Direct disk diffusion test during bacteremia: evaluation of antibiotic susceptibility results

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Abstract

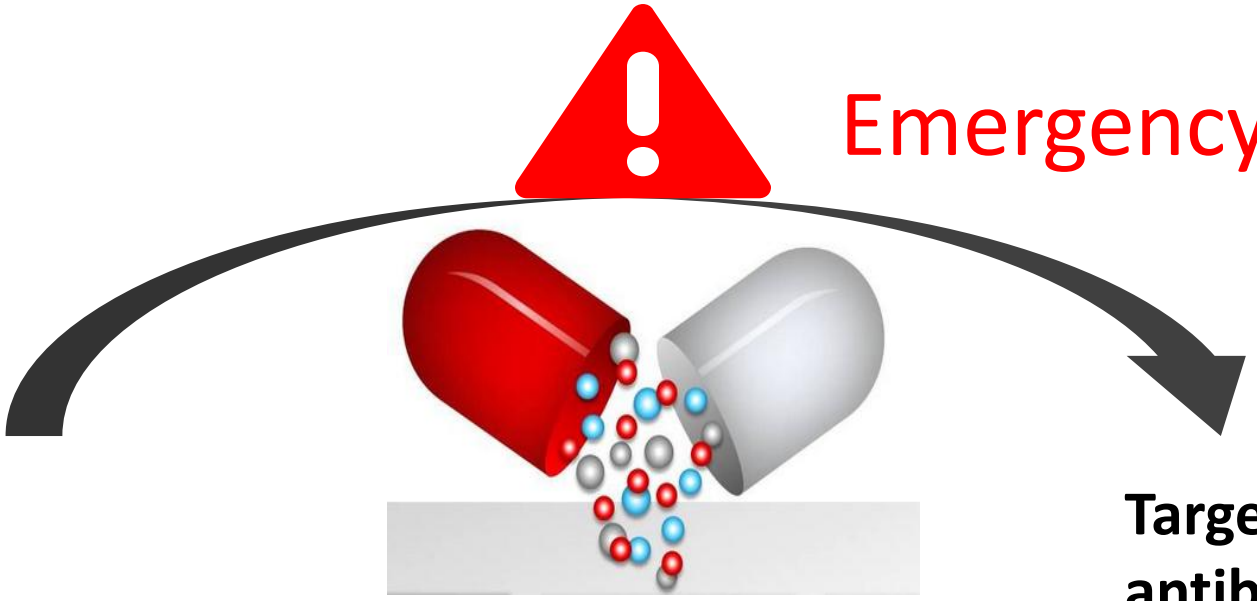
Introduction: Bacteremia are emergencies that are life threatening to patients. Early initiation of adequate antibiotic therapy reduces mortality and morbidity. The purpose of this work was to evaluate the results obtained with the direct AST, carried out directly from positive blood cultures on Mueller-Hinton CHROMagar medium (CHROMagar 4, place du 18 Juin 1940 - 75006 Paris, France) and compare them with those obtained with the standard AST. **Methods:** To do this, 124 strains isolated from 124 bottles were tested against 21 antibiotics. The resulting diameters were read after 8h and 18h of incubation, interpreted using the CLSI breakpoints and compared to those obtained with the standard method. **Results:** It was found that, the results were extremely satisfactory at 18h (94.43% CA, 0.24% ME and 0.00% VME), compared to less conclusive results at 8h (87.32% CA). The best %CA were obtained with gentamicin, sulfamethoxazole+trimethoprim, levofloxacin, ampicillin and cefoxitin at 8h (all >93%) and 18h (all >97%). Also, non-fermenting GNB recorded the best results with 98.74%CA at 18h and Staphylococcus species the lowest ones with 90.70% CA at 18h. **Conclusion:** The encouraging results obtained during the present study suggest a possible future implementation of the direct-from-bloodculture AST as a routine technique. However, the standard AST remains the reference technique.

KEY WORDS: Antibiotic, Bacteremia, Blood culture, Direct AST, Disk diffusion technique

INTRODUCTION

Bacteremia,
A life threatening infection !

Mortality ⇧ 7,6%
per hour



Emergency

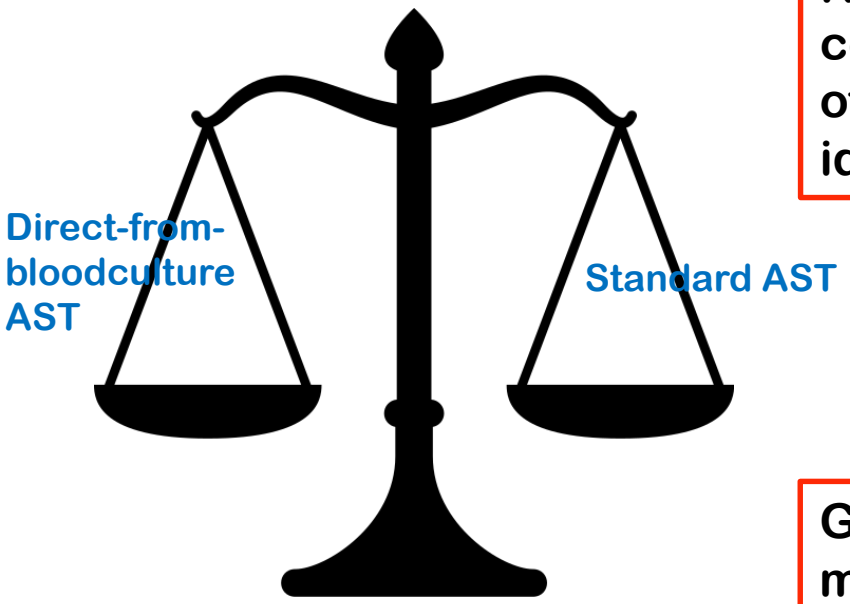
Probabilistic antibiotic therapy

Targeted antibiotic therapy

Goals

Reduce time-limits incompatible with emergency

Rapid communication of presumptive identification



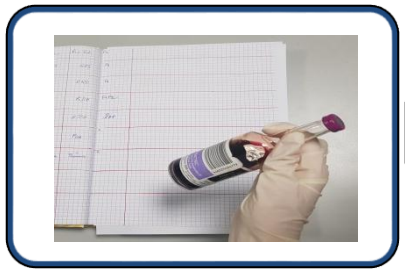
Rapid communication of antibiotic susceptibility results

