

## Methicillin-Resistant *Staphylococcus aureus* Infections in California Hospital Patients, 1999 to 2007

WINTER 2009

This analysis of OSHPD data identified trends and patterns related to methicillin-resistant *Staphylococcus aureus* (MRSA) infection among hospital patients in California, 1999 to 2007, and found that there was a dramatic increase in reported MRSA cases. Numbers rose more than four-fold, from about 13,000 cases in 1999 to about 52,000 cases in 2007. The increase was due primarily to the rise in MRSA cases among persons ages 18 to 64 years old (mid-adult age range), admitted from home with skin infections; however, the largest increase (1,663%) occurred among children (ages 0 to 17 years of age). Meanwhile, the number of reported non-methicillin resistant *S. aureus* cases remained constant at 30,000 a year, with virtually no change in patterns of age, diagnosis, or source of admission. OSHPD hospital patient discharge data provides no reliable way to know which of these cases were community-acquired and which became infected in healthcare settings.

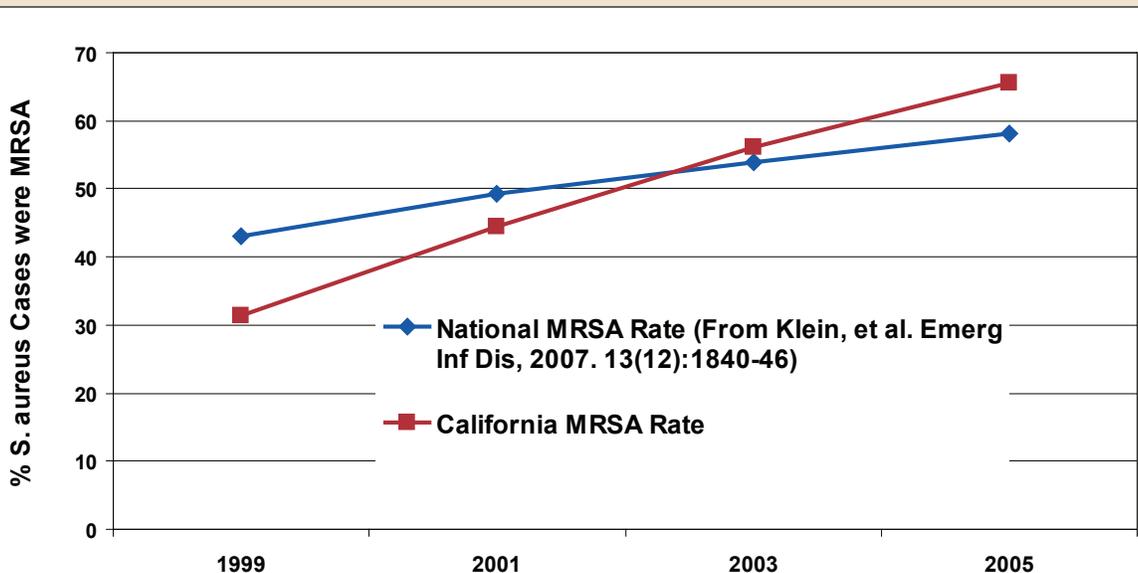
Trending downward over time for the MRSA group were length of hospital stay (LOS), hospital charges, and the likelihood of dying. In 1999, LOS, charges and mortality were all higher for MRSA cases than for methicillin-

sensitive *S. aureus* infection cases, as reported in previous publications. However, by 2007 the reverse was true. Nevertheless, the increase in MRSA cases among hospital patients is a concern for infection control in hospitals, as well as in the community. This analysis is intended to inform and provide a framework for healthcare providers and policy-makers who desire to target specific populations at risk for the disease.

### Background

*Staphylococcus aureus* (*S. aureus*) is a type of bacteria normally present on skin and in the nose. It is a common cause of skin infections as well as potentially life threatening infections that affect the whole body, such as pneumonia, and septicemia ("blood stream infection"). Antibiotic resistant strains of *S. aureus* have been evolving separately in hospitals and in the community since penicillin was first introduced as a hospital-administered drug in the 1940s. Within years, penicillin-resistant strains were prevalent in hospitals and were resistant to multiple types of antibiotics.<sup>1</sup> However, these strains did not reach significant levels in the community for another 20 years.

**Figure 1. MRSA Prevalence in Hospital Patients with *S. aureus* Infections, Nationally and in California, 1999-2005**



Methicillin and related antibiotics were introduced in 1961 to treat penicillin-resistant infections, initially in hospitals. Resistance to methicillin appeared in hospitalized patients the same year the antibiotic was introduced and since then resistance steadily became more common. The percentage of *S. aureus* infections reported to be methicillin-resistant (MRSA rate) in hospitalized patients is now more than 50% in most U.S. hospitals.<sup>2,3</sup> Between 1999 and 2005 this percentage jumped from 43% to 58%.<sup>4</sup> In California, the 1999 MRSA rate for hospital patients (31%) was 12% lower than the national rate, but by 2005 it increased to 65.4%, surpassing the national rate (Figure 1).

In contrast, the rise in MRSA in the community went undetected in individuals having no healthcare contact (what we call “community-associated”) until the late 1990s. The appearance of community-associated MRSA indicated that methicillin resistance had become present in *S. aureus* strains that were already circulating in the community and was not limited to the movement of resistant strains from healthcare facilities into the community.

The amount of methicillin resistance in patients without any healthcare contact who have been admitted to U.S. hospitals with *S. aureus* infections has been increasing<sup>5,6</sup> and is typically more than 50% in patients seen in emergency departments.<sup>7</sup> As with penicillin resistance previously, healthcare-associated strains are resistant to many types of antibiotics, while community-associated strains have been resistant to fewer. However, it is not possible to distinguish

healthcare associated from community associated infections in hospital discharge data without additional epidemiologic (absence or presence of healthcare associations) or microbiologic (genetic testing of the bacteria from patients) information.

Nationally, the charges for a MRSA patient’s hospital stay in 2004 were nearly double the costs for non-MRSA stays—\$14,000 for MRSA vs. \$7,600 for non-MRSA—and MRSA patients had an average length of stay more than double that for a non-MRSA stay—10.0 days versus 4.6 days.<sup>8</sup> In addition, both in-hospital and 30-day mortality rates for MRSA cases have previously been reported to be higher than the rates for non-methicillin resistant *S. aureus* cases.<sup>9,10</sup> The more recent data presented here indicate that this pattern appears to have changed.

### Methicillin-Resistant and Non-Resistant *S. aureus* in California Hospital Patients

#### Rising Volume of MRSA Infections in Hospital Patients

In 1999 a total of 44,277 cases of *S. aureus* infection were reported among California hospital patients and by 2007 this number had risen 80% to 79,839. This was due to the increased numbers of MRSA infections between 1999 and 2007. The number of non-resistant *S. aureus* cases reported annually actually decreased 10% (from 30,773 to 27,620), while the number of MRSA cases increased 287% (from 13,504 to 52,219).

**Figures 2a and 2b.** Percentage of Staphylococcus aureus Infection cases that were methicillin-resistant among California hospital patients, by patient’s county of residence. California Hospital Patients, 1999 and 2007.



In 1999 70% of the *S. aureus* cases reported for hospital patients were infections that were treatable by methicillin. That is, they were non-resistant. The percent of *S. aureus* cases that were MRSA infections rose from 30% in 1999 to 65% by 2007. This increase occurred in hospitals in nearly all counties, statewide (Figures 2a and 2b).

