MRSA in animals: the Dutch experience

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Outline

- MRSA – background, the problem
- MRSA in farm animals
- MRSA in food products
- MRPI (MRSI) in companion animals
- MRSA and use of antimicrobials
- Future

Staphylococcus aureus

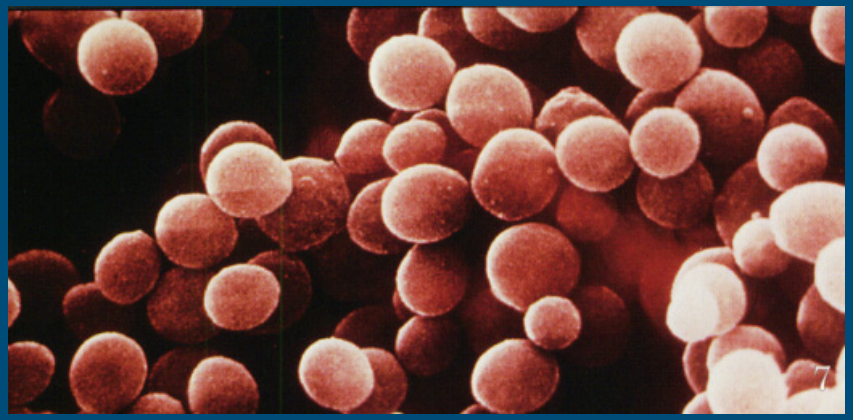
Gram positive coc

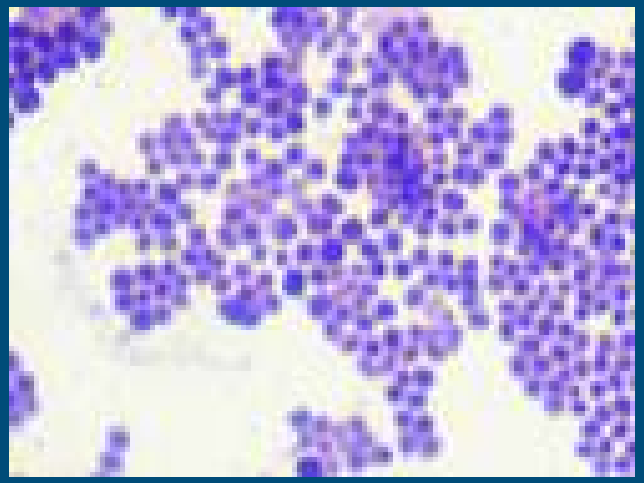
Cause of several veterinary problems:

- bovine mastitis
- problems in equine
- joints problems in chickens
- systemic disease in pigs (rare)
- pyodermia dog (more often *S. pseudintermedius/ intermedius*)

Human: 33% of healthy people are carrier

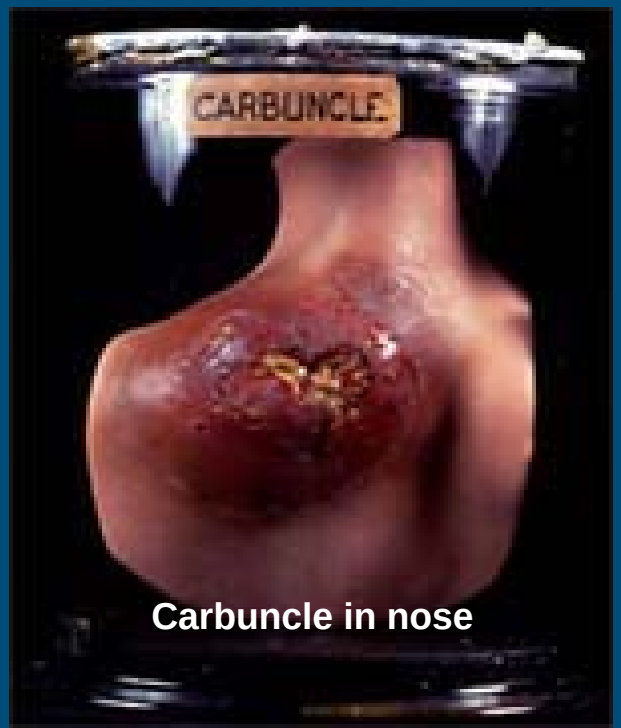
Veterinary carriers





Scalded Skin Syndrome (SSS)

Carbunculosis



Carbuncle in nose

Resistance in *S. aureus*

The first treatment:

penicillin (1930); end 40's: 50% *S. aureus* resistant)

1959: introduction methicillin; after 3 months 3/5000 R

2009: high frequent resistance against penicillines (by enzyme penicillinase/beta-lactamase) => clavulanic acid!)

Resistance against other groups of antimicrobials ''not extreme''

S. aureus becomes MRSA…..

……by acquiring *mecA* gen

- Methicillin Resistant *Staphylococcus aureus*
- Chromosome (Staphyloccal Chromosome Cassette - SCC*mec*)
- Penicillin binding protein PBP2a
- Resistant against all beta-lactam antimicrobials - penicillines, cephalosporines

  (beta-lactamase inhibitors like clavulanic acid are not active)

HA-MRSA and CA-MRSA (humans)

- HA-MRSA: Hospital acquired
  - emerged in the 60's (after introduction of methicillin in 1959)
  - multi-resistant but lame
  - antibiotic usage facilitates spread
  - most important control method is prevention of cross-infection

- CA-MRSA: Community associated
  - emerged in the 90's
  - in community – no relation health care settings
  - resistance moderate but often toxin (PVL+)
  - risk factors

A clone of methicillin-resistant *Staphylococcus aureus* among professional football players.

