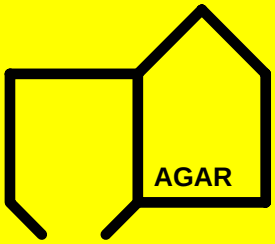


The Australian Group on Antimicrobial Resistance

http://antimicrobial-resistance.com

Staphylococcus aureus Survey

2005 Antimicrobial Susceptibility Report

A/Prof Graeme Nimmo
Director
Division of Microbiology
Queensland Health Pathology Service
Central Laboratory
Herston, QLD

Prof Peter Collignon
Director
Infectious Diseases Unit and Microbiology Department
The Canberra Hospital
Woden, ACT
Professor, Canberra Clinical School
Australian National University
Acton, ACT

Mr Geoffrey Coombs
Principal Scientist
Microbiology and Infectious Diseases
PathWest Laboratory Medicine WA
Royal Perth Hospital
Perth, WA

A/Prof Keryn Christiansen
Head of Department
Microbiology and Infectious Diseases
PathWest Laboratory Medicine WA
Royal Perth Hospital
Perth, WA

Ms Jan Bell
Scientist
Microbiology and Infectious Diseases
Children, Youth & Women's Health Service
Women's & Children's Hospital
North Adelaide, SA

Ms Julie Pearson
Scientific Officer
Department of Microbiology and Infectious Diseases
PathWest Laboratory Medicine WA
Royal Perth Hospital
Perth, WA

A/Prof Mary-Louise McLaws
Director
Hospital Infection Epidemiology and Surveillance Unit
University of New South Wales
Sydney, NSW

On behalf of the Australian Group for Antimicrobial Resistance (AGAR)

Address correspondence to: Ms Julie Pearson c/o AGAR

Antimicrobial Susceptibility Report of *Staphylococcus aureus* Isolates from the Australian Group on Antimicrobial Resistance (AGAR)

2005 Surveillance Report

Members of AGAR who participated in this study:

Victoria	
Alfred Hospital	Denis Spelman, Clare Franklin
Austin Hospital	Barrie Mayall, Peter Ward
Gribbles Pathology	John Andrew, Di Olden
Monash Medical Centre	Tony Korman, Despina Kotsanas
Royal Women's and Children's Hospital	Suzanne Garland, Gena Gonis
St Vincent's Hospital	Mary Jo Waters, Linda Joyce
New South Wales	
Concord Hospital	Thomas Gottlieb, Glenn Funnell
Douglass Hanly Moir Pathology	Miriam Paul, Richard Jones
John Hunter Hospital	John Ferguson, Jo Anderson
Nepean Hospital	James Branley, Samantha Ryder
Royal North Shore Hospital	George Kotsiou, Clarence Fernandes
Royal Prince Alfred Hospital	Richard Benn, Barbara Yan
South Western Area Pathology Service	Iain Gosbell, Helen Ziochos
Westmead Hospital	David Mitchell, Lee Thomas
Australian Capital Territory	
The Canberra Hospital	Peter Collignon, Susan Bradley
South Australia	
SouthPath	David Gordon, Hendrik Pruul
Gribbles Pathology (SA)	PC Lee, Barbara Koldej
Institute of Medical and Veterinary Science	Ivan Bastian, Rachael Pratt
Women's and Children's Hospital	John Turnidge, Jan Bell
Western Australia	
PathWest, Fremantle Hospital	David McGechie, Graham Francis
PathWest, QE2 Medical Centre	Clay Golledge, Barbara Henderson
PathWest, Royal Perth Hospital	Keryn Christiansen, Geoffrey Coombs
St John of God Pathology	Susan Benson, Janine Fenton
Queensland	
Queensland Health Pathology Service, Cairns Base Hospital	Enzo Binotto, Bronwyn Thomsett
Queensland Health Pathology Service, Gold Coast Hospital	Dale Thorley
Queensland Health Pathology Service, Prince Charles Hospital	Chris Coulter, Sonali Gribble
Queensland Health Pathology Service, Princess Alexandra Hospital	Joan Faoagali, Gwen Lye
Queensland Health Pathology Service, Royal Brisbane Hospital	Graeme Nimmo, Narelle George
Sullivan Nicolaides Pathology	Jenny Robson, Renee Bell
Tasmania	
Launceston General Hospital	Erika Cox, Kathy Wilcox
Royal Hobart Hospital	Alistair McGregor, Rob Peterson
Northern Territory	
Royal Darwin Hospital	Gary Lum, Paul Southwell

The AGAR group has been funded by the Commonwealth of Australia, Department of Health and Ageing since 2001

Table of Contents

1 Executive Summary

The Australian Group on Antimicrobial Resistance (AGAR) performs regular multicentre point-prevalence studies to monitor changes in antimicrobial resistance. In 2005, 32 laboratories participated in national surveillance of *Staphylococcus aureus* resistance. Two thousand nine hundred and eight isolates of *S. aureus* were collected prospectively and tested by Vitek2®, disc diffusion and Etest®.

For the first time the survey included only unique isolates from clinical specimens collected 48 hours or more after hospital admission. Previous surveys from 1986 to 1999 and for 2001 and 2003 included all unique clinical isolates received by the participating laboratories. Those for 2000, 2002 and 2004 included only outpatient isolates in order to estimate the prevalence of MRSA in community staphylococcal infections. Therefore, the 2005 survey represents the first national study of the prevalence of resistance in *S. aureus* causing infections in hospital inpatients in Australia.

Regional prevalence of methicillin-resistant *S. aureus* (MRSA) varied from 22.5% in WA to 43.4% in NSW/ACT. The overall prevalence of MRSA in inpatients was 31.9%. Notably the prevalence was higher in invasive isolates (35.7%) than in non-invasive isolates (31.5%). This is in keeping with the increased virulence of MRSA compared to methicillin-sensitive *S. aureus* (MSSA). Resistance to non-beta-lactam antimicrobials with the exception of erythromycin was uncommon in MSSA. Resistance to erythromycin (80.0%), clindamycin (44.2%), tetracycline (59.4%), cotrimoxazole (60.3%), ciprofloxacin (76.8%) and gentamicin (60.6%) was common in MRSA and varied considerably between regions. Regional variation is due to the differential distribution of MRSA clones between regions and particularly of the major nosocomial clone, ST239-MRSA-III. The latter strain is predominant in the eastern states and is resistant to multiple non-beta-lactam antimicrobials.

Prevalence of MRSA in individual hospitals varied markedly from 4.0% to 58.0%. Increasing age was associated with risk for MRSA. However, the association between institutional prevalence and institutional mean age was only weak. The weakness of the association may have been related to sample size or to other factors, such as activity, acuity and infection control practice, beyond the scope of this survey. MRSA infection is associated with increased mortality, morbidity and healthcare costs. It is generally accepted that the prevalence of MRSA in an institution reflects the effectiveness of infection control practice. Furthermore, there is ample and consistent evidence that infection control strategies based on screening, isolation and decolonisation are successful and highly cost effective.

2 Introduction

2.1 Objective of the Programme

The objective of the 2005 surveillance program was to determine the prevalence of antimicrobial resistance in clinical isolates of *S. aureus* throughout Australia in hospital inpatients admitted for 48 hours or more.

2.2 Importance of *Staphylococcus aureus*

S. aureus is one of the major pyogenic bacteria and causes a wide variety of infections in man which are associated with considerable morbidity and significant mortality. Manifestations of *S. aureus* infection range from skin and soft tissue infections such as impetigo and furunculosis to invasive infections such as osteomyelitis, necrotising pneumonia and infective endocarditis. Invasive infections are frequently associated with bacteraemia. In the pre-antibiotic era the mortality of staphylococcal bacteraemia was as high as 90%[1]. With antibiotic treatment, estimates of mortality for staphylococcal bacteremia vary considerably: 0.0% to 83.3% for MRSA and 3.6% to 51.7% for MSSA[2]. In Australia, as in most of the world, antimicrobial resistance in *S. aureus* is a major impediment to effective treatment. Hospital strains are frequently resistant to methicillin and multiple other antimicrobials[3].

Methicillin-resistant *Staphylococcus aureus* (MRSA) was first reported in Australia in 1968[4]. This archaic strain of MRSA was not usually resistant to other non-beta-lactam antimicrobials and was not resistant to gentamicin. The emergence of MRSA resistant to gentamicin and other classes of antimicrobials was first noted in eastern Australia in 1976 and outbreaks of hospital infection due to multiresistant MRSA (mMRSA) occurred in the state of Victoria in the late 1970s and early 1980s[5, 6]. mMRSA became endemic in hospitals in the eastern Australian states in the late 1980s and the 1990s with some spread to hospitals in South Australia, the Northern Territory and Tasmania[3, 7]. However, these strains did not become established in Western Australian hospitals due to active screening and infection control policies[3, 8]. Eastern Australian MRSA has now been shown to be one clone by MLST – ST239-MRSA-III[9]. This is one of the most successful MRSA clones and is now found extensively in Europe, Asia, and South America. MRSA clones of overseas origin have also been found in Australia. Most notably the United Kingdom strain, EMRSA-15, has spread widely in Australia to become a major endemic cause of hospital sepsis.

Vancomycin has been the mainstay of treatment for serious infections due to MRSA. However, there is evidence that vancomycin is less effective in the treatment of methicillin-sensitive *S. aureus* than anti-staphylococcal beta-lactams[10, 11]. Failure of vancomycin treatment of MRSA has been associated with the emergence of strains with MICs to vancomycin in the intermediate range (VISA)[12, 13]. These strains have been described in many parts of the world including Australia[14]. Isolation of VISA follows failure of prolonged treatment with vancomycin. One recent study has suggested that treatment failure is related to slightly higher vancomycin MICs (1.0 to 2.0 mg/L versus ≤0.5 mg/L) in pre-treatment isolates of MRSA[15]. Few treatment options remain for multi-resistant MRSA and resistance to linezolid, one of the few new anti-staphylococcal agents of recent years, is already being reported[16].

While it is well known that *S. aureus* is a major cause of severe sepsis, few population based estimates of its incidence or prevalence are available. A recent Australian survey of *S. aureus* bacteraemia from 1999 to 2002 documented 3,129 episodes[2]. Approximately 51% of bacteremic episodes had their onset in hospitals. MRSA caused 40% of hospital-onset and 12% of community-onset episodes. The authors estimated that approximately 6,900 episodes of *S. aureus* bacteraemia occur in Australia annually. This equates to 35/100,000 of population. Meta-analysis of the outcomes of *S.*

aureus bacteraemia has shown that the relative risk of death due to MRSA bacteraemia is at least twice that due to MSSA[17]. It is widely acknowledged that nosocomial MRSA infection represents an additional burden of disease not just replacement of MSSA infection[18]. The cost of these additional infections is substantial for hospitals, patients and society. While costs vary from country to country, annual additional hospital costs in the USA are estimated at between US$1.5 billion and US$4.2 billion[18]. In Australia, the additional hospital costs associated with nosocomial *S. aureus* bacteraemia alone are estimated at approximately $150 million[2]. Effective infection control measures have been shown to substantially reduce nosocomial infection and to result in substantial savings[18].

3 Methods

Thirty two laboratories from the each State and Territory of Australia participated in the *S. aureus* AGAR survey. Starting 1st May 2005, each laboratory collected up to 100 consecutive significant clinical isolates from hospital inpatients (hospital stay >48 hours at the time of specimen collection) of the largest hospital served by the laboratory. Only one isolate per patient was tested. If *S. aureus* was isolated from more than one site, then the isolate from the most significant clinical site was tested. Specimens received for the purpose of gathering surveillance data were excluded.

3.1 Species Identification

The minimum tests for identification of *S. aureus* were two positive test results from the following:

1. Slide coagulase test
2. Tube coagulase test
3. Demonstration of deoxyribonuclease production

Additional tests such as fermentation of mannitol or growth on mannitol-salt agar may have been performed for confirmation.

3.2 Susceptibility Testing Methodology

Participating laboratories performed antimicrobial susceptibility tests using the Vitek2® AST-P545 card (Table 1). Penicillin susceptible strains were tested for β-lactamase production using nitrocefin. Mupirocin and cefoxitin were tested by disc diffusion using the CLSI or CDS methods {Bell, 2004 #347; NCCLS, 2003 #349; NCCLS, 2004 #348}. The MIC of mupirocin resistant isolates was determined by Etest® (AB Biodisk, Solna, Sweden). The macro Etest® (AB Biodisk, Solna, Sweden) method was used to determine hetero-resistance to vancomycin according to manufacturer's recommendations.

