

Teen's staph death worrisome

Strong drug-resistant bacteria can lead to severe pneumonia

Wednesday, January 9, 2008 3:19 AM

BY JOSH JARMAN
THE COLUMBUS DISPATCH

It's the kind of worst-case scenario that worries health-care professionals. A county teen dies of an antibiotic-resistant staph infection.

Tyler Bundock, 14, died Monday at Nationwide Children's Hospital in Columbus, where he was being treated.

MSNBC.com

'Superbug' deaths could surpass AIDS

Drug-resistant germs becoming more common, government report finds

The Associated Press
Updated: 4:03 p.m. ET Oct 16, 2007

CHICAGO - More than 90,000 Americans get potentially deadly infections each year from a drug-resistant "superbug," the government reported Tuesday in its first overall estimate of invasive disease caused by the

Deaths tied to these infections may exceed those caused by AIDS, said one public health expert commenting on the new study. The report shows just how far one form of the staph germ has spread beyond its traditional hospital setting.

CNN.com

Experts: Drug-resistant staph deaths may surpass AIDS toll

- Story Highlights
- CDC: More than 90,000 get potentially deadly "superbug" infections annually
- The incidence rate was about 32 invasive infections per 100,000 people
- Prevention methods include curbing the overuse of antibiotics

CHICAGO, Illinois (AP) — More than 90,000 Americans get potentially deadly infections each year from a drug-resistant staph "superbug," the government reported Tuesday in its first overall estimate of invasive disease caused by the germ.

Deaths tied to these infections may exceed those caused by AIDS, said one public health expert commenting on the new study. The report shows just how far one form of the staph germ has spread beyond its traditional hospital setting.

The overall incidence rate was about 32 invasive infections per 100,000 people. That's an "astounding" figure, said an editorial in Wednesday's Journal of the American Medical Association, which published the study.



Experts: U.S. Deaths From Deadly Drug-Resistant Staph May Surpass AIDS Deaths

Tuesday, October 16, 2007

Associated Press

CHICAGO —

More than 90,000 Americans get potentially deadly infections each year from a drug-resistant staph "superbug," the government reported Tuesday in its first overall estimate of invasive disease caused by the germ.

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MSNBC.com

21 schools shut after teen dies of staph

Virginia student contracted drug-resistant strain of infection

The Associated Press
Updated: 1:42 p.m. ET Oct 16, 2007

BEDFORD, Va. - A high school student who was hospitalized for more than a week with an antibiotic-resistant staph infection has died, and officials shut down 21 schools for cleaning to keep the illness from spreading.

Ashton Bonds, 17, a senior at Staunton River High School, died Monday after being diagnosed with Methicillin-resistant Staphylococcus aureus, or MRSA, his mother said.

MSNBC.com

Spike in staph infections at schools

Outbreaks, which include drug-resistant strain, more common in athletes

By LARRY O'DELL
Associated Press Writer
The Associated Press
Updated: 7:50 p.m. ET Oct 12, 2007

RICHMOND, Va. - Schools across the country are reporting outbreaks of staph infections, particularly among athletes, and the germs include an antibiotic-resistant strain that is sometimes associated with serious skin problems and blood disorders.



The Ohio State University

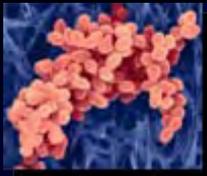
College of Veterinary Medicine

College of Public Health

Zoonotic MRSA: A New Headache?

Armando E. Hoet, DVM, PhD, DACVPM

Veterinary Public Health Coordinator



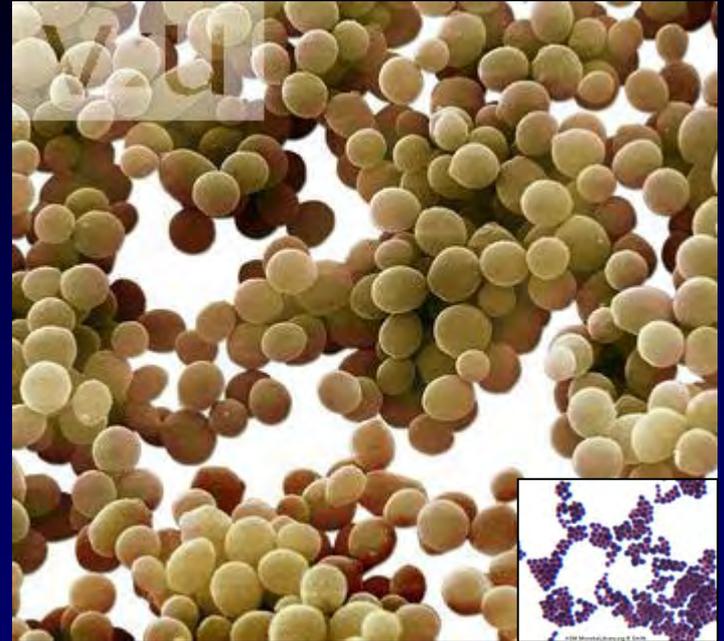
MRSA

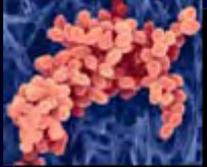
- 1. Background**
- 2. Colonized vs. Infected**
- 3. Is MRSA important?**
- 4. Prevalence of MRSA in Animals**
- 5. Zoonotic Transmission of MRSA**
- 6. Guidelines for treatment decision making**

Background

➤ Etiology

- Genus: *Staphylococcus*
- Species: *Staphylococcus aureus*
- Gram positive cocci bacterium
- Coagulase positive
- Normal inhabitant of skin and/or nose of healthy people and animals
- No detrimental risks to immunocompetent host
- Severe infection or death in immunocompromised host



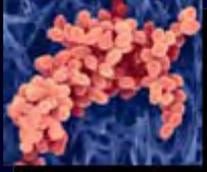


Background

➤ Etiology

Methicillin (Oxacillin)-resistant *Staphylococcus aureus* (MRSA)

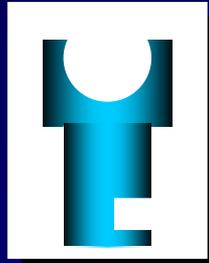
- MRSA as well as other *Staphs* spp expressed an **altered penicillin-binding protein (PBP2a)** that is encoded in the *mecA* gene
- The PBP2a binds beta-lactams with lower avidity than normal PBP, which results in **resistance to all β -lactam antimicrobial agents**



