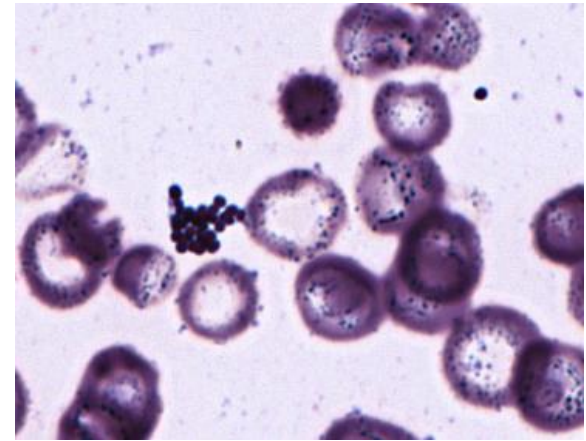


# Outbreak Investigation of Community Associated Methicillin- Resistant *Staphylococcus aureus*

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# Introduction

- *Staphylococcus aureus* gram-positive, nonmotile, coagulase-positive coccoid bacterium
- *S. aureus* is present in the human commensal microbiota of the nasal mucosa in 20–40% of the general population
- *S. aureus* can cause infections via access to the underlying tissues or the bloodstream. Persons with invasive medical devices or compromised immune systems are particularly vulnerable to *S. aureus* infection
- Methicillin-resistant Staphylococcus aureus (MRSA) was first described in 1961



Picture by WASPLab®

## Methicillin-resistant *Staphylococcus aureus*

Andie S. Lee<sup>1,2\*</sup>, Herminia de Lencastre<sup>3,4</sup>, Javier Garau<sup>5</sup>, Jan Kluytmans<sup>6,7</sup>, Surbhi Malhotra-Kumar<sup>8</sup>, Andreas Pesche<sup>9,10</sup> and Stephan Harbarth<sup>11\*</sup>

[Nature Reviews Disease Primers](#) 4, Article number: 18033 (2018)

## Methicillin-resistant *Staphylococcus aureus* emerged long before the introduction of methicillin into clinical practice

Catriona P. Harkins<sup>1,2</sup>, Bruno Pichon<sup>3</sup>, Michel Doumith<sup>3</sup>, Julian Parkhill<sup>4</sup>, Henrik Westh<sup>5,6</sup>, Alexander Tomasz<sup>7</sup>, Herminia de Lencastre<sup>7,8</sup>, Stephen D. Bentley<sup>9</sup>, Angela M. Kearns<sup>3</sup> and Matthew T. G. Holden<sup>1,4\*</sup>

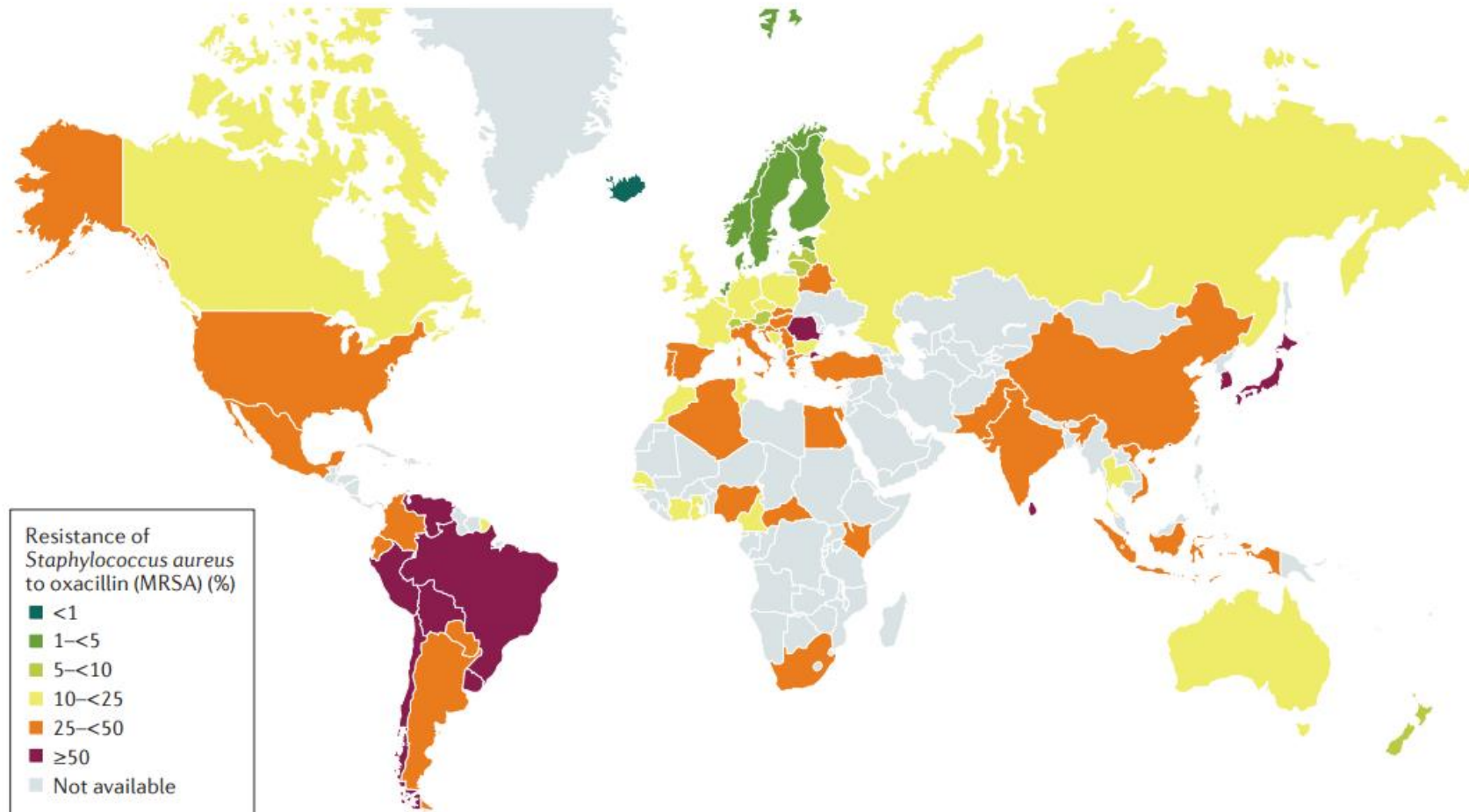
Harkins et al. [Genome Biology](#) (2017) 18:130  
DOI 10.1186/s13059-017-1252-9

