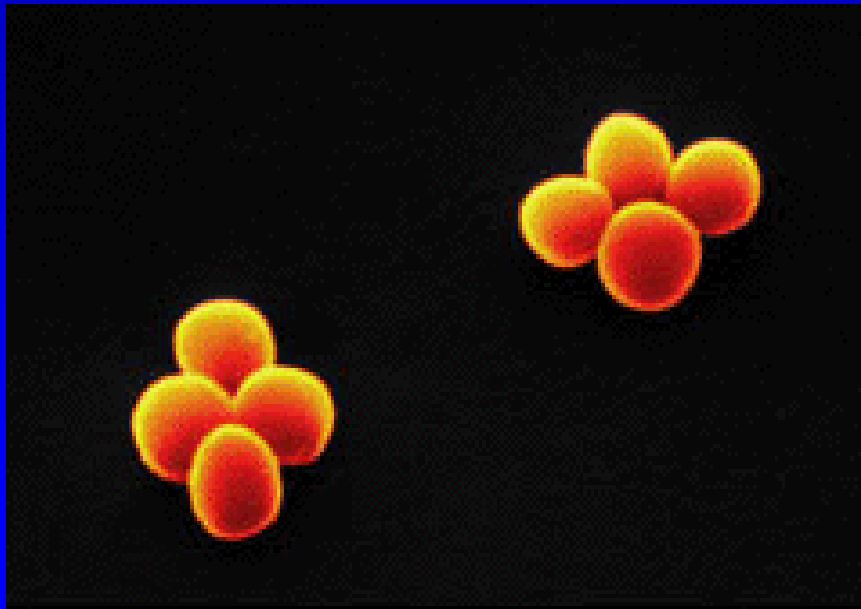


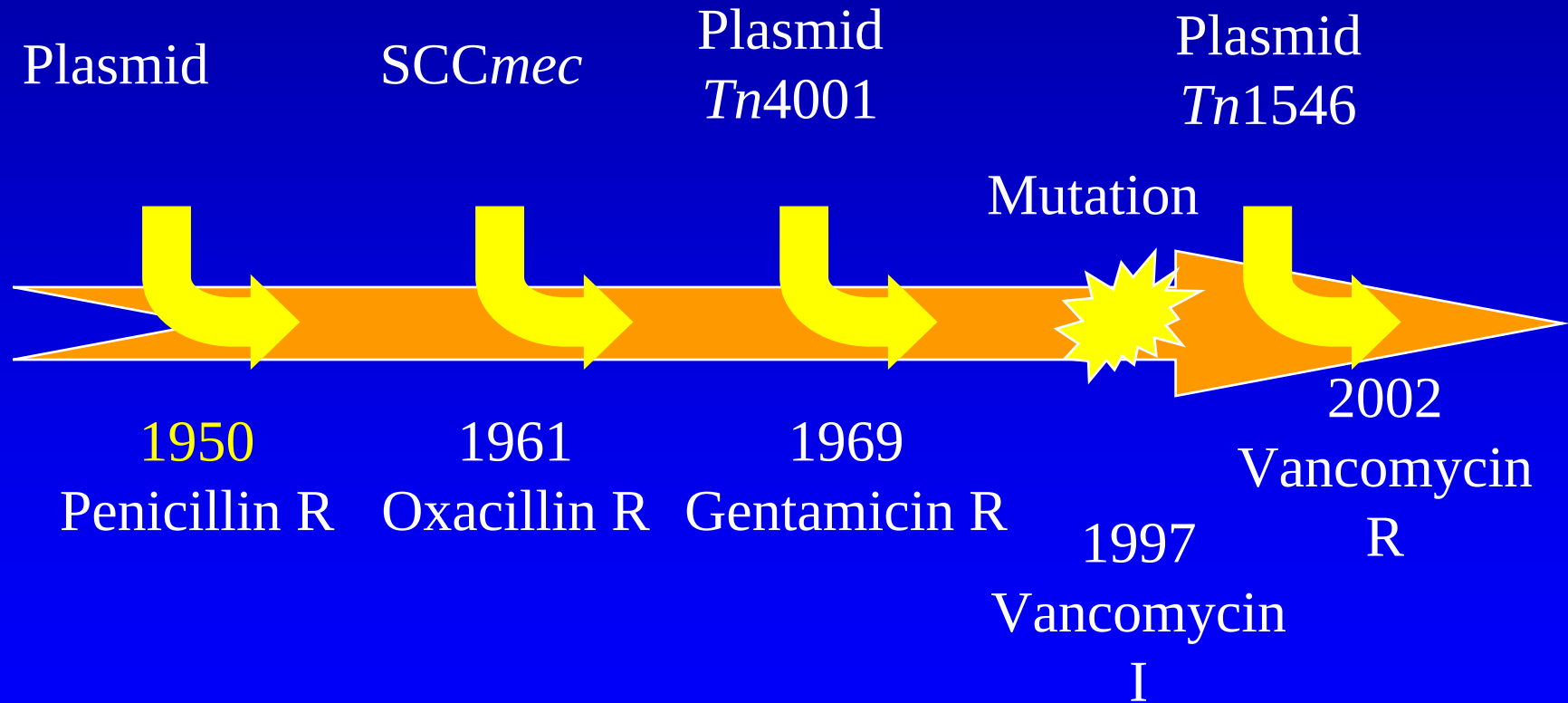
Epidemiology and resistance of *S.aureus* in the hospital and the community