Background

➤ Normal Cell Wall Activity of Staphs

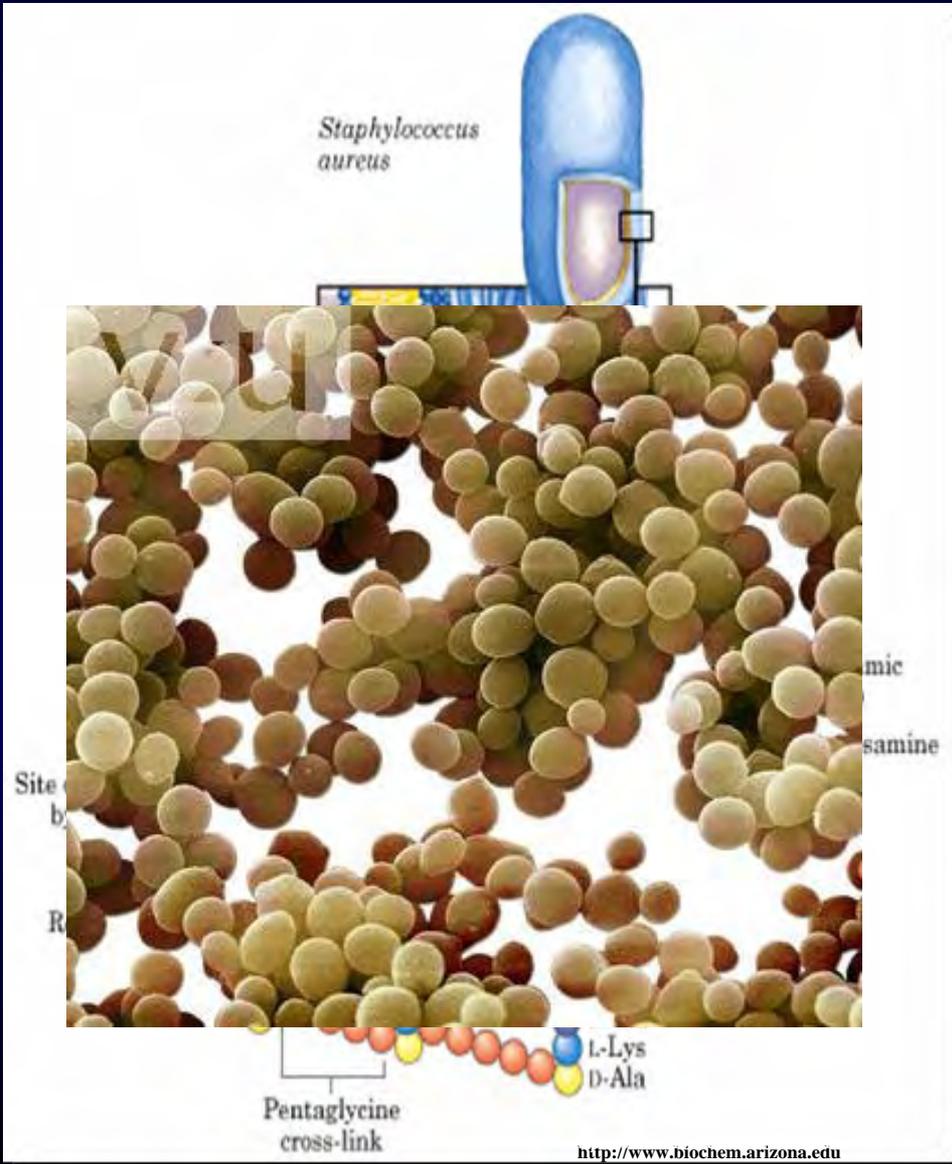
**Penicillin Binding Protein
PBP
(Transpeptidase)**



**Cross link aa's of sugar chains
to form 3D structure of
peptidoglycan layer**

**Bacteria Cell Wall
Biosynthesis**

**Bacteria Growth
and Multiplication**

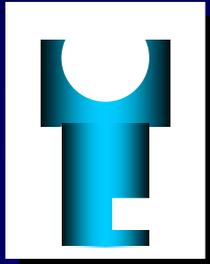


Background



➤ Antimicrobial activity of β -lactam drugs

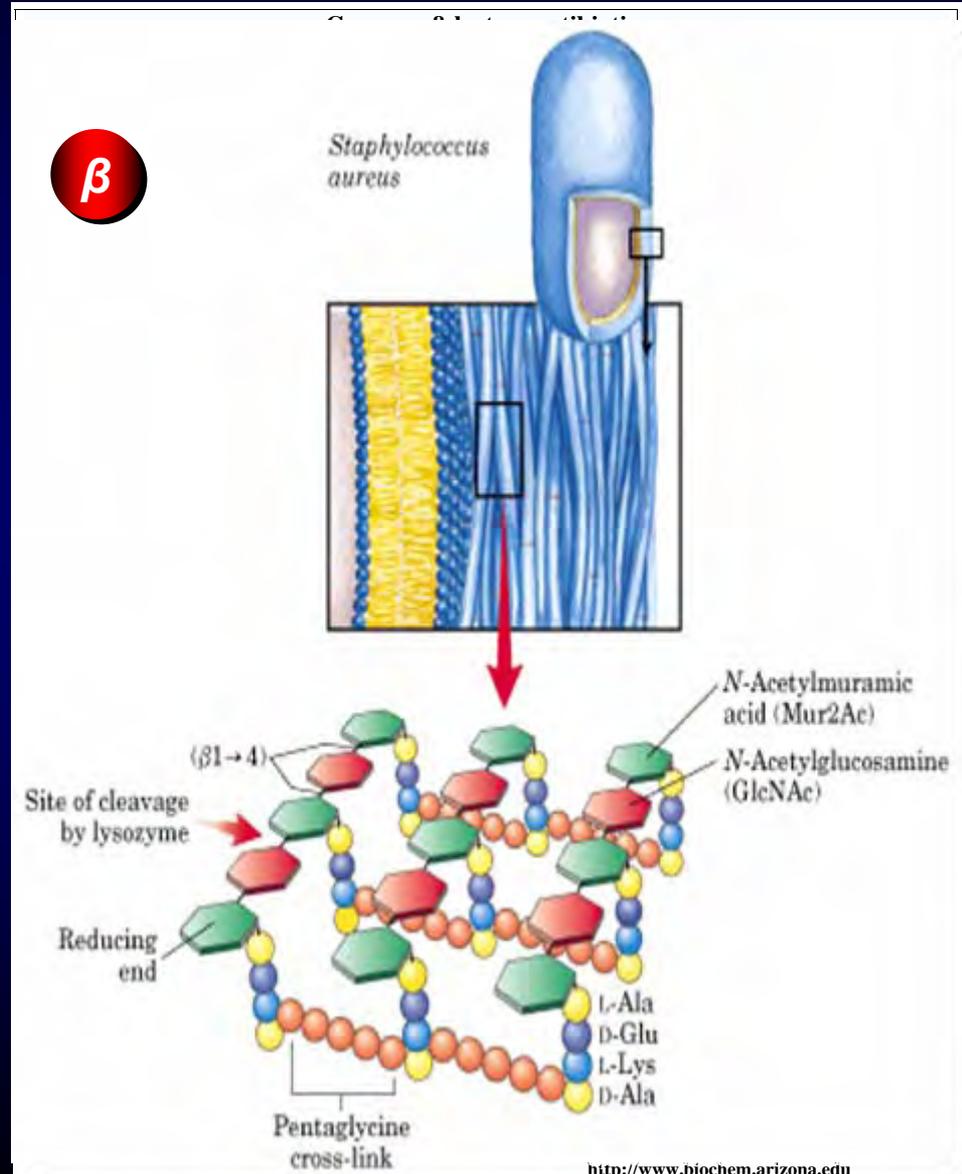
Penicillin Binding Protein
PBP
(Transpeptidase)



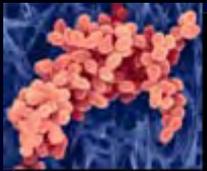
Disruption of peptidoglycan
Synthesis

Trigger Bacteria
Autolysis

Bacterial Death
(Bactericidal)

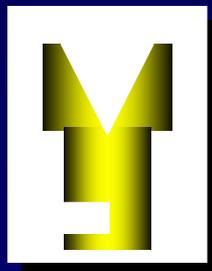


Background



➤ Antimicrobial Resistance to β -lactam drugs (MRSA)

Altered Penicillin Binding Protein – PBP2a (Transpeptidase)



