Prospective Multicenter Study of Community-Associated Skin and Skin Structure Infections due to Methicillin-Resistant *Staphylococcus aureus* in Buenos Aires, Argentina

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Abstract

**Background:** Community-associated methicillin-resistant *Staphylococcus aureus* (CA-MRSA) is now the most common cause of skin and skin structure infections (SSSI) in several world regions. In Argentina prospective, multicenter clinical studies have only been conducted in pediatric populations.

**Objective:** Primary: describe the prevalence, clinical and demographic characteristics of adult patients with community acquired SSSI due to MRSA; secondary: molecular evaluation of CA-MRSA strains. Patients with MRSA were compared to those without MRSA.

**Materials and Methods:** Prospective, observational, multicenter, epidemiologic study, with molecular analysis, conducted at 19 sites in Argentina (18 in Buenos Aires) between March 2010 and October 2011. Patients were included if they were ≥14 years, were diagnosed with SSSI, a culture was obtained, and there had no significant healthcare contact identified. A logistic regression model was used to identify factors associated with CA-MRSA. Pulse field types, SCCmec, and PVL status were also determined.

**Results:** A total of 311 patients were included. CA-MRSA was isolated in 70% (218/311) of patients. Clinical variables independently associated with CA-MRSA were: presence of purulent lesion (OR 3.29; 95%CI 1.67, 6.49) and age <50 years (OR 2.39; 95%CI 1.22, 4.70). The vast majority of CA-MRSA strains causing SSSI carried PVL genes (95%) and were SCCmec type IV. The sequence type CA-MRSA ST30 spa t019 was the predominant clone.

**Conclusions:** CA-MRSA is now the most common cause of SSSI in our adult patients without healthcare contact. ST30, SCCmec IV, PVL+, spa t019 is the predominant clone in Buenos Aires, Argentina.

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Introduction

Community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA) has emerged in different world regions [1] including Latin America [2,3] as a major cause of acute bacterial skin and skin structure infections (SSSI). Different from hospital-acquired MRSA, CA-MRSA usually is mec type IV, carries genes for Panton-Valentine leukocidin (PVL) and is susceptible to several non ß-lactam antibiotics [4].

In Argentina, prospective, multicenter, studies with molecular evaluation of community MRSA in patients with SSSI have only been conducted in pediatric populations [5,6]. However, despite the observation that the clinical characteristics of SSSI in adults appear similar to those of children the prevalence of CA-MRSA in adolescents and adults presenting with SSSI infection have not been determined.

The epidemic of CA-MRSA is evolving [7]. A specific clone that is initially propagating and causing CA-MRSA infections can be displaced by a more successfully one. For example in the US the initially reported CA-MRSA clone USA 400 was subsequently replaced by the USA 300 which became the most common cause of SSSI [1,8]. In Argentina previous studies have identified ST5, SCCmec IV, spa type 311 as the predominant CA-MRSA clone causing infections [6] and colonizing children [9]. Microbiologically based studies have suggested the same clonal predominance of CA-MRSA among Argentinean adults [10]. Whether this clone of CA-MRSA is still dominant or has been replaced in adult patient with SSSI in our country needs to be determined. The current study was conducted to establish the prevalence, clinical and molecular characteristics of CA-MRSA in adolescents and adults with SSSI in Argentina.

Materials and Methods

A prospective, observational, multicenter study was conducted in a total 19 centers (18 in Buenos Aires state and city, and 1 in Santa Fe state) between March 2010 and October 2011. The primary objective was to determine prevalence, clinical and demographic characteristics in patients with SSSI due to CA-MRSA. Secondary objective was to perform a molecular analysis of CA-MRSA strains.

Patients were included if they had ≥14 years old, presented with SSSI and had a culture obtained. Patients were excluded if they had any of the following contacts with the healthcare system within the last 12 months: hospitalization, chronic care (e.g. nursing home), catheter placement, dialysis or surgery.

The information was collected using an electronic clinical report form (eCRF). Patients were followed for at least one visit after the point at which no further antibiotics or procedures were deemed necessary. Clinical outcomes were defined as a) end of antimicrobial therapy. Clinical outcomes were defined as a) end of antimicrobial therapy.

