

## Annex F – Data reported on antimicrobial resistance in MRSA from food-producing animals and derived meat

### Annex to:

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**Table 1a:** Meticillin-resistant *Staphylococcus aureus* in food, 2018

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)
<b>Confectionery products and pastes</b>				
Slovakia	Processing plant Surveillance	Batch	20	0
		Single	41	0
	Catering outlet Surveillance	Single	2	0
<b>Dairy products (excluding cheeses)</b>				
Slovakia	Ice-cream – Processing plant Surveillance	Batch	3	0
		Single	71	0
	Ice-cream – Catering outlet Surveillance	Single	2	0
<b>Infant formula</b>				
Slovakia	Dried – Retail Surveillance	Batch	19	0
		Single	10	0
<b>Meat from bovine animals</b>				
Netherlands	Fresh – Retail Monitoring	Single	140	3 (2.1%)*
<b>Meat from broilers (<i>Gallus gallus</i>)</b>				
Austria	Fresh – Retail Monitoring (active)	Single	298	3 (1.0%)(a)
Germany	Fresh (skinned) – Retail Monitoring (active)	Single	444	73 (16.4%)*
Netherlands	Fresh (chilled) – Retail Monitoring	Single	129	26 (20.2%)*
Switzerland	Fresh – Retail Monitoring	Single	312	4 (1.3%)(b)
<b>Meat from pigs</b>				
Netherlands	Fresh – Retail Monitoring	Single	135	8 (5.9%)*
<b>Meat from turkeys</b>				
Austria	Fresh – Retail Monitoring (active)	Single	1	1 (100%)(c)
Germany	Fresh (skinned) – Retail Monitoring (active)	Single	525	224 (42.7%)*
Netherlands	Fresh (chilled) – Retail Monitoring	Single	3	3 (100%)*
<b>Other processed food products and prepared dishes</b>				
Slovakia	Fish/seafood-based dishes – Catering outlet Surveillance	Single	3	0
	Ices and similar frozen desserts – Processing plant Surveillance	Batch	7	0
		Single	54	0
	Ices and similar frozen desserts – Retail Surveillance	Batch	1	0
	Meat-based dishes – Catering Surveillance	Single	3	0
	Meat-based dishes – Hospital or medical care facility Surveillance	Single	6	0
	Meat-based dishes – Catering outlet Surveillance	Single	171	0
	Pasta dishes – Catering Surveillance	Single	1	0
Pasta dishes – Catering outlet Surveillance	Single	11	0	
Slovakia	Potato-based dishes – Catering Surveillance	Single	1	0
	Potato-based dishes – Hospital or medical care facility Surveillance	Single	5	0
	Potato-based dishes – Catering outlet	Batch	1	0

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)
	Surveillance	Single	86	0
	Rice-based dishes – Catering Surveillance	Single	2	0
	Rice-based dishes – Hospital or medical care facility Surveillance	Single	5	0
	Rice-based dishes – Catering outlet Surveillance	Single	82	0
	Sandwiches (non-meat) – Catering Surveillance	Single	1	0
	Sandwiches (non-meat) – Processing plant Surveillance	Single	4	0
	Sandwiches (with meat) – Catering Surveillance	Batch	1	0
		Single	20	0
	Sandwiches (with meat) – Processing plant Surveillance	Batch	3	0
		Single	26	0
	Sandwiches (with meat) – Retail Surveillance	Single	3	0
	Sushi – Catering outlet Surveillance	Single	3	0
	Unspecified ready-to-eat foods – Hospital or medical care facility Surveillance	Single	3	0
	Unspecified ready-to-eat foods – Catering outlet Surveillance	Single	25	0

#### Ready-to-eat foods

Slovakia	Salads (containing mayonnaise) – Catering Surveillance	Single	3	0
	Salads (containing mayonnaise) – Catering outlet Surveillance	Single	1	0
	Soup – Catering outlet Surveillance	Single	1	0
	Vegetables (pre-cut) – Catering Surveillance	Single	4	0
	Vegetables (pre-cut) – Hospital or medical care facility Surveillance	Single	1	0
	Vegetables (pre-cut) – Catering outlet Surveillance	Single	62	0

(a): *spa*-types : t011 (2 isolates), t034 (1).

(b): *spa*-types: t034 CC398 (1 isolate), t1430 (1), t571 CC398 (1), t13177 (1).

(c): *spa*-type : t011 (1 isolate).

\* *spa*-types not reported.

**Table 1b:** Meticillin-resistant *Staphylococcus aureus* in food, 2019

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)
<b>Meat from bovine animals</b>				
Austria	Fresh – Retail Monitoring	Batch	228	6 (2.6%) <sup>(a)</sup>
Netherlands	Fresh – Retail Monitoring	Single	286	11 (3.8%)*
Switzerland	Fresh (chilled) – Retail Monitoring	Single	309	2 (0.6%) <sup>(b)</sup>
<b>Meat from broilers (<i>Gallus gallus</i>)</b>				
Netherlands	Fresh (chilled) – Retail Monitoring	Single	237	41 (17.3%)*
<b>Meat from pigs</b>				
Austria	Fresh – Retail Monitoring	Batch	318	50 (15.7%) <sup>(c)</sup>
Netherlands	Fresh – Retail Monitoring	Single	296	25 (8.4%)*
Switzerland	Fresh (chilled) – Retail Monitoring	Single	311	1 (0.3%) <sup>(d)</sup>

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)

**Meat from turkey**

Netherlands	Fresh (chilled) – Retail Monitoring	Single	14	9 (64.3%)*
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**Milk from cows**

Germany	Raw milk for manufacture – Farm Monitoring (active)	Single	366	28 (7.7%)*
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(a): *spa*-types: t008 ST8 (1 isolate), t011 (2), t127 ST1 (2), t2346 (1). The t008 isolate was PVL-positive; the two t127 isolates were PVL-negative.

(b): *spa*-types were not reported; however, both isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).

(c): *spa*-types: t002 ST5 (1 isolate), t003 ST3944 (1), t008 ST8 (1), t011 (22), t011 ST398 (1), t034 (12), t127 ST1 (2), t321 ST5050 (1), t843 ST130 (1), t899 (5), t1451 (2), t1456 (1). The t002 and t008 isolates were PVL-positive. The two t127 isolates, as well as the single t003 and t321 isolates were PVL-negative. The t843 isolate was reported to carry the *mecC* gene. [Additional *ad hoc* sampling of pig meat by Austria revealed MRSA *spa*-types t011 (2 isolates), t034 (1) and t012 ST30 (1); the t012 isolate was PVL-negative. The isolates recovered from additional *ad hoc* sampling are not included in the prevalence data of Table 1b.]

(d): *spa*-type was not reported; however, the isolate was confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).

\* *spa*-types not reported.