Cross link aa's of sugar chains to form 3D structure of peptidoglycan layer

Bacteria Cell Wall Biosynthesis

Bacteria Growth and Multiplication

β β β β

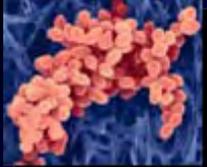
Staphylococcus aureus

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cross-link

<http://www.biochem.arizona.edu>

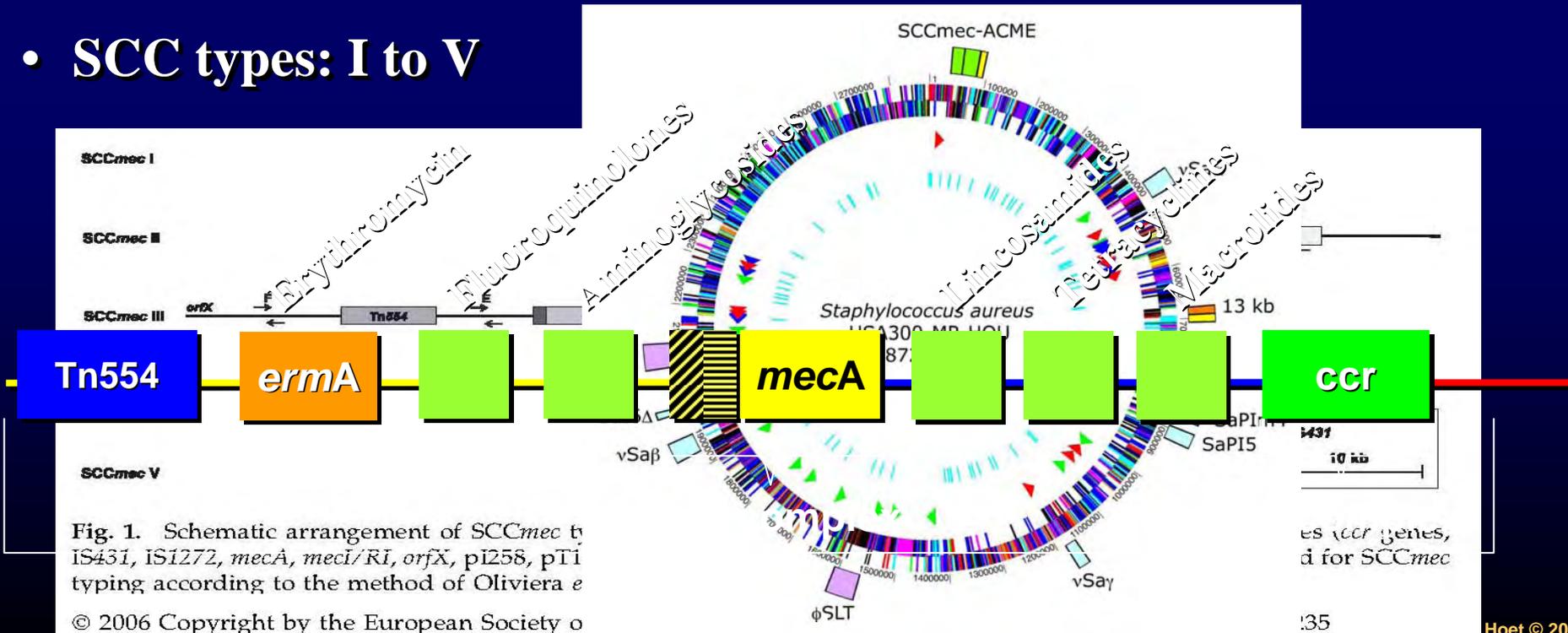


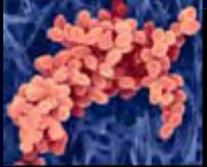
MRSA

➤ Etiology

Methicillin (Oxacillin)-resistant *Staphylococcus aureus* (MRSA)

- *mecA* gene is contained in a “mobile” genetic element: SCC*mec*
- Staphylococcal cassette chromosome *mec*
- SCC types: I to V

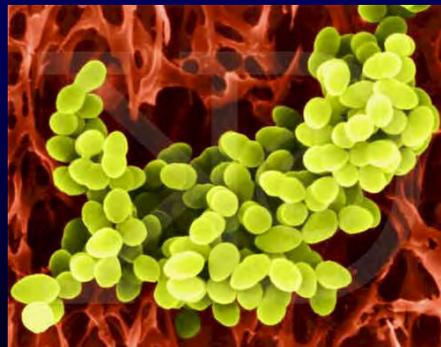




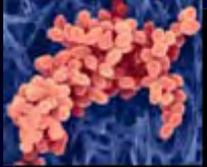
MRSA

➤ Etiology

- MRSA can be isolated from dogs, cats, horses, pigs, and other animals
- Methicillin-resistant *S. intermedius* (MRSI)
- Methicillin-resistant *S. schleiferi* (MRSS) subspecies *coagulans*



COLONIZED VS. INFECTED

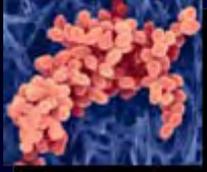


MRSA

➤ Colonization vs. Infection

- **Colonized** individuals can carry the organism but show no clinical signs or symptoms of infection, and can harbor the organism for many months
 - **Dogs and other animals have not shown long term colonization (this is a human pathogen)*****
 - **Maybe different in pigs and horses...**
- **Infected** individuals are showing clinical manifestations or negative health effects due to the presence of the microorganism
 - **Animals can get infected!!**

IS MRSA IMPORTANT?



MRSA

➤ Epidemiology

- Occurrence – Human side

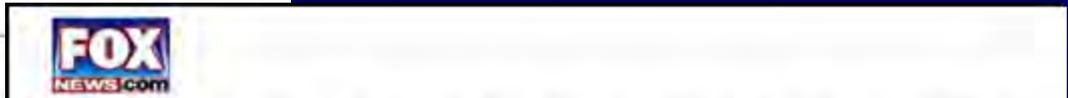
- The estimated number of people developing a serious MRSA infection (i.e., invasive) in 2005 was about 94,360
- Approximately 18,650 persons died during a hospital stay related to these serious MRSA infections



'Superbug' deaths could surpass AIDS
 Drug-resistant germs becoming more common, government report finds
 The Associated Press
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Experts: U.S. Deaths From Deadly Drug-Resistant Staph May Surpass AIDS Deaths



Experts: Drug-resistant staph deaths may surpass AIDS toll

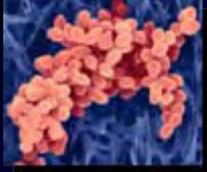
- Drug-resistant germs
- CDC: More than 90,000 get potentially deadly "superbug" infections each year
- The toll may rise to about 120,000 by 2010, says report
- Infections include meningitis, pneumonia, bloodstream infections

CHICAGO, Illinois (AP) — More than 90,000 Americans get potentially deadly infections each year from "superbug," the government reported Tuesday in its first overall estimate of invasive d...
 Deaths tied to...
 hospital setti...

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MRSA

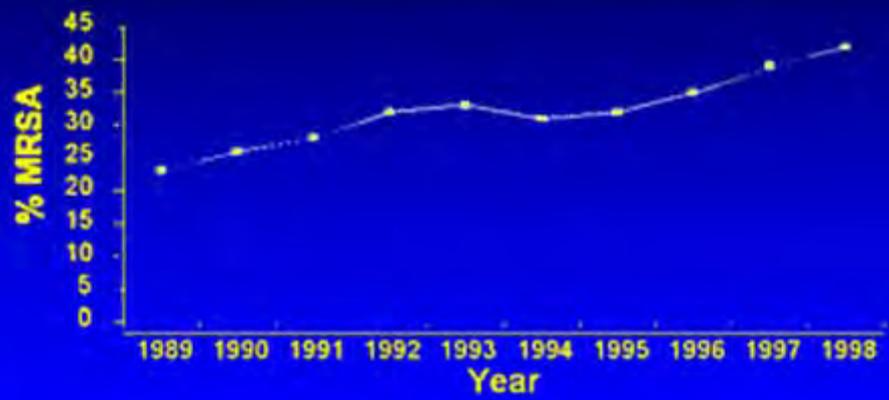
➤ HA-MRSA VS. CA-MRSA

Hospital-associated MRSA (Hospital-acquired MRSA)

- Increasing prevalence (CDC):

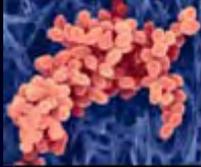
1971: 2 % => 2004: 63 % => 2007: 70-95 %

Percentage of Nosocomial *Staphylococcus aureus* Reported as Resistant to Methicillin, by Year*



*National Nosocomial Infections Surveillance (NNIS) System Data, 1989-1998.