### Major Increases in Cases Admitted from Home

As shown in Figure 3, the increase in *S. aureus* infection among California hospital patients between 1999 and 2007 was primarily due to a large increase in the number of MRSA cases admitted from home. This grew 438%, from 7,231 in 1999 (54% of all MRSA cases) to 38,864 (74% of MRSA cases) in 2007. In addition, the number of MRSA cases approximately doubled among patients admitted from long-term care (from 2,881 to 6,353 per year) and from other hospital settings (from 3,256 to 6,169 per year) (See Appendix, Table A).

### Shift in Patient Characteristics

Among non-resistant *S. aureus* cases, there was little change from year to year in patient characteristics. About 10% were children (ages 0-17), 50% were middle adults, and 40% were seniors. Slightly over half (57%) were male. The racial/ethnic distribution was approximately 60% White, 20% Hispanic, 10% African American, 6% Asian/Pacific Islander, and 4% Native American and other or mixed background. Medicare was the expected payment source for 50% of the cases, private insurance for 25%, Medi-Cal for just under 20%, and 3% to 4% paid out-of-pocket.

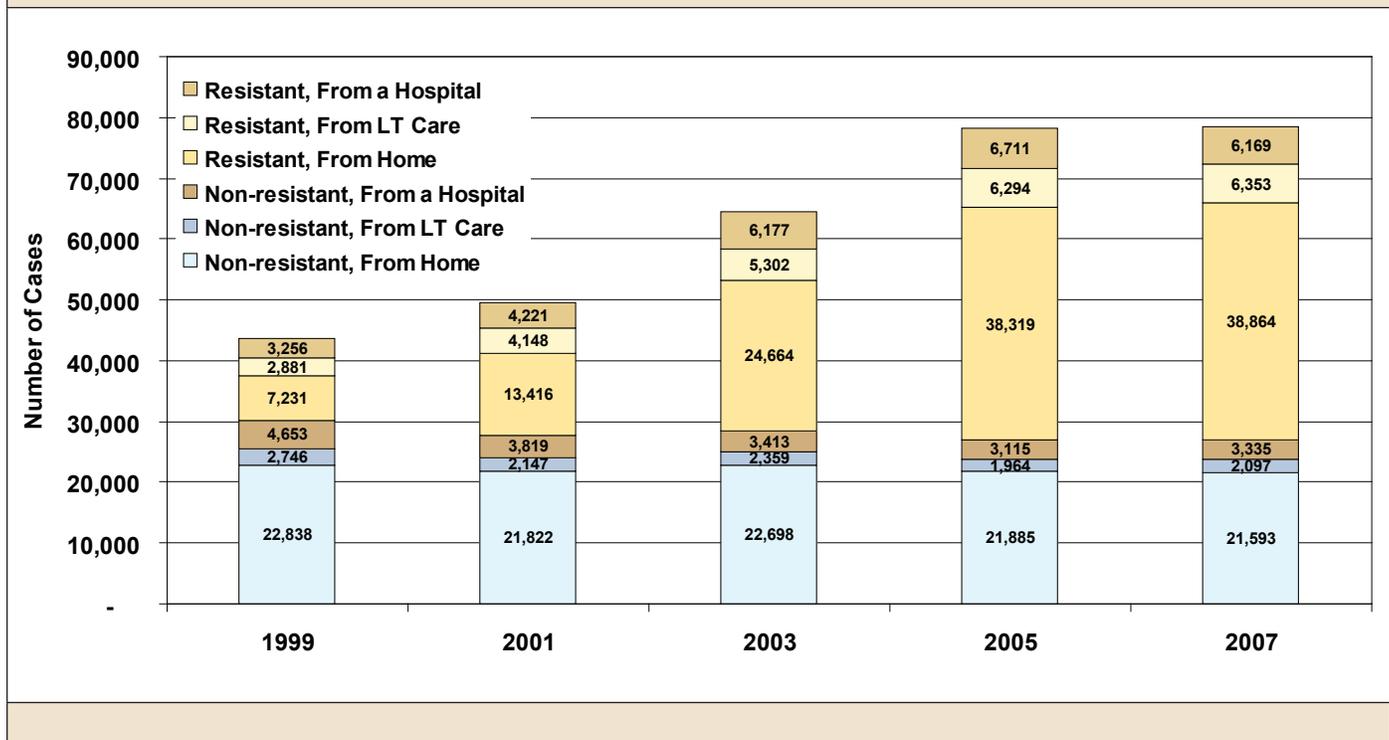
For MRSA cases there was a shift in the characteristics of the group (See Appendix, Table B). There was a 1,663% increase in the number of children with MRSA infection (from 188 to 3,315), a 556% increase in the number of adults 18-64 (from 3,996 to 26,226), and 143% in the number of seniors (from 9,320 to 22,678). The percentage of MRSA cases that were in the 18-64 age range increased from 30% to 50%, while the percentage of seniors dropped from 69% to 43%.

By 2007, the race/ethnic distribution for MRSA cases was approximately 49% White, 30% Hispanic, 8% African American, 8% Asian/Pacific Islander, and less than 1% Native American. Medicare was the expected payment source for 31% of the cases, private insurance for 35%, Medi-Cal for 26%, and 4% paid out-of-pocket. The percent increase in number of cases for these population groups from 1999 to 2007 was as follows: Hispanics increased 503%, Native Americans increased 448%, African Americans increased 316%, Asian/Pacific Islanders increased 239%, and Whites increased 237%.

Compared to the overall hospital patient population during the period 1999 to 2007, children (ages 0-17) were underrepresented in the MRSA and non-resistant groups (6% and 9% respectively, compared to 21% for all child hospital patients) and seniors were overrepresented (43% and 40% for MRSA and non-resistant *S. aureus*, respectively, compared with 30% for the total hospital population). With respect to race/ethnicity, Hispanics were underrepresented among MRSA and non-resistant *S. aureus* cases

**Figure 3. Number of Cases with *S. aureus* Infection, by Source of Admission and Methicillin Resistance/Non-Resistance. California Hospital Patients, 1999-2007**

(Newborn and Prison/Jail Admissions not shown)



(at 22% and 23% respectively, compared to all hospital patients 30%), while Whites were overrepresented (with 58% and 57% for MRSA and non-resistant *S. aureus* cases respectively, compared with 49% for hospital patients overall).

Nevertheless, by 2007, the percentage of *S. aureus* cases that were methicillin-resistant (MRSA rate), compared with non-resistant *S. aureus*, was similar across all subgroups. The rate ranged from 56% to 67% across age groups, from 61% to 69% across race/ethnic groups, and from 59% to 68% across groups with different sources of payment (See Appendix, Table C).

The greatest increases in the volume of MRSA cases occurred among patients admitted from home ages 18-64 years and seniors (ages 65+), increasing from 2,605 to 21,510 and from 4,501 to 14,453, respectively. In addition there was a doubling of the number of seniors admitted from long-term care facilities, increasing from 2,417 to 4,761 (Figure 4).

### Dramatic Increase in the Number of MRSA Cases with Skin Infection

The most common admitting diagnoses for cases with non-resistant *S. aureus* in 1999 were: skin and subcutaneous tissue infection (2,627), pneumonia (2,342), septicemia (2,265), complications of implanted devices and grafts (2,135), and complications of surgery (1,871). These remained the most frequent admitting diagnoses in 2007 and the percentages of cases reported for these categories varied only slightly each year.