Table 1: Vitek 2® AST-P545 card

Antibiotic	MIC Range (mg/L)
Benzylpenicillin	0.03 - 0.5
Oxacillin	0.25 - 4.0
Cefazolin	4.0 - 64.0
Vancomycin	1.0 - 32.0
Rifampicin	0.5 - 32.0
Fusidic acid	0.5 - 32.0
Gentamicin	0.5 - 16.0
Erythromycin	0.25 - 8.0
Clindamycin	0.25 - 8.0
Tetracycline	1.0 - 16.0
Trimethoprim/Sulphamethoxazole	10.0 - 320.0
Ciprofloxacin	0.5 - 8.0
Quinupristin/dalfopristin (Synercid®)	0.25 - 16.0
Teicoplanin	0.5 - 32.0
Linezolid	0.5 - 8.0
Imipenem	1.0 - 16.0
Nitrofurantoin	16.0 - 152.0

3.3 Quality Control

Additional quality control was not performed for this survey. As all participating laboratories are NATA accredited, routine QC testing of antimicrobial susceptibility test methods is an integral part of routine procedures.

3.4 Statistical Analysis

P values were calculated using Fischer's exact test (GraphPad® Prism Software).

4 Demographics

Both public (27) and private laboratories (5) participated in the study. Participants included New South Wales (8), ACT (1), Queensland (6), Victoria (6), Tasmania (2), Northern Territory (1), South Australia (4) and Western Australia (4). There were 2,908 isolates from 32 institutions (Table 2). To ensure institutional anonymity data from NSW and ACT, from Tasmania and Victoria and from Queensland and Northern Territory have been combined.

4.1 Regional Source of Isolates

The number of participating institutions and the number of isolates collected from each region is shown in Table 2.

Table 2. Isolates by Region

Region	Number of Institutions	Total	%
New South Wales (NSW) Australian Capital Territory (ACT)	9	825	28.4
Queensland (Qld) Northern Territory (NT)	7	664	22.8
South Australia (SA)	4	340	11.7
Victoria (Vic) Tasmania (Tas)	8	724	24.9
Western Australia (WA)	4	355	12.2
Total	32	2908	100.0

4.2 Age

The age distribution of patients is shown in Table 3.

Table 3. Age of Patients

Age Range (years)	n	%
0-1	264	9.1
2-16	132	4.5
17-40	427	14.7
41-61	642	22.1
62-100	1443	49.6
Total	**2908**	**100.0**

5 Specimen Source

The majority of isolates (67.6%) were from skin and soft tissue infections (Table 4). Blood culture isolates made up 6.7% of the total while all invasive isolates accounted for 8.7%. Respiratory specimens were the second most common source (17.4%).

Table 4. Source of Isolates

Specimen Source	n	%
Skin and Soft Tissue	1967	67.6
Respiratory	506	17.4
Blood	194	6.7
Urine	92	3.2
Eye	62	2.1
Sterile Site	50	1.7
Ear	13	0.4
CSF	8	0.3
Other	11	0.4
Unknown	5	0.2
Total	**2908**	
Invasive	252	8.7
Non-Invasive	2651	91.2
Not Specified	5	0.2

6 Susceptibility Testing Results: 2005 Study

6.1 Methicillin-resistant *S. aureus*

Cefoxitin was used to test for methicillin-resistance. Table 5 shows the proportion of methicillin-resistant *S. aureus* (MRSA) by region and source. Australia-wide, 928 isolates (31.9%) were MRSA. The proportion of MRSA varied significantly between states/territories ($X^2 = 110.54$, $p<0.0001$). The proportion of MRSA in NSW/ACT hospitals was significantly higher ($P<0.001$) than the Australian average. Although the proportion of *S. aureus* that were MRSA was higher amongst invasive isolates than non-invasive isolates this was not statistically significant. The proportion of MRSA varied markedly between institutions (Table 6).

Resistance in MRSA to non-beta-lactam antimicrobials varied significantly between states with the exception of mupirocin (Table 7). Resistance with the widest range was identified for gentamicin (5.0% to 79.5%, $p<0.0001$), tetracycline (6.3% to 83.0%, $p<0.0001$), cotrimoxazole (7.5% to 80.8%, $p<0.0001$) and clindamycin (8.3% to 68.7%, $p<0.0001$). Resistance to ciprofloxacin was also common ranging from 42.5% to 89.4% ($p<0.0001$). Resistance to fusidic acid across the States varied significantly ($p=0.0023$) with the highest proportion in South Australia (11.9%). These differences are due to differences in the carriage of resistance determinants by prevalent clones of MRSA which in turn vary in their geographic distribution. A full description of clonal prevalence is provided in a companion Epidemiology and Typing Report. There was no significant difference ($p=0.713$) in the low levels of mupirocin resistance. One isolate from Vic/Tas had a quinupristin/dalfopristin MIC of >2 mg/L by broth micro-dilution and Etest® MIC of 6 mg/L. In addition one result for quinupristin/dalfospristin was missing. One isolate from NSW/ACT had a Vitek® MIC result of 4 mg/L for vancomycin and teicoplanin. The broth dilution MIC of both agents was 2 mg/L and the isolate was confirmed as a hetero-vancomycin intermediate *S. aureus* (hVISA) by the macro Etest® method. A further 25 isolates had a Vitek® MIC result of 2 mg/L for vancomycin, while the remainder were ≤1 mg/L. A detailed analysis of regional and individual institutional results is presented in Appendix 1.

Table 5: Proportion of MRSA by Region and Source

	NSW/ACT	Qld/NT	SA	Vic/Tas	WA	Aus
All	358/825 **(43.4%)**	177/664 **(26.7%)**	84/340 **(24.7%)**	229/724 **(31.6%)**	80/355 **(22.5%)**	928/2908 **(31.9%)**
Invasive	35/85 **(41.2%)**	13/36 **(36.1%)**	10/34 **(29.4%)**	23/59 **(39.0%)**	6/30 **(20.0%)**	87/244 **(35.7%)**
Non-invasive	323/739 **(43.7%)**	164/628 **(26.1%)**	73/304 **(24.0%)**	206/664 **(31.0%)**	74/325 **(22.8%)**	840/2660 **(31.6%)**

Table 6: Proportion of MRSA by Institution

Region	Lab Code	% MRSA
NSW/ACT	1	31.0
	2	50.0
	3	31.3
	4	47.0
	5	58.0
	6	51.0
	7	38.5
	8	46.0
	9	34.0
Qld/NT	10	30.0
	11	19.0
	12	20.0
	13	29.9
	28	23.2
	29	28.8
	30	36.0
SA	14	29.0
	15	29.0
	16	15.0
	17	27.5
Vic/Tas	18	4.0
	19	45.0
	20	23.1
	21	10.0
	22	43.0
	23	53.5
	31	35.0
	32	33.0
WA	24	14.5
	25	25.0
	26	22.0
	27	29.2
Australia		31.9

Table 7: MRSA: Number and Proportion Non-Susceptible

Drug	NSW/ACT	Qld/NT	SA	Vic/Tas	WA	Aus	Difference across regions X^2 P
Erythromycin	309/357 **(86.6%)**	129/177 **(72.9%)**	51/84 **(60.7%)**	207/229 **(90.4%)**	46/80 **(57.5%)**	742/927 **(80.0%)**	75.61 <0.0001
Clindamycin*	193/281 **(68.7%)**	74/177 **(41.8%)**	7/84 **(8.3%)**	94/228 **(41.2%)**	8/80 **(10.0%)**	376/850 **(44.2%)**	151.25 <0.0001
Tetracycline	247/358 **(69.0%)**	79/177 **(44.6%)**	30/84 **(35.7%)**	190/229 **(83.0%)**	5/80 **(6.3%)**	551/928 **(59.4%)**	201.42 <0.0001
Trimethoprim-Sulphamethoxazole	251/358 **(70.1%)**	91/177 **(51.4%)**	27/84 **(32.1%)**	185/229 **(80.8%)**	6/80 **(7.5%)**	560/928 **(60.3%)**	181.44 <0.0001
Ciprofloxacin	320/358 **(89.4%)**	111/177 **(62.7%)**	46/84 **(54.8%)**	202/229 **(88.2%)**	34/80 **(42.5%)**	713/928 **(76.8%)**	144.13 <0.0001
Gentamicin	250/358 **(69.8%)**	98/177 **(55.4%)**	28/84 **(33.3%)**	182/229 **(79.5%)**	4/80 **(5.0%)**	562/928 **(60.6%)**	178.66 <0.0001
Fusidic Acid	13/358 **(3.6%)**	10/177 **(5.6%)**	10/84 **(11.9%)**	4/229 **(1.7%)**	3/80 **(3.8%)**	40/928 **(4.3%)**	16.63 0.0023
Mupirocin	12/358 **(3.4%)**	4/177 **(2.3%)**	1/84 **(1.2%)**	6/229 **(2.6%)**	1/80 **(1.3%)**	24/928 **(2.6%)**	2.13 0.7130

* Constitutive resistance

6.2 Methicillin-susceptible *S. aureus*

MSSA were generally susceptible to most non-beta-lactam antimicrobials. Resistance to erythromycin was most common but regional proportions only ranged from 7.6% to 13.3% (p=0.052). The only significant differences in proportion across all regions were for the level of resistance in tetracycline (p=0.0005) with NSW/ACT having the highest level at 3.6%, and gentamicin (p=0.0047) with Vic/Tas having the highest level at 3.2% (Table 8). A detailed analysis of regional and individual institutional results is presented in Appendix 1.

Table 8: MSSA: Number and Proportion Non-Susceptible

Drug	NSW/ACT	Qld/NT	SA	Vic/Tas	WA	Aus	Difference across regions X^2 P
Penicillin	405/467 **(86.7%)**	416/487 **(85.4%)**	219/256 **(85.5%)**	406/495 **(82.0%)**	241/275 **(87.6%)**	1687/1980 **(85.2%)**	6.17 0.1870
Erythromycin	60/467 **(12.8%)**	63/487 **(12.9%)**	22/256 **(8.6%)**	66/495 **(13.3%)**	21/275 **(7.6%)**	232/1980 **(11.7%)**	9.37 0.0520
Clindamycin*	8/448 **(1.8%)**	2/487 **(0.4%)**	3/256 **(1.2%)**	8/495 **(1.6%)**	4/275 **(1.5%)**	25/1961 **(1.3%)**	4.37 0.3580
Tetracycline	17/467 **(3.6%)**	8/487 **(1.6%)**	7/256 **(2.7%)**	25/495 **(5.1%)**	0/275 **(0.0%)**	57/1980 **(2.9%)**	20.15 0.0005
Trimethoprim-Sulphamethoxazole	12/467 **(2.6%)**	3/487 **(0.6%)**	3/256 **(1.2%)**	8/495 **(1.6%)**	2/275 **(0.7%)**	28/1980 **(1.4%)**	7.88 0.0960
Ciprofloxacin	18/466 **(3.9%)**	8/487 **(1.6%)**	6/256 **(2.3%)**	10/495 **(2.0%)**	6/275 **(2.2%)**	48/1979 **(2.4%)**	5.75 0.2190
Gentamicin	5/467 **(1.1%)**	5/487 **(1.0%)**	2/256 **(0.8%)**	16/495 **(3.2%)**	1/275 **(0.4%)**	29/1980 **(1.5%)**	15.01 0.0047
Fusidic Acid	13/467 **(2.8%)**	18/487 **(3.7%)**	7/256 **(2.7%)**	18/495 **(3.6%)**	15/275 **(5.5%)**	71/1980 **(3.6%)**	4.20 0.3790
Mupirocin	4/467 **(0.9%)**	5/487 **(1.0%)**	2/256 **(0.8%)**	6/495 **(1.2%)**	3/275 **(1.1%)**	20/1980 **(1.0%)**	0.47 0.9770

6.3 Relationship of Age to MRSA Prevalence

Ages ranged from <1 years to 100 years, while the mean was 54.3 years the distribution was skewed as illustrated by 25th percentile at 35 years, 50th at 61 years and 75th 77 years of age. Age data were categorised into neonatal (<1-1 years), paediatric (2-16), adult (17-40), middle-age (41-61) and the older (62-100) (Table 9). MSSA was significantly ($p<0.0001$) more common than MRSA in all five age groups.

