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## Objectives

In the period 1999-2006 a large expansion of the CC80-IV European community associated MRSA clone was observed and in the same period the first cases of the ST8-IV:USA300 appeared. Since 2006, introductions and expansions of new clones has appeared in the community. In this study the dynamics in the population structure of the predominant CA-MRSA clones from 2007 to 2011 was investigated based on the national surveillance of MRSA.

## Methods

MRSA has been a notifiable disease in Denmark since November 1st 2006. All isolates, including infections and screening samples are submitted to the National Reference Laboratory for Staphylococci at Statens Serum Institut, where susceptibility testing and *spa* typing are performed.

Epidemiological information is submitted by the general practitioner or the hospital doctor. All cases are classified as Imported (Import), Hospital acquired (HA), Community-onset but with a healthcare association (HACO) or Community-acquired (CA). In this study all new cases of CA-MRSA from January 1st 2007 - December 31 2011 were included. Detection of *pvl* gene (*lukF-pv*) by PCR was performed on all isolates from 2008

## Results

A total of 4,723 new MRSA cases were reported between 2007-11. The annual numbers of new MRSA cases (including both infections and from asymptomatic carriage) almost doubled: 2007 (N=663) and 2011 (N=1,293). CA-MRSA accounted for 2,568 new MRSA cases and increased significantly from 333 in 2007 to 751 in 2011. In contrast HA-MRSA was very stable with c.100 new cases per year (Figure 1). The proportion of CA-MRSA isolates from infections compared to healthy carriage was rather stable (Mean: 54.5%; range 48.6%- 61.5%).

A total of 257 different *spa* types were detected and assigned to 23 different MLST clonal clusters (CC) (Table 1).

Ten predominant CCs accounted for 2,348 cases (91.6%): CC8 (N=475); CC5 (N=383), CC398 (N=373); CC80 (N=264); CC30 (N=249); CC22 (N=202); CC1 (N=152); CC45 (N=114); CC59 (N=73) and CC88 (N=63). The live stock associated CC398 increased more than 10-fold in the study period from 14 in 2007 to 155 in 2011 (P<0.001). A statistically significant increase was also observed for MRSA belonging to CC30 and CC8 (P<0.001). The *pvl* gene was detected in 828/2,223 CA-MRSA isolates (37.2%) from 2008-11. The dynamics of the globally predominant *pvl* positive CA-MRSA clones (USA300, ST5-IV, ST80-IV, ST30-IV, ST59-V) are shown in Figure 2.