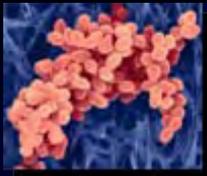


MRSA

➤ Epidemiology

- Occurrence – Human side

- Approximately 25% to 30% of the US population is colonized in the nose with *Staph* bacteria (normal flora)
- According to CDC approximately 1% of the US population is colonized with MRSA
- Up to 4.6% of inpatients at US health care facilities are colonized/infected (APIC, Am J Infect Control. 2007 Dec)



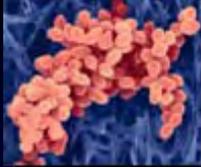
MRSA

➤ Epidemiology

- Occurrence – Animal Side

- It is in general unknown...
- Few MRSA epidemiological studies
 - Mostly cross sectional
 - Associated with outbreaks in veterinary clinics
 - Target specific group of animals



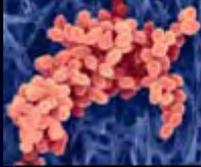


MRSA

➤ Epidemiology

- Occurrence – Animal Side

- 14% MRSA in patients with *S. aureus* infections at 7 veterinary teaching hospitals Middleton et al. 2005
- 1% nasal MRSA carriage rate in dogs in referral hospitals Hanselmann et al. 2005
- 4.7% isolation rate of MRSA in screened horses rising to 12% using targeted surveillance Weese et al. 2005
- 0.6% MRSA carriage in dogs rising to 8% in dogs clinically assessed as suspect cases Abbott et al. 2006
- Approx. 0.48% of equine cases presented at veterinary teaching hospital infected with MRSA Cuny et al. 2006
- 2.7 % of MRSA colonization rate in horses admitted to a veterinary teaching hospital Weese et.al. 2006



MRSA

➤ Epidemiology

- Occurrence – Animal Side (Preliminary Data)

– OSU-VTH

- 2004-2006 (3 year retrospective study)

- The Ohio State University Veterinary Hospital's
Clinical Microbiology Laboratory

- 53 MRSA out of 109 *S. aureus* samples

- 48.6% of all *S. aureus* identified were methicillin
resistant

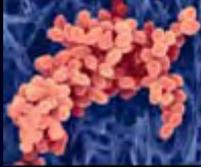
- Distribution of MRSA by species:

- » Dogs: 33 / 53 MRSA (63 %)

- » Horses: 16 / 53 MRSA (30 %)

- » Cats: 3 / 53 MRSA (6 %)

- » Llamas: 1 / 53 MRSA (2 %)



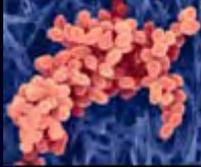
MRSA

➤ Epidemiology

- Occurrence – Animal Side (Preliminary Data)

– OSU-VTH

- 2004-2006 (3 year retrospective study)
- Proportion of MRSA and *S. aureus* by species:
 - Dogs: 33 MRSA / 53 *S. aureus* (62 %)
 - Horses: 16 MRSA / 32 *S. aureus* (50 %)
 - Cats: 3 MRSA / 7 *S. aureus* (43 %)
 - Llamas: 1 MRSA / 3 *S. aureus* (33 %)



MRSA

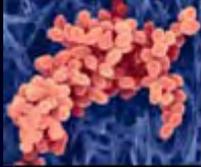
➤ Epidemiology

- Occurrence – Animal Side (Preliminary Data)

– Private Diagnostic Laboratory in Ohio

- Jan 2001- Jan 2004 (3 year retrospective study)
 - 30529 Submissions => 636 *S. aureus*
 - 22 MRSA out of 301 *S. aureus* tested
 - 7.3% of all *S. aureus* tested were methicillin resistant





MRSA

➤ Epidemiology

- Occurrence – Animal Side (Preliminary Data)

– Private Diagnostic Laboratory in Ohio

- Jan 2001- Jan 2004

- Distribution of MRSA by species:

- » Dogs: 16 / 22 MRSA (72 %)

- » Cats: 5 / 22 MRSA (23 %)

- » Horses: 1 / 22 MRSA (5 %)

- Proportion of MRSA and *S. aureus* by species:

- » Dogs: 16 MRSA / 172 *S. aureus* (9 %)

- » Cats: 5 MRSA / 87 *S. aureus* (6 %)

- » Horses: 1 MRSA / 25 *S. aureus* (4 %)



PRELIMINARY RESULTS OF THE SURVEILLANCE PROGRAM FOR METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS AT A VETERINARY TEACHING HOSPITAL

A. Johnson¹, R. Nava-Hoet, T. Landers², S. Bateman³, A. Hillier³, A. Lawrence³, W.A. Gebreyes¹, T.E. Wittum¹, A.E. Hoet^{1,4*}

¹ Department of Preventive Medicine, ³ Department of Clinical Sciences, College of Veterinary Medicine, ⁴ College of Public Health, The Ohio State University. ² College of Nursing, The Ohio State University

Abstract

There is growing concern within the public health community about the transmission of Methicillin-Resistant *Staphylococcus aureus* (MRSA) from animals to humans, and vice versa especially within veterinary hospital settings. These zoonotic transmission paths have been described in several studies, which also indicated the negative effect of this pathogen on the health status of humans and animals. The present report is a preliminary study to determine the estimated prevalence of MRSA at the OSU-VTH, which will lead into a year-long active and passive surveillance system to monitor the environment, as well as canine patients that are admitted at the OSU-VTH. Preliminary samples were collected from the small animal, equine, and food animal environments within the hospital to screen for MRSA. Samples from a variety of surfaces were collected with a Swiffer® or a pre-moistened swab. Identification of *S. aureus* was performed by standard microbiology procedures and latex agglutination reaction. Identification of MRSA was confirmed by growth on Mueller-Hinton agar supplemented with NaCl and oxacillin. Currently, genotyping and pulse field gel electrophoresis experiments are being performed. Preliminary data indicates that the prevalence of MRSA in the hospital environment is 11.45%. Specifically, the prevalence of MRSA in the small animal, equine and food animal areas are 15.13%, 4.35%, and 0% respectively. 42.1% of the MRSA's were isolated from human contact surfaces and 57.9% were isolated from animal contact surfaces. The results from this preliminary study indicate that MRSA is present in the OSU-VTH. The OSU-VTH is establishing specific protocols to handle and manage MRSA positive animals and their environment.

Introduction

- > *Staphylococcus aureus* is one of the most common nosocomial infections in human hospitals.
- > Severe and difficult to treat soft tissue and skin infections associated with high morbidity, mortality, and treatment costs have been attributed to an emerging strain of *S. aureus* named Methicillin Resistant *S. aureus* or MRSA.
- > MRSA strains are resistant to all β -lactam antimicrobials and often to a wide range of additional antimicrobial classes.
- > It is documented that MRSA can be zoonotically transmitted from humans to animals and vice versa, as well as having the ability to survive in the environment.
- > Several reports have also indicated that MRSA can be transmitted among humans, animals, and the environment at veterinary hospitals.
- > This is not only a concern for the veterinary community where staff and veterinarians are routinely exposed to a number of animals, but it is also a growing public health concern due to the fact that some pet owners may share living and sleeping quarters with possibly infected animals.
- > A retrospective study from 2004 to 2006 at the Ohio State University, Veterinary Teaching Hospital (OSU-VTH) determined that MRSA was already prevalent in the canine and horse populations (Table 1).
- > Nevertheless, we still do not know the real prevalence of this important emerging zoonotic pathogen, as well as the risk factors associated with it.

TABLE 1: RETROSPECTIVE DATA FROM CLINICAL CASES SUBMITTED TO THE CLINICAL MICROBIOLOGY LABORATORY (CML) AT OSU-VTH FROM 2004 TO 2006

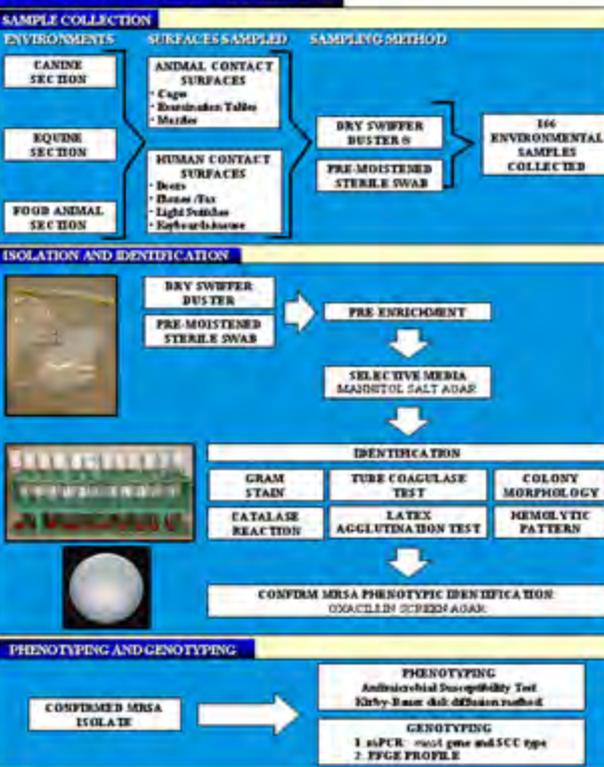
	TOTAL MRSA CASES BY SECTION	PROPORTION MRSA / <i>S. aureus</i> INFECTIONS
CANINE	23 / 59 MRSA (39%)	23 MRSA / 59 <i>S. aureus</i> (39%)
EQUINE	14 / 59 MRSA (24%)	14 MRSA / 59 <i>S. aureus</i> (24%)
FOOD ANIMAL SPECIES	4 / 59 MRSA (7%)	4 MRSA / 59 <i>S. aureus</i> (7%)
TOTAL	53 MRSA CASES	53 MRSA / 109 <i>S. aureus</i> (48%)

* Of 109 *S. aureus* isolates identified from a variety of host species at the OSU-VTH, 53 (48.6%) of these isolates were phenotypically classified as MRSA.