# Introduction

## Methicillin-resistant *Staphylococcus aureus*

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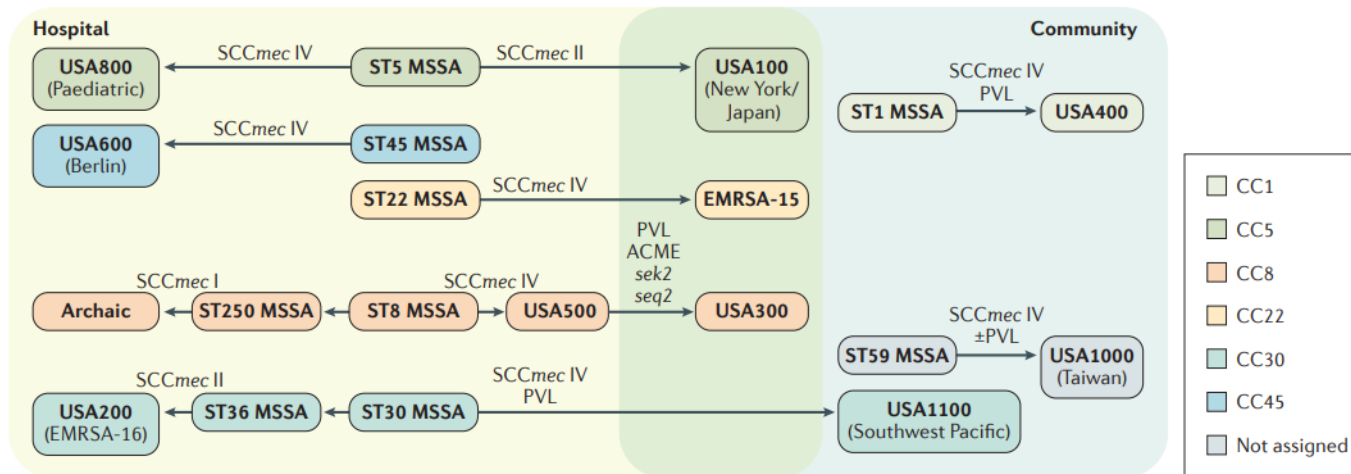
# Introduction

- HA-MRSA was responsible for hospital outbreaks in many parts of the world.
- CA-MRSA and LA-MRSA can also cause infections in individuals without previous health-care contact

## Methicillin-resistant *Staphylococcus aureus*

Andie S. Lee<sup>1,2\*</sup>, Herminia de Lencastre<sup>3,4</sup>, Javier Garau<sup>5</sup>, Jan Kluytmans<sup>6,7</sup>,  
Surbhi Malhotra-Kumar<sup>8</sup>, Andreas Pesche<sup>9,10</sup> and Stephan Harbarth<sup>11\*</sup>

