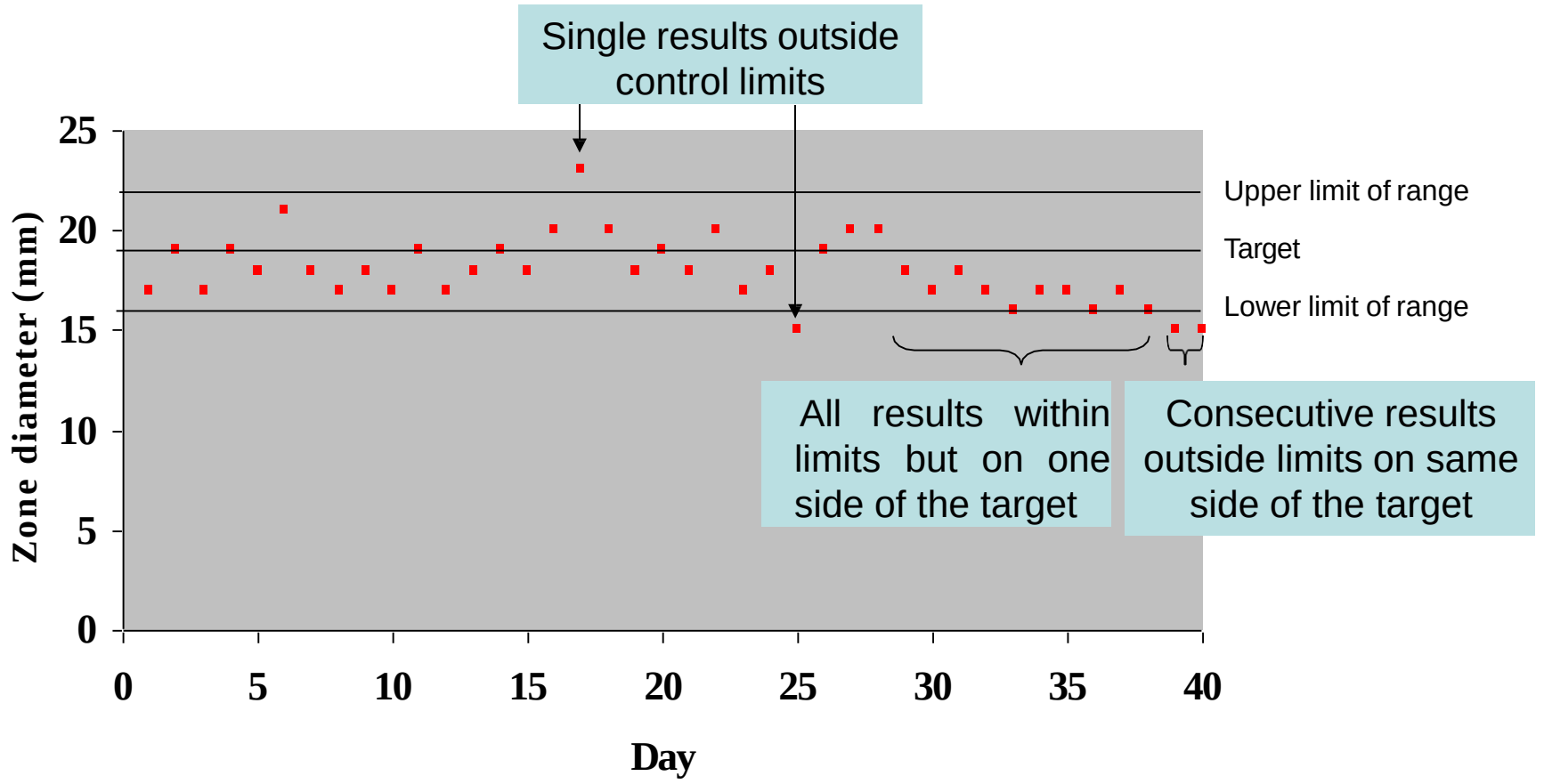
Daily Quality Control Testing

A laboratory can perform QC testing daily. Daily (vs weekly) QC testing must be performed each day patient isolates are tested if disk diffusion tests are performed less than once a week.

“Daily QC testing” or testing on “consecutive test days” means testing of QC strains each day disk diffusion tests are performed on patient isolates. It does not refer to calendar days.



