

GRAM-POSITIVE BACTERIA TYPING AND RESEARCH UNIT

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**Western Australian
Antibiotic-resistant Gram-positive Bacteria
Epidemiology and Typing Report
(MRSA & VRE)**

01 July – 31 December 2007

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Table of Contents

1	Overview	3
1.1	Epidemic MRSA (EMRSA).....	3
1.2	Community MRSA (cMRSA).....	5
1.3	Vancomycin Resistant Enterococci (VRE)	6
2	MRSA Nomenclature	8
2.1	MLST.....	8
2.2	SCC mec	8
3	Tests performed by the Gram-Positive Bacteria Research and Typing Laboratory, July 2007 to December 2007.....	10
4	Unique isolates of methicillin-resistant <i>Staphylococcus aureus</i> (MRSA), July 2007 to December 2007	12
5	Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) trend data, July 2003 to December 2007.....	22
6	Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) isolates received by the GPBTRU, July 1997 to December 2007	33
6.1	Epidemic methicillin-resistant <i>Staphylococcus aureus</i>	37
6.1.1	ST22-MRSA-IV (UK EMRSA-15).....	39
6.1.2	ST239-MRSA-III (Aus-2 EMRSA)	41
6.1.3	ST239-MRSA-III (Aus-3 EMRSA)	43
6.1.4	ST5-MRSA-II (New York/Japan EMRSA)	46
6.1.5	ST36-MRSA-II (UK EMRSA-16)	48
6.2	Community MRSA, July to December 2007	50
6.2.1	ST93-MRSA-IV (Queensland cMRSA).....	51
6.2.2	ST30-MRSA-IV (Western Samoan MRSA -WSPP MRSA)	53
6.2.3	ST8-MRSA-IV (USA300 MRSA)	55
6.2.4	ST80-MRSA-IV (European cMRSA)	57
6.2.5	ST59-MRSA-V $_T$ (Taiwan cMRSA)	59
6.2.6	WA MRSA	61
7	Panton Valentine Leukocidin (PVL)	68
8	Vancomycin-resistant <i>Enterococcus</i> species (VRE)	73
9	Acknowledgements	74

1 Overview

From 1 July – 31 December 2007 2,221 methicillin resistant *Staphylococcus aureus* (MRSA) isolates from 1,818 patients were referred to the Gram-positive Bacteria Typing and Research Unit (GPBTRU) for epidemiological typing. Two hundred and ninety one patients (16%) were infected or colonised with epidemic MRSA (EMRSA) and 1,527 (84%) patients were infected or colonised with community MRSA (cMRSA) of which 15% were known PVL-positive clones.

	Epidemic MRSA	Community MRSA
Characterised MRSA	291	1,527
Non Characterised MRSA	0	0
Total MRSA	291 (16.0%)	1,527 (84.0%)

1.1 Epidemic MRSA (EMRSA)

MLST/SCC <i>mec</i>	Clone	CC*	Patients n=270 (92.8%)		Staff n=21 (7.2%)		n (%)
			Clinical	Screen	Clinical	Screen	
ST22-MRSA-IV	UK EMRSA-15, Barnim EMRSA	22	155	72	1	18	246 (84.5)
ST239-MRSA-III	EMRSA-1, -4, -11, Portuguese, Brazilian EMRSA, Aus-2 EMRSA, Aus-3 EMRSA	8	14	14	0	1	29 (10.0)
ST5-MRSA-II	New York/Japan EMRSA	5	4	4	0	0	8 (2.7)
ST8-MRSA-VI	Irish-2 EMRSA	8	2	3	0	0	5 (1.7)
ST36-MRSA-II	UK EMRSA-16	30	2	0	0	1	3 (1.0)
Total			177	93	1	20	291

* Clonal Complex.

Percentage figures relate to the EMRSA isolates

Between 01/07/07 and 31/12/07:

- 246 (84.5%) EMRSA isolated in Western Australia were characterised as ST22-MRSA-IV (UK EMRSA-15). 227 were from patient specimens (155 clinical specimens and 72 screening swabs) and 19 from staff specimens (one clinical specimen and 18 screening swabs).
- 29 (10.0%) EMRSA were characterised as ST239-MRSA-III. These were further classified into 18 (6.2%) Aus-2 EMRSA and 11 (3.8%) Aus-3 EMRSA.
- Eight (2.7%) EMRSA isolated were characterised as ST5-MRSA-II (New York/Japan EMRSA). These isolates were from four clinical and four screening specimens.
- Five (1.7%) EMRSA were characterised as ST8-MRSA-VI (Irish-2 EMRSA). Two isolates were from patient clinical samples and three from patient screening specimens.
- Three (1.0%) EMRSA were characterised as ST36-MRSA-II (UK EMRSA-16). Two isolates were from patient clinical samples and one from a staff screening specimen.

1.2 Community MRSA (cMRSA)

MLST/SCC <i>mec</i>	Clone	CC	Patients n= 1,493 (97.8)		Staff n=34 (2.2%)		n (%)
			Clinical	Screen	Clinical	Screen	
ST1-MRSA-IV [^]	WA MRSA-1	1	542	123	0	16	681 (44.6)
ST78-MRSA-IV	WA MRSA-2	78	332	92	0	7	431 (28.2)
ST93-MRSA-IV*	Qld cMRSA	S [#]	157	6	0	1	164 (10.7)
ST5-MRSA-IV	WA MRSA-3	5	89	31	1	4	125 (8.2)
ST30-MRSA-IV*	WSPP MRSA	30	37	1	0	0	38 (2.5)
ST8-MRSA-IV*	USA300	8	20	0	0	0	20 (1.3)
ST59-MRSA-V*	Taiwan MRSA	59	3	0	0	0	3 (0.2)
ST80-MRSA-IV*	European cMRSA	80	0	1	0	0	1 (<0.1)
Other known PVL-positive cMRSA*			3	0	0	0	3 (0.2)
Other known PVL-negative cMRSA			48	9	1	3	61 (4.0)
Total			1,231	262	2	32	1,527

*Known PVL-positive clone.

[^]Approximately 3% of WA MRSA-1 isolates are PVL positive. PVL PCR is not routinely performed on all MRSA therefore PVL-positive WA MRSA-1 are not included in 'known PVL-positive cMRSA' figures.

[#] S = Singleton

Percentage figures relate to cMRSA isolates

Between 01/07/07 and 31/12/07:

1,527 (84.0%) patients were infected and/or colonized with cMRSA.

91.7% of cMRSA were classified into four major community clones:

ST1-MRSA-IV (n = 681)

ST78-MRSA-IV (n = 431)

ST93-MRSA-IV (n=164)

ST5-MRSA-IV (n = 125)

Five non-Western Australian cMRSA were characterised:

ST93-MRSA-IV (also known as Queensland cMRSA)

ST30-MRSA-IV (also known as WSPP MRSA)

ST8-MRSA-IV (also known as USA300)

ST59-MRSA-V (also known as Taiwan MRSA)

ST80-MRSA-IV (also known as European cMRSA)

1.3 Vancomycin Resistant Enterococci (VRE)

From 01/07/07 – 31/12/07, 9 new carriers of VRE were referred to the Typing Unit.

One isolate was identified as *E faecalis* (*vanB*) and six as *E faecium* (including one *vanA* and five *vanB*).

A *vanB E gallinarum* and a *vanA E gallinarum* were also identified.

Section 2
MRSA Nomenclature

2 MRSA Nomenclature

Since July 2003, the Gram-positive Bacteria Typing and Research Unit has employed the international MRSA nomenclature system described by Dr Mark Enright *et al* (Enright MC *et al*. The evolutionary history of methicillin-resistant *Staphylococcus aureus* (MRSA) *Proc Natl. Acad Sci. USA* 99:7687-7692). This system provides a universally standardised MRSA nomenclature allowing MRSA clones to be readily compared between laboratories. It is based upon the combination of seven housekeeping genes sequence types (STs) using multilocus sequence typing (MLST) and the SCC*mec* type using multiplex PCR. The MRSA genotype is therefore the sum of the SCC*mec* type and the type of its recipient chromosome. For example, an MRSA clone of ST22 and SCC*mec* type IV is referred to as ST22-MRSA-IV (previously known as UK EMRSA-15).

2.1 MLST

MLST is a highly discriminatory method of characterising MRSA. For each of the seven housekeeping gene fragments, different sequences are assigned as distinct alleles, and an isolate is defined by the alleles of each of the seven housekeeping loci (the allelic profile or ST). The ST can be compared with other strains using the program BURST located on the MLST website (www.saureus.mlst.net). As there are many alleles for each loci, isolates are highly unlikely to have identical ST by chance, and therefore isolates with the same ST are considered members of the same clone.

2.2 SCC*mec*

Six SCC*mec* types have been identified globally. Types I, II, III and VI (previously known as IV_{paediatric}) are normally associated with “health-care-associated MRSA” while Types IV and V are normally associated with “community associated MRSA”.

Using MLST/SCC*mec* typing the Gram-positive Bacteria Typing and Research Unit has identified several MRSA clones which previously were collectively known as “WA MRSA”. These clones have been fully characterised using a variety of molecular and non-molecular methods.

MRSA have been identified as either “epidemic” (health-care-associated) or “community” (community associated) and assigned a MLST/SCC*mec* type. The previous nomenclature applied to epidemic MRSA has also been reported.

Section 3

**Tests performed by the Gram-positive Bacteria Typing and
Research Unit**

July 2007 to December 2007

3 Tests performed by the Gram-Positive Bacteria Research and Typing Laboratory, July 2007 to December 2007

The testing performed by the Gram-positive Bacteria Typing and Research Unit during this six month period was as follows:

	Number of MRSA isolates tested
Routine Antibiogram (9 antibiotics)	2,257
<i>mecA/nuc</i> PCR	79
Panton Valentine leucocidin PCR	242
Coagulase Gene Polymerase Chain Reaction (PCR) Assay	1,817
Resistogram	32
Pulsed – Field Gel Electrophoresis (PFGE)	473
Urease Reaction	2,258
Multi Locus Sequencing Typing (MLST)	19
SCC <i>mec</i> PCR	19
Mupirocin Etest®	35
Ciprofloxacin Etest®	39
Total Number of Typing Tests Performed	7,270

Clones are initially identified by phenotype (antibiogram and urease production) and coagulase PCR-Restriction Fragment Length Polymorphism. PFGE, MLST and SCC*mec* typing are performed if required.

Section 4

**Unique isolates (duplicates excluded) of MRSA by public health
region and patient age**

July 2007 to December 2007

4 Unique isolates of methicillin-resistant *Staphylococcus aureus* (MRSA), July 2007 to December 2007

From 1 July – 31 December 2007, 2,221 methicillin resistant *Staphylococcus aureus* (MRSA) isolates from 1,818 patients were referred to the Gram-positive Bacteria Typing and Research Unit for epidemiological typing. Unique isolates (duplicate isolates excluded) is presented in the Overview and sections 4 and 5 of this report. A duplicate isolate is defined as an isolate with an identical phenotype to an isolate received from the same patient in the previous 12 month period.

Tables 1, 2 and 3 and figures 1 and 2 show unique isolates of MRSA (number and rate per 100,000 population) by public health region according to postcode of residence.

The majority (70%) of MRSA were referred from the Metropolitan region. South West isolates accounted for 6% of referred MRSA with all other regions contributing less than 5% of isolates. MRSA infection and/or colonisation rates were highest for the Kimberley region (223.79/100,000 population). The Great Southern, Mid West, Goldfields, and Pilbara-Gascoyne regions all had rates greater than 100/100,000 population. The Great Southern region has the highest rate of Epidemic MRSA (EMRSA) (20.5/100,000 population) while the Pilbara-Gascoyne and Kimberley regions had the highest rates of community MRSA (cMRSA) (150.2 and 218.2/100,000 population respectively). The Central, Pilbara-Gascoyne, Great Southern and Kimberley regions had the highest rates of PVL-positive cMRSA (ranging from 18.2 to 47.6/100,000 population).

Tables 4 and 5 and figures 3, 4, 5, 6, 7 and 8 show the proportion and rate of EMRSA and cMRSA by decade of life.

Figures 4 and 5 show that increasing age is a risk factor for infection or colonisation with EMRSA and cMRSA. Figures 7 and 8 show cMRSA divided into PVL-positive and PVL-negative clones. While the rate of PVL-negative MRSA increases with age, the rate of PVL-positive MRSA is highest among the young adult age groups (teens to 30s).

Table 1: New MRSA cases notified to Department of Health by Public Health Region according to postcode of residence, July to December 2007

MLST/SCCmec	PFGE	Public Health Region										Total
		Metro	Kimb	SthW	Gold	PG	GStH	MidW	Cent	Unk	NoWA	
Epidemic MRSA (291)												
ST239-MRSA-III	Aus-2 EMRSA	15		1			1				1	18
ST239-MRSA-III	Aus -3 EMRSA	7		2			1	1				11
ST22-MRSA-IV	UK EMRSA-15	202	2	4	4	2	9	4	7	10	2	246
ST36-MRSA-II	UK EMRSA-16	3										3
ST8-MRSA-VI	Irish -2 EMRSA	5										5
ST5-MRSA-II	New York/Japan EMRSA	3		3					1	1		8
PVL-negative community MRSA (1,298)												
ST1-MRSA-IV	WA MRSA 1	473	40	29	26	25	17	35	16	18	2	681
ST78-MRSA-IV	WA MRSA 2	300	13	40	14	8	12	15	19	10		431
ST5-MRSA-IV	WA MRSA 3	76	8	5	9	16	4	3	1	3		125
ST45-MRSA-V	WA MRSA 4	27		1	1	1		1				31
ST8-MRSA-IV	WA MRSA 5	11		2								13
ST584-MRSA-IV	WA MRSA 13	1										1
ST59-MRSA-IV	WA MRSA 15	1										1
ST45-MRSA-IV	WA MRSA 23	1										1
ST575-MRSA-IV	WA MRSA 25	1										1
ST72-MRSA-IV	WA MRSA 44	4										4
ST835-MRSA-IV	WA MRSA 48	1										1
ST6-MRSA-IV	WA MRSA 51									1		1
ST1005-MRSA-IV	WA MRSA 57	1										1
ST1173-MRSA-IV	WA MRSA 58					1						1
ST641-MRSA-V	WA MRSA 61									1		1
ST1174-MRSA-IV	WA MRSA 63	1										1
ST6-MRSA-IV	WA MRSA 66							1				1
ST8-MRSA-IV	WA MRSA 67							1				1
ST12-MRSA-IV	WA MRSA 69	1										1
PVL-positive community MRSA (229)												
ST583-MRSA-IV	WA MRSA 17	2										2
ST923-MRSA-IV	WA MRSA 62	1										1
ST59-MRSA-V	Taiwan cMRSA	1			2							3
ST8-MRSA-IV	USA300 MRSA	16		1	1						2	20
ST93-MRSA-IV	Qld cMRSA	90	12	18	2	7	11	6	13	1	4	164
ST80-MRSA-IV	European cMRSA			1								1
ST30-MRSA-IV	WSPP MRSA	24	5	2	1	1	1			3	1	38
Total		1,268	80	109	60	61	56	66	57	49	12	1,818

Metro = Metropolitan, Kimb = Kimberley, SthW = South West, Gold = Goldfields, PG = Pilbara/Gascoyne, GStH – Great Southern, MidW = Midwest, Cent = Central, UnK = Unknown; NoWA = Outside WA
 MLST/SCCmec types may have multiple PFGE pulsotypes.

Table 2: MRSA notification rates per 100,000 population by Public Health Region according to postcode of residence (where known), July to December 2007

		Public Health Region								
		Metro	Kimb	SthWest	Gold	PG	GSth	MidWest	Central	Total
Population		1,555,373	35,748	140,846	53,661	39,282	53,738	59,925	71,540	2,010,113
MLST/SCCmec	PFGE									
Epidemic MRSA										
ST239-MRSA-III	Aus -2 EMRSA	0.96		0.71			1.86			0.85
ST239-MRSA-III	Aus -3 EMRSA	0.45		1.42			1.86	1.67		0.55
ST22-MRSA-IV	UK EMRSA-15	12.99	5.59	2.84	7.45	5.09	16.75	6.68	9.78	11.64
ST36-MRSA-II	UK EMRSA-16	0.19								0.15
ST8-MRSA-VI	Irish-2 EMRSA	0.32								0.25
ST5-MRSA-II	New York/Japan EMRSA	0.19		2.13					1.40	0.35
Total EMRSA		15.11	5.59	7.10	7.45	5.09	20.47	8.34	11.18	13.83
PVL-negative community MRSA										
ST1-MRSA-IV	WA MRSA 1	30.41	111.89	20.59	48.45	63.64	31.63	58.41	22.37	32.88
ST78-MRSA-IV	WA MRSA 2	19.29	36.37	28.40	26.09	20.37	22.33	25.03	26.56	20.94
ST5-MRSA-IV	WA MRSA 3	4.89	22.38	3.55	16.77	40.73	7.44	5.01	1.40	6.07
ST45-MRSA-V	WA MRSA 4	1.74		0.71	1.86	2.55		1.67		1.54
ST8-MRSA-IV	WA MRSA 5	0.71		1.42						0.65
ST584-MRSA-IV	WA MRSA 13	0.06								0.05
ST59-MRSA-IV	WA MRSA 15	0.06								0.05
ST45-MRSA-IV	WA MRSA 23	0.06								0.05
ST575-MRSA-IV	WA MRSA 25	0.06								0.05
ST72-MRSA-IV	WA MRSA 44	0.26								0.20
ST835-MRSA-IV	WA MRSA 48	0.06								0.05
ST6-MRSA-IV	WA MRSA 51									0.05
ST1005-MRSA-IV	WA MRSA 57	0.06								0.05
ST1173-MRSA-IV	WA MRSA 58					2.55				0.05
ST641-MRSA-V	WA MRSA 61									0.05
ST1174-MRSA-IV	WA MRSA 63	0.06								0.05
ST6-MRSA-IV	WA MRSA 66							1.67		0.05
ST8-MRSA-IV	WA MRSA 67							1.67		0.05
ST12-MRSA-IV	WA MRSA 69	0.06								0.05
Total PVL-negative community MRSA		57.80	170.64	54.67	93.18	129.83	61.41	93.45	50.32	62.83
PVL-positive community MRSA										
ST583-MRSA-IV	WA MRSA 17	0.13								0.10
ST923-MRSA-IV	WA MRSA 62	0.06								0.05
ST59-MRSA-V	Taiwan cMRSA	0.06			3.73					0.15
ST5-MRSA-IV	USA300 MRSA	1.03		0.71	1.86					0.90
ST93-MRSA-IV	Qld cMRSA	5.79	33.57	12.78	3.73	17.82	20.47	10.01	18.17	7.91
ST80-MRSA-IV	European cMRSA			0.71						0.05
ST30-MRSA-IV	WSPP MRSA	1.54	13.99	1.42	1.86	2.55	1.86			1.69
Total PVL-positive community MRSA		8.62	47.56	15.62	11.18	20.37	22.33	10.01	18.17	10.85
Total community MRSA		66.41	218.19	70.29	104.36	150.20	83.74	103.46	68.49	73.69
Total MRSA		81.52	223.79	77.39	111.81	157.83	104.21	110.14	79.68	87.46

Metro = Metropolitan, Kimb = Kimberley, SthWest = South West, Gold = Goldfields, PG = Pilbara/Gascoyne, GSth – Great Southern, MidWest = Midwest, Central = Central,

Figure 1 : cMRSA and EMRSA notification rates per 100,000 population by public health region according to postcode of residence, July to December 2007

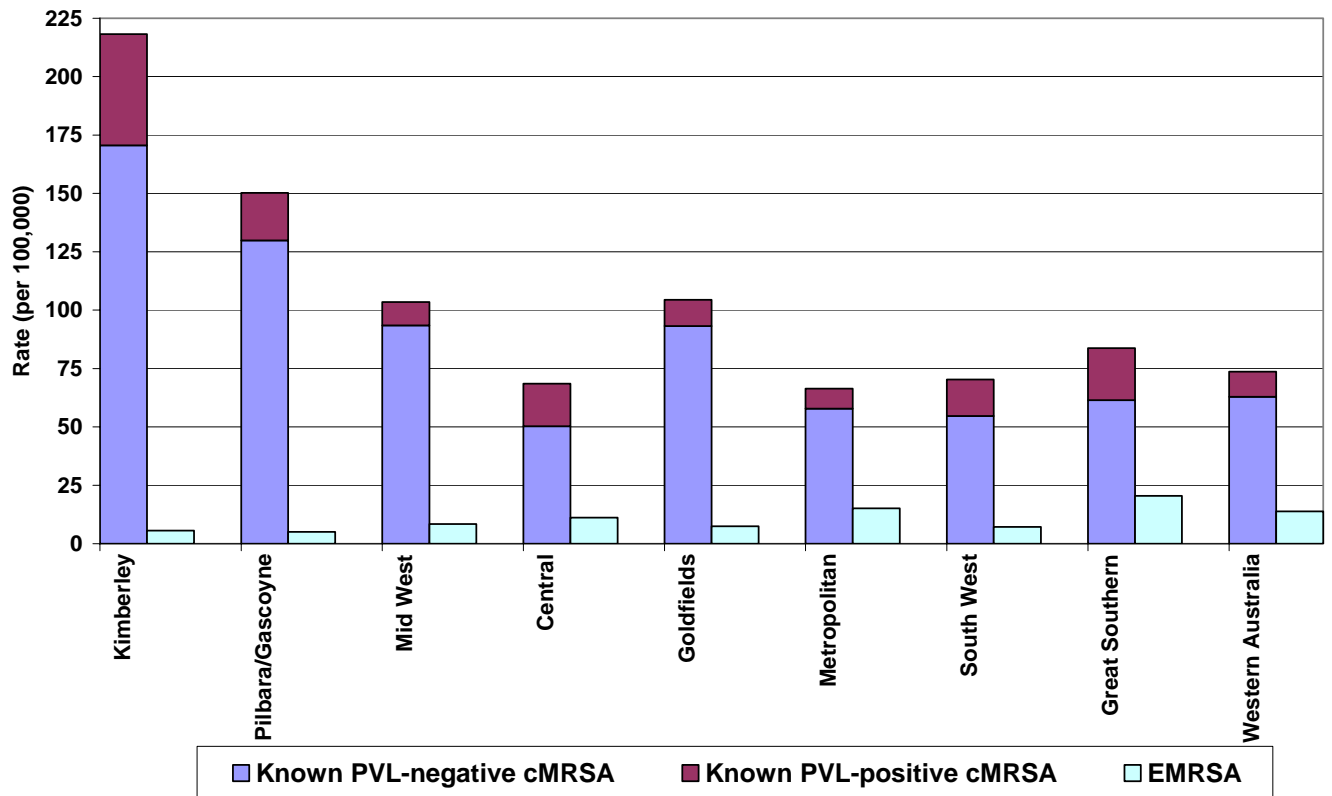


Table 3 : Number and proportion of known PVL-positive and PVL-negative cMRSA clones by region

Region	Known PVL-positive cMRSA	Known PVL-negative cMRSA
Kimberley	17 (21.8%)	61 (78.2%)
Pilbara/Gascoyne	8 (13.6%)	51 (86.4%)
Mid West	6 (9.7%)	56 (90.3%)
Central	13 (26.5%)	36 (73.5%)
Goldfields	6 (10.7%)	50 (89.3%)
Metropolitan	134 (13.0%)	899 (87.0%)
South West	22 (22.2%)	77 (77.8%)
Great Southern	12 (26.7%)	33 (73.3%)
Western Australia	218 (14.7%)	12.63 (85.3%)

Figure 2 : Proportion of known PVL-positive and PVL-negative cMRSA by public health region according to postcode of residence, July to December 2007