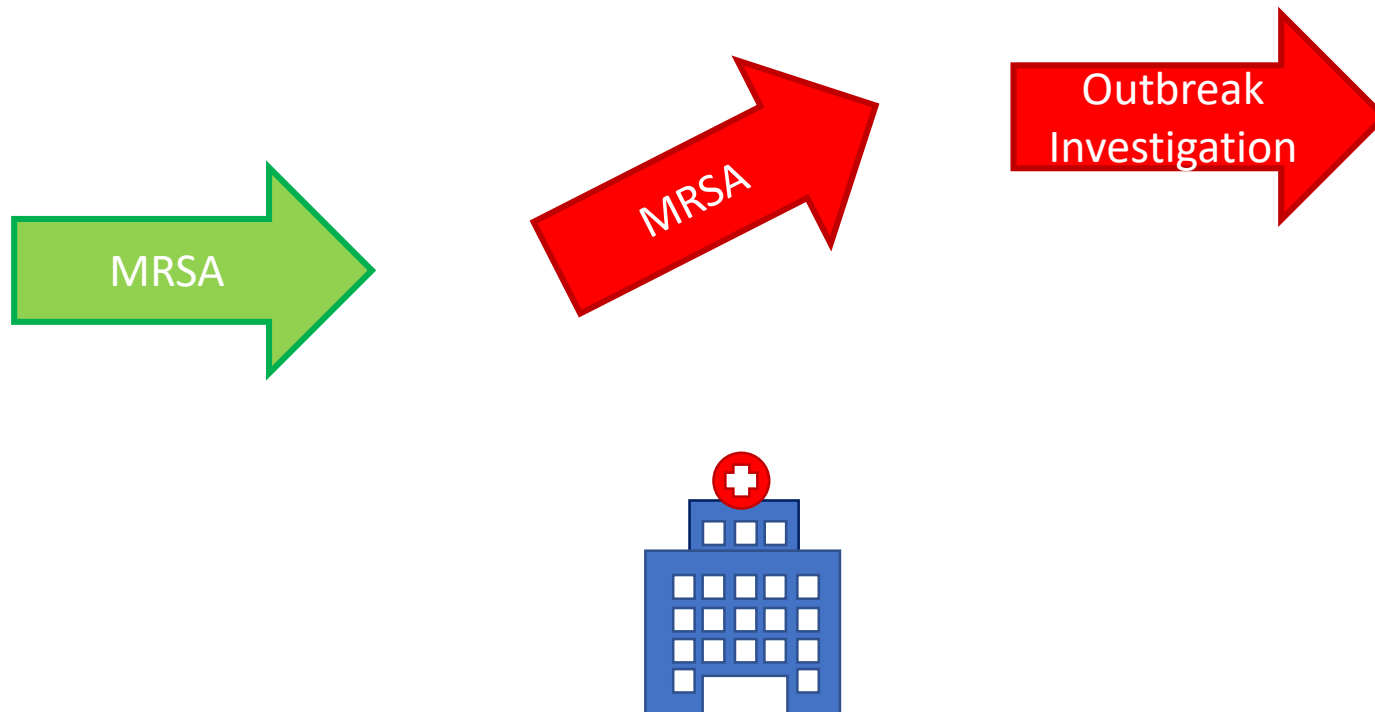
*Nature Reviews Disease Primers* 4, Article number: 18033 (2018)



# Introduction

- Why do we monitor MRSA?
  - Patient/Individual level
    - Wide range of infections: SSTIs (skin and soft tissue infection), pneumonia, osteoarticular infections, toxic shock syndrome and bacteraemia, which may be complicated by endocarditis or severe sepsis
    - Reduced treatment options
  - Health-institution level
    - Prevent person-to-person transmission
    - Prevent “endemic” situation
  - National/International level
    - Implementation of improved national control interventions
    - Study the epidemiology

# Outbreak investigation - Methods



## Laboratory

Microbiological case definition

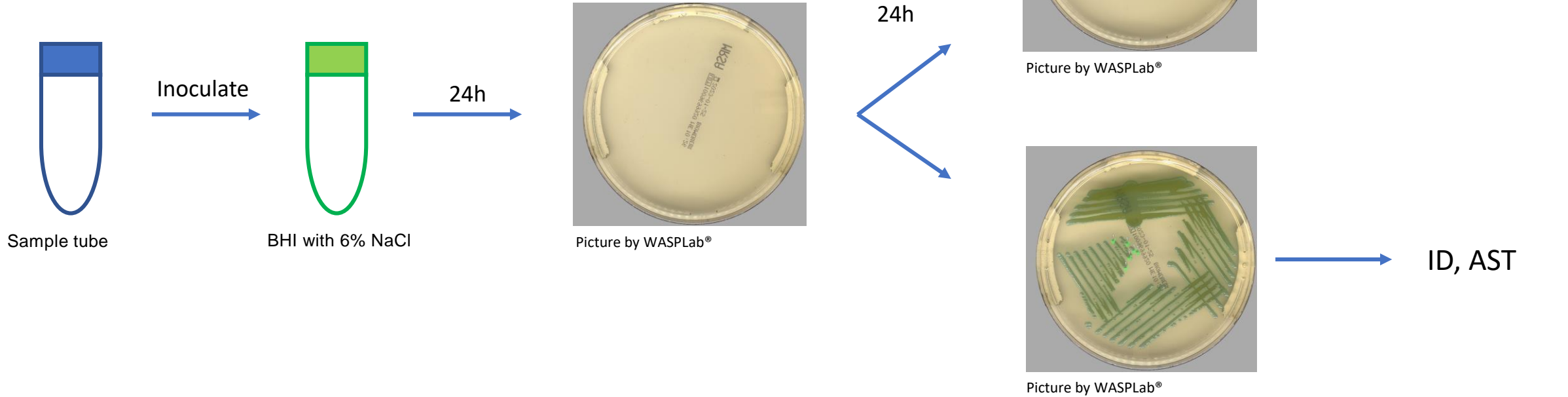
- AST
- WGS

## Hospital Hygiene

- Implementation of measures
- Risk factors and source(s)
- Cross sectional study
- Case and outbreak description

# Outbreak investigation - Methods

- MRSA Screening at ZLM



chromID chromogenic MRSA plate (bioMérieux, Marcy l'Etoile, France)

# Outbreak investigation - Methods

- Molecular Diagnostic for the study

Resistenzprüfung *Staphylococcus aureus* [1]

