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Antimicrobial Resistance Patterns of and Activities of Tigecycline against Clinical Isolates of *Streptococcus pneumoniae* from the SMART Program in Taiwan, 2003

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From August 2003 to December 2003, three medical centers located in northern, central, and southern regions of Taiwan participated in the MYSTIC program. The three hospitals included National Taiwan University Hospital (NTUH) in Taipei (2000 beds), Taichung Veterans General Hospital in Taichung (VGH-Taichung) (1400 beds), and Kaohsiung Veterans General Hospital in Kaohsiung (VGH-Kaohsiung) (1600 beds).

A total of 194 isolates of *S. pneumoniae* were collected from patients with infections in the three hospitals. Prior to susceptibility testing, these isolates were stored at –70oC. Antimicrobial agents were provided by their manufacturers for use in this study (Table 1). Minimum inhibitory concentrations (MICs) were determined for all isolates using the agar dilution method according to the guidelines established by the National Committee for Clinical Laboratory Standards (NCCLS). Regular quality assurance was performed among isolates processing with the American Type Culture Collection (ATCC) strains: *Staphylococcus aureus* ATCC 29213, *Enterococcus faecalis* ATCC 29212, *S. pneumoniae* ATCC 49619, Interpretive criteria for susceptibility and resistance for each antimicrobial agent followed those recommended by the NCCLS.

MICs of antimicrobial agents tested for all the control strains were within the MIC ranges provided by the NCCLS. In vitro susceptibilities of this collection of *S. pneumoniae* species to 17 selected antimicrobial agents are shown in Table 1. Seventy-two percent of 194 *S. pneumoniae* isolates were not susceptible to penicillin (intermediate [MICs, 0.12-1 μg/ml], 69%, and resistant [MICs, ≥2 μg/ml], 3%) and 30% were not susceptible to cefotaxime (intermediate [MICs, 1 μg/ml], 27%, and resistant

[MICs, ≥2 μg/ml], 3%) based on meningitis criteria provided by the NCCLS. Two (1%) isolates of *S. pneumoniae* exhibited cefotaxime MICs of ≥4 μg/ml.

Tigecycline had excellent in vitro activities against *S. pneumoniae* isolates (MICs, ≤0.06 μg/ml).

TABLE 1. Antimicrobial susceptibilities of 194 isolates of *S. pneumoniae* recovered from patients treated at three major teaching hospitals in Taiwan, MYSTIC-Taiwan antimicrobial surveillance programme, 2003.

Antimicrobial	MIC (μg/ml)			No. (%) of isolates		
agent	Range	MIC_{50}	MIC_{90}	S	I	R
Penicillin	0.03-2	0.5	1	56 (29)	133 (69)	5 (3)
				189 (97)	5 (3)	0 (0)
Cefotaxime	0.03-4	0.5	1	136 (70)	53 (27)	5 (3)
				189 (97)	3 (2)	2 (1)
Cefepime	0.03-4	1	1	80 (41)	104 (54)	10 (5)
				184 (95)	8 (4)	2 (1)
Cefpirome	0.03-2	0.5	0.5	-	-	-
Imipenem	0.03-1	0.12	0.25	169 (87)	24 (12)	1 (1)
Meropenem	0.03-0.5	0.25	0.5	156 (80)	38 (20)	0 (0)
Ertapenem	0.03-4	0.5	1	190 (98)	3 (2)	1 (1)
Ciprofloxacin	0.12->32	1	2	-	-	-
Levofloxacin	0.12->32	1	1	189 (97)	0 (0)	5 (3)
Moxifloxacin	0.03-16	0.12	0.12	192 (99)	1 (1)	1 (1)
Gatifloxacin	0.03-32	0.25	0.25	189 (97)	2 (1)	3 (2)
Vancomycin	0.12-0.5	0.25	0.25	194 (100)	-	-
Q/D	0.5-8	2	4	83 (42)	60 (31)	51 (26)
Linezolid	0.25-2	1	1	194 (100)	-	-
Telithromycin	0.03-8	0.25	2	173 (89)	13 (7)	8 (4)
Telithromycin*	0.03-2	0.03	0.25	155 (97)	4 (3)	0 (0)
Tigecycline	0.03-0.06	0.03	0.06	-	-	-

FIG. 1. MIC distribution of penicillin, telithromycin, and quinupristin-dalfopristin to 194 *S. pneumoniae* isolates recovered from patients treated at three major teaching hospitals in Taiwan, MYSTIC-Taiwan antimicrobial surveillance programme, 2003.