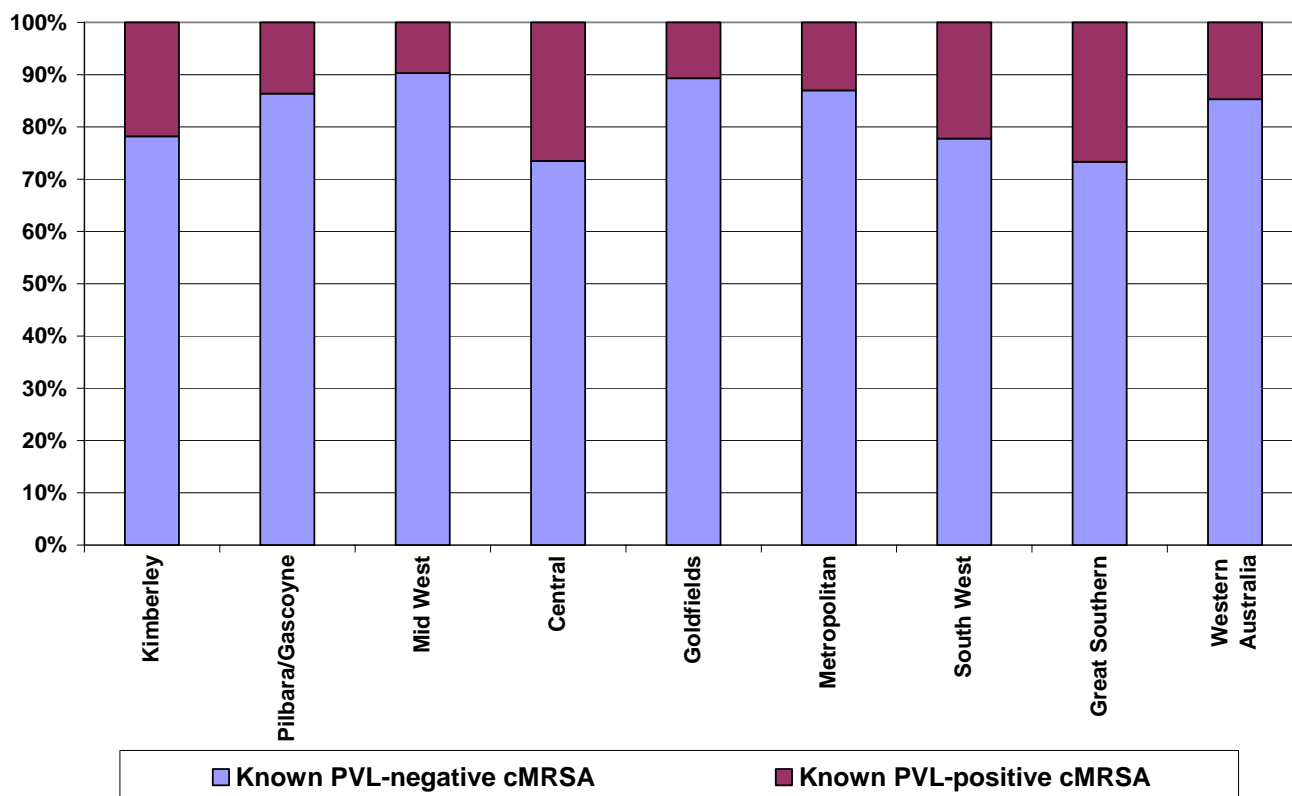


Table 4 : Number, proportion and rate (per 100,000 population) of cMRSA and EMRSA by decade of life

Decade of life	Number of cMRSA (%)	Number of EMRSA (%)	Rate (per 100,000 population)	
			cMRSA	EMRSA
1	143 (97.3%)	4 (2.7%)	5.3	0.1
2	115 (95.8%)	5 (4.2%)	4.0	0.2
3	163 (92.6%)	13 (7.4%)	5.5	0.4
4	146 (91.3%)	14 (8.8%)	4.8	0.5
5	146 (87.4%)	21 (12.6%)	4.8	0.7
6	155 (84.7%)	28 (15.3%)	5.8	1.1
7	135 (79.9%)	34 (20.1%)	7.2	1.8
8	164 (74.9%)	55 (25.1%)	13.7	4.6
9	245 (73.8%)	87 (26.2%)	38.0	13.5
10	115 (79.3%)	30 (20.7%)	103.5	27.0
Total	1527 (84.0%)	291 (16.0%)	7.3	1.4

Figure 3 : Proportion of EMRSA and cMRSA by decade of life, July to December 2007

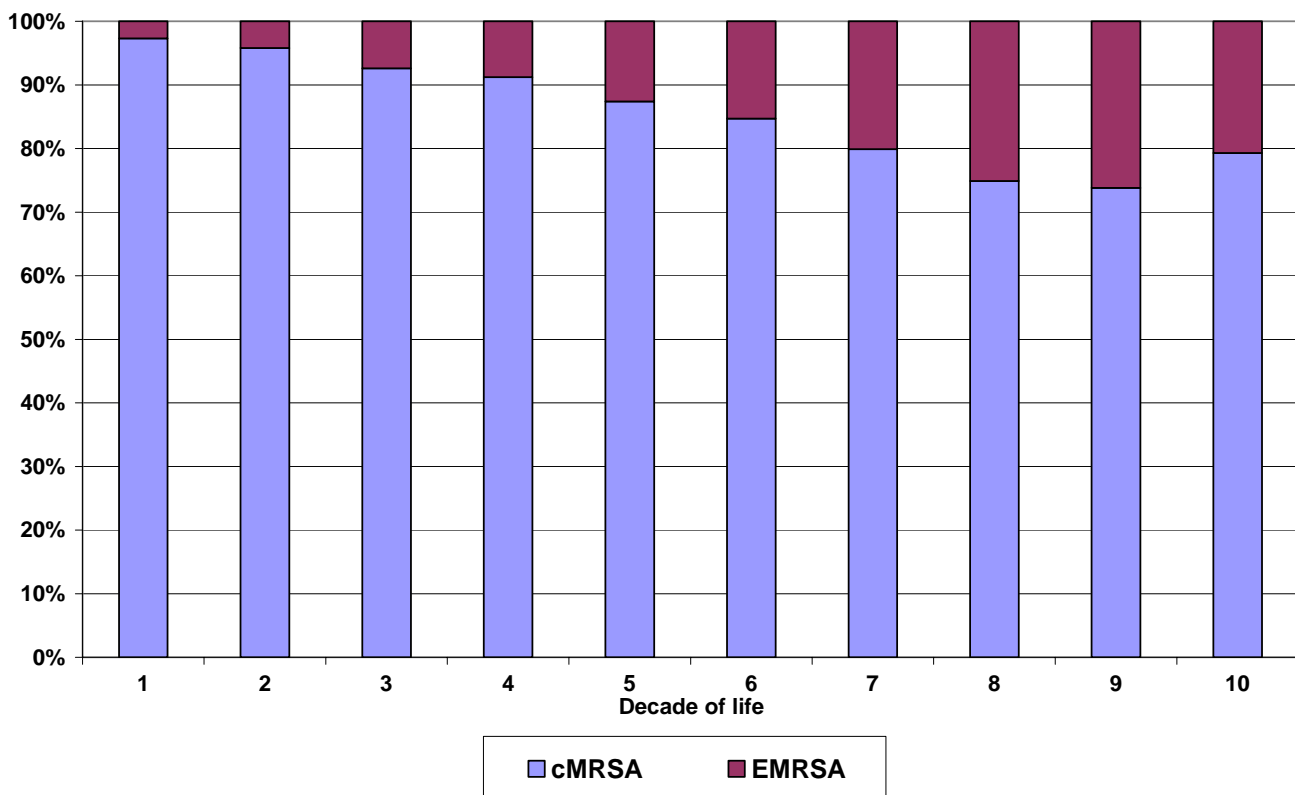


Figure 4 : Rate of EMRSA (per 100,000 population) by decade of life, July to December 2007

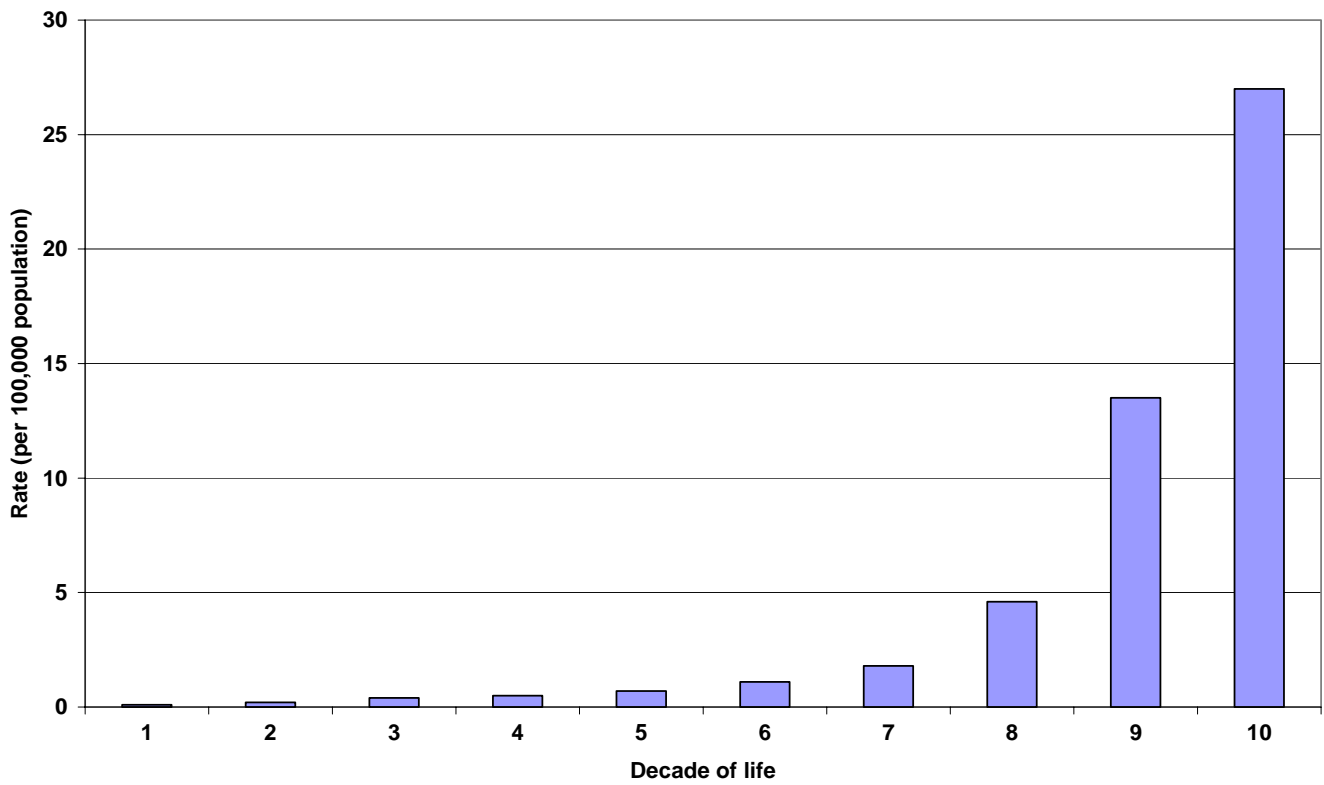


Figure 5 : Rate of cMRSA (per 100,000 population) by decade of life, July to December 2007

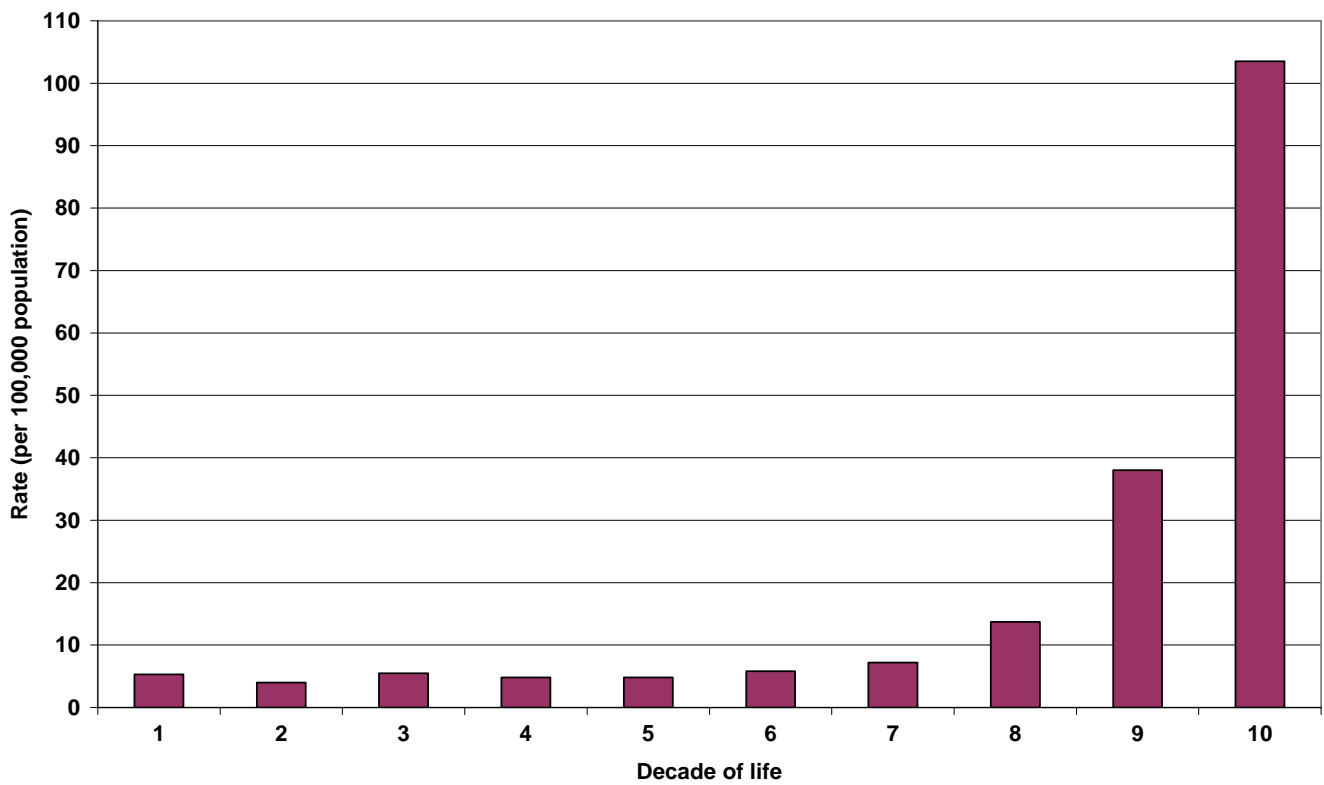


Table 5 : Number, proportion and rate (per 100,000 population) of known PVL-positive and PVL-negative cMRSA by decade of life, July to December 2007.

Decade of life	Number of PVL-positive cMRSA (%)	Number of PVL-negative cMRSA (%)	Rate of cMRSA (per 100,000 population)	
			PVL positive	PVL negative
1	30 (21.0%)	113 (79.0%)	1.2	4.4
2	44 (38.3%)	71 (61.7%)	2.0	2.8
3	60 (36.8%)	103 (63.2%)	2.4	4.0
4	29 (19.9%)	117 (80.1%)	1.3	3.9
5	26 (17.8%)	120 (82.2%)	0.9	4.4
6	22 (14.2%)	133 (85.8%)	1.1	5.6
7	6 (4.4%)	129 (95.6%)	0.3	9.0
8	8 (4.9%)	156 (95.1%)	0.8	15.2
9	3 (1.2%)	242 (98.8%)	0.6	45.4
10	1 (0.9%)	114 (99.1%)	0.9	126.9
Total	229 (15.0%)	1298 (85.0%)	1.3	7.1

Figure 6 : Proportion of known PVL-positive and PVL-negative cMRSA by decade of life, July to December 2007

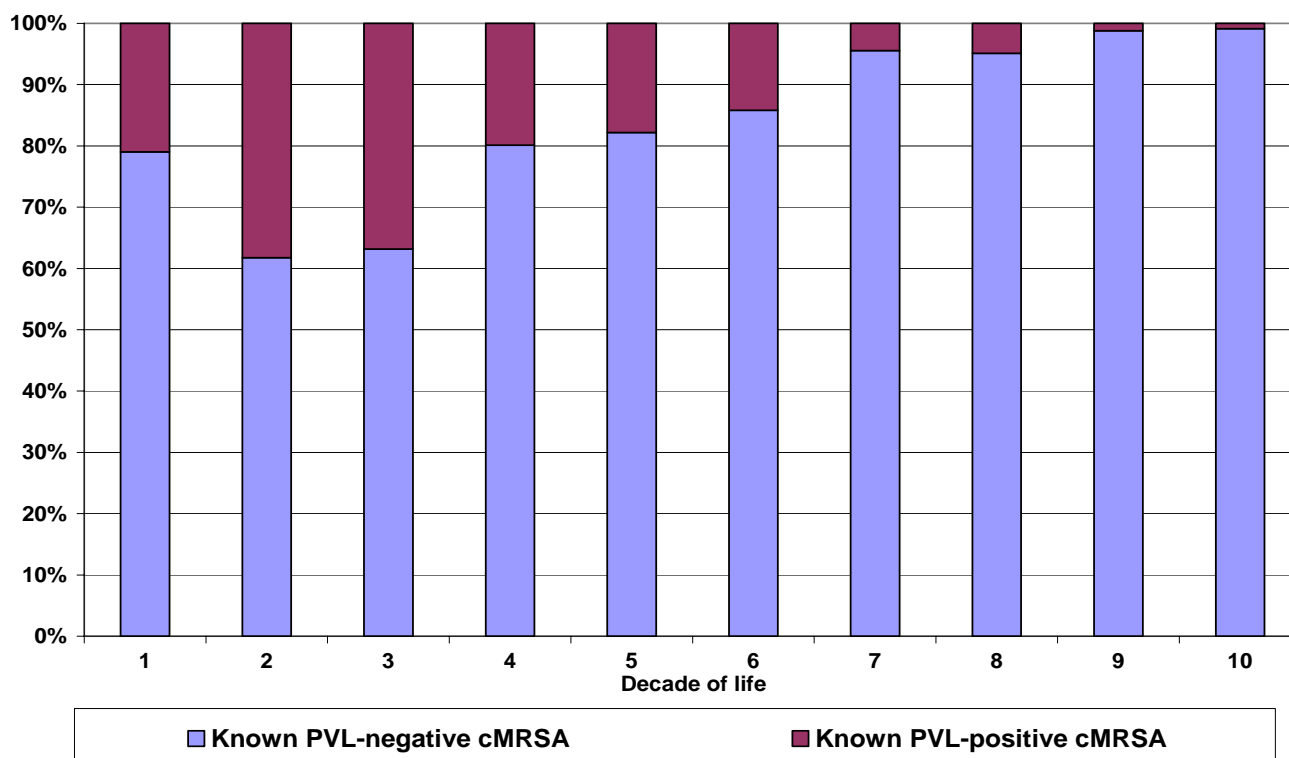


Figure 7 : Rate (per 100,000 population) of known PVL-negative cMRSA by decade of life, July to December 2007

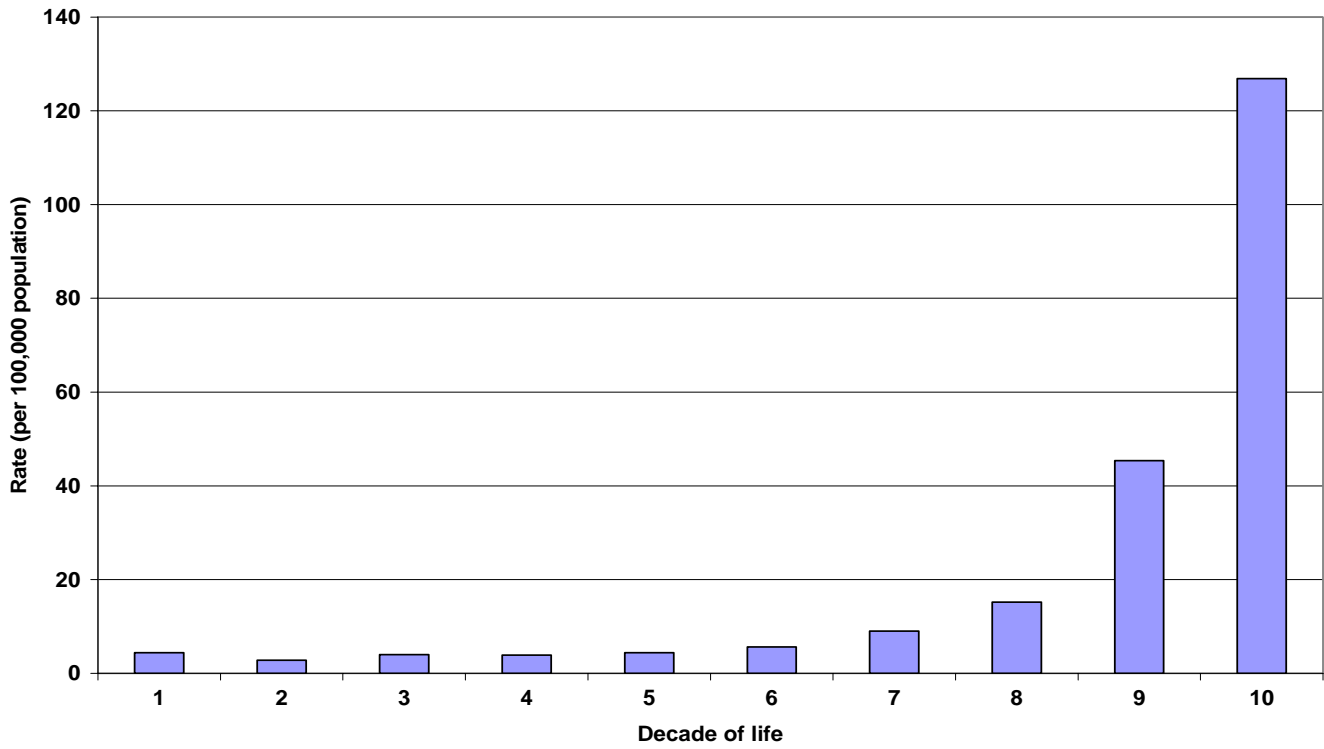
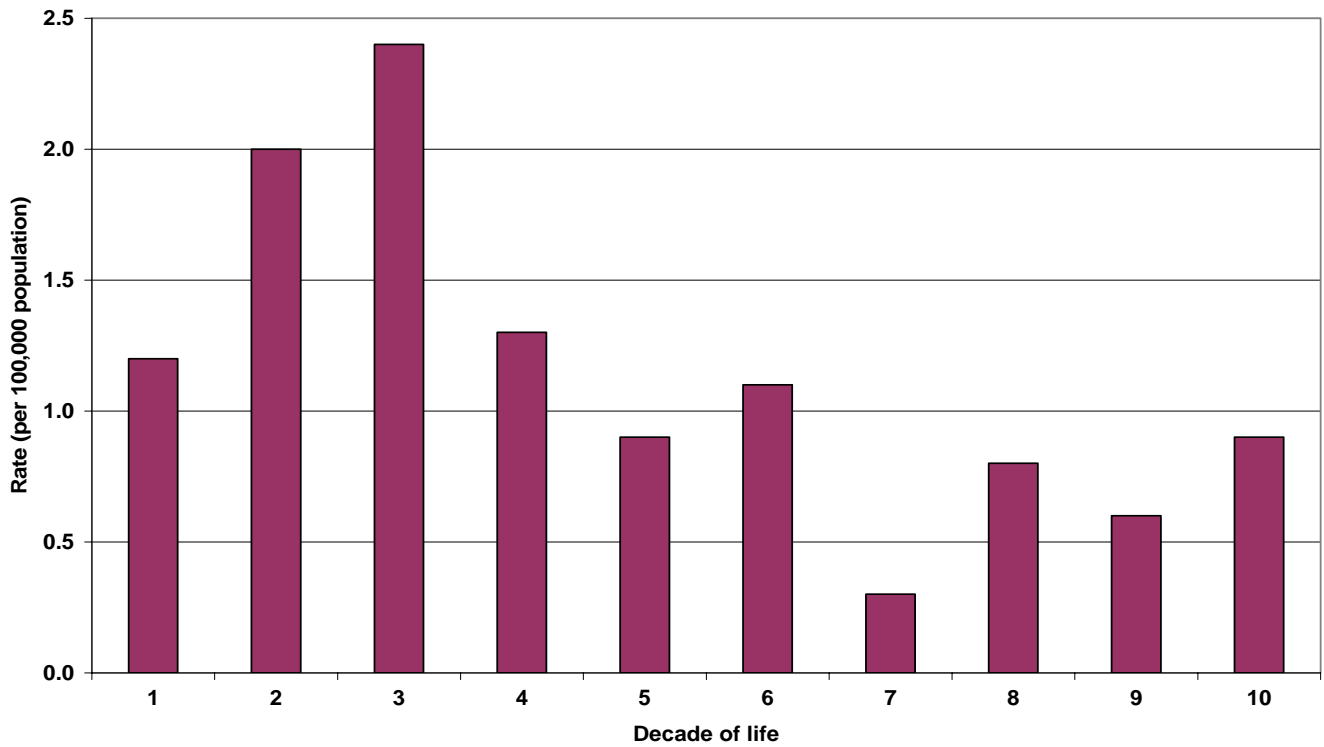


Figure 8 : Rate (per 100,000 population) of known PVL-positive cMRSA by decade of life, July to December 2007



Section 5
MRSA Trend Data
July 2003 to December 2007

5 Methicillin-resistant *Staphylococcus aureus* (MRSA) trend data, July 2003 to December 2007

Since July 2003, all MRSA referred to the GPBTRU have been characterised by phenotypic and molecular methods including antibiogram, urease production, coagulase PCR-RFLP, pulsed-field gel electrophoresis, multi-locus sequence typing and staphylococcal chromosome cassette *mec* typing.