Penicillin G	R			
Ampicillin	R			
Oxacillin	R			
Pip-Tazobactam	R			
Amoxicillin-Clav.	R			
Cefalotin	R			
Cefamandol	R			
Cefuroxim	R			
Imipenem	R			
Meropenem	R			
Gentamicin	S			
Rifampicin	S			
Ciprofloxacin	S			
Levofloxacin	S			
Co-Trimoxazol	S			
Clindamycin	S			
Azithromycin	R			
Clarithromycin	R			
Erythromycin	R			
Vancomycin	S			
Vancomycin MHK [µg/ml]	1.0			
Tetracyclin	S			
Fusidinsäure	S			



DNA  
extraction



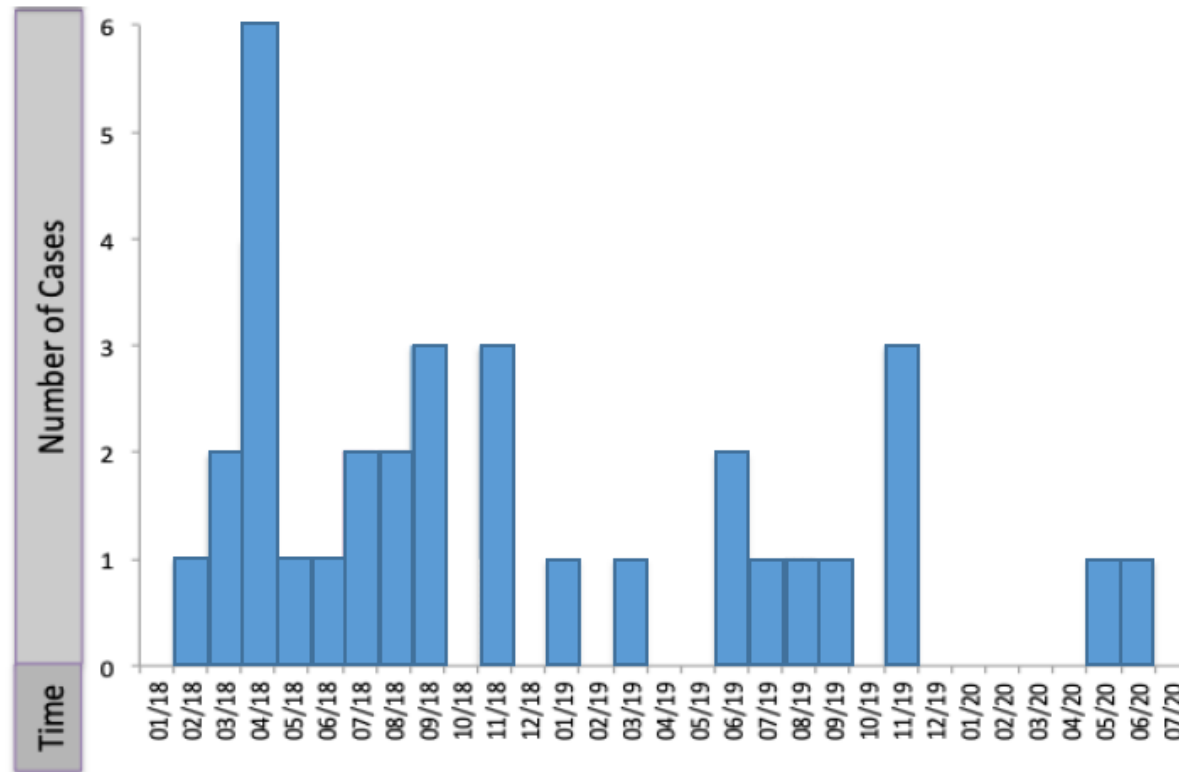
Analysis was performed  
using the SeqSphere  
software of Ridom®



# Outbreak investigation - Methods

- Hospital Hygiene
  - Implementation of measures
  - Risk factors and source(s)
  - Cross sectional study
  - Case and outbreak description

