

Table 10. MIC and zone diameter breakpoints for staphylococci

Comments 1-3 relate to urinary tract infections (UTI) only.

¹ These recommendations are for organisms associated with uncomplicated urinary tract infections only. For complicated infections and infections caused by *Staphylococcus aureus* and *Staphylococcus epidermidis*, which are associated with more serious infections, systemic recommendations should be used.

² If an organism is isolated from multiple sites, for example from blood and urine, interpretation of susceptibility should be made with regard to the systemic site (e.g., if the blood isolate is resistant and the urine isolate susceptible, both should be reported resistant irrespective of the results obtained using interpretative criteria for urine isolates).

³ Direct susceptibility tests on urine samples may be interpreted only if the inoculum gives semi-confluent growth.

Table 10. MIC and zone diameter breakpoints for staphylococci

Antibiotic	MIC breakpoint (mg/L)			Disc content (µg)	Interpretation of zone diameters (mm)			Comment
	R >	I	S ≤		R ≤	I	S ≥	
Aminoglycosides								
Amikacin for <i>Staphylococcus aureus</i>	16	16	8	30	15	16-18	19	
Amikacin for coagulase-negative staphylococci	16	16	8	30	21	22-24	25	
Gentamicin	1	-	1	10	19	-	20	
Tobramycin for <i>Staphylococcus aureus</i>	1	-	1	10	20	-	21	
Tobramycin for coagulase-negative staphylococci	1	-	1	10	29	-	30	
Neomycin	-	-	-	10	16	-	17	For topical use only. The zone diameter breakpoint distinguishes the "wild type" susceptible population from isolates with reduced susceptibility.

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	MIC breakpoint (mg/L)				Interpretation of zone diameters (mm)			
β-Lactams								
Ampicillin UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	32	-	32	25	25	-	26	<p>Staphylococci exhibiting resistance to methicillin/oxacillin/cefotaxime should be regarded as resistant to other penicillins, cephalosporins, carbapenems and combinations of β-lactam and β-lactamase inhibitors.</p> <p>For methicillin and oxacillin tests on Mueller–Hinton or Columbia agars with 2% NaCl: Some hyper-producers of β-lactamase give zones within the range of 7-14 mm and if possible, should be checked by a PCR method for <i>mecA</i> or a latex agglutination test for PBP2a. Increase in methicillin/oxacillin zone size in the presence of clavulanic acid is not a reliable test for hyper-producers of β-lactamase as zones of inhibition with some MRSA also increase in the presence of clavulanic acid. Rarely, hyper-producers of β-lactamase give no zone in this test and would therefore not be distinguished from MRSA.</p> <p>With penicillin check for a heaped zone edge which equals resistant.</p>
Cefotaxime <i>Staphylococcus aureus</i>	4	-	4	10	21	-	22	
Cefotaxime coagulase-negative staphylococci	4	-	4	10	21	-	27	
Co-amoxiclav	1	-	1	2/1	17	-	18	
Co-amoxiclav UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	32	-	32	20/10	27	-	28	
Mecillinam UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	64	-	64	50	9	-	10	
Methicillin	4	-	4	5	14	-	15	
Oxacillin	2	-	2	1	14	-	15	
Penicillin	0.12	-	0.12	1 unit	24	-	25	
Quinolones								
Ciprofloxacin	1	-	1	1	13	-	14	MIC breakpoints relate to high-dose therapy (750 mg BD).
Ciprofloxacin UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	4	-	4	1	17	-	18	
Gatifloxacin	1	-	1	2	19	-	20	
Gemifloxacin	0.25	-	0.25	1	19	-	20	
Moxifloxacin	1	1	0.5	1	15	16-19	20	
Ofloxacin	1	-	1	5	27	-	28	