(Kazakova et al, 2005)

BACKGROUND: Methicillin-resistant Staphylococcus aureus (MRSA) is an emerging cause of infections outside of health care settings. We investigated an outbreak of abscesses due to MRSA among members of a professional football team and examined the transmission and microbiologic characteristics of the outbreak strain. METHODS: We conducted a retrospective cohort study and nasal-swab survey of 84 St. Louis Rams football players and staff members. S. aureus recovered from wound, nasal, and environmental cultures was analyzed by means of pulsed-field gel electrophoresis (PFGE) and typing for resistance and toxin genes. MRSA from the team was compared with other community isolates and hospital isolates. RESULTS: During the 2003 football season, eight MRSA infections occurred among 5 of the 58 Rams players (9 percent); all of the infections developed at turf-abrasion sites. MRSA infection was significantly associated with the lineman or linebacker position and a higher body-mass index. No MRSA was found in nasal or environmental samples; however, methicillin-susceptible S. aureus was recovered from whirlpools and taping gel and from 35 of the 84 nasal swabs from players and staff members (42 percent). MRSA from a competing football team and from other community clusters and sporadic cases had PFGE patterns that were indistinguishable from those of the Rams' MRSA; all carried the gene for Panton-Valentine leukocidin and the gene complex for staphylococcal-cassette-chromosome mec type IVa resistance (clone USA300-0114). CONCLUSIONS: We describe a highly conserved, community-associated MRSA clone that caused abscesses among professional football players and that was indistinguishable from isolates from various other regions of the United States.

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FOX Sports - NFL - St. Louis Rams Team Salary

ALL-PRO FOOTBALL 2K8 PLAY THE GAME THIS SUMMER. 2K SPORTS FOOTBALLRESURRECTED.COM

St. Louis Rams

Fan Poll Rank	FOXSports.com Rank
#30	#18

2006 SALARIES

Rk	Player	Salary (US$)
1	Orlando Pace	$18,000,000
2	Isaac Bruce	$7,400,000
3	Jeff Wilkins	$4,376,320
4	La'Roi Glover	$4,004,840
5	Dexter Coakley	$4,004,400
6	Marshall Faulk	$4,001,210
7	Leonard Little	$4,000,000
8	Drew Bennett	$2,751,050
9	Torry Holt	$2,735,000
10	Stephen Davis	$2,600,000
11	Steven Jackson	$2,287,500
12	James Hall	$2,256,160
13	Corey Chavous	$2,250,000
14	Randy McMichael	$2,000,000
15	Jason Fisk	$1,769,510
16	Ron Bartell	$1,724,000
17	Dante Hall	$1,550,000
18	Gus Frerotte	$1,500,000
19	Lenny Walls	$1,435,720
20	Will Witherspoon	$1,435,720
21	Alex Barron	$1,230,000

NFL TEAM PAYROLLS

Rk	Team	Payroll (US$)
1	Falcons	$121,715,529
2	Seahawks	$112,338,037
3	Raiders	$97,412,279
4	Rams	$96,030,523
5	Panthers	$95,217,046
6	Buccaneers	$94,190,888
7	Broncos	$93,987,851
8	Redskins	$90,863,421
9	Patriots	$90,585,828
10	Jaguars	$89,377,281
11	Ravens	$89,377,281
12	Texans	$89,377,281
13	Giants	$86,905,392
14	Chiefs	$86,496,585
15	Jets	$84,879,756
16	Cowboys	$83,593,328
17	Steelers	$80,477,220
18	Cardinals	$80,412,272
19	Bears	$78,287,213
20	Eagles	$78,242,782
21	Saints	$74,321,745

TEAM SALARIES

Rams

PLAYER SEARCH

Enter player's name

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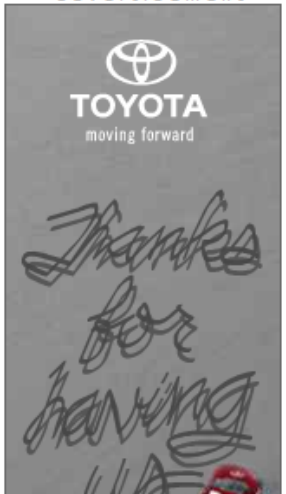

http://www.cdc.gov/ncidod/EID/vol12no10/pdfs/06-0387.pdf - Microsoft Internet Explorer provided by ICT Diergeneeskunde

Methicillin-resistant *Staphylococcus aureus* in Dutch Soccer Team

Xander W. Huijsdens,* Ans M. C. van Lier,† Eric van Kregten,‡ Liesbeth Verhoef,§ Marga G. van Santen-Verheuvel,* Emile Spalburg,* and Wim J. B. Wannet*

An outbreak of community-acquired methicillin-resistant *Staphylococcus aureus* occurred among members and close contacts of a soccer team. Typing of the isolates showed the outbreak was caused by the well-known European ST80-IV strain. To our knowledge, this is the first report of an outbreak of this strain among members of a sports team.

Community-acquired methicillin-resistant *Staphy-*

We report on the results of the screening that was conducted after MRSA was isolated from a boil on a Dutch soccer player and, subsequently, soft-tissue infections developed on other members of the soccer team.

The Study

Starting in June 2005, several players of a Dutch soccer team, consisting of ≈35 members, noted soft-tissue infections. In October 2005, the municipal health service received a report of a patient, a member of this soccer team, who had been hospitalized for an abscess resulting from MRSA. Other members of the team had skin infections as well, and screening was started.

A case was defined as a patient who had a culture-confirmed MRSA infection during the outbreak period October 2005 through January 2006. Healthcare staff obtained specimens by swabbing the patients' nose, throat, or wound. A total of 56 persons were screened: 42 members of the soccer club and 14 of their roommates. The 42 members consisted of soccer players, coaches, and people who used the same training facilities, locker room, and showers. The roommates screened were all those who lived with an MRSA-positive player and those who lived with an MRSA-negative player but had skin infections. Of

1 of 3
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MRSA in hospitals….

zibb.nl /gezondheidszorg > **zoekresultaat**

MRSA in Diaconessenhuis Meppel

Twee medewerkers en één patiënt besmet

MEPPEL - Een patiënt en twee medewerkers van het Diaconessenhuis in Meppel zijn besmet met de MRSA-bacterie. De patiënt is in een Frans ziekenhuis besmet geraakt.

