



The Changing Face of Oxacillin-resistant *Staphylococcus aureus* in the Asia-Pacific Region. A SENTRY Report 1998 -2007

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INTRODUCTION

Oxacillin-resistant *Staphylococcus aureus* (MRSA) are known to be prevalent in the Asia-Pacific Region. Non-multi-drug resistant MRSA (nmMRSA) are now emerging and are these strains usually reflect community-acquired types (CA-MRSA). In this study, we examined *S. aureus* isolated from hospitalised patients between 1998 and 2007 from 10 countries in the Asia-Pacific region, with emphasis on those with nmMRSA phenotype.

METHODS

Isolates

S. aureus isolated from infected hospitalized patients in 10 countries (42 medical centres) collected during 2006. Isolates came from patients with bacteraemia, pneumonia, complicated skin and skin structure infections, and other infections. All strains were referred to the Women's and Children's Hospital, Adelaide, Australia for testing.

No isolates were collected from any country in 2005. Korea commenced participation in the SENTRY surveillance in 2003, and South Africa contributed from 1998 to 2004 only. India, Indonesia and Thailand commenced in 2006.

Susceptibility testing

Isolates were tested using custom made dry-form broth microdilution (BMD) panels (TREK Diagnostic Systems) against a wide range of antimicrobials according to CLSI standards. Breakpoints for resistance to other antimicrobial agents were those recommended by the CLSI.

Quality control strains utilized included *Escherichia coli* ATCC 25922 and 35218, *P. aeruginosa* ATCC 27853; all MIC results were within CLSI specified ranges.

Definitions

Non-multi-drug-resistant *S. aureus* (nmMRSA): resistance to less than two of the following antimicrobials: erythromycin (ERY), tetracycline (TET), gentamicin (GEN), ciprofloxacin (CIP), and trimethoprim/sulphamethoxazole (SXT).

Table 1. Resistance profiles of oxacillin-resistant *S. aureus* from the SENTRY Asia-Pacific region, 1998-2007

Resistance Profile ^a	Australia (n=817)	China (n=338)	Hong Kong (n=364)	India (n=335)	Japan (n=791)	Korea (n=237)	Philippines (n=87)	Singapore (n=332)	SouthAfrica (n=191)	Taiwan (n=363)
	146		10	3		14	74	4		3
Tet	4		1			1		1	2	2
Gen	2				4	3	2			
Cip	28		13	12						
EryCip	102	4	1	5	3	17	3	11		13
EryCip Gen	71	3	33	17	113	10	3	54	45	
Ery Gen	6	1	2	2	12	6		1	1	18
Ery Tet	1	1			2	1		2		14
Cip Tet		1	5					1		
CipGen	1		2	5	1					
EryCipGen	2	24	12	19	70	9	1	2	1	19
CipGenTet	1	13	3						3	1
Ery TetSXT	21									
Ery Gen SXT				5						1
Ery GenTet	1				1	3			3	29
EryCip SXT	2			3						
EryCip Tet	3	6	25	26	250	12		14	8	
CipGenTetSXT				4						
Ery GenTetSXT	36								7	1
EryCip TetSXT	14		1	4			2			2
EryCipGen SXT	29	1		46					2	
EryCipGenTet	25	204	243	66	335	113		14	64	2
EryCipGenTetSXT	322	79	13	112		40	3	307	54	258

^a Ery, erythromycin; Cip, ciprofloxacin; Gen, gentamicin; Tet, tetracycline; SXT, trimethoprim/sulphamethoxazole

RESULTS

- A total of 9,295 *S. aureus* isolates (5,309 oxacillin-sensitive; 3,896 oxacillin-resistant) were received from 1998 to 2007.
- The prevalence of MRSA varies significantly throughout the SENTRY Asia-Pacific region (Figure 1); Singapore, Taiwan and Japan have over 50% MRSA.
- Of the MRSA, 489 (12.5%) were nmMRSA; >50% of these had no additional resistances.
- Australia experienced a major increase in the incidence of nmMRSA phenotypes and they made up an increasing proportion of MRSA seen in hospitalised patients, reaching 47% of

- all MRSA by 2007.
- Multi-resistant hospital-associated MRSA types remained uncommon in the Philippines but in 2003 nmMRSA phenotypes appeared and became established. These are likely ST30-MRSA-IV.
- nmMRSA phenotypes remained at a low proportion of MRSA types in Singapore, Japan, Taiwan, Hong Kong, mainland China and South Africa, and were slowly increasing in incidence in Korea.
- The resistance profiles for the MRSA isolates for each country is shown in Table 1. Although

Figure 1. Proportion of oxacillin-resistant *Staphylococcus aureus* by year and country



- molecular typing has not been performed on all of these strains, the profile can predict the likely clones.
- Resistance to ERY and CIP was seen in many countries. In Singapore, South Africa, and Australia, this was often associated with the epidemic clone ST22-MRSA-IV (EMRSA-15), which is urease negative. In Japan, this pattern is often produced by the The New York/Japan strain (ST5-MRSA-II), which is urease positive
- In Taiwan, strains typical of the CA-MRSA strain ST59-MRSA-V_T were evident.

Conclusions

- Community-associated nmMRSA phenotypes are becoming established in some countries in the Asia-Pacific region and are making up an increasing proportion of strains associated with infections in hospitalised patients, due both to the increasing reservoir in the community and hand hygiene programs to control multi-resistant hospital-associated clones.
- Community-associated nmMRSA phenotypes are a prominent problem in Australia and the Philippines.