Objective

The present report is a preliminary study to determine the estimated prevalence of MRSA at the OSU-VTH, which will lead into a year-long active and passive surveillance system to monitor the environment, as well as canine patients that are admitted at the OSU-VTH.

Materials and Methods



Results

TABLE 2: PREVALENCE OF MRSA IN THE SMALL ANIMAL, EQUINE, FOOD ANIMAL, AND OVERALL HOSPITAL ENVIRONMENT (2007)

LOCATION	PREVALENCE
CANINE SECTION	18 / 119 (15.1%)
EQUINE SECTION	1 / 23 (4.3%)
FOOD ANIMAL SECTION	0 / 24 (0.0%)
TOTAL	19 / 166 (11.4%)

- During the period of sampling the highest prevalence of environmental contamination was found to be in the canine sections of the hospital.
- Of the 19 isolates obtained, 12 have been already phenotyped and genotyped, all of them from the canine section.

References:

1. Engel G, Leick C, Chabot LA, Ward E, Edlin R. Prevalence of Methicillin-Resistant *Staphylococcus aureus* in the Environment of a Veterinary Teaching Hospital. *Journal of Clinical Microbiology* 2006; 44(12):3471-3475.

TABLE 3: PREVALENCE OF MRSA ON HUMAN AND ANIMAL CONTACT SURFACES AT A VETERINARY TEACHING HOSPITAL

Animal Contact	11 / 19 (57.9%)	Human Contact	8 / 19 (42.1%)
Cages	3 / 11 (27.3%)	Doors	6 / 8 (75.0%)
Carts	3 / 11 (27.3%)	Computer	1 / 8 (12.5%)
Examination Table	1 / 11 (9.1%)	Faucets	1 / 8 (12.5%)
Muzzles	1 / 11 (9.1%)		
Oxygen Monitor	1 / 11 (9.1%)		
Floor	1 / 11 (9.1%)		
Water Bowls	1 / 11 (9.1%)		

• The high prevalence of MRSA isolated from human contact surfaces, such as computer keyboards and door surfaces indicates a need for increased MRSA awareness among faculty, staff, students, and clients.

TABLE 4: ANTIMICROBIAL RESISTANCE PATTERNS OF MRSA ISOLATED FROM ENVIRONMENTAL SURFACES AT A VETERINARY HOSPITAL

Major Resistance Patterns	Number	Percent
AmAnAraEhErOmOxPb	6	50
AmAnAraEhErOmOxPb	5	41.7
AmAraEhErOmOxPb	1	8.3

- All 12 MRSA isolates currently phenotyped were grouped in three antimicrobial resistance patterns, showing in general a broad multidrug pattern.
- All 12 environmental isolates carried the *meaC* gene and were SCC-type II.

FIGURE 1: PULSE FIELD GEL ELECTROPHORESIS PROFILES OF MRSA ISOLATED FROM THE ENVIRONMENT AT THE OSU-VTH

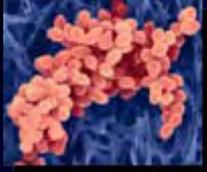


• The PFGE profile of 11 MRSA isolates present in the environment revealed that they are closely related among each other.

Conclusion

- > The results from these preliminary studies indicate that MRSA is present in the environment, including animal and human contact surfaces.
- > Further genotyping has shown that all the isolates obtained are SCC type II, similar to the HA-MRSA isolated in human hospital settings.
- > The MRSA isolates obtained showed multidrug resistance.
- > The OSU-VTH is establishing specific protocols to handle and manage MRSA positive animals and their environment.

Wittum TE, Gebreyes WA, Johnson A, Lawrence A, Hillier A, Nava-Hoet R, Landers T, Bateman S, Hoet AE. Prevalence of Methicillin-Resistant *Staphylococcus aureus* in the Environment of a Veterinary Teaching Hospital. *Journal of Clinical Microbiology* 2007; 45(12):3471-3475.



MRSA

➤ Epidemiology

- Occurrence – Animal Side (Preliminary Data)

– Prospective Study at OSU

- November 2007 to present

- Total dogs sampled to date: 220

- Total MRSA positive dogs: 15 (6.85%)

MRSA Survey Name (ID): _____ Date: _____
History No: _____

Patient Information

Species: _____ Breed: _____ Age: _____ Weight: _____

Gender: M F Reproductive Status: Spayed/Neutered Intact Hair: Long Short
Color: _____

Admission/Examination Information

Section Admitted: Dermatology Surgery ICU Community Service

Reason for admittance/examination: _____

Medical History

Primary Owner Complaint: _____

Present Illness:

- Onset Duration: _____
- Previous use of Antibiotics: Yes No
- < 1 month < 3 months < 6 months < 12 months No Antibiotic used or ≥ 12 months ago

Antibiotic/ Drugs Used	Route of Treatment	Length of Treatment	Response to Treatment	Observations

Other Drugs Used: _____

Past History: Date: _____

- Prior or Secondary Illnesses: Yes No
Details: _____
- Hospitalization History: Hospitalized in last 12 months Yes No
Details: _____
- Travel History: _____

Diet and Environment:

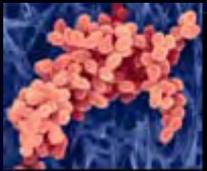
- Diet: Commercial Home Made Mixed Other
Brand (s): _____ Description: _____
- Living Environment:
 - Housing: Indoor Outdoor
 - Others Animals in Household (N° and spp): _____
 - Any Showing Similar Signs/Illnesses: Yes No
 - Contact with Farm Animals: Yes No Species: _____
 - N° Family Members in Household: _____ (# Children: _____ # Seniors: _____)
 - Any Showing Similar Signs/Illnesses: Yes No
 - Does the Animal Visit:
 - Parks Playgrounds Nursing Homes Hospitals Therapy Groups Schools
 - Farms Grooming Detail: _____
 - Is your animal used for: Hunting/sports Work/service Companion Other
Detail: _____

Additional Comments: _____

Samples Collected:

Ear: R L Skin: List site(s) collected: _____
 Nares: R L
 Vulva/Prepuce/Perianal _____

ZOONOTIC POTENTIAL

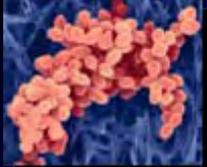


MRSA

Animal Species	Occupation/Condition	Zoonotic Transmission? ^a	Author/Year
Feline	Rehab Geriatric Ward	Suspected	Scott et al., 1988
Canine	Nurse/Nursing Home	Confirmed	Cefai et al., 1994
Equine	Veterinary Personnel		Seguin et al., 1999
Canine/Feline	Family – 2 households	Confirmed	Simoons-Smit et al., 2000
Canine	Household (Diabetic and Organ Transplant Recipient)	Confirmed	Manian, 2003
Canine/Feline	Veterinary Personnel/Household	Suspected	Duquette & Nuttall, 2004
Canine	Community	Suspected	van Duijkeren et al., 2004
Canine	Nurse (Psoriasis)	Confirmed	van Duijkeren et al., 2004
Canine/Feline/Equine/Rabbit/Seal/Psittacine	Veterinary Personnel	Suspected/(Confirmed)	O'Mahoney et al., 2005
Canine	Veterinary Personnel	Confirmed	Baptiste et al., 2005
Canine/Feline	Veterinary Hospital	Suspected	Loeffler et al., 2005
Equine	Veterinary Personnel/Horse-Handlers	Confirmed	Weese et al., 2005
Canine/Feline	Household/Community	Suspected/(Confirmed)	Weese, 2005
Canine	Household	Confirmed	van Duijkeren et al., 2005
Canine/Feline	Veterinary Personnel/Household	Suspected	Weese et al., 2006
Feline	Household	Suspected	Vitale et al., 2006
Feline	Community	Suspected	Morris et al., 2006