These were also the most frequent admitting diagnoses for the cases with MRSA infection, but their numbers increased dramatically from 1999 to 2007. As shown in Figure 5, among cases with MRSA infections, the number of skin/subcutaneous tissue infections reported annually increased 2,813% (from 345 to 10,049), septicemia cases increased 553% (from 639 to 4,175) and pneumonia cases increased 123% (from 1,131 to 2,519). There were also significant increases in the number of MRSA infections in patients admitted for complications of implanted devices and grafts (a 461% increase, from 487 to 2,731) and complications of surgery (a 376% increase, from 503 to 2,395) (See Appendix, Table D).

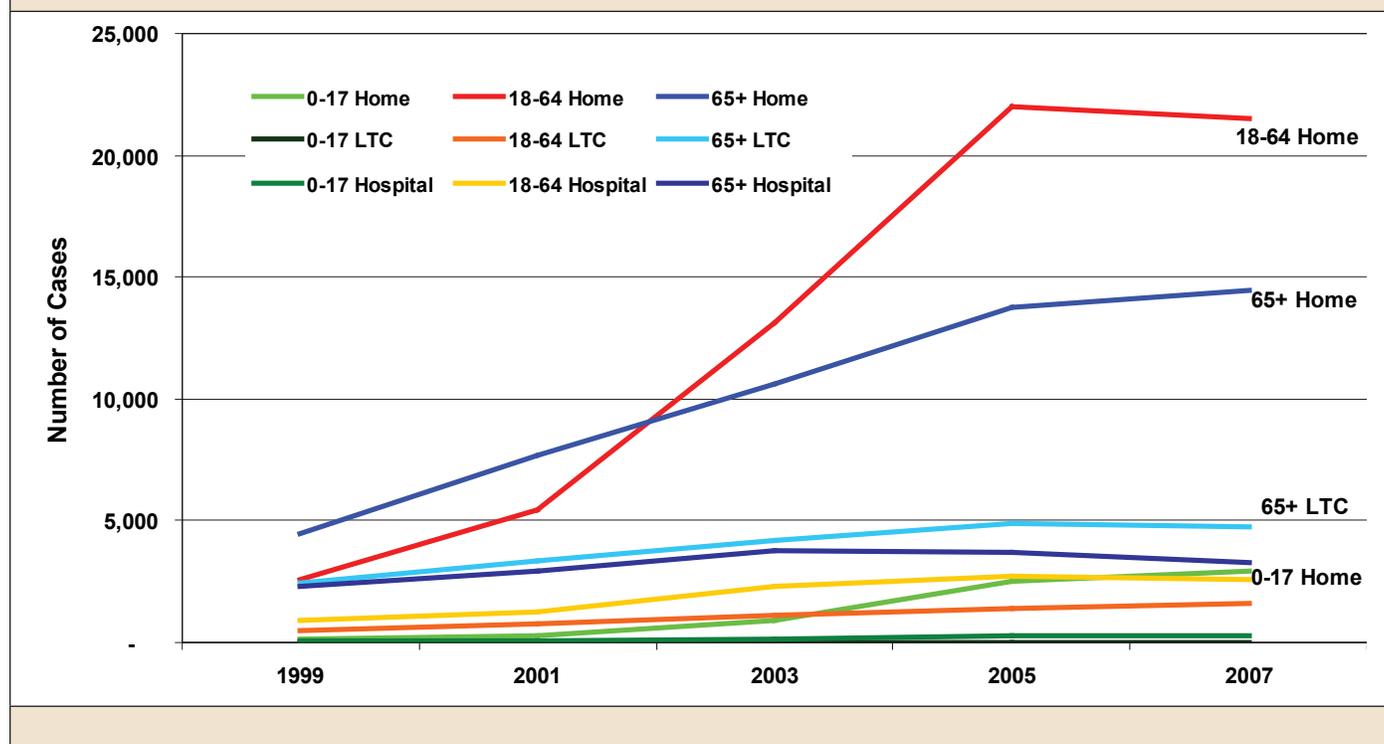
### Outcomes for Patients with Methicillin-Resistant and Non-Resistant *S. aureus* Infection

#### Length of Hospital Stay and Hospital Charges Decreased for MRSA Cases

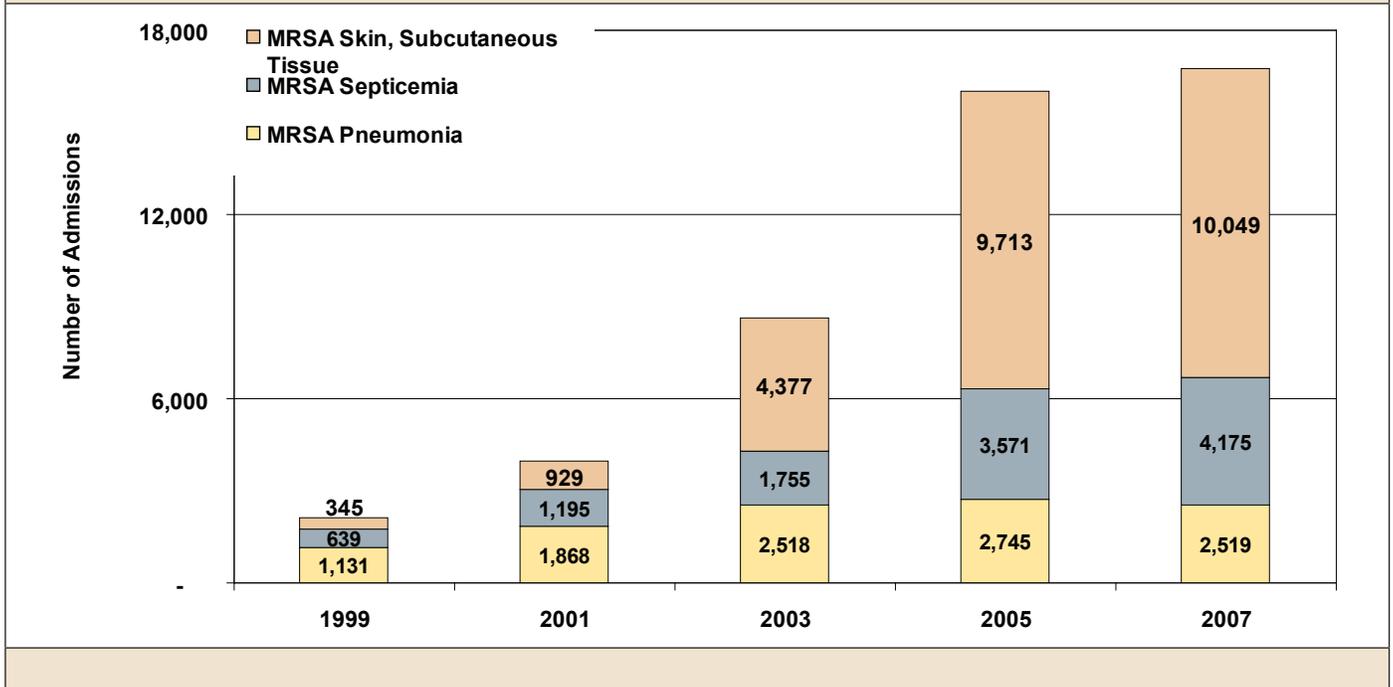
For the non-resistant *S. aureus* cases, the average length of stay varied between 15 days and 16 days between 1999 and 2007. However, for the cases with MRSA the average length of stay began at 21 days in 1999 (six days longer than for the non-resistant cases) and then began declining in 2003. By 2007 the MRSA average length of stay had dropped 36%, to under 14 days. These downward trends may be related to the rising percentage of MRSA cases that were skin and subcutaneous infections, rather than systemic illnesses such as pneumonia and septicemia.