Pathogen identification and antibiotic susceptibility was obtained from each institutional microbiology laboratory. MRSA isolates were sent to a reference laboratory (Catedra de Microbiología, Facultad de Farmacia y Bioquímica, Universidad de Buenos Aires). Resistance to methicillin was confirmed through PCR amplification of mecA gene. S. aureus ATCC strains 43300 and 29213 were used as positive and negative controls, respectively. SCCmec types were identified analyzing mec and ccr elements [11]. Presence Panton-Valentine leukocidin (PVL) genes ( lukS/F-PV) were also determined [12].

Pulse field gel electrophoresis (PFGE) was performed as described by Chung [13]. PFGE also included locally circulating clones (e.g. clone CAAX, pulse field type A, ST5, spa311, SCCmecIV, PVL+) and one strain characterized as pulse field type C, ST30, spa019, SCCmecIV, PVL+ [14]. The analysis of PFGE profiles was carried out by visual inspection. A dendrogram (Treecon 1.3b) was built applying unweighted pair-group method clustering analysis (UPGMA) algorithm and Dice coefficient.

Genotype analysis of isolates was also performed using spv typing [15]. Data obtained was analyzed using a reference website: http://www.ridom.de/spaserver (last accessed on November 20th 2012). A representative proportion of isolates from each pulse field type were studied using multi locus sequence typing (MLST) (http://saureus.mlst.net/; last accessed on November 20th 2012).

The study was approved by Institutional Review Boards (IRB) from participating institutions. In all cases the adult participants gave written or verbal consent as required by the IRBs. In accord with local IRB instructions the following participating sites required written informed consent (ICF): Hospital Dr. José María Cullen, Hospital Español de Buenos Aires, Hospital Bernardo Houssay de Vicente López, Htal. F. Santoyanni, Policlinico Central de La Matanza (for patients <18 years old) and Sanatorio Otamendi. At the above sites written informed consent forms for patients <18 years old were obtained from parents or legal guardians on the behalf of the participant minors/children. Given the observational nature of the study and the anonymity of data the remaining IRBs from participating institutions did not require written ICF (regardless of patient’s age). The IRBs from the following participating sites approved the study and required only verbal consent without need of documentation: Centro de Educación Médica e Investigaciones Clínicas (CEMIC), Htal. Aeronáutico Central, Htal. Español de Buenos Aires, Htal. Evita Pueblo, Htal. Juan A. Fernández, IPER, Htal. Nuestra Señora de Luján, Htal. Privado de la Comunidad, Htal. Tornú, Htal. Universidad Abierta Interamericana, Htal. Velez Sarfield, Htal. IGA Vicente López, Policlinico Central de La Matanza (for ≥18 years old), Sanatorio Municipal Dr. Julio Méndez, Sanatorio Tandil. The verbal consent for patients <18 years old were obtained from parents or legal guardians on the behalf of the minors/children participants. There was no need for IRB approval at Hospital Británico de Buenos Aires (study previously discussed with the site IRB and in compliance with their policies for observational studies with anonymized data; verbal waiver obtained from the IRB board members).
## Results

A total of 311 patients were enrolled during the study period in 19 centers. The majority of patients were male (60%) and the mean age was 38.8 (±18.1) years old (Table 1). A history of previous furuncles was the most predisposing factor for SSSI (36%). Almost 70% of patients had an identifiable predisposing factor for CA-MRSA. Among such factors the receipt of antibiotics within the last 12 months was the most common. Abscesses and furuncles were the most frequent SSSIs accounting for 70% of the cases. A vast majority of patients had purulent lesions and one third presented with fever. Almost 90% (271/311) of patients had positive cultures. Among subjects with positive cultures C-MRSA was obtained in 80.4% followed by

### Table 1. Clinical and demographic characteristics in patients with skin and skin structure infections due to community-associated MRSA.