Kellie Hough, DVM, MPH-VPH 2007

Published Reports of Suspected and Confirmed Zoonotic Transmission of Methicillin-Resistant *Staphylococcus aureus*



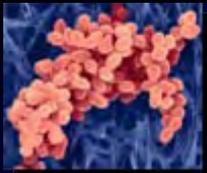
MRSA

➤ Zoonotic Transmission

Main concerns:

- 1) Reverse Zoonosis
- 2) Direct Zoonosis (Reservoirs for humans)
 - a) Disease causation
 - b) Human re-infection => Treatment failure
- 3) Animal to animal transmission
- 4) Sentinel





MRSA

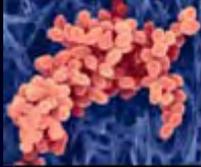


➤ Zoonotic Transmission

1) Reverse Zoonosis

(Zooanthroponotic transmission)

- Human (colonized or infected) transmits MRSA to dogs, horses, or other domestic animals
- Induces clinical infections in animals, which can result in animal health outbreaks
 - Infections occur post-surgery or post-diagnostic procedures in horses and dogs from colonized surgeon and/or veterinary staff (owners?)
 - 11 equine patients with postprocedural MRSA infections => Veterinary hospital staff was the primary source Seguin et. al., JCM, 1999



MRSA

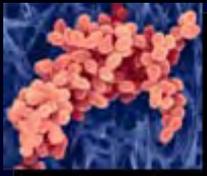
➤ Zoonotic Transmission

2) Direct Zoonosis

a) Disease causation

- Infected/colonized animals can serve as the source of MRSA to humans
- Foal (+ mare) had MRSA infection at arrival ^{Weese, et.al. VM 2006}
 - 3 veterinary students were clinically affected after direct contact
 - 10 other students and veterinary personnel were colonized
 - SCC*mecIV*, PVL negative, multidrug resistant (4): oxacillin, erythromycin, tetracycline, and gentamicin





MRSA

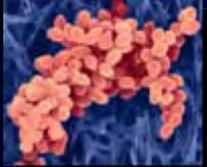
➤ Zoonotic Transmission

2) Direct Zoonosis



b) Human re-infection (reservoir)

- Colonized/infected animals could be responsible for recurrent infections in humans
- Associated with MRSA treatment failure Manian, CID, 2003
 - Diabetic with chronic renal failure (husband)
 - Diabetic and kidney transplant recipient (wife)
 - Failed treatment to MRSA infections in 3 opportunities
 - Healthy 18-month-old female Dalmatian was colonized with MRSA



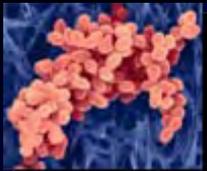
MRSA

➤ Zoonotic Transmission

3) Animal to animal transmission

- The infected animal transmits the MRSA to other animals
- Transmission between domestic pets in households and veterinary settings Weese et.al., VM, 2006; Weese et. al. JAVMA, 2007

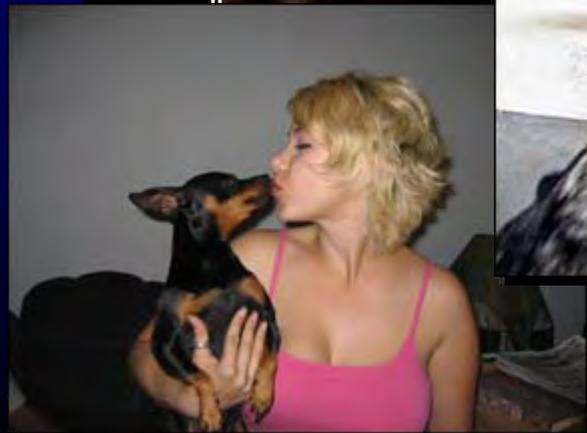




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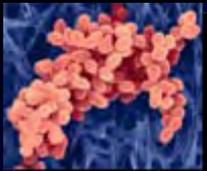
➤ Zoonotic Transmission

4) Sentinel role



PEGOAL

Success Is Knowing Who To Blame



MRSA

➤ Zoonotic Transmission

Animals species:

- Dogs
- Cats
- Horses
- Cattle
- Pigs
- Rabbit
- Sheep



RESEARCH

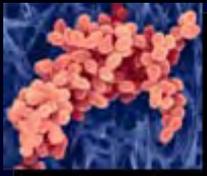
Emergence of Methicillin-Resistant *Staphylococcus aureus* of Animal Origin in Humans

Inge van Loo,^{*1} Xander Huijsdens,^{†1} Edine Tiemersma,[†] Albert de Neeling,[†]
Nienke van de Sande-Bruinsma,[†] Desiree Beaujean,[†] Andreas Voss,[‡] and Jan Kluytmans^{§¶}

1834

Emerging Infectious Diseases • www.cdc.gov/eid • Vol. 13, No. 12, December 2007

TO TREAT OR NOT TO TREAT

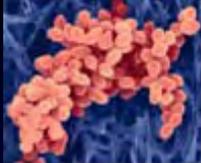


MRSA

➤ Treatment

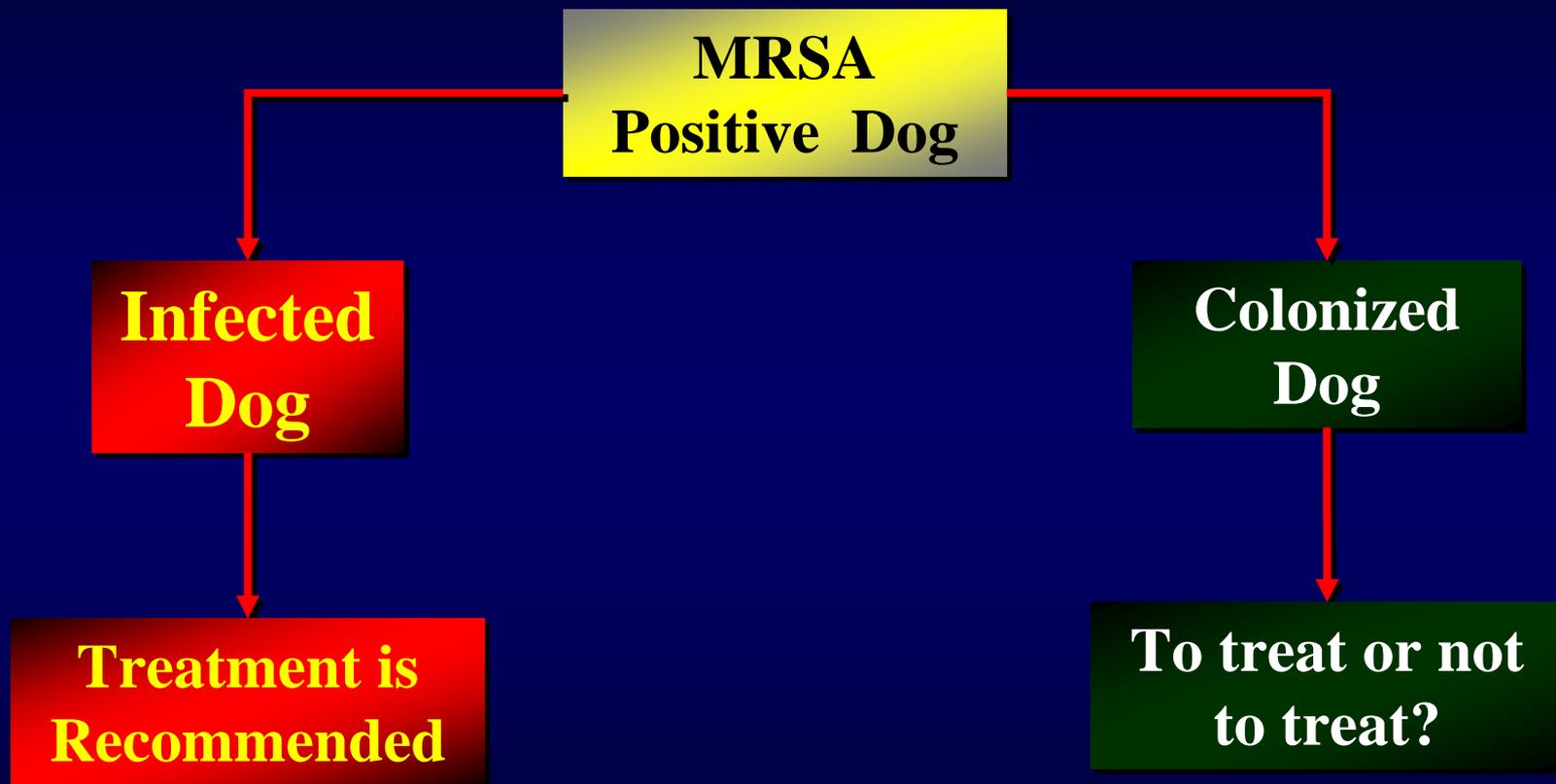
To Treat or Not to Treat?