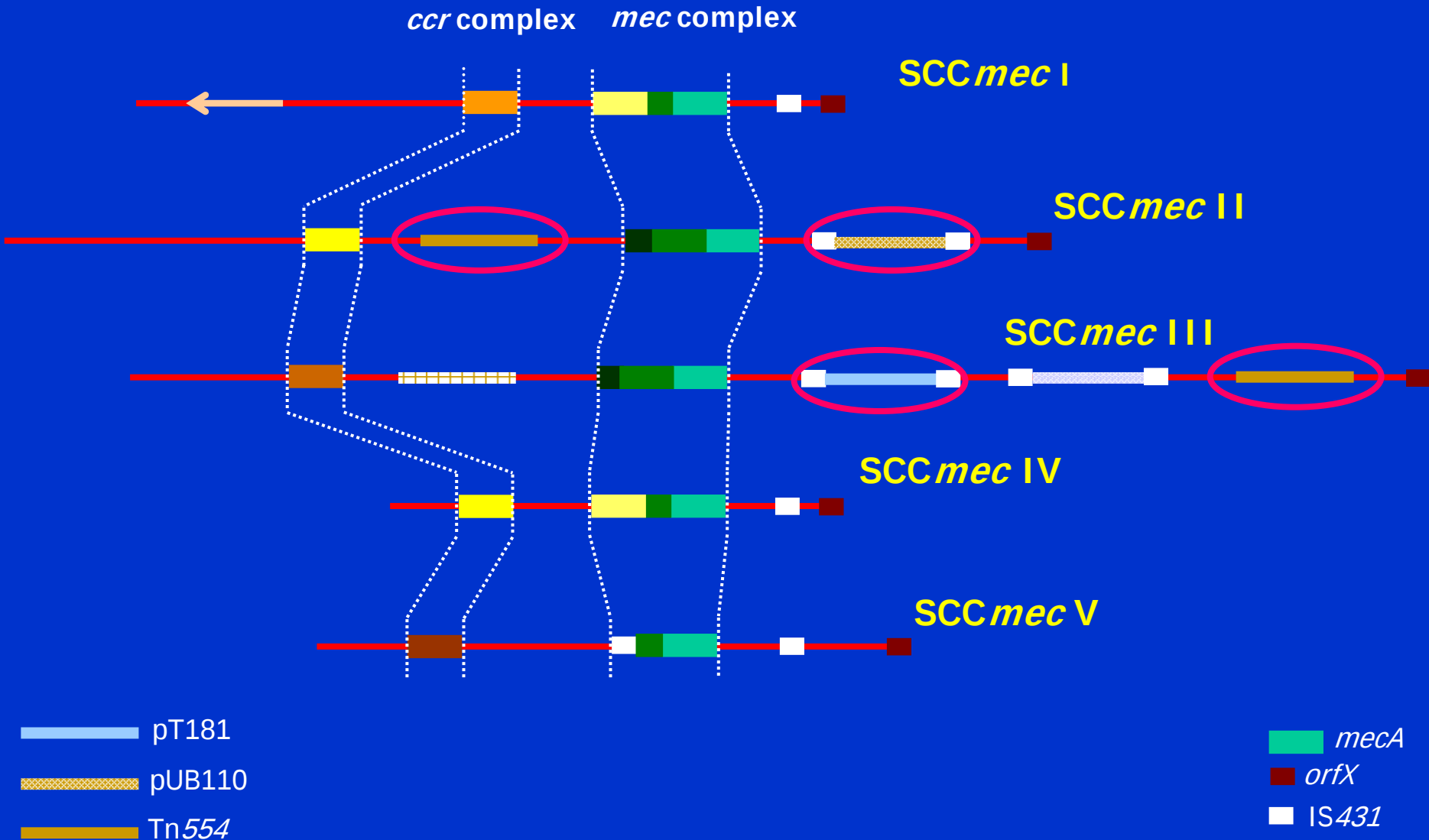
M.Struelens

ULB-Hopital Erasme

The Ever More Resistant *Staphylococcus aureus*

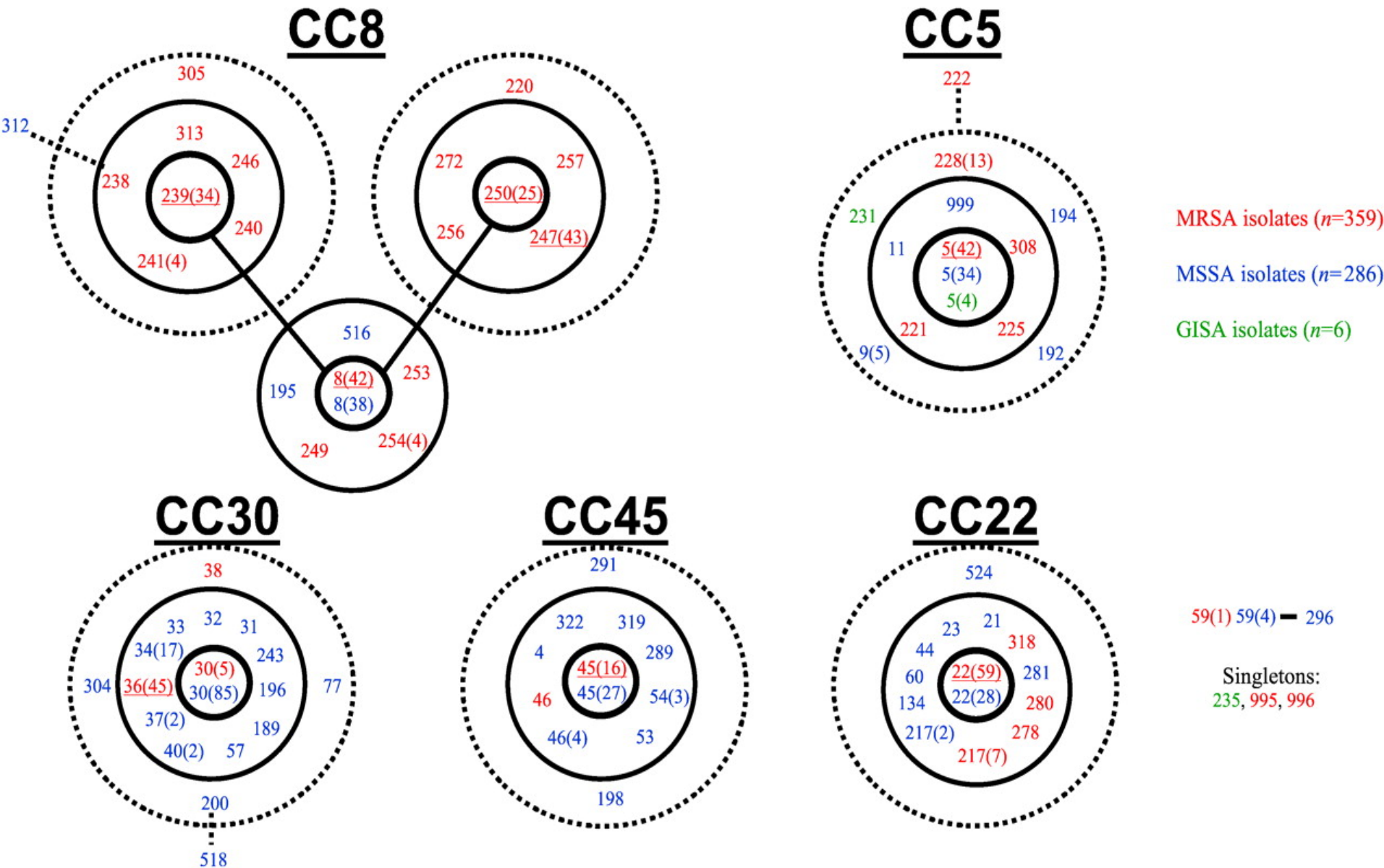


Staphylococcal Cassette Chromosome *mec*

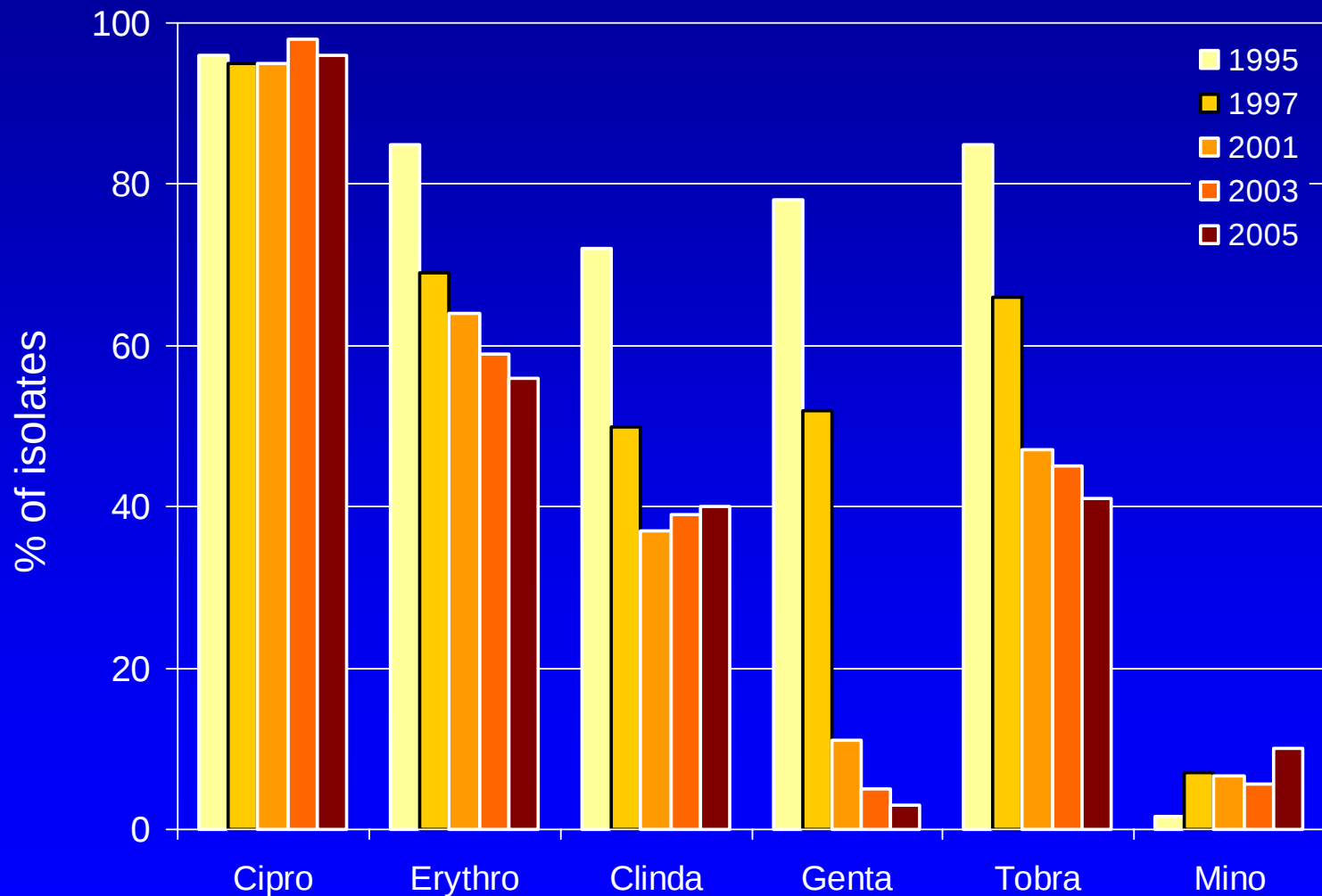


THE EVOLUTION OF MRSA

Enright et al. *PNAS* 2002;99:7687

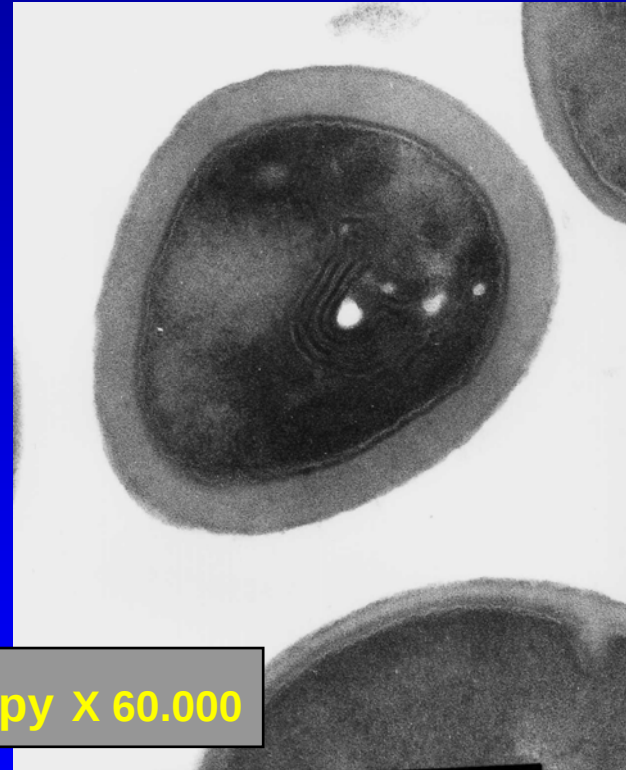
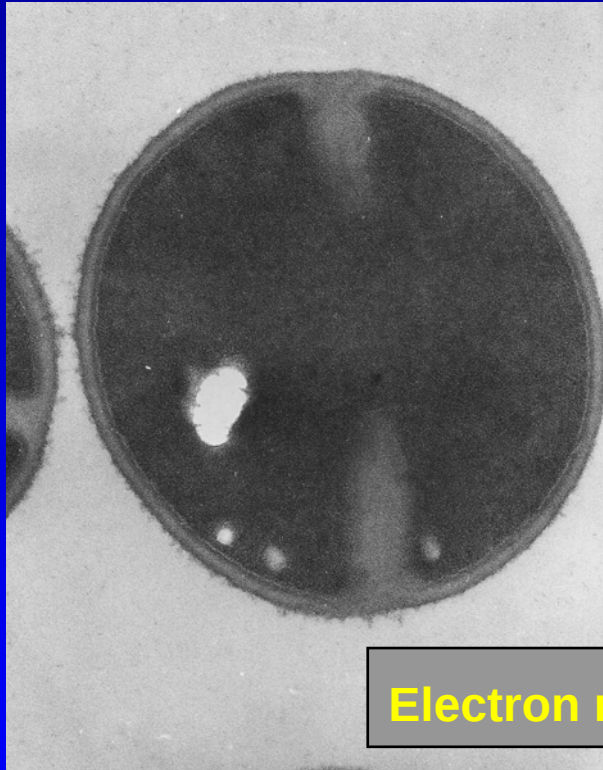


Proportion of MRSA resistant to antimicrobials, Belgium 1995-2005



The Shadow Mutant: Vancomycin Intermediate *S.aureus* / VISA

Denis *JAC* 2002;50:383



Electron microscopy X 60.000

S.aureus ATCC 29213

VISA strain - P1V44
Vancomycin MIC 8 mg/l

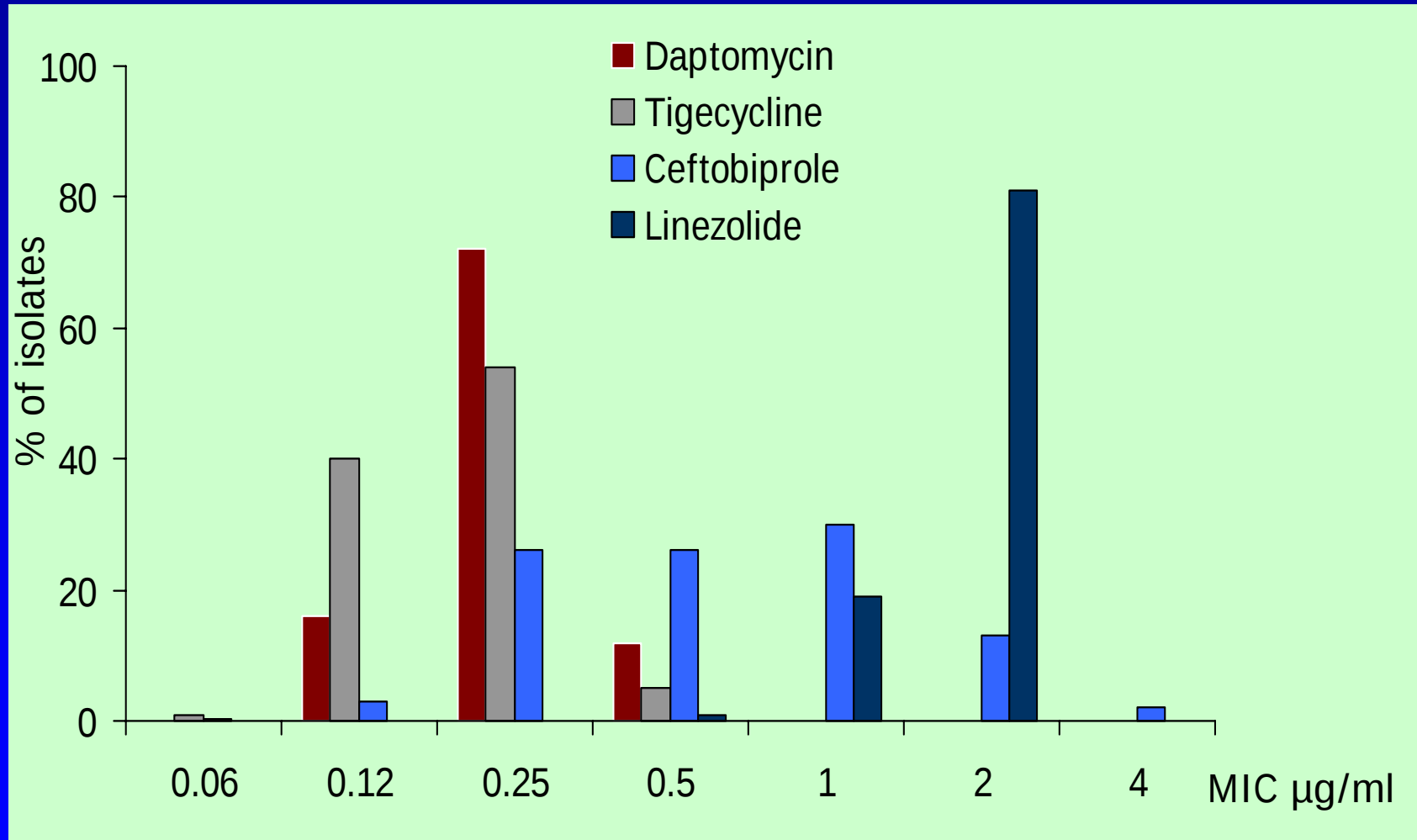
National surveys of MRSA with decreased vancomycin susceptibility

Author, year	Country	No. of Strains	Percent Hetero VISA	Percent VISA
Hiramatsu, 1997	Japan	1149	1_20	0
Kantzanou, 1999	Greece	56	1.8	0
Schmitz, 1999	Europe	302	0	0
Geisel, 1999	Germany	85	8.2 *	0
Bierbaum, 1999	Germany	457	0.5	0.2
Chesneau, 2000	France	25	20	0
Nonhoff, 2005	Belgium	455	0.7	0

*screening at 4 µg/ml and MIC after subculture at increasing concentrations of vancomycin

MIC distribution for 511 MRSA isolates, Belgian hospital survey, 2003

Denis AAC 2006



Linezolid Resistant *S.aureus*

- Rare case reports of emergence during treatment
- Long-term treatment of CAPD MRSA peritonitis
- Multi-copy 23S rRNA V region mutations
- No fitness cost of mutation detected