**Table 2a:** Meticillin-resistant *Staphylococcus aureus* in food-producing animals (including horses), 2018

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)

**Cattle (bovine animals)**

Belgium	Veal calves (under 1 year), nasal swabs – OFM (active)	Herd/flock	145	79 (54.5%)(a)
	Dairy cows, nasal swabs – OFM (active)	Herd/flock	93	13 (14.0%)(b)
	Meat production animals, nasal swabs – OFM (active)	Herd/flock	103	9 (8.7%)(c)
Denmark	Dairy cows, nasal swabs – Farm Survey (National Survey)	Herd/flock	132	8 (6.1%)(d)

**Gallus gallus (fowl)**

Denmark	Laying hens, boot swabs – Farm Survey (National Survey)	Herd/flock	124	4 (3.2%)(e)
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**Mink**

Denmark	Farmed mink, paw – Farm Survey (National Survey)	Herd/flock	122	31 (25.4%)(f)
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**Pigs**

Denmark	Breeding animals, nasal swabs – Farm Survey (National Survey)	Herd/flock	41	34 (82.9%)(g)
	Fattening pigs (not raised under CHC), nasal swabs – Farm Survey (National Survey)	Herd/flock	104	21 (20.2%)(h)
	Fattening pigs (raised under CHC), nasal swabs – Farm Survey (National Survey)	Herd/flock	130	116 (89.2%)(i)
Norway	OFCEP, pooled skin swabs & pooled environmental swabs	Herd/flock	716	0

**Horses**

Denmark	Nasal swabs – Farm Survey (National Survey)	Herd/flock	123	10 (8.1%)(j)
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**Turkeys**

Denmark	Meat production turkeys, boot swabs – Farm Survey (National Survey)	Herd/flock	19	0
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Country	Production type/ monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)
Germany	Fattening turkeys (before slaughter), dust samples – OFM (active)	Herd/flock	297	51 (17.2%)*

OFM: On-farm monitoring; OFCEP: On-farm control and eradication programme; CHC: controlled housing conditions.

- (a): *spa*-types: t011 CC398 (65 isolates), t034 CC398 (8), t1451 CC398 (1), t1580 CC398 (2), t3423 CC398 (1), t3479 CC398 (1), t9433 CC398 (1).
- (b): *spa*-types: t011 CC398 (8 isolates), t034 CC398 (1), t223 (3), t1257 (1). The t223 isolates were PVL-negative; TSST status was not determined. The PVL status of the t1257 isolate was not reported.
- (c): *spa*-types: t011 CC398 (5 isolates), t1451 CC398 (1), t223 (2), t223 ST22 (1). All three t223 isolates were PVL-negative. One t223 isolate was confirmed to belong to ST22, harbour the *tst* gene and IEC genes (*chp*, *sak* and *scn*) from WGS data.
- (d): *spa*-types: t034 (7 isolates), t267 CC97 (1).
- (e): *spa*-types: t011 CC398 (2 isolates), t034 CC398 (2).
- (f): *spa*-types: t011 CC398 (6 isolates), t034 CC398 (19), t571 CC398 (1), t588 CC398 (1), t1456 CC398 (1), t1457 CC398 (2), t13790 CC1 (1).
- (g): *spa*-types: t011 CC398 (6 isolates), t034 CC398 (24), t1250 CC398 (2), t1793 CC398 (1), t3171 CC398 (1).
- (h): *spa*-types: t011 CC398 (4 isolates), t034 CC398 (15), t588 CC398 (1), t1456 CC398 (1).
- (i): *spa*-types: t011 CC398 (22 isolates), t034 CC398 (85), t571 CC398 (3), t898 CC398 (1), t2383 CC398 (1), t2974 CC398 (1), t3423 CC398 (1), t4652 CC398 (1), t9266 CC398 (1).
- (j): *spa*-types: t011 CC398 (3 isolates), t034 CC398 (6), t843 CC130 (1). *spa*-type t843 was confirmed to carry the *mecc* gene.

\* *spa*-types not reported.

**Table 2b:** Meticillin-resistant *Staphylococcus aureus* in food-producing animals (including horses), 2019

Country	Production type/ monitoring description (where specified)	Sample unit	Number	
			Units tested	Positive for MRSA (%)
<b>Cattle (bovine animals)</b>				
Denmark	Veal calves (under 1 year), nasal swabs – Farm Survey (National Survey)	Herd/flock	115	11 (9.6%)(a)
	Dairy cows, nasal swabs – Farm Survey (National Survey)	Herd/flock	131	2 (1.5%)(b)
Switzerland	Calves (under 1 year), nasal swabs – SHM	Animal	299	11 (3.7%)(c)
<b>Gallus gallus (fowl)</b>				
Denmark	Broilers, boot swabs – Farm Survey (National Survey)	Herd/flock	83	0
<b>Pigs</b>				
Belgium	Breeding animals (sows), nasal swabs – OFM (active)	Herd/flock	179	83 (46.4%)(d)
	Fattening pigs, nasal swabs – OFM (active)	Herd/flock	180	105 (58.3%)(e)
Denmark	Breeding animals (multiplier herds), nasal swabs – Farm Survey (National Survey)	Herd/flock	73	69 (94.5%)(f)
Germany	Fattening pigs, boot swabs – OFM (active)	Herd/flock	389	139 (35.7%)*
Netherlands	Fattening pigs, dust swabs – Farm Surveillance	Herd/flock	89	66 (74.2%)*
Norway	OFCEP, pooled skin swabs & pooled environmental swabs	Herd/flock	722	1 (0.1%)(g)
Portugal	Fattening pigs, nasal swabs – SHM	Batch	171	171 (100%)(h)
Switzerland	Fattening pigs, nasal swabs – SHM	Animal	303	160 (52.8%)(i)
<b>Horses</b>				
Denmark	Nasal swabs – Farm Survey (National Survey)	Herd/flock	120	13 (10.8%)(j)

OFM: On-farm monitoring; OFCEP: On-farm control and eradication programme; SHM: slaughterhouse monitoring.

- (a): *spa*-types: t011 CC398 (1 isolate), t034 CC398 (8), t779 CC398 (1), t1580 CC398 (1).
- (b): *spa*-types: t127 CC1 (1 isolate), t843 CC130 (1). The t127 isolate was PVL-negative, as well as negative for the human IEC gene *scn*. *spa*-type t843 was confirmed to carry the *mecc* gene.

- (c): *spa*-types were not reported; however, all 11 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).
- (d): *spa*-types: t011 CC398 (57 isolates), t034 CC398 (18), t108 CC398 (2), t779 CC398 (1), t2346 CC398 (1), t2582 CC398 (1), t2922 CC398 (1), t3119 CC398 (2).
- (e): *spa*-types: t011 CC398 (67 isolates), t034 CC398 (11), t1451 CC398 (2), t1457 CC398 (1), t2346 CC398 (1), t2370 CC398 (2), t2383 CC398 (1), t3041 CC398 (1), t3119 CC398 (1), unspecified (18).
- (f): *spa*-types: t011 CC398 (10 isolates), t034 CC398 (57), t1928 CC398 (1), t4652 CC398 (1).
- (g): *spa*-type: t034 CC398 (1 isolate).
- (h): *spa*-types: t011 CC398 (3 isolates), unspecified (168).
- (i): *spa*-types were not reported; however, 159/160 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011). The remaining isolate did not survive cryo-conservation, therefore molecular typing could not be performed.
- (j): *spa*-types: t011 CC398 (4 isolates), t034 CC398 (6), t1451 CC398 (1), t843 CC130 (1), t3256 CC130 (1). *spa*-types t843 and t3256 were confirmed to carry the *mecC* gene.
- \* *spa*-types not reported.