*Development of Decolonization/Therapy
Guidelines for Veterinarians Dealing with
Methicillin-Resistant Staphylococcus aureus
Positive Dogs*



MRSA

➤ Treatment



- If TX is indicated, should be guided by antimicrobial susceptibility profile of the organism and close supervision (re-culture)

MRSA Colonized Dog

Healthy Dog

Not "Healthy" Dog

Low Risk Family/Individual

High Risk Family/Individual

No Decolonization/Therapy "Necessary"

Consider Decolonization

Surgical Need

Medical Need

Routine Surgical Need

Invasive/ High Risk Surgical Need

Low Risk Family/ High Risk Animal

High Risk Family/ High Risk Animal

Consider Decolonization

Recommend Decolonization

Low Risk Family/ Individual

High Risk Family/ Individual

Low Risk Family/ Individual

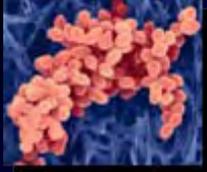
High Risk Family/ Individual

No Decolonization/Therapy "Necessary"

Consider Decolonization

Consider Decolonization

Recommend Decolonization



MRSA

MRSA Risk Checklist for Identification of High vs. Low Risk Individual/ Family

*If you have answered **Yes** to any of the questions, it is recommended that the individual/family physician is consulted to discuss necessary precautions to prevent a MRSA infection or transmission of this infectious agent.*

1. Do you or anyone living in your household have any of the following medical conditions?		
HIV/AIDS	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Cancer	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Renal Failure	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Diabetes	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Lupus or Other Immunosuppressive Disorder	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Are you currently receiving chemotherapy or other immunosuppressive drugs (prednisone, steroids, etc.)?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Have you or anyone in your household been under several antibiotic (antimicrobial) treatment in the last 12 months?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
4. Have you or anyone in your household ever received an organ transplant?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. Have you or anyone in your household underwent a surgical procedure or hospitalize within the past year?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
6. Are you or anyone in your household planning on undergoing a surgical procedure within the next year?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
7. Have you or anyone in your household recently had or is planning on undergoing an invasive medical procedure (dialysis, catheterization, injections, etc) within the next year?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
8. Are you or anyone in your household currently pregnant or planning on becoming pregnant or planning on becoming pregnant within the next year?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
9. Do you or your pets frequently visit a family member/close friend in a nursing home or hospital setting?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10. Do you ever allow your pet(s) to spend time with anyone with any of the above mentioned diseases or conditions?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
11. Do you or anyone in your household work in a nursing home, or medical / veterinary facility?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

MRSA Colonized Dog

Healthy Dog

Not "Healthy" Dog

Low Risk Family/Individual

High Risk Family/Individual

No Decolonization/Therapy "Necessary"

Consider Decolonization

Surgical Need

Medical Need

Routine Surgical Need

Invasive/ High Risk Surgical Need

Low Risk Family/ High Risk Animal

High Risk Family/ High Risk Animal

Consider Decolonization

Recommend Decolonization

Low Risk Family/ Individual

High Risk Family/ Individual

Low Risk Family/ Individual

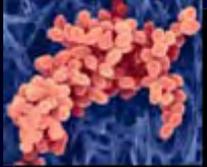
High Risk Family/ Individual

No Decolonization/Therapy "Necessary"

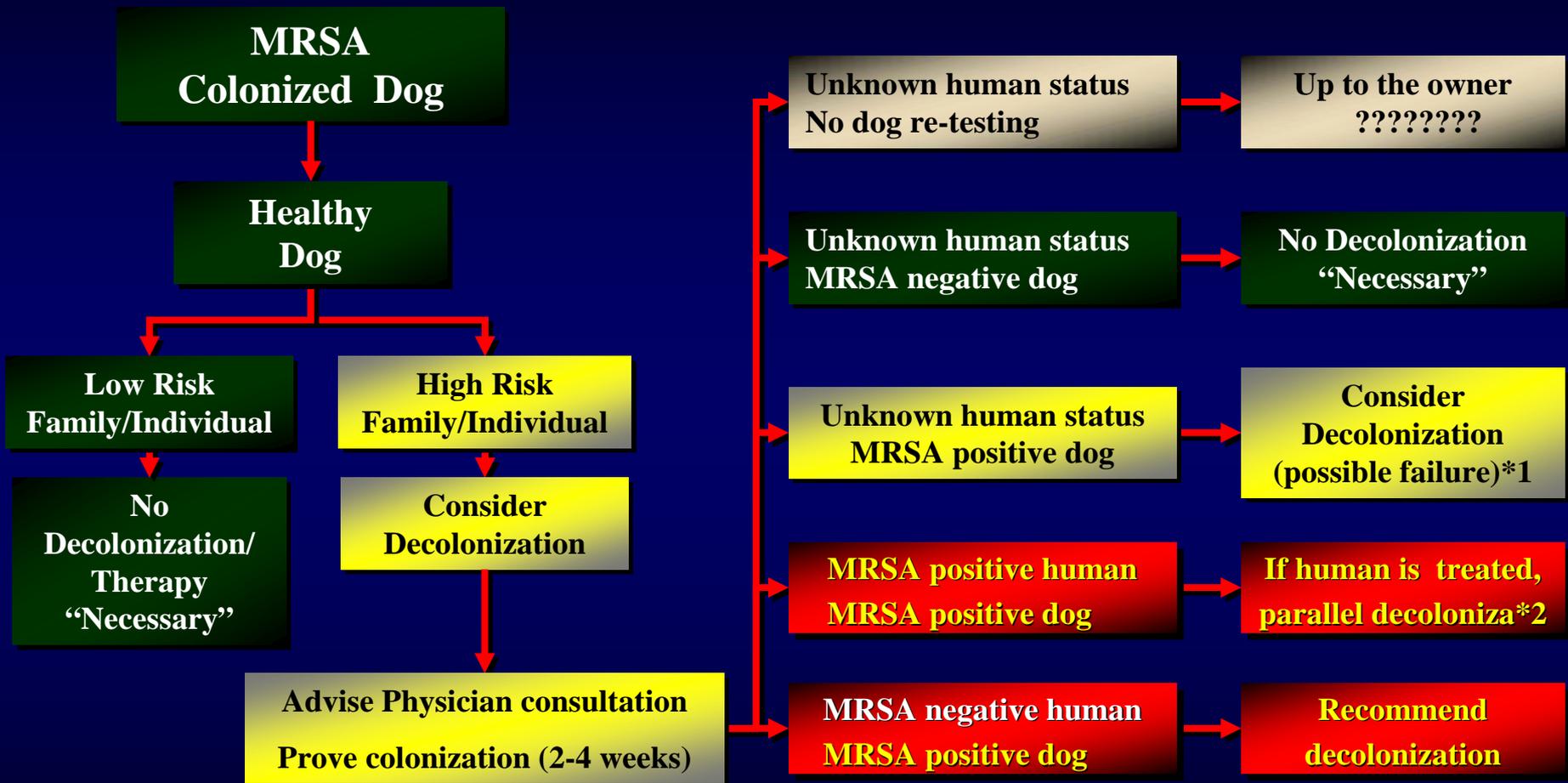
Consider Decolonization

Consider Decolonization

Recommend Decolonization



MRSA



*1 if owner is MRSA positive, the success rate of the decolonization could be low