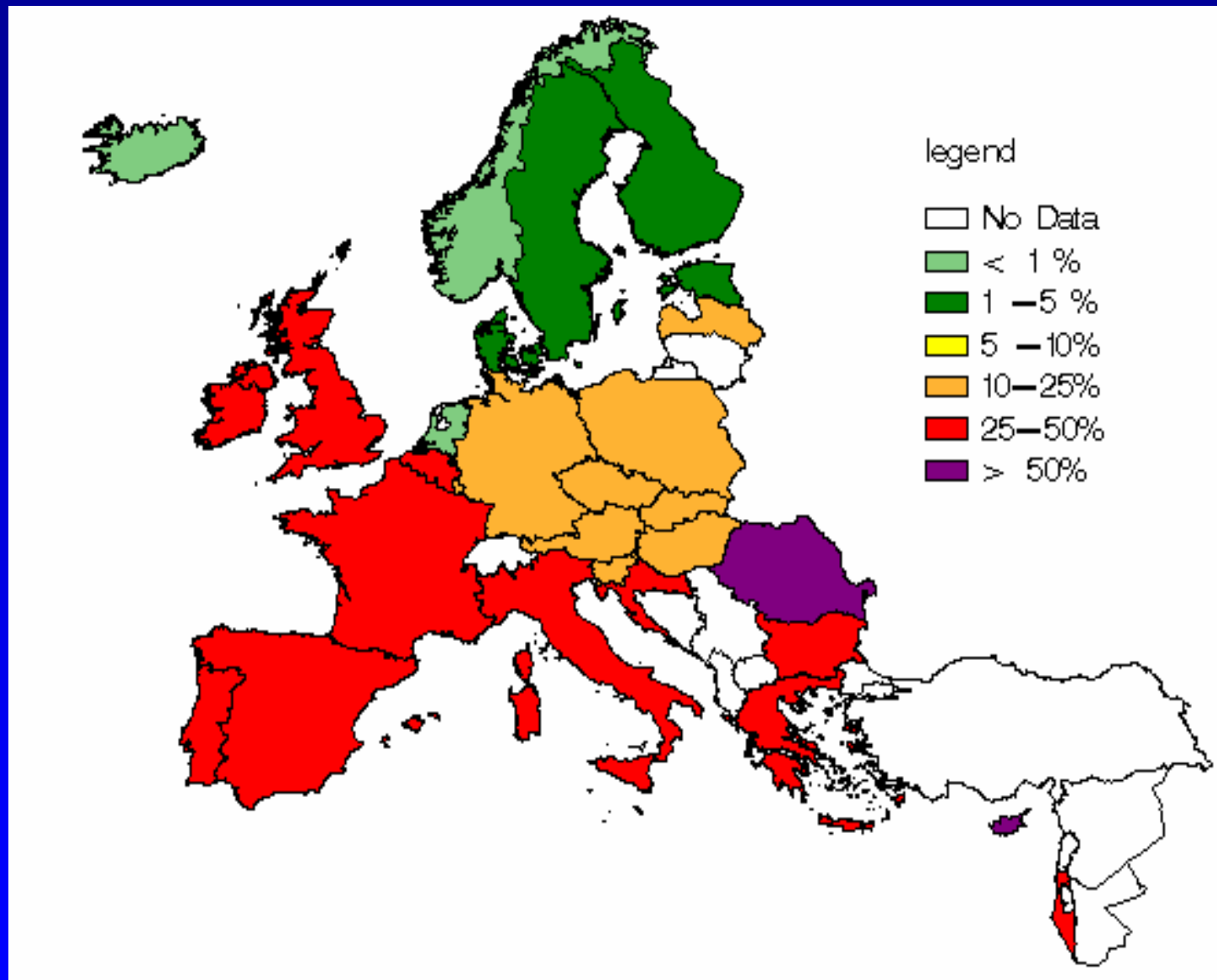
Tsiodras *Lancet* 2001;358:207

Pillai *JID* 2002;186:1603

S.aureus daptomycin resistance emergence in bacteremic patients

- RCT of daptomycin vs PRP or vancomycin + gentamicin for bacteremia/ RS endocarditis
- 44% vs 42 % success at 42 days D vs STD
- Microbiological failure in 16 % D vs 10 % STD therapy
- 6/19 daptomycin failure showed 8-fold MIC increase

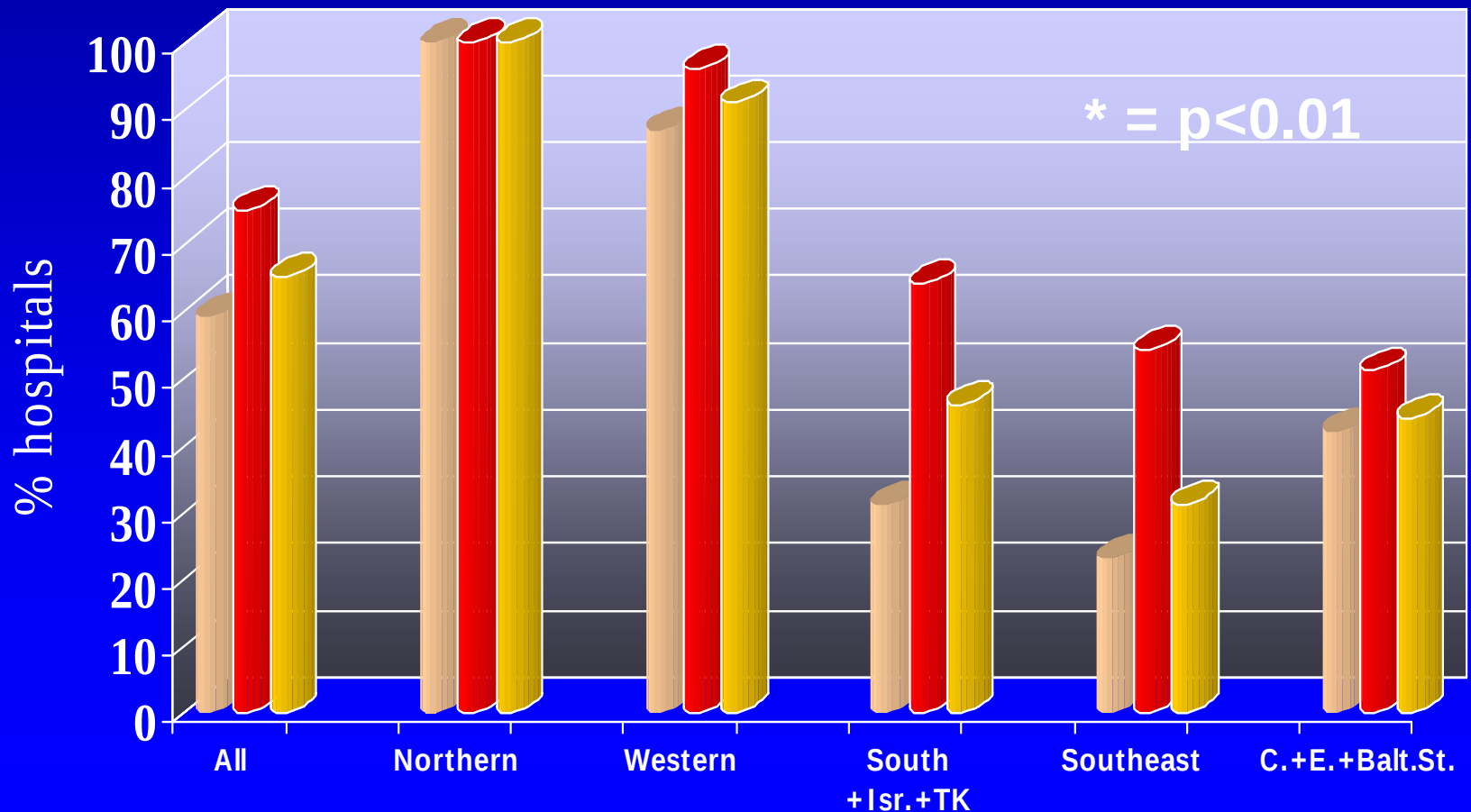
Methicillin resistance of *S. aureus* isolates from blood cultures, 2005