Table 9: Age by methicillin susceptibility of *S. aureus*

Age	MRSA N Row % [Col %]	MSSA N Row % [Col %]	Total N Col%	X^2 P
0-1	17 6.4% [1.8%]	247 93.6% [12.5%]	264 9.1%	400.76 <0.0001
2-16	29 22.0% [3.1%]	103 78.0% [5.2%]	132 4.5%	82.97 <0.0001
17-40	113 26.5% [12.2%]	313 73.5% [15.8%]	426 14.7%	187.79 <0.0001
41-61	207 32.2% [22.3%]	435 67.8% [22.0%]	642 22.1%	161.94 <0.0001
62-100	562 38.9% [60.6%]	881 61.1% [44.5%]	1443 49.6%	1142.81 <0.0001
Total	928 31.9% [100.0%]	1979 68.1% [100.0%]	2907 100.0%	103.96 <0.0001

When the relationship between mean age and proportion of MRSA in institutions was examined, a significant (P two tailed = 0.02), but weak trend (r = 0.4195), was identified. The sample sizes contributed by the member hospitals were small resulting in a wide dispersion of the mean age (Figure 1) across the 32 facilities which resulting in the poor association between mean age and MRSA (Figure 2) .

However, when age was categorised into five ranges for the aggregated data from all hospitals and odds ratio of MRSA cases for each age group was examined against the youngest, patients in successive age groups were more likely to have MRSA (as opposed to MSSA) (Table 11). Patients between 62 years and 100 years were 10.33 (P<0.0001) times more likely to have MRSA (not MSSA) compared with babies. This finding does not assist the individual hospital to determine whether their patient risk for MRSA increased with age but it does indicate that age is a proxy for a strongly significant risk factor for acquisition across the 32 hospitals.

Table 10: Odds ratios of risk for MRSA in age categories

	Unadjusted Odds Ratio (95%CI)	*Adjusted Odds Ratio (95%CI)
Age (years):		
0-1	1.00	1.00
2-16	4.09 (2.06-8.16) P<0.0001	4.25 (2.22-8.11) P<0.0001
17-40	5.25 (2.99-9.32) P<0.0001	5.72 (3.22-9.85) P<0.0001
41-61	6.91 (4.02-12.04) P<0.0001	7.37 (4.36-12.46) P<0.0001
62-100	9.27 (5.49-15.86) P<0.0001	10.33 (6.21-17.10) P<0.0001
	P<0.0001 X^2 for linearity =119.729	*adjusted for State/Territories

Figure 1: Mean age compared with proportion of MRSA in participating institutions

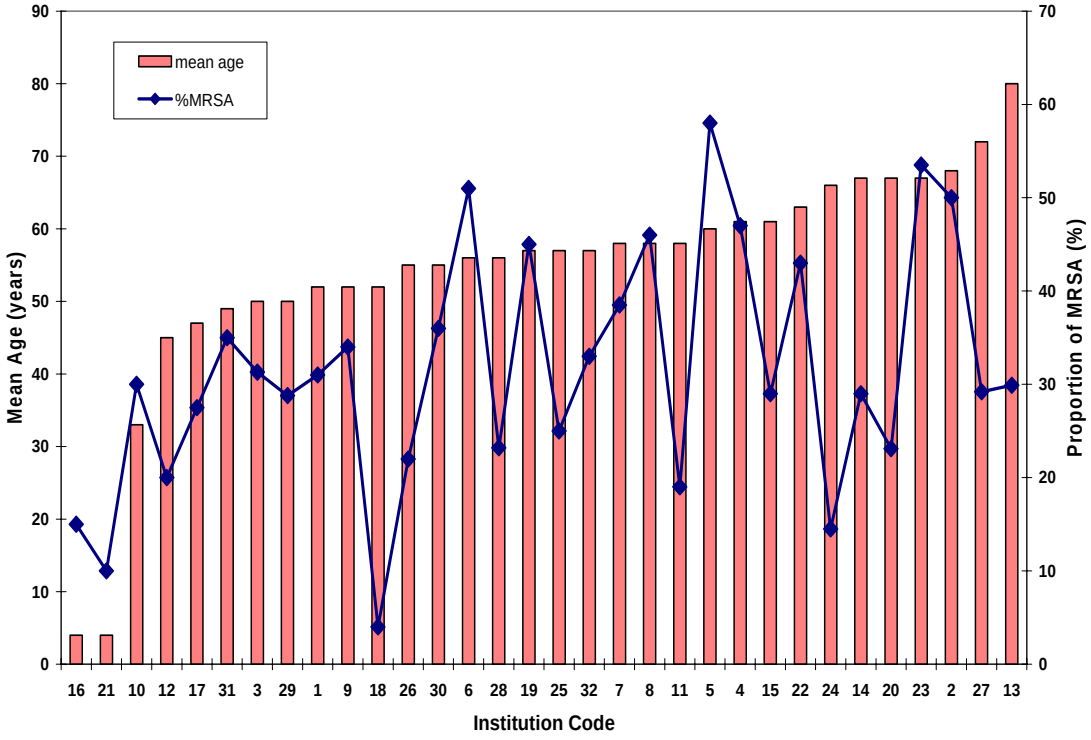
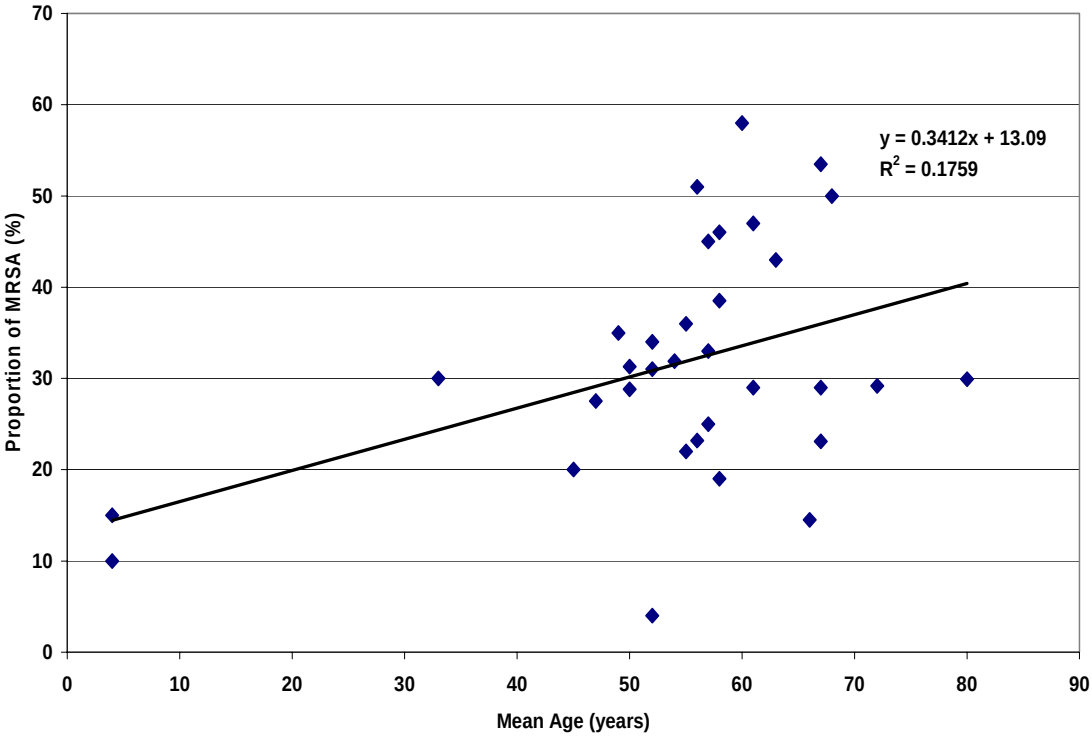


Figure 2: Relationship of mean age and proportion of MRSA for 32 institutions



7 Discussion

Surveys conducted by AGAR from 1986 to 1999 included all consecutive clinical isolates of *S. aureus* during the survey period regardless of acquisition[3, 7, 19]. Participating laboratories did not need to acquire any additional information to distinguish between inpatients and outpatients and so an overall MRSA prevalence was derived. Compliance with methodology was a potential issue particularly in the early days of the surveys but this simple data collection was reliably achieved. It also allowed for comparison of results over a prolonged period. The advent of community strains of MRSA during the 1990s[20, 21] led to interest in studying the prevalence of MRSA in outpatient infections alone. AGAR responded by conducting biennial outpatient surveys from 2000 onwards[9, 22]. Since then evidence has emerged that strains that initially were acquired almost exclusively in the community were now being acquired in the healthcare setting with increasing frequency[23]. Therefore, in 2005 a survey of hospital-acquired *S. aureus* infection was undertaken. The results provide us with the first accurate estimates at a national level of the proportion of hospital-acquired *S. aureus* infection that are due to MRSA.

In the 2005 survey 2908 isolates were collected in 32 laboratories covering all states and territories. Overall, 31.9% of isolates were MRSA. While there was a significant difference in proportion of MRSA between regions (from 22.5% in WA to 43.4% in NSW), this may have been due to different age distributions. The overall proportion of MRSA in invasive (mainly bacteraemia) isolates was similar to that of non-invasive isolates (35.7% and 31.6% respectively, p=0.195). The high proportion of MRSA in invasive isolates is of concern as MRSA bacteraemia is associated with increased mortality compared with MSSA[17, 18, 24]. Direct comparison with prevalence in other countries is difficult due to methodological differences. For example, the European surveillance system reports the proportion of MRSA in bacteraemia isolates in both inpatients and outpatients in 23 countries[25]. Even so, the overall proportion in Europe in 2005 varied from only 1.7% in Denmark to 55% in Malta. The Netherlands and the Scandinavian countries have been consistently able to keep MRSA at very low levels in their hospitals over long periods.

Resistance to non-beta-lactams in MRSA was common for erythromycin, clindamycin, tetracycline, cotrimoxazole, ciprofloxacin and gentamicin and varied considerably from region to region. This regional variability is due to the differential distribution of MRSA strains in the major cities. For example, ST239-MRSA-III (AUS-2 and AUS-3 strains), which is resistant to multiple non-beta-lactams including gentamicin, erythromycin and tetracycline, is endemic in the eastern states but is less common in Western Australia and South Australia. ST22-MRSA-IV (UK EMRSA-15), which is resistant to ciprofloxacin and often erythromycin but susceptible to all other non-beta-lactams, is more common in Western Australia as are other non-multiresistant strains[9, 22]. The lack of resistance to quinupristin/dalfopristin (one resistant isolate only detected) is in keeping with the low usage of this antibiotic. Resistance of MSSA to non-beta-lactam antimicrobials was uncommon except for erythromycin. There was little variability between regions in the low levels of resistance to other agents, with the exception of tetracycline and gentamicin. Once again this may be due to regional variations in the prevalence of strains of MSSA carrying different combinations of resistance genes.

The proportion of MRSA isolates varied between institutions from 4.0% to 58.0%. This is a cause for concern given the increased mortality, morbidity and cost associated with MRSA infection[18, 26]. While it is generally accepted that the prevalence of MRSA in an institution reflects the effectiveness of infection control practice [27], it is also true that age is a risk factor for MRSA infection[24]. Analysis of the 2005 survey data confirmed that risk of MRSA does increase significantly with age (p<0.0001). There was also a weak association between mean age and proportion of MRSA in institutions. The weakness of the association may have been due at least in part to the low sample size resulting in variability in the mean age. Equally other factors such as variability in activity, acuity and infection control practice may also have contributed. Given the marked variability in prevalence between institutions it seems unlikely that mean age alone could explain the difference. The possibility of controlling MRSA in the healthcare setting was demonstrated quite early in Australia[8]. There is now ample and consistent evidence that infection

control strategies based on screening, isolation and decolonisation are successful and highly cost effective[18].

8 References

1 Smith IM, Vickers AB. Natural history of 338 treated and untreated patients with staphylococcal septicaemia (1936-1955). *Lancet* 1960;1:1318-22.

2 Collignon P, Nimmo GR, Gottlieb T, Gosbell IB. *Staphylococcus aureus* bacteraemia, Australia. *Emerg Infect Dis* 2005;11(4):554-61.

3 Nimmo GR, Bell JM, Mitchell D, Gosbell IB, Pearman JW, Turnidge JD. Antimicrobial resistance in *Staphylococcus aureus* in Australian teaching hospitals 1989-1999. *Microbial Drug Resistance* 2003;9:155-60.

4 Rountree PM, Beard MA. Hospital strains of *Staphylococcus aureus* with particular reference to methicillin-resistant strains. *Med J Aust* 1968;2(26):1163-8.