**Table 3:** Meticillin-resistant *Staphylococcus aureus* in food-producing animals, clinical investigations, 2018

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	(%) positive for MRSA
<b>Cattle (bovine animals)</b>				
Slovakia	Production type unspecified – OFCI	Animal	3	0
	Calves (under 1 year) – OFCI	Animal	2	0
	Dairy cows – OFCI	Animal	65	0
<b>Gallus gallus (fowl)</b>				
Slovakia	Broilers (day-old chicks) – OFCI	Animal	2	0
<b>Goats</b>				
Slovakia	Production type unspecified – OFCI	Animal	8	0
<b>Sheep</b>				
Slovakia	Production type unspecified – OFCI	Animal	1	0
	Milk ewes – OFCI	Animal	20	0

VCCI: At-veterinary-clinic clinical investigations; OFCI: On-farm clinical investigations.

**Table 4a:** Meticillin-resistant *Staphylococcus aureus* in companion animals, clinical investigations, 2018

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	(%) positive for MRSA
<b>Cats</b>				
Netherlands	VCCI	Animal	354	5 (1.4%)*
Slovakia	Pet animals – VCCI	Animal	5	0
<b>Dogs</b>				
Netherlands	VCCI	Animal	584	1 (0.2%)*
Slovakia	Pet animals – VCCI	Animal	67	0
<b>Guinea pigs</b>				
Slovakia	Pet animals – VCCI	Animal	1	0
<b>Rabbits</b>				
Slovakia	VCCI	Animal	2	0
<b>Horses</b>				
Netherlands	OFCI	Animal	253	24 (9.5%)*
Slovakia	OFCI	Animal	2	0

VCCI: At-veterinary-clinic clinical investigations; OFCI: On-farm clinical investigations.

\* *spa*-types not reported.

**Table 4b:** Meticillin-resistant *Staphylococcus aureus* in companion animals, clinical investigations, 2019

Country	Production type/monitoring description (where specified)	Sample unit	Number	
			Units tested	(%) positive for MRSA
<b>Cats</b>				
Netherlands	VCCI	Animal	428	2 (0.5%)*
<b>Dogs</b>				
Netherlands	VCCI	Animal	874	5 (0.6%)*
<b>Horses</b>				
Netherlands	OFCI	Animal	270	33 (12.2%)*

VCCI: At-veterinary-clinic clinical investigations; OFCI: On-farm clinical investigations.

\* *spa*-types not reported.

**Table 5:** Temporal trends in prevalence of meticillin-resistant *Staphylococcus aureus* in various types of meat (at retail monitoring), 3 reporting countries, 2018/2019

Country	Year	Production type/description	Sample unit	Method of isolation	Number	
					Units tested	Positive for MRSA (%)
<b>Meat from bovine animals</b>						
Netherlands	2018	Fresh – ARM	Single	1-S	140	3 (2.1%)*
	2019	Fresh – ARM	Single	1-S	286	11 (3.8%)*
Switzerland <sup>1</sup>	2017	Fresh (chilled) – ARM	Single	2-S	299	0
	2019	Fresh (chilled) – ARM	Single	<b>1-S</b>	309	2 (0.6%)(a)
<b>Meat from pigs</b>						
Netherlands	2018	Fresh – ARM	Single	1-S	135	8 (5.9%)*
	2019	Fresh – ARM	Single	1-S	296	25 (8.4%)*
Switzerland <sup>2</sup>	2017	Fresh (chilled) – ARM	Single	2-S	301	2 (0.7%)(b)
	2019	Fresh (chilled) – ARM	Single	<b>1-S</b>	311	1 (0.3%)(c)
<b>Meat from broilers (<i>Gallus gallus</i>)</b>						
Germany	2011	Fresh – ARM	Single	2-S	404	107 (26.5%)*
	2013	Fresh – ARM	Single	2-S	443	107 (24.2%)*
	2016	Fresh – ARM (active)	Single	2-S	422	55 (13.0%)*
	2018	Fresh (skinned) – ARM (active)	Single	2-S	444	73 (16.4%)*
Netherlands	2018	Fresh (chilled) – ARM	Single	1-S	129	26 (20.2%)*
	2019	Fresh (chilled) – ARM	Single	1-S	237	41 (17.3%)*
Switzerland <sup>3</sup>	2016	Fresh – ARM	Single	2-S	302	9 (3.0%)(d)
	2018	Fresh – ARM	Single	2-S	312	4 (1.3%)(e)
<b>Meat from turkeys</b>						
Germany	2012	Fresh – ARM	Single	2-S	749	282 (37.7%)*
	2014	Fresh – ARM (active)	Single	2-S	339	144 (42.5%)*
	2016	Fresh – ARM (active)	Single	2-S	458	204 (44.5%)*
	2018	Fresh (skinned) – ARM (active)	Single	2-S	525	224 (42.7%)*

Netherlands	2018	Fresh (chilled) – ARM	Single	1-S	3	3 (100%)*
	2019	Fresh (chilled) – ARM	Single	1-S	14	9 (64.3%)*

ARM: at retail monitoring. Method of isolation: 1-S (1 step method); 2-S (2 step method).

- 1: In 2015, Switzerland also tested bovine meat samples (ARM) using the 2-S method of isolation. While the number of units tested was similar throughout all years, the sampling strategy differed; in 2015, batches of bovine meat were tested as opposed to single meat samples in 2017 and 2019. No batches tested positive for MRSA in 2015 (0/298).
  - 2: In 2015, Switzerland also tested fresh pig meat samples (ARM) using the 2-S method of isolation. While the number of units tested was similar throughout all years, the sampling strategy differed; in 2015, batches of pig meat were tested as opposed to single pig meat samples in 2017 and 2019. MRSA prevalence was reported at a similar very low level in 2015 (2/301, 0.7%), with *spa*-type t034 identified (2 isolates).
  - 3: In 2014, Switzerland also tested fresh broiler meat samples (ARM) using the 2-S method of isolation. While the number of units tested was similar throughout all years, the sampling strategy differed; in 2014, batches of broiler meat were tested as opposed to single broiler meat samples in 2016 and 2018. MRSA prevalence was also reported at a low level in 2014 (22/319, 6.9%), with *spa*-types t011 (3 isolates), t032 (3), t034 (14), t571 (1) and t899 (1) identified.
- (a): In 2019, *spa*-types were not reported; however, both isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).
- (b): In 2017, *spa*-type: t011 (1 isolate), t002 (1). PVL status of the t002 isolate was not reported.
- (c): In 2019, *spa*-type was not reported; however, the isolate was confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).
- (d): In 2016, *spa*-types: t034 (3 isolates), t153 (1), t1430 (3), t2123 (2). PVL status of the t153 isolate was not reported.
- (e): In 2018, *spa*-types: t034 CC398 (1 isolate), t1430 (1), t571 CC398 (1), t13177 (1).
- \* *spa*-types not reported.

