

# Methicillin resistant *Staphylococcus aureus* carrying *mecC* in Norway

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## Introduction

Since June 2011, the reference laboratory for MRSA has investigated all cefoxitin resistant, *mecA* negative, *S. aureus* isolates for the presence of the *mecC* gene. We describe phenotypic and genotypic characteristics of the Norwegian MRSA *mecC* isolates recovered by March 2014.

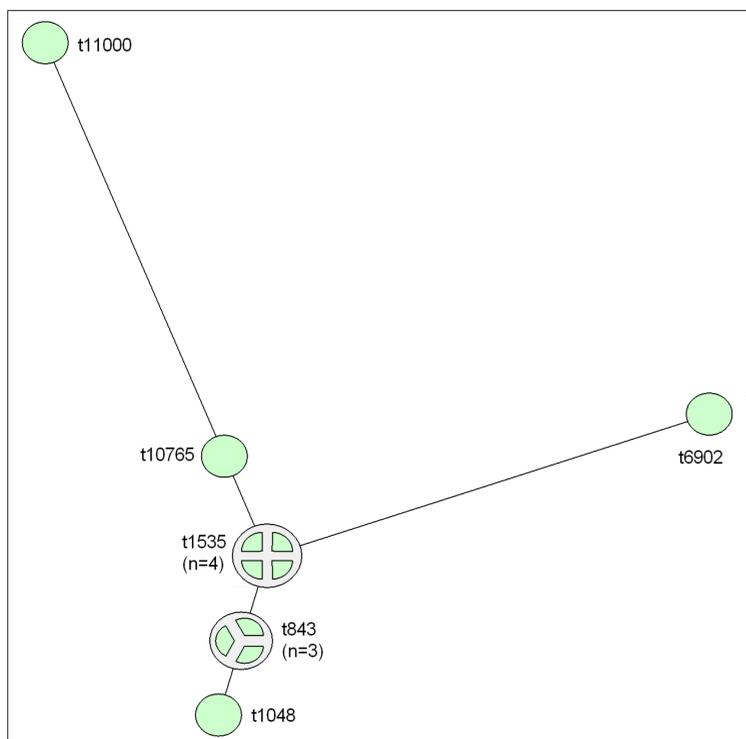
## Material and methods

55 isolates were analysed by an in-house PCR for the *mecC* gene (1). 13 stored borderline resistant *S. aureus* strains (BORSA, n=13) from 2006-2009 were also included. *Spa* typing and MLST was performed as previously described (2,3). Susceptibility testing was done by disc diffusion method (Oxoid) on Muller Hinton agar (BBL) for the following agents: cefoxitin, erythromycin, clindamycin, linezolid, gentamycin, doxycycline, mupirocin, rifampicin, norfloxacin, TMS and fucidic acid. Vancomycin, oxacillin and cefoxitin MIC's were determined by agar gradient method (Liofilmchem). Inhibition zones and MIC's were interpreted according to EUCAST clinical breakpoints. Screening for vancomycin heteroresistance was done by GRD Etest (bioMérieux).

## Results

11 MRSA isolates carrying *mecC* (10 human, 1 feline) were identified. Six were found among the 55 strains after implementation of the *mecC* PCR in 2011, and 5 among the 13 BORSA strains. The isolates belonged to 6 different *spa* types (figure 1) and to multilocus sequence types (MLST) ST130 (n=9), ST2496 (n= 1) and ST 2497 (n=1) (Table 1). One strain was PVL positive (*spa* t1048).

Figure 1



Minimum spanning tree showing detected MRSA *mecC* spa types in Norway

None of the isolates displayed resistance to other agents than cefoxitin. Cefoxitin MICs (range 8-16 mg/L) were universally higher than oxacillin MICs (range 1-8 mg/L). All strains were susceptible to vancomycin, and none displayed vancomycin heteroresistance. All strains grew on both CHROMagar (SmithMed) and ChromID MRSA (BioMérieux).

## References

- García-Álvarez L, Holden MTG, Lindsay H et al. Methicillin-resistant *Staphylococcus aureus* with a novel *mecA* homologue in human and bovine populations in the UK and Denmark: a descriptive study. *Lancet Infect Dis* 2011; 11: 595-603.
- <http://www.segnet.org/downloads.html>
- Enright MC, Day NP, Davies CE, Peacock SJ, Spratt BG. Multilocus sequence typing for characterization of methicillin-resistant and methicillin-susceptible clones of *Staphylococcus aureus*. *J Clin Microbiol*. 2000 Mar;38(3):1008-15.