5 Pavillard R, Harvey K, Douglas D, et al. Epidemic of hospital-acquired infection due to methicillin-resistant *Staphylococcus aureus* in major Victorian hospitals. *Med J Aust* 1982;1(11):451-4.

6 Perceval A, McLean AJ, Wellington CV. Emergence of gentamicin resistance in *Staphylococcus aureus*. *Med J Aust* 1976;2:74.

7 Turnidge JD, Nimmo GR, Francis G. Evolution of resistance in *Staphylococcus aureus* in Australian teaching hospitals. *Med J Aust* 1996;164:68-71.

8 Pearman JW, Christiansen KJ, Annear DI, et al. Control of methicillin-resistant *Staphylococcus aureus* (MRSA) in an Australian metropolitan teaching hospital complex. *Med J Aust* 1985;142(2):103-8.

9 Coombs GW, Nimmo GR, Bell JM, et al. Community methicillin-resistant *Staphylococcus aureus* in Australia: genetic diversity in strains causing outpatient infections. *J Clin Microbiol* 2004;42(10):4735-43.

10 Chambers HF, Miller RT, Newman MD. Right-sided *Staphylococcus aureus* endocarditis in intravenous drug abusers: two-week combination therapy. *Ann Intern Med* 1988;109(8):619-24.

11 Levine DP, Fromm BS, Reddy BR. Slow response to vancomycin or vancomycin plus rifampin in methicillin-resistant *Staphylococcus aureus* endocarditis. *Ann Intern Med* 1991;115(9):674-80.

12 Hiramatsu K, Aritaka N, Hanaki H, et al. Dissemination in Japanese hospitals of strains of *Staphylococcus aureus* heterogeneously resistant to vancomycin. *Lancet* 1997;350:1670-3.

13 Hiramatsu K, Hanaki H, Ino T, Yabuta K, Oguri T, Tenover FC. Methicillin-resistant *Staphylococcus aureus* clinical strain with reduced vancomycin susceptibility. *J Antimicrob Chemother* 1997;40:135-6.

14 Ward PB, Johnson PDR, Grabsch EA, Mayall BC, Grayson ML. Treatment failure due to methicillin-resistant *Staphylococcus aureus* (MRSA) with reduced susceptibility to vancomycin. *Med J Aust* 2001;175:480-3.

15 Sakoulas G, Moise-Broder PA, Schentag J, Forrest A, Moellering RC, Jr., Eliopoulos GM. Relationship of MIC and bactericidal activity to efficacy of vancomycin for treatment of methicillin-resistant *Staphylococcus aureus* bacteremia. *J Clin Microbiol* 2004;42(6):2398-402.

16 Meka VG, Pillai SK, Sakoulas G, et al. Linezolid resistance in sequential *Staphylococcus aureus* isolates associated with a T2500A mutation in the 23S rRNA gene and loss of a single copy of rRNA. *J Infect Dis* 2004;190(2):311-7.

17 Whitby M, McLaws ML, Berry G. Risk of death from methicillin-resistant *Staphylococcus aureus* bacteraemia: a meta-analysis. *Med J Aust* 2001;175:264-7.

18 Gould IM. Costs of hospital-acquired methicillin-resistant *Staphylococcus aureus* (MRSA) and its control. *Int J Antimicrob Agents* 2006;28(5):379-84.

19 Turnidge J, Lawson P, Munro R, Benn R. A national survey of antimicrobial resistance in *Staphylococcus aureus* in Australian teaching hospitals. *Med J Aust* 1989;150:65-72.

20 Collignon P, Gosbell I, Vickery A, Nimmo G, Stylianopoulos T, Gottlieb T. Community-acquired meticillin-resistant *Staphylococcus aureus* in Australia. *Lancet* 1998;352:146-7.

21 Riley TV, Pearman JW, Rouse IL. Changing epidemiology of methicillin-resistant *Staphylococcus aureus* in Western Australia. *Med J Aust* 1995;163:412-4.

22 Nimmo GR, Coombs GW, Pearson JC, et al. MRSA in the Australian community: an evolving epidemic. *Med J Aust* 2006;184:384-8.

23 David MD, Kearns AM, Gossain S, Ganner M, Holmes A. Community-associated meticillin-resistant *Staphylococcus aureus*: nosocomial transmission in a neonatal unit. *J Hosp Infect* 2006;64(3):244-50.

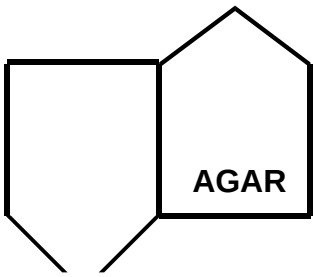
24 Doebbeling BN. The epidemiology of methicillin-resistant *Staphylococcus aureus* colonisation and infection. *J Chemother* 1995;7 Suppl 3:99-103.

25 EARSS interactive database. RIVM, 2005. http://www.rivm.nl/earss/database/ Accessed 9 February, 2007.

26 Cosgrove SE. The relationship between antimicrobial resistance and patient outcomes: mortality, length of hospital stay, and health care costs. *Clin Infect Dis* 2006;42 Suppl 2:S82-9.

27 Herwaldt LA. Control of methicillin-resistant *Staphylococcus aureus* in the hospital setting. *Am J Med* 1999;106(5A):11S-8S; discussion 48S-52S.

Appendix 1: Susceptibility Data by Region and Laboratory



The Australian Group on Antimicrobial Resistance

Staphylococcus Awareness Program

Final Data

Survey 21 - November 2005

Staphylococcus aureus **- number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
QLD/NT																
10	100	98 (100)	31 (100)	0 (100)	0 (100)	0 (100)	4 (100)	14 (100)	35 (100)	6 (100)	10 (100)	11 (100)	10 (100)	2 (100)	0 (100)	0 (100)
		98.0%	*31.0%*	*0%*	*0%*	*0%*	*4.0%*	*14.0%*	*35.0%*	*6.0%*	*10.0%*	*11.0%*	*10.0%*	*2.0%*	*0%*	*0%*
11	100	84 (100)	20 (100)	0 (100)	0 (100)	4 (100)	1 (100)	10 (100)	20 (100)	7 (100)	10 (100)	11 (100)	17 (100)	0 (100)	0 (100)	0 (100)
		84.0%	*20.0%*	*0%*	*0%*	*4.0%*	*1.0%*	*10.0%*	*20.0%*	*7.0%*	*10.0%*	*11.0%*	*17.0%*	*0%*	*0%*	*0%*
12	98	88 (98)	20 (98)	0 (98)	0 (98)	3 (98)	4 (98)	12 (98)	22 (98)	7 (98)	13 (98)	12 (98))	12 (98)	5 (98)	0 (98)	0 (98)
		89.8%	*20.4%*	*0%*	*0%*	*3.1%*	*4.1%*	*12.2%*	*22.4%*	*7.1%*	*13.3%*	*12.2%*	*12.2%*	*5.1%*	*0%*	*0%*
13	87	79 (87)	26 (87)	0 (87)	0 (87)	2 (87)	3 (87)	14 (87)	26 (87)	11 (87)	15 (87)	9 (87))	19 (87)	0 (87)	0 (87)	0 (87)
		90.8%	*29.9%*	*0%*	*0%*	*2.3%*	*3.4%*	*16.1%*	*29.9%*	*12.6%*	*17.2%*	*10.3%*	*21.8%*	*0%*	*0%*	*0%*
28	99	88 (99)	23 (99)	0 (99)	0 (99)	2 (99)	7 (99)	15 (99)	25 (99)	12 (99)	18 (99)	13 (99))	18 (99)	0 (99)	0 (99)	0 (99)
		88.9%	*23.2%*	*0%*	*0%*	*2.0%*	*7.1%*	*15.2%*	*25.3%*	*12.1%*	*18.2%*	*13.1%*	*18.2%*	*0%*	*0%*	*0%*
29	80	72 (80)	23 (80)	0 (80)	0 (80)	0 (80)	4 (80)	8 (80)	22 (80)	5 (80)	8 (80)	7 (80))	10 (80)	1 (80)	0 (80)	0 (80)
		90.0%	*28.8%*	*0%*	*0%*	*0%*	*5.0%*	*10.0%*	*27.5%*	*6.3%*	*10.0%*	*8.8%*	*12.5%*	*1.3%*	*0%*	*0%*
30	100	84 (100)	34 (100)	0 (100)	0 (100)	20 (100)	5 (100)	30 (100)	42 (100)	28 (100)	13 (100)	31 (100)	33 (100)	1 (100)	0 (100)	0 (100)
		84.0%	*34.0%*	*0%*	*0%*	*20.0%*	*5.0%*	*30.0%*	*42.0%*	*28.0%*	*13.0%*	*31.0%*	*33.0%*	*1.0%*	*0%*	*0%*
Total	*664*	*593*	*177*	*0*	*0*	*31*	*28*	*103*	*192*	*76*	*87*	*94*	*119*	*9*	*0*	*0*
		89.3%	*26.7%*	*0%*	*0%*	*4.7%*	*4.2%*	*15.5%*	*28.9%*	*11.4%*	*13.1%*	*14.2%*	*17.9%*	*1.4%*	*0%*	*0%*

Staphylococcus aureus **- number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
ACT/NSW																
1	100	92 (100)	31 (100)	0 (100)	0 (100)	1 (100)	1 (100)	26 (100)	38 (100)	24 (100)	29 (100)	30 (100)	34 (100)	0 (100)	0 (100)	0 (100)
		92.0%	*31.0%*	*0%*	*0%*	*1.0%*	*1.0%*	*26.0%*	*38.0%*	*24.0%*	*29.0%*	*30.0%*	*34.0%*	*0%*	*0%*	*0%*
2	100	87 (100)	49 (100)	0 (100)	0 (100)	0 (100)	4 (100)	32 (100)	50 (99)	34 (83)	33 (100)	35 (100)	50 (100)	3 (100)	0 (99)	0 (100)
		87.0%	*49.0%*	*0%*	*0%*	*0%*	*4.0%*	*32.0%*	*50.5%*	*41.0%*	*33.0%*	*35.0%*	*50.0%*	*3.0%*	*0%*	*0%*
3	99	93 (99)	32 (99)	0 (99)	0 (99)	0 (99)	4 (99)	17 (99)	29 (99)	9 (83)	18 (99)	17 (99))	26 (99)	4 (99)	0 (99)	0 (99)
		93.9%	*32.3%*	*0%*	*0%*	*0%*	*4.0%*	*17.2%*	*29.3%*	*10.8%*	*18.2%*	*17.2%*	*26.3%*	*4.0%*	*0%*	*0%*
4	100	95 (100)	47 (100)	1 (100)	0 (100)	0 (100)	2 (100)	36 (100)	51 (100)	16 (68)	38 (100)	38 (100)	46 (100)	1 (100)	0 (100)	0 (100)
		95.0%	*47.0%*	*1.0%*	*0%*	*0%*	*2.0%*	*36.0%*	*51.0%*	*23.5%*	*38.0%*	*38.0%*	*46.0%*	*1.0%*	*0%*	*0%*
5	100	92 (100)	58 (100)	0 (100)	0 (100)	3 (100)	1 (100)	52 (100)	57 (100)	41 (100)	50 (100)	53 (100)	58 (100)	1 (100)	0 (100)	0 (100)
		92.0%	*58.0%*	*0%*	*0%*	*3.0%*	*1.0%*	*52.0%*	*57.0%*	*41.0%*	*50.0%*	*53.0%*	*58.0%*	*1.0%*	*0%*	*0%*
6	100	97 (100)	51 (100)	0 (100)	0 (100)	1 (100)	3 (100)	35 (100)	45 (100)	28 (100)	36 (100)	35 (100)	46 (100)	2 (100)	0 (100)	0 (100)
		97.0%	*51.0%*	*0%*	*0%*	*1.0%*	*3.0%*	*35.0%*	*45.0%*	*28.0%*	*36.0%*	*35.0%*	*46.0%*	*2.0%*	*0%*	*0%*
7	26	23 (26)	10 (26)	0 (26)	0 (26)	0 (26)	1 (26)	8 (26)	14 (26)	1 (26)	8 (26)	6 (26))	9 (26)	1 (26)	0 (26)	0 (26)
		88.5%	*38.5%*	*0%*	*0%*	*0%*	*3.8%*	*30.8%*	*53.8%*	*3.8%*	*30.8%*	*23.1%*	*34.6%*	*3.8%*	*0%*	*0%*
8	100	92 (100)	45 (100)	0 (100)	0 (100)	0 (100)	3 (100)	30 (100)	50 (100)	33 (83)	32 (100)	31 (100)	47 (100)	0 (100)	0 (100)	0 (100)
		92.0%	*45.0%*	*0%*	*0%*	*0%*	*3.0%*	*30.0%*	*50.0%*	*39.8%*	*32.0%*	*31.0%*	*47.0%*	*0%*	*0%*	*0%*
9	100	91 (100)	35 (100)	0 (100)	0 (100)	1 (100)	7 (100)	19 (100)	35 (100)	15 (86)	20 (100)	18 (100)	22 (99)	4 (100)	0 (100)	0 (100)
		91.0%	*35.0%*	*0%*	*0%*	*1.0%*	*7.0%*	*19.0%*	*35.0%*	*17.4%*	*20.0%*	*18.0%*	*22.2%*	*4.0%*	*0%*	*0%*
Total	*825*	*762*	*358*	*1*	*0*	*6*	*26*	*255*	*369*	*201*	*264*	*263*	*338*	*16*	*0*	*0*
		92.4%	*43.4%*	*0.1%*	*0%*	*0.7%*	*3.2%*	*30.9%*	*44.7%*	*24.4%*	*32.0%*	*31.9%*	*41.0%*	*1.9%*	*0%*	*0%*

