



Trends in Invasive Infection with Methicillin-Resistant *Staphylococcus aureus* (MRSA) in Three San Francisco Bay Area Counties, 2005-2011

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Background

- In 2004, the California Emerging Infections Program (CEIP), at the request of the Centers for Disease Control and Prevention, initiated population-based laboratory surveillance for invasive Methicillin-resistant *Staphylococcus aureus* (iMRSA). MRSA had long been among the most important nosocomial pathogens and had recently emerged as an important pathogen in the community (1).
- Data collected are used to describe the changing MRSA epidemiology.
- In January 2008, select severe community-onset *Staphylococcus aureus* infections became reportable in California. Case defining criteria include patients without documented hospital-associated risk factors, indwelling devices, and/or nursing home exposures.

Methods

- Cases are identified through laboratory-based surveillance and are defined as MRSA cultured from a normally sterile body site from a resident of the CEIP catchment area (Alameda, San Francisco, and Contra Costa counties) per Active Bacterial Core Surveillance protocol (2).
- Medical record review was conducted to collect demographic and risk factor information. Cases were assigned one of three mutually exclusive epidemiologic classifications: healthcare-associated community-onset (HACO; previous hospitalization, surgery, dialysis, long-term care facility stay in the year prior to culture, or central vascular catheter [CVC] at time of culture and not HO), hospital onset (HO, culture collected >3 days after admission), or community associated (CA, no documented previous healthcare exposures, neither HO nor HACO).
- Healthcare exposures were compared using chi square tests and significance was defined as $p \leq 0.05$.
- Analyses were performed using SAS version 9.3[®].
- Annual and age-adjusted incidence rates were calculated using California Department of Finance estimates (3).

Tables and Figures

Epidemiologic Classification Key	
HACO: Healthcare-Associated Community-Onset	Hospitalization, surgery, dialysis, or long-term care facility stay in the year prior to culture, or central vascular catheter (CVC) at time of culture (and not HO)
HO: Hospital-Onset	Culture >3 days after hospital admission
CA: Community-Associated	Neither HO nor HACO

Table 1. Demographics of Invasive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infections in the San Francisco Bay Area by Epidemiologic Classification, 2005-2011.[†]

Demographic	HACO N (%)	HO N (%)	CA N (%)	Total N (%)
Sex*				
Male	2195 (62)	866 (62)	852 (68)	3913 (63)
Female	1324 (38)	542 (38)	396 (32)	2262 (37)
Age, years				
< 18	28 (1)	51 (4)	77 (6)	156 (3)
18-34	163 (5)	103 (7)	152 (12)	418 (7)
35-49	576 (16)	240 (17)	327 (26)	1141 (18)
50-64	1027 (29)	429 (30)	366 (29)	1822 (29)
≥65	1735 (49)	586 (42)	327 (26)	2648 (43)
Race*				
White	2165 (62)	848 (60)	802 (65)	3815 (62)
Black	711 (20)	282 (20)	200 (16)	1193 (19)
Asian	294 (8)	107 (8)	63 (5)	464 (7)
Other	34 (1)	9 (0)	19 (2)	62 (1)
Hispanic	282 (8)	136 (10)	128 (10)	546 (9)
Unknown	43 (1)	24 (2)	28 (2)	95 (2)
Total	3529	1409	1249	6187

[†]Of cases with known epidemiologic category data.

*Of cases with known sex and race/ethnicity data.

Table 2. Healthcare Exposures of Invasive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infections in the San Francisco Bay Area by Epidemiologic Classification, 2005-2011.[†]

Exposure*	HACO (N=3529) N (%)	HO (N=1409) N (%)	CA (N=1249) N (%)	p-value
Hospitalized in the previous year	2716 (77)	737 (52)	0 (0)	<0.0001
Surgery in the previous year	1305 (37)	386 (27)	0 (0)	<0.0001
Long-term care facility	1290 (37)	287 (20)	0 (0)	<0.0001
Dialysis in the previous year	976 (28)	149 (11)	0 (0)	<0.0001
Central venous catheter within 2 days	739 (21)	204 (14)	0 (0)	<0.0001

[†]Of cases with known epidemiologic category data.

*Variables are not mutually exclusive.

References

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- Klevens RM, Morrison MA, Nadle J, et al. Invasive methicillin-resistant *Staphylococcus aureus* infection in the United States. *JAMA*. Oct 17 2007;298(15):1763-1771.
- State of California, Department of Finance. Race/Ethnic Population with Age and Sex Detail, 2000-2050. Sacramento, CA, July 2007.
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Limitations

- CEIP's MRSA surveillance does not include health interviews. Therefore, some HACO cases may have been misclassified as CA due to data collected by medical record review of only the iMRSA admission.
- Data only represents invasive MRSA infections.

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Figure 1. Incidence of Invasive MRSA of San Francisco Bay Area by Epidemiologic Classification and Total by Year, 2005-2011.

