



衛生防護中心  
Centre for Health Protection

## Scientific Committee on Emerging and Zoonotic Diseases

### A review of community-associated methicillin resistant *staphylococcal aureus* (CA-MRSA) cases in Hong Kong

#### Background

Methicillin-resistant *Staphylococcal aureus* (MRSA), being reported for the first time in the UK in 1961<sup>1</sup> and in the US in 1968<sup>2</sup>, has long been recognized in patients required hospitalization or long term care facilities. Recent recognition of MRSA infections in healthy individuals without risk factors for MRSA signaled that MRSA epidemiology has undergone changes<sup>3</sup>.

2. This new community-associated MRSA (CA-MRSA) generally refers to MRSA infection with onset in the community in an individual lacking established MRSA risk factors, including recent hospitalization, surgery, residence in a long-term care facility, receipt of dialysis or presence of invasive medical devices<sup>4</sup>. Moreover, recent researches found that CA-MRSA is distinct from traditional hospital-associated MRSA (HA-MRSA) in terms of molecular characteristics, antimicrobial susceptibility, groups of persons at risk of contracting the disease, clinical presentation and presence of exotoxins (Annex 1)<sup>5</sup>.

3. Outbreaks of CA-MRSA were first reported in the early 1980s in Detroit, Michigan of the US. In the late 1990s, increasing reports began to emerge in Finland, Germany, the US, etc. CA-MRSA now becomes a common community-based pathogen in many overseas countries and it demonstrated great geographic diversity. Outbreaks have been reported in the US, Canada, Europe, Finland, Saudi Arabia, India, Asia, Australia and New Zealand<sup>6</sup>.



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4. The Netherlands was claimed to have the lowest prevalence of MRSA in the world. The prevalence of MRSA among clinical *S.aureus* isolates was reported to be below 1%, as compared with Belgium (28%), France (33%), Germany (19%) and the US (50%). The low prevalence in the Netherlands may be related to the national “search and destroy” policy, in combination with restrictive antibiotic use.<sup>7</sup>

## **Situation in Hong Kong**

5. CA-MRSA was first reported in Hong Kong in 2004<sup>8</sup>. Since 2004, a monitoring group was formed under the coordination of the Centre for Health Protection (CHP) of Department of Health and the Centre of Infection of the University of Hong Kong to conduct a laboratory-based surveillance for CA-MRSA<sup>9</sup>. The participating microbiology network, which comprised 5 public hospital laboratories, 6 private hospital laboratories and 6 stand-alone community laboratories, screened the clinical information in the request forms and paid attention to MRSA isolates with a non-multiresistant antibiogram. Suspected CA-MRSA isolates were referred to HKU Centre of Infection for further molecular testings. It was estimated that this network covered half of the Hong Kong population.

6. Since January 2005, all hospital microbiologists in Hong Kong were encouraged to report CA-MRSA cases to this monitoring system. The CHP has received voluntary reports of cases of CA-MRSA infections from public hospitals and general practitioners. In response to an apparent increase of reported cases in 2006, it was decided to include CA-MRSA infection as a statutory notifiable infectious disease in January 2007 with a view to strengthen the surveillance and implement effective public health preventive and control measures.

## **A review of CA-MRSA cases reported in Hong Kong**

### **Notification details**

7. The paper describes the epidemiologic features of CA-MRSA cases received by the CHP during January 2005 and April 2007. During 2005 and 2006, reporting of cases was voluntary. Since 2 January 2007, doctors are required by law to report CA-MRSA infections.

8. There were a total of 112 notifications received during the reporting period (46 cases during 2005-2006 and 66 cases reported in the first 4 months in 2007). About 80% notifications were made by public sectors. 82 cases (73%) were found to have microbiological characteristics of CA-MRSA, i.e. Staphylococcal cassette chromosome *mec* (SCC*mec*) type IV or V and presence of Panton-Valentine leucocidin (PVL) gene.

9. There was no geographical clustering of the 82 confirmed cases among the 4 districts in Hong Kong (Hong Kong Island 27%, Kowloon 28%, New Territories East 20% and New Territories West 26%). The average lag time from the date of symptoms onset to date of notification was 21 days.

### **Basic demographics**

10. The 82 cases comprised 45 males and 37 females. Their ages ranged from 12 days to 93 years (median 32 years). 80% were adults aged between 20 and 59 years. About 15% (12 cases) were children under 18 years of age.

11. Fifty-five cases (67%) were Chinese. The remaining 17 cases (21%) were Filipinos, 3 cases (4%) were Nepalese, 3 cases (4%) were Americans and others were Danish, English, Spanish and Sri Lankan. The underlying reasons why one-third of the cases were non-Chinese were unknown. In 2004, US CDC also reported some CA-MRSA outbreaks affecting Pacific Islanders, Native Americans / Alaska Natives, Pacific and Canadian aboriginals<sup>10</sup>.

12. We identified 15 different occupational groups from the 82 reported cases. Among the 55 Chinese cases, there were 7 manual workers (13%), 7 students (13%), 7 professionals (13%) and 7 businessmen (13%). For the 27 non-Chinese cases, 14 (52%) were domestic helpers and 3 were students (11%). The ethnicity of the domestic helpers was Filipino (13 cases) and Sri Lankan (1 case).

