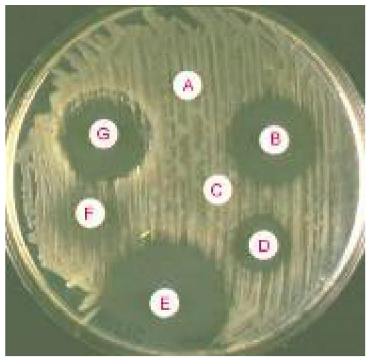
Quality Control of Antimicrobial Susceptibility Tests

Antimicrobial Susceptibility Tests



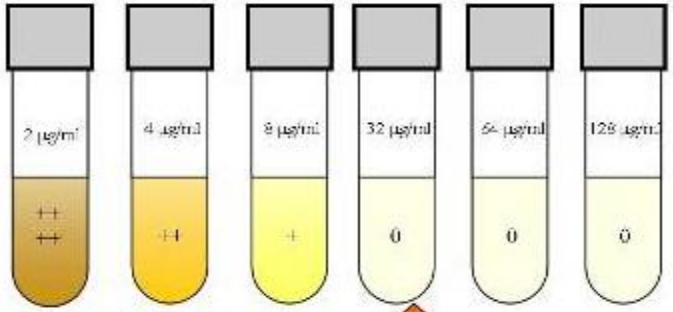


provide information for selection of an appropriate agent for antimicrobial therapy

AST Methods Interpretation

- **agar disk diffusion method** provides qualitative interpretive category results of susceptible, intermediate, and resistant
- **microdilution and agar gradient diffusion methods** provide a quantitative result, a minimum inhibitory concentration

AST Methods



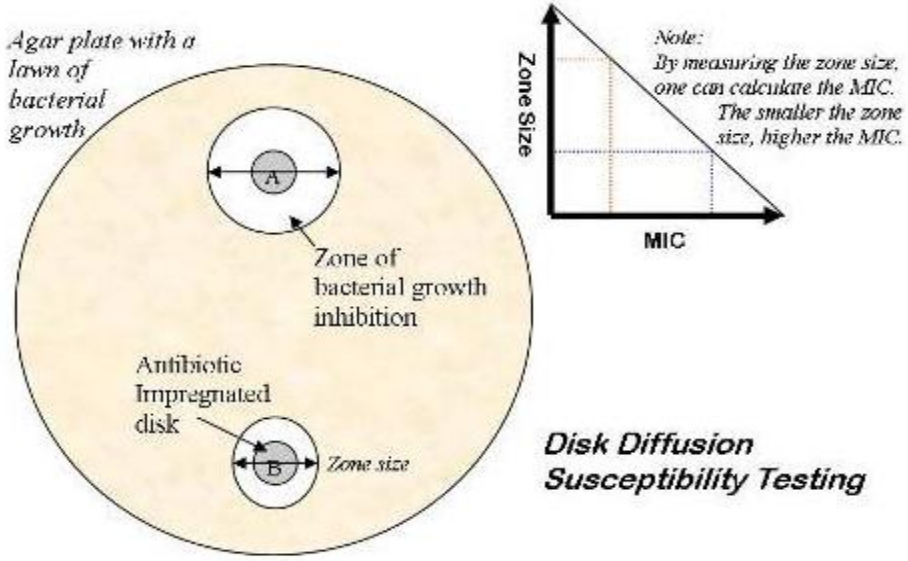
Tubes with broth media, bacteria, and increasing amounts of antimicrobial

Minimum **I**nhibitory **C**oncentration

Broth Dilution Susceptibility Testing

Susceptibility Testing determines if bacteria is likely to be inhibited by an antimicrobial.

Susceptibility is based on the concentration required to reduce growth below the visible level (see MIC).