**Table 6:** Temporal trends in prevalence of meticillin-resistant *Staphylococcus aureus* in various food-producing animals (including horses), 5 reporting countries, 2018/2019

Country	Year	Production type/description	Sample unit	Method of isolation	Number	
					Units tested	Positive for MRSA (%)
<b>Cattle (bovine animals)</b>						
Belgium	2012	Veal calves (under 1 year), NS – OFM	Herd	2-S	104	49 (47.1%)(a)
	2015	Veal calves (under 1 year), NS – OFM (active)	Herd	2-S	147	116 (78.9%)(b)
	2018	Veal calves (under 1 year), NS – OFM (active)	Herd	2-S	145	79 (54.5%)(c)
	2012	Dairy cows, NS – OFM (active)	Herd	2-S	141	14 (9.9%)(d)
	2015	Dairy cows, NS – OFM (active)	Herd	2-S	96	10 (10.4%)(e)
	2018	Dairy cows, NS – OFM (active)	Herd	2-S	93	13 (14.0%)(f)
	2012	Meat production animals, NS – OFM	Herd	2-S	187	19 (10.2%)(g)
	2015	Meat production animals, NS – OFM (active)	Herd	2-S	104	16 (15.4%)(h)
	2018	Meat production animals, NS – OFM (active)	Herd	2-S	103	9 (8.7%)(i)
Denmark	2018	Dairy cows, NS – FS (National Survey)	Herd	1-S	132	8 (6.1%)(j)
	2019	Dairy cows, NS – FS (National Survey)	Herd	1-S	131	2 (1.5%)(k)
Switzerland	2015	Calves (<1 year), NS – SHM	Animal	2-S	292	19 (6.5%)(l)
	2017	Calves (<1 year), NS – SHM	Animal	2-S	297	24 (8.1%)(m)
	2019	Calves (<1 year), NS – SHM	Animal	<b>1-S</b>	299	11 (3.7%)(n)
<b>Pigs</b>						
Belgium	2016	Breeding animals, NS – OFM	Herd	2-S	153	91 (59.5%)(o)



	2019	Breeding animals, NS – OFM	Herd	2-S	179	83 (46.4%) <sup>(p)</sup>
	2016	Fattening pigs, NS – OFM	Herd	2-S	177	112 (63.3%) <sup>(q)</sup>
	2019	Fattening pigs, NS – OFM	Herd	2-S	180	105 (58.3%) <sup>(r)</sup>
Denmark	2016	Breeding animals, NS – OFM (National Survey)	Herd	2-S	6	6 (100%)*
	2018	Breeding animals, NS – OFM (National Survey)	Herd	<b>1-S</b>	41	34 (82.9%) <sup>(s)</sup>
	2016	Fattening pigs (conventional herds), NS – OFM (National Survey)	Herd	2-S	57	50 (87.7%)*
	2018	Fattening pigs (raised under CHC), NS – OFM (National Survey)	Herd	<b>1-S</b>	130	116 (89.2%) <sup>(t)</sup>
Germany	2017	Fattening pigs, BS – OFM (active)	Herd	2-S	341	130 (38.1%)*
	2019	Fattening pigs, BS – OFM (active)	Herd	2-S	389	139 (35.7%)*
Norway	2014	Pigs, PSS & PES – NFCEP	Herd	2-S	986	1 (0.1%) <sup>(u)</sup>
	2015	Pigs, PSS & PES – NFCEP	Herd	2-S	821	4 (0.5%) <sup>(v)</sup>
	2016	Pigs, PSS & PES – NFCEP	Herd	2-S	872	1 (0.1%) <sup>(w)</sup>
	2017	Pigs, PSS & PES – NFCEP	Herd	2-S	826	3 (0.4%) <sup>(x)</sup>
	2018	Pigs, PSS & PES – NFCEP	Herd	<b>1-S</b>	716	0
	2019	Pigs, PSS & PES – NFCEP	Herd	<b>1-S</b>	722	1 (0.1%) <sup>(y)</sup>
Switzerland	2010	Fattening pigs, NS – SHM	Animal	2-S	392	23 (5.9%) <sup>(z)</sup>
	2011	Fattening pigs, NS – SHM	Animal	2-S	392	22 (5.6%) <sup>(aa)</sup>
	2012	Fattening pigs, NS – SHM	Animal	2-S	397	72 (18.1%) <sup>(bb)</sup>
	2013	Fattening pigs, NS – SHM	Animal	2-S	351	73 (20.8%) <sup>(cc)</sup>
	2014	Fattening pigs, NS – SHM	Animal	2-S	298	79 (26.5%) <sup>(dd)</sup>
	2015	Fattening pigs, NS – SHM	Animal	2-S	300	77 (25.7%) <sup>(ee)</sup>
	2017	Fattening pigs, NS – SHM	Animal	2-S	298	131 (44.0%) <sup>(ff)</sup>
	2019	Fattening pigs, NS – SHM	Animal	<b>1-S</b>	303	160 (52.8%) <sup>(gg)</sup>
<b>Horses</b>						
Denmark	2018	Horses, NS – FS (National Survey)	Premises (stable)	1-S	123	10 (8.1%) <sup>(hh)</sup>
	2019	Horses, NS – FS (National Survey)	Premises (stable)	1-S	120	13 (10.8%) <sup>(ii)</sup>
<b>Turkeys</b>						
Germany	2012	Meat production animals, DS – OFM	Flock	2-S	235	30 (12.8%)*
	2014	Meat production animals, DS – OFM (active)	Flock	2-S	192	42 (21.9%)*
	2018	Fattening turkeys (before slaughter), DS – OFM (active)	Flock	2-S	297	51 (17.2%)*

OFM: on-farm monitoring; NFCEP: National Farm Control and Eradication Programme; FS: Farm survey; CHC: controlled housing conditions; SHM: slaughterhouse monitoring; BS: boot swabs; NS: nasal swabs, PSS: pooled skin swabs; PES: pooled environmental swabs; DS: dust samples. Method of isolation: 1-S (1 step method); 2-S (2 step method).

(a): In 2012, *spa*-types: t011 (40 isolates), t1451 (3), t1456 (1), t1985 (3), t3423 (1), untypable (1).