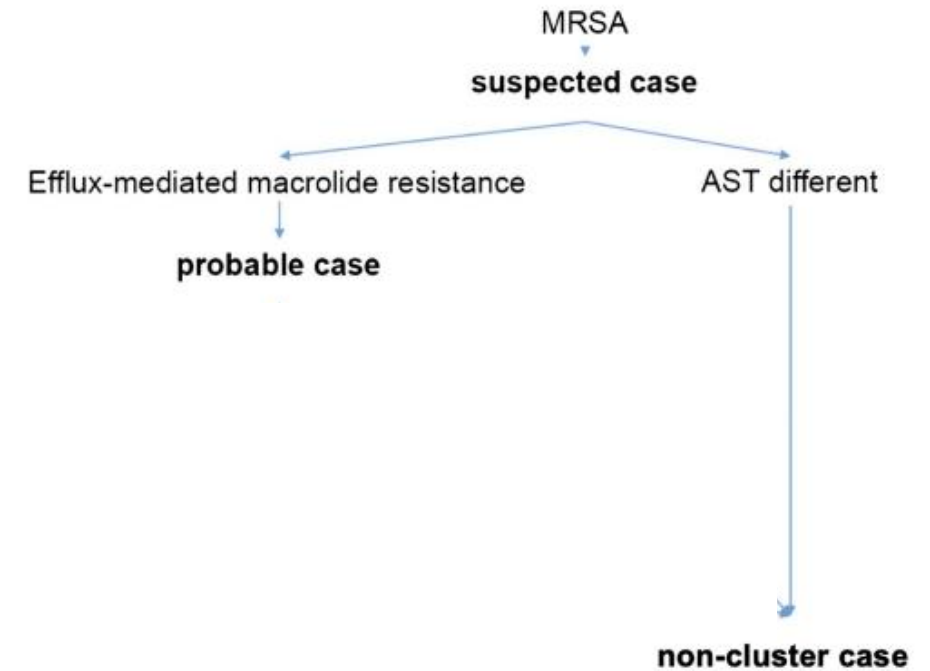
# Results



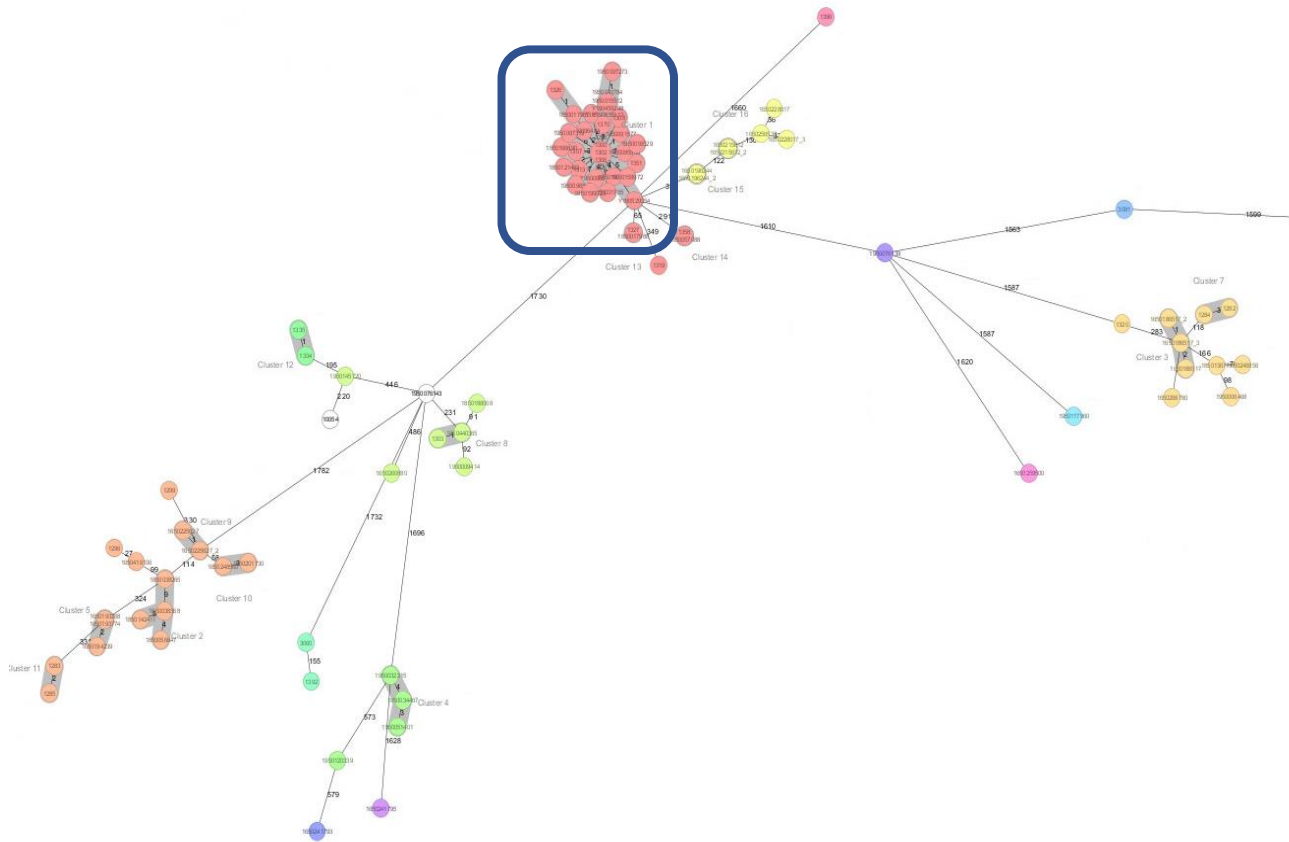
## Laboratory

Microbiological case definition

- Antimicrobial susceptibility testing (AST)
- WGS