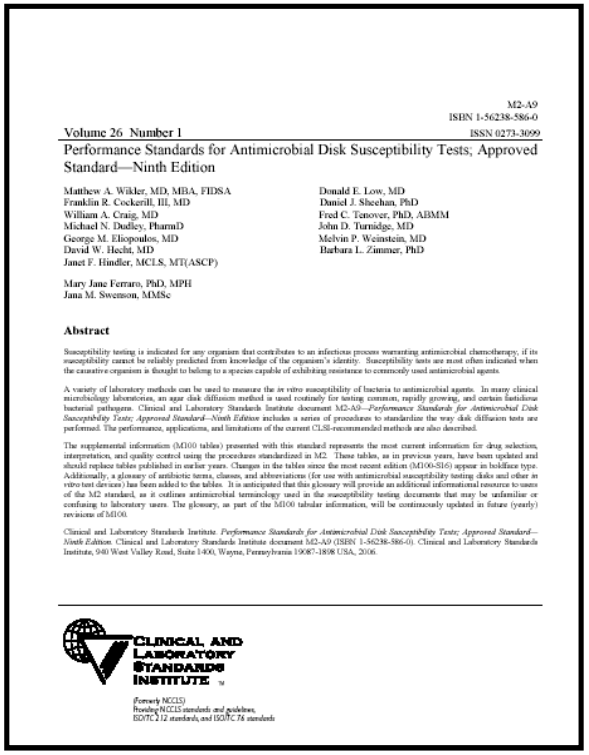
Disk Diffusion Susceptibility Testing

Sensitive
A bacteria is said to be sensitive to an antimicrobial if growth is inhibited by concentration that is **EASILY** and **SAFELY** achieved in the patient's **BLOODSTREAM.**
A positive clinical response by the patient is anticipated.

Resistant
The opposite of Sensitive.

References

- Clinical and Laboratory Standards Institute
- French Society of Microbiology
- British Society for Antimicrobial Chemotherapy



M2-A9
ISBN 1-56238-586-0
Volume 26 Number 1 ISSN 0273-3099

Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard—Ninth Edition

Matthew A. Wikler, MD, MBA, FIDSA
Franklin R. Cockerill, III, MD
William A. Craig, MD
Michael N. Dudley, PharmD
George M. Eliopoulos, MD
David W. Hecht, MD
Janet F. Hindler, MCLS, MT(ASCP)
Donald E. Low, MD
Daniel J. Sheehan, PhD
Fred C. Tenover, PhD, ABMM
John D. Turnidge, MD
Melvin P. Weinstein, MD
Barbara L. Zimmer, PhD
Mary Jane Ferraro, PhD, MPH
Jana M. Swenson, MMSc

Abstract

Susceptibility testing is indicated for any organism that contributes to an infectious process warranting antimicrobial chemotherapy, if its susceptibility cannot be reliably predicted from knowledge of the organism's identity. Susceptibility tests are most often indicated when the causative organism is thought to belong to a species capable of exhibiting resistance to commonly used antimicrobial agents.

A variety of laboratory methods can be used to measure the *in vitro* susceptibility of bacteria to antimicrobial agents. In many clinical microbiology laboratories, an agar disk diffusion method is used routinely for testing common, rapidly growing, and certain fastidious bacterial pathogens. Clinical and Laboratory Standards Institute document M2-A9—*Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard—Ninth Edition* includes a series of procedures to standardize the way disk diffusion tests are performed. The performance, applications, and limitations of the current CLSI-recommended methods are also described.

The supplemental information (M100 tables) presented with this standard represents the most current information for drug selection, interpretation, and quality control using the procedures standardized in M2. These tables, as in previous years, have been updated and should replace tables published in earlier years. Changes in the tables since the most recent edition (M100-S16) appear in boldface type. Additionally, a glossary of antibiotic terms, classes, and abbreviations (for use with antimicrobial susceptibility testing disks and other *in vitro* test devices) has been added to the tables. It is anticipated that this glossary will provide an additional informational resource to users of the M2 standard, as it outlines antimicrobial terminology used in the susceptibility testing documents that may be unfamiliar or confusing to laboratory users. The glossary, as part of the M100 tabular information, will be continuously updated in future (yearly) revisions of M100.

