



# Risk Factors Among Pediatric Patients with Community-Associated Methicillin Resistant *Staphylococcus aureus* in San Francisco

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## BACKGROUND

- Community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) in children is increasing nationwide.
- Limited prospective studies have assessed epidemiologic risk factors for CA-MRSA in children.

## OBJECTIVES

- To determine the prevalence of risk factors among children with CA-MRSA in San Francisco.
- To describe clinical characteristics of CA-MRSA infection in children.
- To evaluate antibiotic susceptibilities of pediatric CA-MRSA.
- To determine the prevalence of MRSA among community associated SA infections.
- To compare demographics of patients with CA-MRSA to those with Community-associated methicillin sensitive *Staphylococcus aureus* (CA-MSSA)

## METHODS

- Staphylococcus aureus* (SA) isolate information from San Francisco residents 0-18 years old were collected over 6 months at 2 hospitals and their affiliated clinics.
- Community-associated status met the following criteria:
  - Culture collected from outpatient or within 48 hours of hospitalization; no hospitalization in the past year (other than routine newborn hospitalization of children <1 year old); no history of surgery in the past year; no residence in a long-term care facility; and no history of an indwelling catheter or any percutaneous device
- Patient demographics and clinical details were gathered from electronic chart review. Site of culture and susceptibilities were collected from lab reports.
- Clinical diagnosis was determined by ICD-9 code, admission or OR diagnosis.
- Deep SSTI were defined as abscess or cellulitis, cellulitis, carbuncle/furuncle, lymphadenitis, omphalitis, peritonsillar abscess, parapharyngeal abscess or preseptal cellulitis.
- Superficial SSTI were defined as impetigo or an underlying skin condition (atopic dermatitis, disease of hair follicle, eczema, hair disease NEC, solvent dermatitis, dermatophytosis, insect bite, hordeolum, local skin infection, nonspecific skin eruption, scabies, dermatitis NOS, ingrowing nail, acne or psoriasis, onychia/paronychia, diaper rash, rash, HSV, otitis externa, dermatomyositis)
- Patient guardians and patients >12 years old were interviewed by phone about underlying conditions and potential risk factors for CA-MRSA such as:
  - previous MRSA / skin or soft tissue infection (SSTI) in patient or household
  - exposure to healthcare setting (recent antibiotics, emergency room (ER) visits, chronic disease or healthcare worker in household)
  - community exposures (daycare, team sports, history of homelessness/group home, injection drug use (IDU) or incarceration in patient or household)

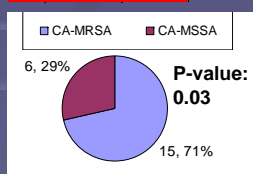
## RESULTS

### Patient Characteristics

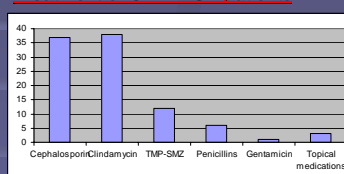
	CA-SA N=170 pts	CA-MRSA N=90 pts	CA-MSSA N=90 pts	P-value
<b>Age, years</b>				
Mean ±SD	6.8 years ± 6.3	6.3 years ± 6.2	7.3 years ± 6.4	0.17
<1	38 (22.4%)	20 (23.5%)	18 (21.2%)	0.20
0-3	46 (27.1%)	27 (31.8%)	19 (22.4%)	
4-9	32 (18.8%)	11 (12.9%)	21 (24.7%)	
>10	54 (31.8%)	27 (31.8%)	27 (31.8%)	
<b>Race/ethnicity</b>				<0.001
White	18 (10.6%)	8 (9.4%)	10 (11.8%)	0.62
Black	48 (28.2%)	33 (38.8%)	15 (17.7%)	0.002
Hispanic	49 (28.8%)	28 (32.9%)	21 (24.7%)	0.24
Asian/Native Hawaiian/Pacific Islander	35 (20.6%)	11 (13.0%)	24 (28.2%)	0.02
American Indian/Alaskan Native	1 (0.6%)	1 (1.2%)	0	--
Other	15 (8.8%)	3 (3.5%)	12 (14.2%)	--
Unknown	4 (2.4%)	1 (1.2%)	3 (3.3%)	--
<b>Male</b>	91 (53.5%)	41 (48.2%)	50 (58.8%)	0.17