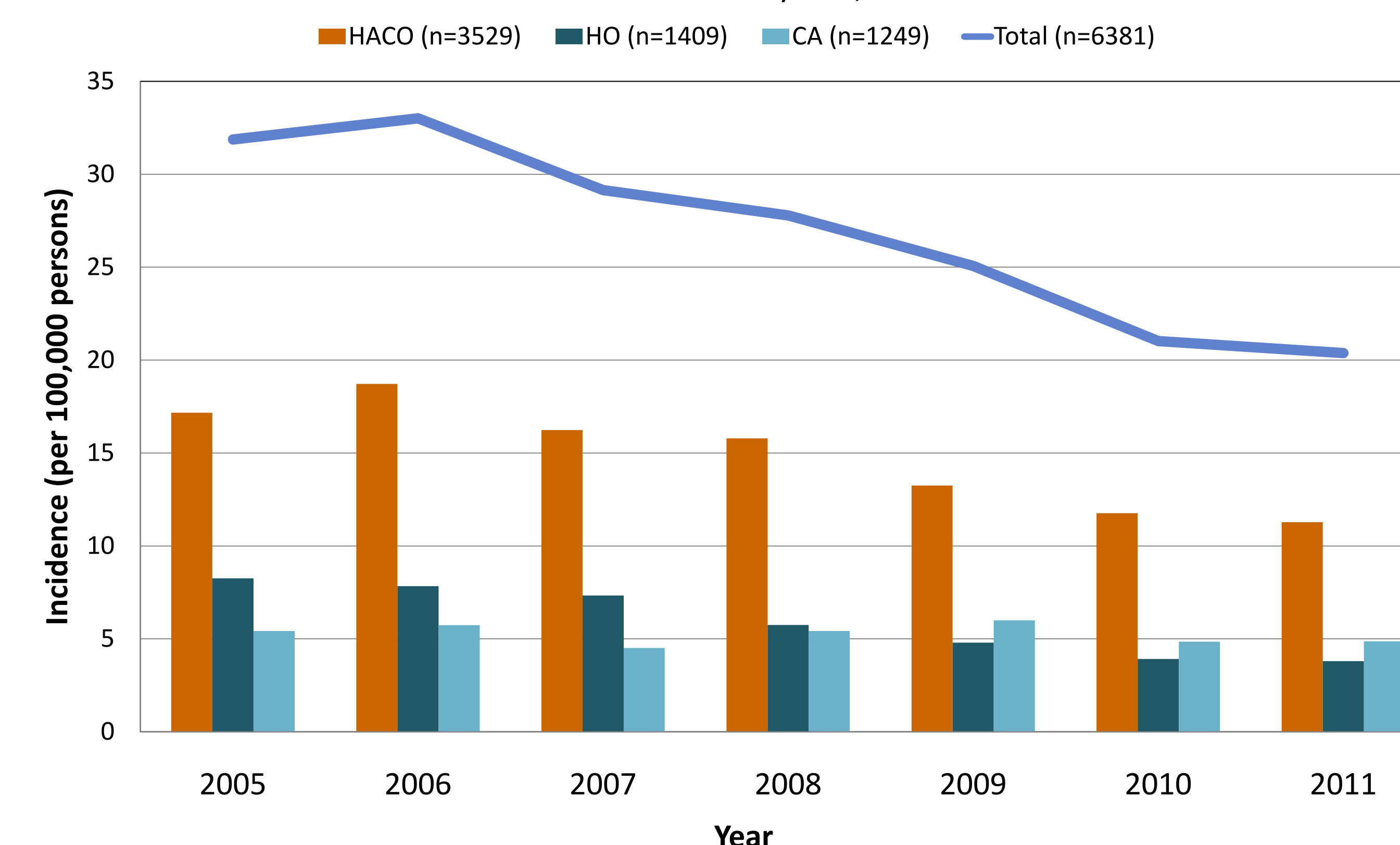


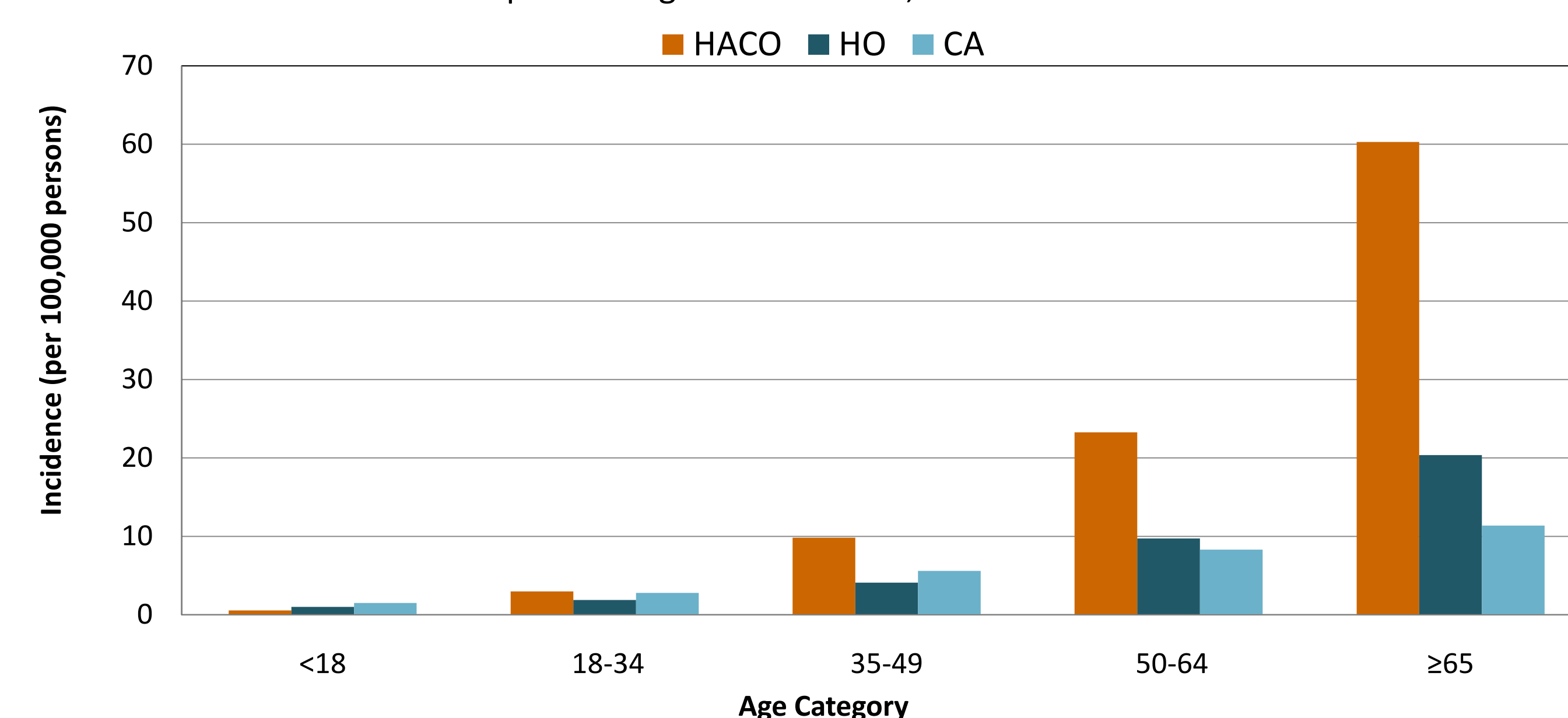
Table 3. Outcome of Invasive Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infections in the San Francisco Bay Area by Epidemiologic Classification, 2005-2011.[†]

Outcome*	HACO (N=3529) N (%)	HO (N=1409) N (%)	CA (N=1249) N (%)
Hospitalized	3182 (90)	1409 (100)	1081 (87)
Fatality	599 (17)	358 (26)	108 (9)
Fatality associated with MRSA	396 (78)	198 (72)	72 (82)
Median length of stay, days (range)	9 (0-373)	27 (3-977)	10 (0-377)

[†]Of cases with known epidemiologic category data.

*Of those with known outcome data.

Figure 2. Average Age Adjusted Incidence of Invasive MRSA by Epidemiologic Classification, 2005-2011.



Results

- Between 2005 and 2011, 6381 cases of iMRSA were detected: 22% HO, 55% HACO and 12% CA. iMRSA cases classified as HACO remain the largest proportion over all years.
- Between 2005 and 2011, there was an overall decrease in iMRSA incidence, from 31.9 cases/100,000 persons in 2005 to 20.4 cases/100,000 persons in 2011.
- The largest incidence decrease (54%) was seen among HO, from 8.3 /100,000 persons in 2005 to 3.8/100,000 persons in 2011.
- HACO incidence decreased by 34% from 17.2 /100,000 persons in 2005 to 11.3/100,000 persons in 2011.
- CA incidence remained steady over the seven-year period, 5.4 /100,000 persons in 2005 to 4.9 /100,000 persons in 2011.
- Race and sex distribution is similar across all epidemiologic classifications. (Table 1)
- The greatest proportion of cases under 35 years old was classified as CA, 2% were <18 and 12 % were 18-34. (Table 1)
- A higher proportion of HACO cases had all five of the healthcare exposures measured, compared to HO and CA cases. (Table 2)
- The highest fatality proportion was seen in HO (26%), followed by HACO (17%), and CA (9%) cases. (Table 3)
- Median length of hospital stay associated with current iMRSA infection was 27 days (range 3-977) for HO cases, 9 days (range 0-373) for HACO cases, and 10 days (range 0-377) for CA cases. (Table 3)
- The highest average age-adjusted incidence of 60.3/100,000 persons was found among HACO iMRSA who were ≥ 65 years old. (Figure 2)

Conclusions

Since 2005, incidence of iMRSA in the San Francisco Bay Area has decreased, most notably among HO iMRSA, consistent with previous findings (4). Healthcare based iMRSA intervention practices such as hand hygiene, MRSA infection control methods including bundles, isolation practices, and creation of antimicrobial stewardships may have been responsible for the decrease in hospital-associated iMRSA. Continued examination of iMRSA trends and monitoring effectiveness of prevention strategies is recommended.