Gain 24 hours or more with early readings

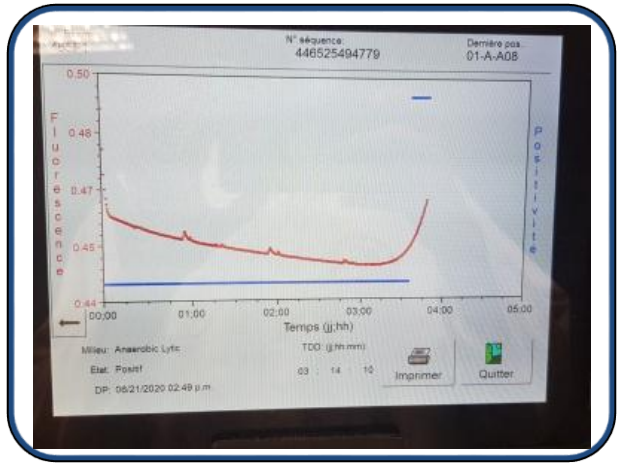
Comparison and evaluation

Faster adjustment of probabilistic antibiotic therapy

Materials and Methods



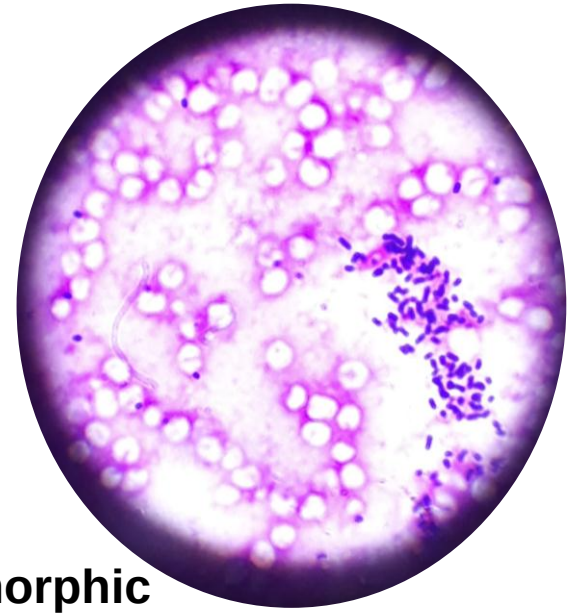
Blood-culture bottles from patients or inoculation technique