AD Diagnose

www.AD.nl

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NIEUWS
Binnenland
Sportwereld

Audi daagt Porsche uit met de R8

Autowereld

donderdag 18 januari 2007

MRSA in Haags ziekenhuis

DEN HAAG - Het Hagaziekenhuis in Den Haag heeft een gedeeltelijk afgekondigd in verband met aanwezigheid van de MRSA-bacterie. afdelingen gynaecologie, verloskunde en neonatologie in het voo Kruisziekenhuis aan de Sportlaan.

CULTUUR | ECONOMIE | AGENDA | MISSIE

Kennis die werkt
Blik verruimen?
Klik hier!
HanzeConnect

Hoelang moet ú wachten op uw geld?

Contact
Abonnee voordeel online

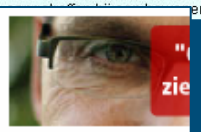
Rubrieken
Hoofdartikel
Beschouwing over

zaterdag, 27 juli 2002, Regio

MRSA onder controle in verpleeghuis Sneek

Sneek – De ziekenhuisbacterie in verpleegtehuis De Ielânen in Sneek is onder

BRABANTS DAGBLAD



4 februari 2007

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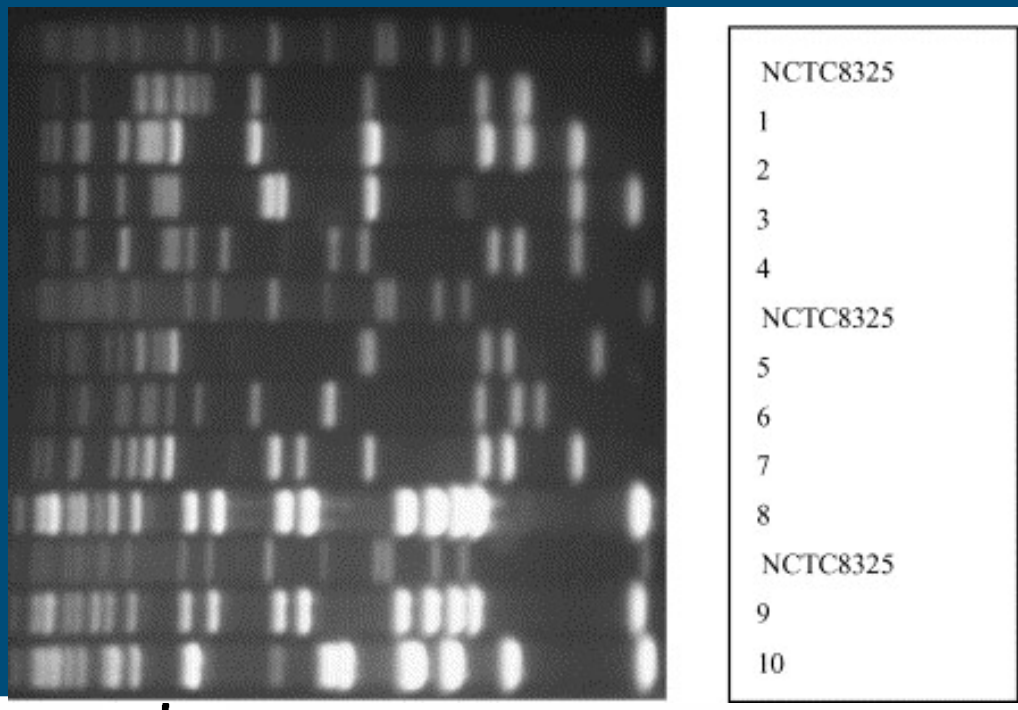
Ziekenhuis Bernhoven Veghel mrsa-vrij

van een verslaggever

Zaterdag 18 november 2006 - Veghel - Ziekenhuis Bernhoven in Veghel lijkt verlost van de mrsa-bacterie. Althans, de chirurg en de medewerker van het ziekenhuis, bij wie vorige week een mrsa-bacterie werd geconstateerd, dragen de bacterie niet meer bij zich. Beiden zijn weer aan het werk.