**Figure 4. Number of Hospitalizations with MRSA, by Age Group and Source of Admission. California Hospital Admissions, 1999-2007**

(Newborn and Prison/Jail Admissions not shown)



**Figure 5. Number of Admissions from Home for Pneumonia, Skin Infections and Septicemia Among Cases with MRSA Infection. California Hospital Patients, 1999-2007**



For non-resistant cases the average daily charge for hospital services increased steadily during this period, from \$3,845 to \$9,107 per day. For the MRSA cases, average daily charges were nearly equal to those of the non-resistant cases in 1999, at \$3,506 per day. However, they did not increase as steeply and by 2007 were 17% lower than non-resistant *S. aureus*, at \$7,583 per day (Table 1).

**30-Day Mortality Rates about the Same for Methicillin-Resistant and Non-Resistant Cases**

In 1999, the 30-day mortality rate was slightly higher for cases with MRSA compared to non-resistant cases (34.6% vs. 25.7% died, respectively), as shown in Appendix, Table E. However, the death rate of MRSA cases declined steadily; by 2005 the death rate

**Table 1. Average Length of Stay (Days), Total Hospital Charges and Daily Hospital Charges for Methicillin-Resistant and Non-Resistant *S. aureus* Cases. California Hospital Patients, 1999-2007.**

	1999	2001	2003	2005	2007	% Change 1999-2007
<b>Length of Stay</b>	<b>Average Length of Stay (Days)</b>					
S. aureus: Non-Resistant	14.7	15.7	16.1	15.9	16.1	9.4
Resistant	21.2	20.8	17.5	14.5	13.6	-35.9
Non-S. aureus Cases	5.0	5.0	5.0	4.9	4.9	-1.8
<b>Total Charges</b>	<b>Average Total Charges (\$)</b>					
S. aureus: Non-Resistant	56,506	82,404	109,985	123,671	146,391	159.1
Resistant	74,415	91,126	100,252	99,127	103,134	38.6
Non-S. aureus Cases	16,009	20,650	27,014	31,452	36,321	126.9
<b>Daily Charges</b>	<b>Average Daily Charges (\$)</b>					
S. aureus: Non-Resistant	3,845	5,250	6,818	7,781	9,107	136.9
Resistant	3,506	4,379	5,716	6,827	7,583	116.3
Non-S. aureus Cases	3,183	4,103	5,355	6,362	7,351	131.0

for cases with MRSA was slightly lower than for the non-resistant cases (23.9% vs. 25.6% died, respectively). This finding was confirmed by statistical testing (logistic regression) that adjusted for differences in patient characteristics that would affect risk of dying, such as age, source of admission, and diagnosis.<sup>11</sup>

Mortality rates were highest for newborns with *S. aureus* infection; 80% of newborns with *S. aureus* infection died, regardless of whether they had non-resistant or resistant *S. aureus* infections. However, this percentage is based on a small number of cases (1999 to 2005, N=728 non-resistant cases with 581 deaths and 134 MRSA cases with 109 deaths). Among the remaining patients mortality rates were as follows: 44% for cases admitted to the hospital from prison or jail, 40% for cases from long-term care, 31% for cases admitted from a hospital, and 23% for cases admitted from home (See Appendix, Table F).

### Declining Mortality Rates for Patients with MRSA in the Hospitals

To understand the pattern of mortality, this analysis focused on the cases that died within 30 days of admission. Among these cases, some died in the hospital and some after they were discharged. The 30-day mortality rate for methicillin-sensitive cases remained constant each year from 1999 to 2005, at about 25%. Among reported MRSA cases it declined 31%, from 35% to 24%. Note that the mortality rate for MRSA was higher in 1999 than the rate for non-resistant cases,

consistent with reports from other agencies. However, the MRSA mortality rate declined and was actually lower by 2005.

From 1999 to 2005, the percentage of methicillin-sensitive cases that died in the hospital was about 10% each year. However, among reported MRSA-infected cases the percentage that died in-hospital declined, from 16% to 8%.

The percentage of methicillin-sensitive cases that died after discharge from the hospital (but still within 30 days of admission) remained at 15% to 16% during the years 1999 to 2005. For MRSA cases this percentage declined slightly, from 19% to 16% (Figure 6 and Appendix, Tables F and G).

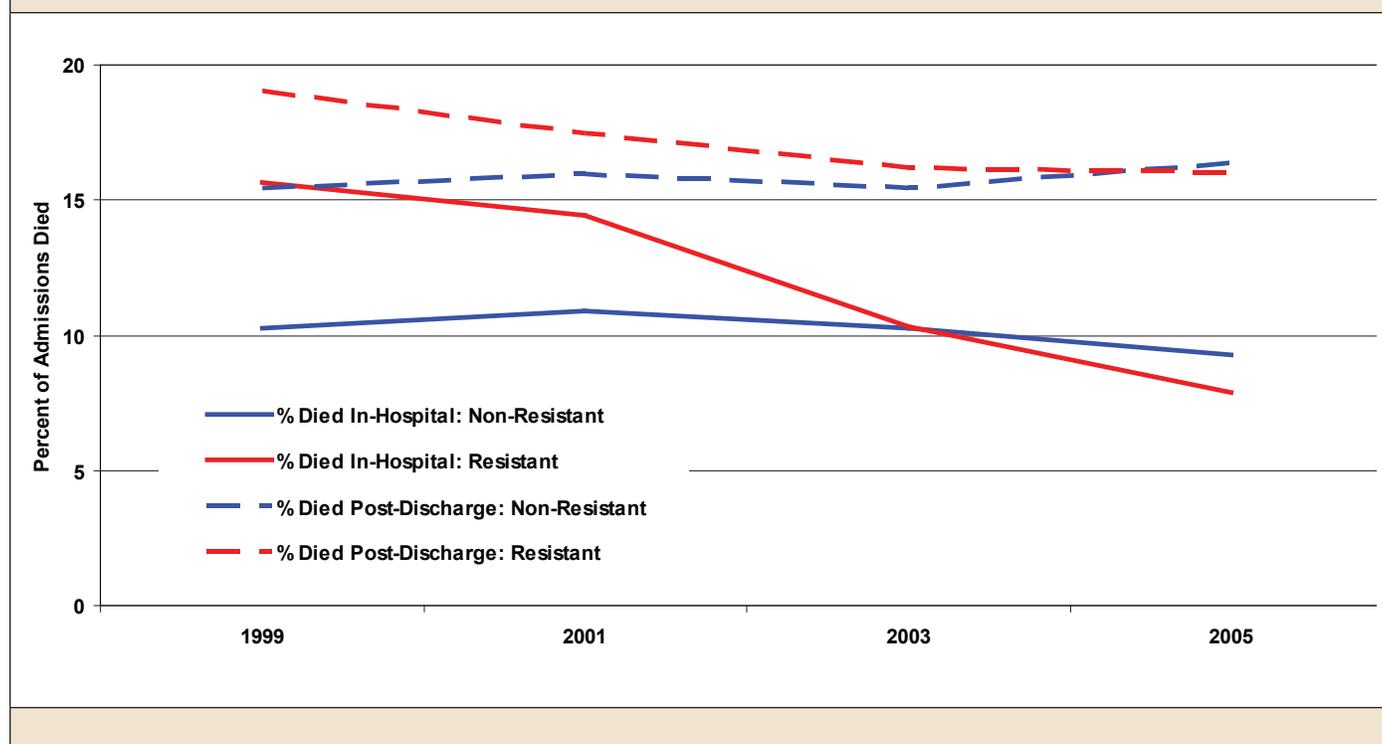
### Limitations of the Analysis

This report presents a conservative estimate of the volume of MRSA in California hospital patients because it is likely that not all of those found to be resistant were tested for antibiotic resistance and not all of these were reported as resistant in the patient records provided to OSHPD. It also presents a conservative estimate of the occurrence of MRSA in the general population because it only includes people who were hospitalized.