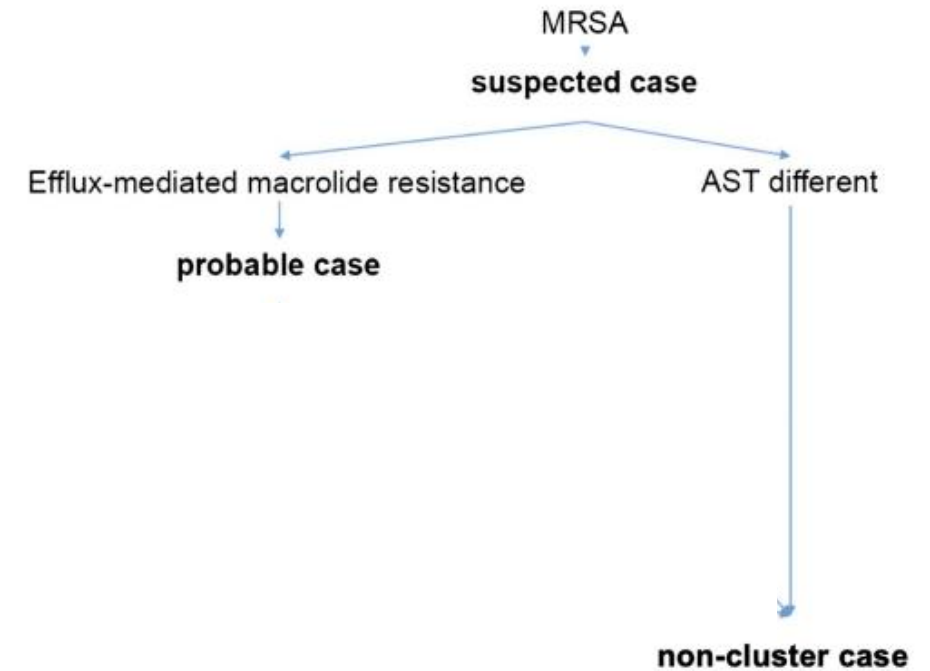
# Results



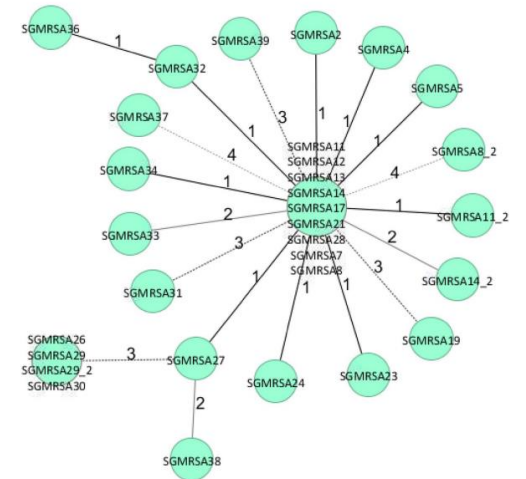
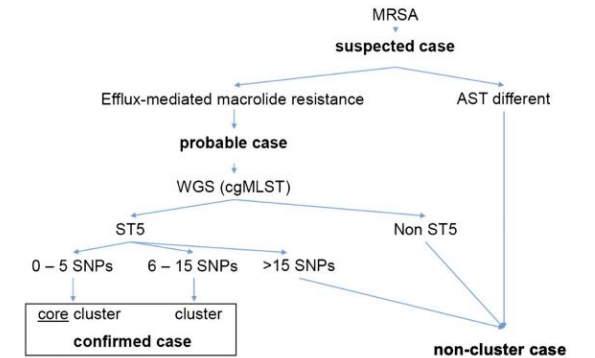
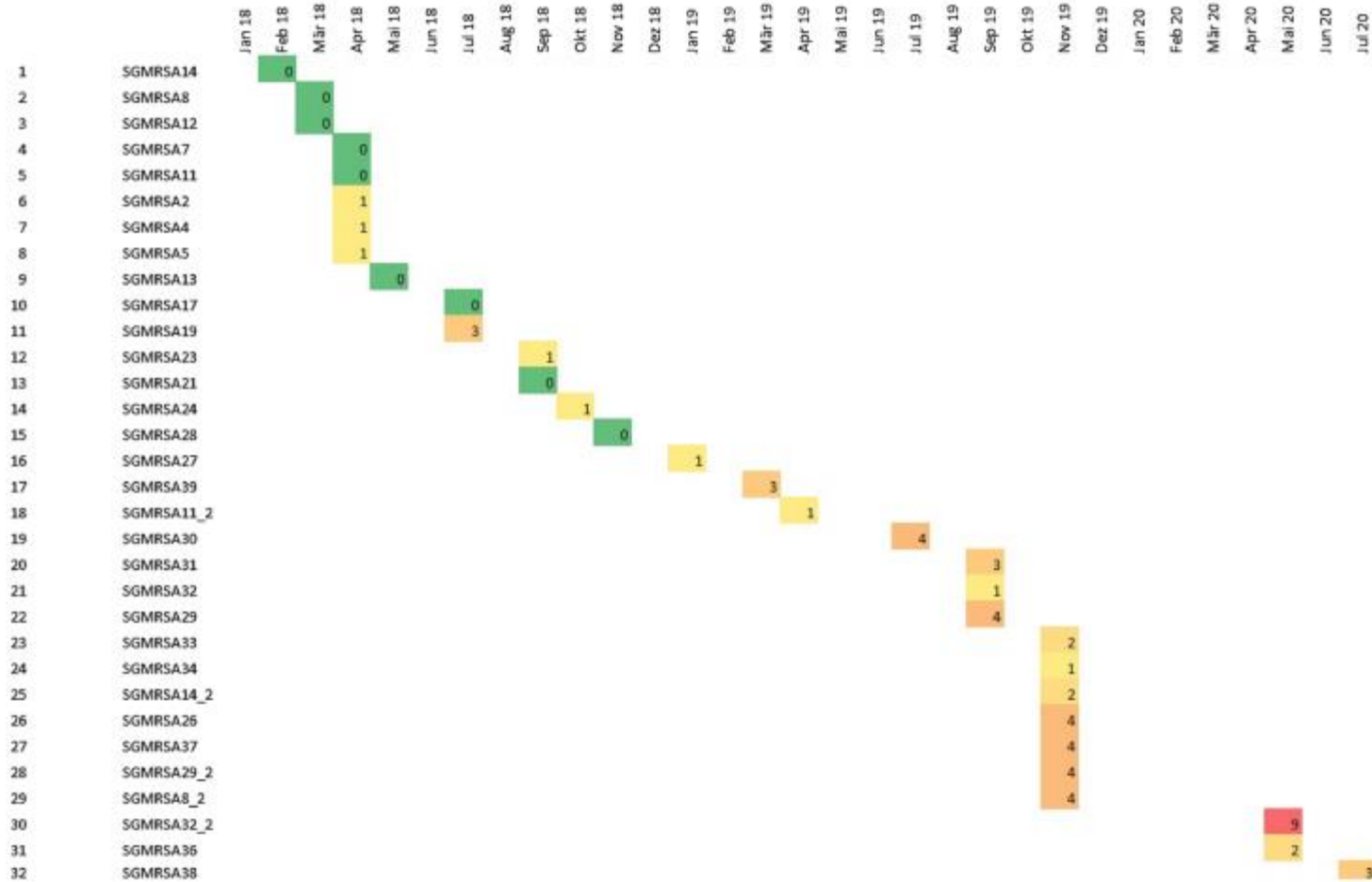
## Laboratory