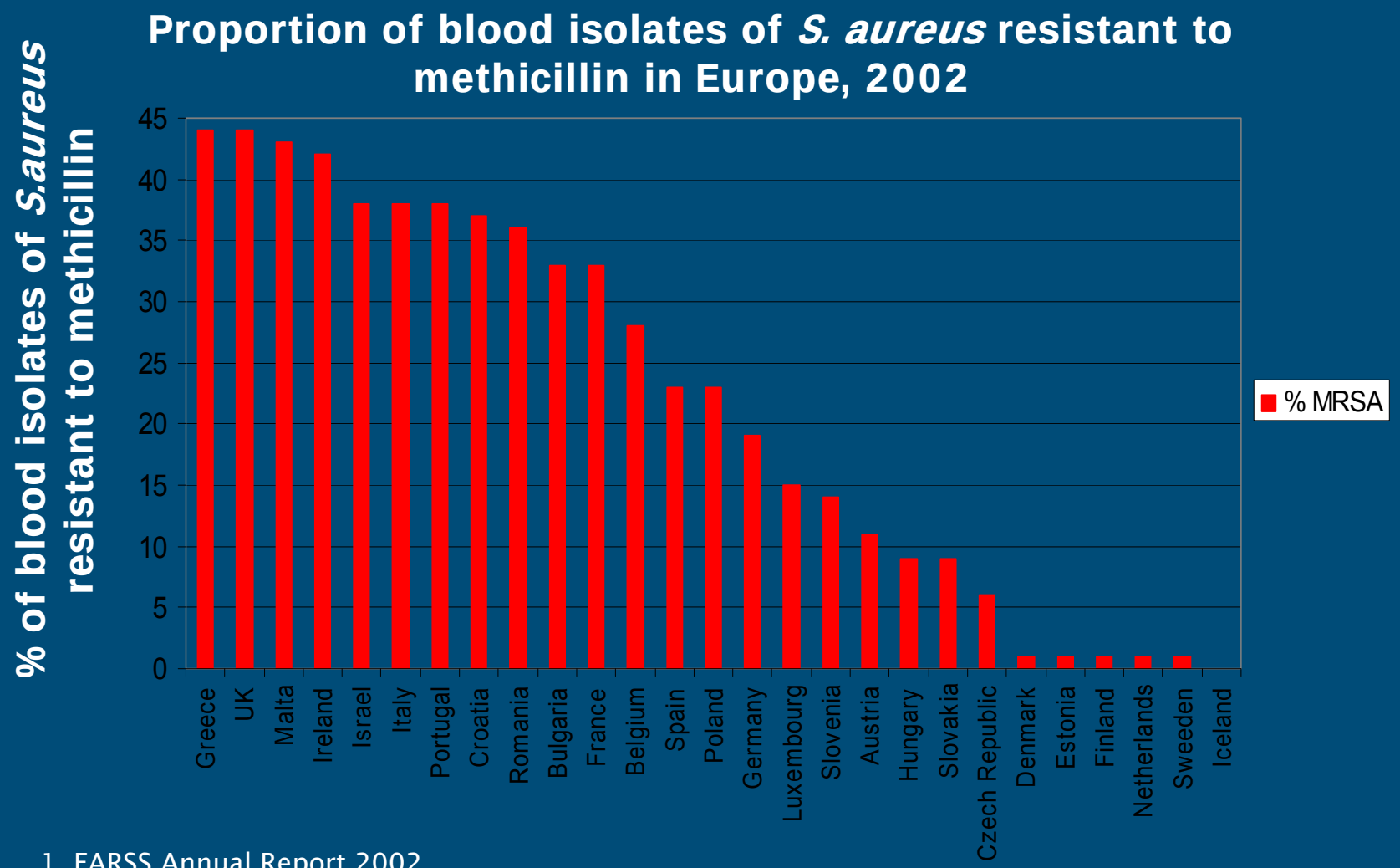
MRSA: database in RIVM - Bilthoven

- Staphylococcal Cassette Chromosome *mec* (SCC*mec)*
- Typing:
  - PFGE
  - Spa-typing
  - MLST
- NT-MRSA



MRSA in hospitals: a problem?

MRSA in Europe



1 EARSS Annual Report 2002

MRSA in health care settings

- MRSA infections are more difficult to treat
  - less effective antibiotics available
  - no new drugs on the horizon
  - without an effective control strategy > 50-60%
  - high morbidity and mortality
  - increases costs (more expensive drugs, longer duration of hospitalization, more diagnostics)

MRSA in the Netherlands (humans)

- Prevalence of MRSA among clinical isolates < 1%
- Dutch policy for health care institutions:
  - Restrictive use of antibiotics
  - MRSA search and destroy policy:
    - Screening of persons at high risk for MRSA at admission to a hospital
    - Isolation of colonized patients and decolonization therapy
- Prevalence of MRSA in the Dutch community < 0.1%

WIP – MRSA guideline

WERKGROEP INFECTIE PREVENTIE

Implemented in 1984

Category when entering the hospital:

1: MRSA carrier → isolation + eradication
2: high increased risk for carriership → isolation + screening
3: moderate increased risk → screening
4: no increased risk

MRSA in Dutch hospitals

→ Isolation:

Ward with anteroom

Emergency: MRSA separate room

surgery program/X-ray → end of the day/disinfection

→ Screening: culture of nares, throat and perineum

MRSA in Dutch hospitals

Dutch Health Council (October 2006):

Proceed with current policy → discontinuation will be more expensive

MRSA control in humans

- Use of antimicrobials facilitates colonization and spread
- Most important control measure: prevent cross contamination!
- “search and destroy” strategy

MRSA and animals (slide 2003….)

- MRSA in dogs, cats, rabbits, horse, chickens, cattle, pigs: sporadic cases
- MRSI in dogs with pyodermia from Spanje
- Methicillin resistant CoNS in sheep UK and horses from Japan

2004: 3 human cases NT-MRSA pig related (NL)

- Daughter of a pig farmer (+ pigs)
- Son of pig veterinarian
- Pig farmer (+ pigs)
- Studygroup pig farmers (23% +)

- Not identified as risk group!
- Till 2002 no ‘’pig-MRSA’’ (NT-MRSA)
- Many pig farmers, many people in contact with pigs, nurses living on farms…….