There are limitations in coding diagnoses in patient discharge data files that identified admission source and the presence of antibiotic

**Figure 6. Percent of Resistant and Non-Resistant *S. aureus* Infection Cases That Died Within 30 Days of Admission, by Place of Death. California Hospital Admissions, 1999-2005**

(Note: Data match for 2007 deaths not available.)



resistance. First, cases reported as “admissions from home” may include patients recently discharged from a hospital or from a long-term care facility, where they might have been exposed to infections more like those of patients admitted from hospitals and Skilled Nursing Facilities (SNFs). Secondly, while the diagnosis code that is used to identify methicillin-resistance (V09.0) is correct for indicating methicillin resistance among *S. aureus* cases, it can also be used to indicate resistance to other penicillin-related antibiotics. Thus, some of the resistant cases could have been resistant to penicillin-family antibiotics other than methicillin.

Under-reporting of antibiotic resistance in cases with antibiotic resistant *S. aureus* infection might have been greater in the earlier years; reporting accuracy might have improved as awareness and surveillance of MRSA infection increased.

There was insufficient information in the patient discharge data to determine whether the *S. aureus* cases acquired their infection in the community or in a healthcare facility. Also, there was no information about the specific strains of *S. aureus* that were involved, so these infections could represent either community- or healthcare-related strains.

## Technical Notes

California data were obtained by analysis of the OSHPD Patient Discharge Data files for 1999, 2001, 2003, and 2005 and 2007. Patients with *S. aureus* infection were cases with a principal or secondary diagnosis ICD-9 code of 038.11, 482.11 or 041.11. MRSA cases were those *S. aureus* cases that also had an ICD-9 code of V09.0 in any secondary diagnosis field. The MRSA rate for a given group of patients was defined as the percent of *S. aureus* cases reported to be resistant (i.e., had the additional ICD-9 code of V09.0). Diagnosis ICD-9 codes were rolled up into clinically related categories using the Clinical Classifications Software (CCS) developed by the federal Agency for Healthcare Research and Quality (AHRQ).

To identify cases that died within 30 days of hospital admission, hospital patient records were matched with California vital statistics files for deaths in the state. Matched files were available only up to the year 2005, so 30-day mortality was not determined for cases hospitalized in 2007.

## Acknowledgements

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- <sup>11</sup>This conclusion is supported by the results of additional statistical tests (logistic regression) that adjusted for various other patient characteristics that might affect likelihood of dying, such as age, race/ethnicity, source of admission, and admitting diagnosis. In 1999 having a resistant (MRSA) infection increased likelihood of death by 22% (Odds Ratio = 1.22, CI: 1.17-1.29). In 2003 there was no additional risk associated with MRSA (Odds Ratio = 1.00) and by 2005 the risk of dying was actually slightly less for MRSA cases (Odds Ratio = 0.95, CI: 0.92-0.99).

# APPENDIX

Table cells with fewer than 20 cases are indicated with an asterisk (\*). The totals for related rows and columns are approximated (for example, ~150) as needed due to suppression of data in these cells.

**Table A. Volume of Resistant and Non-Resistant S. aureus Cases by Source of Admission. California Hospital Patients, 1999-2007.**

Source of Admission	S. aureus	1999	2001	2003	2005	2007	% Change
Home	Non-Resistant	22,838	21,822	22,698	21,885	21,593	-5.5
	Resistant	7,231	13,416	24,664	38,319	38,864	437.5
LT Care	Non-Resistant	2,746	2,147	2,359	1,964	2,097	-23.6
	Resistant	2,881	4,148	5,302	6,294	6,353	120.5
Hospital	Non-Resistant	4,653	3,819	3,413	3,115	3,335	-28.3
	Resistant	3,256	4,221	6,177	6,711	6,169	89.5
Newborn	Non-Resistant	146	175	170	237	218	49.3
	Resistant	*	*	28	78	96	540.0
Prison/Jail	Non-Resistant	109	120	116	104	141	29.4
	Resistant	*	67	187	331	336	>2,000
Other	Non-Resistant	281	206	230	306	236	-16.0
	Resistant	106	144	267	476	401	278.3
All Admissions	Non-Resistant	30,773	28,289	28,986	27,611	27,620	-10.2
	Resistant	13,504	22,009	36,625	52,209	52,219	286.7
<b>Total Cases</b>		<b>44,277</b>	<b>~50,300</b>	<b>65,611</b>	<b>79,820</b>	<b>79,839</b>	<b>80.3</b>
% Cases = MRSA		30.5	43.8	55.8	65.4	65.4	114.5
% MRSA From Home		53.5	61.0	67.3	73.4	74.4	39.0

**Table B. Characteristics of All Inpatients with Methicillin-Resistant and Non-Resistant S. aureus Cases, by Age, Race/Ethnicity and Source of Payment. California Hospital Patients, 1999 and 2007.**