| Variables                      | Total N = 311 n/N (%) | CA- MRSA N = 218 n/N (%) | No MRSA N = 93 n/N (%) | p*  |
|--------------------------------|-----------------------|--------------------------|------------------------|-----|
| **Demographic characteristics** |                       |                          |                        |     |
| Gender male                    | 187/311 (60,1%)       | 133/218 (61%)            | 54/93 (58,1%)          | 0,63|
| Age in years, mean (± SD)      | 38.8 (±18.1)          | 36.1 (±16.7)             | 45.3 (±19.7)           | 0,0001|
| <50 years old                  | 225/307 (73,6%)       | 172/215 (80,0%)          | 53/92 (57,6%)          | <0,0001|
| BMI, mean (± SD)               | 26.5 (±5.7)           | 25.8 (±5.1)              | 28.2 (±6.6)            | 0,006|
| BMI≤25                         | 107/239 (44,8%)       | 82/166 (49,4%)           | 25/73 (34,2%)          | 0,03|
| **Predisposing factors for skin infections** |                  |                          |                        |     |
| Total                          | 232/311 (74,6%)       | 160/218 (73,4%)          | 72/93 (77,4%)          | –   |
| Furunculosis (history)         | 113/311 (36,3%)       | 93/218 (42,7%)           | 20/93 (21,5%)          | 0,0004|
| Trauma                         | 44/311 (14,2%)        | 29/218 (13,3%)           | 15/93 (16,1%)          | 0,51|
| Diabetes                       | 37/311 (11,2%)        | 23/218 (10,6%)           | 14/93 (15,1%)          | 0,26|
| HIV                            | 24/311 (7,7%)         | 20/218 (9,2%)            | 4/93 (4,3%)            | 0,14|
| Peripheral vascular disease    | 22/311 (7,1%)         | 12/218 (5,5%)            | 10/93 (10,8%)          | 0,1  |
| Immunosuppressant therapy      | 22/311 (7,1%)         | 11/218 (5,1%)            | 11/93 (11,8%)          | 0,03|
| **Predisposing factors for CA-MRSA** |                      |                          |                        |     |
| Total                          | 217/311 (69,8%)       | 167/218 (73,6%)          | 50/93 (53,8%)          | –   |
| Previous antibiotics last 12 months | 152/311 (48,9%)   | 117/218 (53,7%)          | 35/93 (37,6%)          | 0,01|
| Previous antibiotics last 30 days | 121/311 (38,9%) | 90/218 (41,3%)           | 31/93 (33,3%)          | 0,19|
| House contacts with similar lesions | 78/311 (25,1%)   | 64/218 (29,4%)           | 14/93 (15,1%)          | 0,008|
| Contact sports                 | 49/311 (15,8%)        | 37/218 (17,0%)           | 12/93 (12,9%)          | 0,37|
| **Nasal swab, MRSA positive**  | 15/65 (23,1%)         | 15/50 (30,0%)            | 0/15 (0%)              | 0,01|
| **Type of lesion**             |                       |                          |                        | 0,0001|
| Furuncle                       | 111/311 (35,7%)       | 88/218 (40,4%)           | 23/93 (24,7%)          | –   |
| Abscess                        | 107/311 (34,4%)       | 91/218 (41,7%)           | 16/93 (17,2%)          | –   |
| Cellulitis                     | 77/311 (24,8%)        | 33/218 (15,1%)           | 44/93 (47,3%)          | –   |
| Ulcer                          | 9/311 (2,9%)          | 5/218 (2,3%)             | 4/93 (4,3%)            | –   |
| Fasciitis                      | 4/311 (1,3%)          | 0/218 (%)                | 4/93 (4,3%)            | –   |
| Erysypela                      | 2/311 (0,6%)          | 0/218 (0%)               | 2/93 (2,2%)            | –   |
| Burn                           | 1/311 (0,3%)          | 1/218 (0,5%)             | 0/93 (0%)              | –   |
| Fever                          | 102/311 (32,8%)       | 70/218 (32,1%)           | 32/93 (34,4%)          | 0,69|
| Skin lesion multiple           | 93/311 (29,9%)        | 77/218 (35,3%)           | 16/93 (17,2%)          | 0,001|
| Skin lesion purulent           | 236/311 (75,9%)       | 184/218 (84,4%)          | 52/93 (55,9%)          | <0,0001|
| Skin lesion necrotic           | 26/311 (8,4%)         | 13/218 (6,0%)            | 13/93 (13,4%)          | 0,02|
| WBC>10×10⁹/L                   | 78/126 (61,9%)        | 53/84 (63,1%)            | 25/42 (59,5%)          | 0,70|
| Antibiotics within the last 72 hours | 145/311 (46,7%) | 104/218 (47,7%)          | 41/93 (44,1%)          | 0,56|

MRSA denotes methicillin-resistant *Staphylococcus aureus*; CA-MRSA denotes community-associated MRSA; BMI, body mass index. Data are displayed with n/N (%), except for continuous variables which are expressed by mean or median (standard deviation or interquartile range). Predisposing factors for skin infections as well predisposing factors for Community MRSA displayed in this table were selected from medical literature. Comparisons were exploratory.