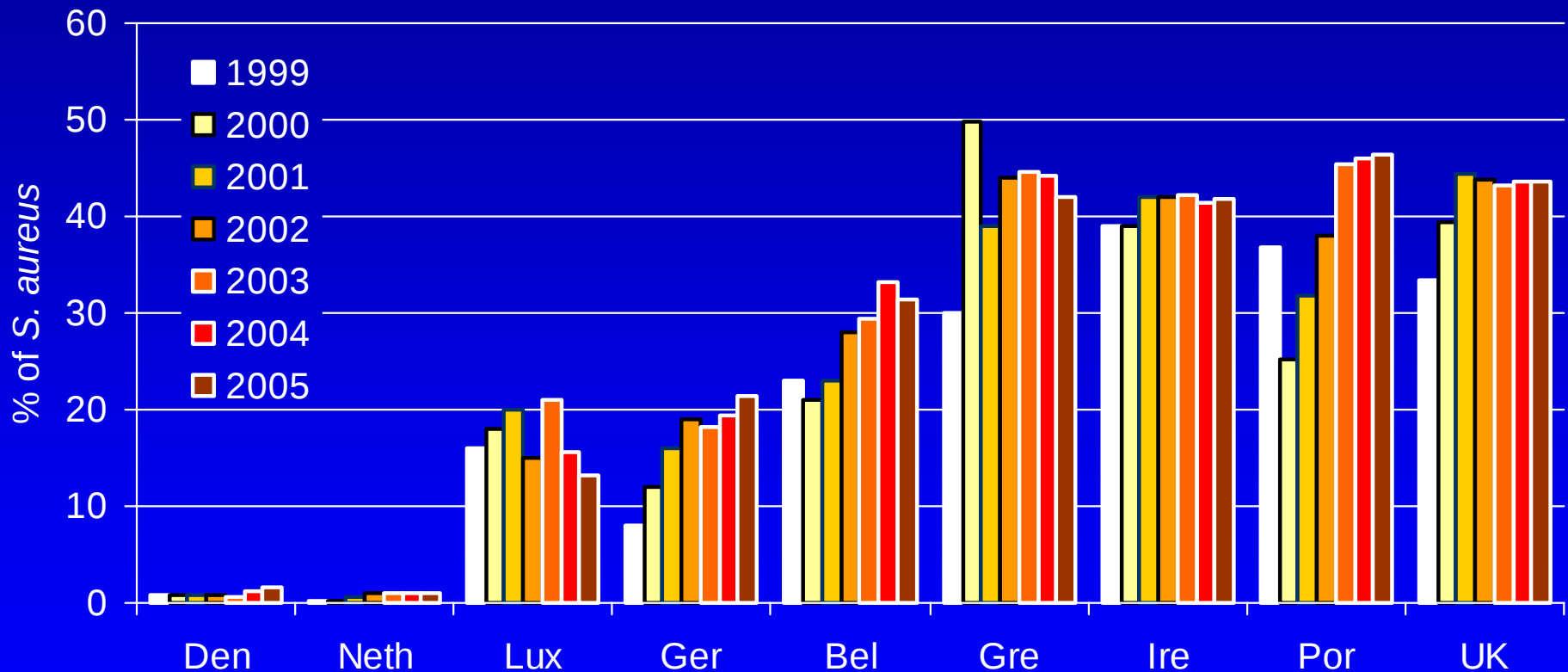


Isolation Precautions for MRSA by European Region, 2001

■ SINGLE ROOM ■ GLOVES ■ GOWN



Trends in MRSA bacteraemia EARSS, 1999 to 2005



Excess mortality associated with MRSA vs MSSA bacteremia

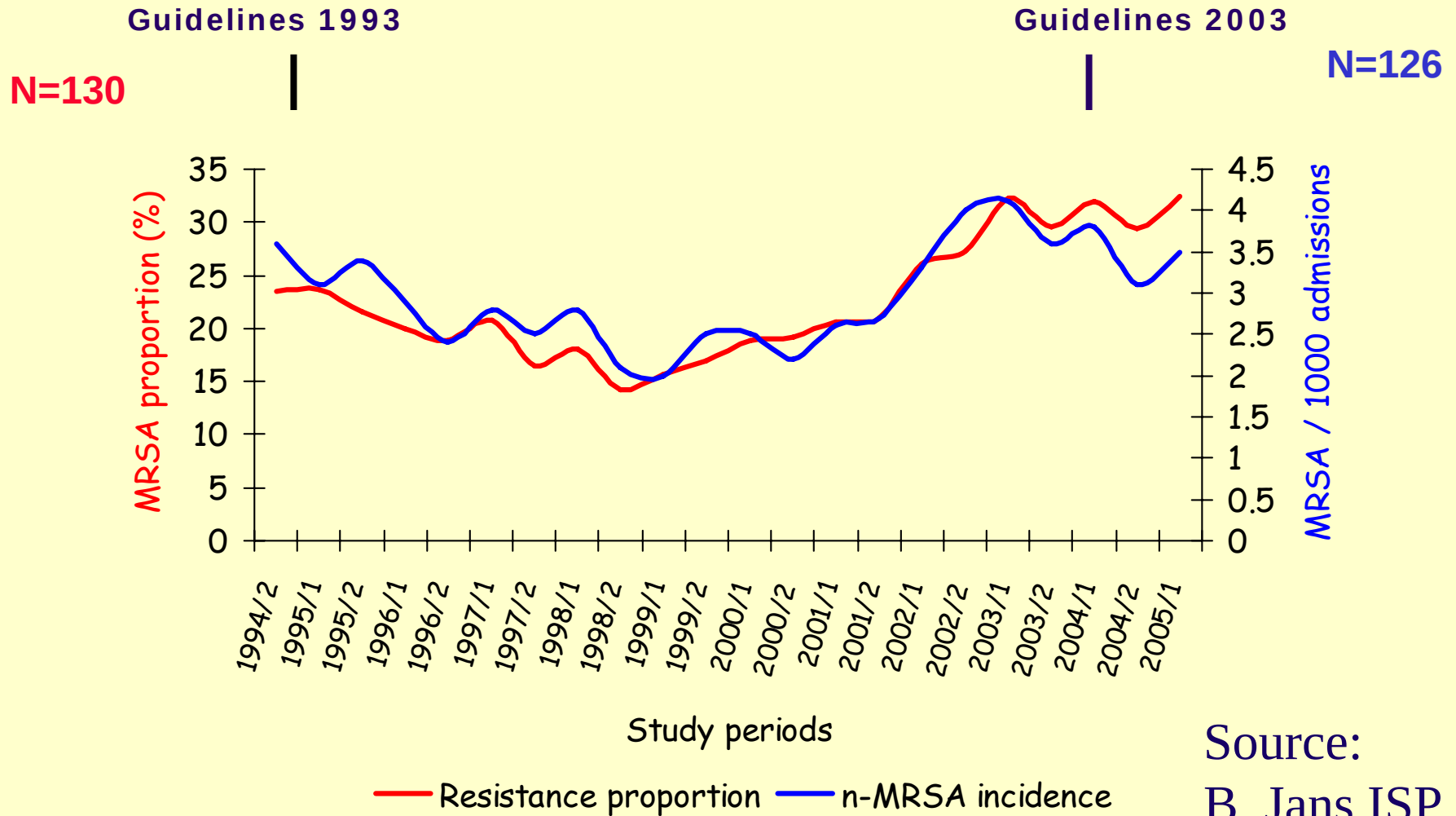
Study	Design	Relative risk
Cosgrove, 2003	Meta-analysis	2.03 (1.55-2.65)
Blot, 2002	ICU Cohort study	1.93 (1.54-2.42)
Talon, 2002	Cohort study	2.97 (1.12-3.18)
Melzer, 2003	Cohort study	1.72 (0.92-3.20)
Gastmeier, 2005	Multi-ICU cohort	3.84 (1.51-10.2)

Burden of MRSA Infections in Europe

- Estimate from 2002 EARSS data:
- 11,697 cases of MRSA bacteremia
- 1,277 attributable deaths
- Extra-cost of care: 117 million Euros

Source: SCORE Report, 2004(www.scoreproject.org)