- (b): In 2015, *spa*-types: t011 (64 isolates), t034 (15), t037 (8), t044 (3), t1451 (3), t1580 (7), t1985 (8), t2287 (2), t3423 (5), untypable (1). The t044 isolates were PVL-negative.
- (c): In 2018, *spa*-types: t011 CC398 (65 isolates), t034 CC398 (8), t1451 CC398 (1), t1580 CC398 (2), t3423 CC398 (1), t3479 CC398 (1), t9433 CC398 (1).
- (d): In 2012, *spa*-types: t011 (8 isolates), t037 (1), t388 (1), t1456 (1), t6228 (2), untypable (1).
- (e): In 2015, t011 (4 isolates), t034 (1), t1580 (1), t1985 (2), t2383 (1), untypable (1).
- (f): In 2018, *spa*-types: t011 CC398 (8 isolates), t034 CC398 (1), t223 (3), t1257 (1). The t223 isolates were PVL-negative; TSST status was not determined. The PVL status of the t1257 isolate was not reported.
- (g): In 2012, *spa*-types: t011 (16 isolates), t121 (1), t1456 (1), t1985 (1).
- (h): In 2015, *spa*-types: t011 (9 isolates), t034 (2), t1451 (1), t1580 (2), t2287 (1), t3423 (1).
- (i): In 2018, *spa*-types: t011 CC398 (5 isolates), t1451 CC398 (1), t223 (2), t223 ST22 (1). All three t223 isolates were PVL-negative. One t223 isolate was confirmed to belong to ST22, harbour the *tst* gene and IEC genes (*chp*, *sak* and *scn*) from WGS data.
- (j): In 2018, *spa*-types: t034 (7 isolates), t267 CC97 (1).
- (k): In 2019, *spa*-types: t127 CC1 (1 isolate), t843 CC130 (1). The t127 isolate was PVL-negative, as well as negative for the human IEC gene *scn*. *spa*-type t843 was confirmed to carry the *mecC* gene.
- (l): In 2015, *spa*-types: t011 (11 isolates), t034 (6) and t008 (2). The t008 isolates were PVL-positive.
- (m): In 2017, *spa*-types: t011 (14 isolates), t034 (7), t127 (1), t17339 (2). PVL status of the t127 isolate was not reported.
- (n): In 2019, *spa*-types were not reported; however, all 11 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).
- (o): In 2016, *spa*-types: t011 CC398 (55 isolates), t1451 (2), t1456 (1), t1456 CC398 (3), t1580 (1), t1985 (5), t1985 CC398 (1), t034 (1), t034 CC398 (4), t4659 CC398 (1), unspecified (17).
- (p): In 2019, *spa*-types: t011 CC398 (57 isolates), t034 CC398 (18), t108 CC398 (2), t779 CC398 (1), t2346 CC398 (1), t2582 CC398 (1), t2922 CC398 (1), t3119 CC398 (2).
- (q): In 2016, *spa*-types: t011 CC398 (71 isolates), t1451 (1), t1456 (1), t1456 CC398 (1), t1580 (5), t1985 (8), t1985 CC398 (3), t034 (7), t034 CC398 (2), t037 (1), t898 (1), unspecified (11).
- (r): In 2019, *spa*-types: t011 CC398 (67 isolates), t034 CC398 (11), t1451 CC398 (2), t1457 CC398 (1), t2346 CC398 (1), t2370 CC398 (2), t2383 CC398 (1), t3041 CC398 (1), t3119 CC398 (1), unspecified (18).
- (s): In 2018, *spa*-types: t011 CC398 (6 isolates), t034 CC398 (24), t1250 CC398 (2), t1793 CC398 (1), t3171 CC398 (1).
- (t): In 2018, *spa*-types: t011 CC398 (22 isolates), t034 CC398 (85), t571 CC398 (3), t898 CC398 (1), t2383 CC398 (1), t2974 CC398 (1), t3423 CC398 (1), t4652 CC398 (1), t9266 CC398 (1).
- (u): In 2014, *spa*-type: t011 CC398 (1).
- (v): In 2015, *spa*-type: t034 CC398 (2), t177 CC1 (2).
- (w): In 2016, *spa*-type: t034 CC398 (1).
- (x): In 2017, *spa*-types: t091 CC7 (1 isolate), t843 CC130 (1), t6292 CC425 (1). The t091 isolate was PVL-negative, *spa*-types t843 and t6292 were confirmed to carry the *mecC* gene.
- (y): In 2019, *spa*-type: t034 CC398 (1).
- (z): In 2010, *spa*-types: t034 ST398 (17 isolates), t011 ST398 (1), t208 ST49 (5).
- (aa): In 2011, *spa*-types: t034 ST398 (19 isolates), t011 ST398 (1), t208 ST49 (1), t2279 ST1 (1).
- (bb): In 2012, *spa*-types: t034 CC398 (61 isolates), t011 CC398 (9), t208 ST49 (2).
- (cc): In 2013, *spa*-types: t034 (63 isolates), t011 (10).
- (dd): In 2014, *spa*-types: t034 (57 isolates), t011 (19), t208 (1), t899 (1), t2741 (1).
- (ee): In 2015, *spa*-types: t034 (48 isolates), t011 (23), t032 (1), t571 (1), t899 (1), t1145 (1), t1250 (1), t4475 (1).
- (ff): In 2017, *spa*-types: t034 (63 isolates), t011 (61), t899 (2), t1451 (3), t2330 (1), t2876 (1).
- (gg): In 2019, *spa*-types were not reported; however, 159/160 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011). The remaining isolate did not survive cryo-conservation, therefore typing could not be performed.
- (hh): In 2018, *spa*-types: t011 CC398 (3 isolates), t034 CC398 (6), t843 CC130 (1). *spa*-type t843 was confirmed to carry the *mecC* gene.
- (ii): In 2019, *spa*-types: t011 CC398 (4 isolates), t034 CC398 (6), t1451 CC398 (1), t843 CC130 (1), t3256 CC130 (1). *spa*-types t843 and t3256 were confirmed to carry the *mecC* gene.
- \* *spa*-types not reported.

**Table 7a:** Occurrence of resistance (%) to selected antimicrobials in MRSA from food and animals, 2018

Country	N	GEN	KAN	STR	CHL	RIF	CIP	ERY	CLI	Q/D	TIA	MUP	FUS	SMX	TMP	TET
<b>Meat from turkeys – fresh</b>																
Austria	1 <sup>(a)</sup>	0	0	0	0	0	0	100	100	0	0	0	0	0	100	100
<b>Meat from broilers (<i>Gallus gallus</i>) – fresh</b>																
Austria	3 <sup>(b)</sup>	0	0	33.3	33.3	0	66.7	0	33.3	33.3	33.3	0	0	0	66.7	100
Switzerland	4 <sup>(c)</sup>	0	0	25	0	0	75	75	75	50	50	0	0	25	50	75
<b>Cattle (bovine animals) herds – calves (under 1 year)</b>																
Belgium	79 <sup>(d)</sup>	64.6	69.6	11.4	3.8	0	32.9	84.8	88.6	21.5	11.4	0	0	5.1	97.5	100
<b>Cattle (bovine animals) herds – dairy cows</b>																
Belgium	13 <sup>(e)</sup>	46.2	46.2	15.4	7.7	7.7	46.2	38.5	30.8	23.1	30.8	0	15.4	15.4	69.2	69.2
<b>Cattle (bovine animals) herds – meat production animals</b>																
Belgium	9 <sup>(f)</sup>	22.2	22.2	0	0	0	33.3	33.3	33.3	11.1	11.1	0	0	0	55.6	66.7

N: Number of isolates tested; GEN: gentamicin; KAN: kanamycin; STR: streptomycin; CHL: chloramphenicol; RIF: rifampicin; CIP: ciprofloxacin; ERY: erythromycin; CLI: clindamycin; Q/D: quinupristin/dalfopristin; TIA: tiamulin; MUP: mupirocin; FUS: fusidic acid; SMX: sulfamethoxazole; TMP: trimethoprim; TET: tetracycline.

All MRSA isolates were resistant to penicillin and ceftiofur, as expected. All isolates were susceptible to vancomycin and linezolid.

(a): *spa*-types: t011 (1 isolate).

(b): *spa*-types: t011 (2 isolates), t034 (1).

(c): *spa*-types: t034 CC398 (1 isolate), t1430 (1), t571 CC398 (1), t13177 (1).

(d): *spa*-types: t011 CC398 (65 isolates), t034 CC398 (8), t1451 CC398 (1), t1580 CC398 (2), t3423 CC398 (1), t3479 CC398 (1), t9433 CC398 (1).

(e): *spa*-types: t011 CC398 (8 isolates), t034 CC398 (1), t223 (3), t1257 (1). The t223 isolates were PVL-negative; TSST status was not determined. The PVL status of the t1257 isolate was not reported.

(f): *spa*-types: t011 CC398 (5 isolates), t1451 CC398 (1), t223 (2), t223 ST22 (1). All three t223 isolates were PVL-negative. One t223 isolate was subjected to WGS and confirmed to belong to ST22 and harbour the *tst* gene, as well as IEC genes, *chp*, *sak* and *scn*.