Pigs: preliminary screening

- 9 slaughterhouses with 6 herds each (10 swabs per herd):
  - 209/540 pig +
  - 44/54 herds +
- All isolates tetracyclin resistant
- All isolates TMPS sensitive
- No clinical signs in pigs

De Neeling et al., Vet. Microbiol. 2007

Dutch MRSA programme (Min Agriculture)

Programme management

Communication and education

Data management & internet wg environment

Harmonization & optimalization MRSA detection

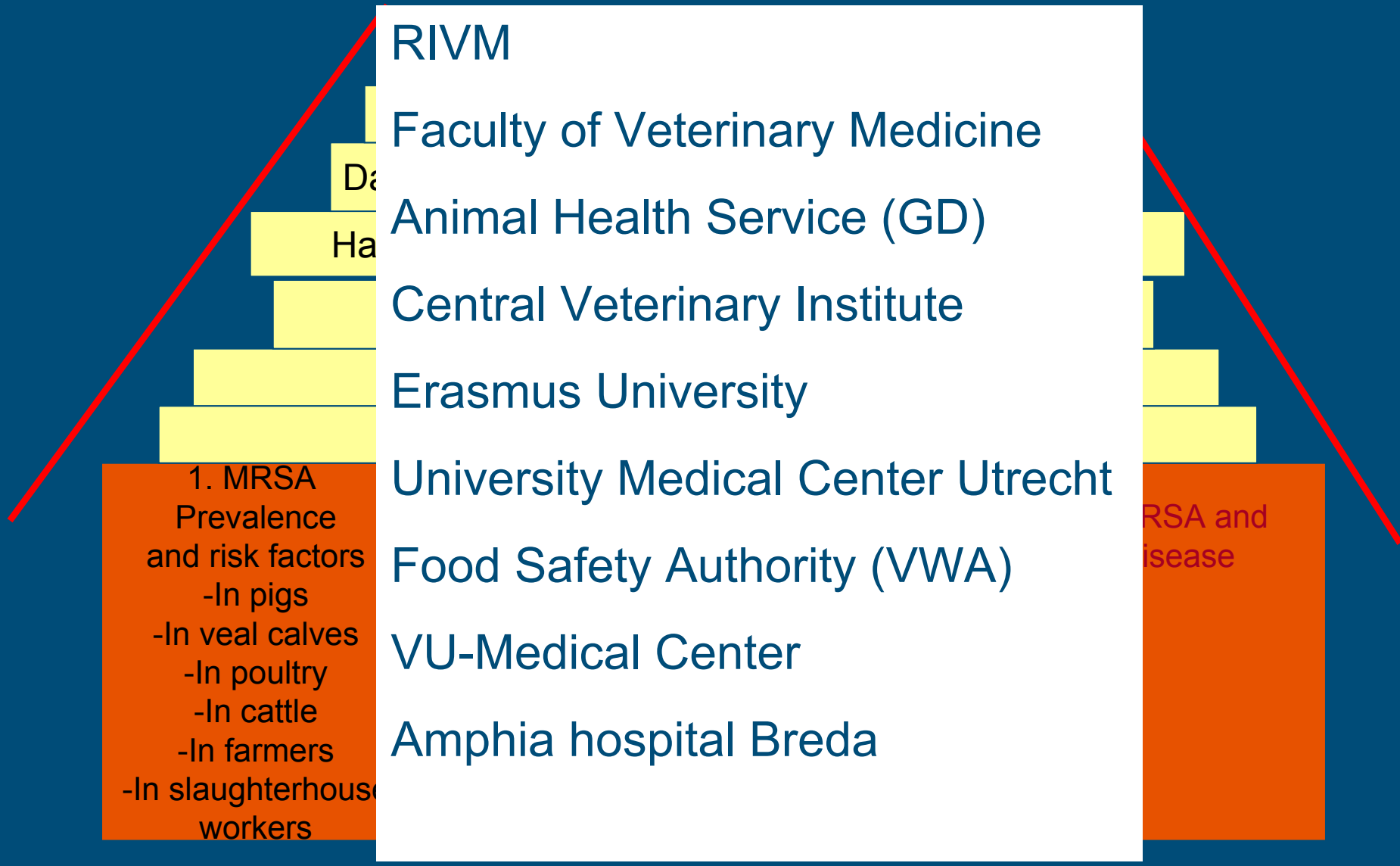
Genotyping MRSA isolates

Resistance testing MRSA isolates

Genetic characterization MRSA

1. MRSA Prevalence and risk factors	2. MRSA transmission in production chains	3. MRSA In raw meats	4. MRSA and Disease
-In pigs -In veal calves -In poultry -In cattle -In farmers -In slaughterhouse workers			

Dutch MRSA programme (Min Agriculture)



- RIVM
- Faculty of Veterinary Medicine
- Animal Health Service (GD)
- Central Veterinary Institute
- Erasmus University
- University Medical Center Utrecht
- Food Safety Authority (VWA)
- VU-Medical Center
- Amphia hospital Breda

Results of the MoA funded project

- Pigs (Els Broens)
  - 56% of the farms MRSA +
- Pig farmers (Ingrid van de Broek)
  - 14% MRSA +
- Raw meat (Enne de Boer)
  - 1-31% (import chicken – turkey)

Veal farming

- Prevalence MRSA veal calves 28%
- Prevalence MRSA veal farms: 88%
  (MRSA positive calves and/or dust samples found)
- Risk factors MRSA veal calves: age, number of calves on the farm, rodent control, hygiene and antibiotic use

Haitske Graveland PhD student

Veal farming

- Veal farmers (16%)
  - Large differences between farmers (33%) and family members (8%)
  - Strong association with working hours and percentage MRSA positive calves

Haitske Graveland PhD student

MRSA in meat

	% positive
Beef	9,6
Calf	16,8
Lamb/sheep	5,6
Porc	10,4
Chicken (EU)	27,3
Chicken (import)	1,3
Turkey	31,3
Game	3

Additional studies and other animal species

MRSA in different kinds of pig farms

- Screening of 31 pig farms (farrowing, rearing and finishing)
- 7/31 farms MRSA positive (23 %)
- 1 farm MRSA negative, farmer MRSA positive
  - Treatment with tetracycline
  - 8/10 pigs MRSA positive
- All MLST 398, NT-MRSA
- Use of antibiotics risk factor

Van Duijkeren et al., Vet Micobiol. 2007

- More about risk factors: study Els Broens RIVM/GD/WUR

Clinical disease in pigs?