Positive signal

Delay < 18h

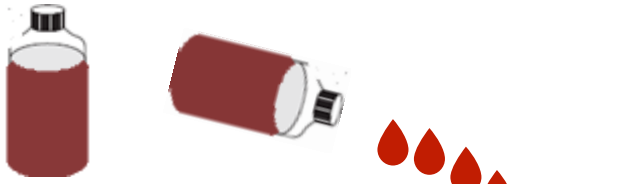
Gram stain



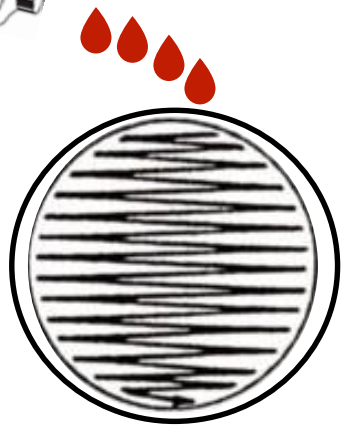
Monomorphic appearence

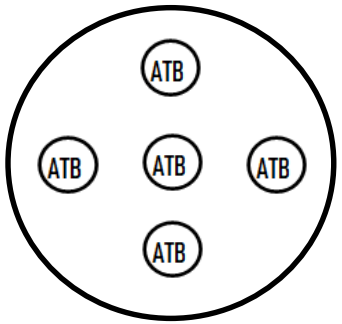
Selected for the study

Materials and Methods



Blood-cultures selected

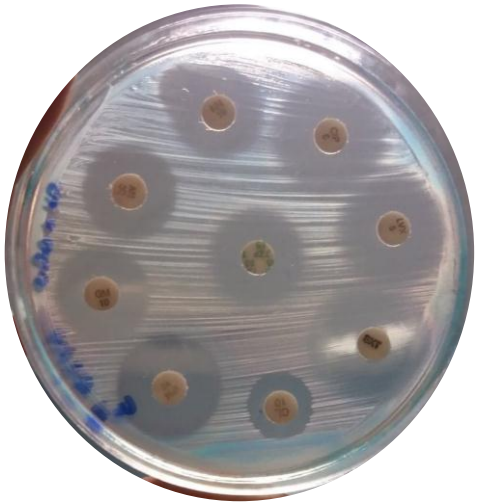




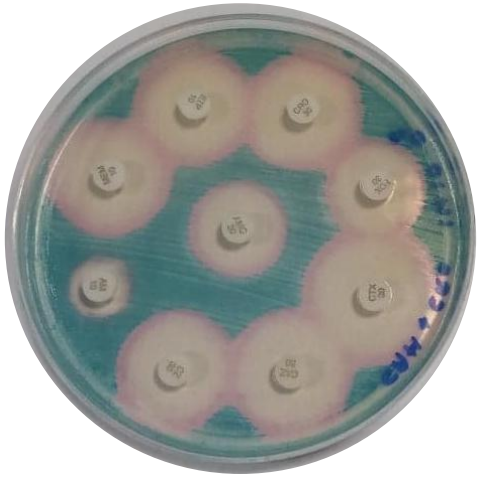
MH CHROMagar Medium

Incubation
At 37°

Early reading at 8h



Reading at 18h

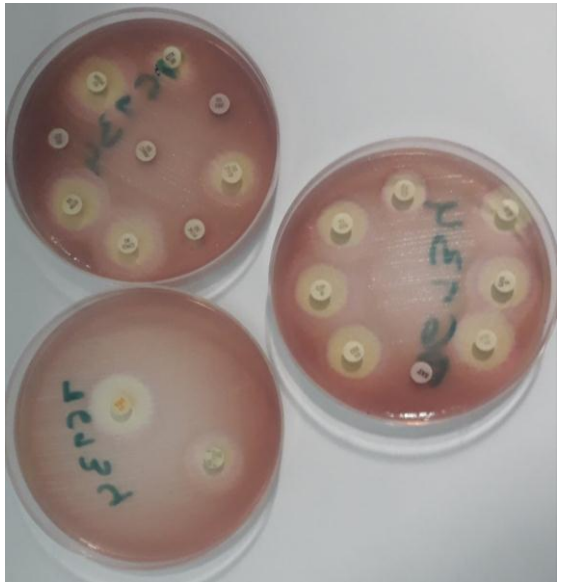


Reading ant interpretation of results at 8h then 18h of incubation

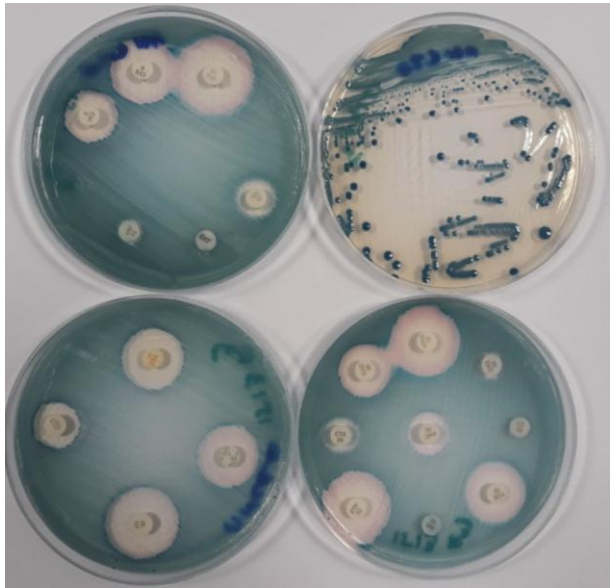
Comparison of the results found, with those obtained with the standard technique