Figures 9 to 26 display unique isolates by year and by region from July 2003 to December 2007. Duplicate isolates are excluded.

In Western Australia, cases of infection or colonisation with EMRSA remain constant. There were 616 cases of EMRSA in 2007 compared with 649 in 2004. The majority of EMRSA in each year were UK EMRSA-15 (ST22-MRSA-IV) (ranging from 78.6% in 2004 to 90.1% in 2006).

cMRSA numbers have significantly increased both for known PVL-positive and PVL-negative clones ($p < 0.0001$ and $p = 0.0007$ respectively). Of the PVL-positive clones, the Queensland clone (ST93-MRSA-IV), the Western Samoan clone (ST30-MRSA-IV) and the USA300 clone (ST8-MRSA-IV) increased significantly from 2004 to 2007 ($p < 0.0001$, $p < 0.0001$ and $p = 0.0016$ respectively). The Queensland clone showed the greatest increase from 1% of all MRSA in 2004 to 8% in 2007.

All public health regions except for the Goldfields showed significant increases in the number of known PVL-positive clones from 2004 to 2007. The greatest increases were seen in the Kimberley and Central regions. In the Kimberley, PVL-positive clones increased from 0% of all isolates in 2000 to 22% in 2007 and in the Central region, PVL-positive clones increased from 2% to 22% in the same time period.

Figure 9 : Proportion of EMRSA and cMRSA, Western Australia July 2003 to December 2007

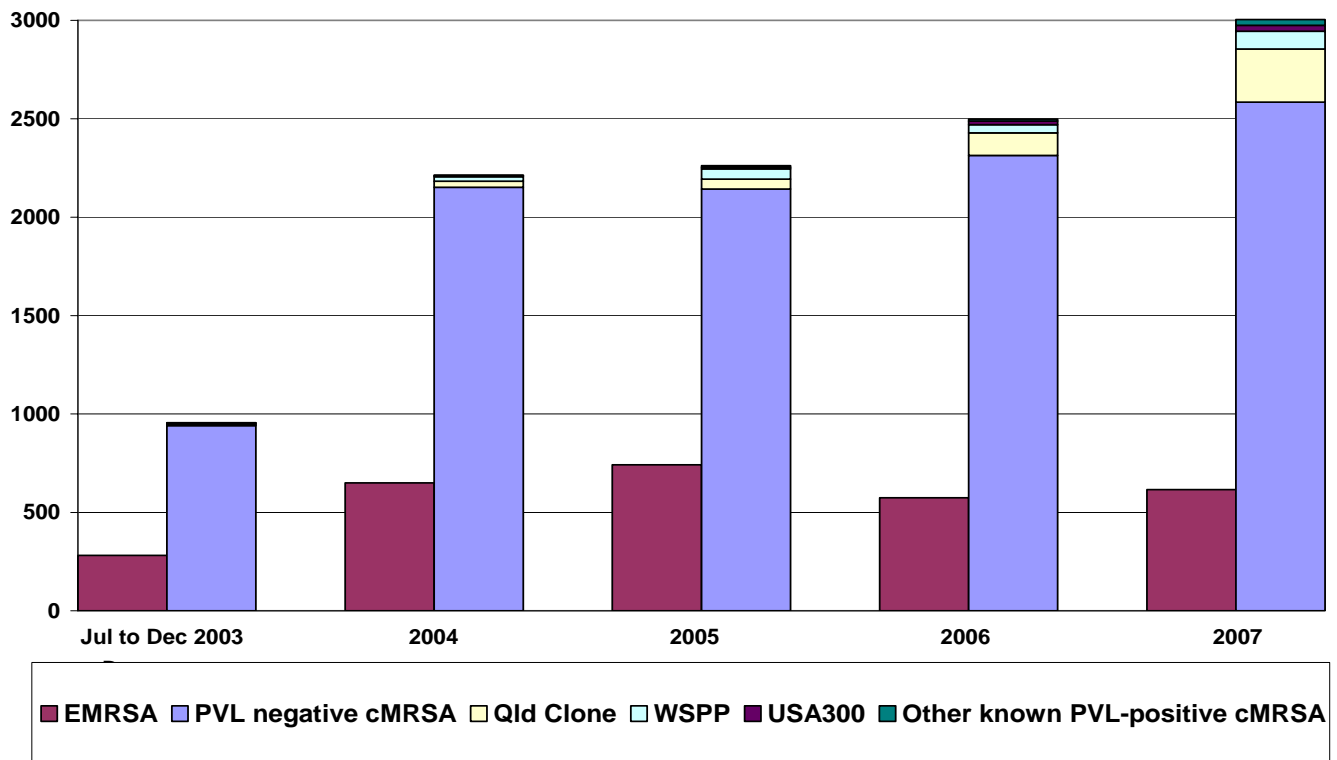


Figure 10 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Western Australia 2004 to 2007

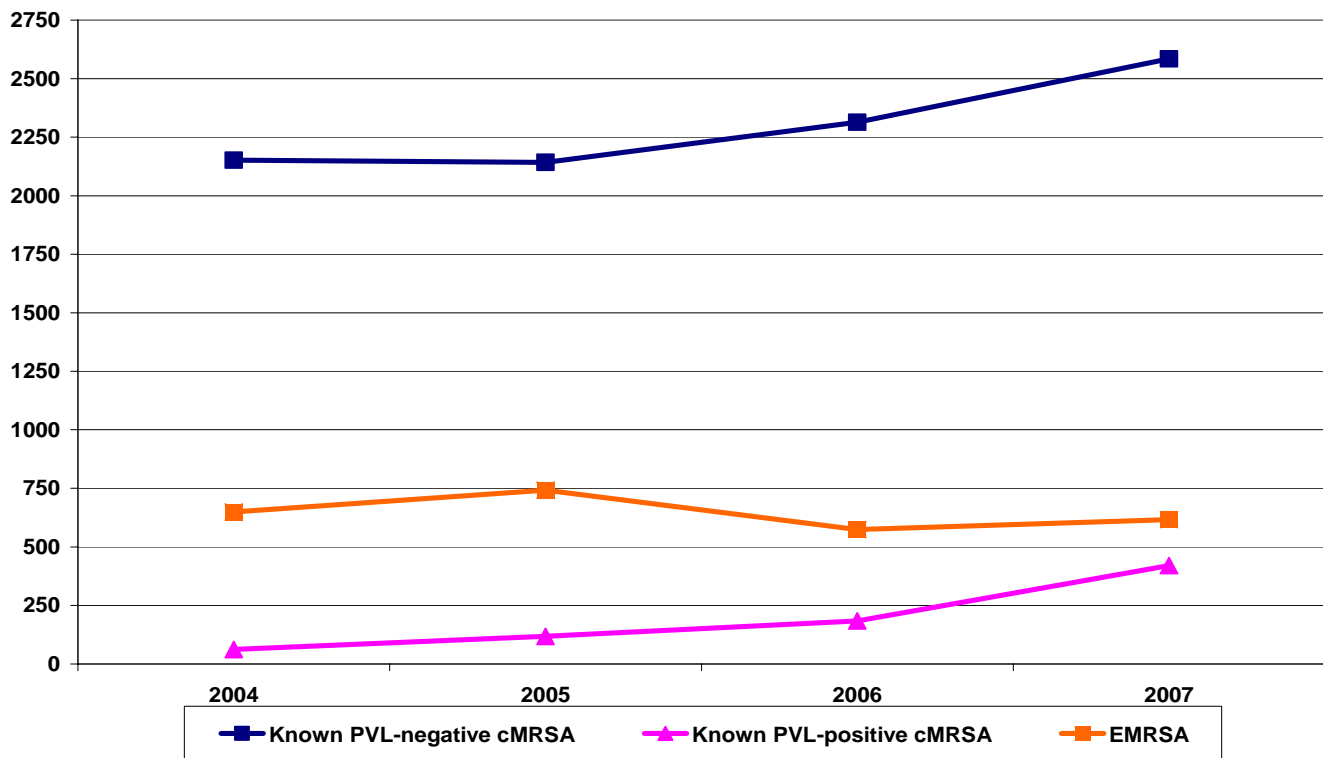


Figure 11 : Proportion of EMRSA and cMRSA, Metropolitan region July 2003 to December 2007

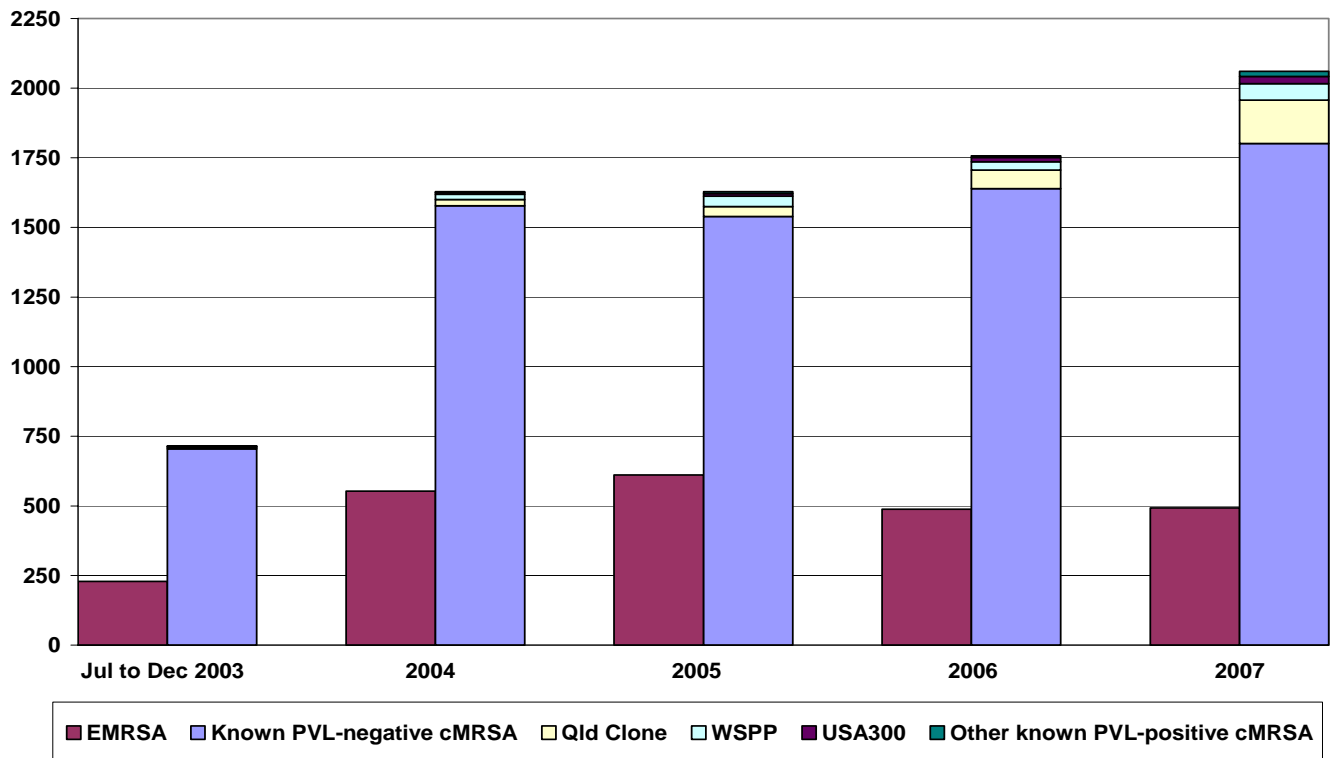


Figure 12 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Metropolitan region 2004 to 2007

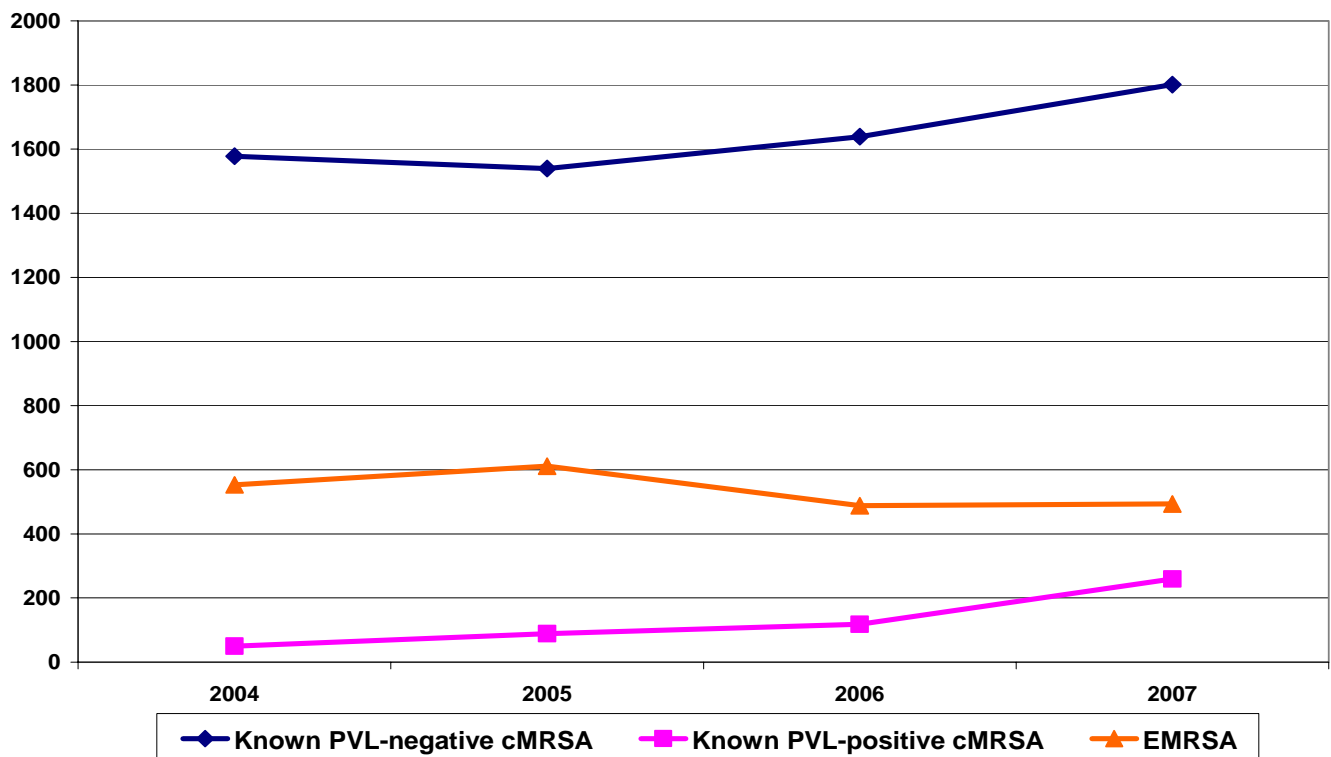


Figure 13 : Proportion of EMRSA and cMRSA, Kimberley region July 2003 to December 2007

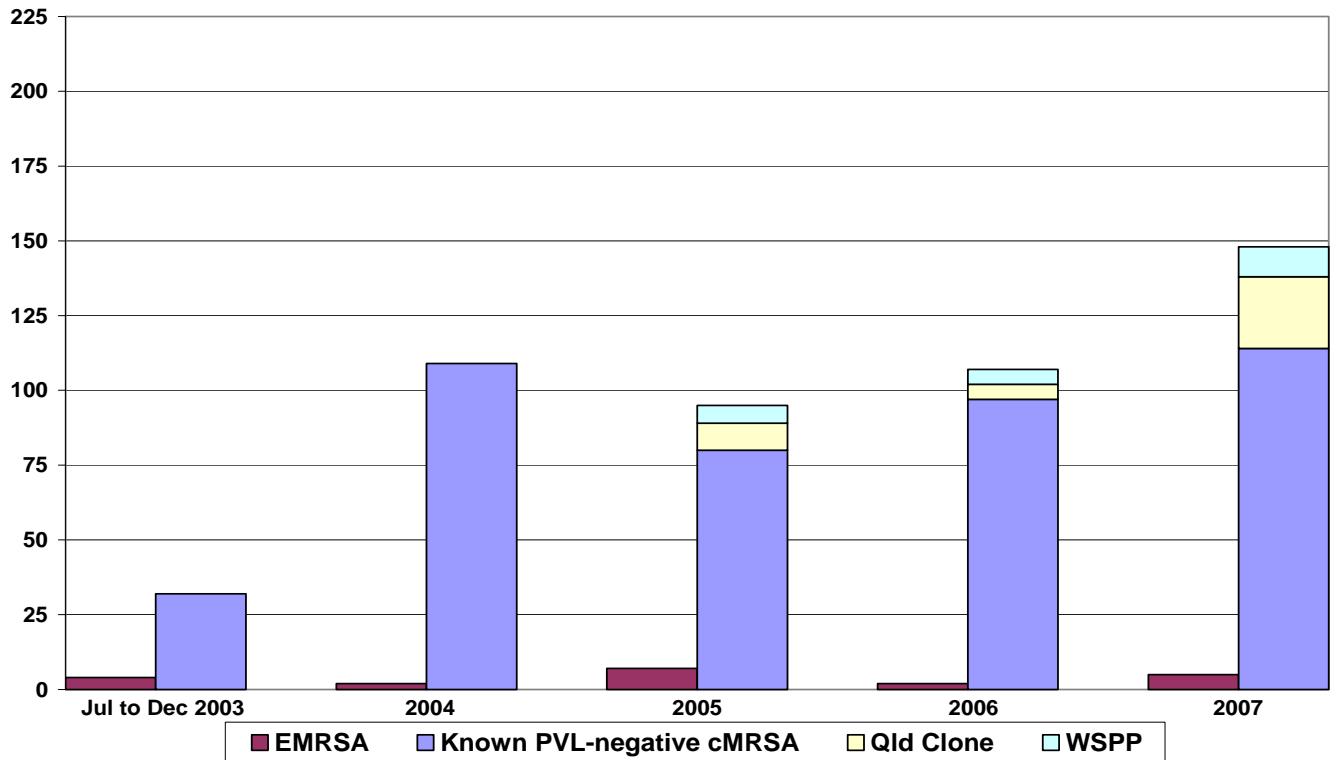


Figure 14 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Kimberley region 2004 to 2007

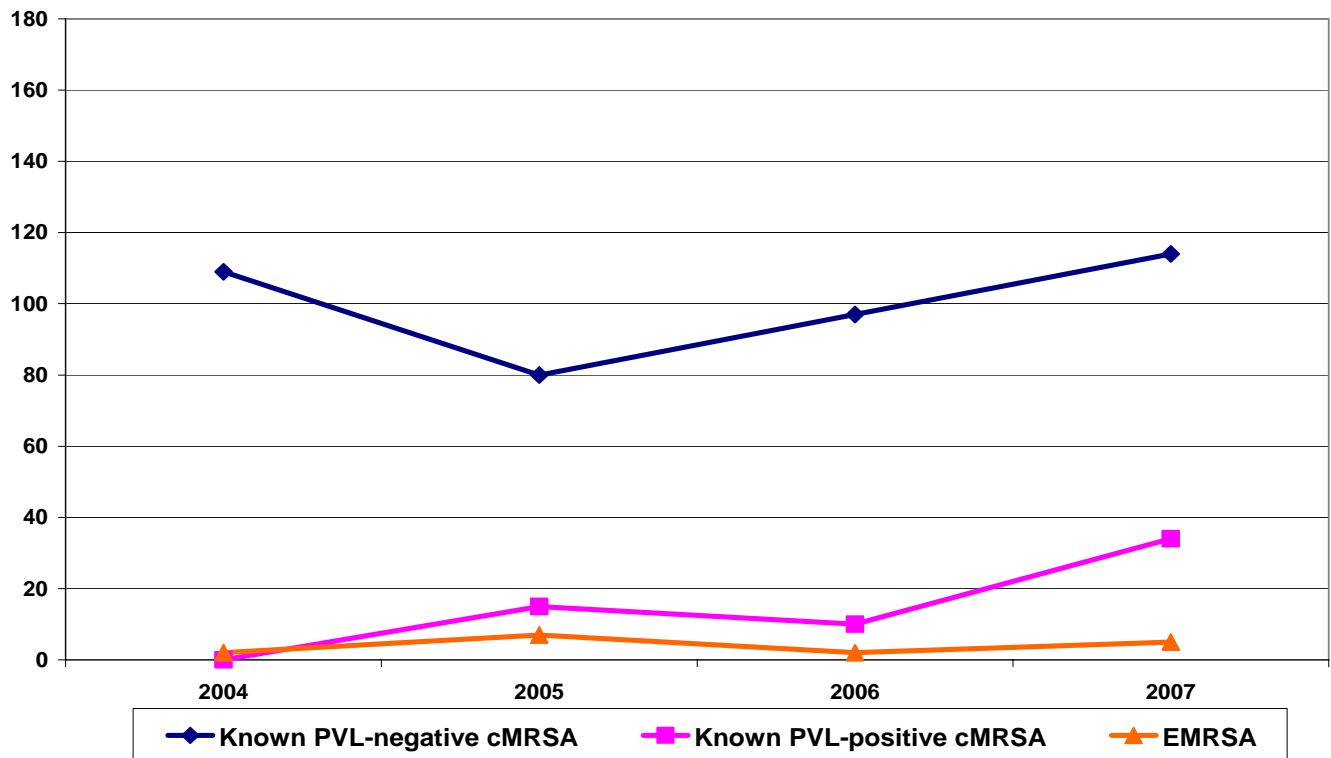


Figure 15 : Proportion of EMRSA and cMRSA, Pilbara-Gascoyne region July 2003 to December 2007

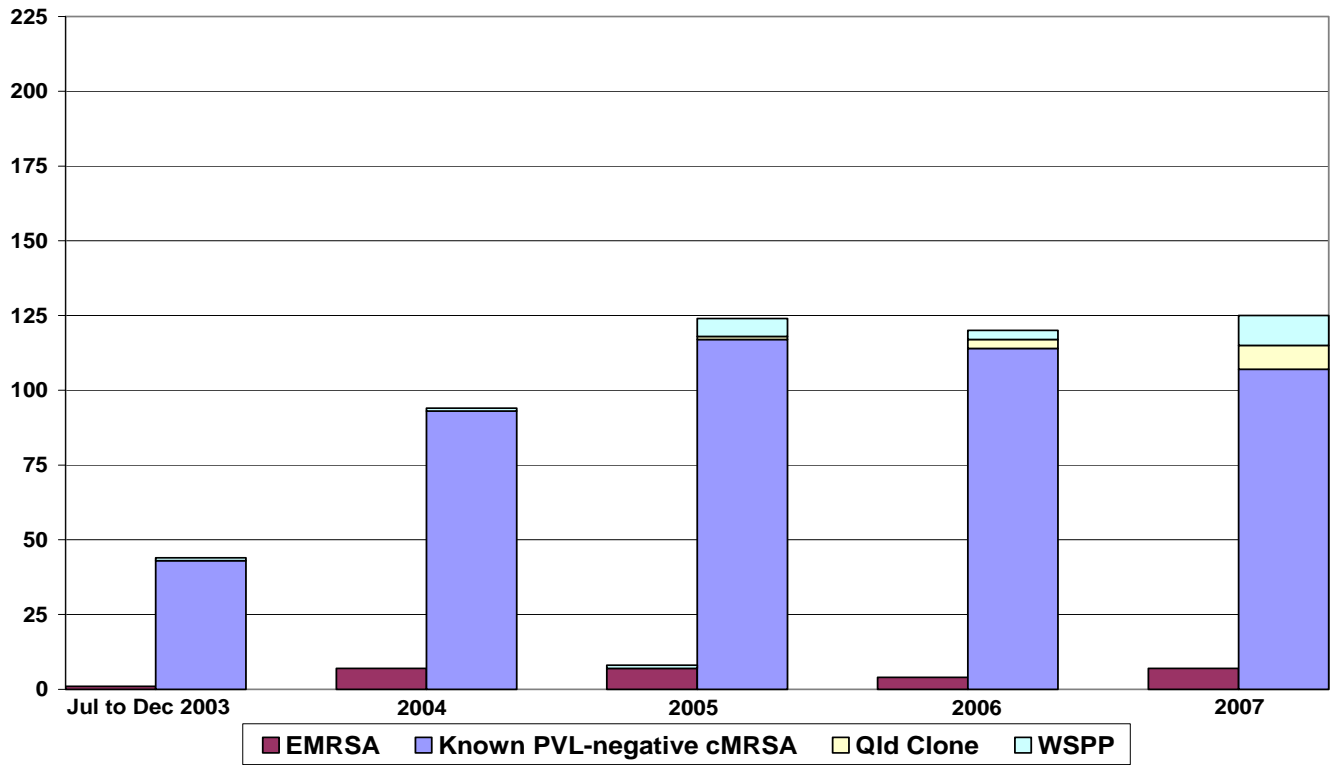


Figure 16 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Pilbara-Gascoyne region 2004 to 2007