- One case with exsudative dermatitis

DISPATCHES

Methicillin-Resistant *Staphylococcus aureus* in Pigs with Exudative Epidermitis

Engeline van Duijkeren,* Marc D. Jansen,†
S. Carolien Flemming,* Han de Neeling,‡
Jaap A. Wagenaar,* Anky H.W. Schoormans,*
Arie van Nes,* and Ad C. Fluit†

EID 2007

DISPATCHES

MRSA Transmission between Cows and Humans

Éva Juhász-Kaszanyitzky,* Szilárd Jánosi,*
Pál Somogyi,* Ádám Dán,*
Linda van der Graaf-van Bloois,†‡
Engeline van Duijkeren,‡
and Jaap A. Wagenaar†‡

We isolated methicillin-resistant *Staphylococcus aureus* (MRSA) from cows with subclinical mastitis and

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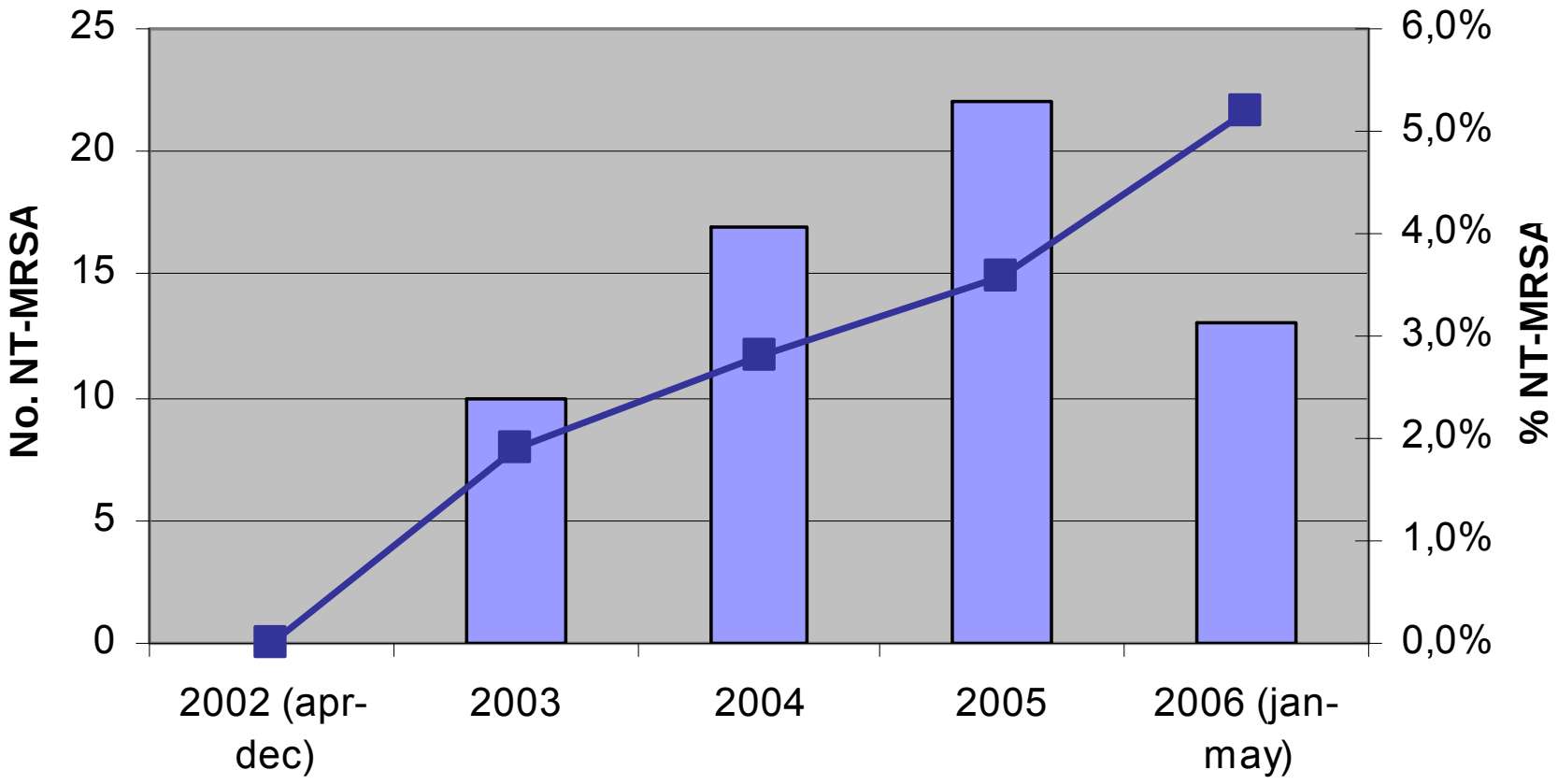
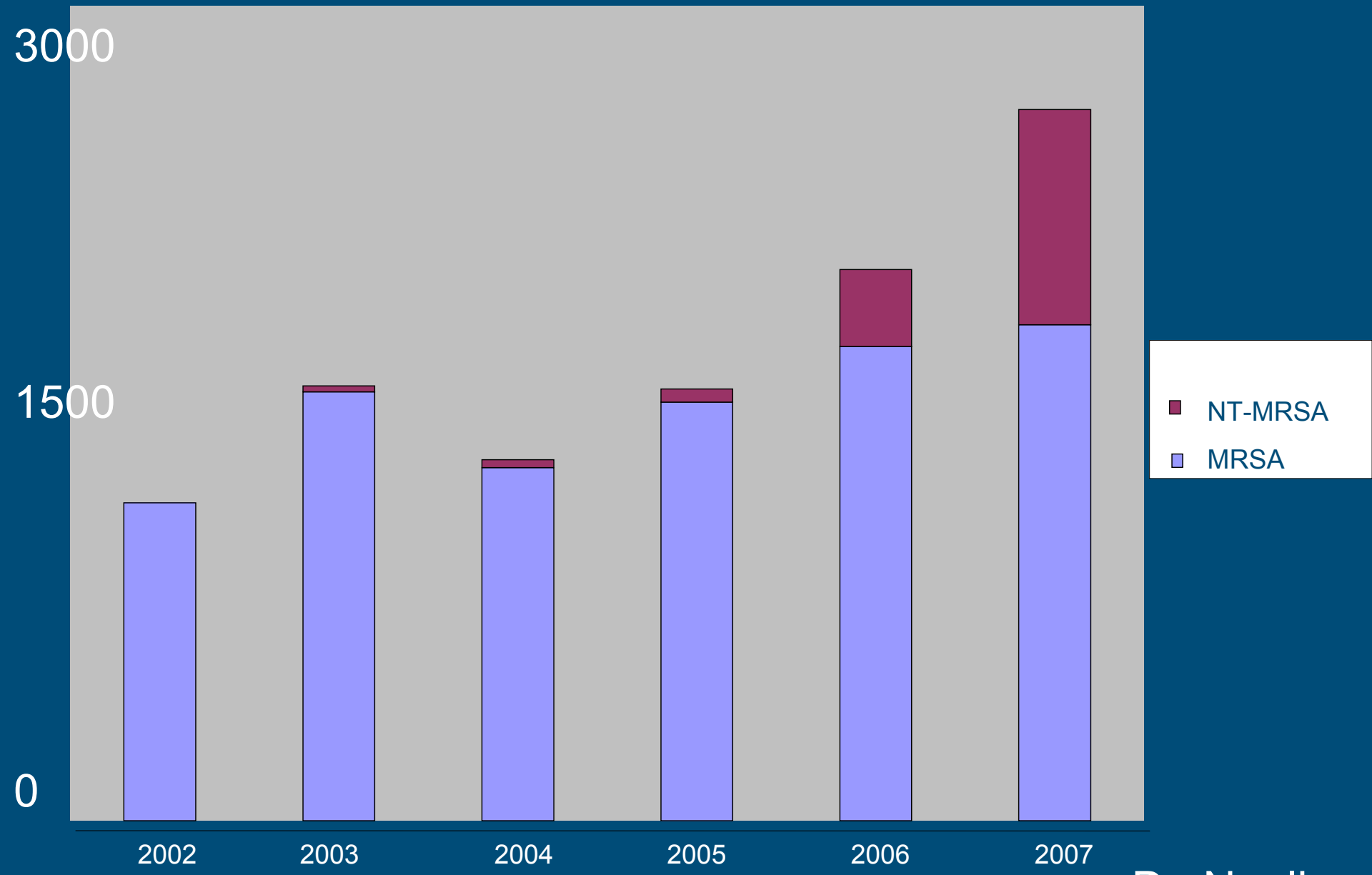
Humans and NT-MRSA (and concern of medical microbiologists)