Staphylococcus aureus **- number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
VIC/TAS																
18	99	80 (99)	4 (99)	0 (99)	0 (99)	0 (99)	5 (99)	3 (99)	14 (99)	4 (99)	11 (99)	5 (99))	6 (99)	0 (99)	0 (99)	0 (99)
		80.8%	*4.0%*	*0%*	*0%*	*0%*	*5.1%*	*3.0%*	*14.1%*	*4.0%*	*11.1%*	*5.1%*	*6.1%*	*0%*	*0%*	*0%*
19	100	94 (100)	45 (100)	0 (100)	0 (100)	2 (100)	3 (100)	43 (100)	48 (100)	22 (100)	46 (100)	40 (100)	44 (100)	0 (100)	0 (100)	0 (100)
		94.0%	*45.0%*	*0%*	*0%*	*2.0%*	*3.0%*	*43.0%*	*48.0%*	*22.0%*	*46.0%*	*40.0%*	*44.0%*	*0%*	*0%*	*0%*
20	26	20 (26)	6 (26)	0 (26)	0 (26)	0 (26)	0 (26)	1 (26)	3 (26)	1 (26)	2 (26)	1 (26))	2 (26)	0 (26)	0 (26)	0 (26)
		76.9%	*23.1%*	*0%*	*0%*	*0%*	*0%*	*3.8%*	*11.5%*	*3.8%*	*7.7%*	*3.8%*	*7.7%*	*0%*	*0%*	*0%*
21	100	81 (99)	9 (99)	0 (99)	0 (99)	0 (99)	3 (99)	15 (99)	17 (99)	4 (99)	5 (99)	6 (99))	5 (100)	1 (100)	0 (99)	0 (98)
		81.8%	*9.1%*	*0%*	*0%*	*0%*	*3.0%*	*15.2%*	*17.2%*	*4.0%*	*5.1%*	*6.1%*	*5.0%*	*1.0%*	*0%*	*0%*
22	100	92 (100)	42 (100)	0 (100)	0 (100)	3 (100)	2 (100)	35 (100)	49 (100)	22 (100)	39 (100)	37 (100)	38 (100)	1 (100)	1 (100)	0 (100)
		92.0%	*42.0%*	*0%*	*0%*	*3.0%*	*2.0%*	*35.0%*	*49.0%*	*22.0%*	*39.0%*	*37.0%*	*38.0%*	*1.0%*	*1.0%*	*0%*
23	99	92 (99)	54 (99)	0 (99)	0 (99)	1 (99)	4 (99)	44 (99)	56 (99)	7 (99)	51 (99)	47 (99))	48 (99)	1 (99)	0 (99)	0 (99)
		92.9%	*54.5%*	*0%*	*0%*	*1.0%*	*4.0%*	*44.4%*	*56.6%*	*7.1%*	*51.5%*	*47.5%*	*48.5%*	*1.0%*	*0%*	*0%*
31	100	88 (100)	36 (100)	0 (100)	0 (100)	1 (100)	2 (100)	29 (100)	43 (100)	18 (100)	32 (100)	29 (100)	35 (100)	6 (100)	0 (100)	0 (100)
		88.0%	*36.0%*	*0%*	*0%*	*1.0%*	*2.0%*	*29.0%*	*43.0%*	*18.0%*	*32.0%*	*29.0%*	*35.0%*	*6.0%*	*0%*	*0%*
32	100	87 (100)	33 (100)	0 (100)	0 (100)	1 (100)	3 (100)	27 (100)	42 (100)	24 (100)	28 (100)	27 (100)	33 (100)	3 (100)	0 (100)	0 (100)
		87.0%	*33.0%*	*0%*	*0%*	*1.0%*	*3.0%*	*27.0%*	*42.0%*	*24.0%*	*28.0%*	*27.0%*	*33.0%*	*3.0%*	*0%*	*0%*
Total	*724*	*634*	*229*	*0*	*0*	*8*	*22*	*197*	*272*	*102*	*214*	*192*	*211*	*12*	*1*	*0*
		87.6%	*31.6%*	*0%*	*0%*	*1.1%*	*3.0%*	*27.2%*	*37.6%*	*14.1%*	*29.6%*	*26.5%*	*29.1%*	*1.7%*	*0.1%*	*0%*

AGAR Staphylococcus Survey 21 (November 2005 Hospital Survey)

Staphylococcus aureus **- number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
SA																
14	100	86 (100)	28 (100)	0 (100)	0 (100)	6 (100)	6 (100)	13 (100)	24 (100)	6 (100)	18 (100)	12 (100)	21 (100)	1 (100)	0 (100)	0 (100)
		86.0%	*28.0%*	*0%*	*0%*	*6.0%*	*6.0%*	*13.0%*	*24.0%*	*6.0%*	*18.0%*	*12.0%*	*21.0%*	*1.0%*	*0%*	*0%*
15	100	91 (100)	29 (100)	0 (100)	0 (100)	0 (100)	6 (100)	13 (100)	31 (100)	2 (100)	13 (100)	13 (100)	22 (100)	1 (100)	0 (100)	0 (100)
		91.0%	*29.0%*	*0%*	*0%*	*0%*	*6.0%*	*13.0%*	*31.0%*	*2.0%*	*13.0%*	*13.0%*	*22.0%*	*1.0%*	*0%*	*0%*
16	100	87 (100)	15 (100)	0 (100)	0 (100)	0 (100)	4 (100)	2 (100)	11 (100)	2 (100)	4 (100)	3 (100)	6 (100)	1 (100)	0 (100)	0 (100)
		87.0%	*15.0%*	*0%*	*0%*	*0%*	*4.0%*	*2.0%*	*11.0%*	*2.0%*	*4.0%*	*3.0%*	*6.0%*	*1.0%*	*0%*	*0%*
17	40	38 (40)	10 (40)	0 (40)	0 (40)	0 (40)	1 (40)	2 (40)	7 (40)	0 (40)	2 (40)	2 (40))	3 (40)	0 (40)	0 (40)	0 (40)
		95.0%	*25.0%*	*0%*	*0%*	*0%*	*2.5%*	*5.0%*	*17.5%*	*0%*	*5.0%*	*5.0%*	*7.5%*	*0%*	*0%*	*0%*
Total	*340*	*302*	*82*	*0*	*0*	*6*	*17*	*30*	*73*	*10*	*37*	*30*	*52*	*3*	*0*	*0*
		88.8%	*24.1%*	*0%*	*0%*	*1.8%*	*5.0%*	*8.8%*	*21.5%*	*2.9%*	*10.9%*	*8.8%*	*15.3%*	*0.9%*	*0%*	*0%*

Staphylococcus aureus **- number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
WA																
24	83	74 (83)	13 (83)	0 (83)	0 (83)	0 (83)	6 (83)	1 (83)	11 (83)	0 (83)	1 (83)	2 (83))	1 (83)	1 (83)	0 (83)	0 (83)
		89.2%	*15.7%*	*0%*	*0%*	*0%*	*7.2%*	*1.2%*	*13.3%*	*0%*	*1.2%*	*2.4%*	*1.2%*	*1.2%*	*0%*	*0%*
25	100	89 (100)	25 (100)	0 (100)	0 (100)	0 (100)	3 (100)	1 (100)	22 (100)	10 (100)	1 (100)	3 (100)	17 (100)	2 (100)	0 (100)	0 (100)
		89.0%	*25.0%*	*0%*	*0%*	*0%*	*3.0%*	*1.0%*	*22.0%*	*10.0%*	*1.0%*	*3.0%*	*17.0%*	*2.0%*	*0%*	*0%*
26	100	92 (100)	22 (100)	0 (100)	0 (100)	1 (100)	5 (100)	2 (100)	20 (100)	2 (100)	3 (100)	2 (100)	12 (100)	1 (100)	0 (100)	0 (100)
		92.0%	*22.0%*	*0%*	*0%*	*1.0%*	*5.0%*	*2.0%*	*20.0%*	*2.0%*	*3.0%*	*2.0%*	*12.0%*	*1.0%*	*0%*	*0%*
27	72	66 (72)	21 (72)	0 (72)	0 (72)	0 (72)	4 (72)	1 (72)	14 (72)	0 (72)	0 (72)	1 (72))	10 (72)	0 (72)	0 (72)	0 (72)
		91.7%	*29.2%*	*0%*	*0%*	*0%*	*5.6%*	*1.4%*	*19.4%*	*0%*	*0%*	*1.4%*	*13.9%*	*0%*	*0%*	*0%*
Total	*355*	*321*	*81*	*0*	*0*	*1*	*18*	*5*	*67*	*12*	*5*	*8*	*40*	*4*	*0*	*0*
		90.4%	*22.8%*	*0%*	*0%*	*0.3%*	*5.1%*	*1.4%*	*18.9%*	*3.4%*	*1.4%*	*2.3%*	*11.3%*	*1.1%*	*0%*	*0%*
AUSTRALIA																
Total	*2,908*	*2,612*	*927*	*1*	*0*	*52*	*111*	*590*	*973*	*401*	*607*	*587*	*760*	*44*	*1*	*0*
		89.8%	*31.9%*	*0.0%*	*0%*	*1.8%*	*3.8%*	*20.3%*	*33.5%*	*13.8%*	*20.9%*	*20.2%*	*26.1%*	*1.5%*	*0.0%*	*0%*

