POPULATION SURVEILLANCE FOR PEDIATRIC COMMUNITY-ASSOCIATED METHICILLIN-RESISTANT *STAPHYLOCOCCUS AUREUS* IN LOS ANGELES COUNTY

BACKGROUND

Community-associated methicillin-resistant *Staphylococcus aureus* (CAMRSA) has emerged as a significant cause of skin and soft tissue infections. In a recent study, over 50% of wound infections seen in an emergency room in northern California were due to CAMRSA. CAMRSA is distinguished from healthcare-associated MRSA (HAMRSA) clinically and genetically. CAMRSA strains are characterized by the presence of genes for the Panton-Valentine leukocidin (PVL) and the presence of the staphylococcal chromosomal cassette (SCC) *mec* type IV (HAMRSA typically has SCC*mec* types I, II, and III and does not contain genes for PVL). The majority of infections caused by CAMRSA are skin and soft tissue infections—though some deaths and invasive disease have been reported—and often occur in children. HAMRSA is associated with invasive disease and is seen in older patients with a history of hospitalization or nosocomial exposure.

With increasing reports of CAMRSA outbreaks in Los Angeles County (LAC) in jail inmates, men who have sex with men, athletes, and in newborn nurseries, the Los Angeles County Department of Health Services (LACDHS) declared MRSA in hospitalized children less than 18 years to be a reportable disease for 6 months in 2003. The goal of making MRSA reportable was to understand the incidence, diagnosis, treatment, and risk factors for MRSA. We chose to make it only reportable in children because of increasing anecdotal reports of CAMRSA in children in LAC, widespread reports of CAMRSA in children in other jurisdictions, and because of limited resources in LACDHS to follow-up adult patients.

METHODS

The reporting requirement included all LAC residents younger than 18 years of age who were hospitalized with an invasive or skin or soft-tissue infections caused by MRSA between May 5 and November 7, 2003. Nosocomial MRSA infections, as determined by the reporting healthcare professional, were exempt from the reporting requirement. Infection control practitioners and physicians were notified about the reporting requirement through the internet and the mail.

Medical charts of cases were reviewed for the following information: demographics (race/ethnicity, age), address, primary diagnosis, length of stay in the hospital, isolate source, treatment, and outcome. One research nurse reviewed all the charts.

Telephone interviews were attempted with a parent or guardian of each child. Information collected on the telephone interviews included: 1) race/ethnicity, 2) household size, 3) history of nosocomial exposure (hospitalization, dialysis, or surgery in the prior year; family member who is a healthcare worker or family member with a chronic disease that required frequent hospitalization), 4) history of chronic disease, 5) presence of skin infections in the household before and after hospitalization, 6) exposure to antibiotics in the previous six months, and 7) exposure to recently incarcerated persons and men who have sex with men in the 30 days before onset of symptoms.

Population data were abstracted from the 2000 US Census Data and the 2002–2003 LAC Health Survey. Cases were assigned a household income based on the 2000 US census median income for their zip code of residence. The median household income of the cases was calculated and compared by paired t-test to LAC overall median income.

Data were entered into MS Access and analyzed with SAS version 8 (Cary, NC). Race and ethnicity were coded separately in the survey.

Laboratory Investigation: Isolates were sent to a research laboratory at the University of California San Francisco (UCSF) for analysis. MRSA isolates were compared to strains seen in the United States and they were analyzed for the presence of SCC*mec* IV and genes for PVL.

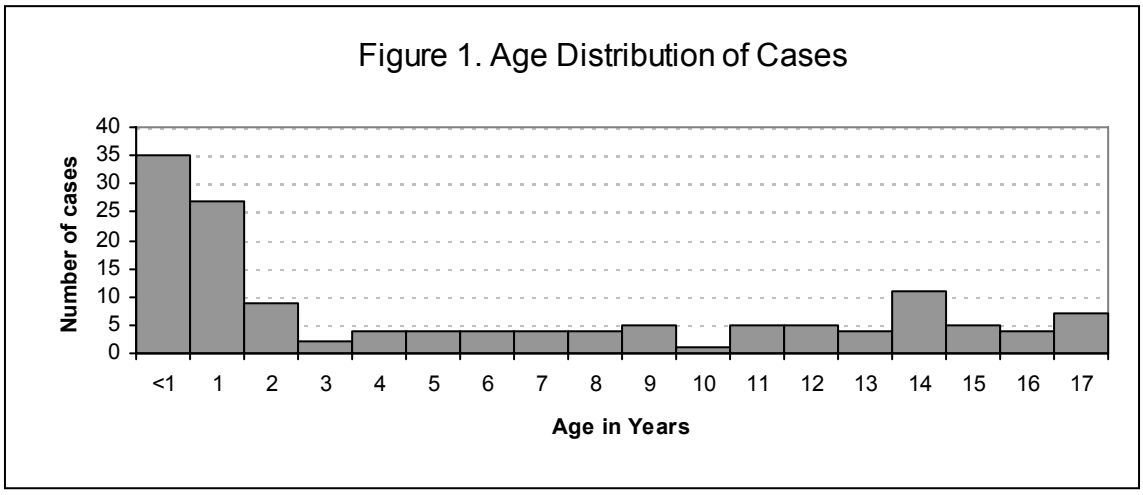
RESULTS

A total of 140 cases of MRSA were reported from 31 hospitals (range 1–17 cases/hospital). The mean age of the cases was 6.25 years and the median was 2.68 years (Table 1); the largest number of cases (n=35, 25%) were in children <1 year of age (Figure 1). The majority of cases were of Latino origin (66%). For age, gender, and race/ethnicity, there were no statistically significant differences between the reported cases and LAC residents under 18 years of age (Table 1). However, 75% (105 of 140) of cases lived in zip codes with a lower median income than the median income of LAC and the median surrogate household income for cases ($35,744) was less than the median annual income ($42,189) for LAC overall (p=0.0023).