*Comparing patients with community-associated MRSA vs. those without community-associated MRSA.

†Including furunculosis as a predisposing factor.

*From the total of patients with nasal swabs.

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mecA type IV was detected in 93.1% (136/146) of CA-MRSA isolates and only one strain had SCCmec type V. The predominant clone of CA-MRSA in patients with SSTI was characterized as pulse field type C, sequence type 30 (ST-30), spa t019 (Table 3). The most common PFGE types identified are displayed in Figure 1.

Approximately half of study patients received prior antibiotic therapy for their SSSIs (Table 4). The most commonly used prior antibiotics were first generation cephalosporins followed by amoxicillin-clavulanate. Prior antibiotic therapy was more common among patients infected with CA-MRSA than in those without CA-MRSA (58.3% vs. 43%; p = 0.01). Prior antibiotic therapy received in the majority of patients with CA-MRSA was deemed to be inadequate based on in vitro susceptibilities (78%). Almost all patients with prior therapy (with or without CA-MRSA) required continued antibiotic therapy after the first study visit and in 82% of cases such therapy was adjusted to a different antibiotic. The most frequently used antibiotics after the first study visit were trimethoprim-sulfamethoxazole and clindamycin. Antibiotic therapy had a median duration of 10 days. Slightly more than half of the patients underwent drainage at the beginning of the study. There were no differences between patients infected with CA-MRSA and those who were not infected with CA-MRSA in terms of number, type of drainage (surgical vs. non-surgical) or length of therapy received in the majority of patients with CA-MRSA was deemed to be inadequate based on in vitro susceptibilities (78%). Almost all patients with prior therapy (with or without CA-MRSA) required continued antibiotic therapy after the first study visit and in 82% of cases such therapy was adjusted to a different antibiotic. The most frequently used antibiotics after the first study visit were trimethoprim-sulfamethoxazole and clindamycin. Antibiotic therapy had a median duration of 10 days. Slightly more than half of the patients underwent drainage at the beginning of the study. There were no differences between patients infected with CA-MRSA and those who were not infected with CA-MRSA in terms of number, type of drainage (surgical vs. non-surgical) or length of

**Table 2.** Microbiological results and MRSA susceptibilities in patients with skin and skin structure infections.

| Variables                               | n/N (%)       |
|-----------------------------------------|---------------|
| Positive culture                        |               |
| Total                                   | 271/311 (87.1%) |
| Monomicrobial                           | 267/271 (98.5%) |
| Most frequent pathogens*                |               |
| MRSA                                    | 218/271 (80.4%) |
| MSSA                                    | 30/271 (11.1%) |
| Coagulase negative staphylococci        |               |
| 5/271 (1.8%)                            |
| S. pyogenes                             | 3/271 (1.1%)  |
| S. viridans                             | 4/271 (1.5%)  |
| Streptococcus group B, C, G             | 5/271 (1.8%)  |
| P. aeruginosa                           | 3/271 (1.1%)  |
| Other                                   | 7/271 (2.6%)  |
| Culture of primary skin lesion          |               |
| Total                                   | 311/311 (100%)|
| Needle aspiration                       | 265/311 (85.2%)|
| Surgical sample                         | 55/311 (17.7%)|
| MRSA susceptibilities‡                  |               |
| Minocycline                             | 141/141 (100%)|
| Rifampin                                | 184/186 (98.9%)|
| TMP-SMX                                 | 207/210 (98.6%)|
| Quinolones                              | 175/185 (94.6%)|
| Aminoglycosides                         | 153/166 (92.2%)|
| Clindamycin                             | 188/211 (89.1%)|
| Macrolides                              | 172/200 (86.0%)|

MRSA denotes methicillin-resistant Staphylococcus aureus; MSSA, methicillin-susceptible Staphylococcus aureus; TMP-SMX, trimethoprim-sulphamethoxazole.