### Patient Outcomes

#### Hospitalized patients



#### Treatment of CA-MRSA patients

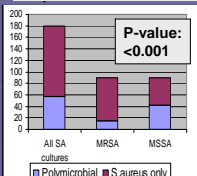


### Culture Characteristics

	CA-SA 180 isolates	CA-MRSA 85 isolates	CA-MSSA 85 isolates	P-value
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<b>Culture Site</b>				
Abscess	63 (35.0%)	53 (58.2%)	10 (11.1%)	<0.001
Wound	80 (44.4%)	30 (33.3%)	50 (58.8%)	0.003
Other Skin site	24 (13.3%)	1 (1.1%)	23 (25.6%)	
Lymph node/FNA	1 (0.5%)	0	1 (1.1%)	
Nares	1 (0.5%)	0	1 (1.1%)	
Blood	1 (0.5%)	1 (1.1%)	0	
Sputum/CF culture/throat	3 (1.7%)	1 (1.1%)	2 (2.2%)	
Urine	3 (1.7%)	0	3 (3.3%)	
Pleural Fluid	0	0	0	
Joint	0	0	0	
Bone	0	0	0	

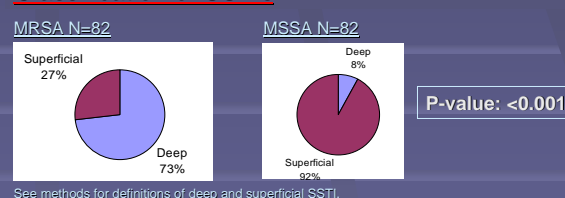
#### Polymicrobial cultures



### Clinical characteristics

	CA-SA 180 isolates	CA-MRSA 85 isolates	CA-MSSA 85 isolates
<b>Clinical Diagnosis/ICD-9 code</b>			
<b>a) Diagnosis related to infection</b>			
<b>Soft tissue infections</b>			
Cellulitis & abscess/cellulitis/carb/furuncle	59	54	5
Impetigo	14	3	11
Infected lymph node or acute lymphadenitis	2	1	1
Omphalitis	2	2	0
Parapharyngeal or peritonsillar abscess	2	2	0
Preseptal cellulitis	1	1	0
<b>Other</b>			
Septic arthritis	1	0	1
Conjunctivitis	3	0	3
Otitis media	2	0	2
Vaginitis	1	0	1
<b>b) Underlying conditions</b>			
Skin condition (see methods)	78	19	59
Cystic fibrosis	3	1	2
<b>c. Other unrelated diagnosis</b>	8	5	3
<b>d. Unknown/missing diagnosis</b>	4	2	2

### Classification of SSTIs



### Patient Underlying Conditions

Atopy	29 (50%)
Asthma	11
Eczema	21
Allergies	9
<b>Condition requiring frequent interaction with health care setting</b>	6 (10.3%)
Lupus	1
Frequent otitis media	1
Ex-premature infant	2
Bladder diverticulum, hydronephrosis	2
<b>Other known risk for SA infection</b>	2 (3.4%)
Folliculitis	3
Psoriasis	1
Lab confirmed Influenza in prior 10 days	1 (1.6%)

### Patient Risk Factors

Any risk factor:  
56 of 58 interviewed patients (96.6%)



**a) Previous MRSA or contact with SSTI/MRSA**  
27 (46.6%)

Previous documented MRSA infection.	11 (19.0%)
Mean number of months between specimen collection date and date of last documented MRSA infection.	8.6 mos ± 5.1
Previous documented MRSA colonization.	0 (0.0%)
Member of patient's household has been diagnosed with an MRSA infection.	4 (6.9%)
Member of patient's household has a soft tissue infection, or a recent history of one.	22 (37.9%)