## Figures and tables

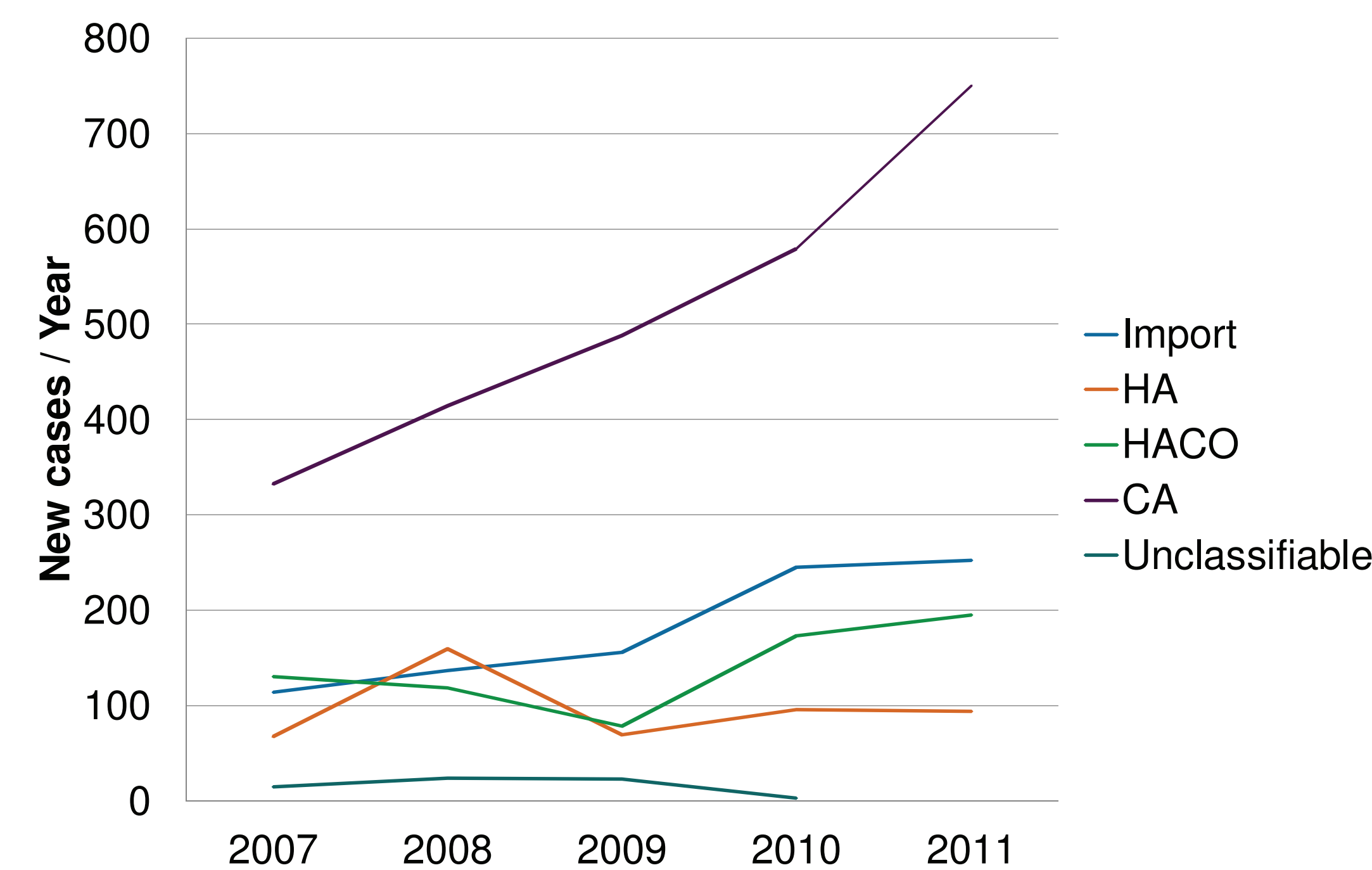


Figure 1. Annual numbers 2007-2011 of new MRSA cases (both screening and infections) classified as imported (Import), Hospital acquired (HA), Community-onset but with a healthcare association (HACO) or Community-acquired (CA).