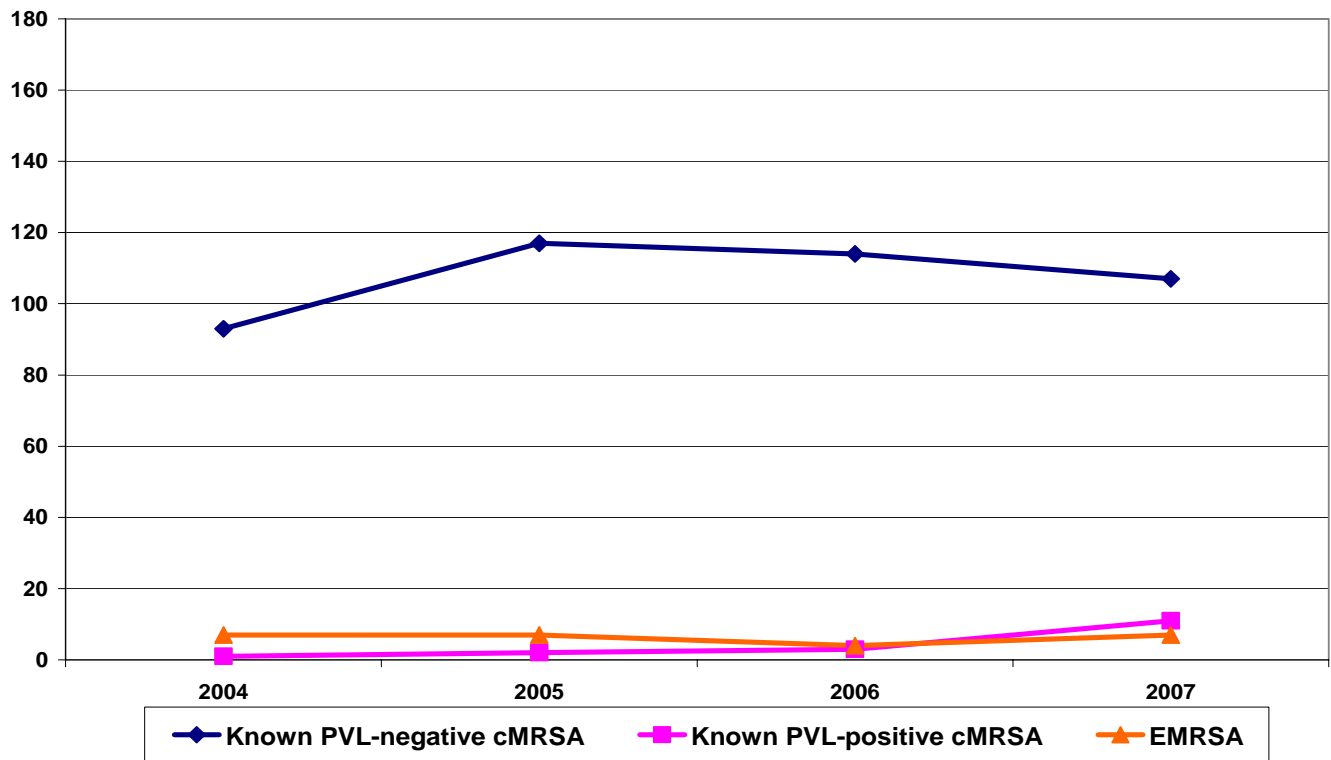


Figure 17 : Proportion of EMRSA and cMRSA, Mid West region July 2003 to December 2007

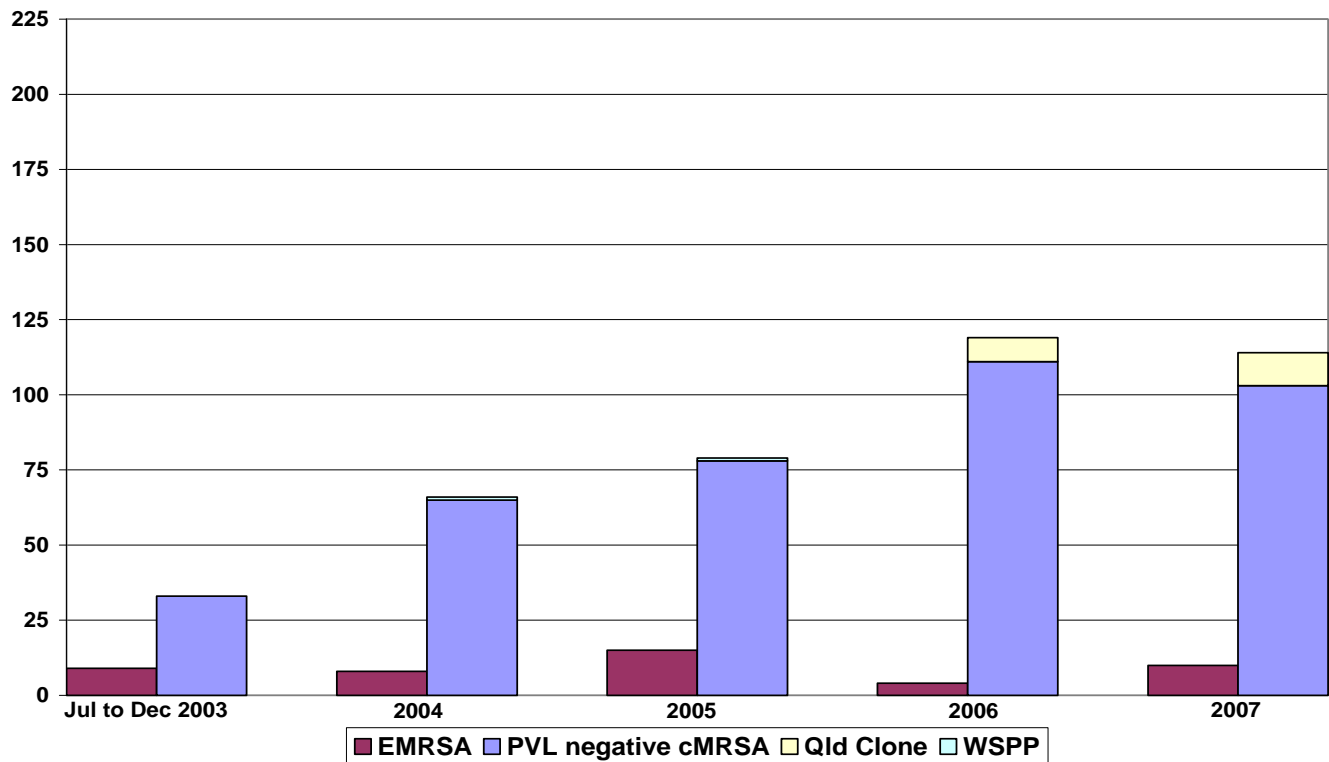


Figure 18 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Mid West region 2004 to 2007

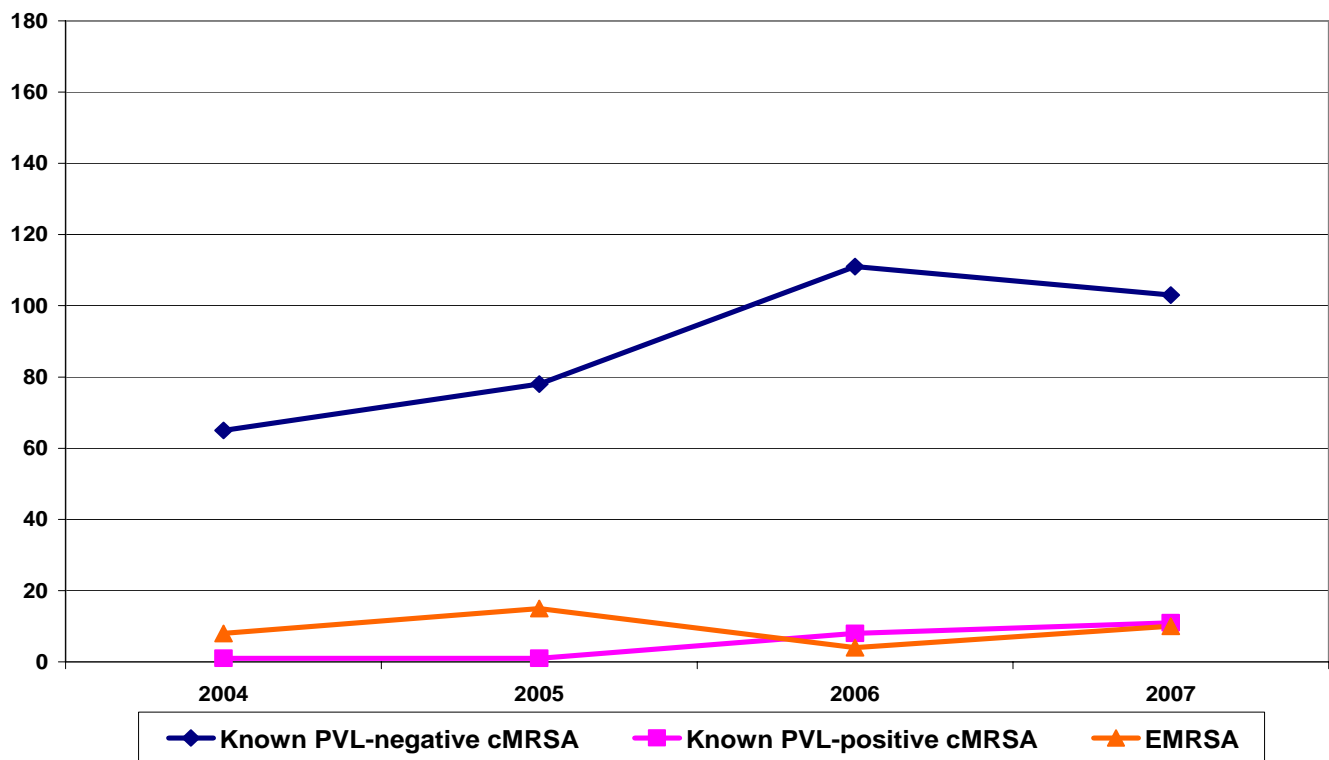


Figure 19 : Proportion of EMRSA and cMRSA, Goldfields region July 2003 to December 2007

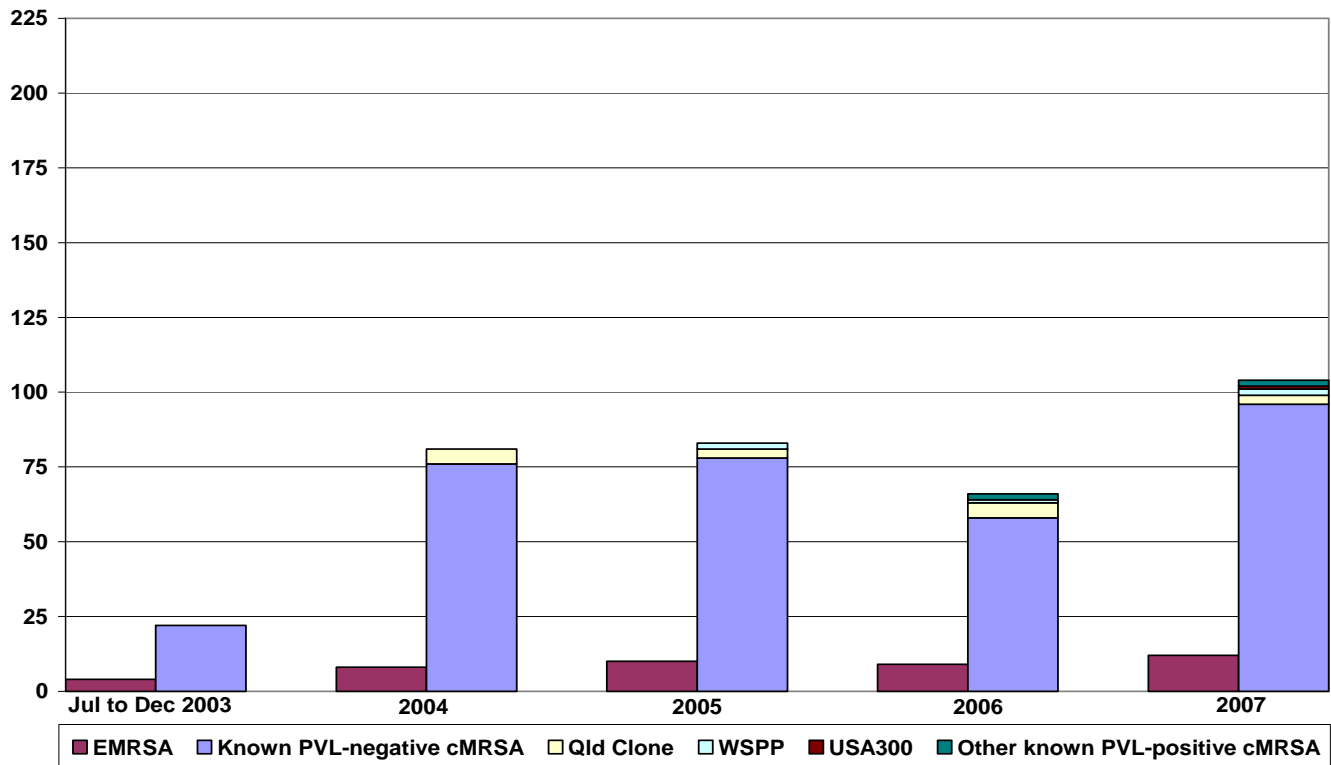


Figure 20 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Goldfields region 2004 to 2007

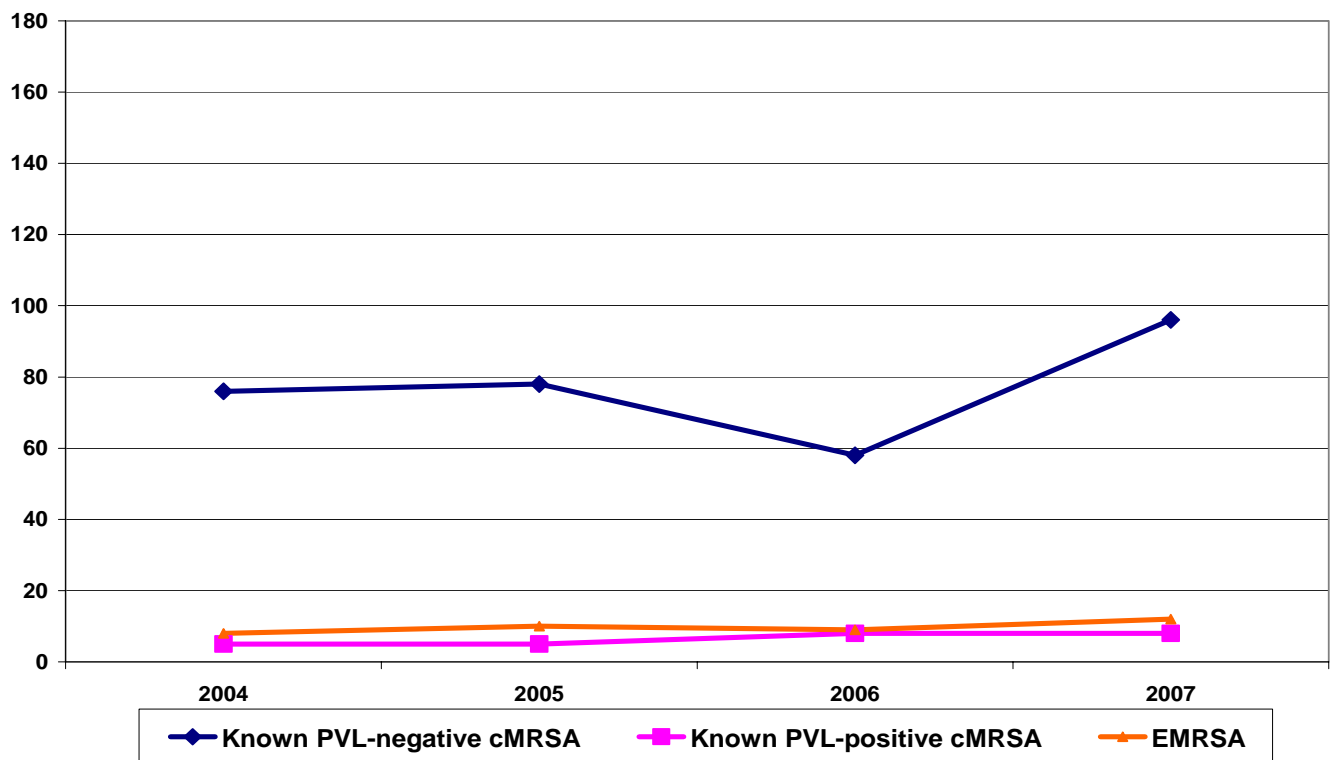


Figure 21 : Proportion of EMRSA and cMRSA, Central region July 2003 to December 2007

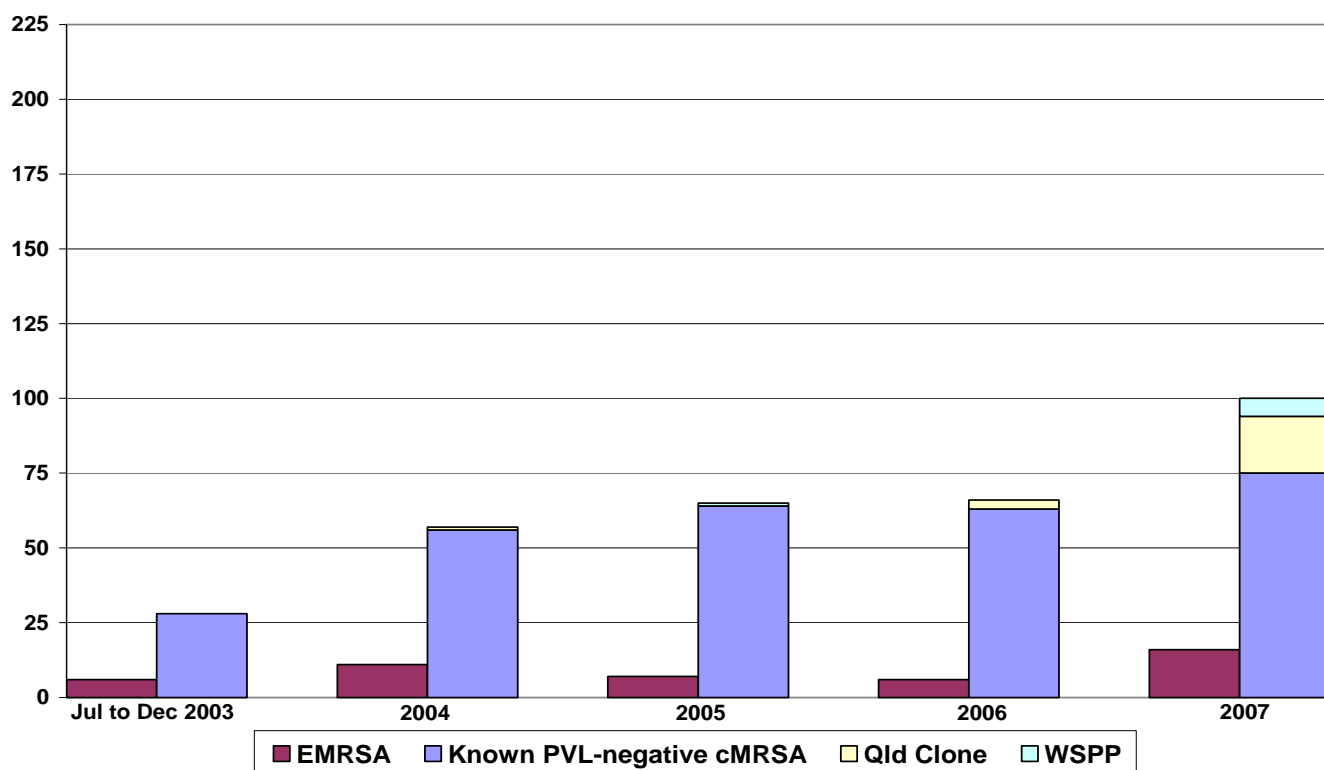


Figure 22 : Number of known PVL-positive and PVL-negative cMRSA and EMRSA, Central region 2004 to 2007

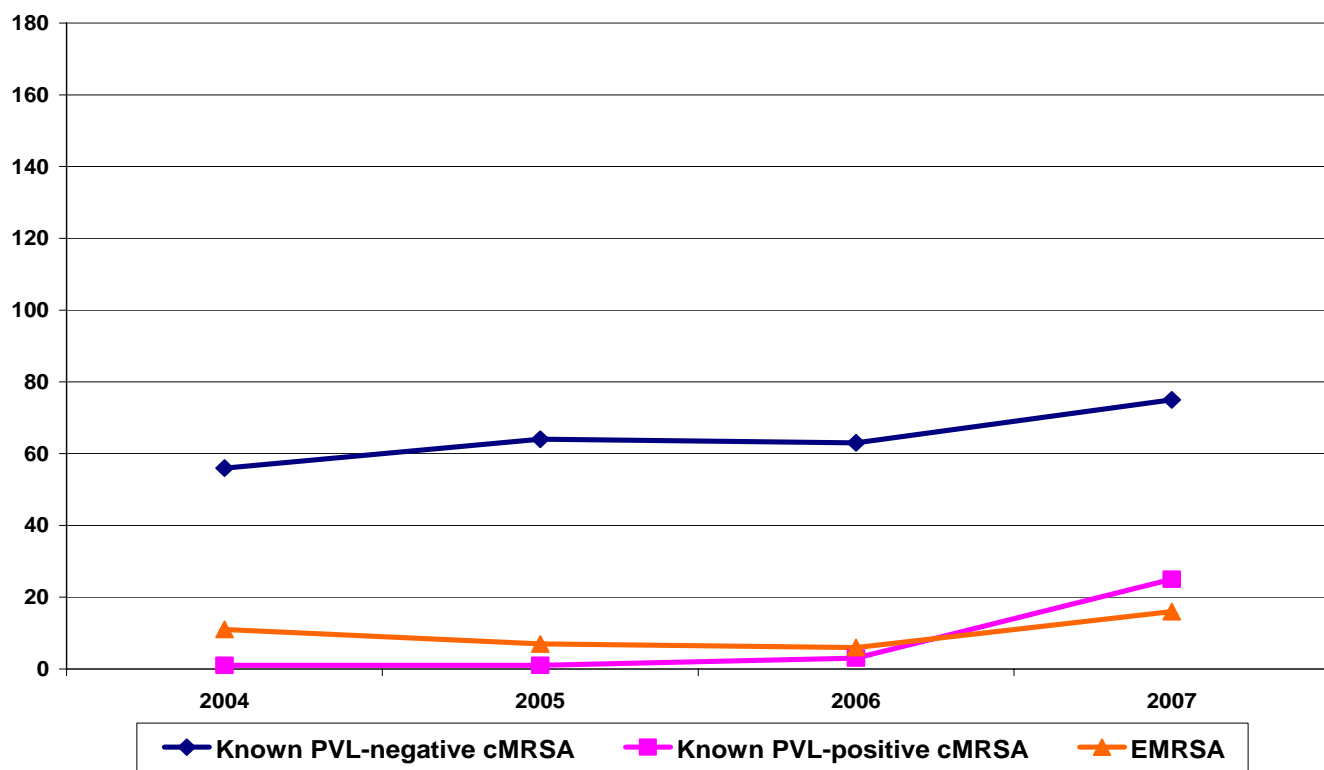


Figure 23 : Proportion of EMRSA and cMRSA, South West region July 2003 to December 2007