**Table 7b:** Occurrence of resistance (%) to selected antimicrobials in MRSA from food and animals, 2019

Country	N	GEN	KAN	STR	CHL	RIF	CIP	ERY	CLI	Q/D	LZD	TIA	MUP	FUS	SMX	TMP	TET
<b>Meat from pigs – fresh</b>																	
Austria <sup>1</sup>	54 <sup>(a)</sup>	5.6	9.3	13	7.4	1.9	38.9	50	46.3	22.2	0	27.8	0	0	0	35.2	83.3
Switzerland	1 <sup>(b)</sup>	0	0	0	0	0	100	0	0	0	0	0	0	0	0	100	0
<b>Meat from cattle (bovine animals) – fresh</b>																	
Austria	6 <sup>(c)</sup>	33.3	83.3	33.3	0	0	0	83.3	33.3	0	0	0	0	0	0	33.3	83.3
Switzerland	2 <sup>(d)</sup>	0	0	50	0	0	0	50	50	50	0	50	0	0	0	50	100
<b>Fattening pig herds/slaughterhouse batches/fattening pigs</b>																	
Belgium	87 <sup>(e)</sup>	26.4	17.2	3.4	6.9	0	36.8	44.8	58.6	24.1	0	25.3	0	2.3	5.7	93.1	100
Portugal <sup>2</sup>	119 <sup>(f)</sup>	4.2	13.4	7.6	24.4	0.8	27.7	64.7	87.4	66.4	2.5	79.8	1.7	1.7	1.7	48.7	100
Switzerland <sup>3</sup>	159 <sup>(g)</sup>	17	17	28.3	12.6	0.6	31.4	15.7	28.3	27	0	28.3	0	1.9	0.6	31.4	95
<b>Breeding pig herds</b>																	
Belgium	83 <sup>(h)</sup>	16.9	18.1	7.2	0	0	37.3	37.3	55.4	27.7	0	27.7	1.2	1.2	2.4	89.2	100
<b>Cattle (bovine animals) – calves (under 1 year)</b>																	
Switzerland	11 <sup>(i)</sup>	0	0	36.4	9.1	0	45.5	54.6	54.6	36.4	0	27.3	0	0	0	27.3	100

N: Number of isolates tested; GEN: gentamicin; KAN: kanamycin; STR: streptomycin; CHL: chloramphenicol; RIF: rifampicin; CIP: ciprofloxacin; ERY: erythromycin; CLI: clindamycin; Q/D: quinupristin/dalfopristin; LZD: linezolid; TIA: tiamulin; MUP: mupirocin; FUS: fusidic acid; SMX: sulfamethoxazole; TMP: trimethoprim; TET: tetracycline.

All MRSA isolates were resistant to penicillin and ceftioxin, as expected. All isolates were susceptible to vancomycin.

1: Antimicrobial susceptibility data are also included for four isolates recovered from additional *ad hoc* sampling of some of the batches of pig meat.

2: Susceptibility data for 52 isolates recovered from batches of fattening pigs were not reported.

3: Susceptibility data for one isolate recovered from a fattening pig was not available; the isolate did not survive cryo-conservation.

(a): *spa*-types: t002 ST5 (1 isolate), t003 ST3944 (1), t008 ST8 (1), t011 (22), t011 ST398 (1), t034 (12), t127 ST1 (2), t321 ST5050 (1), t843 ST130 (1), t899 (5), t1451 (2), t1456 (1). The t002 and t008 isolates were PVL-positive. The two t127 isolates, as well as the single t003 and t321 isolates, were PVL-negative. The t843 isolate was reported to carry the *meccC* gene. Additional *ad hoc* sampling of pig meat by Austria revealed MRSA *spa*-types t011 (2 isolates), t034 (1) and t012 ST30 (1); the t012 isolate was PVL-negative. Susceptibility data for the isolates recovered from additional *ad hoc* sampling are included in Table 7b.

(b): *spa*-type was not reported; however, the isolate was confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).

(c): *spa*-types: t008 ST8 (1 isolate), t011 (2), t127 ST1 (2), t2346 (1). The t008 isolate was PVL-positive; the two t127 isolates were PVL-negative.

(d): *spa*-types were not reported; however, both isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).

(e): *spa*-types: t011 CC398 (67 isolates), t034 CC398 (11), t1451 CC398 (2), t1457 CC398 (1), t2346 CC398 (1), t2370 CC398 (2), t2383 CC398 (1), t3041 CC398 (1), t3119 CC398 (1), unspecified (18).

(f): *spa*-types: t011 CC398 (3), unspecified (116). Susceptibility data for 52 isolates recovered from batches of fattening pigs were not reported and are not included in Table 7b.

(g): *spa*-types were not reported; however, all 159 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011). Susceptibility data for one isolate recovered from a fattening pig is not included in Table 7b.

(h): *spa*-types: t011 CC398 (57 isolates), t034 CC398 (18), t108 CC398 (2), t779 CC398 (1), t2346 CC398 (1), t2582 CC398 (1), t2922 CC398 (1), t3119 CC398 (2).

(i): *spa*-types were not reported; however, all 11 isolates were confirmed to belong to CC398 using the *sau1-hsdS1* CC398 PCR reaction (Stegger et al., 2011).

**Table 8a:** MRSA *spa*-type characterisation, 2018

Category	Country	Animal/ food type	Sample type/unit	No. of isolates	Where reported				Inferred ST/CC	LA, CA or HA	Inferred ST/CC & type
					<i>Spa</i> -type(s)	PVL status/ IEC genes	ST/CC	<i>mec</i> gene			
Food- producing animals	BE	Veal calves (<1yr)	Herd, nasal swabs, OFM	79/145	t011 (65)	-	CC398	-	-	LA	CC398 / LA
					t034 (8)	-	CC398	-	-	LA	CC398 / LA
					t1451 (1)	-	CC398	-	-	LA	CC398 / LA
					t1580 (2)	-	CC398	-	-	LA	CC398 / LA
					t3423 (1)	-	CC398	-	-	LA	CC398 / LA
					t3479 (1)	-	CC398	-	-	LA	CC398 / LA
		t9433 (1)	-	CC398	-	-	LA	CC398 / LA			
		Dairy cows	Herd, nasal swabs, OFM	13/93	t011 (8)	-	CC398	-	-	LA	CC398 / LA
					t034 (1)	-	CC398	-	-	LA	CC398 / LA
					t223 (3)	PVL negative	-	-	ST22 (CC22) (3)	HA	ST22 (CC22) / HA
					t1257 (1)	Not reported	-	-	ST612 (CC8) (1)	HA or CA	ST612/Not categorised
		Meat production cattle	Herd, nasal swabs, OFM	9/103	t011 (5)	-	CC398	-	-	LA	CC398 / LA
	t1451 (1)				-	CC398	-	-	LA	CC398 / LA	
				t223 (3)	PVL negative (3), <i>chp, sak &amp; scn</i> (1)	ST22 (1)	-	ST22 (CC22) (2)	HA	ST22 (CC22) / HA	
	DK	Dairy cows	Herd, nasal swabs, FS (NS)	8/132	t034 (7)	-	CC398	-	-	LA	CC398 / LA
					t267 (1)	-	CC97	-	-	LA or CA	CC97 / LA
		Laying hens	Flock, boot swabs, FS (NS)	4/124	t011 (2)	-	CC398	-	-	LA	CC398 / LA
					t034 (2)	-	CC398	-	-	LA	CC398 / LA
		Mink	Herd, paw, FS (NS)	31/122	t011 (6)	-	CC398	-	-	LA	CC398 / LA
					t034 (19)	-	CC398	-	-	LA	CC398 / LA
					t571 (1)	-	CC398	-	-	LA	CC398 / LA
					t588 (1)	-	CC398	-	-	LA	CC398 / LA
					t1456 (1)	-	CC398	-	-	LA	CC398 / LA
					t1457 (2)	-	CC398	-	-	LA	CC398 / LA
		t13790 (1)	negative for <i>scn</i>	CC1	-	-	CA or LA	CC1 / LA			
		Breeding pigs	Herd, nasal swabs, FS (NS)	34/41	t011 (6)	-	CC398	-	-	LA	CC398 / LA
t034 (24)					-	CC398	-	-	LA	CC398 / LA	
t1250 (2)					-	CC398	-	-	LA	CC398 / LA	
t1793 (1)	-				CC398	-	-	LA	CC398 / LA		
Fattening pigs	Not raised under CHC, herd, nasal swabs, FS (NS)	21/104	t3171 (1)	-	CC398	-	-	LA	CC398 / LA		
			t011 (4)	-	CC398	-	-	LA	CC398 / LA		
			t034 (15)	-	CC398	-	-	LA	CC398 / LA		
			t588 (1)	-	CC398	-	-	LA	CC398 / LA		
			t1456 (1)	-	CC398	-	-	LA	CC398 / LA		