**b) Potential health care exposure**  
48 (84.8%)

Antibiotics in 12 months prior to culture.	32 (56.2%)
Mean number of months between specimen collection date and date of last antibiotic course.	3.9 mos ± 3.7
Previous visit to an emergency room in 12 months prior to culture.	1.8 courses ± 2.2
Member of patient's household works in a hospital or clinic.	15 (25.9%)
Member of patient's household has a chronic medical problem.	9 (15.5%)
Atopy (asthma, eczema).	28 (48.3%)
Medical problem which require repeated interaction with a healthcare institution (Diabetes mellitus, hypertension, sarcoidosis, sickle cell anemia).	13
*Antibiotics taken include: amoxicillin (14), ceftaxime (9), piperacillin (5), TMP-SMX (2), rifampin (1), Clinda. (1), unknown (5)	15

**c) Potential community exposure**  
35 (60.3%)

Patient currently attends daycare (for patients 0-4 years old only).	9 (27.3%)
Member of the patient's household ever been to prison or jail.	10 (17.2%)
Patient participates in any teams or group sports (for patients 4-18 only).	12 (46.2%)
Member of the patient's household ever used injection drugs.	0 (0.0%)
Patient has ever been homeless or marginally housed.	10 (17.2%)
Patient has lived in a group home.	3 (5.2%)

## CONCLUSIONS

- Of all SA isolates 79% were probable community associated, and 50% of CA-SA infections were due to MRSA.
- 85% of all SA infections were SSTI.
- A larger proportion of CA-MRSA patients were Black, and a lower proportion were Asian/Pacific Islanders than CA-MSSA patients.
- Black patients more likely had a community exposure compared to Hispanic and other groups (85%, 59% and 21%, respectively, p=0.004).
- Most (90%) of deep SSTI were caused by MRSA. Most (76%) of superficial lesions grew MSSA, though it is unclear if many of these cultures represent infection of colonization.
- Deep SSTI were more likely to affect children <1 than other age groups (29% of deep SSTI) and 10-18 year olds (34% of deep SSTI).
- MRSA patients were more likely than MSSA patients to be hospitalized (17% vs. 7%).
- A higher proportion of children <1 with CA-MRSA were hospitalized (53% of CA-MRSA patients <1).
- Only 81% of isolates were clindamycin sensitive. A positive D-test (inducible clindamycin resistance) was rare (7%).
- Patients who had clindamycin resistant/intermediate MRSA were more likely to have a family member with chronic illnesses (p=0.04).
- Multidrug resistance (MDR) was common, accounting for 30% of isolates.
- Most (97%) of patients had at least one potential risk factor for CA-MRSA, most having a potential exposure to a health care setting.
- Many (50%) of CA-MRSA had a history of atopy, most commonly eczema.
- Future studies will include interviews with CA-MSSA patients as a control group to determine if certain risk factors are unique for CA-MRSA infection in children.
- Future studies will include detailed descriptors of depth of infection to further elucidate if MRSA causes more severe disease than MSSA.

### Antibiotic Susceptibilities for all CA-MRSA Isolates

Antibiotic	Clindamycin	Trimethoprim/Sulfa.	Doxycycline	Tetracycline	Ciprofloxacin	Levofloxacin	Erythromycin	Rifampin	Gentamicin	Vancomycin
Sensitive	72 (80.8%)	90 (100%)	37 (97.4%)	50 (96.2%)	44 (48.9%)	32 (62.7%)	13 (14.4%)	90 (100%)	88 (97.8%)	90 (100%)
Resistant	7 (7.9%)	0	1 (2.6%)	0	46 (51.1%)	19 (37.3%)	77 (85.6%)	0	2 (2.2%)	0
Intermediate	10 (11.2%)	0	0	2 (3.8%)	0	0	0	0	0	0