- Many asymptomatic carriers (farmers etc)
- Few clinical cases are described
- Source: case control study => pig and cattle farmers
- Problem: risk for introduction into hospitals: Continuation of Search and Destroy (€€€)
- Spread within hospitals does not (yet) occur often (but what if…..)
- MRSA in food
- Risk for humans – specific groups – community

Emergence of NT-MRSA in the Dutch MRSA-surveillance





De Neeling

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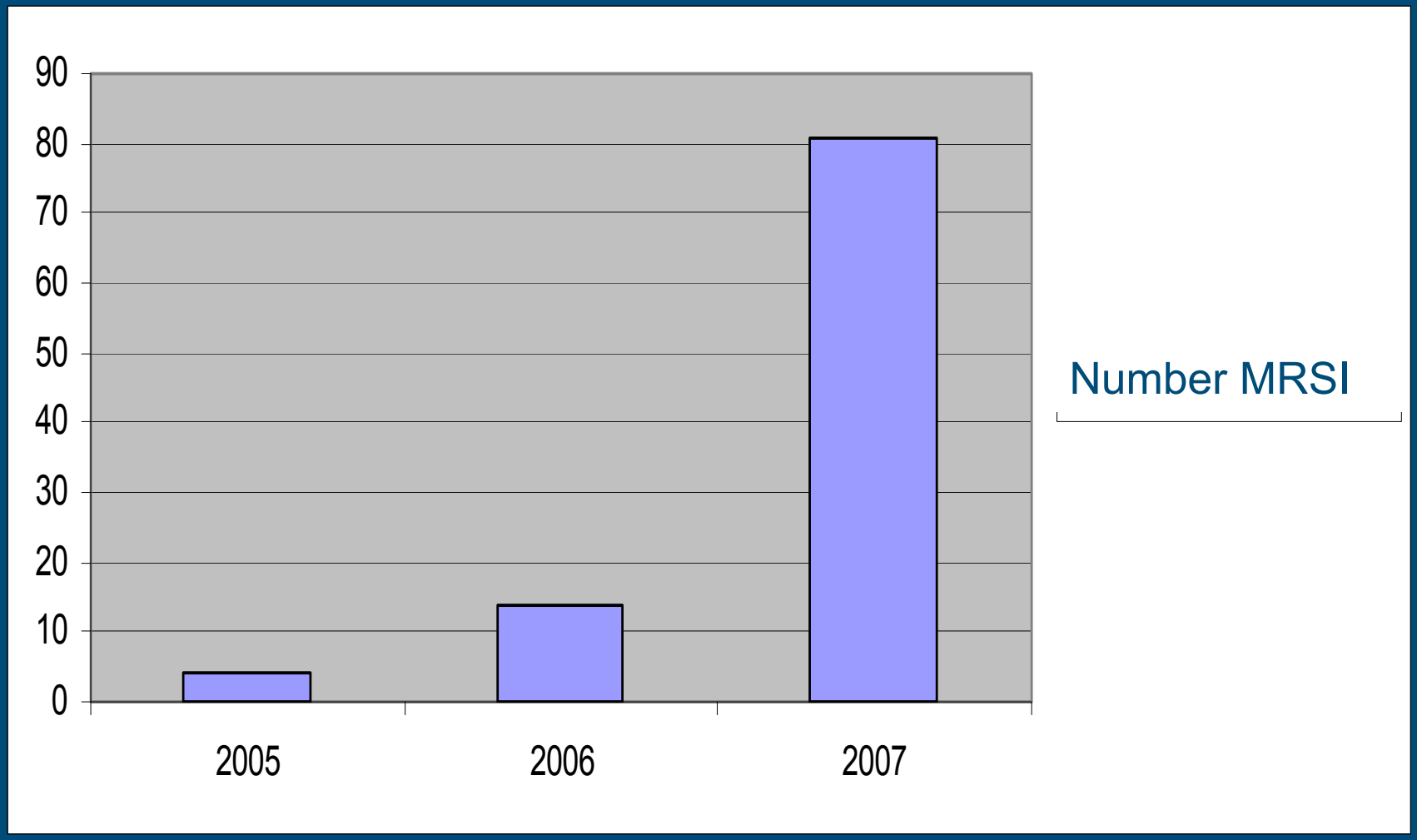
What is the origin of MRSA?