Table 1. Demographic Characteristics of Cases

Characteristics	Case Population* (N=140) no.	(%)	LAC Population* (N=2,667,976) no.	(%)
Gender				
Male	69	(49%)	1,366,921	(51)
Female	71	(51%)	1,301055	(49)
Race/Ethnicity**				
Latino	78	(66%)	1,636,000	(60%)
White	19	(16%)	552,000	(20%)
Black	18	(15%)	279,000	(10%)
Asian/PI	3	(3%)	281,000	(10%)
Other	1	(1%)	–	–

* Age younger than 18 years.
** Information for 21 LAC cases missing.



The most common diagnoses were cellulitis (43%), abscess (36%), and abscess/cellulitis (11%). A few (n=10, 7%) were diagnosed with invasive disease including (some overlapping diagnoses) which included: bacteremia (n=4), meningitis (n=2), osteomyelitis (n=3), bursitis (n=2), and renal abscess (n=1). Three (3%) were other/unknown. Many of the charts (n=32, 23%) indicated a possible insect or spider bite as the cause of the lesion. There were no deaths.

The average number of days hospitalized was 5.15, median 4, and the range was 1–30 days. Almost all cases (99%) were treated with antibiotics including 91% with oral antibiotics and 98% with IV antibiotics. Initially, 75% of cases received ß-lactam antibiotics; although many received these antibiotics in conjunction with a second antibiotic to which the isolate was sensitive (clindamycin, vancomycin, or TMP-SMX). The majority (n=89, 70%) underwent incision and drainage procedures for their skin lesions.

A parent or guardian of 82 (58%) cases was interviewed. More than a third of the cases (35%, n=29) had risk factors for nosocomial MRSA (Table 2) including hospitalization in the previous year (not including hospitalization at birth). Almost one-half (43%, n=35) had other risk factors for MRSA (Table 3).

One fifth of patients (20%, n=16) had a household contact with a self-diagnosed skin infection in the month before onset of infection and 10% (n=8) had a household contact who developed a skin infection in the month after the case was hospitalized (median follow-up 24.5 days after onset of cases' symptoms, range 8–137 days).

The rate of hospitalization with MRSA was 10.3/100,000 person-year in those younger than 18 years old. This rate is considerably higher than the corresponding rates of hospitalization for the most commonly reported infectious diseases of public health significance (Table 4) in LAC.

Table 2. Risk Factors for Nosocomial MRSA

Exposure	Interviewed Cases (N=82)	
	no.	(%)
Healthcare worker in household	10	(12%)
Household contact with underlying illness	8	(10%)
Hospitalization in prior year	18	(22%)
TOTAL	29	(35%)

Table 3. Other Risk Factors for MRSA

Exposure	Interviewed Cases (N=82)	
	no.	(%)
Antibiotic use in prior 6 months	29	(35%)
Contact with recently incarcerated individual*	9	(11%)
TOTAL	35	(43%)

* Contact in the 30 days prior to onset of symptoms of MRSA.

Table 4. Rates of Hospitalization for Infectious Diseases in Persons <18 Years—Los Angeles County, 2003

Organism	Number Reported	Rate of Hospitalization*
MRSA	140**	10.30
Salmonella	99	3.71
Invasive *Streptococcus pneumoniae*	84	3.15
Shigella	65	2.44
Campylobacter	30	1.12

* Cases per 100,000 population <18 years old.
** Only reported May 5 to November 7, 2003.

Laboratory Results: Over half of MRSA isolates (n=83, 58%) were collected and analyzed; 79 (96%) were consistent with the USA 300 CAMRSA strain. Almost all (n=82, 99%) carried SCC*mec* IVa and 100% of the isolates possessed genes for PVL.

DISCUSSION

This is the first population based report of children hospitalized with MRSA and there are several notable findings. First, there was a high rate of morbidity associated with MRSA and the rate of hospitalization with MRSA was higher than any of the other reportable infectious diseases in LAC. Furthermore, laboratory findings identified that almost all the cases were caused by CAMRSA strains despite risk factors for HAMRSA in more than one-third of the cases. The majority of the cases in this report were skin and soft tissue (90%) infections and only 7% were invasive which is consistent with other reports of CAMRSA.

The majority (75%) of initial treatment regimens included ß-lactam antibiotics which are not effective against MRSA. Almost one-quarter were initially misdiagnosed as insect or spider bites which may have delayed proper treatment. Twenty-two percent of household contacts developed a self-reported skin infection in the month prior to or after the onset of symptoms of the index case suggesting that this organism is easily transmitted to close contacts. These findings demonstrate the need for healthcare provider education about the correct diagnosis and treatment of CAMRSA and the need to inquire about household and close contacts with skin infections to prevent recurrent exposures to the organism.

Of note, almost half (46%) of the cases were younger than 2 years—this may represent hospitalization bias. Pediatricians may have been more likely to hospitalize very young patients with MRSA. More needs to be understood about physicians' decisions about hospitalization for CAMRSA SSTI since several investigators have shown that these lesions may be treated with wound care and may not require either antibiotics or hospitalization.

This study, in conjunction with other studies in California, point to the increasing incidence of CAMRSA, the high morbidity associated with CAMRSA, and the need for increased clinician and patient education. Research is needed on prevention, treatment, and outcomes of CAMRSA.