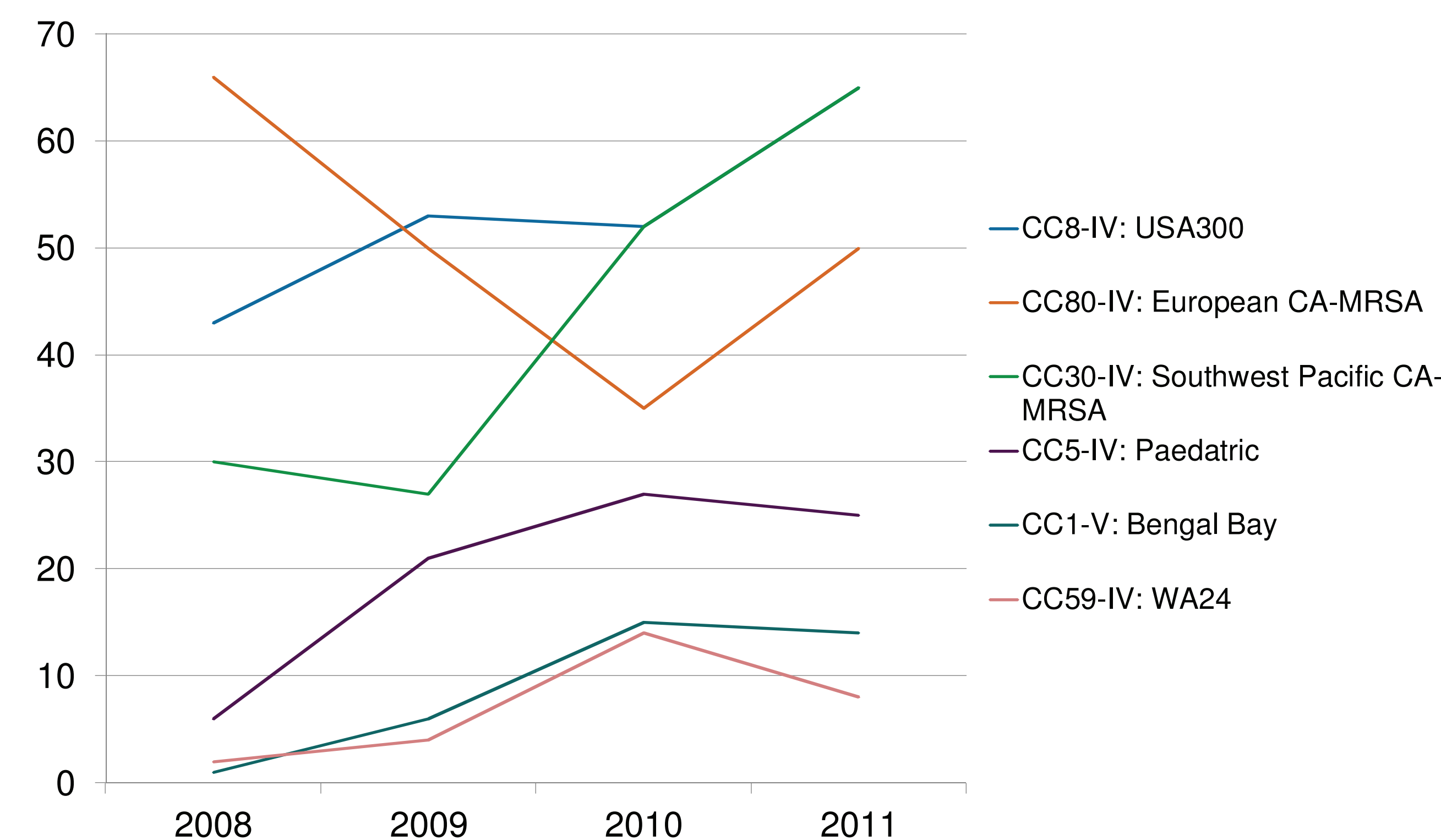


Figure 2. Predominant *pvl* gene+ Community acquired (CA)-MRSA clones in Denmark 2008-11.

MLST CC	<i>spa</i> types (n)	<i>spa</i> types	PVL+ (%)	2007	2008	2009	2010	2011	Total
CC8	33	t008, t024, t304	53.9	80	72	108	102	113	475
CC5	37	t002, t003, t311	23.4	46	66	90	82	99	383
CC398	10	t034, t011, t5706	0	14	60	40	104	155	373
CC80	10	t044, t042, t131	95.7	54	71	52	35	52	264
CC30	23	t019, t021, t012	79.1	29	35	44	63	78	249
CC22	26	t022, t223, t005	9.6	25	41	47	36	53	202
CC1	19	t127, t657, 189	27.7	22	20	23	42	45	152
CC45	17	t015, t126, t1203	3.1	23	17	22	23	29	114
CC59	7	t436, t216, t316	45.9	12	7	19	18	17	73
CC88	12	t690, t186, t5147	46.2	11	9	12	8	23	63
CC130	4	t843, t528, t1048	0			1	15	27	43
CC97	5	t267, t224, t359	0	2	1	12	9	15	39
ST152/377	3	t355, t4346, t4272	92.3	3	1	8	3	14	29
CC72	7	t148, t324, t791	10		5	2	6	7	20
CC12	3	t160, t5561, t888	0		2	2	4	3	11
CC913	1	t991	0			1	6		7
CC509	2	t375, t525	0	2				4	6
CC93	2	t202, t4699	100				2	2	4
Others	36	t1784, t7425, t6203	43.5	10	8	6	22	15	61
<b>Total</b>	<b>257</b>		<b>37.2</b>	<b>333</b>	<b>415</b>	<b>489</b>	<b>580</b>	<b>751</b>	<b>2,568</b>

Table 1. Characteristics of CA-MRSA multi locus sequence type clonal complexes (MLST CCs), regarding *spa* types and carriage of Panton Valentine leukocidin (*pvl*+).

## Conclusions

In the study period a large increase in CA-MRSA was observed. Classic CA-MRSA clones CC8:t008 *pvl*+ (USA300), CC30-IV increased significantly whereas CC80-IV decreased in numbers. New clones also appeared in the period (CC97, CC130 (*mecC*), and CC1-V:Bengal Bay CA-MRSA). Interestingly, we found a large proportion of atypical *pvl* negative CA-MRSA clones in the community (CC22, CC45). Since 2010 LA-MRSA CC398 MRSA has been the predominant CA-MRSA clone.

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