*From the total of patients with positive cultures; 275 pathogens were isolated from 271 patients; 4 patients had two pathogens isolated, respectively; other pathogens include Proteus mirabilis (n = 2), Citrobacter spp (n = 2), Acinetobacter spp (n = 1), E. coli (n = 1), E. faecalis (n = 1).

†From the total of isolates tested; susceptibilities were determined at each microbiology laboratory following their standards.

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**Table 3.** Molecular characteristics of community-associated MRSA in patients with skin and skin structure infections: pulse field types, sequence types, mec and spa types.

| PFGE type | Isolates (n) | ST | SCCmec (n) | spa type (n)* |
|-----------|-------------|----|------------|---------------|
| A         | 35          | 5  | IV (35)    | t011 (14), ND (21) |
| C         | 94          | 30 | IV (94)    | t019 (42), t342(1), t9752(2), t0211(1), ND (48) |
| Others    | 17          | ND | IV (7), V (1), NT (9) | t019 (6), t111 (1), ND (10) |

Numbers within parenthesis indicate the number of isolates belonging to each spa type or SCCmec type.

ST denotes sequence type; ND, not determined; NT, non-typeable.

*A representative proportion of isolates from each pulse field type were studied.

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Second, this study reveals the predominance of the clone ST-30 SCCmec IV, PVL+ spa t019 among our patients from the community. This clone which was previously considered as an uncommon clone in Argentina appears to have displaced the previously predominant clone (ST5, SCCmec IV, PVL+) [6,14]. Consistent with this finding we have recently described predominance of ST-30 SCCmec IV, PVL+ spa t019 among patients with invasive CA-MRSA infections in Argentina [16]. Predominance of one clone over the others could be associated with fitness advantages and reflects the dynamism of CA-MRSA epidemic [7,19,20]. Interestingly strains belonging to clonal complex 30 seem to have a different repertoire of enterotoxins, adhesins as well as important association with infective endocarditis [21]. Although our study was focused on community patients with SSSI CA-MRSA is a well known cause of invasive and hospital acquired infections [22–24] which are also occurring in our country [18,25].

Third, SSSI caused by CA-MRSA have some characteristics that can be easily detected at the initial clinical evaluation. In our community population CA-MRSA is more common in patients <50 years old and presenting with purulent lesion such as abscesses or furuncles. Although PVL is not a primary determinant of outcome in patients with SSTI caused by CA-MRSA [26,27] the leucocidin is associated with pus formation [28]. In fact our multivariable analysis showed that purulent lesions and age <50 years old were both independently associated with CA-MRSA. Also the frequent description of contacts with similar lesions emphasizes the important finding of a high degree of spread within closed groups [29,30]. Cure rates were high among our patients. Importantly, clinical outcomes of patients with SSSI due to CA-MRSA were not different when compared to the clinical outcomes of patients without MRSA. These observations are in agreement with the literature indicating that SSSI due to CA-MRSA (usually PVL+) have good prognosis, and have similar outcomes to infections produced by PVL+ MRSA [27] or MSSA [31].

Our study has several important limitations. Inclusion of patients may be biased by physicians who included those patients for whom they suspected CA-MRSA. We believe that the prospective nature of the study should have attenuated such potential bias. In fact these high rates of CA-MRSA were described in other SSSI studies as mentioned before [1,8]. Second, antibiotic susceptibilities for CA-MRSA were not confirmed in our reference laboratory. However, susceptibility methods used by each microbiology laboratory were usually standard for most determinations. In addition, clinical decisions are based on such reports making them valuable to the study objectives. We did not have vancomycin minimum inhibitory concentration values for all strains. Therefore, we did not report such susceptibility in the current study. Is still worthy to mention that all isolates were reported susceptible to vancomycin by the different methods used for susceptibility determination. (Table 6).

Confidence intervals 1.67, 6.49] and age <50 years old (OR 2.39; 95% confidence intervals 1.22, 4.70) (model c-index 0.75) (Table 6).

**Discussion**

This prospective, multicenter study of CA-MRSA strains in adolescent and adult patients with SSSI in Argentina provided several findings.