- emerging and not only by improved detection
- coagulase negative Staphylocci contain resistance cassette - transfer of genetic material?
- non MRSA ST398 was already in pigs!
- NT-MRSA clonal but not the same: one recombination and subsequently development of this clone into diverse lines?
- Not restricted to the Netherlands

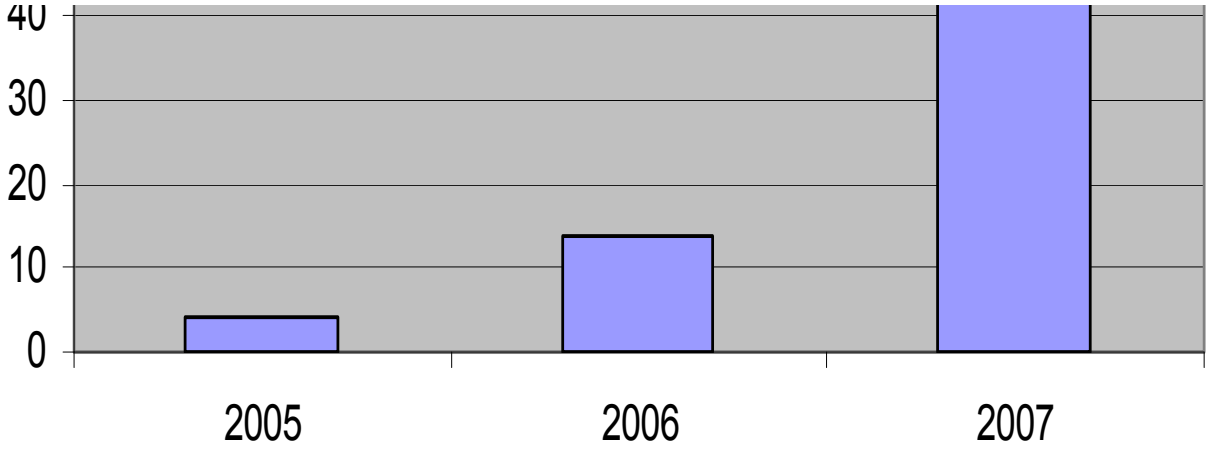
Isolation of MRSI from companion animals



Isolation of MRSI from companion animals

Transmission of methicillin-resistant *Staphylococcus intermedius* between humans and animals.

Van Duijkeren et al, Vet Microbiol 2008.



S. pseudintermedius - humans

Human samples: positive/total (%)		
Human total	Human vet clinic	Human household
8/168 (4.8%)	5/120 (4.2%)	3/48 (6%)

Starting point for control strategies

- High levels of contamination in (mainly) production animals
- Spill over towards companion animals/horses
- Association with use of antimicrobials (!?)

MRSA control in humans

- Use of antimicrobials facilitates colonization and spread
- Most important control measure: prevent cross contamination!
- “search and destroy” strategy

MRSA negative pig production chains

- Sensitivity of testing
- Risk for introduction
- Antimicrobial use low but no use?
  - Co-selection (chloramphenicol)
  - Disappearance of resistent micro-organisms?
- Changes basic systems (management)

Additional remarks control strategies

- Trade (NL Q1-3 2006)
  - 3.900.000 piglets exported
  - 2.100.000 fattening pigs exported
- Cross-contamination (dust)
  - From veterinarian to animals?
  - Ordinary hygiene procedures sufficient?

MRSA negative veal farming?

- Origin of animals diverse
- Use of antimicrobials

Future approach

- What do we want?
  - Prevent colonization/contamination farmers
  - Prevent contamination of meat?
- Reduction of MRSA load
  - Low use of antimicrobials
  - Reduce dust in houses
- Quantitative approach and measurements

Future threats

- MRSA will not be the last one: ESBLs!

Thanks to:

- Engeline van Duijkeren
- Dik Mevius
- Dirk Houwers
- Haitske Graveland
- Dick Heederik
- Isabella Oosting
- Marian Broekhuizen-Stins
- Anky Schoormans
- Arie van Nes
- Ad Fluit
- Marc Jansen
- Mara Kamphuis
- Marjan Wassenberg
- Annet Troelstra
- Jan Kluytmans
- Mireille Wulf
- Arjen van de Giessen
- Han de Neeling
- Xander Huijsden
- Peter van der Wolf
- Els Broens
- Enne de Boer
- Chantal van der Mije

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