Category	Country	Animal/food type	Sample type/unit	No. of isolates	Where reported				Inferred ST/CC	LA, CA or HA	Inferred ST/CC & type
					<i>Spa</i> -type(s)	PVL status/ IEC genes	ST/CC	<i>mec</i> gene			
Food-producing animals	DK	Fattening pigs	Raised under CHC, herd, nasal swabs, FS (NS)	116/130	t011 (22)	-	CC398	-	-	LA	CC398 / LA
					t034 (85)	-	CC398	-	-	LA	CC398 / LA
					t571 (3)	-	CC398	-	-	LA	CC398 / LA
					t898 (1)	-	CC398	-	-	LA	CC398 / LA
					t2383 (1)	-	CC398	-	-	LA	CC398 / LA
					t2974 (1)	-	CC398	-	-	LA	CC398 / LA
					t3423 (1)	-	CC398	-	-	LA	CC398 / LA
					t4652 (1)	-	CC398	-	-	LA	CC398 / LA
					t9266 (1)	-	CC398	-	-	LA	CC398 / LA
	Horses	Herd, nasal swabs, FS (NS)	10/123	t011 (3)	-	CC398	-	-	LA	CC398 / LA	
				t034 (6)	-	CC398	-	-	LA	CC398 / LA	
t843 (1)				-	CC130	<i>mecC</i>	-	<i>mecC</i>	<i>mecC</i> – CC130		
DE	Fattening turkeys (before slaughter)	Flock, dust sample, OFM	51/297	-	-	-	-	-	-	-	
Food	AT	Broiler meat	Fresh – ARM	3/298	t011 (2)	-	-	-	CC398	LA	CC398 / LA
					t034 (1)	-	-	-	CC398	LA	CC398 / LA
		Turkey meat	Fresh – ARM	1/1	t011 (1)	-	-	-	CC398	LA	CC398 / LA
	DE	Broiler meat	Fresh (skinned) - ARM	73/444	-	-	-	-	-	-	-
		Turkey meat	Fresh (skinned) - ARM	224/525	-	-	-	-	-	-	-
	NL	Cattle meat	Fresh - ARM	3/140	-	-	-	-	-	-	-
		Broiler meat	Fresh (chilled) - ARM	26/129	-	-	-	-	-	-	-
		Pig meat	Fresh - ARM	8/135	-	-	-	-	-	-	-
		Turkey meat	Fresh (chilled) - ARM	3/3	-	-	-	-	-	-	-
	CH	Broiler meat	Fresh - ARM	4/312	t034 (1)	-	CC398	-	-	LA	CC398 / LA
					t1430 (1)	-	-	-	CC9	LA	CC9 / LA
t571 (1)					-	CC398	-	-	LA	CC398 / LA	
t13177 (1)					-	-	-	CC9	LA	CC9 / LA	
Clinical examinations	NL	Cats	Animal sample - VCCI	5/354	-	-	-	-	-	-	-
		Dogs	Animal sample - VCCI	1/584	-	-	-	-	-	-	-
		Horses	Animal sample - OFCI	24/253	-	-	-	-	-	-	-

BE: Belgium; DK: Denmark; DE: Germany; AT: Austria; NL: Netherlands; CH: Switzerland; ARM: At retail monitoring; CHC: controlled housing conditions; FS: Farm Survey; NS: National Survey; OFCI: On-farm clinical investigations; OFM: On-farm monitoring; VCCI: Veterinary clinic clinical investigations.

-: Not reported; PVL: Panton-Valentine leukocidin; IEC genes; immune evasion cluster genes (*chp*: chemotaxis inhibitor protein; *sak*: staphylokinase; *scr*: encoding the staphylococcal complement protein inhibitor); ST: sequence type; CC: clonal complex; *mecA*: meticillin resistance gene; *mecC*: variant of the *mecA* gene, sharing 70% identity with *mecA* at the DNA level; CA: community-associated; HA: healthcare-associated; LA: livestock-associated.

**Table 8b:** MRSA *spa*-type characterisation, 2019

Category	Country	Animal/food type	Sample type/unit	No. of isolates	Where reported				Inferred ST/CC	LA, CA or HA	Inferred ST/CC & type
					<i>spa</i> -type(s)	PVL status / IEC genes	ST/CC	<i>mec</i> gene			
Food-producing animals	BE	Breeding pigs (sows)	Herd, nasal swabs, OFM	83/179	t011 (57)	-	CC398	-	-	LA	CC398 / LA
					t034 (18)	-	CC398	-	-	LA	CC398 / LA
					t108 (2)	-	CC398	-	-	LA	CC398 / LA
					t779 (1)	-	CC398	-	-	LA	CC398 / LA
					t2346 (1)	-	CC398	-	-	LA	CC398 / LA
					t2582 (1)	-	CC398	-	-	LA	CC398 / LA
					t2922 (1)	-	CC398	-	-	LA	CC398 / LA
					t3119 (2)	-	CC398	-	-	LA	CC398 / LA
		Fattening pigs	Herd, nasal swabs, OFM	105/180	t011 (67)	-	CC398	-	-	LA	CC398 / LA
					t034 (11)	-	CC398	-	-	LA	CC398 / LA
					t1451 (2)	-	CC398	-	-	LA	CC398 / LA
					t1457 (1)	-	CC398	-	-	LA	CC398 / LA
					t2346 (1)	-	CC398	-	-	LA	CC398 / LA
					t2370 (2)	-	CC398	-	-	LA	CC398 / LA
	t2383 (1)	-	CC398	-	-	LA	CC398 / LA				
	t3041 (1)	-	CC398	-	-	LA	CC398 / LA				
	t3119 (1)	--	CC398	-	-	LA	CC398 / LA				
	Unspecified (18)	-	-	-	-	-	-	-			
	DK	Veal calves (<1yr)	Herd, nasal swabs, FS (NS)	11/115	t011 (1)	-	CC398	-	-	LA	CC398 / LA
					t034 (8)	-	CC398	-	-	LA	CC398 / LA
					t779 (1)	-	CC398	-	-	LA	CC398 / LA
					t1580 (1)	-	CC398	-	-	LA	CC398 / LA
		Dairy cows	Herd, nasal swabs, FS (NS)	2/131	t127 (1)	PVL negative, negative for <i>scn</i>	CC1	-	-	CA or LA	CC1 / LA
					t843 (1)	-	CC130	<i>mecC</i>	-	<i>mecC</i>	<i>mecC</i> – CC130
		Breeding pigs	Multiplying herds, nasal swabs, FS (NS)	69/73	t011 (10)	-	CC398	-	-	LA	CC398 / LA
					t034 (57)	-	CC398	-	-	LA	CC398 / LA
					t1928 (1)	-	CC398	-	-	LA	CC398 / LA
					t4652 (1)	-	CC398	-	-	LA	CC398 / LA
Horses		Herd, nasal swabs, FS (NS)	13/120	t011 (4)	-	CC398	-	-	LA	CC398 / LA	
				t034 (6)	-	CC398	-	-	LA	CC398 / LA	
				t1451 (1)	-	CC398	-	-	LA	CC398 / LA	
				t843 (1)	-	CC130	<i>mecC</i>	-	<i>mecC</i>	<i>mecC</i> – CC130	
t3256 (1)	-	CC130	<i>mecC</i>	-	<i>mecC</i>	<i>mecC</i> – CC130					

