Agreement of the MIC Test Strip versus Etest in MIC determination of *Streptococcus pneumoniae*

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Objective

We have examined the agreement between MIC-values obtained by the MIC Test Strip (Liofilchem, Roseto degli Abruzzi, Italy) and the Etest (bioMérieux, Marcy l'Etolie, France) for commonly used antibiotics using a well characterized collection of *Streptococcus pneumoniae* strains.

Bacterial strains

A collection of *S. pneumoniae* strains (*n*=93) from the National Institute of Public Health, Norway, which included: wild type (susceptible) strains (*n*=32), penicillin non-susceptible pneumococci (PNSP) (*n*=31), and macrolide resistant strains (*n*=30), was used. The *S. pneumoniae* ATCC 49619 reference strain was also included.

Methods

A total of nine antibiotics were tested: penicillin G (PG), ampicillin (AM), cefotaxime (CT), meropenem (MP), ciprofloxacin (CI), erythromycin (EM), clindamycin (CM), tetracycline (TC), and trimethoprim-sulphamethoxazole (TS).

A 0.5 McFarland bacterial suspension in Mueller-Hinton (MH) broth (BBL, Becton, Dickinson and Company, LePont de Claix, France) were inoculated on MH agar (Oxoid, Basingstoke, Hampshire, UK) with 5% defibrinated horseblood (TCS Biosciences Ltd, Botolph Claydon Buckingham, UK) and incubated for 20-24 hours at 35 ± 2 ˚C in 5% CO2.

Evaluation of results

The numbers of strains with a MIC Test Strip MIC-value > 2 dilution steps, 2 dilution steps, or 1 dilution step difference from, or 100% agreement with that obtained by the Etest were recorded. The SIR (S-susceptible, I-intermediate, or R-resistant) categorization was compared for the strains with > 2 or 2 dilution steps disagreement, using clinical breakpoints as defined by EUCAST.

Differences in MIC Test Strip MIC-values compared to that obtained by Etest were categorized as very major (R → S), major (S → R), or minor errors (S ↔ I, I ↔ R) if the MIC Test Strip MIC resulted in a change in clinical categorization (SIR).

Results

The overall agreement between MIC-values for MIC Test strips compared to Etest, is presented in Table 1 and Figure 1.

A > 2 dilution steps disagreement between MIC Test Strips and Etest was found for three antibiotics (PG, CT, and TS) in three different strains. This did not change the SIR-categorization for two of the strains, while one minor error (S → I) were observed for PG in one strain.

A 2 step divergence was found in altogether 47 observations for seven antibiotics (PG, AM, CT, MP, CI, CM, and TS). This did not cause any change in SIR-categorization in 43 of the observations. In one of the strains two minor errors; R → I (*n*=1) and S → I (*n*=1) for AM and MP, were observed, while one minor error S → I (*n*=1) and I → R (*n*=1) was observed in two strains for MP and CI, respectively.
The numbers of errors are listed in Table 2.

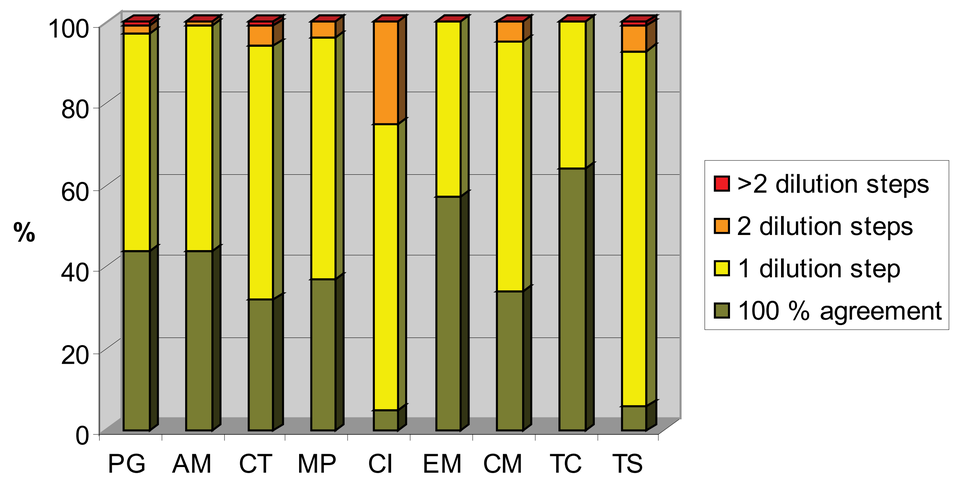

Figure 1. The overall agreement in percentage between MIC-values for the MIC Test Strip compared to the Etest. PG: penicillin G; AM: ampicillin; CT: cefotaxime; MP: meropenem; CI: ciprofloxacin; EM: erythromycin; CM: clindamycin; TC: tetracycline; and TS: trimethoprim-sulphamethoxazole.

Table 1. The overall agreement in absolute numbers and percentage between MIC-values obtained by the MIC Test Strips compared to Etest.

	PG		AM		CT		MP		CI		EM		CM		TC		TS	
	n=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%
100 % agreement	41	44	41	44	30	32	34	37	5	5	53	57	31	34	59	64	6	6
1 dilution step	49	53	51	55	57	62	55	59	64	70	40	43	57	61	34	36	80	87
2 dilution steps	2	2	1	1	5	5	4	4	24	26	0	0	5	5	0	0	6	6
>2 dilution steps	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1

PG: penicillin G; AM: ampicillin; CT: cefotaxime; MP: meropenem, CI: ciprofloxacin; EM: erythromycin; CM: clindamycin; TC: tetracycline; and TS: trimethoprim-sulphamethoxazole.

Table 2. The numbers of ≥ 2 and 2 dilution steps disagreement between MIC Test Strip and Etest for the different antibiotics tested, and their respective categorization of error.

	PG	AM	CT	MP	CI	EM	CM	TC	TS
> 2 dilution steps disagreement, *n*	1	0	1	0	0	0	0	0	1
No error, *n*	0	0	1	0	0	0	0	0	1
Minor error, *n*	1	0	0	0	0	0	0	0	0
2 dilution steps disagreement, *n*	2	1	5	4	24	0	5	0	6
No error, *n*	2	0	5	2	23	0	5	0	6
Minor error, *n*	0	1	0	2	1	0	0	0	0

PG: penicillin G; AM: ampicillin; CT: cefotaxime; MP: meropenem; CI: ciprofloxacin; EM: erythromycin; CM: clindamycin; TC: tetracycline; and TS: trimethoprim-sulphamethoxazole.

Conclusions

Overall, we observed good agreement between the two gradient methods. In total only 5 minor errors in SIR-categorization were observed, with respect to observations with > 2 and 2 dilution steps disagreement.

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Conflict of interests

The MIC Test and Etest strips were kindly donated by Montebello Diagnostics, Oslo, Norway.