Materials and Methods

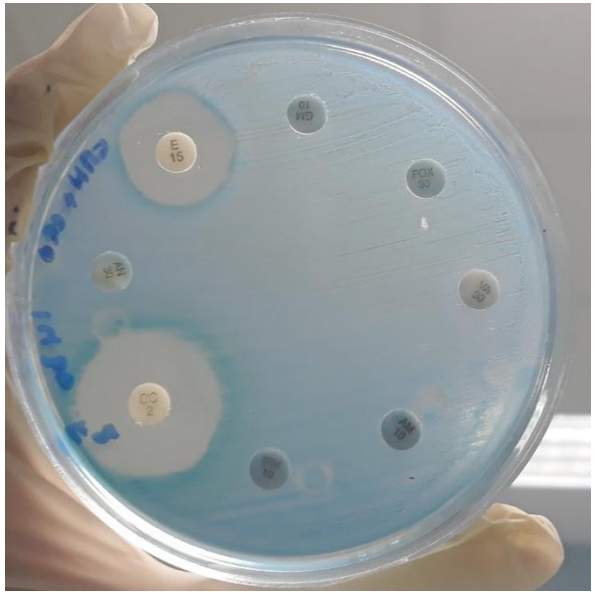
Pseudomonas aeruginosa



Escherichia coli

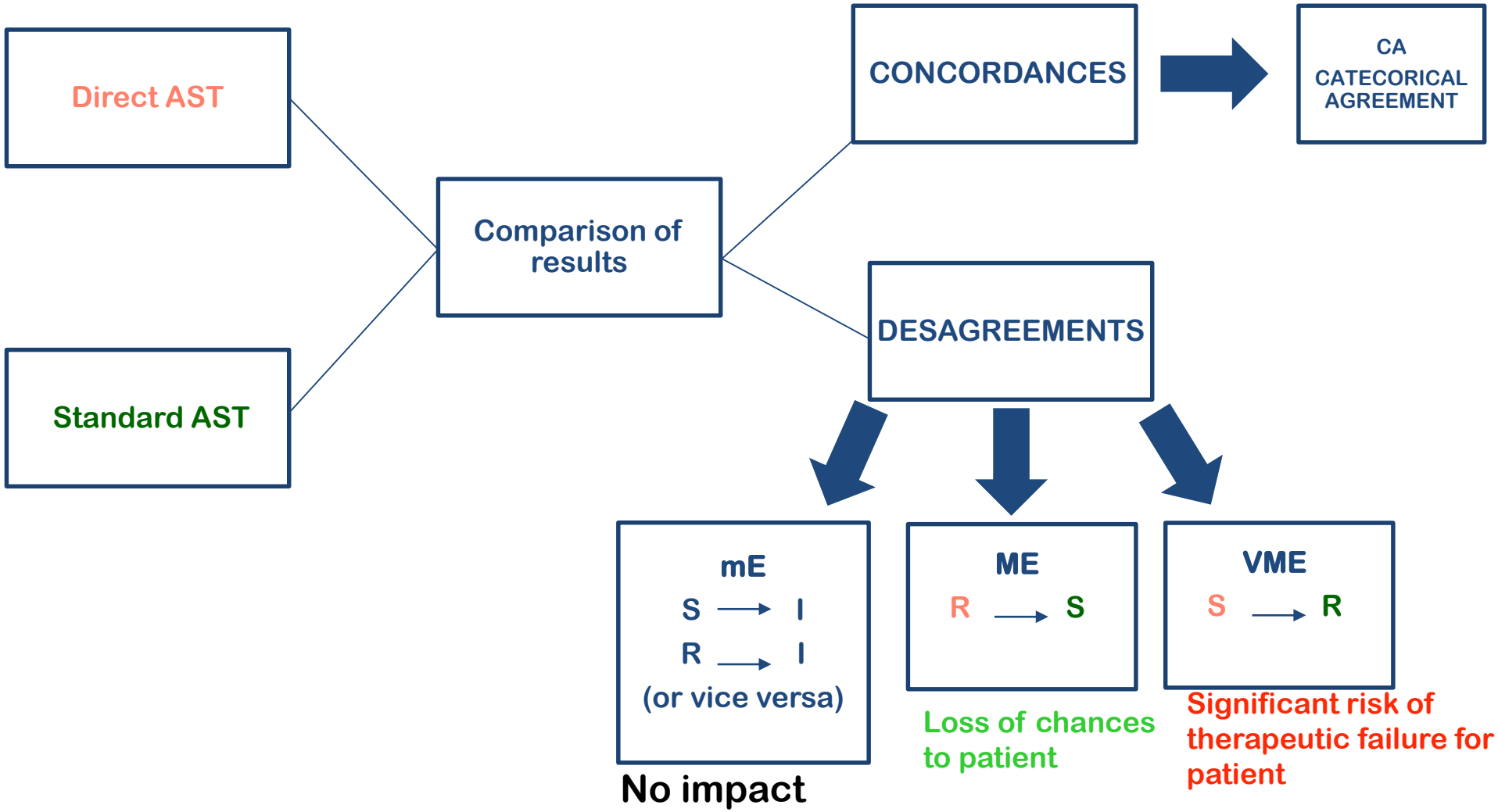


Klebsiella pneumoniae

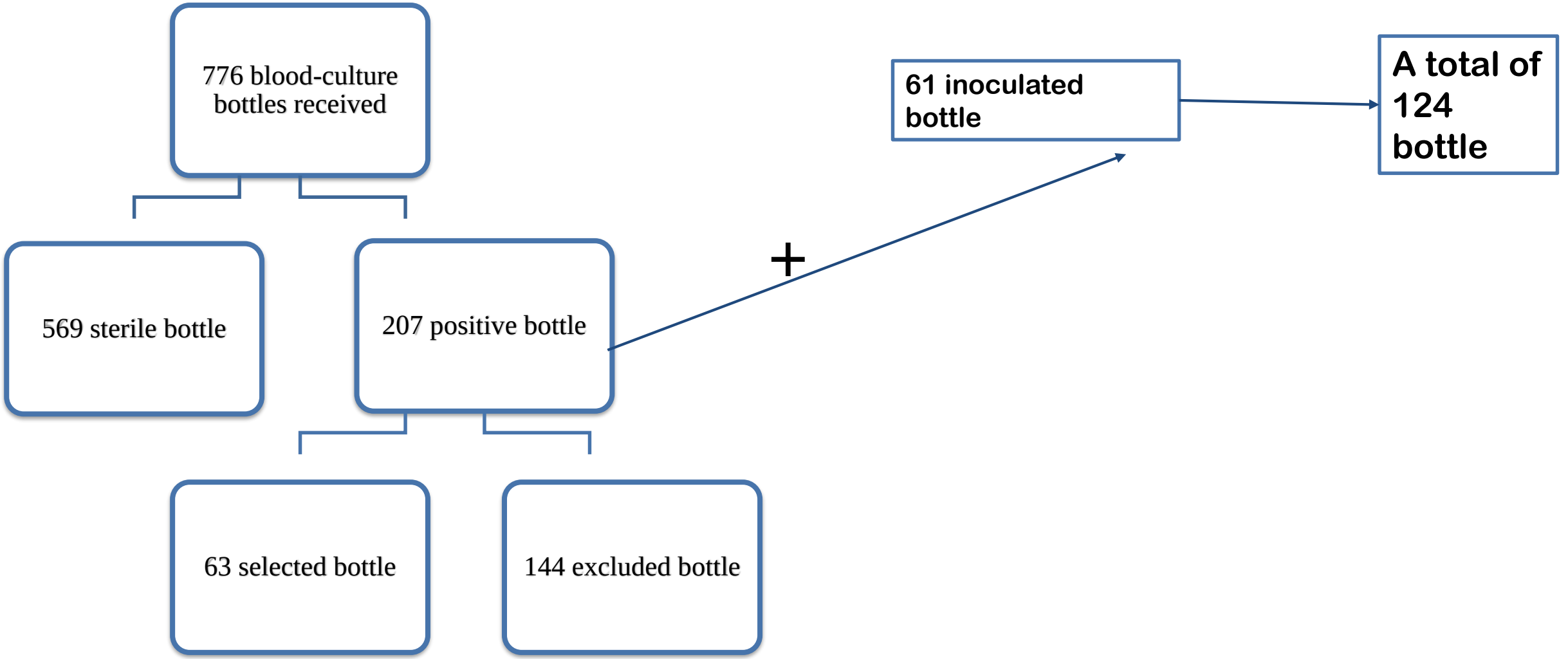


Enterococcus faecium

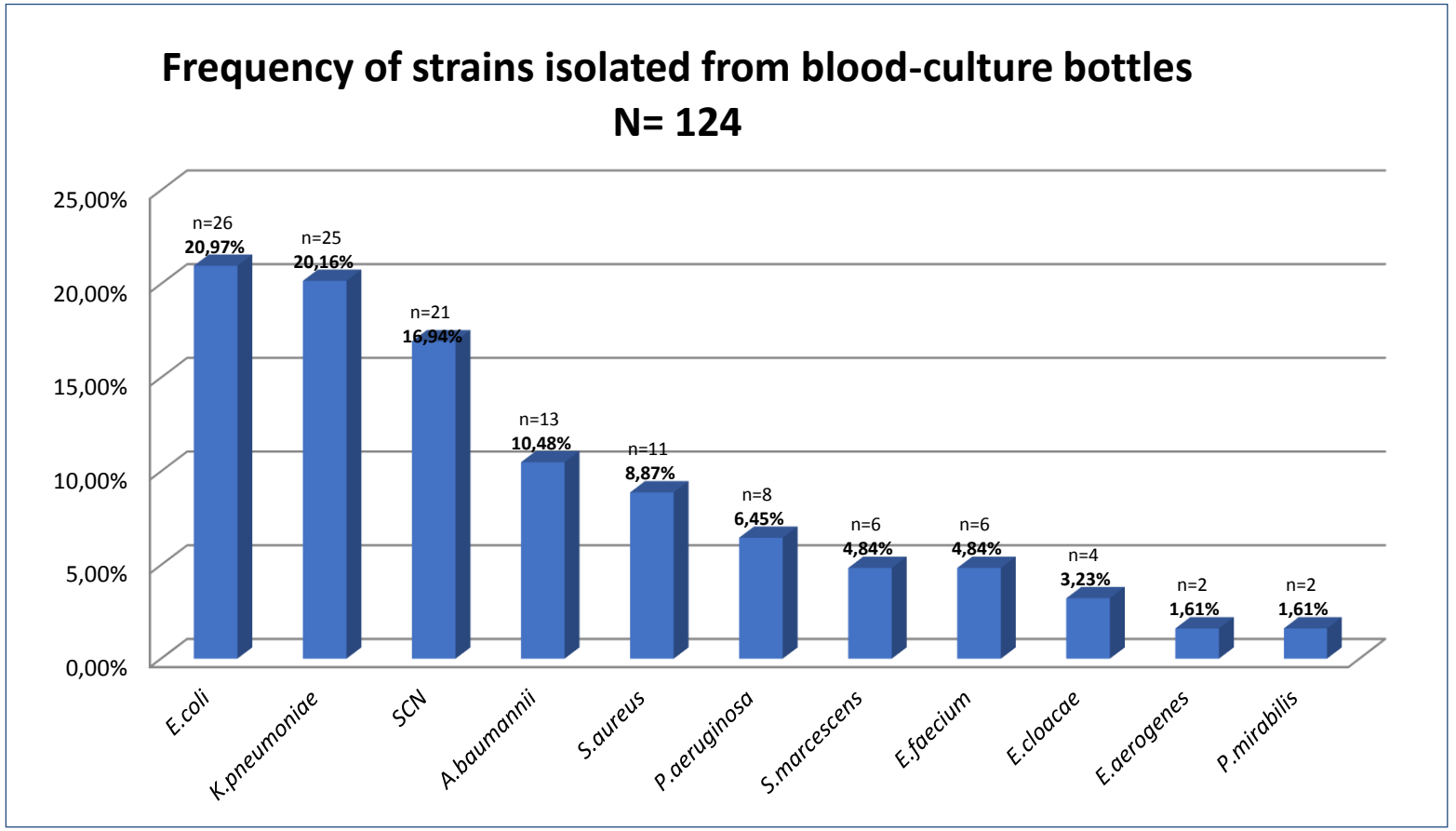
Materials and Methods



Results and Discussions



Bacterial strains isolated



	The stydy of Deepashree Rajshekar 2019
Escherichia coli	18.90%
Pseudomonas spp.	17.30%
Acinetobacter spp.	13.20%
Klebsiella spp.	13%
S.aureus	7.80%

N=965

Overall Results

Reading delay	CA		mE		ME		VME	
	n	%	n	%	n	%	N	%
8h	1116	87,32%	150	11,74%	12	1,66%	0	0,00%
18h	1357	94,43%	78	5,43%	2	0,24%	0	0,00%