13. As reported in overseas studies, some occupations may have a higher risk of contracting the disease via some frequent skin-to-skin contacts or by sharing personal items. They include athletes, military personnel and correctional facilities personnel and prisoners. Except for one reported case in 2006 who was a male staff working in prison, no other CA-MRSA cases fell into these occupations.

### **Clinical Presentation**

14. Skin and soft tissue infections (SSTIs), specifically furuncles, carbuncles and abscesses are the most frequently reported clinical manifestations of CA-MRSA infections<sup>4</sup>. The severity of MRSA SSTIs varies from mild superficial infections to deeper soft-tissue abscesses requiring hospital admission. CA-MRSA can infrequently cause necrotizing pneumonia, empyema, sepsis syndrome, pyomyositis, osteomyelitis, necrotizing fasciitis and disseminated infections with septic emboli. Invasive manifestations occur as complications of preceding SSTIs or influenza infection.

15. For the 82 reported cases, 80 cases (98%) presented as SSTIs,

including skin abscess, boils, furuncle, carbuncle, sebaceous cyst infection, acute paronychia and perineal infection. Two cases (2%) developed more severe non-cutaneous manifestations including meningitis and pneumonia.

16. Among the 80 cases presenting with SSTIs, 28 cases had infections on their lower limbs (35%), followed by upper limbs (20%), buttock (15%), head or neck (10%), trunk (9%) and perineum (4%). Seven cases (10%) reported SSTIs at multiple sites. Thirty cases (36%) also had systemic symptoms (e.g. fever, chills and rigors) as presenting symptoms.

### **Treatment and outcomes**

17. Among the 82 reported CA-MRSA cases, 55 patients (67%) required hospitalization. Sixty-five patients (79%) received surgical treatments and 77 patients (94%) received antibiotics (including empirical and targeted treatment), while sixty-one patients (74%) received both. The surgical treatments included incision and drainage, debridement, aspiration of abscess, masurpialization and flap surgery.

18. Two patients died because of CA-MRSA infection (one in 2005 and the other in 2006). The first fatal case was a 37-year-old Chinese female travel agent who presented with headache and neck stiffness in December 2005 and was diagnosed with meningitis in a public hospital. Cerebrospinal fluid and blood culture yielded CA-MRSA and she died despite antibiotics treatment 12 days after onset of symptoms. The second fatal case was a 30-year-old Chinese female hotel waitress who presented with right facial swelling in November 2006. She was given oral erythromycin but her condition rapidly deteriorated after admission and developed septicaemia 2 days afterwards. Blood culture and wound swab of her face yielded CA-MRSA. She died 5 days after symptoms onset.

### **Family cluster of CA-MRSA in Hong Kong**

19. CA-MRSA is known to be contagious and often associated with infection appearing within other family members and close contacts<sup>11</sup>. In 2006, some local researchers documented that MRSA could spread among household contacts of individuals with CA-MRSA infections. CA-MRSA infection or carriage was found in 6 (13%) of the 46 household contacts studied. And the transmission was confirmed by molecular analysis (PFGE analysis)<sup>9</sup>.

20. Among our cases, four family clusters were identified, involving a total of 8 confirmed cases. The first family cluster was reported in 2005, where 2 members (F/19 and M/17 siblings) of a Nepalese family were infected with CA-MRSA. Their other 3 siblings all had history of skin abscesses in the past 1 year, without laboratory confirmation of CA-MRSA infection. The second family cluster, reported in 2006, consisted of a brother (M/25) who

developed a left arm skin abscess and his sister (F/29) who had a breast abscess and carbuncles. Their onset dates were separated by more than 2 months. The third family cluster (in 2006) involved a mother (F/61) and son (M/33). The mother had an upper back carbuncle and her son developed an elbow abscess. The son's abscess was developed about five weeks after his mother's onset. In 2007, a husband (M/35) and wife (F/31) formed the fourth family cluster. The husband had recurrent abscesses over right ear and back and the wife developed a leg furuncle around the same time. They kept a pet dog.

## **Risk factors**

21. According to the US CDC, factors that facilitate the spread of CA-MRSA include crowding, frequent skin-to-skin contact between individuals, participation in activities that result in compromised skin surfaces, sharing of personal items that may become contaminated with wound drainage, and challenges in maintaining personal cleanliness and hygiene. Children, young adults, individuals from racial minority groups or low socioeconomic status were disproportionately affected<sup>4</sup>. Transmission of CA-MRSA have reported among inmates in correctional facilities, competitive sports participants, military recruits, day care attendees, men who have sex with men and injecting drug users. Other studies also suggest that using antibiotics in the preceding 12 months, keeping household pets and visiting sauna may also be additional risk factors<sup>12</sup>.

22. Among our cases, there are 21 cases (26%) reported antibiotic usage within 1 year of symptoms onset. Twelve patients (15%) were children younger than 18 years old, and 5 of them aged 6 months or below. Eleven (13%) patients had engaged in contact sports and 11 patients had received massage services within 1 year before their illnesses. Four patients (5%) had history of prior contact to known CA-MRSA patients. Eight patients (10%) had some forms of chronic illness. From our investigation, none of them were IV drug user and no male patient claimed to have sex with men.