Monitoring test performance



Daily Testing

Performance is satisfactory for daily QC testing when no more than three out of 30 results obtained on consecutive test days for each antimicrobial agent/organism combination are outside the acceptable limit

Performance Criteria for Reducing Quality Control Frequency to Weekly

Two plans are available to demonstrate satisfactory performance with daily QC testing before going to weekly QC testing. These include: 1) the 20- or 30-day plan or 2) the 15-replicate (3 × 5 day) plan.

The 20- or 30-Day Plan

- Test all applicable QC strains for 20 or 30 consecutive test days and document results.
- Follow recommended actions as described in Appendix A.
- If no more than one out of 20 or three out of 30 zone diameter measurements for each antimicrobial agent/organism combination are outside the acceptable zone diameter QC range listed in M100[1] Tables 4A and 4B, it is acceptable to go to weekly QC testing.
- If completion of the 20- or 30-day plan is unsuccessful, take corrective action as appropriate, and continue daily QC testing.

- If a laboratory is routinely testing QC strains each day of use and desires to convert to a weekly QC plan, it is acceptable to retrospectively analyze QC data from consecutive tests available during the previous two years, providing no aspects of the test system have changed.

The 15-Replicate (3 × 5 Day) Plan

- Test three replicates of each applicable QC strain using individual inoculum preparations for five consecutive test days and document results.
- Follow recommended actions as described in Appendix A and Table 5, below.
- Upon successful completion of the 15-replicate (3 × 5 day) plan, it is acceptable to go to weekly QC testing.
- If completion of the 15-replicate (3 × 5 day) plan is unsuccessful, take corrective action as appropriate, and continue daily QC testing.

Table 5. 15-Replicate (3 × 5 Day) Plan: Acceptance Criteria and Recommended Action*

Number Out of Range With Initial Testing (Based on 15 Replicates)	Conclusion From Initial Testing (Based on 15 Replicates)	Number Out of Range After Repeat Testing (Based on All 30 Replicates)	Conclusion After Repeat Testing
0–1	Plan is successful. Convert to weekly QC testing.	N/A	N/A
2–3	Test another 3 replicates for 5 days.	2–3	Plan is successful. Convert to weekly QC testing.
≥4	Plan fails. Investigate and take corrective action as appropriate. Continue QC each test day.	≥4	Plan fails. Investigate and take corrective action as appropriate. Continue QC each test day.

*Assess each QC strain/antimicrobial agent combination separately.
Abbreviations: N/A, not applicable; QC, quality control.

Out-of-Range Results With Quality Control Strains and Corrective Action

Out-of-range QC results can be categorized into those that are 1) random, 2) identifiable, or 3) system related.

QC ranges are established to include ≥95% of results obtained from routine testing of QC strains. A small number of (random) out-of-range QC results may be obtained even when the test method is performed correctly and materials are maintained according to recommended protocols. Such occurrences are due to chance.

Out-of-range results with QC strains due to random or identifiable errors can usually be resolved by a single repeat of the QC test. However, out-of-range QC results that are due to a problem with the test system usually do not correct when the QC test is repeated and may indicate a serious problem that can adversely affect patient results. Every out-of-range QC result must be investigated.

Daily or Weekly Quality Control Testing – Out-of-Range Result Due to Identifiable Error

If the reason for an out-of-range result can be identified and easily corrected, correct the problem, document the reason, and retest the QC strain on the day the error is observed. If the repeated result is within range, no further corrective action is required.

Out-of-Control Result Due to Identifiable Error

- QC strain
  - Use of the wrong QC strain
  - Improper storage
  - Inadequate maintenance (eg, use of the same working culture for > 1 month)
  - Contamination
  - Nonviability
  - Changes in the organism (eg, mutation, loss of plasmid)

- Testing supplies
  - Improper storage or shipping conditions
  - Contamination
  - Use of a defective agar plate (eg, too thick or too thin)
  - Use of damaged (eg, cracked) plates
  - Use of expired materials

- Testing process
  - Use of the wrong incubation temperature or conditions
  - Inoculum suspensions incorrectly prepared or adjusted
  - Inoculum prepared from a plate incubated for the incorrect length of time
  - Inoculum prepared from differential or selective media containing anti-infective agents or other growth-inhibiting compounds
  - Use of wrong disk, ancillary supplies
  - Improper disk placement (eg, inadequate contact with the agar)
  - Incorrect reading or interpretation of test results
  - Transcription error

- Equipment
  - Not functioning properly or out of calibration (eg, pipettes)

Out-of-Control Result With No Error Identified

Immediate Corrective Action

• Test the out-of-control antimicrobial agent/organism combination on the day the error is observed and/or as soon as a new working culture or subculture is available. Monitor for five consecutive test days. Document all results.