	Number of Cases						Percent of Cases by Age, Race/Ethnicity, and Payer						Percent Change from 1999 to 2007		
	All Inpatients		Non-Resistant		Resistant		All Inpatients		Non-Resistant		Resistant		All Inpatients	Non-Resistant	Resistant
	1999	2007	1999	2007	1999	2007	1999	2007	1999	2007	1999	2007	1999	2007	1999
<b>Age Group</b>	<b>1999</b>	<b>2007</b>	<b>1999</b>	<b>2007</b>	<b>1999</b>	<b>2007</b>	<b>1999</b>	<b>2007</b>	<b>1999</b>	<b>2007</b>	<b>1999</b>	<b>2007</b>			
0-17	799,202	826,886	2,354	2,564	188	3,315	21.2	20.6	7.6	9.3	1.4	6.3	3.5	8.9	1,663.3
18-64	1,768,485	1,999,290	14,077	13,999	3,996	26,226	46.8	49.8	45.7	50.7	29.6	50.2	13.1	-0.6	556.3
65+	1,208,024	1,186,598	14,342	11,057	9,320	22,678	32.0	29.6	46.6	40.0	69.0	43.4	-1.8	-22.9	143.3
<b>Total</b>	<b>3,775,711</b>	<b>4,012,774</b>	<b>30,773</b>	<b>27,620</b>	<b>13,504</b>	<b>52,219</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>6.3</b>	<b>-10.2</b>	<b>286.7</b>
<b>Race/Ethnic Group</b>															
Hispanic	985,101	1,218,100	6,138	6,456	1,902	11,468	26.1	30.4	19.9	23.4	14.1	22.0	23.7	5.2	502.9
Native American	9,330	9,628	101	80	31	170	0.2	0.2	0.3	0.3	0.2	0.3	3.2	-20.8	448.4
Asian/Pacific Islander	248,476	320,924	1,790	1,888	862	2,925	6.6	8.0	5.8	6.8	6.4	5.6	29.2	5.5	239.3
African American	317,938	327,065	3,206	2,562	1,363	5,671	8.4	8.2	10.4	9.3	10.1	10.9	2.9	-20.1	316.1
White	2,110,081	1,982,850	18,856	15,752	9,024	30,452	55.9	49.4	61.3	57.0	66.8	58.3	-6.0	-16.5	237.5
Other/Multiple	67,397	110,742	427	652	208	1,079	1.8	2.8	1.4	2.4	1.5	2.1	64.3	52.7	418.8
Unknown/Mssg.	37,388	43,465	255	230	114	454	1.0	1.1	0.8	0.8	0.8	0.9	16.3	-9.8	298.2
<b>Total</b>	<b>3,775,711</b>	<b>4,012,774</b>	<b>30,773</b>	<b>27,620</b>	<b>13,504</b>	<b>52,219</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>6.3</b>	<b>-10.2</b>	<b>286.7</b>
<b>Payer</b>															
Medicare	1,183,358	1,233,409	15,304	12,620	9,240	26,481	31.3	30.7	49.7	45.7	68.4	50.7	4.2	-17.5	186.6
Medi-Cal	834,472	1,025,258	5,364	5,386	1,729	10,336	22.1	25.5	17.4	19.5	12.8	19.8	22.9	0.4	497.8
Private	1,429,631	1,413,633	7,380	6,780	2,043	9,832	37.9	35.2	24.0	24.5	15.1	18.8	-1.1	-8.1	381.3
Self Pay	122,739	141,175	809	1,050	140	2,237	3.3	3.5	2.6	3.8	1.0	4.3	15.0	29.8	1,497.9
Other	205,511	199,299	1,916	1,784	352	3,333	5.4	5.0	6.2	6.5	2.6	6.4	-3.0	-6.9	846.9
<b>Total</b>	<b>3,775,711</b>	<b>4,012,774</b>	<b>30,773</b>	<b>27,620</b>	<b>13,504</b>	<b>52,219</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>6.3</b>	<b>-10.2</b>	<b>286.7</b>

**Table C. Volume of S. aureus Cases and Percent Methicillin-Resistant by Age, Sex, Race/Ethnicity and Source of Payment. California Hospital Patients, 1999-2007.**

	1999			2001			2003			2005			2007			1999-2007 Percent Change		
	# Non-resistant	# Resistant	% Resistant	# Non-resistant	# Resistant	% Resistant	# Non-resistant	# Resistant	% Resistant	# Non-resistant	# Resistant	% Resistant	# Non-resistant	# Resistant	% Resistant	# Non-resistant	# Resistant	% Resistant
<b>Age Group</b>																		
0-17 Years	2,354	188	7.4	2,478	382	13.4	2,466	1,056	30.0	2,624	2,914	52.6	2,564	3,315	56.4	8.9	1,663.3	662.4
18-64 Years	14,077	3,996	22.1	13,232	7,579	36.4	14,444	16,817	53.8	14,018	26,689	65.6	13,999	26,226	65.2	-0.6	556.3	194.9
65+ Years	14,341	9,320	39.4	12,579	14,047	52.8	12,076	18,752	60.8	10,969	22,606	67.3	11,057	22,678	67.2	-22.9	143.3	70.7
<b>Total</b>	<b>30,772</b>	<b>13,504</b>	<b>30.5</b>	<b>28,289</b>	<b>22,008</b>	<b>43.8</b>	<b>28,986</b>	<b>36,625</b>	<b>55.8</b>	<b>27,611</b>	<b>52,209</b>	<b>65.4</b>	<b>27,620</b>	<b>52,219</b>	<b>65.4</b>	<b>-10.2</b>	<b>286.7</b>	<b>114.4</b>
<b>Sex</b>																		
Male	17,266	7,252	29.6	16,186	11,876	42.3	16,647	20,352	55.0	16,117	29,488	64.7	16,074	29,280	64.6	-6.9	303.8	118.3
Female	13,506	6,251	31.6	12,101	10,132	45.6	12,339	16,272	56.9	11,493	22,719	66.4	11,545	22,937	66.5	-14.5	266.9	110.2
Missing	0	1		2	0		0	1		1	2		1	2				
<b>Total</b>	<b>30,772</b>	<b>13,504</b>	<b>30.5</b>	<b>28,289</b>	<b>22,008</b>	<b>43.8</b>	<b>28,986</b>	<b>36,625</b>	<b>55.8</b>	<b>27,611</b>	<b>52,209</b>	<b>65.4</b>	<b>27,620</b>	<b>52,219</b>	<b>65.4</b>	<b>-10.2</b>	<b>286.7</b>	<b>114.4</b>
<b>Race/ethnicity</b>																		
Hispanic	6,138	1,902	23.7	6,076	3,579	37.1	6,164	6,746	52.3	6,374	10,909	63.1	6,456	11,468	64.0	5.2	502.9	170.5
Native American	101	31	23.5	89	61	40.7	94	85	47.5	95	208	68.6	80	170	68.0	-20.8	448.4	189.5
Asian/Pacific Islander	1,790	862	32.5	1,878	1,324	41.3	1,812	2,183	54.6	1,745	2,750	61.2	1,888	2,925	60.8	5.5	239.3	87.0
African American	3,206	1,363	29.8	2,749	2,384	46.4	2,942	4,398	59.9	2,846	6,042	68.0	2,562	5,671	68.9	-20.1	316.1	130.9
White	18,855	9,024	32.4	16,791	14,074	45.6	17,160	22,382	56.6	15,646	30,795	66.3	15,752	30,452	65.9	-16.5	237.5	103.6
Other/Multiple	427	208	32.8	518	389	42.9	614	573	48.3	646	1,077	62.5	652	1,079	62.3	52.7	418.8	90.3
Unknown/Missing	255	114	30.9	188	197	51.2	200	258	56.3	259	428	62.3	230	454	66.4	-9.8	298.2	114.8
<b>Total</b>	<b>30,772</b>	<b>13,504</b>	<b>30.5</b>	<b>28,289</b>	<b>22,008</b>	<b>43.8</b>	<b>28,986</b>	<b>36,625</b>	<b>55.8</b>	<b>27,611</b>	<b>52,209</b>	<b>65.4</b>	<b>27,620</b>	<b>52,219</b>	<b>65.4</b>	<b>-10.2</b>	<b>286.7</b>	<b>114.4</b>
<b>Payer</b>																		
Medicare	15,303	9,240	37.6	13,608	14,485	51.6	13,696	20,863	60.4	12,823	26,233	67.2	12,620	26,481	67.7	-17.5	186.6	79.9
Medi-Cal	5,364	1,729	24.4	5,243	3,292	38.6	5,652	6,726	54.3	5,292	10,908	67.3	5,386	10,336	65.7	0.4	497.8	169.7
Private Insurance	7,380	2,043	21.7	6,967	3,243	31.8	6,862	5,718	45.5	6,622	8,950	57.5	6,780	9,832	59.2	-8.1	381.3	173.0
Self-Pay	809	140	14.8	796	294	27.0	947	1,233	56.6	1,029	2,502	70.9	1,050	2,237	68.1	29.8	1,497.9	361.3
Other Coverage	1,916	352	15.5	1,675	694	29.3	1,829	2,085	53.3	1,845	3,616	66.2	1,784	3,333	65.1	-6.9	846.9	319.7
<b>Total</b>	<b>30,772</b>	<b>13,504</b>	<b>30.5</b>	<b>28,289</b>	<b>22,008</b>	<b>43.8</b>	<b>28,986</b>	<b>36,625</b>	<b>55.8</b>	<b>27,611</b>	<b>52,209</b>	<b>65.4</b>	<b>27,620</b>	<b>52,219</b>	<b>65.4</b>	<b>-10.2</b>	<b>286.7</b>	<b>114.4</b>