Staphylococcus aureus **- cefoxitin susceptible: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
QLD/NT																
10	70	68 (70)	2 (70)	0 (70)	0 (70)	0 (70)	2 (70)	1 (70)	19 (70)	0 (70)	0 (70)	0 (70)	1 (70)	0 (70)	0 (70)	0 (70)
		97.1%	*2.9%*	*0%*	*0%*	*0%*	*2.9%*	*1.4%*	*27.1%*	*0%*	*0%*	*0%*	*1.4%*	*0%*	*0%*	*0%*
11	81	65 (81)	1 (81)	0 (81)	0 (81)	0 (81)	1 (81)	0 (81)	7 (81)	1 (81)	0 (81)	1 (81)	1 (81)	0 (81)	0 (81)	0 (81)
		80.2%	*1.2%*	*0%*	*0%*	*0%*	*1.2%*	*0%*	*8.6%*	*1.2%*	*0%*	*1.2%*	*1.2%*	*0%*	*0%*	*0%*
12	78	68 (78)	0 (78)	0 (78)	0 (78)	0 (78)	2 (78)	1 (78)	10 (78)	0 (78)	1 (78)	0 (78)	1 (78)	3 (78)	0 (78)	0 (78)
		87.2%	*0%*	*0%*	*0%*	*0%*	*2.6%*	*1.3%*	*12.8%*	*0%*	*1.3%*	*0%*	*1.3%*	*3.8%*	*0%*	*0%*
13	61	53 (61)	0 (61)	0 (61)	0 (61)	0 (61)	2 (61)	1 (61)	5 (61)	0 (61)	2 (61)	1 (61)	2 (61)	0 (61)	0 (61)	0 (61)
		86.9%	*0%*	*0%*	*0%*	*0%*	*3.3%*	*1.6%*	*8.2%*	*0%*	*3.3%*	*1.6%*	*3.3%*	*0%*	*0%*	*0%*
28	76	65 (76)	0 (76)	0 (76)	0 (76)	0 (76)	5 (76)	0 (76)	5 (76)	0 (76)	1 (76)	0 (76)	2 (76)	0 (76)	0 (76)	0 (76)
		85.5%	*0%*	*0%*	*0%*	*0%*	*6.6%*	*0%*	*6.6%*	*0%*	*1.3%*	*0%*	*2.6%*	*0%*	*0%*	*0%*
29	57	49 (57)	0 (57)	0 (57)	0 (57)	0 (57)	3 (57)	1 (57)	9 (57)	1 (57)	1 (57)	0 (57)	0 (57)	1 (57)	0 (57)	0 (57)
		86.0%	*0%*	*0%*	*0%*	*0%*	*5.3%*	*1.8%*	*15.8%*	*1.8%*	*1.8%*	*0%*	*0%*	*1.8%*	*0%*	*0%*
30	64	48 (64)	0 (64)	0 (64)	0 (64)	0 (64)	3 (64)	1 (64)	8 (64)	0 (64)	3 (64)	1 (64)	1 (64)	1 (64)	0 (64)	0 (64)
		75.0%	*0%*	*0%*	*0%*	*0%*	*4.7%*	*1.6%*	*12.5%*	*0%*	*4.7%*	*1.6%*	*1.6%*	*1.6%*	*0%*	*0%*
Total	*487*	*416*	*3*	*0*	*0*	*0*	*18*	*5*	*63*	*2*	*8*	*3*	*8*	*5*	*0*	*0*
		85.4%	*0.6%*	*0%*	*0%*	*0%*	*3.7%*	*1.0%*	*12.9%*	*0.4%*	*1.6%*	*0.6%*	*1.6%*	*1.0%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin susceptible: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
ACT/NSW																
1	69	61 (69)	0 (69)	0 (69)	0 (69)	1 (69)	1 (69)	0 (69)	11 (69)	1 (69)	3 (69)	4 (69)	5 (69)	0 (69)	0 (69)	0 (69)
		88.4%	*0%*	*0%*	*0%*	*1.4%*	*1.4%*	*0%*	*15.9%*	*1.4%*	*4.3%*	*5.8%*	*7.2%*	*0%*	*0%*	*0%*
2	50	38 (50)	1 (50)	0 (50)	0 (50)	0 (50)	2 (50)	1 (50)	5 (50)	2 (47)	2 (50)	2 (50)	2 (50)	0 (50)	0 (50)	0 (50)
		76.0%	*2.0%*	*0%*	*0%*	*0%*	*4.0%*	*2.0%*	*10.0%*	*4.3%*	*4.0%*	*4.0%*	*4.0%*	*0%*	*0%*	*0%*
3	68	62 (68)	1 (68)	0 (68)	0 (68)	0 (68)	3 (68)	1 (68)	7 (68)	0 (64)	4 (68)	2 (68)	2 (68)	2 (68)	0 (68)	0 (68)
		91.2%	*1.5%*	*0%*	*0%*	*0%*	*4.4%*	*1.5%*	*10.3%*	*0%*	*5.9%*	*2.9%*	*2.9%*	*2.9%*	*0%*	*0%*
4	53	48 (53)	0 (53)	0 (53)	0 (53)	0 (53)	1 (53)	1 (53)	5 (53)	0 (51)	3 (53)	1 (53)	1 (53)	0 (53)	0 (53)	0 (53)
		90.6%	*0%*	*0%*	*0%*	*0%*	*1.9%*	*1.9%*	*9.4%*	*0%*	*5.7%*	*1.9%*	*1.9%*	*0%*	*0%*	*0%*
5	42	34 (42)	0 (42)	0 (42)	0 (42)	0 (42)	0 (42)	0 (42)	4 (42)	0 (42)	1 (42)	1 (42)	2 (42)	0 (42)	0 (42)	0 (42)
		81.0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*9.5%*	*0%*	*2.4%*	*2.4%*	*4.8%*	*0%*	*0%*	*0%*
6	49	46 (49)	0 (49)	0 (49)	0 (49)	0 (49)	0 (49)	0 (49)	3 (49)	0 (49)	1 (49)	0 (49)	2 (49)	1 (49)	0 (49)	0 (49)
		93.9%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*6.1%*	*0%*	*2.0%*	*0%*	*4.1%*	*2.0%*	*0%*	*0%*
7	16	13 (16)	0 (16)	0 (16)	0 (16)	0 (16)	1 (16)	0 (16)	6 (16)	0 (16)	0 (16)	0 (16)	0 (16)	0 (16)	0 (16)	0 (16)
		81.3%	*0%*	*0%*	*0%*	*0%*	*6.3%*	*0%*	*37.5%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
8	54	46 (54)	1 (54)	0 (54)	0 (54)	0 (54)	2 (54)	1 (54)	9 (54)	3 (48)	1 (54)	1 (54)	3 (54)	0 (54)	0 (54)	0 (54)
		85.2%	*1.9%*	*0%*	*0%*	*0%*	*3.7%*	*1.9%*	*16.7%*	*6.3%*	*1.9%*	*1.9%*	*5.6%*	*0%*	*0%*	*0%*
9	66	57 (66)	1 (66)	0 (66)	0 (66)	0 (66)	3 (66)	1 (66)	10 (66)	2 (62)	2 (66)	1 (66)	1 (65)	1 (66)	0 (66)	0 (66)
		86.4%	*1.5%*	*0%*	*0%*	*0%*	*4.5%*	*1.5%*	*15.2%*	*3.2%*	*3.0%*	*1.5%*	*1.5%*	*1.5%*	*0%*	*0%*
Total	*467*	*405*	*4*	*0*	*0*	*1*	*13*	*5*	*60*	*8*	*17*	*12*	*18*	*4*	*0*	*0*
		86.7%	*0.9%*	*0%*	*0%*	*0.2%*	*2.8%*	*1.1%*	*12.8%*	*1.7%*	*3.6%*	*2.6%*	*3.9%*	*0.9%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin susceptible: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
VIC/TAS																
18	95	76 (95)	0 (95)	0 (95)	0 (95)	0 (95)	5 (95)	0 (95)	10 (95)	0 (95)	7 (95)	1 (95)	2 (95)	0 (95)	0 (95)	0 (95)
		80.0%	*0%*	*0%*	*0%*	*0%*	*5.3%*	*0%*	*10.5%*	*0%*	*7.4%*	*1.1%*	*2.1%*	*0%*	*0%*	*0%*
19	55	49 (55)	0 (55)	0 (55)	0 (55)	0 (55)	2 (55)	2 (55)	6 (55)	0 (55)	4 (55)	1 (55)	2 (55)	0 (55)	0 (55)	0 (55)
		89.1%	*0%*	*0%*	*0%*	*0%*	*3.6%*	*3.6%*	*10.9%*	*0%*	*7.3%*	*1.8%*	*3.6%*	*0%*	*0%*	*0%*
20	20	14 (20)	0 (20)	0 (20)	0 (20)	0 (20)	0 (20)	0 (20)	1 (20)	0 (20)	1 (20)	0 (20)	0 (20)	0 (20)	0 (20)	0 (20)
		70.0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*5.0%*	*0%*	*5.0%*	*0%*	*0%*	*0%*	*0%*	*0%*
21	90	72 (90)	0 (90)	0 (90)	0 (90)	0 (90)	3 (90)	10 (90)	10 (90)	0 (90)	0 (90)	0 (90)	0 (90)	1 (90)	0 (90)	0 (89)
		80.0%	*0%*	*0%*	*0%*	*0%*	*3.3%*	*11.1%*	*11.1%*	*0%*	*0%*	*0%*	*0%*	*1.1%*	*0%*	*0%*
22	57	49 (57)	0 (57)	0 (57)	0 (57)	1 (57)	1 (57)	1 (57)	9 (57)	2 (57)	4 (57)	2 (57)	1 (57)	0 (57)	1 (57)	0 (57)
		86.0%	*0%*	*0%*	*0%*	*1.8%*	*1.8%*	*1.8%*	*15.8%*	*3.5%*	*7.0%*	*3.5%*	*1.8%*	*0%*	*1.8%*	*0%*
23	46	39 (46)	2 (46)	0 (46)	0 (46)	1 (46)	4 (46)	2 (46)	8 (46)	2 (46)	4 (46)	2 (46)	2 (46)	1 (46)	0 (46)	0 (46)
		84.8%	*4.3%*	*0%*	*0%*	*2.2%*	*8.7%*	*4.3%*	*17.4%*	*4.3%*	*8.7%*	*4.3%*	*4.3%*	*2.2%*	*0%*	*0%*
31	65	53 (65)	1 (65)	0 (65)	0 (65)	0 (65)	1 (65)	0 (65)	12 (65)	2 (65)	3 (65)	1 (65)	2 (65)	4 (65)	0 (65)	0 (65)
		81.5%	*1.5%*	*0%*	*0%*	*0%*	*1.5%*	*0%*	*18.5%*	*3.1%*	*4.6%*	*1.5%*	*3.1%*	*6.2%*	*0%*	*0%*
32	67	54 (67)	0 (67)	0 (67)	0 (67)	0 (67)	2 (67)	1 (67)	10 (67)	2 (67)	2 (67)	1 (67)	1 (67)	0 (67)	0 (67)	0 (67)
		80.6%	*0%*	*0%*	*0%*	*0%*	*3.0%*	*1.5%*	*14.9%*	*3.0%*	*3.0%*	*1.5%*	*1.5%*	*0%*	*0%*	*0%*
Total	*495*	*406*	*3*	*0*	*0*	*2*	*18*	*16*	*66*	*8*	*25*	*8*	*10*	*6*	*1*	*0*
		82.0%	*0.6%*	*0%*	*0%*	*0.4%*	*3.6%*	*3.2%*	*13.3%*	*1.6%*	*5.1%*	*1.6%*	*2.0%*	*1.2%*	*0.2%*	*0%*

Staphylococcus aureus **- cefoxitin susceptible: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
SA																
14	71	58 (71)	0 (71)	0 (71)	0 (71)	1 (71)	2 (71)	0 (71)	6 (71)	1 (71)	3 (71)	0 (71)	2 (71)	1 (71)	0 (71)	0 (71)
		81.7%	*0%*	*0%*	*0%*	*1.4%*	*2.8%*	*0%*	*8.5%*	*1.4%*	*4.2%*	*0%*	*2.8%*	*1.4%*	*0%*	*0%*
15	71	62 (71)	0 (71)	0 (71)	0 (71)	0 (71)	4 (71)	1 (71)	8 (71)	1 (71)	1 (71)	1 (71)	2 (71)	0 (71)	0 (71)	0 (71)
		87.3%	*0%*	*0%*	*0%*	*0%*	*5.6%*	*1.4%*	*11.3%*	*1.4%*	*1.4%*	*1.4%*	*2.8%*	*0%*	*0%*	*0%*
16	85	72 (85)	0 (85)	0 (85)	0 (85)	0 (85)	1 (85)	1 (85)	6 (85)	1 (85)	3 (85)	2 (85)	2 (85)	1 (85)	0 (85)	0 (85)
		84.7%	*0%*	*0%*	*0%*	*0%*	*1.2%*	*1.2%*	*7.1%*	*1.2%*	*3.5%*	*2.4%*	*2.4%*	*1.2%*	*0%*	*0%*
17	29	27 (29)	0 (29)	0 (29)	0 (29)	0 (29)	0 (29)	0 (29)	2 (29)	0 (29)	0 (29)	0 (29)	0 (29)	0 (29)	0 (29)	0 (29)
		93.1%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*6.9%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	*256*	*219*	*0*	*0*	*0*	*1*	*7*	*2*	*22*	*3*	*7*	*3*	*6*	*2*	*0*	*0*
		85.5%	*0%*	*0%*	*0%*	*0.4%*	*2.7%*	*0.8%*	*8.6%*	*1.2%*	*2.7%*	*1.2%*	*2.3%*	*0.8%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin susceptible: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
WA																
24	71	62 (71)	1 (71)	0 (71)	0 (71)	0 (71)	5 (71)	1 (71)	5 (71)	0 (71)	0 (71)	1 (71)	0 (71)	1 (71)	0 (71)	0 (71)
		87.3%	*1.4%*	*0%*	*0%*	*0%*	*7.0%*	*1.4%*	*7.0%*	*0%*	*0%*	*1.4%*	*0%*	*1.4%*	*0%*	*0%*
25	75	64 (75)	1 (75)	0 (75)	0 (75)	0 (75)	3 (75)	0 (75)	8 (75)	4 (75)	0 (75)	0 (75)	5 (75)	2 (75)	0 (75)	0 (75)
		85.3%	*1.3%*	*0%*	*0%*	*0%*	*4.0%*	*0%*	*10.7%*	*5.3%*	*0%*	*0%*	*6.7%*	*2.7%*	*0%*	*0%*
26	78	70 (78)	0 (78)	0 (78)	0 (78)	0 (78)	4 (78)	0 (78)	6 (78)	0 (78)	0 (78)	0 (78)	0 (78)	0 (78)	0 (78)	0 (78)
		89.7%	*0%*	*0%*	*0%*	*0%*	*5.1%*	*0%*	*7.7%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
27	51	45 (51)	0 (51)	0 (51)	0 (51)	0 (51)	3 (51)	0 (51)	2 (51)	0 (51)	0 (51)	1 (51)	1 (51)	0 (51)	0 (51)	0 (51)
		88.2%	*0%*	*0%*	*0%*	*0%*	*5.9%*	*0%*	*3.9%*	*0%*	*0%*	*2.0%*	*2.0%*	*0%*	*0%*	*0%*
Total	*275*	*241*	*2*	*0*	*0*	*0*	*15*	*1*	*21*	*4*	*0*	*2*	*6*	*3*	*0*	*0*
		87.6%	*0.7%*	*0%*	*0%*	*0%*	*5.5%*	*0.4%*	*7.6%*	*1.5%*	*0%*	*0.7%*	*2.2%*	*1.1%*	*0%*	*0%*
AUSTRALIA																
Total	*1,980*	*1,687*	*12*	*0*	*0*	*4*	*71*	*29*	*232*	*25*	*57*	*28*	*48*	*20*	*1*	*0*
		85.2%	*0.6%*	*0%*	*0%*	*0.2%*	*3.6%*	*1.5%*	*11.7%*	*1.3%*	*2.9%*	*1.4%*	*2.4%*	*1.0%*	*0.1%*	*0%*