Microbiological case definition

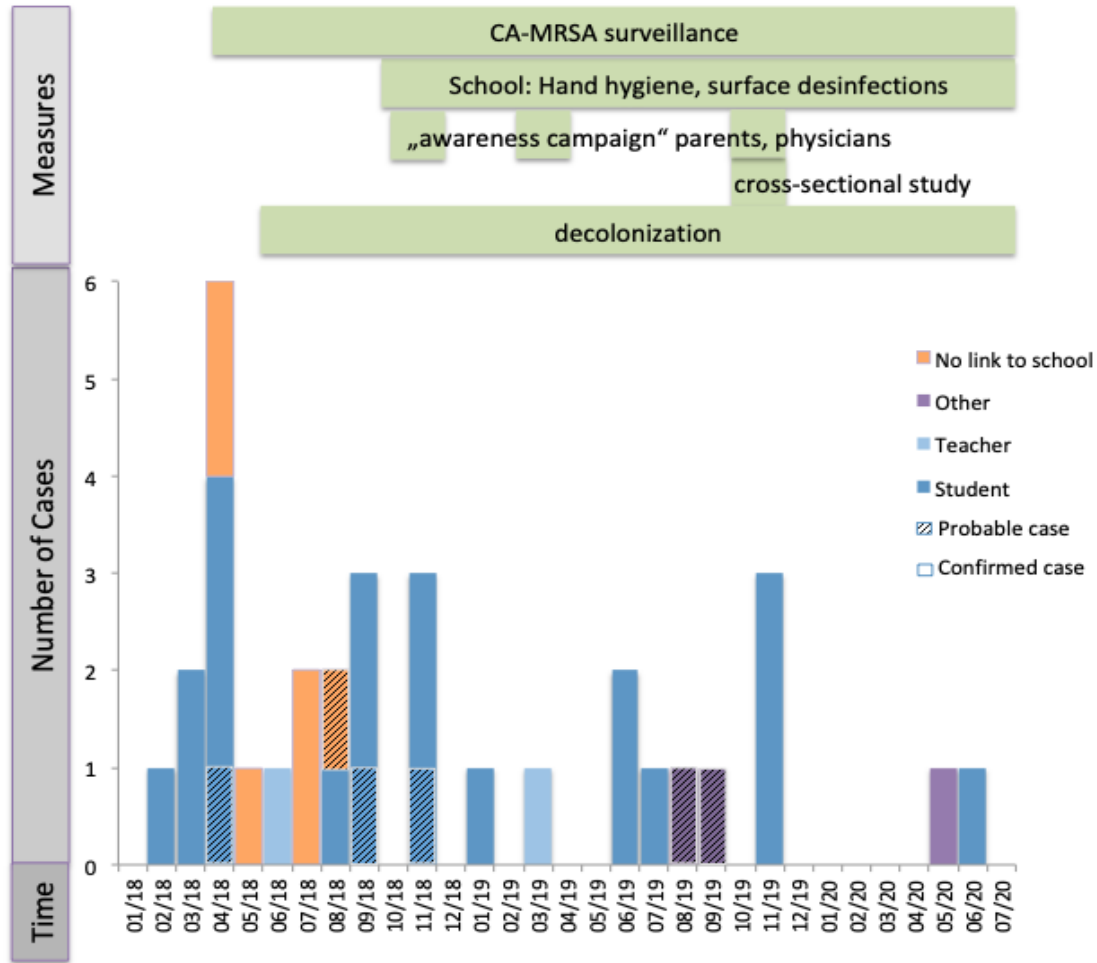
- Antimicrobial susceptibility testing (AST)
- WGS