– If all five zone diameter measurements for the antimicrobial agent/organism combination are within the acceptable ranges, no additional corrective action is necessary.

– If any of the five zone diameter measurements are still outside the acceptable range, additional corrective action is required

• Daily control tests must be continued until final resolution of the problem is achieved.

Additional Corrective Action

When immediate corrective action does not resolve the problem, the problem is likely due to a system error rather than a random error.

If necessary, obtain a new QC strain (either from freezer storage or a reliable source) and new lots of materials (including new turbidity standards), possibly from different manufacturers. It is also helpful to exchange QC strains and materials with another laboratory using the same method in order to determine the root cause of unexplained system problems.

If a problem is identified and corrected, documentation of satisfactory performance for another five days is required to return to weekly QC testing. If a problem is not identified, but results go back into control without any specific corrective action, documentation of satisfactory performance for another 20 or 30 consecutive test days is required in order to return to weekly QC testing

Ampicillin *E. coli* ATCC® 25922; acceptable range: 15 to 22 mm

Week	Day	Lot Number (Disks)	Lot Number (MHA)	Result	Action
1	1	3564	16481	18	
2	1	3564	16481	19	
3	1	3564	16481	18	
4	1	3564	16481	19	
5	1	3564	16481	14	Out of range. Repeat QC same day.
5	2	3564	16481	17	In range. Five acceptable in-range QC tests for *E. coli* ATCC® 25922 with ampicillin disks lot 3564 and MHA lot 16481. Resume weekly QC testing.

Abbreviations: ATCC®, American Type Culture Collection; MHA, Mueller-Hinton agar; QC, quality control.

Conclusion: Random QC error.

Ampicillin *E. coli* ATCC® 25922; acceptable range: 15 to 22 mm

Week	Day	Lot Number (Disks)	Lot Number (MHA)	Result	Action
1	1	9661	16922	18	
2	1	9661	16922	19	
3	1	9661	16922	14	Out of range. Repeat QC same day.
3	2	9661	16922	18	In range. Three acceptable in-range QC tests for *E. coli* ATCC® 25922 with ampicillin disks lot 9661 and MHA lot 16922. Repeat QC 2 more consecutive days.
3	3	9661	16922	18	In range.
3	4	9661	16922	17	In range. Five acceptable in-range QC tests for *E. coli* ATCC® 25922 with ampicillin disks lot 9661 and MHA lot 16922. Resume weekly QC testing.

Abbreviations: ATCC®, American Type Culture Collection; MHA, Mueller-Hinton agar; QC, quality control.

Conclusion: Random QC error.

- If repeat results with QC strains are still out of range, additional corrective action is required. It is possible that the problem is due to a system error rather than a random error (see Subchapter 4.8.1 and M100[1] Tables 4A and 4B).

- Daily QC tests must be continued until final resolution of the problem is achieved.

- If necessary, obtain a new QC strain (either from stock cultures or a reliable source) and new lots of materials (including new turbidity standards), possibly from different manufacturers. If the problem appears to be related to a manufacturer, contact and provide the manufacturer with the test results and lot numbers of materials used. It may be helpful to exchange QC strains and materials with another laboratory using the same method in order to determine the root cause of out-of-range QC results where the reason is not identifiable. Until the problem is resolved, it may be necessary to use an alternative test method.

Reporting Patient Results When Out-of-Control Tests Occur

Whenever an out-of-control result occurs or corrective action is necessary, careful assessment of whether to report patient test results should be made on an individual patient basis, taking into account if the source of the error, when known, is likely to have affected relevant patient test results. Considerations may include, but are not limited to:

• Size and direction of error (eg, slightly or significantly increased zone size, slightly or significantly decreased zone size).

• Is the patient result close to the interpretive breakpoint?

• Results with other QC organisms.

• Results with other antimicrobial agents.

• Is the QC strain/antimicrobial agent an indicator for a procedural or storage issue (eg, inoculum dependent, heat labile)?