Table 1

<i>spa</i> type	MLST	<i>arcC</i>	<i>aroE</i>	<i>glpF</i>	<i>gmk</i>	<i>pta</i>	<i>tpi</i>	<i>yqi</i>
t1535, t843, t1048, t10765	130 (n=9)	6	57	45	2	7	58	52
t11000	2496 (n=1)	6	115	311	2	7	32	5
t6902	2497 (n=1)	18	153	312	18	7	223	5

MLST and allele numbers of the 11 MRSA *mecC* strains

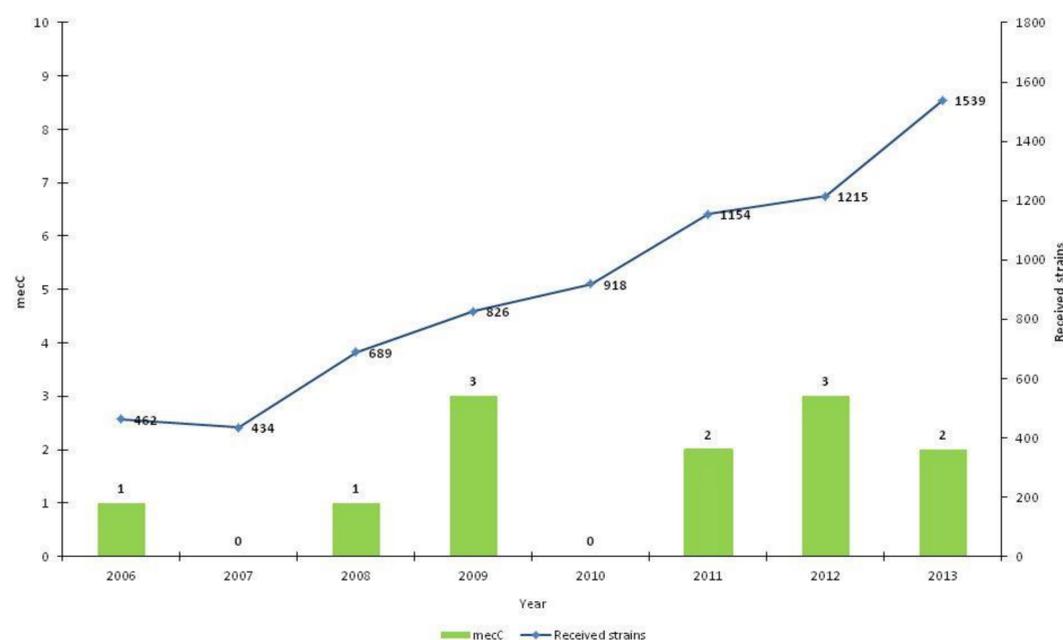
## Discussion

Norway has a low but increasing MRSA prevalence, where many strains are imported and  $\geq 200$  different *spa* types are detected every year. Although the presence of MRSA *mecC* can be documented back to 2006, its prevalence has been  $< 0.4\%$  of all MRSA strains received (figure 2). This corresponds with estimated prevalence rates of  $< 1\%$  from other countries. The 11 strains were geographically dispersed.

The strains grew well on the two most commonly used screening media in Norway, and were detected with the current EUCAST disc diffusion breakpoint for cefoxitin. Only a few laboratories use PCR based screening methods that may not detect the *mecC* gene. MRSA infections are usually detected through culture on conventional media and susceptibility testing. It is therefore unlikely with a large pool of undetected MRSA *mecC* in Norway. Among *mecA* negative, cefoxitin resistant strains, MRSA *mecC* should be suspected and further testing implemented as 5 of 13 (38.5%) of the strains previously categorized as BORSA and 6 of 55 (10.9%) of cefoxitin resistant, *mecA* negative samples carried the *mecC* gene.

Despite an increase in MRSA infections and colonization during the past decade, the prevalence of MRSA carrying *mecC* remains at a low level in Norway.

Figure 2



Number of MRSA *mecC* in relation to the total number of MRSA strains received at the MRSA reference laboratory

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