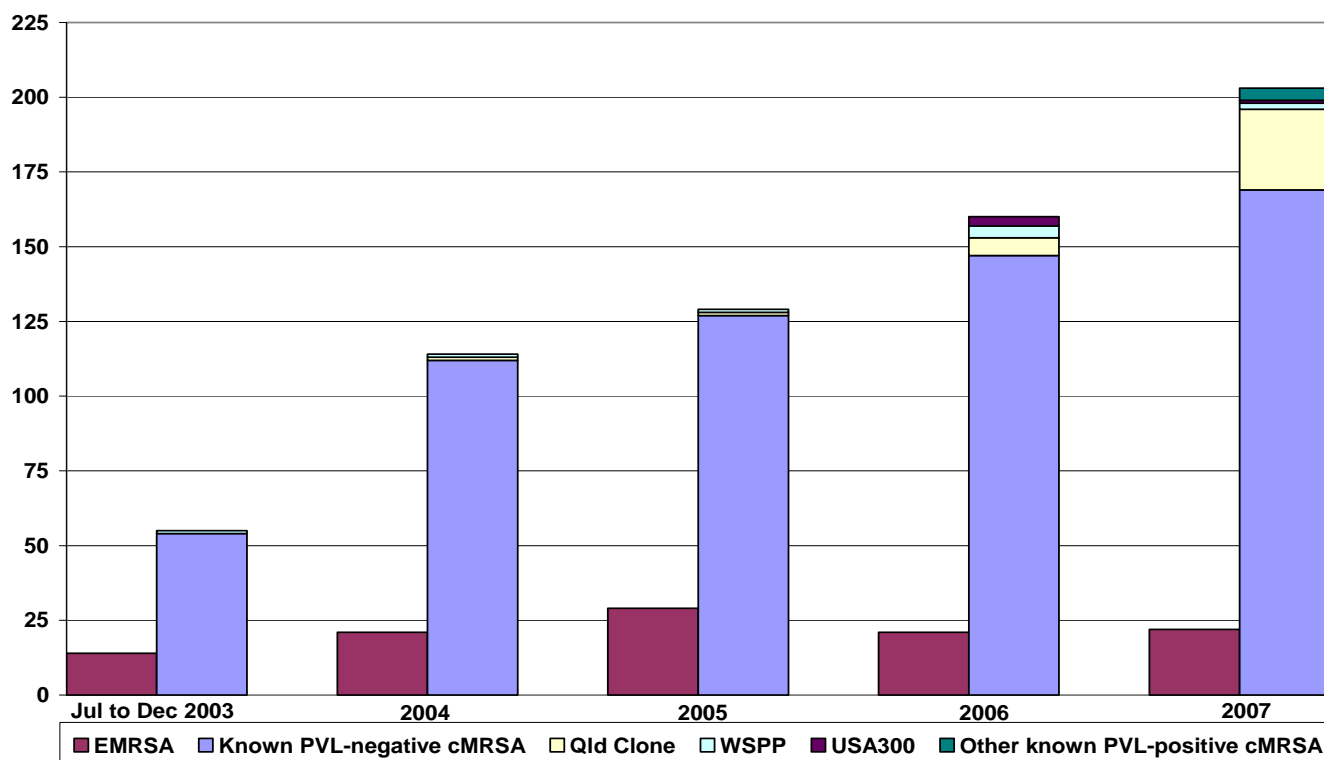


Figure 24 : Number known PVL-positive and PVL-negative cMRSA and EMRSA, South West region 2004 to 2007

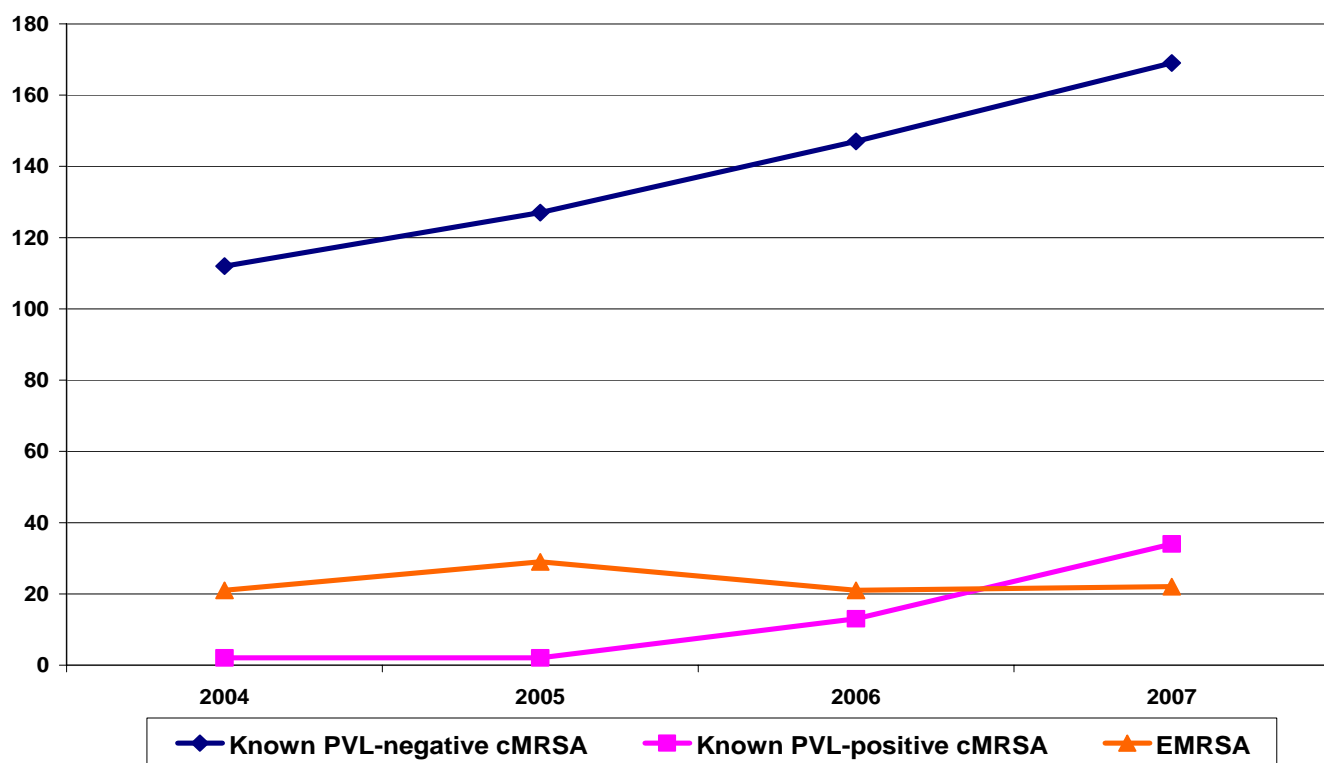


Figure 25 : Proportion of EMRSA and cMRSA, Great Southern region July 2003 to December 2007

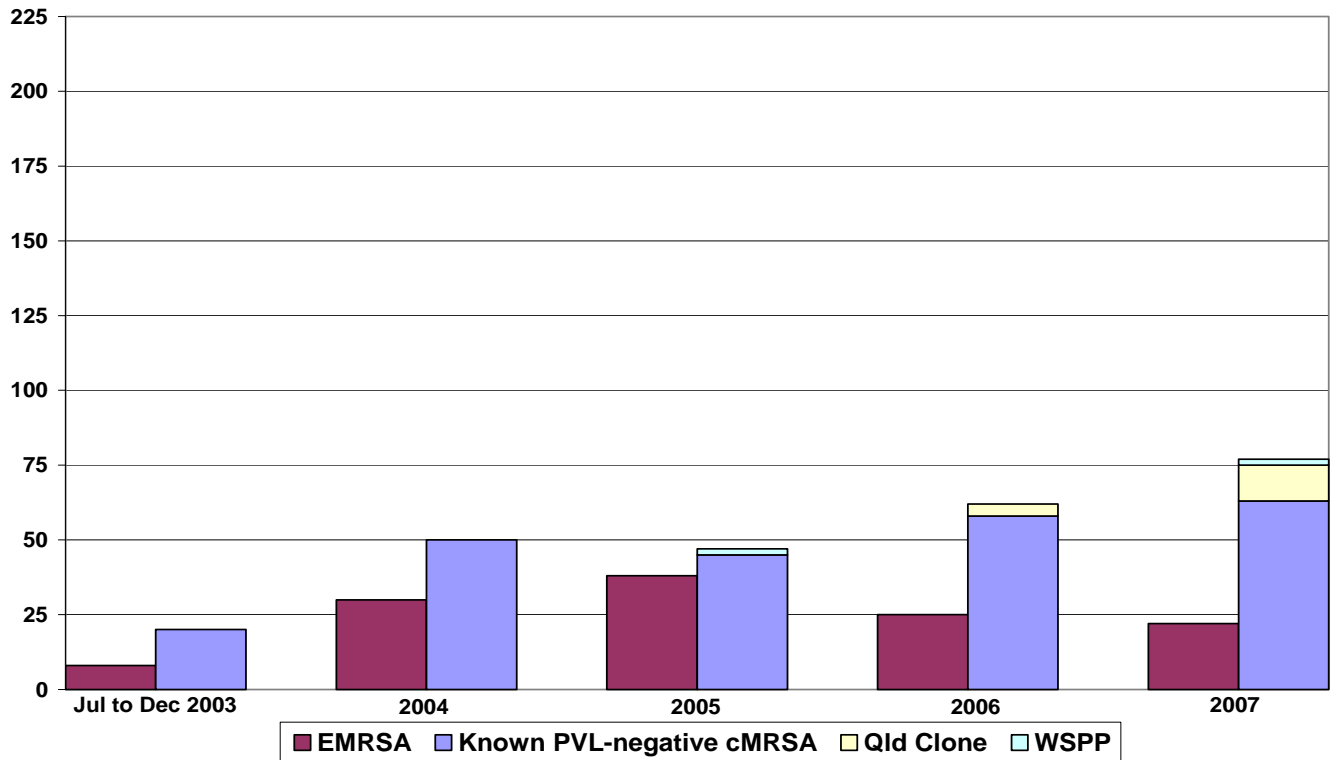
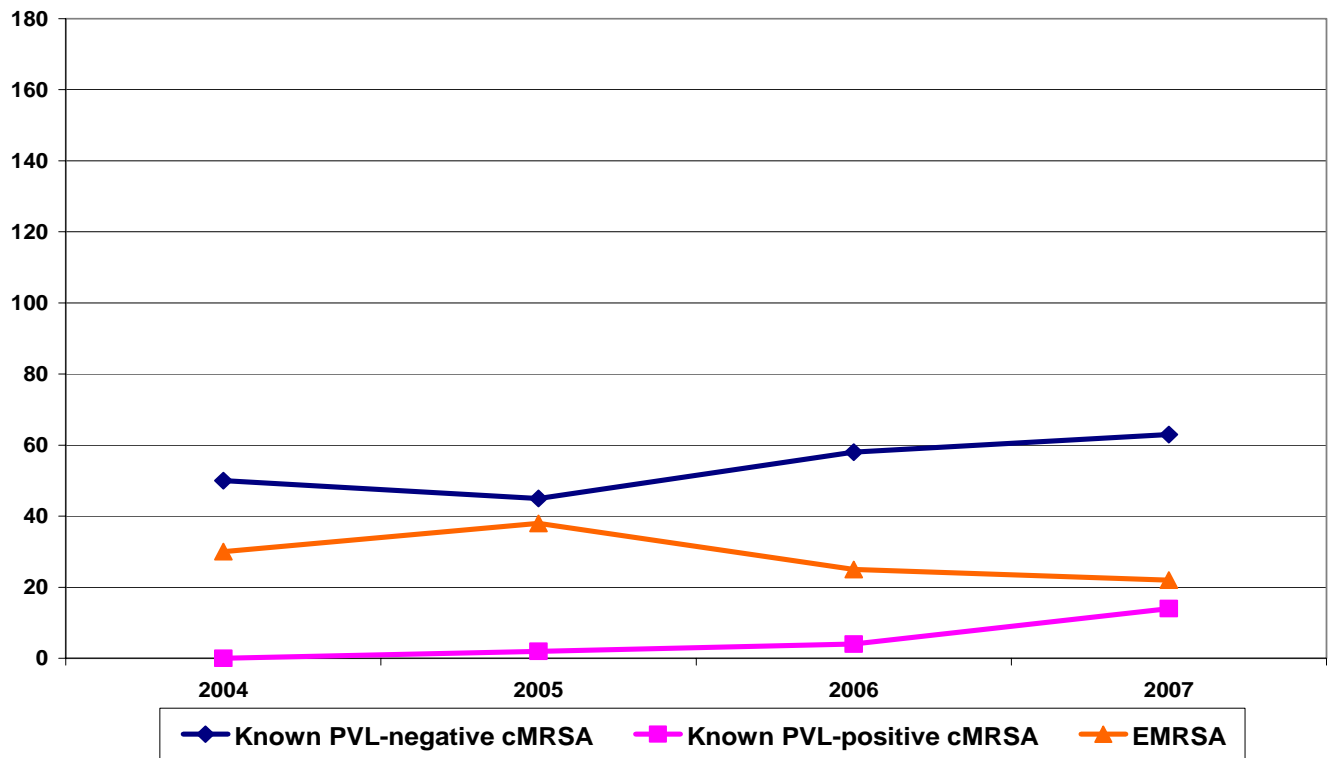


Figure 26 : Number of PVL known PVL-positive and PVL-negative cMRSA and EMRSA, Great Southern region 2004 to 2007



Section 6

MRSA Isolates (Duplicates included) Received by the GPBTRU

July 1997 to December 2007

6 Methicillin-resistant *Staphylococcus aureus* (MRSA) isolates received by the GPBTRU, July 1997 to December 2007

Table 6: MRSA isolated in WA referred to the Gram-positive Bacteria Typing and Research Unit, 1 July 1997 – 31 December 2007

EMRSA Clones	1997/98 (%)	1998/99 (%)	1999/00 (%)	2000/01 (%)	2001/02 (%)	2002/03 (%)	2003/04 (%)	2004/05 (%)	2005/06 (%)	2006/07 (%)
ST8-MRSA-VI (Irish-2 EMRSA)	46 (3.4)	45 (2.8)	42 (2.2)	35 (1.58)	17 (0.74)	19 (0.80)	16 (0.56)	8 (0.23)	8 (0.22)	1 (0.03)
ST22-MRSA-IV (UK EMRSA-15)	34 (2.51)	91 (5.65)	168 (8.79)	338 (15.25)	324 (14.06)	390 (16.50)	484 (16.81)	732 (21.32)	744 (20.66)	664 (17.01)
**ST239-MRSA-III (Aus-2 EMRSA)	-	-	-	95 (4.28)	119 (5.16)	51 (2.16)	75 (2.61)	39 (1.14)	20 (0.56)	26 (0.67)
**ST239-MRSA-III (Aus-3 EMRSA)	-	-	-	26 (1.17)	16 (0.69)	25 (1.06)	29 (1.0)	65 (1.89)	45 (1.25)	17 (0.44)
ST36-MRSA-II (UK EMRSA-16)	-	-	5 (0.26)	2 (0.09)	28 (1.22)	32 (1.35)	9 (0.31)	18 (0.52)	5 (0.14)	11 (0.28)
ST247-MRSA-I (UK EMRSA-17)	-	-	-	-	-	-	-	1 (0.03)	1 (0.03)	2 (0.05)
ST5-MRSA-II (New York/Japan EMRSA)	-	-	-	-	-	-	15 (0.52)	32 (0.93)	8 (0.22)	18 (0.46)
ST225-MRSA-II (Related to NY/Japan EMRSA)	-	-	-	-	-	-	-	-	-	1 (0.03)
ST8-MRSA-III (UK EMRSA-7)	-	-	-	-	-	-	1 (0.03)	-	-	-
ST250-MRSA-I (Classic MRSA)	-	-	-	-	-	-	1 (0.03)	-	-	-
ST250slv-MRSA-I (Related to Classic MRSA)	-	-	-	-	-	-	-	-	-	1 (0.03)
ST8-MRSA-II (Irish-1 EMRSA)	-	-	-	-	-	-	2 (0.07)	1 (0.03)	-	4 (0.10)
ST228-MRSA-I (Southern German MRSA)	-	-	-	-	-	-	-	-	-	1 (0.03)
Total epidemic strains	80 (5.91)	136 (8.44)	215 (11.25)	496 (22.37)	504 (21.87)	517 (21.87)	632 (21.95)	896 (26.09)	831 (23.04)	746 (19.11)

**Aus-2 and Aus-3 EMRSA were not separated from uncharacterised multiresistant strains before 1/07/02

Table 6 cont: MRSA isolated in WA referred to the Gram-positive Bacteria Typing and Research Unit, 1 July 1997 – 31 December 2007

EMRSA Clones	Jul – Dec 07 (%)									
ST8-MRSA-VI (Irish-2 EMRSA)	5 (0.2)									
ST22-MRSA-IV (UK EMRSA-15)	328 (14.8)									
**ST239-MRSA-III (Aus-2 EMRSA)	19 (0.9)									
**ST239-MRSA-III (Aus-3 EMRSA)	13 (0.6)									
ST36-MRSA-II (UK EMRSA-16)	6 (0.3)									
ST247-MRSA-I (UK EMRSA-17)	-									
ST5-MRSA-II (New York/Japan EMRSA)	15 (0.7)									
ST225-MRSA-II (Related to NY/Japan EMRSA)	-									
ST8-MRSA-III (UK EMRSA-7)	-									
ST250-MRSA-I (Classic MRSA)	-									
ST250slv-MRSA-I (Related to Classic MRSA)	-									
ST8-MRSA-II (Irish-1 EMRSA)	4 (0.2)									
Total epidemic strains	390 (17.7)									

**Aus-2 and Aus-3 EMRSA were not separated from uncharacterised multiresistant strains before 1/07/02

Table 6 cont: MRSA isolated in WA referred to the Gram-positive Bacteria Typing and Research Unit, 1 July 1997 – 31 December 2007

Strains of MRSA	1997/98 (%)	1998/99 (%)	1999/00 (%)	2000/01 (%)	2001/02 (%)	2002/03 (%)	2003/04 (%)	2004/05 (%)	2005/06 (%)	2006/07 (%)
ST30-MRSA-IV (WSPP MRSA)	-	-	-	2 (0.09)	9 (0.39)	10 (0.42)	16 (0.56)	46 (1.34)	54 (1.50)	91 (2.33)
ST93-MRSA-IV (Qld cMRSA)	-	-	-	-	-	-	21 (0.73)	48 (1.40)	95 (2.63)	184 (4.71)
ST80-MRSA-IV (European cMRSA)	-	-	-	-	-	-	-	-	5 (0.14)	8 (0.20)
ST8-MRSA-IV (USA300)	-	-	-	-	-	-	4 (0.14)	8 (0.23)	13 (0.36)	21 (0.54)
ST59-MRSA-V (Taiwan MRSA)	-	-	-	-	-	-	1 (0.03)	3 (0.09)	2 (0.06)	6 (0.15)
*WA MRSA							2,205 (76.59)	2,431 (70.79)	2,607 (72.45)	2,847 (72.94)
Characterised sporadic multiresistant strains	-	-	-	-	-	-	-	2 (0.06)	-	-
Non characterised multiresistant strains	67 (4.95)	74 (4.59)	91 (4.76)	49 (2.21)	48 (2.08)	33 (1.40)	-	-	-	-
Non characterised non- multiresistant strains	1,207 (89.14)	1,401 (86.97)	1,605 (83.99)	1,670 (75.33)	1,744 (75.66)	1,804 (76.31)	-	-	-	-
Total all strains	1,354	1,611	1,911	2,217	2,305	2,364	2,879	3,434	3,601	3,903

*WA MRSA were not separated from uncharacterised non-multiresistant strains before 01/07/03

Table 6 cont: MRSA isolated in WA referred to the Gram-positive Bacteria Typing and Research Unit, 1 July 1997 – 31 December 2007

Strains of MRSA	Jul – Dec 07 (%)									
ST30-MRSA-IV (WSPM MRSA) (PVL positive)	42 (1.9)									
ST93-MRSA-IV (Qld cMRSA) (PVL positive)	207 (9.3)									
ST80-MRSA-IV (European cMRSA) (PVL positive)	2 (0.1)									
ST8-MRSA-IV (USA300) (PVL positive)	26 (1.2)									
ST59-MRSA-V (Taiwan MRSA) (PVL positive)	4 (0.2)									
Other known PVL-positive cMRSA strains	7 (0.3)									
PVL-negative cMRSA strains	1,543 (69.5)									
Characterised sporadic multiresistant strains	-									
Non characterised multiresistant strains	-									
Non characterised non-multiresistant strains	-									
Total all strains	2,221									

6.1 Epidemic methicillin-resistant *Staphylococcus aureus*

MRSA strains known to spread easily within and between hospitals are designated epidemic MRSA (EMRSA).

During the six-month period 01/07/07 to 31/12/07, six international EMRSA clones (390 strains) were characterised.

MLST/SCC _{mec}	Clone	CC*	Patients n=369 (94.6%)		Staff n=21 (5.4%)		n (%)
			Clinical	Screen	Clinical	Screen	
ST22-MRSA-IV	UK EMRSA-15, Barnim EMRSA	22	210	99	1	18	328 (84.1)
ST239-MRSA-III	EMRSA-1, -4, -11, Portuguese, Brazilian EMRSA, Aus-2 EMRSA, Aus-3 EMRSA	8	16	15	0	1	32 (8.2)
ST5-MRSA-II	New York/Japan EMRSA	5	9	6	0	0	15 (3.8)
ST36-MRSA-II	UK EMRSA-16	30	3	2	0	1	6 (1.5)
ST8-MRSA-VI	Irish-2 EMRSA	8	2	3	0	0	5 (1.3)
ST8-MRSA-II	Irish-1 EMRSA	8	2	2	0	0	4 (1.0)
Total			242	127	1	20	390

* Clonal Complex.

Percentage figures relate to the EMRSA isolates

Annual number of isolates of EMRSA and the percentage of MRSA identified as EMRSA are described in Figures 27 and 28.

Figure 27: Annual number of referred strains of Epidemic MRSA isolated in Western Australia, July 1997 to December 2007

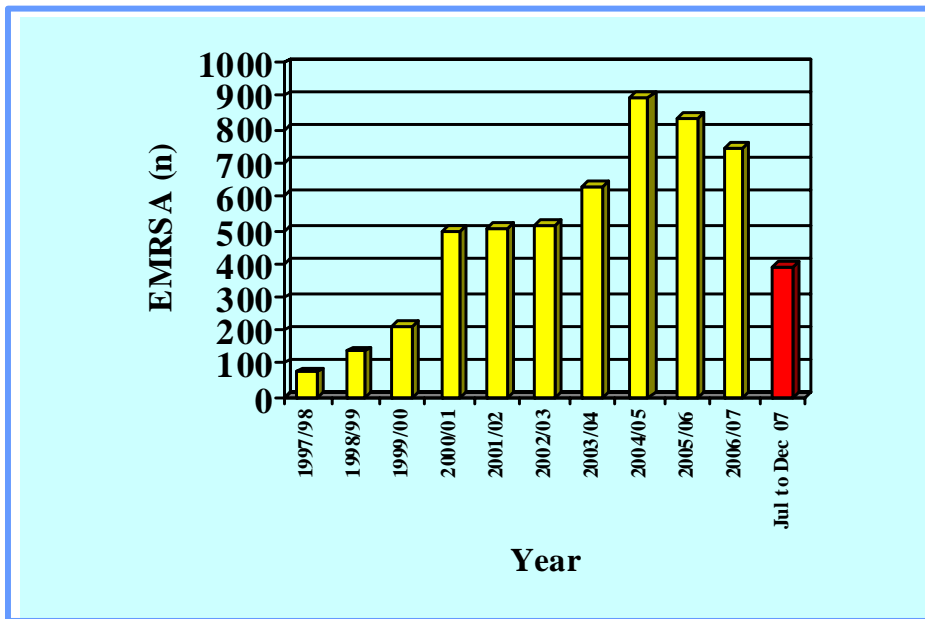
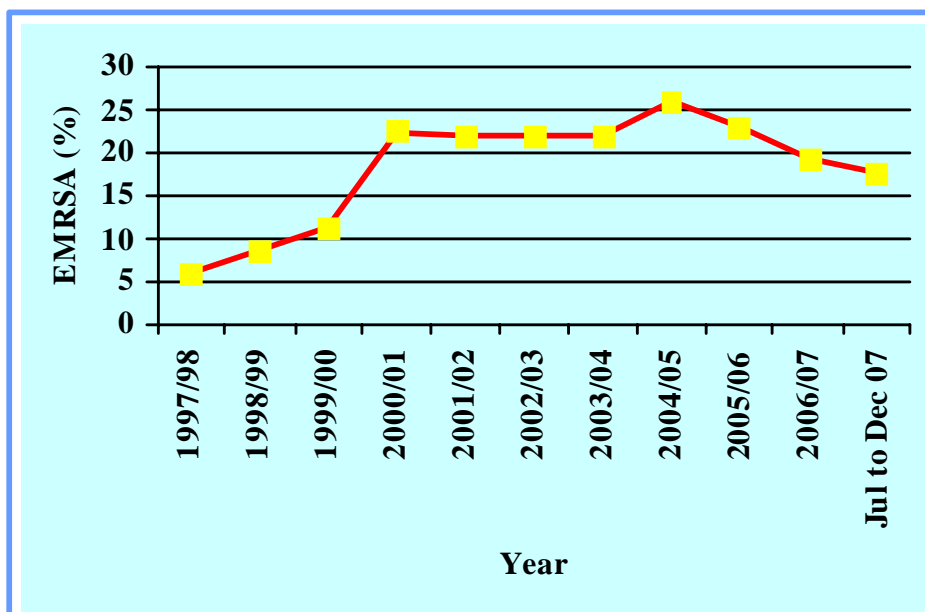


Figure 28: Epidemic MRSA as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.1.1 ST22-MRSA-IV (UK EMRSA-15)

In the six month period 01/07/2007 – 31/12/2007, 328 ST22-MRSA-IV (UK EMRSA-15) were referred from 24 laboratories:

Typing Characteristics

Coagulase Gene PCR-RFLP:

Type 22

Antibiogram:

Ciprofloxacin^R (99%)

Erythromycin^R (60%)

Mupirocin^R (4%)

Trimethoprim^R (3%)

Gentamicin^R (1%)

Fusidic Acid^R (1%)

Tetracycline^R (<1%)

Rifampicin^R (<1%)

Urease:

Negative

Patients (309)	
Clinical Specimens	210
Screening Specimens	99
Hospital Staff (19)	
Clinical Specimens	1
Screening Specimens	18

Annual number of isolates of ST22-MRSA-IV and the percentage of MRSA identified as ST22-MRSA-IV are described in Figures 29 and 30.