Category	Country	Animal/food type	Sample type/unit	No. of isolates	Where reported				Inferred ST/CC	LA, CA or HA	Inferred ST/CC & type
					<i>spa</i> -type(s)	PVL status / IEC genes	ST/CC	<i>mec</i> gene			
Food-producing animals	DE	Fattening pigs	Herd, boot swabs, OFM	139/389	-	-	-	-	-	-	-
	NL	Fattening pigs	Herd, dust swabs, OFS	66/89	-	-	-	-	-	-	-
	NO	Pigs	Herd, animal hide - OFCEP	1/722	t034 (1)	-	CC398	-	-	LA	CC398 / LA
	PT	Fattening pigs	Slaughter batch, nasal swabs, SHM	171/171	t011 (3)	-	CC398	-	-	LA	CC398 / LA
					Unspecified (168)	-	-	-	-	-	-
	CH	Calves (<1yr)	Animal, nasal swabs, SHM	11/299	-	-	CC398	-	-	LA	CC398 / LA
Fattening pigs		Animal, nasal swabs, SHM	160/303	-	-	CC398 (159)	-	-	LA	CC398 / LA (159)	
					Untypable (1) <sup>(a)</sup>	-	Unknown (1) <sup>(a)</sup>	-	-	-	-
Food		Cattle meat	Fresh – ARM	6/228	t008 (1)	PVL <b>positive</b> , <i>sak</i> & <i>scn</i> detected	ST8	<i>mecA</i>	-	CA or HA	ST8 (CC8) / CA
					t011 (2)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
					t127 (2)	PVL negative, <i>sak</i> & <i>scn</i> detected	ST1	<i>mecA</i>	-	CA or LA	ST1 (CC1) / LA
					t2346 (1)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
	AT	Pig meat	Fresh – ARM	50/318	t002 (1)	PVL <b>positive</b> , <i>sak</i> & <i>scn</i> detected	ST5	<i>mecA</i>	-	HA, CA or LA	ST5 (CC5) / CA
					t003 (1)	PVL negative, <i>sak</i> & <i>scn</i> detected	ST3944	<i>mecA</i>	-	HA or CA	ST3944 (CC5) / HA
					t008 (1)	PVL <b>positive</b> , <i>sak</i> & <i>scn</i> detected	ST8	<i>mecA</i>	-	HA or CA	ST8 (CC8) / CA
					t011 (23)	PVL negative (1)	ST398 (1)	<i>mecA</i>	CC398 (22)	LA	CC398 / LA
					t034 (12)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
					t127 (2)	PVL negative, <i>sak</i> & <i>scn</i> detected	ST1	<i>mecA</i>	-	CA or LA	ST1 (CC1) / LA
					t321 (1)	PVL negative	ST5050	<i>mecA</i>	-	CA	ST5050 (CC1) / CA (regardless of PVL)
					t899 (5) <sup>(b)</sup>	-	-	<i>mecA</i>	CC9/CC398	LA	CC9/CC398 / LA
					t1451 (2)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
					t1456 (1)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
t843 (1)	-	ST130	<i>mecC</i>	-	<i>mecC</i>	<i>mecC</i> – CC130					



Category	Country	Animal/food type	Sample type/unit	No. of isolates	Where reported				Inferred ST/CC	LA, CA or HA	Inferred ST/CC & type
					<i>spa</i> -type(s)	PVL status / IEC genes	ST/CC	<i>mec</i> gene			
Food	AT	Pig meat - Additional <i>ad hoc</i> sampling	Fresh – ARM	4	t011 (2)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
					t012 (1)	PVL negative, <i>sak</i> & <i>scn</i> detected	ST30	<i>mecA</i>	-	HA or CA	ST30 (CC30) / CA (regardless of PVL)
					t034 (1)	-	-	<i>mecA</i>	CC398	LA	CC398 / LA
	DE	Milk from cows	Raw milk – OFM	28/366	-	-	-	-	-	-	-
	NL	Cattle meat	Fresh - ARM	11/286	-	-	-	-	-	-	-
		Broiler meat	Fresh (chilled) - ARM	41/237	-	-	-	-	-	-	-
		Pig meat	Fresh - ARM	25/296	-	-	-	-	-	-	-
		Turkey meat	Fresh (chilled) - ARM	9/14	-	-	-	-	-	-	-
	CH	Cattle meat	Fresh (chilled) - ARM	2/309	-	-	CC398	-	-	LA	CC398 / LA
Pig meat		Fresh (chilled) - ARM	1/311	-	-	CC398	-	-	LA	CC398 / LA	
Clinical examinations	NL	Cats	Animal sample - VCCI	2/428	-	-	-	-	-	-	-
		Dogs	Animal sample - VCCI	5/874	-	-	-	-	-	-	-
		Horses	Animal sample - OFCI	33/270	-	-	-	-	-	-	-

BE: Belgium; DK: Denmark; DE: Germany; NL: Netherlands; NO: Norway; PT: Portugal; CH: Switzerland; AT: Austria; ARM: At retail monitoring; FS: Farm Survey; NS: National Survey; OFCI: On-farm clinical investigations; OFCEP: On-farm control and eradication programme; OFM: On-farm monitoring; OFS: On-farm surveillance; SHM: Slaughterhouse monitoring; VCCI: Veterinary clinic clinical investigations.

-: Not reported; PVL: Pantone-Valentine leukocidin; IEC genes; immune evasion cluster genes (*chp*: chemotaxis inhibitor protein; *sak*: staphylokinase; *scn*: encoding the staphylococcal complement protein inhibitor); ST: sequence type; CC: clonal complex; *mecA*: methicillin resistance gene; *mecC*: variant of the *mecA* gene, sharing 70% identity with *mecA* at the DNA level; CA: community-associated; HA: healthcare-associated; LA: livestock-associated.

(a): One isolate did not survive cryo-conservation, therefore molecular typing could not be performed.

(b): These are *spa*-types which can be associated with sequence types which have mosaic or hybrid genomes.