%CA >89.9%
%ME ≤ 3%
FDA

at 18h

%CA extremely satifaying

%ME et %VME very satisfaying

at 8h

%CA under acceptability criteria

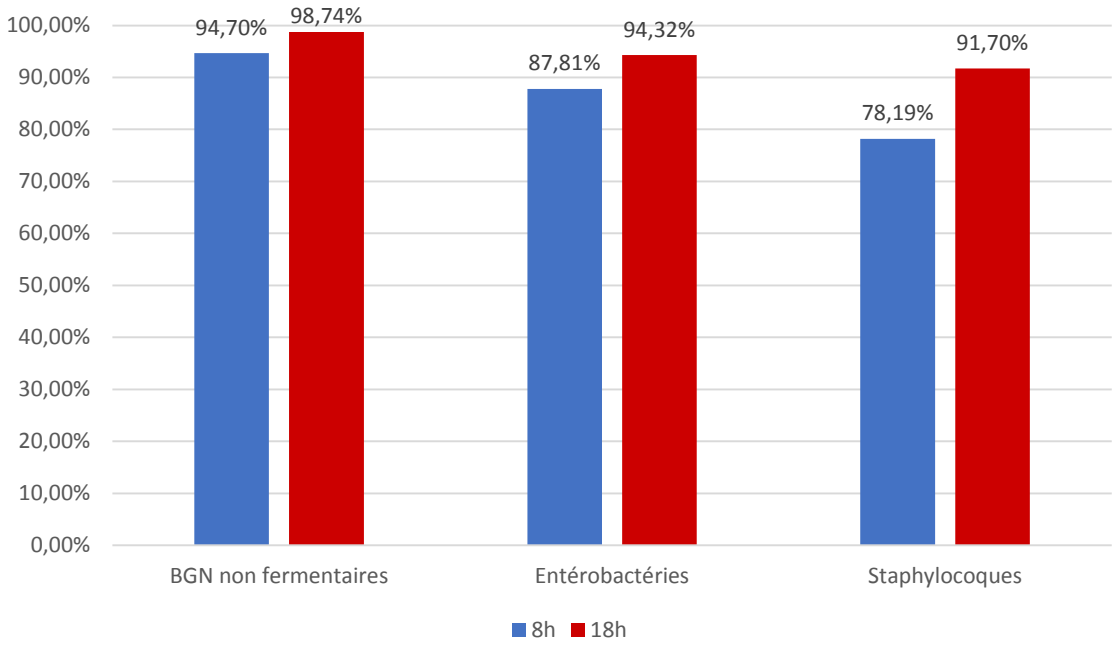
%ME et %VME very satisfaying

Overall Results

	Our study N=124	Other similar studies	
% CA at 18h	94.43%	87.40% Sukantha Chandrasekaran, 2018	CLSI N=60
		96% Deepashree Rajshekar 2019	N=965
		90.40% Avani Desai, 2016	N=776
% CA at 8h	87.32%	69,9% (at 6h) Sukantha Chandrasekaran, 2018	CLSI N=60
%ME et % VME at 18 h	meet FDA criteria	meet FDA criteria	N=965 N=776

Distribution by bacterial type

Highest %CA at 8h and 18h for non fermenting-GNB



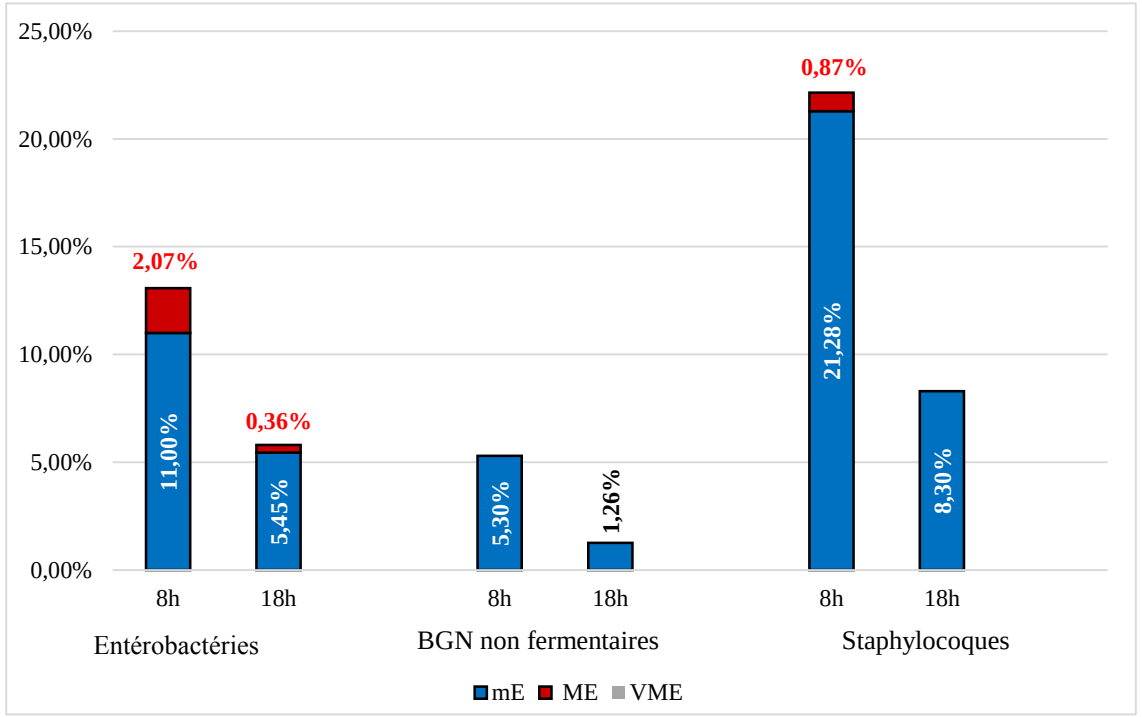
Lowest %CA at 8h and 18h for staphylococci