**Table 1 Possible risk factors identified from the 82 reported cases**

Prior antibiotic use	21 (26%)
Aged below 18	12 (15%)
Massage services	11 (13%)
Contact sports	11 (13%)
Chronic illness	8 (10%)
Surgery	7 (9%)
Burn injury	5 (6%)
Spa / sauna	5 (6%)
Prior contact with known CA-MRSA case	4 (5%)
Pet ownership	4 (5%)
Nursing home stay	3 (4%)
Recurrent skin infection	3 (4%)
Work in prison	1 (1%)
Tattoo	1 (1%)
Visit to gym house	1 (1%)

## **Laboratory findings**

23. Among the 82 cases, 62 patients (76%) belonged to type IV and 20 patients (24%) were type V. Non-Chinese patients accounted for 44% (27 cases) of type IV cases, while all the type V cases were Chinese. All 82 cases were PVL gene positive.

24. Unlike HA-MRSA, which is usually resistant to multiple classes of antimicrobial agents, many CA-MRSA isolates have been resistant only to beta-lactams (including penicillins and cephalosporins) and macrolides and azalides (including erythromycin, clarithromycin and azithromycin). Most CA-MRSA isolates have been susceptible to trimethoprim-sulfamethoxazole (TMP/SMX), gentamicin, tetracycline and clindamycin<sup>4</sup>.

25. The antibiotic susceptibility pattern of our 82 CA-MRSA cases is shown in Table 2. All isolates were sensitive to vancomycin and the vast majority tested was sensitive to gentamicin, co-trimoxazole and fusidic acid. From our data, only three isolates were tested for mupirocin and were sensitive to it.

**Table 2 Antibiotic susceptibility pattern of the 82 reported cases**

<b>Antibiotic</b>	<b>Vancomycin</b>	<b>Erythromycin</b>	<b>Clindamycin</b>	<b>Gentamicin</b>	<b>Co-trimoxazole</b>	<b>Fusidic acid</b>	<b>Mupirocin</b>	<b>Methicillin</b>
<b>Number of isolates sensitive / total number tested</b>	82/82 (100%)	54/80 (68%)	45/61 (74%)	72/75 (96%)	53/54 (98%)	72/72 (100%)	3/3 (100%)	0/82 (0%)

## **CA-MRSA colonization in patients and their contacts**

26. During our epidemiological investigation of CA-MRSA infection, body swabs will be taken from patients (from nostrils, axilla and from groin, perineum or wounds if are present) for culture. Among the 82 cases, 20 of them (24%) were found to have CA-MRSA yielded in the body swabs.

27. The CHP interviewed the close contacts of the patients for possible symptoms, history of skin infections and treatment received. Close



contacts are generally defined as those individuals with frequent bodily contact with the CA-MRSA case. They include household contacts and others who may have intimate contacts (e.g. carers, boyfriends or girlfriends). Body swabs will also be collected from them for examination.

28. A total of 271 close contacts were identified for the 82 reported cases. Some 530 body swabs were collected for examination. Twenty-six (10%) close contacts were found to be carrying the CA-MRSA without showing symptoms.

### **The control and preventive measures**

29. In most instances, the acute clinical management of the case had already been carried out by the physician-in-charge. In addition to epidemiological investigation to screen the index cases and their close contacts for MRSA colonization status, empirical decolonization therapy will be given to both cases and close contacts. Those who screened positive would be followed up and re-tested to ensure eradication of the organism. Home visit would be arranged for selected cases.

30. Decolonization therapy adopted by the CHP includes application of 2% mupirocin ointment (Bactroban) twice daily to both nostrils, and a daily wash or bath using 4% chlorhexidine gluconate (Hibiscrub) for 5 consecutive days. No systemic antimicrobial therapy will be offered by the CHP to the cases or close contacts.

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### Characteristics of CA-MRSA vs HA-MRSA

	<b>CA-MRSA</b>	<b>HA-MRSA</b>
<b>At-risk groups or conditions</b>	Children, competitive athletes, prisoners, soldiers, selected ethnic populations (Native Americans / Alaska Natives, Pacific Islanders), intravenous drug users, men who have sex with men	Residents in long-term care facility, patient with diabetes mellitus, patients undergoing haemodialysis / peritoneal dialysis, prolonged hospitalization, intensive care unit admission, indwelling intravascular catheters
<b>SCC type</b>	Type IV	Type I, II, III
<b>Antimicrobial resistance</b>	B-Lactam resistance alone, common	Multiple drug resistance, common
<b>PVL toxin</b>	Frequent	Rare
<b>Associated clinical symptoms</b>	Skin and soft tissue infections (furuncles, skin abscesses), post-influenza necrotizing pneumonia	Nosocomial pneumonia, nosocomial- or catheter-related urinary tract infections, intravascular catheter or bloodstream infections, surgical-site infections

*(adopted from Todd, et al 2005)*