Staphylococcus aureus **- cefoxitin RESISTANT: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
QLD/NT																
10	30	30 (30)	29 (30)	0 (30)	0 (30)	0 (30)	2 (30)	13 (30)	16 (30)	6 (30)	10 (30)	11 (30)	9 (30)	2 (30)	0 (30)	0 (30)
		100%	*96.7%*	*0%*	*0%*	*0%*	*6.7%*	*43.3%*	*53.3%*	*20.0%*	*33.3%*	*36.7%*	*30.0%*	*6.7%*	*0%*	*0%*
11	19	19 (19)	19 (19)	0 (19)	0 (19)	4 (19)	0 (19)	10 (19)	13 (19)	6 (19)	10 (19)	10 (19)	16 (19)	0 (19)	0 (19)	0 (19)
		100%	*100%*	*0%*	*0%*	*21.1%*	*0%*	*52.6%*	*68.4%*	*31.6%*	*52.6%*	*52.6%*	*84.2%*	*0%*	*0%*	*0%*
12	20	20 (20)	20 (20)	0 (20)	0 (20)	3 (20)	2 (20)	11 (20)	12 (20)	7 (20)	12 (20)	12 (20)	11 (20)	2 (20)	0 (20)	0 (20)
		100%	*100%*	*0%*	*0%*	*15.0%*	*10.0%*	*55.0%*	*60.0%*	*35.0%*	*60.0%*	*60.0%*	*55.0%*	*10.0%*	*0%*	*0%*
13	26	26 (26)	26 (26)	0 (26)	0 (26)	2 (26)	1 (26)	13 (26)	21 (26)	11 (26)	13 (26)	8 (26)	17 (26)	0 (26)	0 (26)	0 (26)
		100%	*100%*	*0%*	*0%*	*7.7%*	*3.8%*	*50.0%*	*80.8%*	*42.3%*	*50.0%*	*30.8%*	*65.4%*	*0%*	*0%*	*0%*
28	23	23 (23)	23 (23)	0 (23)	0 (23)	2 (23)	2 (23)	15 (23)	20 (23)	12 (23)	17 (23)	13 (23)	16 (23)	0 (23)	0 (23)	0 (23)
		100%	*100%*	*0%*	*0%*	*8.7%*	*8.7%*	*65.2%*	*87.0%*	*52.2%*	*73.9%*	*56.5%*	*69.6%*	*0%*	*0%*	*0%*
29	23	23 (23)	23 (23)	0 (23)	0 (23)	0 (23)	1 (23)	7 (23)	13 (23)	4 (23)	7 (23)	7 (23)	10 (23)	0 (23)	0 (23)	0 (23)
		100%	*100%*	*0%*	*0%*	*0%*	*4.3%*	*30.4%*	*56.5%*	*17.4%*	*30.4%*	*30.4%*	*43.5%*	*0%*	*0%*	*0%*
30	36	36 (36)	34 (36)	0 (36)	0 (36)	20 (36)	2 (36)	29 (36)	34 (36)	28 (36)	10 (36)	30 (36)	32 (36)	0 (36)	0 (36)	0 (36)
		100%	*94.4%*	*0%*	*0%*	*55.6%*	*5.6%*	*80.6%*	*94.4%*	*77.8%*	*27.8%*	*83.3%*	*88.9%*	*0%*	*0%*	*0%*
Total	*177*	*177*	*174*	*0*	*0*	*31*	*10*	*98*	*129*	*74*	*79*	*91*	*111*	*4*	*0*	*0*
		100%	*98.3%*	*0%*	*0%*	*17.5%*	*5.6%*	*55.4%*	*72.9%*	*41.8%*	*44.6%*	*51.4%*	*62.7%*	*2.3%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin RESISTANT: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
ACT/NSW																
1	31	31 (31)	31 (31)	0 (31)	0 (31)	0 (31)	0 (31)	26 (31)	27 (31)	23 (31)	26 (31)	26 (31)	29 (31)	0 (31)	0 (31)	0 (31)
		100%	*100%*	*0%*	*0%*	*0%*	*0%*	*83.9%*	*87.1%*	*74.2%*	*83.9%*	*83.9%*	*93.5%*	*0%*	*0%*	*0%*
2	50	49 (50)	48 (50)	0 (50)	0 (50)	0 (50)	2 (50)	31 (50)	45 (49)	32 (36)	31 (50)	33 (50)	48 (50)	3 (50)	0 (49)	0 (50)
		98.0%	*96.0%*	*0%*	*0%*	*0%*	*4.0%*	*62.0%*	*91.8%*	*88.9%*	*62.0%*	*66.0%*	*96.0%*	*6.0%*	*0%*	*0%*
3	31	31 (31)	31 (31)	0 (31)	0 (31)	0 (31)	1 (31)	16 (31)	22 (31)	9 (19)	14 (31)	15 (31)	24 (31)	2 (31)	0 (31)	0 (31)
		100%	*100%*	*0%*	*0%*	*0%*	*3.2%*	*51.6%*	*71.0%*	*47.4%*	*45.2%*	*48.4%*	*77.4%*	*6.5%*	*0%*	*0%*
4	47	47 (47)	47 (47)	1 (47)	0 (47)	0 (47)	1 (47)	35 (47)	46 (47)	16 (17)	35 (47)	37 (47)	45 (47)	1 (47)	0 (47)	0 (47)
		100%	*100%*	*2.1%*	*0%*	*0%*	*2.1%*	*74.5%*	*97.9%*	*94.1%*	*74.5%*	*78.7%*	*95.7%*	*2.1%*	*0%*	*0%*
5	58	58 (58)	58 (58)	0 (58)	0 (58)	3 (58)	1 (58)	52 (58)	53 (58)	41 (58)	49 (58)	52 (58)	56 (58)	1 (58)	0 (58)	0 (58)
		100%	*100%*	*0%*	*0%*	*5.2%*	*1.7%*	*89.7%*	*91.4%*	*70.7%*	*84.5%*	*89.7%*	*96.6%*	*1.7%*	*0%*	*0%*
6	51	51 (51)	51 (51)	0 (51)	0 (51)	1 (51)	3 (51)	35 (51)	42 (51)	28 (51)	35 (51)	35 (51)	44 (51)	1 (51)	0 (51)	0 (51)
		100%	*100%*	*0%*	*0%*	*2.0%*	*5.9%*	*68.6%*	*82.4%*	*54.9%*	*68.6%*	*68.6%*	*86.3%*	*2.0%*	*0%*	*0%*
7	10	10 (10)	10 (10)	0 (10)	0 (10)	0 (10)	0 (10)	8 (10)	8 (10)	1 (10)	8 (10)	6 (10)	9 (10)	1 (10)	0 (10)	0 (10)
		100%	*100%*	*0%*	*0%*	*0%*	*0%*	*80.0%*	*80.0%*	*10.0%*	*80.0%*	*60.0%*	*90.0%*	*10.0%*	*0%*	*0%*
8	46	46 (46)	44 (46)	0 (46)	0 (46)	0 (46)	1 (46)	29 (46)	41 (46)	30 (35)	31 (46)	30 (46)	44 (46)	0 (46)	0 (46)	0 (46)
		100%	*95.7%*	*0%*	*0%*	*0%*	*2.2%*	*63.0%*	*89.1%*	*85.7%*	*67.4%*	*65.2%*	*95.7%*	*0%*	*0%*	*0%*
9	34	34 (34)	34 (34)	0 (34)	0 (34)	1 (34)	4 (34)	18 (34)	25 (34)	13 (24)	18 (34)	17 (34)	21 (34)	3 (34)	0 (34)	0 (34)
		100%	*100%*	*0%*	*0%*	*2.9%*	*11.8%*	*52.9%*	*73.5%*	*54.2%*	*52.9%*	*50.0%*	*61.8%*	*8.8%*	*0%*	*0%*
Total	*358*	*357*	*354*	*1*	*0*	*5*	*13*	*250*	*309*	*193*	*247*	*251*	*320*	*12*	*0*	*0*
		99.7%	*98.9%*	*0.3%*	*0%*	*1.4%*	*3.6%*	*69.8%*	*86.3%*	*53.9%*	*69.0%*	*70.1%*	*89.4%*	*3.4%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin RESISTANT: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
VIC/TAS																
18	4	4 (4)	4 (4)	0 (4)	0 (4)	0 (4)	0 (4)	3 (4)	4 (4)	4 (4)	4 (4)	4 (4)	4 (4)	0 (4)	0 (4)	0 (4)
		100%	*100%*	*0%*	*0%*	*0%*	*0%*	*75.0%*	*100%*	*100%*	*100%*	*100%*	*100%*	*0%*	*0%*	*0%*
19	45	45 (45)	45 (45)	0 (45)	0 (45)	2 (45)	1 (45)	41 (45)	42 (45)	22 (45)	42 (45)	39 (45)	42 (45)	0 (45)	0 (45)	0 (45)
		100%	*100%*	*0%*	*0%*	*4.4%*	*2.2%*	*91.1%*	*93.3%*	*48.9%*	*93.3%*	*86.7%*	*93.3%*	*0%*	*0%*	*0%*
20	6	6 (6)	6 (6)	0 (6)	0 (6)	0 (6)	0 (6)	1 (6)	2 (6)	1 (6)	1 (6)	1 (6)	2 (6)	0 (6)	0 (6)	0 (6)
		100%	*100%*	*0%*	*0%*	*0%*	*0%*	*16.7%*	*33.3%*	*16.7%*	*16.7%*	*16.7%*	*33.3%*	*0%*	*0%*	*0%*
21	10	9 (9)	9 (9)	0 (9)	0 (9)	0 (9)	0 (9)	5 (9)	7 (9)	4 (9)	5 (9)	6 (9)	5 (10)	0 (10)	0 (9)	0 (9)
		100%	*100%*	*0%*	*0%*	*0%*	*0%*	*55.6%*	*77.8%*	*44.4%*	*55.6%*	*66.7%*	*50.0%*	*0%*	*0%*	*0%*
22	43	43 (43)	42 (43)	0 (43)	0 (43)	2 (43)	1 (43)	34 (43)	40 (43)	20 (43)	35 (43)	35 (43)	37 (43)	1 (43)	0 (43)	0 (43)
		100%	*97.7%*	*0%*	*0%*	*4.7%*	*2.3%*	*79.1%*	*93.0%*	*46.5%*	*81.4%*	*81.4%*	*86.0%*	*2.3%*	*0%*	*0%*
23	53	53 (53)	52 (53)	0 (53)	0 (53)	0 (53)	0 (53)	42 (53)	48 (53)	5 (53)	47 (53)	45 (53)	46 (53)	0 (53)	0 (53)	0 (53)
		100%	*98.1%*	*0%*	*0%*	*0%*	*0%*	*79.2%*	*90.6%*	*9.4%*	*88.7%*	*84.9%*	*86.8%*	*0%*	*0%*	*0%*
31	35	35 (35)	35 (35)	0 (35)	0 (35)	1 (35)	1 (35)	29 (35)	31 (35)	16 (35)	29 (35)	28 (35)	33 (35)	2 (35)	0 (35)	0 (35)
		100%	*100%*	*0%*	*0%*	*2.9%*	*2.9%*	*82.9%*	*88.6%*	*45.7%*	*82.9%*	*80.0%*	*94.3%*	*5.7%*	*0%*	*0%*
32	33	33 (33)	33 (33)	0 (33)	0 (33)	1 (33)	1 (33)	26 (33)	32 (33)	22 (33)	26 (33)	26 (33)	32 (33)	3 (33)	0 (33)	0 (33)
		100%	*100%*	*0%*	*0%*	*3.0%*	*3.0%*	*78.8%*	*97.0%*	*66.7%*	*78.8%*	*78.8%*	*97.0%*	*9.1%*	*0%*	*0%*
Total	*229*	*228*	*226*	*0*	*0*	*6*	*4*	*181*	*206*	*94*	*189*	*184*	*201*	*6*	*0*	*0*
		99.6%	*98.7%*	*0%*	*0%*	*2.6%*	*1.7%*	*79.0%*	*90.0%*	*41.0%*	*82.5%*	*80.3%*	*87.8%*	*2.6%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin RESISTANT: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
SA																
14	29	28 (29)	28 (29)	0 (29)	0 (29)	5 (29)	4 (29)	13 (29)	18 (29)	5 (29)	15 (29)	12 (29)	19 (29)	0 (29)	0 (29)	0 (29)
		96.6%	*96.6%*	*0%*	*0%*	*17.2%*	*13.8%*	*44.8%*	*62.1%*	*17.2%*	*51.7%*	*41.4%*	*65.5%*	*0%*	*0%*	*0%*
15	29	29 (29)	29 (29)	0 (29)	0 (29)	0 (29)	2 (29)	12 (29)	23 (29)	1 (29)	12 (29)	12 (29)	20 (29)	1 (29)	0 (29)	0 (29)
		100%	*100%*	*0%*	*0%*	*0%*	*6.9%*	*41.4%*	*79.3%*	*3.4%*	*41.4%*	*41.4%*	*69.0%*	*3.4%*	*0%*	*0%*
16	15	15 (15)	15 (15)	0 (15)	0 (15)	0 (15)	3 (15)	1 (15)	5 (15)	1 (15)	1 (15)	1 (15)	4 (15)	0 (15)	0 (15)	0 (15)
		100%	*100%*	*0%*	*0%*	*0%*	*20.0%*	*6.7%*	*33.3%*	*6.7%*	*6.7%*	*6.7%*	*26.7%*	*0%*	*0%*	*0%*
17	11	11 (11)	10 (11)	0 (11)	0 (11)	0 (11)	1 (11)	2 (11)	5 (11)	0 (11)	2 (11)	2 (11)	3 (11)	0 (11)	0 (11)	0 (11)
		100%	*90.9%*	*0%*	*0%*	*0%*	*9.1%*	*18.2%*	*45.5%*	*0%*	*18.2%*	*18.2%*	*27.3%*	*0%*	*0%*	*0%*
Total	*84*	*83*	*82*	*0*	*0*	*5*	*10*	*28*	*51*	*7*	*30*	*27*	*46*	*1*	*0*	*0*
		98.8%	*97.6%*	*0%*	*0%*	*6.0%*	*11.9%*	*33.3%*	*60.7%*	*8.3%*	*35.7%*	*32.1%*	*54.8%*	*1.2%*	*0%*	*0%*