Clinical and Laboratory Standards Institute. *Performance Standards for Antimicrobial Disk Susceptibility Tests; Approved Standard—Ninth Edition.* Clinical and Laboratory Standards Institute document M2-A9 (ISBN 1-56238-586-0). Clinical and Laboratory Standards Institute, 940 West Valley Road, Suite 1400, Wayne, Pennsylvania 19087-1898 USA, 2006.

CLINICAL AND LABORATORY STANDARDS INSTITUTE

(Formerly NCCLS)
Providing NCCLS standards and guidelines, ISO/TC 212 standards, and ISO/TC 76 standards

Société Française de Microbiologie

COMITE DE L'ANTIBIOGRAMME DE LA SOCIETE FRANCAISE DE MICROBIOLOGIE

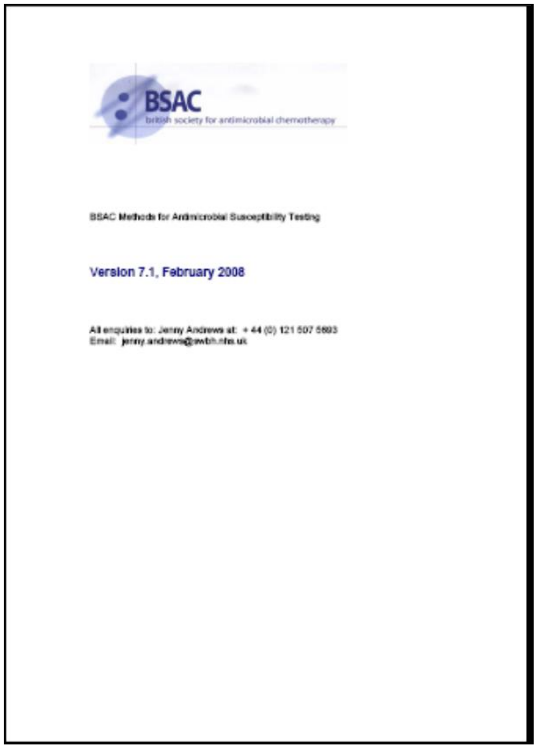
Recommandations 2007

(Edition de Janvier 2007)

Coordonnateur : Pr C.J. SOUSSY
Centre Hospitalier Universitaire Henri Mondor
94010 Créteil Cedex
Tel. : (33) (0)1 49 81 28 31 - Fax.: (33) (0)1 49 81 28 39
E-mail : claude-james.soussy@hmn.aphp.fr

Membres (en 2006) : J.D. CAVALLO, H. CHARDON, C. CHIDIAC, P. CHOUTET, P. COURVALIN, H. DABERNAT, H. DRUGEON, L. DUBREUIL, F. GOLDSTEIN, B. GUERY, V. JARLIER, T. LAMBERT, R. LECLERCQ, M.H. NICOLAS-CHANOINE, C. QUENTIN, B. ROUVEIX, C.J. SOUSSY, E. VARON.

Ce document peut être téléchargé depuis le site internet de la Société Française de Microbiologie : http://www.sfm.asso.fr/



BSAC
british society for antimicrobial chemotherapy

BSAC Methods for Antimicrobial Susceptibility Testing

Version 7.1, February 2008

All enquiries to: Jenny Andrews at: + 44 (0) 121 507 5693
Email: jenny.andrews@uhb.nhs.uk

Example from an excerpt from Reference: Selection of Drug to Test

Table 1. Suggested Groupings of U.S. FDA-Approved Antimicrobial Agents That Should Be Considered for Routine Testing and Reporting on Nonfastidious Organisms by Clinical Microbiology Laboratories