MRSA incidence in Belgian hospitals 1994-2005

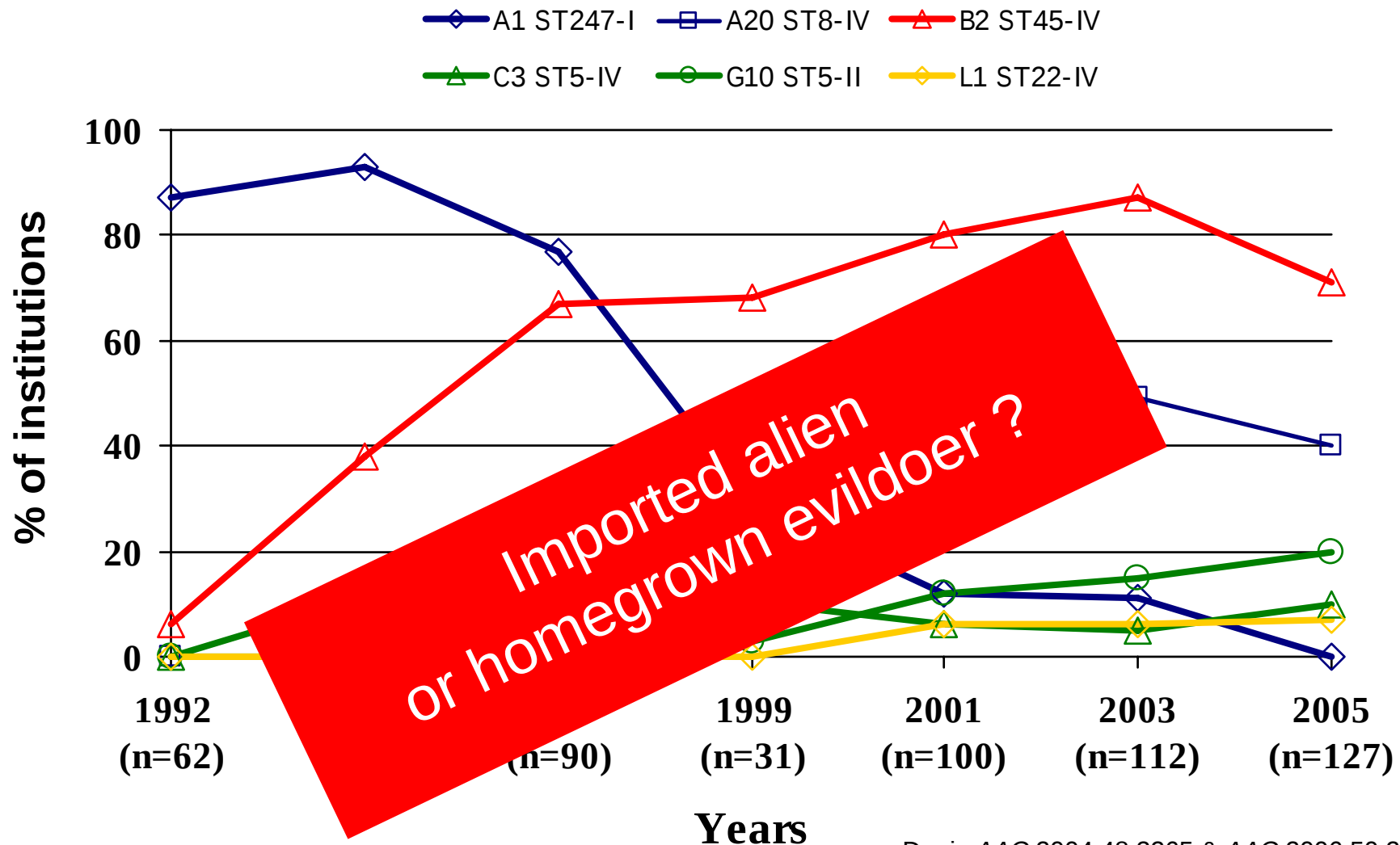


Source:
B. Jans ISP

Hospitals with at least 3 participations between 1994 and 2005

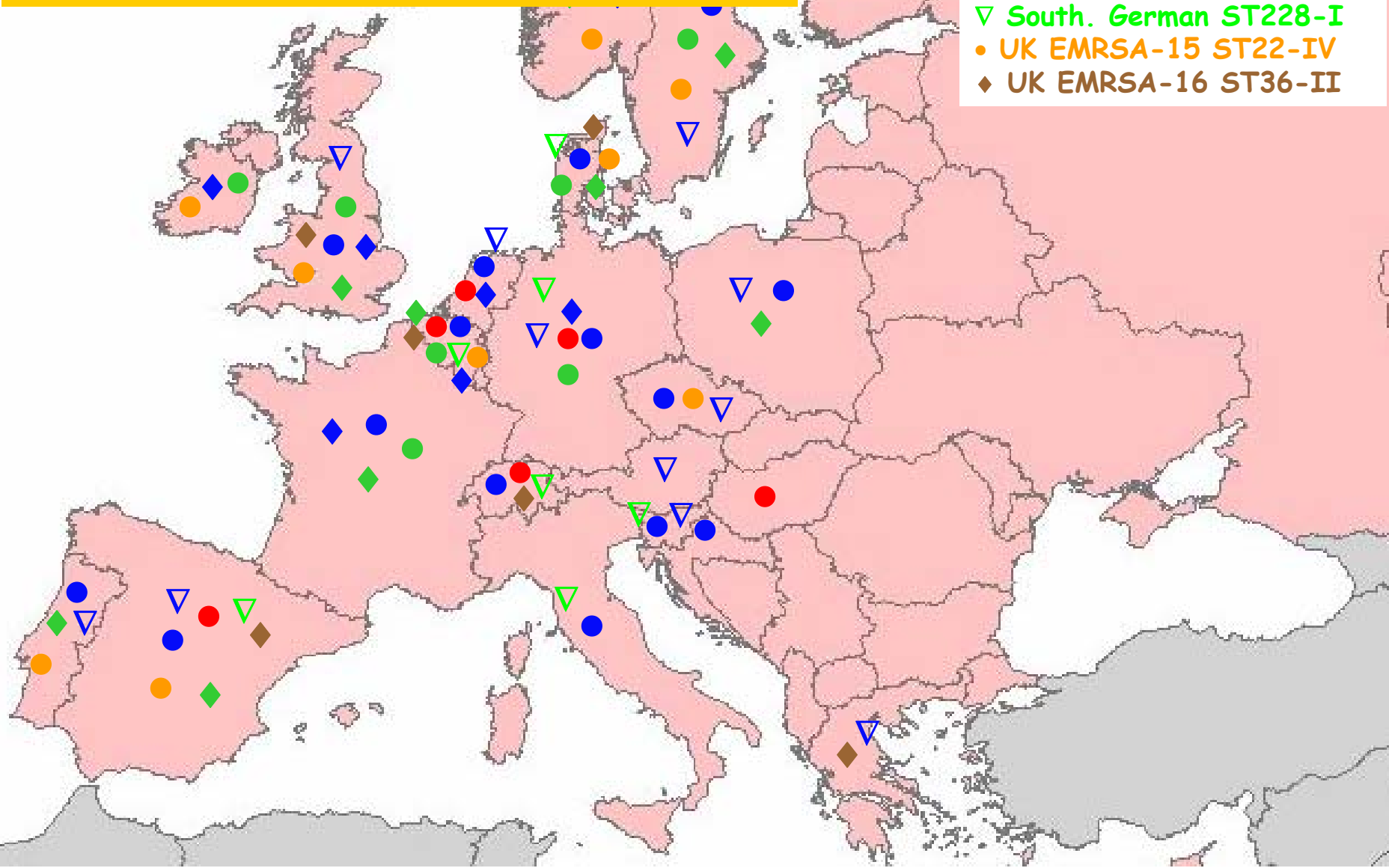
Secular trends of MRSA Clonal Distribution by PFGE-MLST-SCCmec typing

Belgium National Surveillance, Acute Care hospitals, 1992-2005



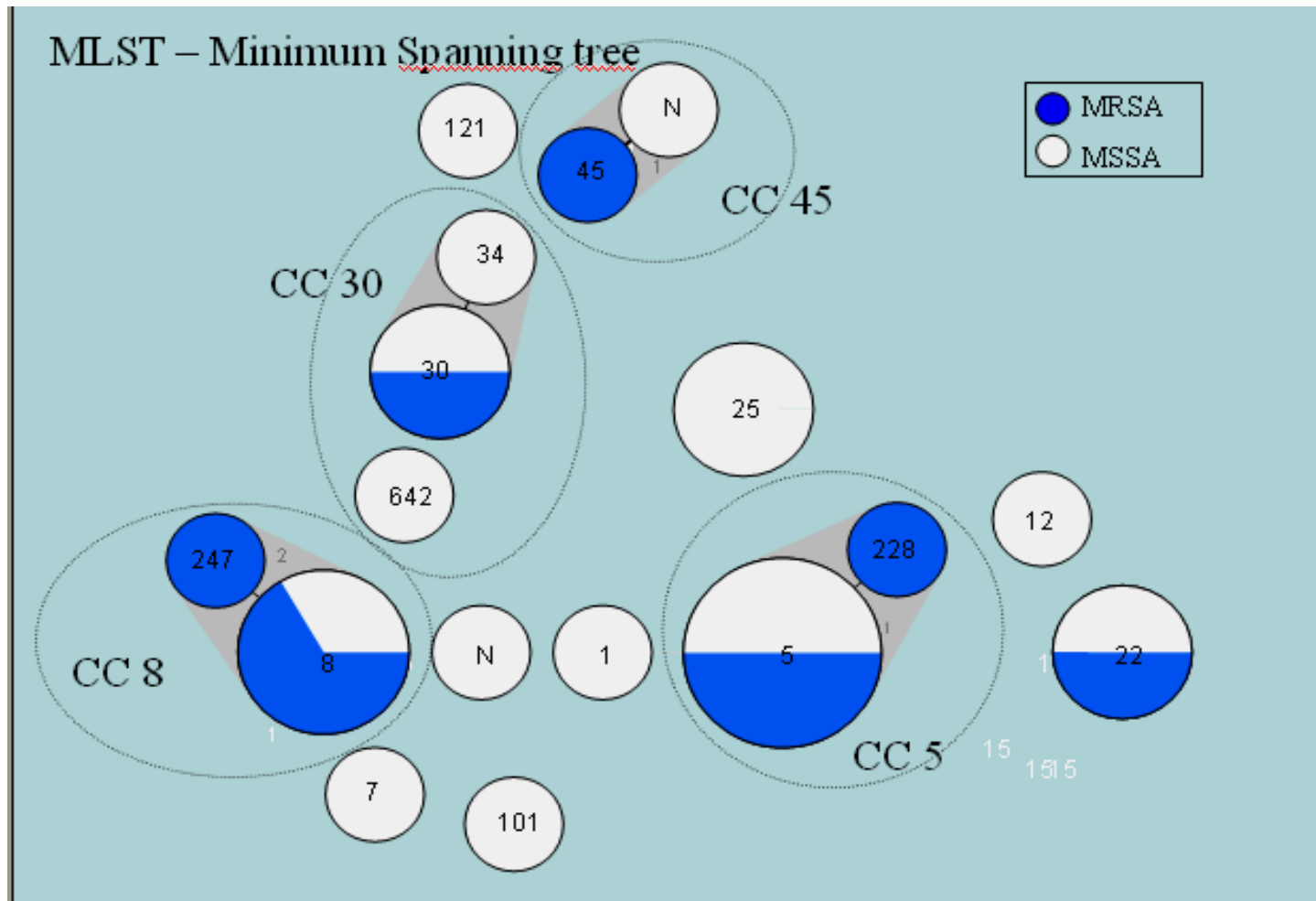
European distribution of HA-MRSA clones

- Berlin ST45-IV
- Iberian ST247-I
- ◆ UK EMRSA-2/-6 ST8-IV
- ▽ Brazi./Hungarian ST8-III
- NY/Japan ST5-II
- ◆ Paediatric ST5-IV
- ▽ South. German ST228-I
- UK EMRSA-15 ST22-IV
- ◆ UK EMRSA-16 ST36-II