**Table D. Most Frequent Admitting Diagnoses (Grouped into CCS Categories) for Resistant and Non-Resistant S. aureus Cases. California Hospital Patients, 1999-2007.**

Admitting Diagnosis	S. aureus	1999	2001	2003	2005	2007	% Change
Pneumonia	Non-Resistant	2,342	1,875	1,837	1,230	1,083	-53.8
	Resistant	1,131	1,868	2,518	2,745	2,519	122.7
Aspiration Pneumonitis	Non-Resistant	437	443	395	215	217	-50.3
	Resistant	368	527	654	639	531	44.3
Respiratory Failure	Non-Resistant	344	393	425	550	485	41.0
	Resistant	204	420	624	1,085	958	369.6
Urinary Tract Infection	Non-Resistant	361	376	374	326	285	-21.1
	Resistant	241	419	558	618	629	161.0
Skin/Subcutaneous Tissue	Non-Resistant	2,627	2,449	2,897	3,452	3,305	25.8
	Resistant	345	929	4,377	9,713	10,049	2,812.8
Chronic Skin Lesions	Non-Resistant	450	358	335	341	321	-28.7
	Resistant	237	375	629	877	857	261.6
Septicemia	Non-Resistant	2,265	2,008	2,115	2,661	2,927	29.2
	Resistant	639	1,195	1,755	3,571	4,175	553.4
Infectious Arthritis/Osteomyelitis	Non-Resistant	1,087	1,116	1,110	947	942	-13.3
	Resistant	226	441	880	1,226	1,216	438.1
Complication of Implanted Device	Non-Resistant	2,135	2,243	2,262	2,201	2,210	3.5
	Resistant	487	1,021	1,762	2,471	2,731	460.8
Complication of Surgery	Non-Resistant	1,871	1,775	1,852	1,667	1,499	-19.9
	Resistant	503	967	1,650	2,280	2,395	376.1
Adjustment of Prosthesis	Non-Resistant	21	20	24	*	*	19.0
	Resistant	*	23	37	40	30	-15.0
Complications of Diabetes	Non-Resistant	1,236	1,052	1,115	1,105	1,173	-5.1
	Resistant	339	646	1,089	1,664	1,754	417.4
Other Diagnosis	Non-Resistant	15,597	14,181	14,245	12,899	13,156	-15.7
	Resistant	8,772	13,178	20,092	25,280	24,375	177.9
Total Cases	Non-Resistant	30,773	28,289	28,986	27,611	27,620	-10
	Resistant	~13,500	22,009	36,625	52,209	52,219	~290

**Table E. In-Hospital and Post-Discharge 30-Day Mortality for Resistant and Non-Resistant S. aureus Cases. California Hospital Patients, 1999-2007. (\*NR=Non-resistant, R=Resistant)**

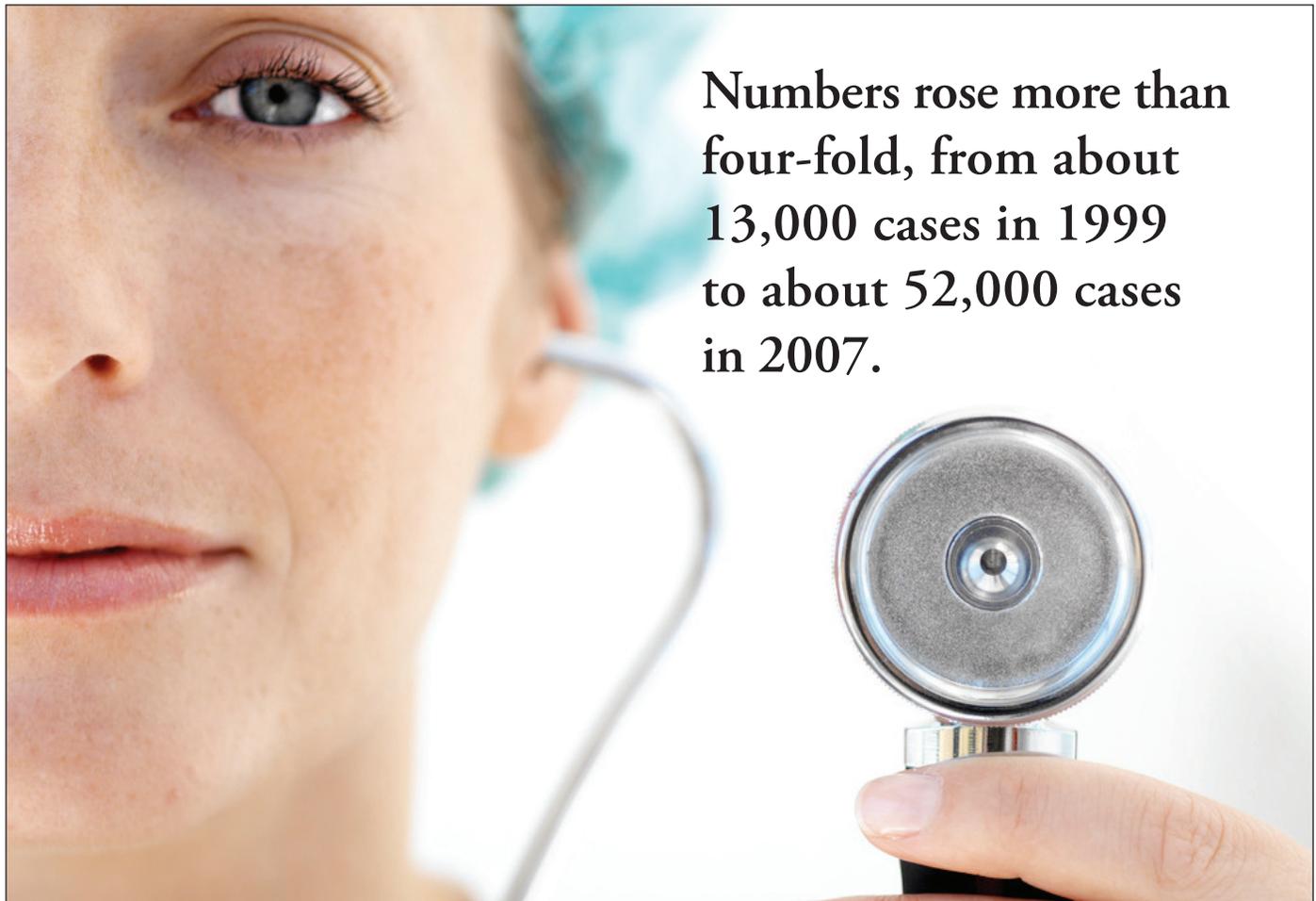
DIAGNOSIS	1999		2001		2003		2005		2007	
	*NR	*R								
<b>Number of Cases</b>										
Total Survived 31+ Days	22,866	8,826	20,697	14,989	21,546	26,915	20,536	39,717	---	---
Total 30 Day Deaths	7,906	4,678	7,592	7,019	7,440	9,710	7,075	12,492	---	---
Died in Hospital	3,155	2,113	3,076	3,173	2,978	3,777	2,556	4,126	2,567	3,607
Died Post-Discharge	4,751	2,565	4,516	3,846	4,462	5,933	4,519	8,366	---	---
Total	30,772	13,504	28,289	22,008	28,986	36,625	27,611	52,209	27,620	52,219
<b>Percent of Cases</b>										
% Survived 31+ Days	74.31	65.36	73.16	68.11	74.33	73.49	74.38	76.07	---	---
% Admissions Died W/in 30 Days	25.69	34.64	26.84	31.89	25.67	26.51	25.62	23.93	---	---
% Died in Hospital	10.25	15.65	10.87	14.42	10.27	10.31	9.26	7.90	---	---
% Died Post-Discharge	15.44	18.99	15.96	17.48	15.39	16.20	16.37	16.02	---	---