Firstly, CA-MRSA has become the most common cause of skin and soft tissue infections in our patient without healthcare contact. From the total of 311 patients enrolled with SSTI 70% had CA-MRSA. The high rates of CA-MRSA observed among our patients with SSSI were similar to the rates observed in certain regions of the US [1,8,16]. This finding confirms our individual observations and will have significant impact on our antibiotic choices in the treatment of such patients. The occurrence of CA-MRSA as the predominant pathogen prompts an urgent change in the empirical therapy used to treat our community patients with SSSI. In addition, results from this study should encourage physicians to obtain cultures in patients with SSSI, most importantly in those areas where the prevalence of CA-MRSA or its antibiotic susceptibility are unknown [17].

**Figure 1.** Pulse field patterns of representative community MRSA isolates in patients with skin and skin structure infections. Lane 1 and 14, pulse field type A clone (CAA); lane 2, control pulse field type C; lane 5, pulse field type A; lanes 13 and 7 other pulse field types; lanes 3, 4, 6 and 8–12 pulse field type C. doi:10.1371/journal.pone.0078303.g001
### Table 4. Most common antibiotic treatments, changes in therapy and drainage in patients with skin and skin structure infections.

| Variables                        | Total N = 311 n/N (%) | Community-associated MRSA N = 218 n/N (%) | No Community-associated MRSA N = 93 n/N (%) | p*   |
|----------------------------------|-----------------------|-------------------------------------------|--------------------------------------------|------|
| Prior antibiotic treatment       | Total                 | 167/311 (53,7%)                           | 127/218 (58,3%)                           | 40/93 (43,0%) | 0,01 |
| (before study visits)            | Cephalosporin (1<sup>st</sup> generation) | 98/311 (31,5%) | 76/218 (34,9%) | 22/93 (23,7%) | 0,05 |
|                                   | Amoxicillin/clavulanate | 35/311 (11,3%) | 24/218 (11%) | 11/93 (11,8%) | 0,83 |
|                                   | Trimethoprim-Sulfamethoxazole | 17/311 (5,5%) | 13/218 (6,0%) | 4/93 (4,3%) | 0,79 |
|                                   | Amoxicillin           | 13/311 (4,2%) | 9/218 (4,1%) | 4/93 (4,3%) | 1,00 |
|                                   | ≥2 antibiotics        | 25/311 (8,0%) | 18/218 (8,3%) | 7/93 (7,5%) | 0,83 |
| Actual antibiotic treatment      | Total                 | 309/311 (99,4%) | 216/218 (99,1%) | 93/93 (100%) | 1,00 |
| (at 1<sup>st</sup> study visit)  | Different from prior therapy | 144/308 (46,8%) | 109/217 (50,2%) | 35/91 (38,5%) | 0,06 |
|                                   | Parenteral therapy    | 87/304 (28,6%) | 52/214 (24,3%) | 35/90 (38,9%) | 0,01 |
|                                   | Oral therapy          | 217/304 (71,4%) | 162/214 (75,7%) | 55/90 (61,1%) | –   |
| Actual antibiotic treatment      | Trimethoprim-Sulfamethoxazole | 137/311 (44,1%) | 110/218 (50,5%) | 27/93 (29,0%) | –   |
| treatment, type of agent (at 1<sup>st</sup> study visit) | Clindamycin | 111/311 (35,7%) | 78/218 (35,8%) | 33/93 (35,5%) | –   |
|                                   | Cephalosporin (1<sup>st</sup> generation) | 35/311 (11,3%) | 13/218 (6,0%) | 22/93 (23,7%) | –   |
|                                   | Quinolone             | 35/311 (11,3%) | 24/218 (11,0%) | 11/93 (11,8%) | –   |
|                                   | Rifampin              | 19/311 (6,1%) | 15/218 (6,9%) | 4/93 (4,3%) | –   |
|                                   | ≥2 antibiotics        | 79/311 (25,4%) | 54/218 (24,8%) | 25/93 (26,9%) | 0,70 |
| Antibiotic modification           | Total                 | 74/311 (23,8%) | 58/218 (26,6%) | 16/93 (17,2%) | 0,07 |
| (after 1<sup>st</sup> visit)     | Based on cultures     | 64/311 (20,6%) | 52/218 (23,9%) | 12/93 (12,9%) | 0,03 |
|                                   | Based on clinical outcomes | 27/311 (8,7%) | 21/218 (9,6%) | 6/93 (6,5%) | 0,36 |
| Length of antibiotic therapy in days, median (interquartile range) | 10 (7, 14) | 10 (7, 14) | 10 (7, 14) | 0,56 |
| Drainage                         | Total                 | 166/311 (53,4%) | 123/218 (56,4%) | 43/93 (46,2%) | 0,1  |
|                                   | Surgical drainage     | 82/311 (26,4%) | 57/218 (26,2%) | 25/93 (26,9%) | 0,89 |
|                                   | Non-surgical drainage | 84/311 (27,0%) | 66/218 (30,2%) | 18/93 (19,3%) | –   |

