

Characterization of imported methicillin-resistant *Staphylococcus aureus* cases in Denmark, 2007-13

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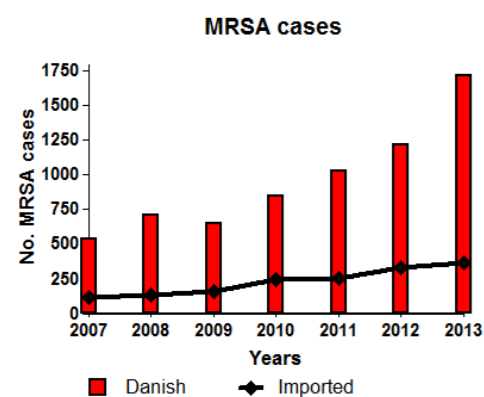
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Objective

To characterize imported MRSA cases in Denmark, from 2007-2013 with respect to patient demography and geographical origin and molecular types.

Methods

During the years 2007-2013 all new cases of MRSA were submitted to the Staphylococcus Reference Laboratory. All MRSA cases categorized as imported cases, e.g. being MRSA positive in relation to travel abroad, were included in the study. Relevant patient information (e.g. age, sex, reason for sampling, travel, history) was obtained from the general practitioner's questionnaires. MRSA isolates were characterized by *spa* typing, assignment to MLST clonal complexes and detection of the *pvI* genes



Results

A total of 1,602 imported cases of MRSA were noted, with an increase from 114 to 368 isolates in 2007 and 2013, respectively ($r^2=0.97$) (Figure 1). 993 (71%) of the individuals presented with infection while 409 (29%) were found in healthy carriers (202 lacked this information). The majority of cases had not reported contact with health service while abroad (n=993, 65%) (Table 1). 1,423 cases had a country of visit noted. The four most visited countries were all located in Asia: The Philippines (N=167), India (N=92), Thailand (N=78), and Sri Lanka (N=62). A total of 303 *spa* types were found, which were annotated to 24 CC groups and with 757 (50% of tested) being *pvI*+. CC8 constituted 20% of all imported cases and was the dominant CC among isolates from Africa, North America, South America, and Oceania. *pvI*+ t008/CC8 (USA300) had a strong geographical connection to USA (N=33) (Table 2).

Table 1. Demographics of imported MRSA cases, 2007-13

Median age (25th-75th percentile)	33 (21-52)
Gender	
Female	45% (720)
Male	55% (880)
Sampling reason	
Infection	71% (991)
Screening	29% (409)
Contact to foreign health care:	
Yes	35% (538)
No	65% (993)

CC5 and CC30 were the second and third largest clonal complex, respectively. CC30 t019, *pvI*+ (Southwest Pacific clone) was predominant among isolates from the Philippines and Thailand with 105 and 10 isolates, respectively. CC80-t044, *pvI*+ (European CA-MRSA clone) was found in 27 (25%) of travelers returning from the Middle East: Lebanon (N=11), Egypt (N=6), Jordan (N=3) and Iraq (N=3). India was highly associated with import of the Bengal Bay clone (*pvI*+ t345/t657) from where more than half of the isolates originated.

Table 2. Geographic distribution of predominant MLST clonal complexes and *pvI*+

Region (Number, <i>pvI</i> +)	Clonal complexes (Number, <i>pvI</i> +)				
	CC8	CC5	CC30	CC22	CC1
Total (1423, 50%)	(279, 56%)	(239, 35%)	(232, 89%)	(138, 23%)	(137, 50%)
Asia (597, 64%)	CC30 (175, 94%)	CC5 (107, 59%)	CC1 (84, 61%)	CC8 (65, 44%)	Others (140, 46%)
Europe (419, 32%)	CC5 (88, 18%)	CC8 (76, 40%)	CC22 (75, 1%)		Others (166, 50%)
Middle East (146, 45%)	CC80 (33, 94%)	CC88 (18, 61%)	CC8 (18, 38%)	CC22 (18, 11%)	Others (52, 28%)
Africa (112, 33%)	CC8 (34, 26%)	CC88 (27, 13%)			Others (43, 53%)
North America (92, 76%)	CC8 (61, 93%)	CC5 (13, 17%)	CC72 (10, 67%)		Others (6, 50%)
South America (41, 65%)	CC8 (21, 95%)	CC5 (10, 0%)	CC30 (7, 100%)		Others (2, 0%)
Oceania (16, 56%)	CC8 (5, 0%)	CC93 (3, 100%)	CC45 (3, 0%)	CC30 (2, 100%)	Others (3, 33%)

Conclusions

- During the years 2007-2013, an increase in imported cases of MRSA occurred.
- 50% of imported MRSA isolates were *pvI*+
- Well-known CA-MRSA clones were frequently found coinciding with a majority of travellers reporting no contact with foreign health care facilities.
- Travellers bring back strain types, which are dominant at the travel destination.
- Travellers are at risk of becoming carriers or infected with MRSA through community contacts.

References

Larsen AR et al., *spa* typing directly from a *mecA*, *spa* and *pvI* multiplex PCR assay- a cost-effective improvement for methicillin-resistant *Staphylococcus aureus* surveillance. Clin Microbiol Infect, 2008. 14(6): p. 611-4.

Larsen AR et al., Emergence and characterization of community-associated methicillin-resistant *Staphylococcus aureus* infections in Denmark, 1999 to 2006. J Clin Microbiol, 2009. 47(1): p. 73-8.

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