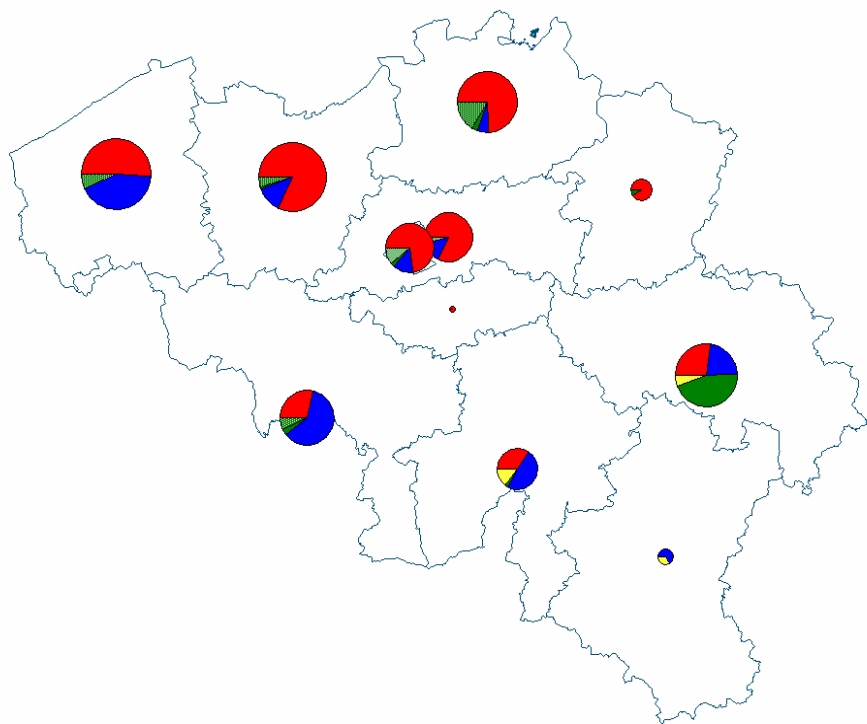


MLST Phylogeny of Belgian Epidemic MRSA and MSSA Strains

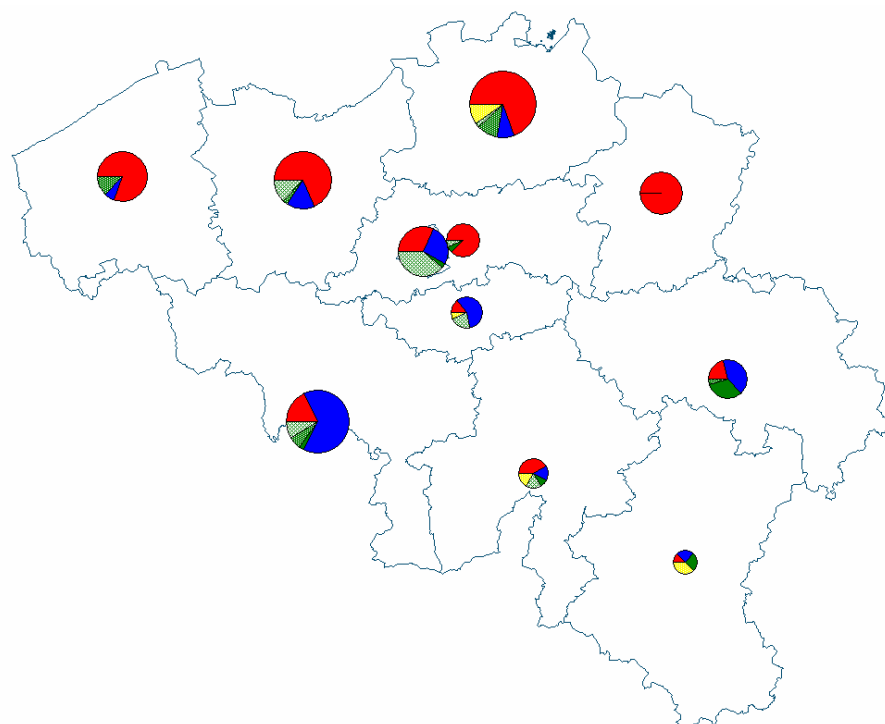
(N=26 strains, National survey, 2003)



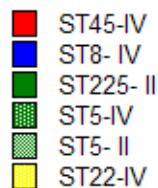
Geographical distribution by province of epidemic MRSA clones, Nursing Homes versus Hospitals, 2005



Nursing Homes
(n = 587 strains)



Hospitals
(n = 326 strains)



Mechanisms of disease

Association between *Staphylococcus aureus* strains carrying gene for Panton-Valentine leukocidin and highly lethal necrotising pneumonia in young immunocompetent patients

Yves Gillet, Bertrand Issartel, Philippe Vanhems, Jean-Christophe Fournet, Gerard Lina, Michèle Bes, François Vandenesch, Yves Piémont, Nicole Brousse, Daniel Floret, Jerome Etienne

Summary

Background Between 1986 and 1998, eight cases of

Introduction

Staphylococcus aureus is responsible for about 2% of cases of community-acquired pneumonia¹ and at least 10% of cases



[CDC Home](#) [Search](#) [Health Topics A-Z](#)

MMWR

Weekly

August 20, 1999 / 48(32):707-710

Four Pediatric Deaths from Community-Acquired Methicillin-Resistant *Staphylococcus aureus* -- Minnesota and North Dakota, 1997-1999

Community-Acquired Methicillin-Resistant *Staphylococcus aureus* Carrying Panton-Valentine Leukocidin Genes: Worldwide Emergence

François Vandenesch,* Timothy Naimi,† Mark C. Enright,‡ Gerard Lina,* Graeme R. Nimmo,§ Helen Heffernan,¶ Nadia Liassine,# Michèle Bes,* Timothy Greenland,** Marie-Elisabeth Reverdy,* and Jerome Etienne*

CA-MRSA infections

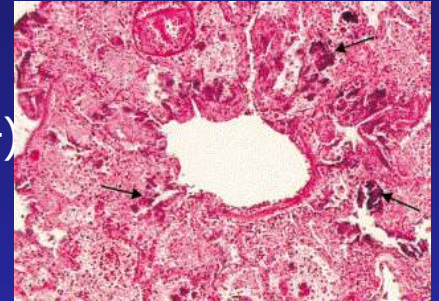
- Skin and soft tissue infections
 - Most frequent (> 90%)
 - Furunculosis, cellulitis, cutaneous and sub-cutaneous abscess, impetigo, ...
 - Exposed surfaces
 - Favourable outcome
 - Major pathogen in the USA
 - Children, Texas :60% hospitalisation
 - Adults, Georgia: 41% hospitalization
 - Major clone USA 300 ST8-SCCmec IV



Wang CC et al. CID 2004 39:481
Lee M. et al. PIDJ 2004 23:123
Kaplan SL et al. CID 2005 40:1785
King MD et al. AIM 2006 144:313

Invasive CA-MRSA infections

- **Pneumonia**
 - Fulminant necrotizing pneumonia
 - Preceding influenza or influenza-like syndrome
 - High fever, hypotension, respiratory distress (+++) haemoptysis, pleural effusion, leucopenia
 - High mortality (75%)
 - Other : septic emboli, empyema, lung abscess,
- **Osteomyelitis and arthritis**
 - Multiple, bacteraemia, pneumonia, thrombophlebitis
- Other : **pyomyositis, necrotizing fasciitis, severe sepsis, ...**

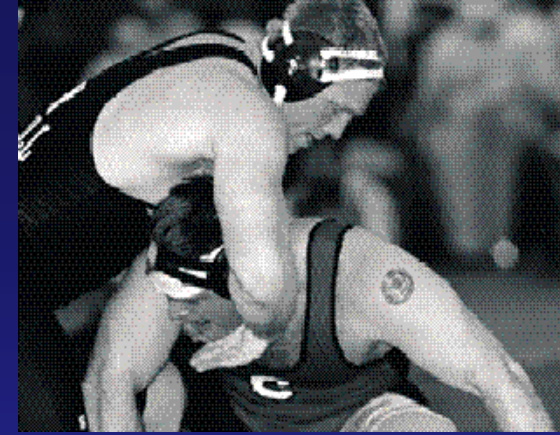


Hunt C. et al. MMWR 1999 48:707
Dufour P. et al. CID 2002 35:819
Gonzalez BE et al CID 2005 41:583
Enayet I. et al. CID 2006 42:e57

Kaplan SL et al. CID 2005 40:785
Miller LG et al. NEJM 2005 352:1445
Adem PV et al. NEJM 2005 353:1245



Epidemiology



- **Community outbreaks**
 - American indians, aborigens, eskimos
 - Prisons, military recruits, schools
 - Sport teams : Wrestler, fencer, football, bodybuilder
 - Gay community
 - Familial transmission
- **Nosocomial outbreaks**
 - Obstetric and neonatal wards
 - Transmission to healthcare worker:
pediatrician, microbiologist...