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Miscellaneous antibiotics								
Daptomycin	1	-	1	-	-	-	-	<p>Strains with MIC values above the susceptible breakpoint are very rare or not yet reported. The identification and antimicrobial susceptibility tests on any such isolate must be repeated and if the result is confirmed the isolate sent to a reference laboratory. Until there is evidence regarding the clinical response for confirmed isolates with MIC above the current resistant breakpoint they should be reported resistant. Susceptibility testing by disc diffusion is not recommended.</p> <p>Susceptibility should be determined using a broth dilution method with Mueller Hinton broth Or by a gradient method on Mueller Hinton agar.</p>
Teicoplanin <i>Staphylococcus aureus</i>	2	-	2	30	17	-	18	<p>Teicoplanin disc diffusion testing is not recommended for coagulase-negative staphylococci. An MIC method should be used to determine susceptibility.</p> <p>The R zone diameter BP will detect <i>vanA</i> mediated resistance, but glycopeptide intermediate <i>Staphylococcus aureus</i> (GISA) cannot be detected by this method or any other disc diffusion method. A gradient method for an MIC determination should be undertaken, but positive results require confirmation. Population analysis is the most reliable method for confirming resistance and for distinguishing susceptible, hetero-GISA and GISA isolates. If, on clinical grounds, resistance to vancomycin is suspected, it is recommended that the organism be sent to a specialist laboratory, such as Southmead Hospital in Bristol or the Antibiotic Research Laboratory in Cardiff.</p>
Teicoplanin Coagulase negative staphylococci	4	-	4	30	15	-	16	
Vancomycin	2	-	2	5	14	-	15	
Azithromycin	2	2	1	15	19	-	20	The zone diameter breakpoint relates to an MIC of 1 mg/l as no data for the intermediate category are currently available.

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Clarithromycin	2	2	1	2	14	15-17	18	
Clindamycin	0.5	0.5	0.25	2	22	23-25	26	Organisms that appear resistant to erythromycin, but susceptible to clindamycin should be checked for the presence of inducible resistance (see www.bsac.org.uk/Susceptibility Testing/BSAC Standardized Disc Susceptibility Method/Additional Methods). Inducible clindamycin resistance can be detected only in the presence of a macrolide antibiotic. Clindamycin should be used with caution (if at all) for organisms with inducible MLS _B resistance.
Erythromycin	2	2	1	5	16	17-19	20	
Quinupristin/dalfopristin	2	2	1	15	18	19-21	22	The presence of blood has a marked effect on the activity of quinupristin/dalfopristin. On the rare occasions when blood needs to be added to enhance the growth of staphylococci, susceptible = ≥15 mm, resistant ≤14 mm.
Chloramphenicol	8	-	8	10	14	-	15	
Co-trimoxazole	4	4	2	1.25/23.75	13	14-16	17	For advice on testing susceptibility to co-trimoxazole see Appendix 1. The MIC breakpoint is based on the trimethoprim concentration in a 1:19 combination with Sulfamethoxazole.
Trimethoprim UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	4	4	2	2.5	12	13-14	15	
Doxycycline	2	2	1	30	30	-	31	The zone diameter breakpoint relates to an MIC of 1 mg/l as no data for the intermediate category are currently available.
Minocycline	1	1	0.5	30	27	-	28	The zone diameter breakpoint relates to an MIC of 0.5 mg/l as no data for the intermediate category are currently available.
Tetracycline	2	2	1	10	19	-	20	The zone diameter breakpoint relates to an MIC of 1 mg/l as no data for the intermediate category are currently available.
Tigecycline	0.5	-	0.5	15	25	-	26	

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Fosfomycin	32	-	32	200/50	33	-	34	Disc content indicates 200 µg fosfomycin/50 µg glucose-6-phosphate
Fusidic acid	1	-	1	10	29	-	30	
Linezolid	4	-	4	10	19	-	20	Information on clinical response in patients with serious staphylococcal infections is not yet available. In such patients an MIC determination might be appropriate.
Mupirocin	4	-	4	5	21	-	22	An Etest or other MIC method should be performed on any strain designated mupirocin resistant when tested with a 5 µg disc. The MIC will indicate whether the strain has low-level (MIC 8 – 256 mg/L) or high-level (MIC ≥512 mg/L) resistance. In nasal decolonization, isolates with low-level resistance to mupirocin (MICs 8-256 mg/L) may be initially cleared but early recolonization is common
Mupirocin	256	8-256	4	20	6	7-26	27	
Nitrofurantoin UTI ¹⁻³ <i>Staphylococcus saprophyticus</i>	64	-	64	200	19	-	20	A review of the data indicates that no adjustment of the zone diameter breakpoints is necessary with the change in MIC breakpoint.
Rifampicin	0.5	012-0.5	0.06	2	23	24-29	30	