	Enterobacteriaceae[g]	*Pseudomonas aeruginosa* and *Acinetobacter* spp.[j]	*Staphylococcus* spp.	*Enterococcus* spp.[m]
GROUP A PRIMARY TEST AND REPORT	Ampicillin[g]	Ceftazidime	Oxacillin[k]	Penicillin[n] or ampicillin
	Cefazolin[a] Cephalothin[a]	Gentamicin	Penicillin[k]	
	Gentamicin	Mezlocillin or ticarcillin Piperacillin		
	Amikacin	Amikacin	Azithromycin[b] or clarithromycin[b] or erythromycin[b]	**Linezolid**
				Quinupristin-dalfopristin[q]
	Amoxicillin-clavulanic acid or ampicillin-sulbactam Piperacillin-tazobactam Ticarcillin-clavulanic acid	Aztreonam Cefoperazone		Vancomycin[o]
	Cefamandole or cefonicid or cefuroxime		Clindamycin[b]	
			Linezolid	
	Cefepime	Cefepime	Trimethoprim-	

Where errors can occur in susceptibility testing

- media
- antimicrobials
- inoculum
- incubation
- equipment
- interpretation

Agar disk diffusion method

■ Medium	Mueller Hinton	4 mm thickness pH 7.2 to 7.4
■ Antibiotic disks	storage temperature	-20°C minimum
■ Inoculum	McFarland 0.5	(10^8 bacteria/mL)
■ Incubator	temperature	35°C
	atmosphere	ambient air

Reference Strains

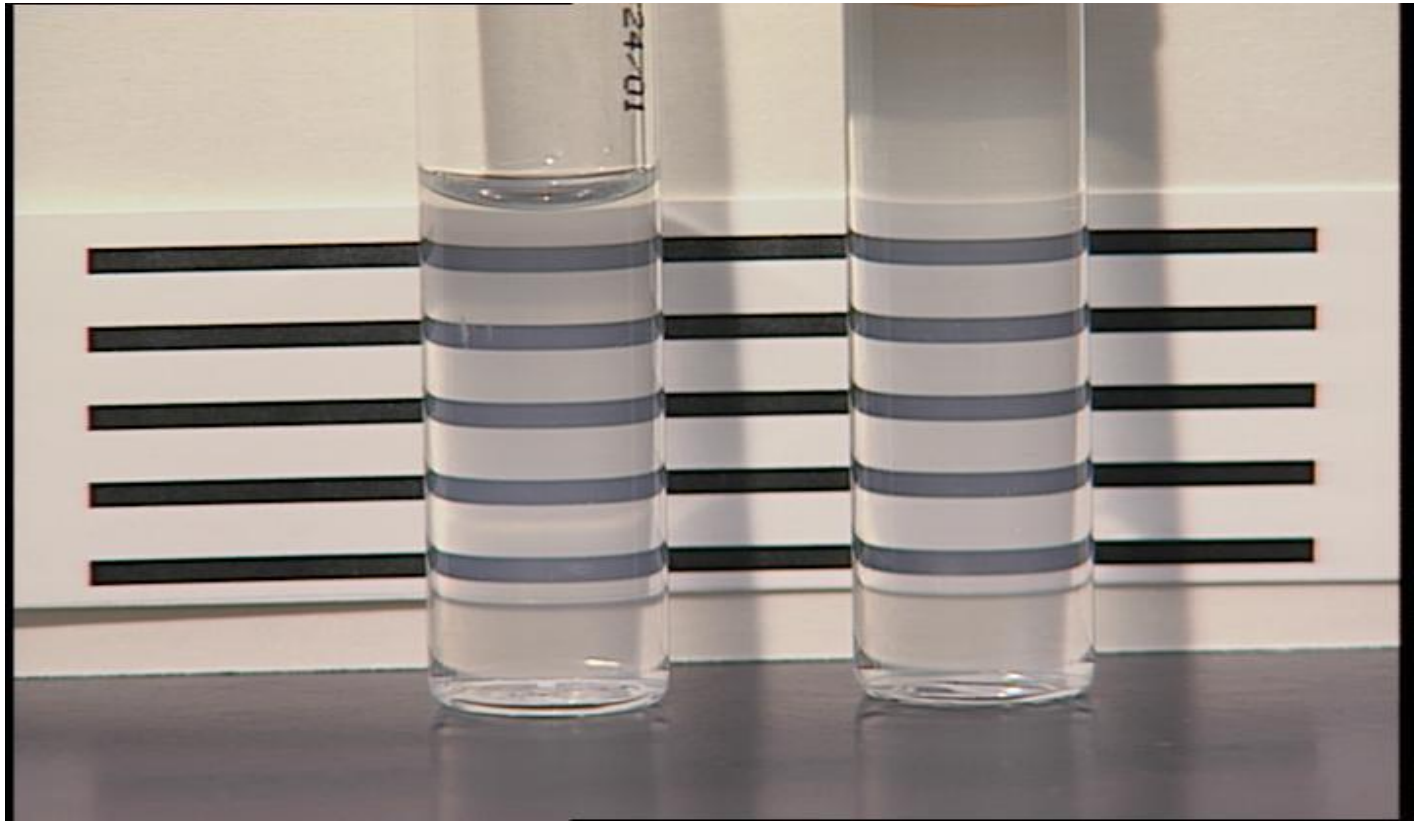
- *E. coli* ATCC 25922
- *S. aureus* ATCC 25923
- *P. aeruginosa* ATCC 27853