Mode of transmission

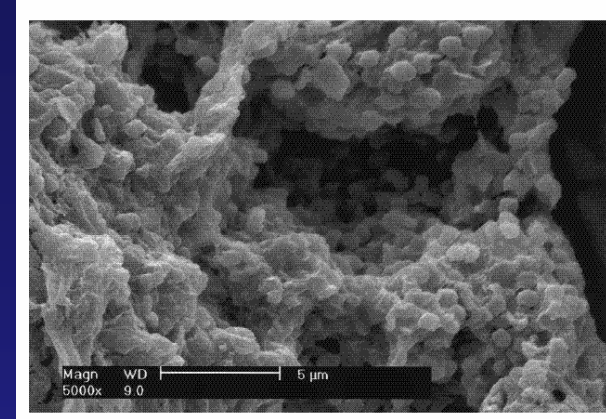
– Direct contact

- Crowding, contact sports
- Mother to child via breastfeeding
- From animals to humans

– Contaminated items

- Towels
- Sport equipment and clothes
- Sauna
- Tatoo
- Needle

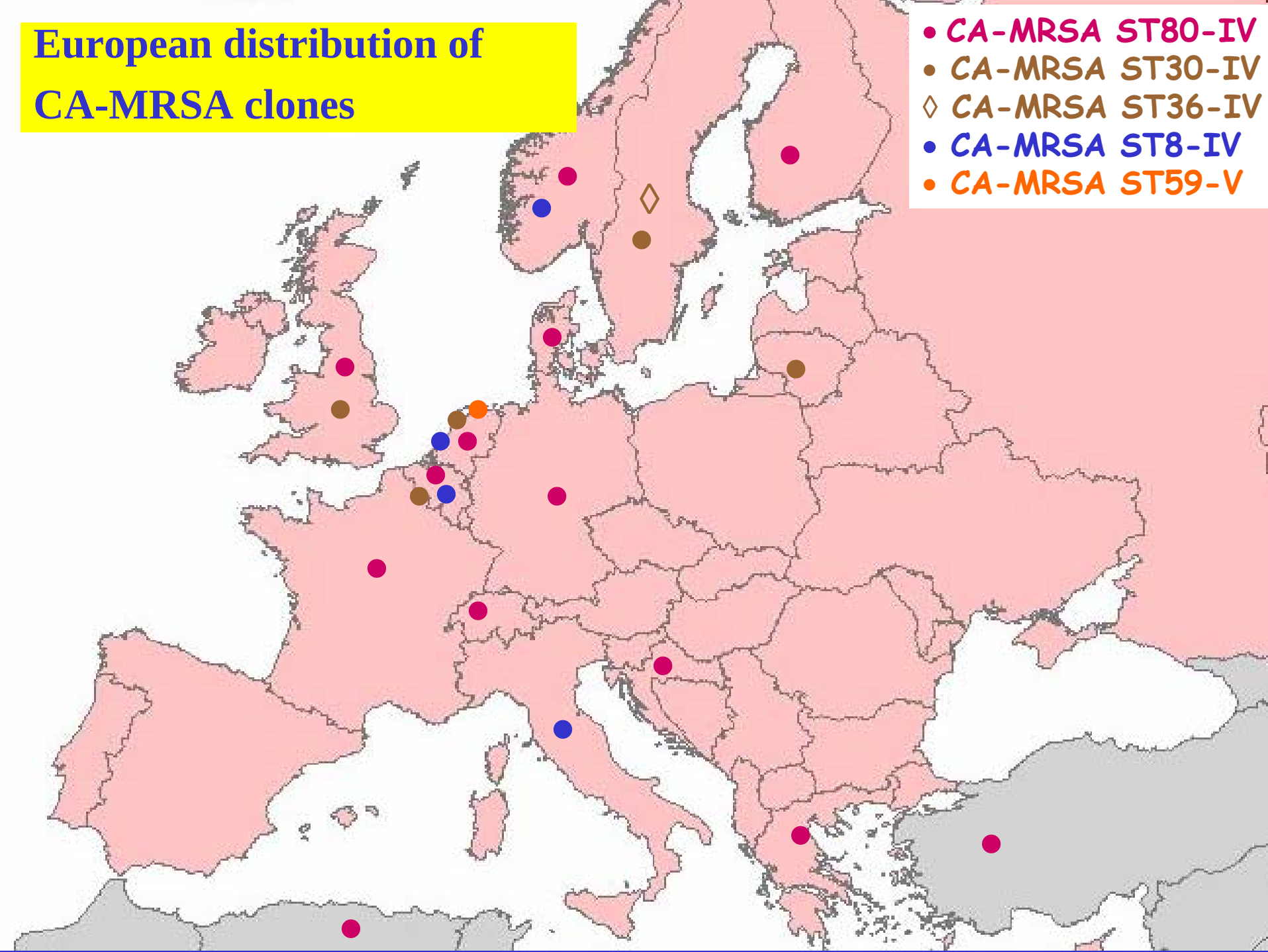
– Minor wounds or skin abrasions increase risk of infection



Van Duijkeren E et al. JCM 2005 43:6209
Gantz N et al. MMWR 2003 52:793
Bagget HC JID 2004 189:1565

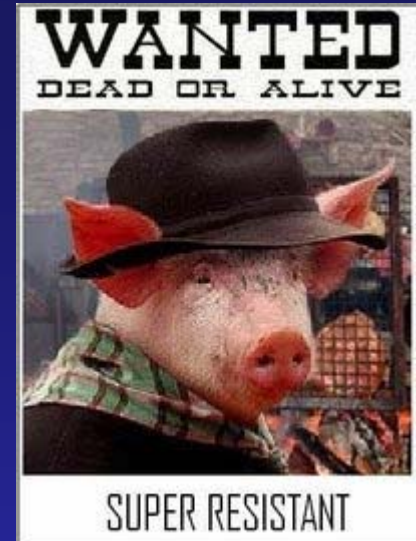
European distribution of CA-MRSA clones

- CA-MRSA ST80-IV
- CA-MRSA ST30-IV
- ◊ CA-MRSA ST36-IV
- CA-MRSA ST8-IV
- CA-MRSA ST59-V



Animals as a reservoir for MRSA

- Transmission between humans and animals
 - Cats, dogs, horses, cows and pigs
 - Transmission of human CA-MRSA and HA-MRSA
- Emerging animal reservoir: Pigs
 - Holland: familial outbreaks in pig farmers
 - High prevalence (5 to 23%) in veterinarians
 - PFGE non-typeable, PVL negative, ST398 and resistant to tetracycline, erythromycin, cotrimoxazole
 - Also in Horses, calves, ...
 - Described in France, Denmark, Spain, Italy,
 - ... and Belgium: horses, pigs, 7 human cases (> 2003)



What should we do to curb MRSA ?

To do list at SBIMC 2002 Meeting

Improved surveillance in hospitals	2007
Improved MRSA detection methods	2005
Antibiotic policy : antibiotic management teams	2002
Improved communication among health care workers: regional IC networks	2003
Surveys in nursing homes and the community	2005
Update of national guidelines	2003
Promotion of hand hygiene	2004
Multi Center Trials of control strategies	2007

Acknowledgements

- **ULB**

- **ISP-WIV**

- **Olivier Denis**
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- **Marie Hallin**
- **Claire Nonhoff**
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- **Baudouin Byl**
- **Francis Rost**
- **Huguette Strale**

- **Bea Jans**
- **Erik Hendrickx**
- **Carl Suetens**

- **BAPCOC**
- **GDEPIH-GOSPIZ**

- **All participants to the Belgian MRSA surveillance studies**