Non-fermenting GNB | Enterobacteria | Staphylococci

Concordance rates (%CA) by bacterial type at 8h and 18h

Distribution by bacterial type

Highest %ME at 8h and 18h with enterobacteria



Highest %mE at 8h and 18h with staphylococci

Enterobacteria Non-fermenting GNB Staphylococci

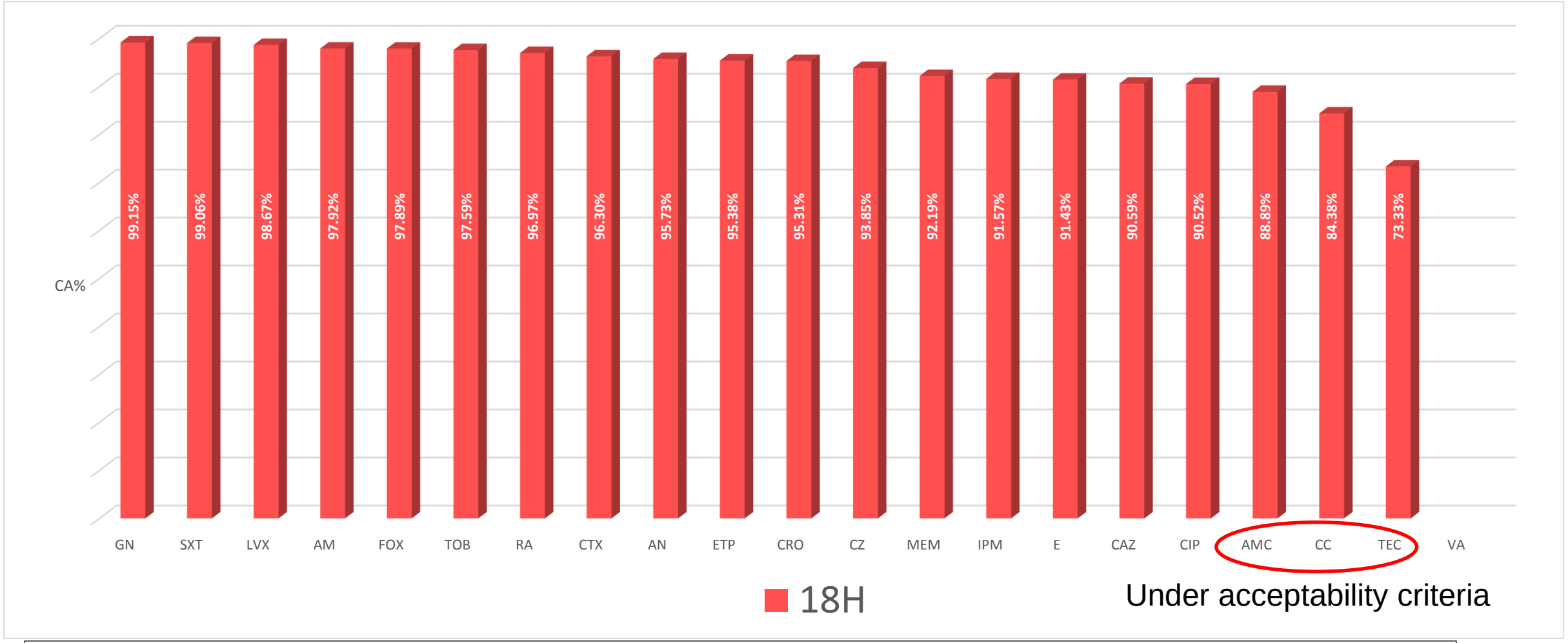
Disagreements (%mE, %ME, %VME) by bacterial type at 8h and 18h

Distribution by bacterial type

	Our stydy N=124	Other similar studies **Deepashree Rajshekar 2019**
The highest %CA	Non-fermenting GNB (8h and 18h)	Staphylococci (98,5%)
The lowest % CA	Staphylococci (8h and 18h)	*Pseudomonas* spp. (94,6%) N=965
The highest % ME	Enterobacteria (8h and 18h)	Enterobacteria (2,8%) N=965