QC organisms must be obtained from reputable source

Use specific QC organisms to test different groups of “drug-bug” combinations

Selection of a Colony to Test

MacFarland 0.5 and Adjusted Test Organism

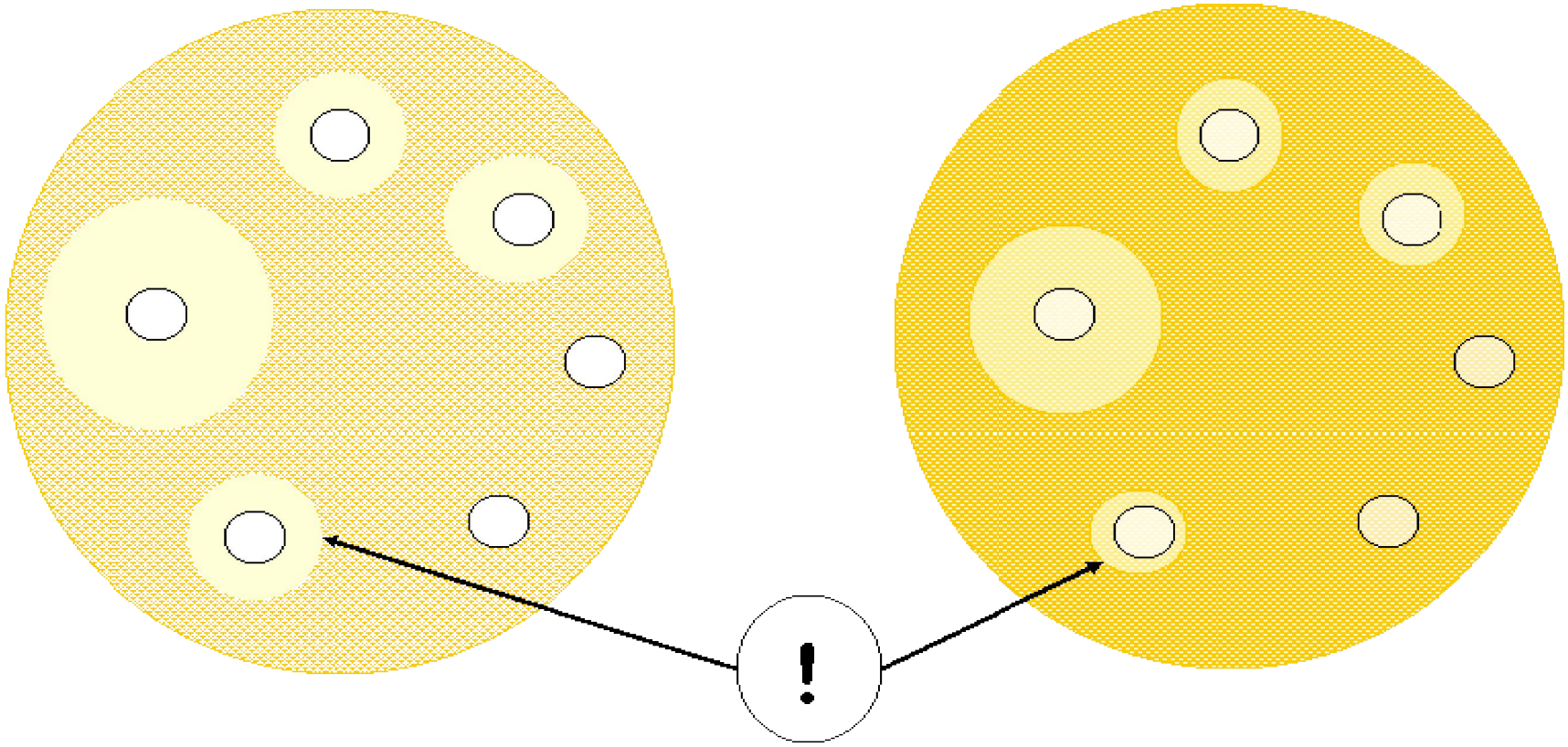


Use of Disk Dispensers

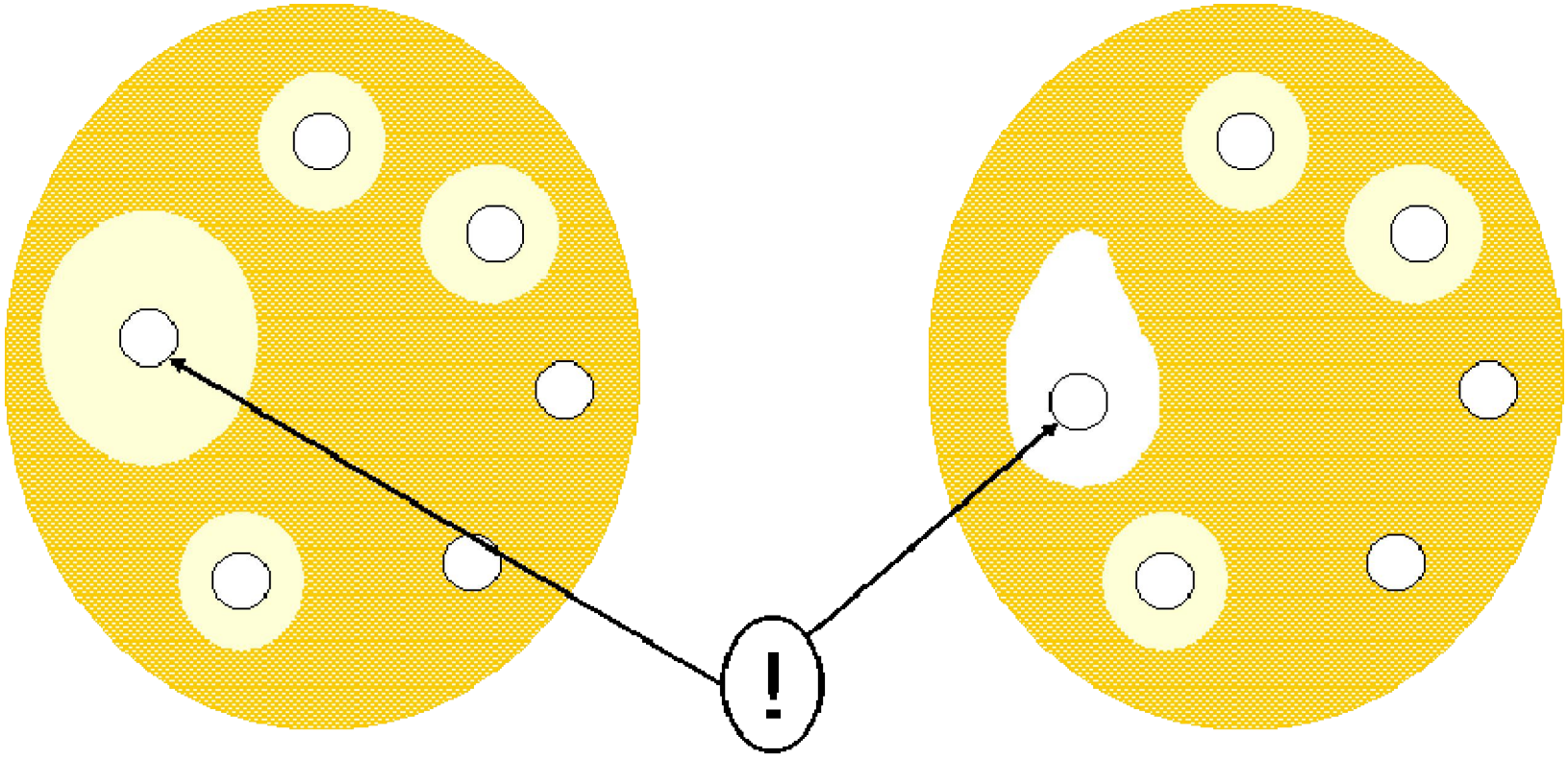
- Advantages
  - practical, rapid
  - increase reproducibility