MRSA denotes methicillin-resistant Staphylococcus aureus.
*Comparing patients infected with community-associated MRSA vs. those patients without community-associated MRSA.
†It refers to drainage without incision (e.g. needle drainage).

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### Table 5. Clinical outcomes in patients with skin and skin structure infections.

| Clinical outcomes                   | Total n/N (%) | Community-associated MRSA n/N (%) | No-Community-associated MRSA n/N (%) | p*    |
|------------------------------------|---------------|----------------------------------|-------------------------------------|-------|
| Hospitalization                    | 120/311 (38,6%) | 73/218 (33,5%) | 47/93 (50,5%) | 0,005 |
| Surgical drainage after 1<sup>st</sup> study consult | 58/311 (18,7%) | 37/218 (17,0%) | 21/93 (22,6%) | 0,25 |
| Cure†                              | 262/301 (87,0%) | 184/210 (89,0%) | 78/91 (85,7%) | 0,65 |
| Failure                            | 8/301 (2,7%) | 3/210 (1,4%) | 5/91 (5,5%) | – |
| Indeterminate                      | 31/301 (10,3%) | 23/210 (11,0%) | 8/91 (8,8%) | – |
| Death                              | 5/311 (1,6%) | 2/218 (0,9%) | 3/93 (3,2%) | 0,16 |

MRSA denotes methicillin-resistant Staphylococcus aureus.
*Comparing patients infected with community-associated MRSA vs. those patients without community-associated MRSA.
†10 patients were excluded because lost of follow up; patients with indeterminate response were included in the denominator.

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(data not shown) at each laboratory. Last, the findings of this study are mostly limited to Buenos Aires city and state as well as the city of Santa Fe (Santa Fe state).

Despite the limitations described the current investigation indicates that CA-MRSA has become the most common cause of SSSI in our patient population. CA-MRSA is primarily seen in young adults presenting with purulent lesions and usually responds well to drainage plus antibiotic therapy. The clone ST30, SCCmec IV, PVL+, is now the predominant clone in adult patients suffering from SSSI in Buenos, Argentina.

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CABA denotes Cuidad Autónoma de Buenos Aires.

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Author Contributions

Conceived and designed the experiments: MJLF LiV SF NG MCG SP EC NL FR MM MES. Performed the experiments: MJLF LiV SF NG MCG SP EC NL FR MM MES. Analyzed the data: MJLF LiV SF NG MCG SP EC NL FR MM MES. Contributed reagents/materials/analysis tools: MJLF LiV SF NG MCG SP EC NL FR MM MES. Wrote the paper: MJLF LiV SF NG MCG SP EC NL FR MM MES.

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Table 6. Logistic regression model identifying clinical variables associated with community-associated MRSA in patients with skin and skin structure infections.

| Variable          | OR   | 95% CI          | p    |
|-------------------|------|-----------------|------|
| Purulent lesion   | 3.29 | 1.67, 6.49      | 0.0006 |
| Multiple lesions  | 1.48 | 0.69, 3.17      | 0.32  |
| Necrotic lesion   | 0.71 | 0.22, 2.31      | 0.57  |
| Immunosuppression| 1.17 | 0.44, 4.06      | 0.81  |
| History of furunculosis | 1.83 | 0.94, 3.56 | 0.07 |
| Age <50 years     | 2.39 | 1.22, 4.70      | 0.01  |
| Body mass index ≤25 | 1.55 | 0.83, 2.90 | 0.17 |

MRSA denotes methicillin-resistant Staphylococcus aureus; OR, odds ratio; 95%CI, confidence intervals 95%.
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