Staphylococcus aureus **- cefoxitin RESISTANT: number and percentage non-susceptible**

LabCode	*Total*	*Pen* 0.125	*Ox* 2	*Van* 2	*Tei* 2	*Rif* 1	*Fus* 1	*Gen* 4	*Ery* 0.5	*Cln* 0.5	*Tet* 4	*SXT* 2	*Cip* 1	*Mup* 1	*QD* 1	*Lin* 4
WA																
24	12	12 (12)	12 (12)	0 (12)	0 (12)	0 (12)	1 (12)	0 (12)	6 (12)	0 (12)	1 (12)	1 (12)	1 (12)	0 (12)	0 (12)	0 (12)
		100%	*100%*	*0%*	*0%*	*0%*	*8.3%*	*0%*	*50.0%*	*0%*	*8.3%*	*8.3%*	*8.3%*	*0%*	*0%*	*0%*
25	25	25 (25)	24 (25)	0 (25)	0 (25)	0 (25)	0 (25)	1 (25)	14 (25)	6 (25)	1 (25)	3 (25)	12 (25)	0 (25)	0 (25)	0 (25)
		100%	*96.0%*	*0%*	*0%*	*0%*	*0%*	*4.0%*	*56.0%*	*24.0%*	*4.0%*	*12.0%*	*48.0%*	*0%*	*0%*	*0%*
26	22	22 (22)	22 (22)	0 (22)	0 (22)	1 (22)	1 (22)	2 (22)	14 (22)	2 (22)	3 (22)	2 (22)	12 (22)	1 (22)	0 (22)	0 (22)
		100%	*100%*	*0%*	*0%*	*4.5%*	*4.5%*	*9.1%*	*63.6%*	*9.1%*	*13.6%*	*9.1%*	*54.5%*	*4.5%*	*0%*	*0%*
27	21	21 (21)	21 (21)	0 (21)	0 (21)	0 (21)	1 (21)	1 (21)	12 (21)	0 (21)	0 (21)	0 (21)	9 (21)	0 (21)	0 (21)	0 (21)
		100%	*100%*	*0%*	*0%*	*0%*	*4.8%*	*4.8%*	*57.1%*	*0%*	*0%*	*0%*	*42.9%*	*0%*	*0%*	*0%*
Total	*80*	*80*	*79*	*0*	*0*	*1*	*3*	*4*	*46*	*8*	*5*	*6*	*34*	*1*	*0*	*0*
		100%	*98.8%*	*0%*	*0%*	*1.3%*	*3.8%*	*5.0%*	*57.5%*	*10.0%*	*6.3%*	*7.5%*	*42.5%*	*1.3%*	*0%*	*0%*
AUSTRALIA																
Total	*928*	*925*	*915*	*1*	*0*	*48*	*40*	*561*	*741*	*376*	*550*	*559*	*712*	*24*	*0*	*0*
		99.7%	*98.6%*	*0.1%*	*0%*	*5.2%*	*4.3%*	*60.5%*	*79.8%*	*40.5%*	*59.3%*	*60.2%*	*76.7%*	*2.6%*	*0%*	*0%*

Staphylococcus aureus - cefoxitin RESISTANT: (n = 926)

Susceptibility to:									Region						
Ery	Fus	Gen	Cip	Tet	Mup	Rif	Tmp	Chl	Rs	QLD/NT	ACT/NSW	VIC/TAS	SA	WA	AUS
R	R	R	R	R	s	R	R	s	7			2			2
R	R	R	R	R	R	s	R	s	7		1				1
R	s	R	R	R	R	R	R	s	7	1				1	2
R	s	R	R	R	R	s	R	s	6	1	6	1			8
R	s	R	R	R	s	R	R	s	6	9	1	3	4		17
R	R	R	R	R	s	s	R	s	6	1	2				3
R	R	R	R	R	s	R	s	s	6		1				1
R	R	s	R	R	s	s	R	s	5		1				1
R	R	R	s	R	s	R	s	s	5			1			1
R	s	s	R	R	s	s	R	R	5		1				1
R	s	R	R	s	s	R	R	s	5	21	3				24
R	s	R	R	R	s	s	R	s	5	46	225	165	21	1	458
R	s	s	R	R	s	s	R	s	4	1	5	5	2		13
R	s	R	R	R	s	s	s	s	4	6	2	3	2		13
R	s	R	R	s	R	s	s	s	4		1	1	1		3
R	s	R	R	s	s	s	R	s	4	2	6				8
R	s	R	s	R	s	s	R	s	4	2		2			4
s	s	R	R	R	s	s	R	s	4			1		1	2
R	s	R	s	s	s	s	R	s	3			1			1
s	s	R	s	R	s	s	R	s	3	1					1
R	R	s	s	s	R	s	s	s	3		1				1
s	R	R	s	s	R	s	s	s	3		1				1
R	R	s	s	R	s	s	s	s	3		1		1		2
R	s	R	s	R	s	s	s	s	3	4					4
s	s	s	R	s	R	s	R	s	3	1					1
R	s	s	s	R	s	s	R	s	3	5		4		1	10
R	s	s	R	R	s	s	s	s	3		1	1			2
R	s	s	R	s	R	s	s	s	3			3			3
R	s	s	R	s	s	s	R	s	3					2	2
R	R	s	R	s	s	s	s	s	3		1		2		3
s	R	s	s	R	s	s	s	s	2	1					1
s	s	s	R	s	R	s	s	s	2		1				1
R	R	s	s	s	s	s	s	s	2	4	1	1	1	1	8
R	s	R	s	s	s	s	s	s	2	1					1
s	R	s	s	s	s	R	s	s	2				1		1
R	s	s	R	s	s	s	s	s	2	16	43	8	11	19	97

Staphylococcus aureus - cefoxitin RESISTANT: (n = 926)

Susceptibility to:									Region					
Ery	Fus	Gen	Cip	Tet	Mup	Rif	Tmp	Chl	Rs	QLD/NT	ACT/NSW	VIC/TAS	SA	WA	AUS
s	R	s	R	s	s	s	s	s	2					1	1
R	s	s	s	s	R	s	s	s	2		1				1
R	s	s	s	R	s	s	s	s	2	1		1		1	3
R	s	s	s	s	s	s	s	s	1	8	5	4	6	20	43
s	s	R	s	s	s	s	s	s	1	3	1	1		1	6
s	s	s	R	s	s	s	s	s	1	6	18	8	3	9	44
s	s	s	s	s	R	s	s	s	1	1		1			2
s	R	s	s	s	s	s	s	s	1	4	3		5	1	13
s	s	s	s	s	s	s	s	s	0	31	24	11	24	21	111

AGAR Staphylococcus Survey 21 (November 2005 Hospital Survey)

Staphylococcus aureus - oxacillin susceptible (n = 1979)

Susceptibility to:									Region						
Ery	Fus	Gen	Cip	Tet	Mup	Rif	Tmp	Chl	Rs	QLD/NT	ACT/NSW	VIC/TAS	SA	WA	AUS
R	R	R	s	s	R	R	R	s	6			1			1
R	s	R	R	R	s	s	R	s	5	1	5	3			9
R	s	R	s	R	R	s	R	s	5	1					1
R	s	R	s	R	s	s	R	s	4				1		1
R	s	s	R	R	s	s	R	s	4		1				1
R	s	R	s	s	R	s	s	s	3				1		1
R	s	R	s	s	s	s	R	s	3			1			1
R	s	s	R	R	s	s	s	s	3			1			1
R	s	s	R	s	s	s	R	s	3		3				3
R	s	s	s	R	s	s	R	s	3		1	2			3
R	s	s	s	s	s	s	R	s	2		1		1		2
R	R	s	s	s	s	s	s	s	2	1	1		2	2	6
R	s	s	R	s	s	s	s	s	2	1	2	3	1	1	8
R	s	s	s	R	s	s	s	s	2	2		5	2		9
R	s	s	s	s	R	s	s	s	2		2	3	1		6
s	R	s	R	s	s	s	s	s	2	1					1
s	s	R	s	s	R	s	s	s	2	2					2
s	s	R	s	s	s	s	R	s	2					1	1
s	s	s	R	R	s	s	s	s	2		1				1
s	s	s	R	s	s	R	s	s	2				1		1
s	s	s	s	R	R	s	s	s	2		1				1
s	R	s	s	s	s	s	s	s	1	16	12	17	5	13	63
s	s	R	s	s	s	s	s	s	1	1		11			12
s	s	s	R	s	s	s	s	s	1	5	6	3	4	5	23
s	s	s	s	R	s	s	s	s	1	4	8	14	4		30
s	s	s	s	s	R	s	s	s	1	2	1	2		3	8
s	s	s	s	s	s	R	s	s	1		1	1			2
s	s	s	s	s	s	s	R	s	1	1	1	1	1	1	5
R	s	s	s	s	s	s	s	s	1	57	44	47	13	18	179
s	s	s	s	s	s	s	s	s	0	392	375	380	219	231	1,597