- Risks:
  - contamination
  - reduces personal judgment skills

Disk Susceptibility Testing Problems



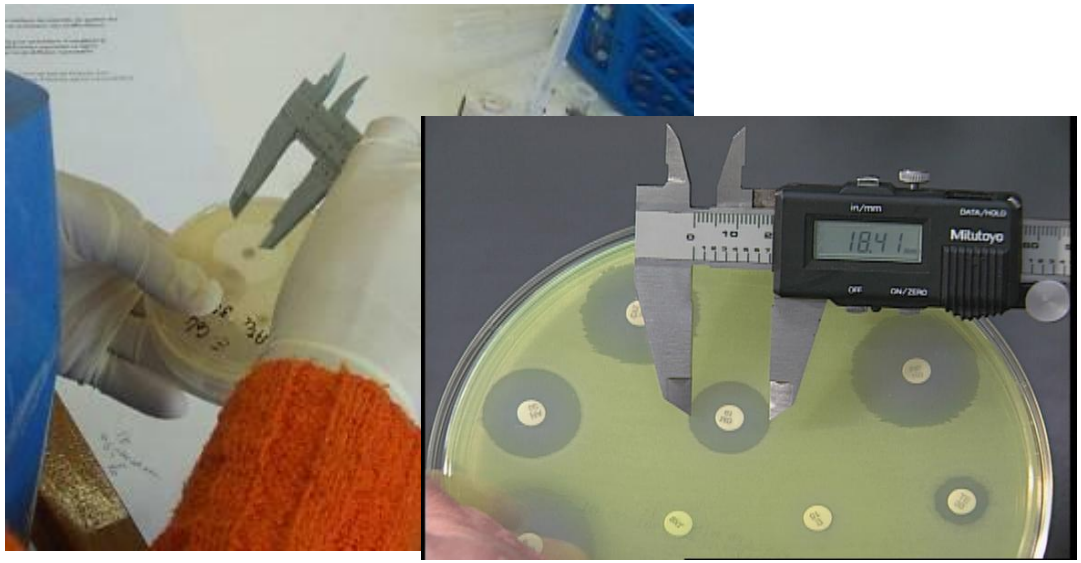
Disk Susceptibility Testing Problems



Disks Properly
Aligned and Spaced

Zone space distorted
because disk not
properly applied

Measuring Conditions

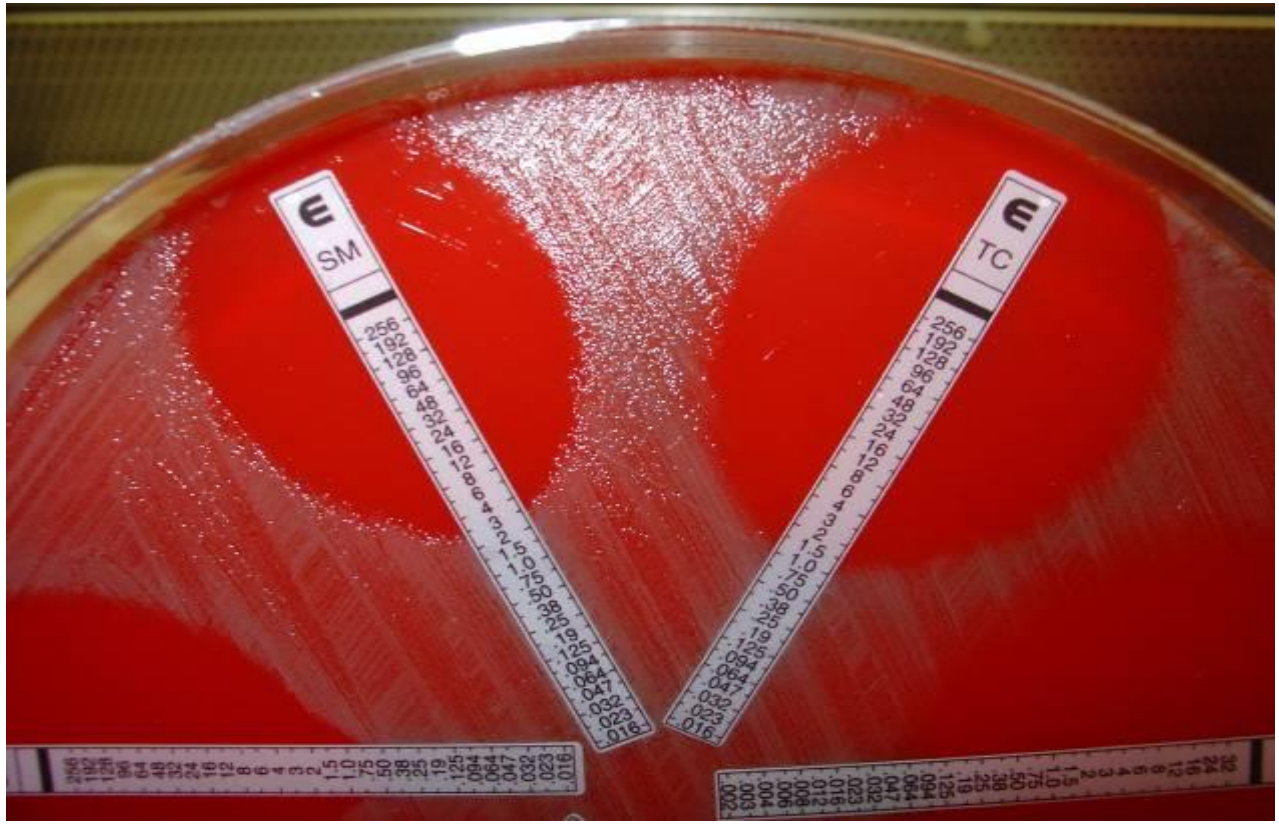


Calipers

Ruler

- read with good light, and from the back of the plate
- zone size reading is drug specific
- magnification may help
- millimeters matter

Etest – antimicrobial gradient method



Patient results may be incorrect if:

- the organism was misidentified
- a clerical error was made
- inappropriate choice of antimicrobials were tested and reported
- the wrong patient's sample was examined
- the wrong test was ordered
- the sample was not preserved properly