*2 If physician treats the owner, then we should treat the dog in parallel including environmental management

MRSA Colonized Dog

Healthy Dog

Not "Healthy" Dog

Low Risk Family/Individual

High Risk Family/Individual

No Decolonization/Therapy "Necessary"

Consider Decolonization

Surgical Need

Medical Need

Routine Surgical Need

Invasive/ High Risk Surgical Need

Low Risk Family/ High Risk Animal

High Risk Family/ High Risk Animal

Consider Decolonization

Recommend Decolonization

Low Risk Family/ Individual

High Risk Family/ Individual

Low Risk Family/ Individual

High Risk Family/ Individual

No Decolonization/Therapy "Necessary"

Consider Decolonization

Consider Decolonization

Recommend Decolonization

FINAL MESSAGE

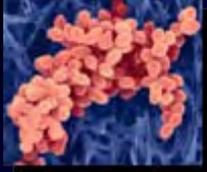


MRSA is out there

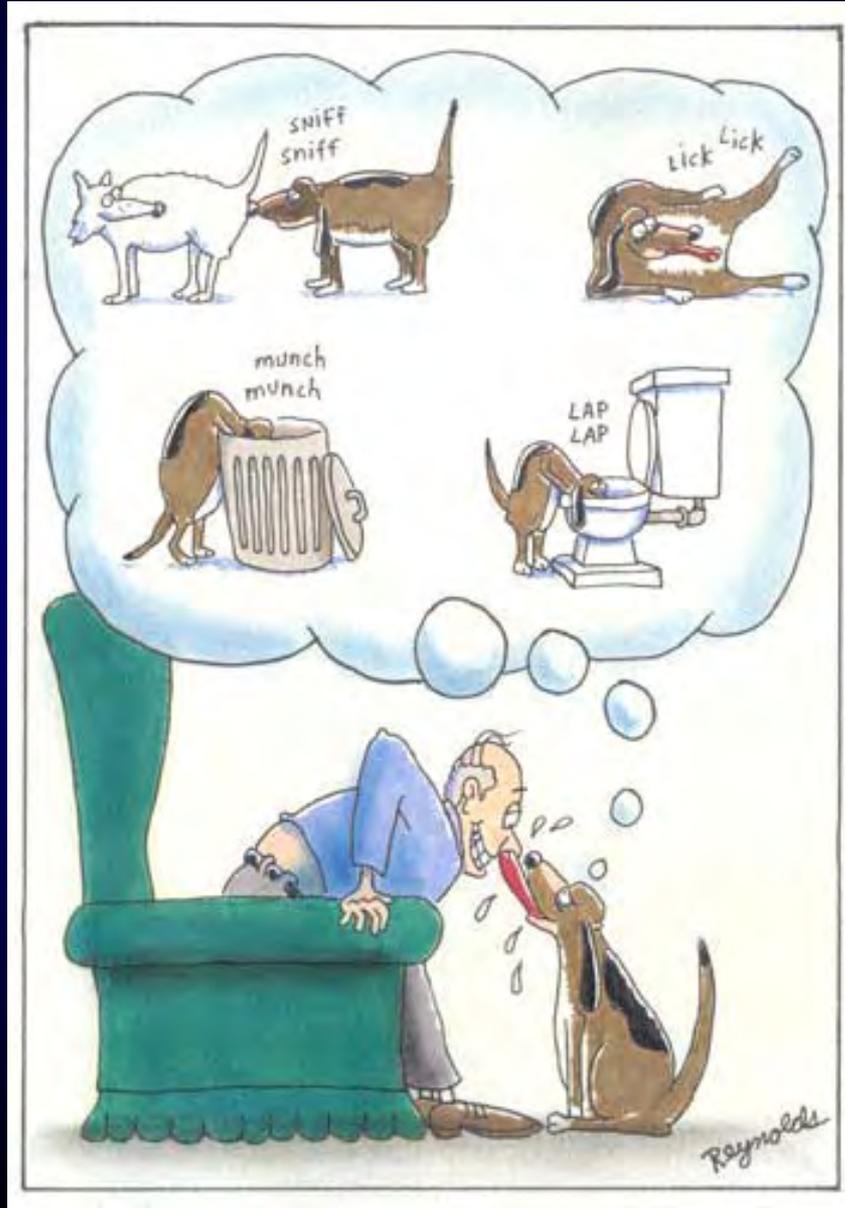


SCAPEGOAT

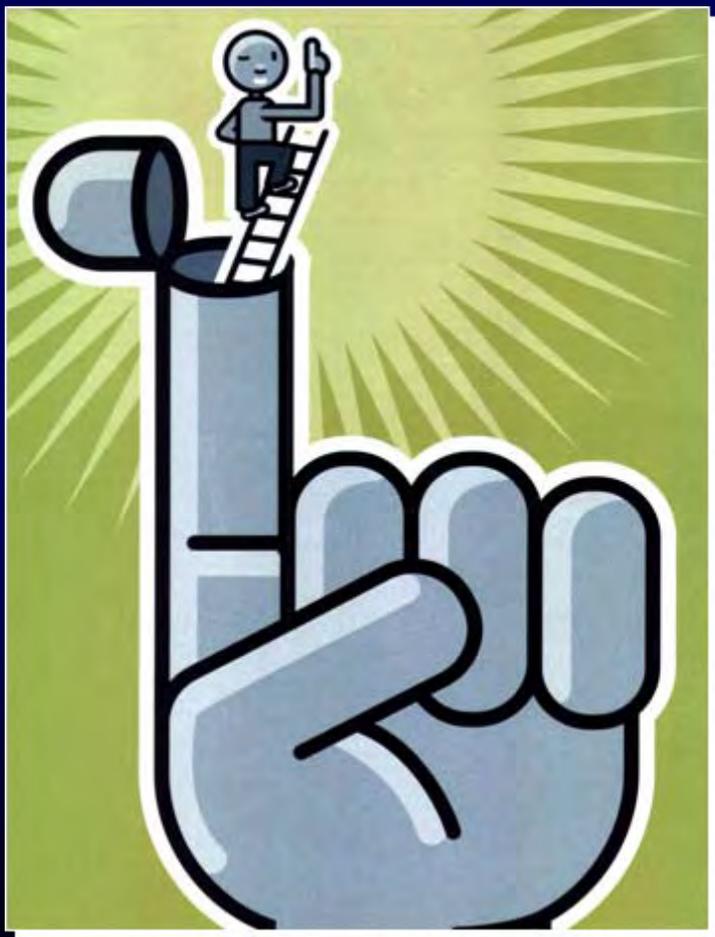
Because we like to sacrifice lambs.



MRSA



QUESTIONS???



Armando E Hoet, DVM, PhD, DACVPM
hoet.1@osu.edu



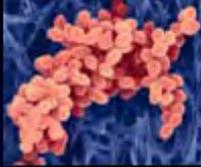
Veterinary Preventive Medicine
The Ohio State University



COLLEGE OF
VETERINARY MEDICINE



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PUBLIC HEALTH



MRSA

- **Short background on MRSA**
- **Incidence in the US**
- **Animals at risk**

How do pets acquire MRSA?

Originally human source or developing in pets?

Owner has MRSA how do they prevent transmission to their pets?

Pet has MRSA how do they prevent transmission to humans?

Should their pets be tested?

Should their pets be treated?

Should the pet be treated if it is not clinical?

Should other pets in house be tested and treated?

Should owner be tested?