**Table F. In-Hospital and Post-Discharge 30-Day Mortality for Resistant and Non-Resistant S. aureus Cases by Source of Admission. California Hospital Patients, 1999-2005.**

Source of Admission	S. aureus Susceptibility	1999				2001				2003				2005			
		Died in Hospital	Died after Discharge	Survived	% Died	Died in Hospital	Died after Discharge	Survived	% Died	Died in Hospital	Died after Discharge	Survived	% Died	Died in Hospital	Died after Discharge	Survived	% Died
Home	Non-Resistant	2,065	3,275	17,498	23.4	2,065	3,198	16,559	24.1	2,020	3,126	17,552	22.7	1,751	3,262	16,872	22.9
	Resistant	997	1,234	5,000	30.9	1,742	2,210	9,464	29.5	2,104	3,534	19,026	22.9	2,485	5,531	30,303	20.9
LT Care	Non-Resistant	527	604	1,615	41.2	423	496	1,228	42.8	470	554	1,335	43.4	345	444	1,175	40.2
	Resistant	526	728	1,627	43.5	742	961	2,445	41.1	785	1,271	3,246	38.8	892	1,459	3,943	37.4
Hospital	Non-Resistant	531	694	3,428	26.3	557	629	2,633	31.1	458	575	2,380	30.3	409	553	2,153	30.9
	Resistant	573	576	2,107	35.3	673	702	2,846	32.6	855	987	4,335	29.8	700	1,107	4,904	26.9
New Born	Non-Resistant	*	102	33	77.4	*	116	50	71.4	*	126	29	82.9	*	187	35	85.2
	Resistant	*	*	*	60.0	*	*	*	84.6	*	21	*	75.0	*	64	*	87.2
Prison/Jail	Non-Resistant	*	45	58	46.8	*	52	63	47.5	*	54	58	50.0	*	41	58	44.2
	Resistant	*	*	*	26.7	*	34	30	55.2	*	91	90	51.9	*	133	193	41.7
Other	Non-Resistant	*	30	235	16.4	*	25	164	20.4	*	27	192	16.5	31	32	243	20.6
	Resistant	*	*	75	29.2	*	*	113	21.5	27	29	211	21.0	40	72	364	23.5
Total Cases	Non-Resistant	3,156	4,750	22,867	25.7	3,076	4,516	20,697	26.8	2,978	4,462	21,546	25.7	2,556	4,519	20,536	25.6
	Resistant	2,113	2,565	8,826	34.6	3,174	3,935	~14,900	32.3	3,777	5,933	~26,900	26.5	4,126	8,366	~39,700	~24

**Table G. 30-Day Mortality for Resistant and Non-Resistant *S. aureus* Cases by Admitting Diagnosis. California Hospital Patients, 1999-2005. (\*NR=Non-resistant, R=Resistant)**

Type of Admission	1999				2001				2003				2005				1999-2005	
	# Deaths		% Died		# Deaths		% Died		# Deaths		% Died		# Deaths		% Died		% Change in % Dead	
DIAGNOSIS	*NR	*R	*NR	*R	*NR	*R												
Pneumonia (except in TB or STD)	1,346	1,108	38.5	45.6	1,135	1,492	39.7	43.3	961	1,750	36.7	40.3	592	1,500	34.1	34.8	-11.5	-23.7
Aspiration Pneumonitis	392	417	45.6	47.8	360	622	47.6	50.7	330	707	45.5	47.8	180	590	47.9	46.4	4.9	-2.8
Respiratory Failure	339	319	48.5	53.9	397	507	56.8	49.5	371	721	49.3	48.2	422	968	46.7	44.7	-3.7	-17.1
Urinary Tract Infection	140	104	25.1	23.0	121	168	24.2	24.8	126	218	26.5	23.2	96	198	23.6	22.0	-5.9	-4.4
Skin / Subcutaneous Tissue Infection	337	53	11.4	11.5	355	135	13.3	11.6	355	452	11.3	9.1	530	1,306	14.3	12.3	25.7	7.2
Chronic Skin Ulcer	96	116	14.7	22.8	82	162	16.1	22.6	65	186	14.7	18.4	76	258	16.7	18.5	13.9	-18.9
Septicemia	1,092	543	35.4	44.5	968	869	36.9	44.3	1,023	1,125	36.7	39.6	1,284	2,083	36.3	38.0	2.5	-14.8
Infectious Arthritis/Osteomyelitis	182	52	13.5	14.9	173	82	13.1	13.3	183	143	14.4	12.1	153	177	14.0	11.4	3.9	-23.3
Complication of Implant/Device	420	156	16.5	21.9	440	315	16.8	22.1	469	450	17.8	19.1	414	699	15.9	21.4	-3.6	-2.1
Complication of Surgery	199	134	8.8	16.7	197	192	9.4	13.6	189	304	8.8	13.1	180	347	9.3	11.6	5.7	-30.6
Adjustment of Prosthesis	73	72	15.1	21.6	68	94	15.8	17.0	85	166	16.6	16.9	64	169	14.3	14.8	-5.7	-31.7
Complications of Diabetes	165	95	11.6	20.0	130	136	11.0	15.5	175	179	14.3	13.3	149	242	12.3	12.3	5.5	-38.4
Other Diagnoses	3,125	1,509	30.0	35.1	3,166	2,335	31.6	33.7	3,108	3,309	30.3	29.1	2,935	3,955	31.9	26.1	6.2	-25.7
<b>Total</b>	<b>7,906</b>	<b>4,678</b>	<b>25.7%</b>	<b>34.6%</b>	<b>7,592</b>	<b>7,109</b>	<b>26.8%</b>	<b>32.3%</b>	<b>7,440</b>	<b>9,710</b>	<b>25.7%</b>	<b>26.5%</b>	<b>7,075</b>	<b>12,492</b>	<b>25.6%</b>	<b>23.9%</b>	<b>-0.4</b>	<b>-30.9</b>



Numbers rose more than four-fold, from about 13,000 cases in 1999 to about 52,000 cases in 2007.



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