Since 01/07/97 4,296 ST22-MRSA-IV have been isolated and characterised in Western Australia

Figure 29: Annual number of referred strains of ST22-MRSA-IV (UK EMRSA-15) isolated in Western Australia, July 1997 to December 2007

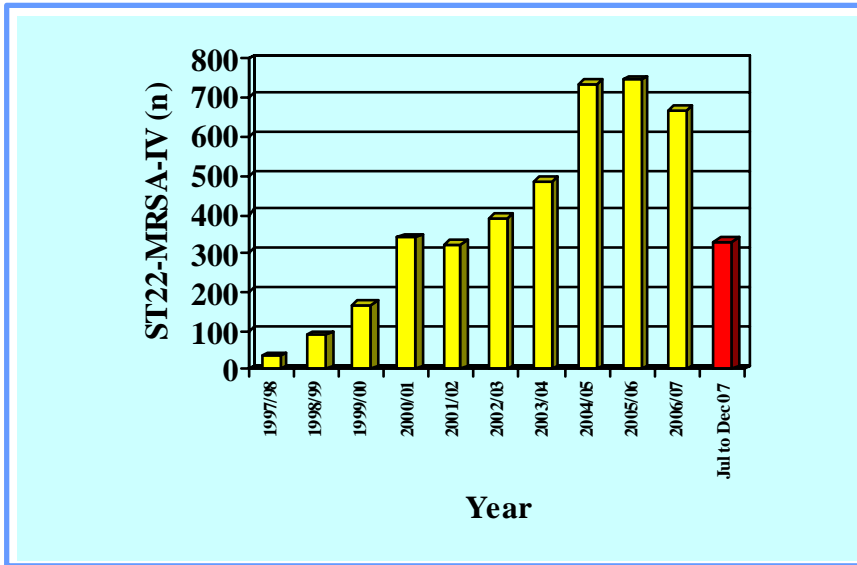
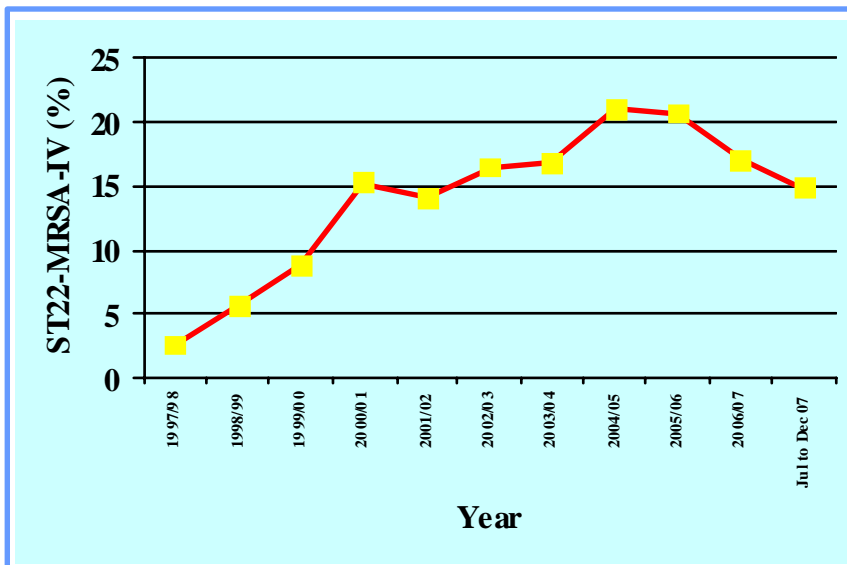


Figure 30: ST22-MRSA-IV (UK EMRSA-15) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.1.2 ST239-MRSA-III (Aus-2 EMRSA)

In the six month period 01/07/2007 – 31/12/2007, 19 ST239-MRSA-III (Aus-2 EMRSA) were referred from 7 laboratories.

Typing Characteristics

Coagulase Gene PCR-RFLP:

Type 24

Antibiogram:

Trimethoprim^R (100%)

Tetracycline^R (100%)

Erythromycin^R (95%)

Gentamicin^R (95%)

Ciprofloxacin^R (79%)

Fusidic Acid^R (0%)

Rifampicin^R (0%)

Mupirocin^R (0%)

Resistogram:

Mercuric Chloride^R (0%)

Phenylmercuric Acetate^R (0%)

Urease:

Positive

Patients (19)	
Clinical Specimens	10
Screening Specimens	9
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST239-MRSA-III (Aus-2 EMRSA) and the percentage of MRSA identified as ST239-MRSA-III (Aus-2 EMRSA) are described in Figures 31 and 32.

Since 01/07/00, 444 ST239-MRSA-III (Aus-2 EMRSA) have been isolated and characterised in Western Australia.

Figure 31: Annual number of referred strains of ST239-MRSA-III (Aus-2 EMRSA) isolated in Western Australia, July 1997 to December 2007

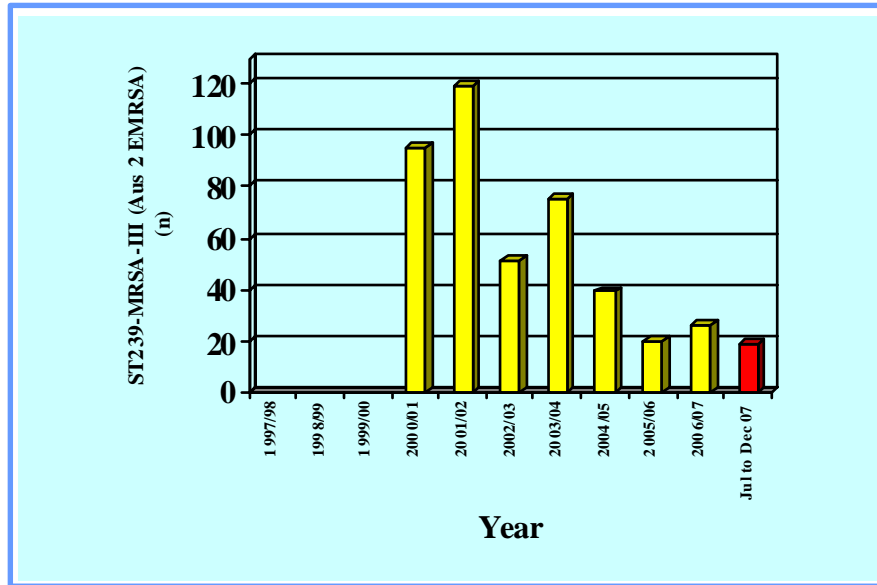
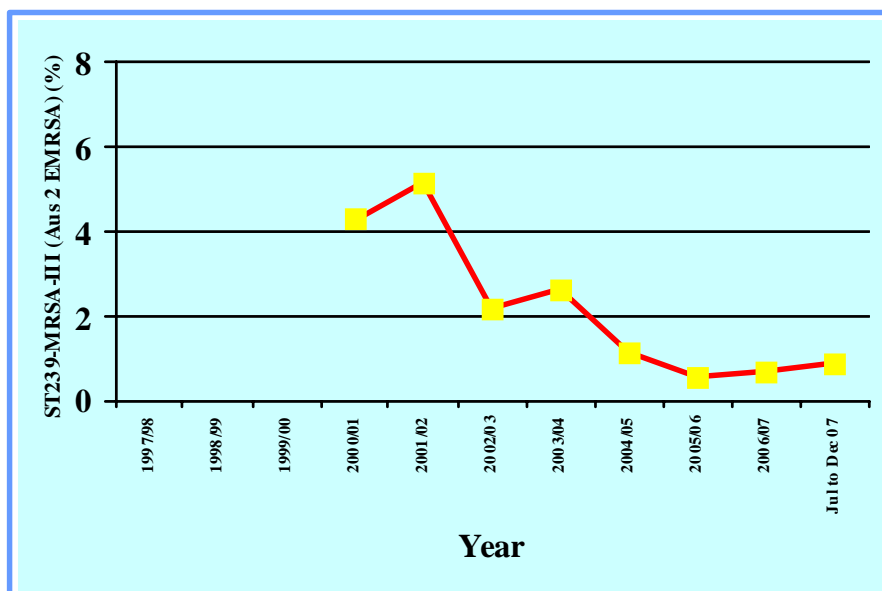


Figure 32: ST239-MRSA-III (Aus-2 EMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.1.3 ST239-MRSA-III (Aus-3 EMRSA)

In the six month period 01/07/2007 – 31/12/2007, 13 ST239-MRSA-III (Aus-3 EMRSA) were referred from eight laboratories.

Typing Characteristics

Coagulase Gene PCR-RFLP:

Type 24

Antibiogram:

Erythromycin^R (100%)
Trimethoprim^R (100%)
Ciprofloxacin^R (100%)
Tetracycline^R (100%)
Gentamicin^R (77%)
Rifampicin^R (23%)
Mupirocin^R (8%)
Fusidic Acid^R (0%)

Resistogram:

Mercuric Chloride^R (100%)
Phenyl Mercuric Acetate^R (100%)

Urease:

Positive

Patients (12)	
Clinical Specimens	6
Screening Specimens	6
Hospital Staff (1)	
Clinical Specimens	0
Screening Specimens	1

Annual number of isolates ST239-MRSA-III (Aus-3 EMRSA) and the percentage of MRSA identified as ST239-MRSA-III (Aus-3 EMRSA) are described in Figures 33 and 34.

Since 01/07/00, 236 ST239-MRSA-III (Aus-3 EMRSA) have been isolated and characterised in Western Australia.

Figure 33: Annual number of referred strains of ST239-MRSA-III (Aus-3 EMRSA) isolated in Western Australia, July 1997 to December 2007

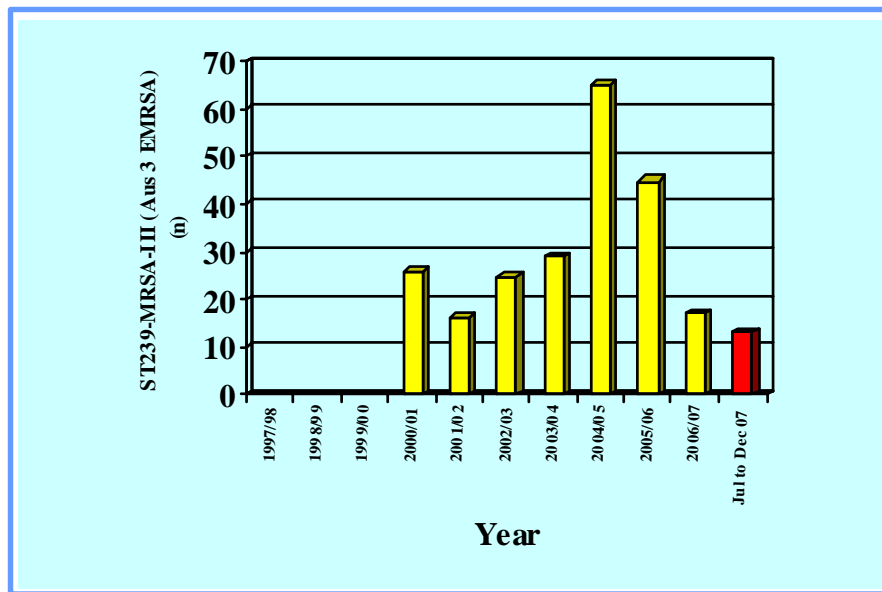
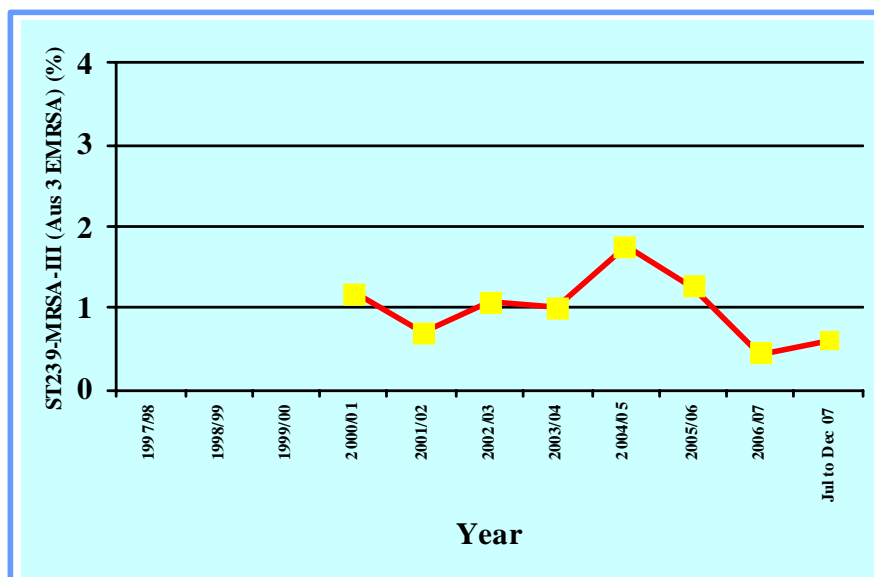


Figure 34: ST239-MRSA-III (Aus-3 EMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



Annual number of isolates of ST239-MRSA-III (Aus-2 and Aus-3 EMRSA) and the percentage of MRSA identified as ST239-MRSA-III (Aus-2 and Aus-3 EMRSA) are described in Figures 35 and 36.

Figure 35: Annual number of referred strains of ST239-MRSA-III isolated in Western Australia, July 1997 to December 2007

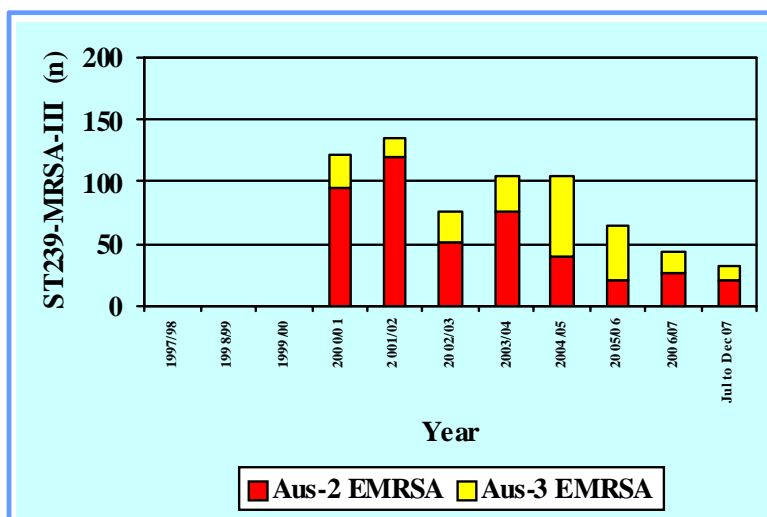
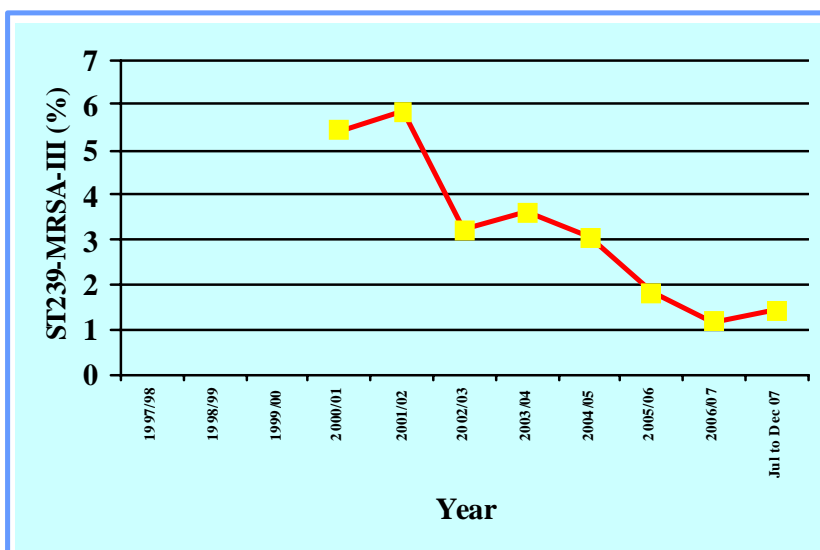


Figure 36: ST239-MRSA-III as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.1.4 ST5-MRSA-II (New York/Japan EMRSA)

In the six month period 01/07/2007 – 31/12/2007, 15 ST5-MRSA-II were referred from six laboratories

Typing Characteristics

Coagulase Gene PCR-RFLP:
Type 36

Antibiogram:

Ciprofloxacin^R (100%)
Erythromycin^R (100%)
Tetracycline^R (7%)
Gentamicin^R (7%)
Mupirocin^R (0%)
Trimethoprim^R (0%)
Rifampicin^R (0%)
Fusidic Acid^R (0%)

Urease:

Positive

Patients (15)	
Clinical Specimens	9
Screening Specimens	6
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST5-MRSA-II and the percentage of MRSA identified as ST5-MRSA-II are described in Figures 37 and 38.

Since 01/07/03, 88 ST5-MRSA-II have been isolated and characterised in Western Australia.

Figure 37: Annual number of referred strains of ST5-MRSA-II (New York/Japan EMRSA) isolated in Western Australia, July 1997 to December 2007

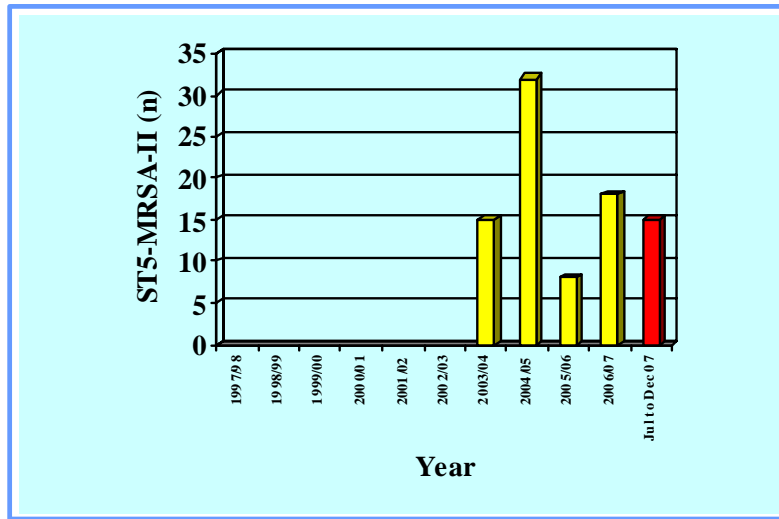
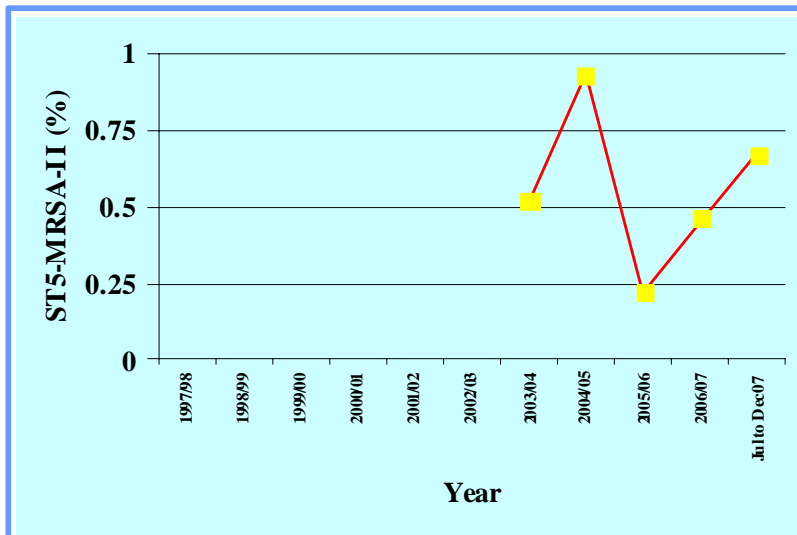


Figure 38: ST5-MRSA-II (New York/Japan EMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.1.5 ST36-MRSA-II (UK EMRSA-16)

In the six month period 01/07/2007 – 31/12/2007, six ST36-MRSA-II were referred from three laboratories

Typing Characteristics

Coagulase Gene PCR-RFLP:

Type 18

Antibiogram:

Erythromycin^R (100%)

Ciprofloxacin^R (100%)

Mupirocin^R (50%)

Trimethoprim^R (17%)

Gentamicin^R (0%)

Rifampicin^R (0%)

Tetracycline^R (0%)

Fusidic Acid^R (0%)

Urease:

Positive

Patients (5)	
Clinical Specimens	3
Screening Specimens	2
Hospital Staff (1)	
Clinical Specimens	0
Screening Specimens	1

Annual number of isolates of ST36-MRSA-II and the percentage of MRSA identified as ST36-MRSA-II are described in Figures 39 and 40.

Since 01/07/99, 116 ST36-MRSA-II have been isolated and characterised in Western Australia.