# Results



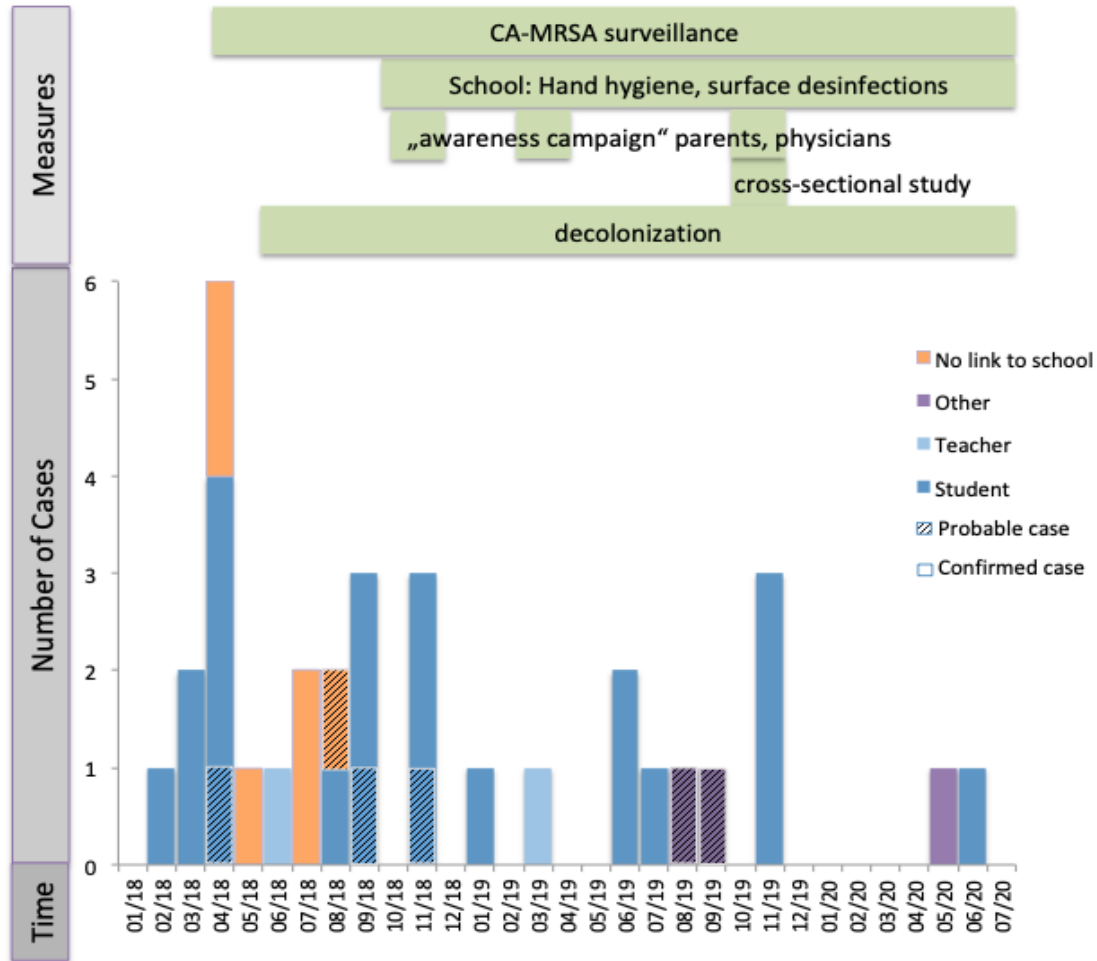
# Results



## Hospital Hygiene

- Implementation of measures
- Risk factors and source(s)
- Cross sectional study
- Case and outbreak description

# Results



Characteristics	Children (n = 28)	Adults (n = 5)	All (n = 33)
Mean age [IQR], years	10.5 [9–12]	37 [33–48]	11 [9–14]
Female sex (%)	13 (46)	2 (40)	15 (45)
<b>Clinical diagnosis</b>			
SSTI	22	5	27
Bacteremia and arthritis	1	0	1
Bursitis	1	0	1
Other	1	0	1
Colonization*	3	0	3
Association with school (%)	21 (75)	5 (100)	26 (79)
Confirmed cases, ST5 (%)	24 (86)	3 (60)	27 (82)

# Results

- 49 individuals (students and staff) with MRSA → 33 belongs to the outbreak
- MRSA characteristics: ST5, non-inducible MLSB resistance, PVL virulence factor
- 79% of the cases had a local elementary and secondary school as main site of transmission
- No further risk factors could be identified
- The initial transmission event is suggested in spring 2018 (no link to children`s festival)
- After implementation of treatment and decolonisation outbreak could be stopped

# Discussion

## Take Home messages

- Molecular methods (i.e. WGS) are important as part of regional, national and international surveillance systems
- With molecular methods outbreaks can be closely managed (i.e. genetic features of the outbreak strain, success of interventions, reporting of new cases)
- Combining microbiological and epidemiological methods were key features for ending the CA-MRSA outbreak



# Thanks to all partners



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Dr. med. Danuta Zemp



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# Thank you for your attention!

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KCHI Klinische Chemie, Hämatologie und Immunologie

HM Humanmedizinische Mikrobiologie

VD Veterinärdiagnostik