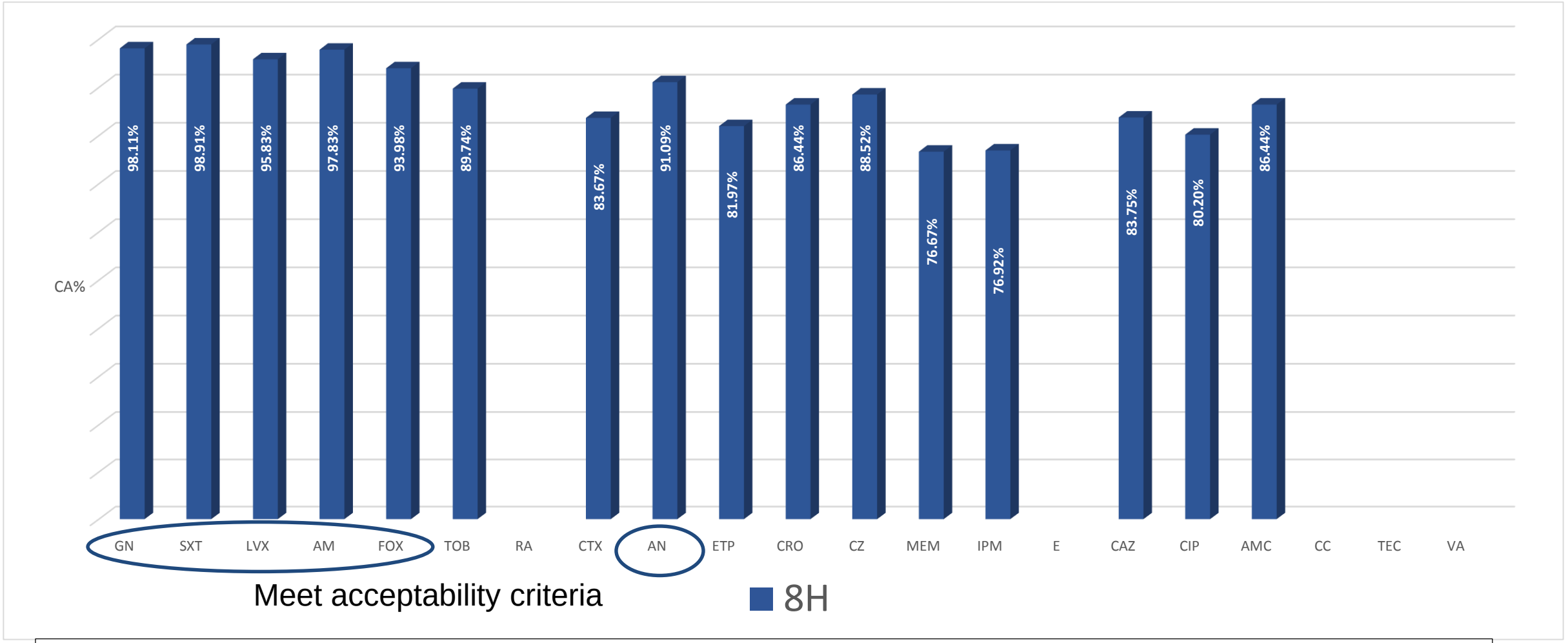
N=965

Distribution per antibiotic molecule



Analysis of direct AST results per antibiotic molecule for all bacteria combined

Distribution per antibiotic molecule



Analysis of direct AST results per antibiotic molecule for all bacteria combined

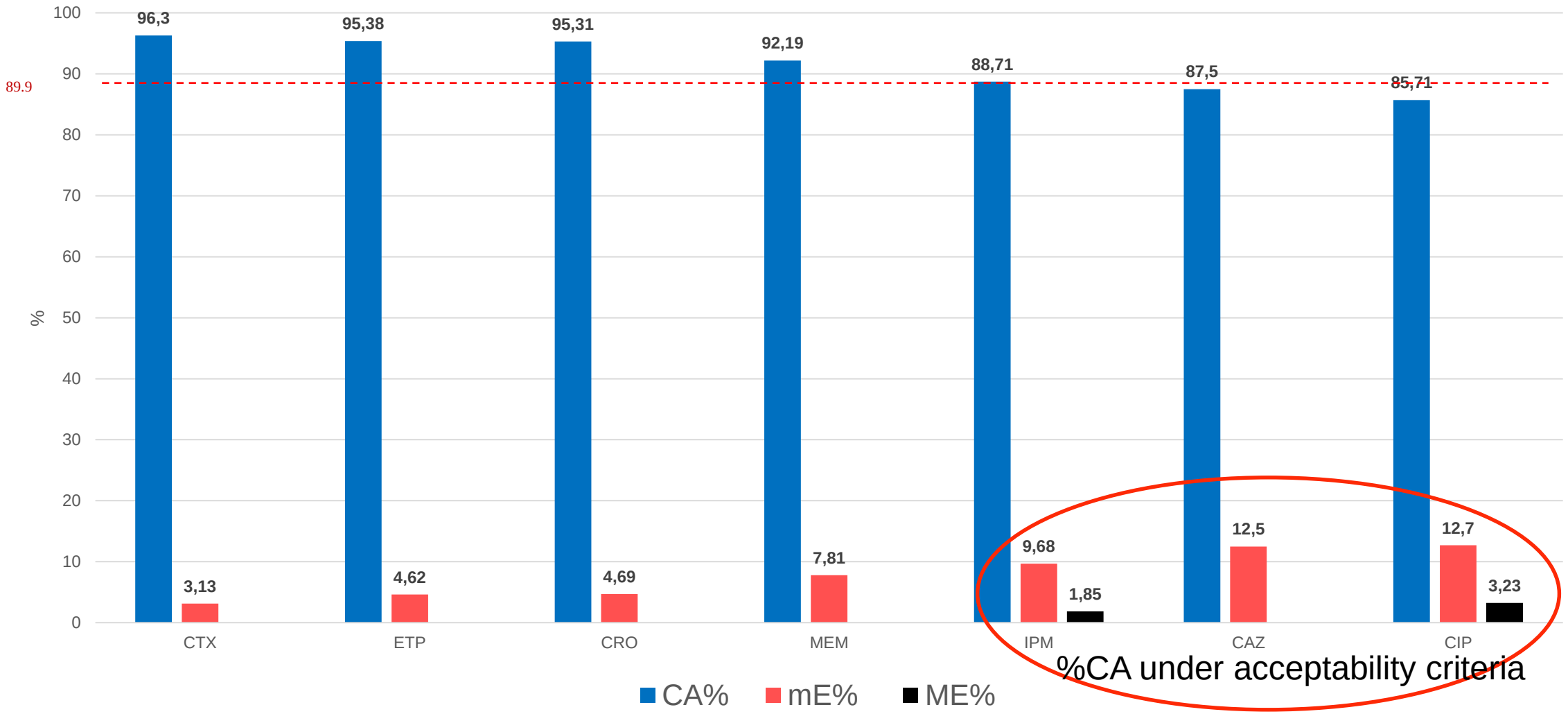
Distribution per antibiotic molecule

	Our study N= 124	Other similar studies Sukantha Chandrasekaran, 2018
The highest % CA	at 8h	at 6h
	GN SXT	GN TOB
The lowest % CA	à 8h	à 6h
	IPM MEM	IPM TGC

CLSI

N=60

Results obtained with Enterobacteria



Concordance and disagreement rates obtained with C3G, carbapenems and CIP againt Enterobacteria at 18h

Results obtained with Enterobacteria

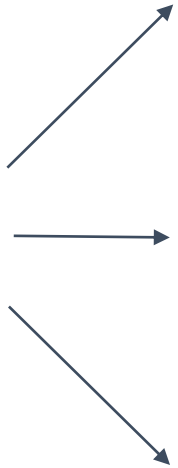
	Our study N=65	Other similar studies
Main results at 18h	% CA satisfying for CTX CRO ETP MEM	% CA satisfying for CRO MEM CAZ et CIP (95% to 98%) **Deepashree Rajshekar 2019**
	% CA unsatisfying for CAZ IPM CIP	
		% CA satifying for C3G (92% to 96%) **Desai A.2016**

N=437

N=776

Results with other bacterial types

Other bacterial types



Non fermenting GNB

- %CA very satisfying at 8h and 18h
- No ME or VME registered

Staphylococci

- %CA satisfying at 18h but low at 8h
- Very low %CA at 8h et 18h for CC and TEC

Enterococci

- Very low number
- No conclusion could be drawn

Résultats obtenus avec les autres types de bactéries

	Our study N= 124	Other studies
% CA for non fermenting GNB	Satifying at 8h and 18h	Satisfying at 18h with *Pseudomonas* spp. and *Acinetobacter* spp.
% CA for staphylococci	Satisfying at 18h	Satisfying at 18h
The lowest % CA obtained with staphylococci	CC and TEC	CC (Desai A. 2016)


N=965


N=776

Conclusion

- Very satifying results at 18h
- Particular attention to be paid to beta-lactams tested against enterobacteria
- Particular attention to be paid to clindamycin and teicoplanin against staphylococci
- Results slightly below the acceptability limit at 8h

Perspectives

- Need to move towards standardization by learned societies
- **Additional studies should be performed with early reading at 10h**
- **Early reading breakpoints should be developed**