Figure 39: Annual number of referred strains of ST36-MRSA-II (UK EMRSA-16) isolated in Western Australia, July 1997 to December 2007

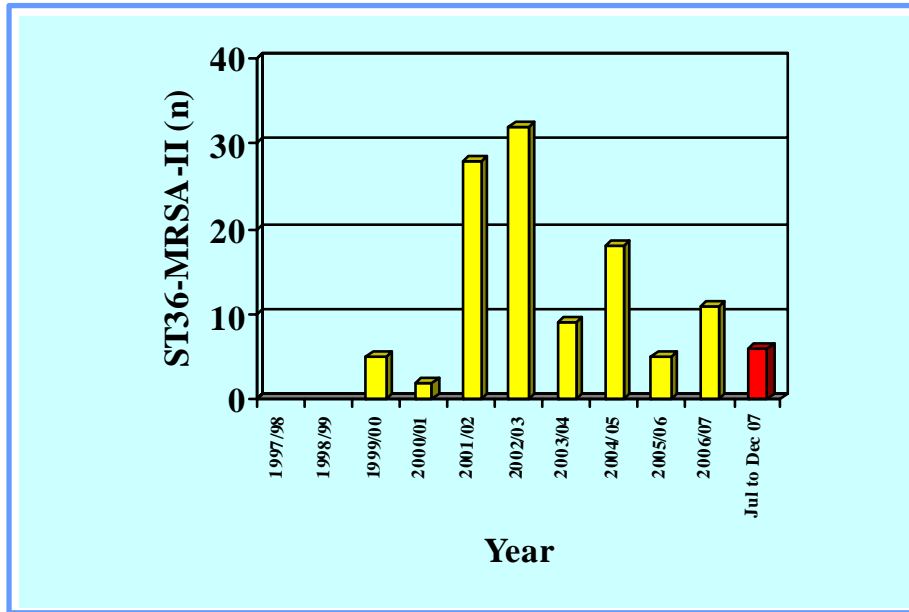
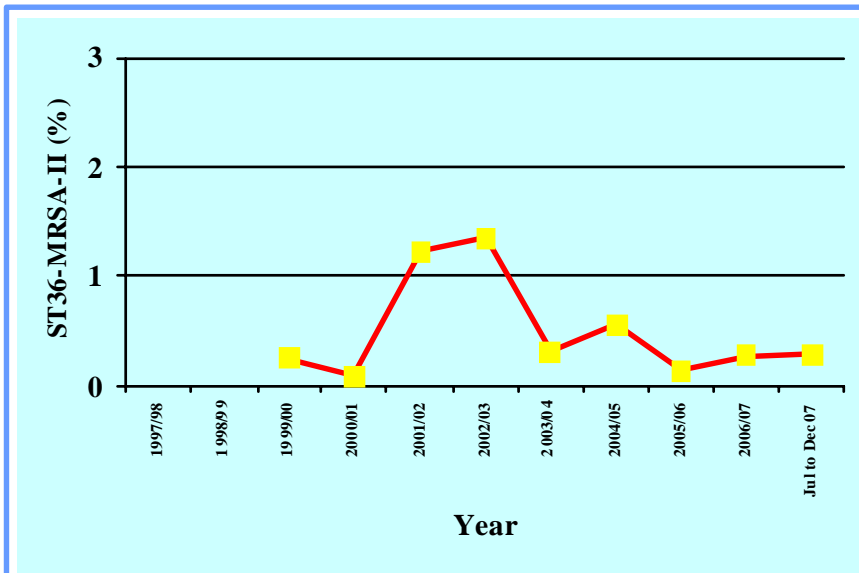


Figure 40: ST36-MRSA-II (UK EMRSA-16) as a percentage of the annual number of Referred MRSA isolated in Western Australia, July 1997 to December 2007



6.2 Community MRSA, July to December 2007

MLST/SCC <i>mec</i>	Clone	CC	Patients n= 1794 (98.0)		Staff n=37 (2.0%)		n (%)
			Clinical	Screen	Clinical	Screen	
ST1-MRSA-IV*	WA MRSA-1	1	644	152	0	18	814 (44.5)
ST78-MRSA-IV	WA MRSA-2	78	408	109	0	7	524 (28.6)
ST5-MRSA-IV	WA MRSA-3	5	99	38	1	4	142 (7.8)
ST93-MRSA-IV**	Qld cMRSA	S	197	8	0	2	207 (11.3)
ST30-MRSA-IV**	WSPP MRSA	30	41	1	0	0	42 (2.3)
ST8-MRSA-IV**	USA 300	8	25	1	0	0	26 (1.4)
ST59-MRSA-V**	Taiwan MRSA	59	4	0	0	0	4 (0.2)
ST80-MRSA-IV**	European cMRSA	80	2	0	0	0	2 (0.1)
Other known PVL-positive cMRSA**			6	1	0	0	7 (0.4)
Other known PVL-negative cMRSA			50	8	1	4	63 (3.4)
Total			1,476	318	2	35	1,831

* Approximately 3% of ST1-MRSA-IV are PVL positive (routine PVL PCR not performed on all isolates)

**Known PVL-positive clone.

Percentage figures relate to cMRSA isolates

During the six month period 01/07/07 to 31/12/07, 30 cMRSA clones (1,831 strains, 34 pulsotypes) were characterised.

6.2.1 ST93-MRSA-IV (Queensland cMRSA)

In the six month period 01/07/2007 – 31/12/2007, 207 ST93-MRSA-IV were referred from 29 laboratories:

Typing Characteristics:

Coagulase Gene PCR-RFLP:

Type 32

Antibiogram:

Erythromycin^R (3%)

Mupirocin^R (0%)

Gentamicin^R (0%)

Tetracycline^R (0%)

Rifampicin^R (0%)

Fusidic Acid^R (0%)

Ciprofloxacin^R (0%)

Trimethoprim^R (0%)

Urease:

Positive

Patients (205)	
Clinical Specimens	97
Screening Specimens	8
Hospital Staff (2)	
Clinical Specimens	0
Screening Specimens	2

Annual number of isolates of ST93-MRSA-IV and the percentage of MRSA identified as ST93-MRSA-IV are described in Figures 41 and 42.

Since 01/01/03, 555 ST93-MRSA-IV have been isolated and characterised in Western Australia.

NOTE: ST93-MRSA-IV has been identified as a PVL-positive community MRSA clone

Figure 41: Annual number of strains of ST93-MRSA-IV (Qld cMRSA) isolated in Western Australia, July 1997 to December 2007

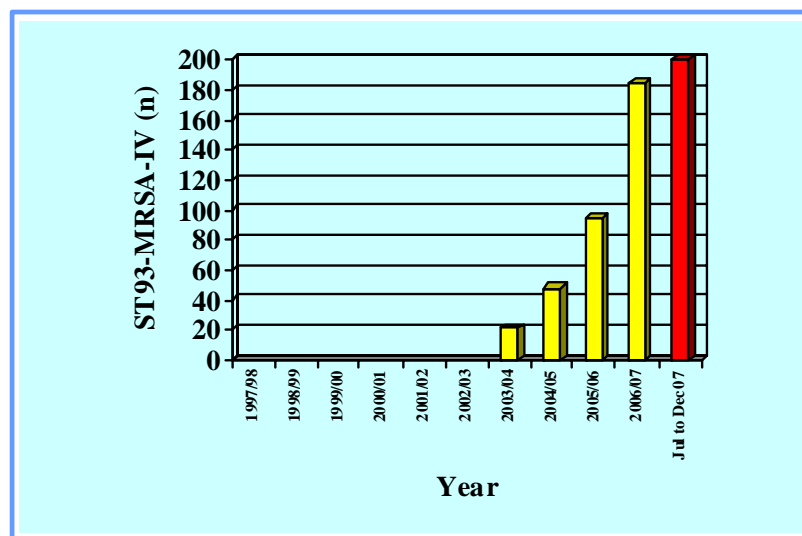
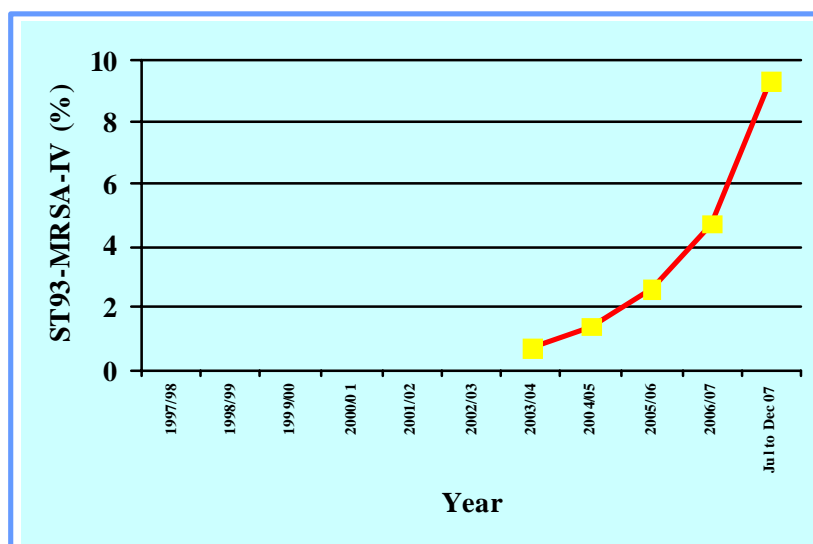


Figure 42: ST93-MRSA-IV (Qld cMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.2.2 ST30-MRSA-IV (Western Samoan MRSA -WSPP MRSA)

In the six month period 01/07/2007 – 31/12/2007, 42 ST30-MRSA-IV were referred from 16 laboratories

Typing Characteristics:

Coagulase Gene PCR-RFLP:
Type 24

Antibiogram:

Mupirocin^R (2%)
Erythromycin^R (0%)
Ciprofloxacin^R (0%)
Tetracycline^R (0%)
Gentamicin^R (0%)
Rifampicin^R (0%)
Fusidic Acid^R (0%)
Trimethoprim^R (0%)

Urease:

Positive

Patients (42)	41
Clinical Specimens	1
Screening Specimens	
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST30-MRSA-IV and the percentage of MRSA identified as ST30-MRSA-IV are described in Figures 43 and 44.

Since 01/01/01, 270 ST30-MRSA-IV have been isolated and characterised in Western Australia.

NOTE: ST30-MRSA-IV has been identified as a PVL-positive community MRSA clone

Figure 43: Annual number of referred strains of ST30-MRSA-IV (WSPP MRSA) isolated in Western Australia, July 1997 to December 2007

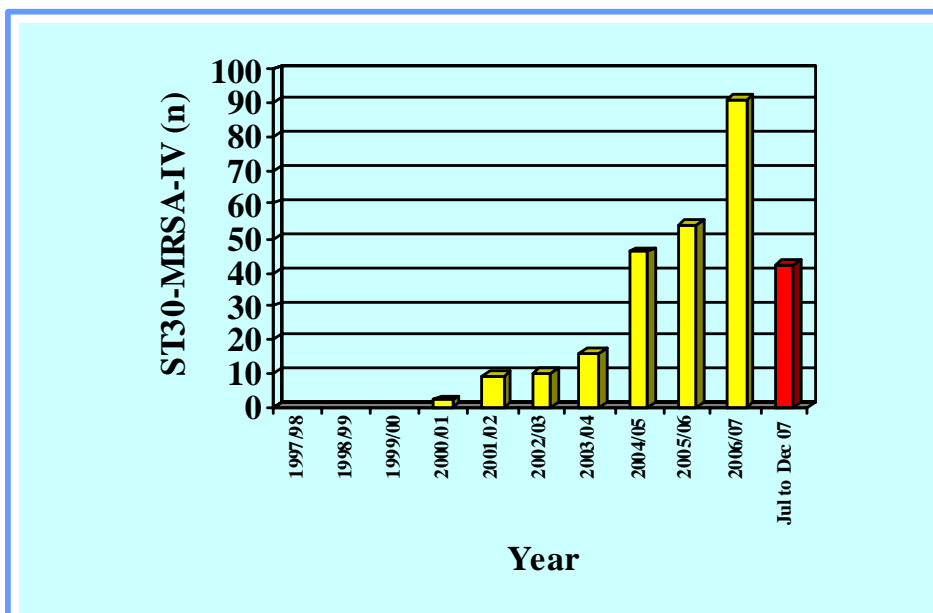
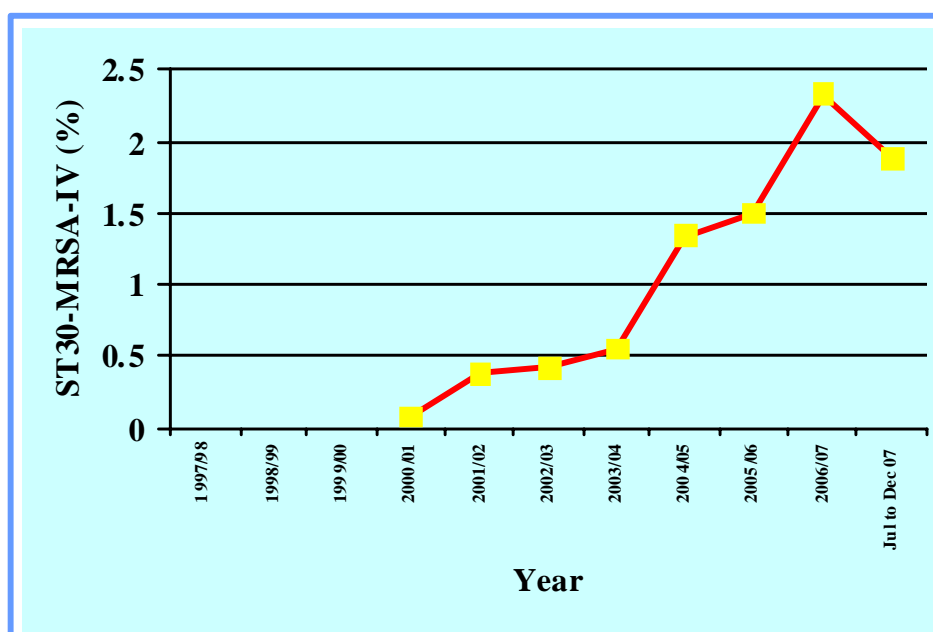


Figure 44: ST30-MRSA-IV (WSPP MRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.2.3 ST8-MRSA-IV (USA300 MRSA)

In the six month period 01/07/2007 – 31/12/2007, 26 ST8-MRSA-IV were referred from 10 laboratories

Typing Characteristics:

Coagulase Gene PCR-RFLP:

18

Antibiogram:

Erythromycin^R (92%)

Ciprofloxacin^R (35%)

Tetracycline^R (8%)

Mupirocin^R (0%)

Gentamicin^R (0%)

Rifampicin^R (0%)

Fusidic Acid^R (0%)

Trimethoprim^R (%)

Urease:

Positive

Patients (26)	
Clinical Specimens	25
Screening Specimens	1
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST8-MRSA-IV (USA300) and the percentage of MRSA identified as ST8-MRSA-IV (USA300) are described in Figures 45 and 46.

Since 01/07/03, 72 ST8-MRSA-IV (USA300) have been isolated and characterised in Western Australia.

NOTE: ST8-MRSA-IV (USA300) has been identified as a PVL-positive community MRSA clone

Figure 46: ST8-MRSA-IV (USA300 MRSA) as a percentage of the annual number of MRSA isolated in Western Australia, July 1997 to December 2007

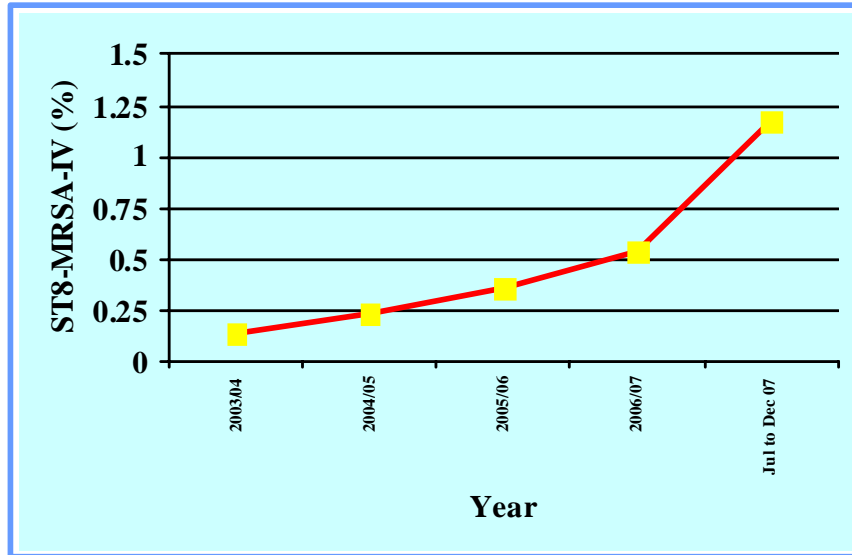
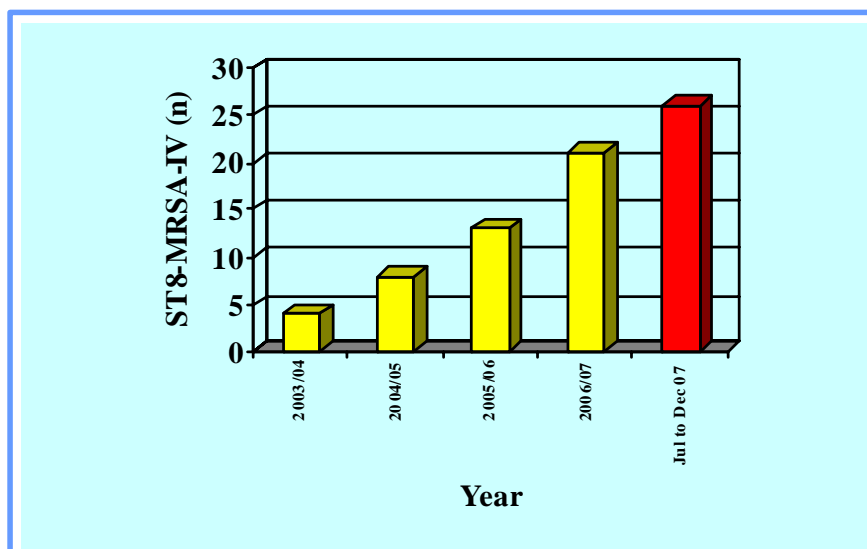


Figure 45: Annual number of referred strains of ST8-MRSA-IV (USA300 MRSA) isolated in Western Australia, July 1997 to December 2007



6.2.4 ST80-MRSA-IV (European cMRSA)

In the six month period 01/07/2007 – 31/12/2007, two ST80-MRSA-IV were referred from one laboratory

Typing Characteristics:

Coagulase Gene PCR-RFLP:

No restriction enzyme site

Antibiogram:

Tetracycline^R (100%)
Erythromycin^R (100%)
Fusidic Acid^R (100%)
Mupirocin^R (0%)
Gentamicin^R (0%)
Rifampicin^R (0%)
Trimethoprim^R (0%)
Ciprofloxacin^R (0%)

Urease:

Positive

Patients (2)	
Clinical Specimens	2
Screening Specimens	0
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST80-MRSA-IV and the percentage of MRSA identified as ST80-MRSA-IV are described in Figures 47 and 48.

Since 01/07/05, 15 ST80-MRSA-IV have been isolated and characterised in Western Australia.

NOTE: ST80-MRSA-IV has been identified as a PVL-positive community MRSA clone

Figure 47: ST80-MRSA-IV (European cMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia MRSA , July 1997 to December 2007

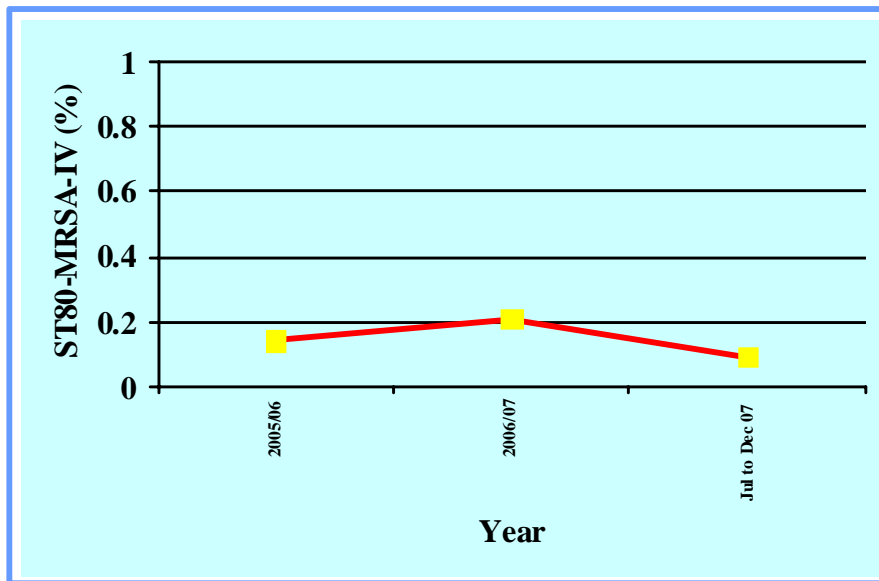
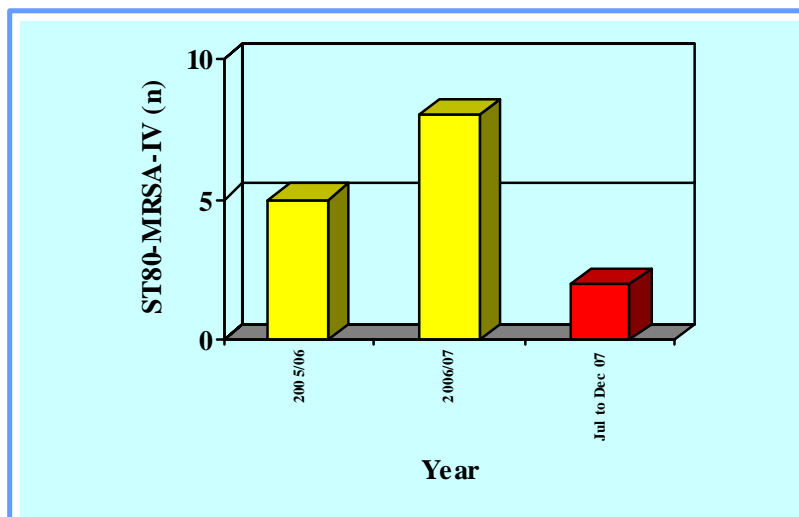


Figure 48: Annual number of referred strains of ST80-MRSA-IV (European cMRSA) isolated in Western Australia, July 1997 to December 2007



6.2.5 ST59-MRSA-V_T (Taiwan cMRSA)

In the six month period 01/07/2007 – 31/12/2007, four ST59-MRSA-V_T were referred from three laboratories:

Typing Characteristics:

Coagulase Gene PCR-RFLP:

40

Antibiogram:

Erythromycin^R (100%)
Tetracycline^R (75%)
Ciprofloxacin^R (0%)
Fusidic Acid^R (0%)
Mupirocin^R (0%)
Gentamicin^R (0%)
Rifampicin^R (0%)
Trimethoprim^R (0%)

Urease:

Positive

Patients (4)	
Clinical Specimens	4
Screening Specimens	0
Hospital Staff (0)	
Clinical Specimens	0
Screening Specimens	0

Annual number of isolates of ST59-MRSA-V and the percentage of MRSA identified as ST59-MRSA-V_T are described in Figures 49 and 50.

Since 01/07/03, 16 ST59-MRSA-V_T have been isolated and characterised in Western Australia.

NOTE: ST59-MRSA-V_T has been identified as a PVL-positive community MRSA clone

Figure 49: Annual number of referred strains of ST59-MRSA-V_T (Taiwan cMRSA) isolated in Western Australia, July 1997 to December 2007

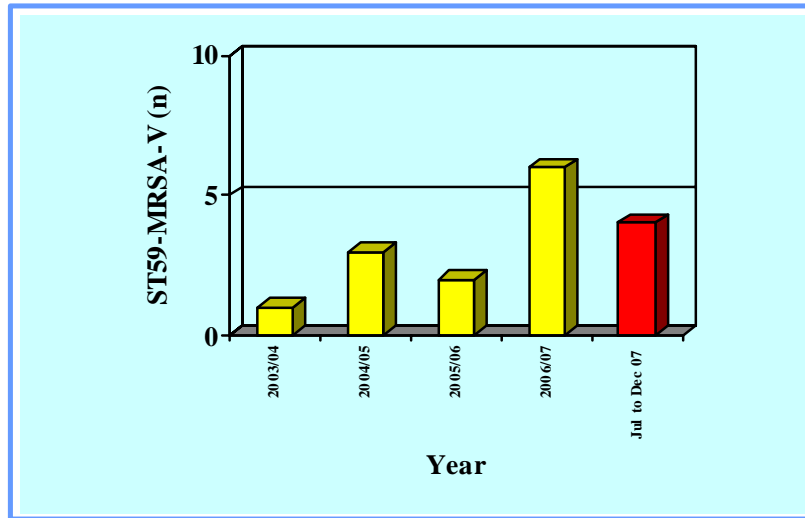
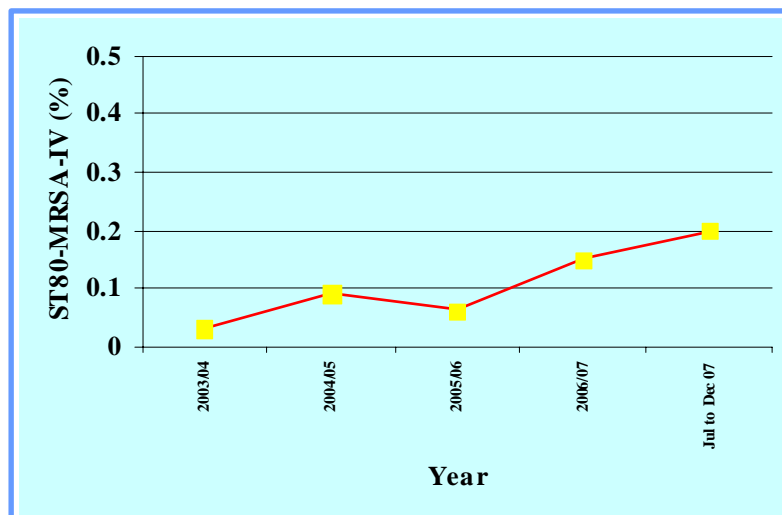


Figure 50: ST59-MRSA-V_T (Taiwan cMRSA) as a percentage of the annual number of referred MRSA isolated in Western Australia, July 1997 to December 2007



6.2.6 WA MRSA

From 01/07/07 to 31/12/07, 1,550 “WA MRSA” were referred to the Gram-positive Bacteria Typing and Research Unit. Using MLST/SCC*mec* typing 30 clones (34 pulsotypes) of WA MRSA were identified.