4.10 Confirmation of Results When Testing Patient Isolates

Multiple test parameters are monitored by following the QC recommendations described in this standard. However, acceptable results derived from testing QC strains do not guarantee accurate results when testing patient isolates. It is important to review all of the results obtained from all drugs tested on a patient's isolate before reporting the results. This should include ensuring that:

- The antimicrobial susceptibility results are consistent with the identification of the isolate.

- The results from individual antimicrobial agents within a specific drug class follow the established hierarchy of activity rules (eg, third-generation cephalosporins are more active than first- or second-generation cephalosporins against *Enterobacteriaceae*).

- The isolate is susceptible to those antimicrobial agents for which resistance has not been documented (eg, vancomycin and *Streptococcus* spp.) and for which only "susceptible" interpretive criteria exist in M100.[1]

Unusual or inconsistent results should be confirmed by checking for:

- Previous results on the patient (eg, did the patient previously have the same isolate with an unusual antibiogram?)

- Previous QC performance (eg, is there a similar trend or observation with recent QC testing?)

- Problems with the testing supplies, process, or equipment (see Subchapter 4.8.1 and M100[1] Table 4D, Troubleshooting Guide)

Table 4C. Disk Diffusion: Reference Guide to QC Frequency

This table summarizes the suggested QC frequency when modifications are made to antimicrobial susceptibility test systems (refer to CLSI document EP23™[1]). It applies only to antimicrobial agents for which satisfactory results have been obtained with either the 15-replicate (3- × 5-day) plan or 20 or 30 consecutive test day plan. Otherwise QC is required each test day.

	Required QC Frequency			
Test Modification	**1 Day**	**5 Days**	**15-Replicate Plan or 20- or 30-Day Plan**	**Comments**
Disks				
Use new shipment or lot number.	X			
Use new manufacturer.	X			
Addition of new antimicrobial agent to existing system.			X	In addition, perform in-house verification studies.
Media (prepared agar plates)				
Use new shipment or lot number.	X			
Use new manufacturer.		X		
Inoculum preparation				
Convert inoculum preparation/ standardization to use of a device that has its own QC protocol.		X		**Example:** Convert from visual adjustment of turbidity to use of a photometric device for which a QC procedure is provided.
Convert inoculum preparation/ standardization to a method that depends on user technique.			X	**Example:** Convert from visual adjustment of turbidity to another method that is not based on a photometric device.
Measuring zones				
Change method of measuring zones.			X	**Example:** Convert from manual zone measurements to automated zone reader. In addition, perform in-house verification studies.
Instrument/software (eg, automated zone reader)				
Software update that affects AST results		X		Monitor all drugs, not just those implicated in software modification
Repair of instrument that affects AST results	X			Depending on extent of repair (eg, critical component such as the photographic device), additional testing may be appropriate (eg, 5 days).

Abbreviations: AST, antimicrobial susceptibility testing; QC, quality control.

Selection of Safe Antibiotic for Pregnancy

Group B : No Risk in Controlled animal studies

All Cephalosporines
All Erythromycines except Erythromycin Estolate
Azithromycin but not Claritromycin
All Penicilines
Clindamycin
Nitrofurantoin before 36 weeks
Trimetoprime sulfamethoxazole (two trimester only)

Group C : Small Risk in controlled animal Studies

Imipenem
All Fluoroquinolones (cartilage damage risk)
Claritromycin
Trimetoprime (may be use a part of SXT in second trimester)
Vancomycine
Chloramphenicol
Gentamycine

Group D : Strong evidence of Risk to Human Fetus

Amikacin
Kanamycin
Streptomycin
Tobramycin
Trimetoprime sulfamethoxazole (Third trimester)
All Tetracyclines
Nitrofurantoin (Third trimester) : hemolytic aenemia , related to immature liver and G6PD deficiency

Antibiotic Selection for Children

Penicilines (AMX , PG)

Beta Lactamase inhibitor (AMX- Clavulonic , Augmentin)

Cephalosporines

Azitromycin , Erythromycin

Trimethoprim sulfamethoxazole

Cephalexine

References

EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

Reading guide

EUCAST disk diffusion method for antimicrobial susceptibility testing

Version 10.0
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EUCAST EUROPEAN COMMITTEE ON ANTIMICROBIAL SUSCEPTIBILITY TESTING
European Society of Clinical Microbiology and Infectious Diseases

Antimicrobial susceptibility testing

EUCAST disk diffusion method

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Thank You For Your Attention