MLST/SCC <i>mec</i>	Clone	CC	Patients n=1,515 (97.8%)		Staff n=35 (2.2%)		n (%)
			Clinical	Screen	Clinical	Screen	
ST1-MRSA-IV	WA MRSA-1	1	644	152	0	18	814 (52.5%)
ST78-MRSA-IV	WA MRSA-2	78	408	109	0	7	524 (33.8%)
ST5-MRSA-IV	WA MRSA-3	5	99	38	1	4	142 (9.2%)
ST45-MRSA-V	WA MRSA-4	45	26	6	0	1	33 (2.1%)
ST8-MRSA-IV	WA MRSA-5	8	12	2	0	1	15 (1.0%)
ST584-MRSA-IV	WA MRSA-13	9	1	0	0	0	1 (<0.1%)
ST59-MRSA-IV	WA MRSA-15	59	1	0	0	0	1 (<0.1%)
ST583-MRSA-IV*	WA MRSA-17	80	2	0	0	0	2 (0.1%)
ST45-MRSA-IV	WA MRSA-23	45	1	0	0	0	1 (<0.1%)
ST575-MRSA-IV	WA MRSA-25	5	1	0	0	0	1 (<0.1%)
ST72-MRSA-IV	WA MRSA-44	72	4	0	0	0	4 (0.3%)
ST835-MRSA-IV	WA MRSA-48	5	1	0	0	0	1 (<0.1%)
ST6-MRSA-IV	WA MRSA-51	5	0	0	0	1	1 (<0.1%)
ST1005-MRSA-IV	WA MRSA-57	1	1	0	0	0	1 (<0.1%)
ST1173-MRSA-IV	WA MRSA-58	8	0	0	1	1	2 (0.1%)
ST772-MRSA-V*	WA MRSA-60	1	1	0	0	0	1 (<0.1%)
ST641-MRSA-V	WA MRSA-61	5	1	0	0	0	1 (<0.1%)
ST923-MRSA-IV*	WA MRSA-62	8	1	0	0	0	1 (<0.1%)
ST1174-MRSA-IV	WA MRSA-63	97	0	1	0	0	1 (<0.1%)
ST6-MRSA-IV	WA MRSA-66	5	1	0	0	0	1 (<0.1%)
ST8-MRSA-IV	WA MRSA-67	8	1	0	0	0	1 (<0.1%)
ST12-MRSA-IV	WA MRSA-69	12	1	0	0	0	1 (<0.1%)
Total			1,207	308	2	33	1,550

*Identified as a PVL-positive cMRSA clone
Percentage figures relate to the WA MRSA isolates

From 01/07/03 to 31/12/07 11,639 “WA MRSA” have been referred to the Gram-positive Bacteria Typing and Research Unit: Using MLST/SCC*mec* typing, 50 clones (62 pulsotypes) of “WA MRSA” have been identified.

MLST/SCC <i>mec</i>	Clone	CC	2003/2004	2004/2005	2005/2006	2006/07	Jul – Dec 07	Total (%)
ST1-MRSA-IV	WA MRSA-1	1	1,251	1,395	1,461	1,636	814	6,557 (56.3)
ST78-MRSA-IV	WA MRSA-2	78	691	750	806	832	524	3,603 (31.0)
ST5-MRSA-IV	WA MRSA-3	5	174	203	238	270	142	1,027 (8.8)
ST45-MRSA-V	WA MRSA-4	45	42	41	48	51	33	215 (1.8)
ST8-MRSA-IV	WA MRSA-5	8	16	17	17	19	15	84 (0.7)
ST8-MRSA-IV	WA MRSA-6	8	0	0	0	0	0	0
ST75-MRSA-IV	WA MRSA-8	S	7	5	1	2	0	15 (0.1)
ST573-MRSA-V	WA MRSA-10	1	2	0	0	0	0	2 (<0.1)
ST5-MRSA-V	WA MRSA-11	5	8	3	1	1	0	13 (0.1)
ST584-MRSA-IV	WA MRSA-13	9	1	0	0	0	1	2 (<0.1)
ST5-MRSA-V	WA MRSA-14	5	2	2	0	0	0	4 (<0.1)
ST59-MRSA-IV	WA MRSA-15	59	2	0	4	4	1	11 (1.0)
ST8-MRSA-novel	WA MRSA-16	8	1	0	0	0	0	1 (<0.1)
ST583-MRSA-IV*	WA MRSA-17	80	1	0	1	1	2	5 (<0.1)
ST5-MRSA-novel	WA MRSA-18	5	0	2	0	0	0	2 (<0.1)

MLST/SCC_{mec}	Clone	CC	2003/2004	2004/2005	2005/2006	2006/07	Jul – Dec 07	Total (%)
ST609-MRSA-IV	WA MRSA-19	8	1	0	0	0	0	1 (<0.1)
ST612-MRSA-IV	WA MRSA-20	8	0	1	0	0	0	1 (<0.1)
ST5-MRSA-novel	WA MRSA-21	5	1	1	0	0	0	2 (<0.1)
ST577-MRSA-V	WA MRSA-22	121	3	0	0	0	0	3 (<0.1)
ST45-MRSA-IV	WA MRSA-23	45	0	1	12	1	1	15 (1.0)
ST87-MRSA-IV	WA MRSA-24	59	0	1	1	0	0	2 (<0.1)
ST575-MRSA-IV	WA MRSA-25	5	1	0	1	2	1	5 (<0.1)
ST59-MRSA-novel	WA MRSA-26	59	0	1	0	0	0	1 (<0.1)
ST361-MRSA-novel	WA MRSA-28	361	0	1	0	0	0	1 (<0.1)
ST672-MRSA-IV	WA MRSA-29	361	0	2	0	0	0	2 (<0.1)
ST738-MRSA-IV	WA MRSA-30	80	0	1	0	0	0	1 (<0.1)
ST576-MRSA-IV	WA MRSA-31	8	0	1	0	0	0	1 (<0.1)
ST733-MRSA-IV	WA MRSA-33	S	0	2	0	0	0	2 (<0.1)
ST5-MRSA-V	WA MRSA-34	5	0	0	1	0	0	1 (<0.1)
ST5-MRSA-V	WA MRSA-35	5	0	0	1	1	0	2 (<0.1)
ST732-MRSA-IV	WA MRSA-37	Undetermined	0	1	0	0	0	1 (<0.1)
ST188-MRSA-IV	WA MRSA-38	188	0	0	1	0	0	1 (<0.1)
ST526-MRSA-IV	WA MRSA-39	5	0	0	1	0	0	1 (<0.1)

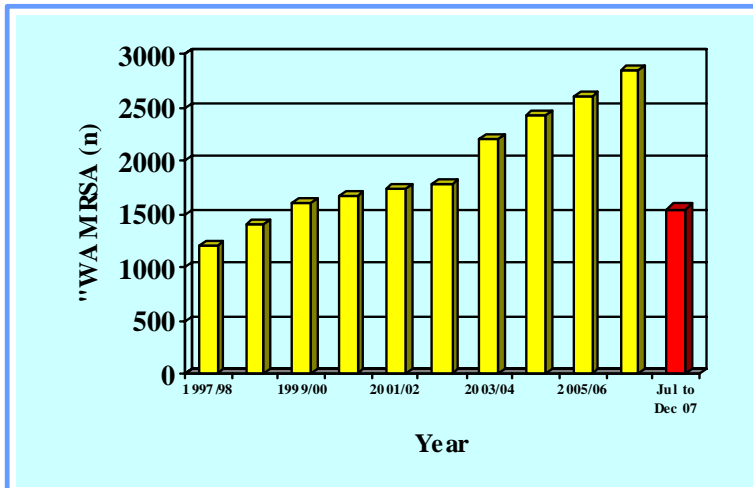
MLST/SCC<i>mec</i>	Clone	CC	2003/2004	2004/2005	2005/2006	2006/07	Jul – Dec 07	Total (%)
ST1-MRSA-novel	WA MRSA-40	1	0	0	3	0	0	3 (<0.1)
ST834-MRSA-IV	WA MRSA-41	9	0	0	3	0	0	3 (<0.1)
ST87-MRSA-IV	WA MRSA-42	59	0	0	1	0	0	1 (<0.1)
ST835-MRSA-novel	WA MRSA-43	5	0	0	1	0	0	1 (<0.1)
ST72-MRSA-IV*	WA MRSA-44	72	0	0	1	4	4	9 (<0.1)
ST872-MRSA-IV	WA MRSA-45	1	0	0	1	0	0	1 (<0.1)
ST835-MRSA-V	WA MRSA-46	5	0	0	1	2	0	3 (<0.1)
ST883-MRSA-IV	WA MRSA-47	S	0	0	1	0	0	1 (<0.1)
ST835-MRSA-IV	WA MRSA-48	5	0	0	0	2	1	3 (<0.1)
ST992-MRSA-IV*	WA MRSA-49	59	0	0	0	1	0	1 (<0.1)
ST73-MRSA-IV	WA MRSA-50	5	0	0	0	1	0	1 (<0.1)
ST6-MRSA-IV	WA MRSA-51	5	0	0	0	1	1	2 (<0.1)
ST592-MRSA-V*	WA MRSA-52	59	0	0	0	4	0	4 (<0.1)
ST8-MRSA-V	WA MRSA-53	8	0	0	0	1	0	1 (<0.1)
ST593-MRSA-IV	WA MRSA-54	97	0	0	0	1	0	1 (<0.1)
ST59-MRSA-IV*	WA MRSA-55	59	0	0	0	2	0	2 (<0.1)
ST59-MRSA-IV*	WA MRSA-56	59	0	0	0	1	0	1 (<0.1)
ST1005-MRSA-IV	WA MRSA-57	1	0	0	0	1	1	2 (<0.1)

MLST/SCC<i>mec</i>	Clone	CC	2003/2004	2004/2005	2005/2006	2006/07	Jul – Dec 07	Total (%)
ST8slv-MRSA-IV	WA MRSA-58	8	0	0	0	3	2	5 (<0.1)
ST12-MRSA-IV	WA MRSA-59	12	0	0	0	1	0	1 (<0.1)
ST772-MRSA-V*	WA MRSA-60	1	0	0	0	1	1	2 (<0.1)
ST641-MRSA-V	WA MRSA-61	5	0	0	0	0	1	1 (<0.1)
ST923-MRSA-IV*	WA MRSA-62	8	0	0	0	0	1	1 (<0.1)
ST1174-MRSA-IV	WA MRSA-63	97	0	0	0	0	1	1 (<0.1)
ST5-MRSA-IV*	WA MRSA-64	5	0	0	0	1	0	1 (<0.1)
ST6-MRSA-IV	WA MRSA-66	5	0	0	0	0	1	1 (<0.1)
ST8-MRSA-IV	WA MRSA-67	8	0	0	0	0	1	1 (<0.1)
ST12-MRSA-IV	WA MRSA-69	12	0	0	0	0	1	1 (<0.1)
Total			2,204	2,431	2,607	2,847	1,550	11,639

Percentage figures relate to the WA MRSA isolates. *Identified as PVL-positive Community MRSA clones

Annual number of persons infected or colonised with WA MRSA are described in Figure 51

Figure 51: Annual number of referred strains of “WA MRSA” isolated in Western Australia, July 1997 to December 2007



Section 7

**Known PVL-positive Community MRSA Isolates
(Duplicates included)**

July 2007 to December 2007

7 Panton Valentine Leukocidin (PVL)

Community MRSA has been shown to acquire several virulence genes including the determinants for PVL. PVL is a necrotizing toxin that causes leucocyte destruction and tissue necrosis and is associated with abscesses and severe pneumonia. It is present in the majority of community MRSA studied in Europe and USA. Several published studies have shown Australia community MRSA infrequently carry the genes encoding PVL. However the five non-Western Australian community MRSA clones isolated in Western Australia have been shown to be PVL positive: ST30-MRSA-IV, ST93-MRSA-IV, ST80-MRSA-IV, ST8-MRSA-IV and ST59-MRSA-V originally reported in New Zealand (WSPP MRSA), Queensland (Queensland cMRSA), Europe (European cMRSA), USA (USA300) and Taiwan (Taiwan cMRSA) respectively. ST30-MRSA-IV was first noted in Australia in 1997 in the Polynesian population living in the eastern Australian states and the Australia Capital Territory. ST93-MRSA-IV was first identified as a cause of community-acquired infection in the Caucasian population living in Ipswich, Queensland in 2000. Both clones are now frequently isolated in several areas of Australia. In WA, ST30-MRSA-IV and ST93-MRSA-IV were first isolated in 2001, ST59-MRSA-V was first isolated in 2003, ST8-MRSA-IV was first isolated in 2004 and ST80-MRSA-IV was first isolated in 2005.

Three single locus variants (slv) of two of these clones have been characterized:

ST952-MRSA-V (CC59 – WA MRSA-52, slv of ST59-MRSA-V)
 ST583-MRSA-IV (CC80 – WA MRSA-17, slv of ST80-MRSA-IV)
 ST728-MRSA-IV (CC80 – WA MRSA-30, slv of ST80-MRSA-IV)

Three PVL-positive clones not related to the above five clones have also been characterized:

ST922-MRSA-IV (CC59 – WA MRSA-49)
 ST59-MRSA-IV (CC59 – WA MRSA-55)
 ST59-MRSA-IV (CC59 – WA MRSA-56)
 ST772-MRSA-V (CC1 – WA MRSA-60)
 ST923-MRSA-IV (CC8 – WA MRSA-62)
 ST5-MRSA-IV (CC5 – WA MRSA-64)
 ST1-MRSA-IV (CC1 – approximately 3% of WA MRSA-1)

Further investigations are required to determine if the PVL-positive ST1-MRSA-IV strains are “USA400 MRSA” or WA MRSA-1 that have acquired the PVL genes.

Based on clone identification, 15.3% of community MRSA characterized in Western Australia between 01/07/07 – 31/12/07 were PVL positive, an increase of 25.4% over the previous twelve months.

MLST/SCC <i>mec</i>	Clone	CC	Patients n= 286		Staff n=2		n (%)*
			Clinical	Screen	Clinical	Screen	
ST93-MRSA-IV**	Qld cMRSA	S	197	8	0	2	207 (11.3)
ST30-MRSA-IV**	WSPP MRSA	30	41	1	0	0	42 (2.3)
ST8-MRSA-IV**	USA 300	8	25	1	0	0	26 (1.4)
ST59-MRSA-V**	Taiwan MRSA	59	4	0	0	0	4 (0.2)
ST80-MRSA-IV**	European cMRSA	80	2	0	0	0	2 (0.1)
Other known PVL-positive cMRSA**			6	1	0	0	7 (0.4)
Total			275	11	0	2	288

*percentage of community MRSA

Of the 286 patient PVL-positive cMRSA isolates, 96.2% were recovered from clinical specimens. In contrast of the 1,508 PVL-negative MRSA strains, 79.6% were recovered from clinical specimens

Figure 52: Annual number of referred PVL-positive strains isolated in Western Australia
 Six month figure only for 2007/2008 (01/07/07 to 31/12/07)

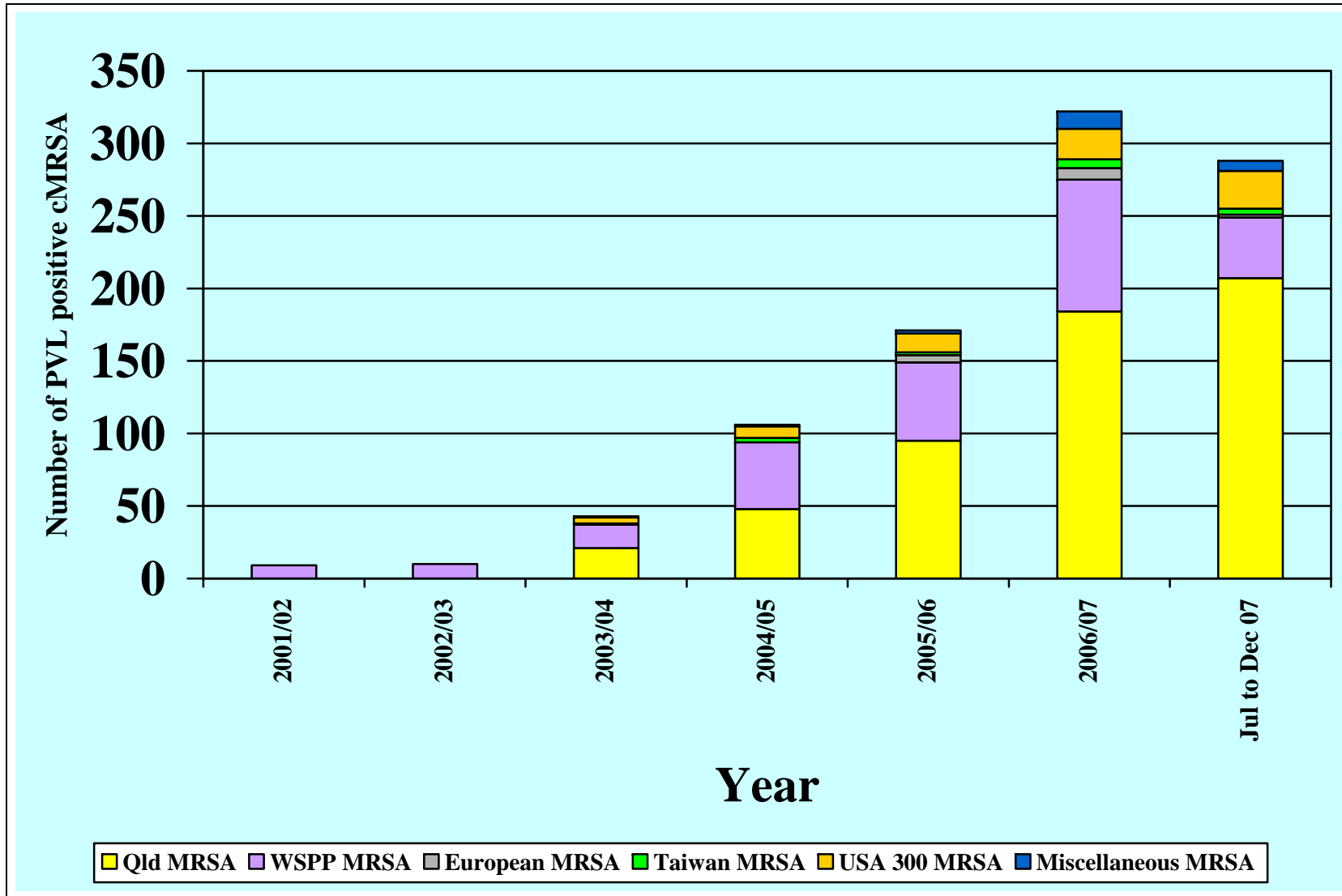
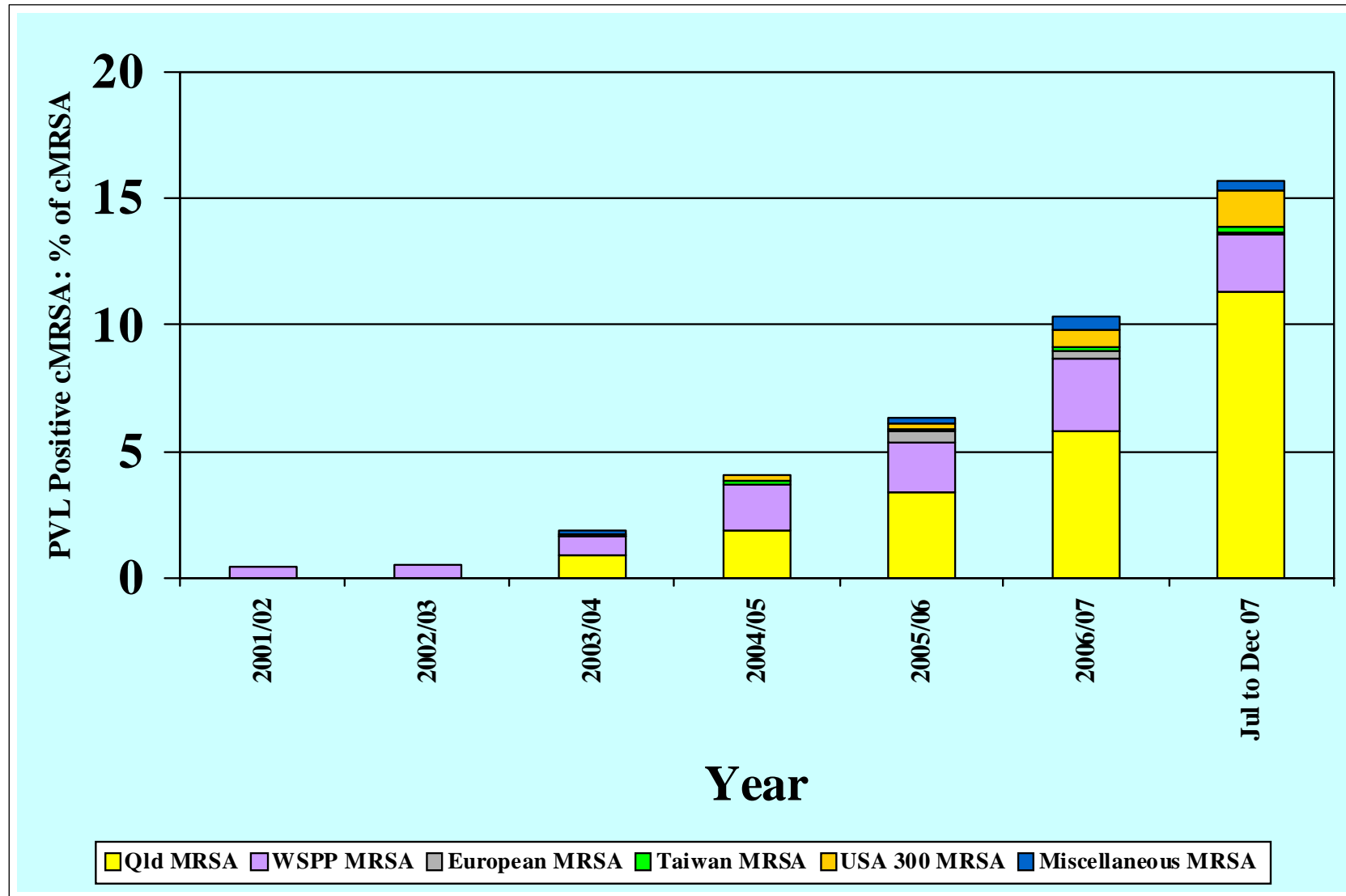


Figure 53: Annual number of referred PVL-positive strains isolated in Western Australia
Six month figure only for 2007/2008 (01/07/07 to 31/12/07)



Section 8
Vancomycin-resistant Enterococci
July 2007 to December 2007

8 Vancomycin-resistant *Enterococcus* species (VRE)

During the six month period 01/07/07 – 31/12/07, 9 new carriers of VRE were reported:

E. faecalis (1)

Referring Laboratory	Pulsed-field Gel Electrophoresis (PFGE)	
	Unique <i>vanB</i>	Total
PathWest Royal Perth Hospital	1	1
Total	1	1

E. faecium (6)

Referring Laboratory	Pulsed-field Gel Electrophoresis (PFGE)			
	Unique <i>vanA</i>	26 <i>vanB</i>	Unique <i>vanB</i>	Total
PathWest Royal Perth Hospital	1	3	1	5
PathWest Fremantle Hospital			1	1
Total	1	3	2	6

vanA E gallinarum (x1)

vanB E gallinarum (x1)

Since 07/09/98 511 VRE have been referred to the GBTRU for *van* gene determinate and molecular characterization.

9 Acknowledgements

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