

Surveillance of Antibiotic Resistance

Dr. Alan Johnson, NHS

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Surveillance of Antibiotic Resistance

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Hosted by Maria Bernallick
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Epidemiology

- The study of the distribution and determination of health-related states or events in specified populations and the application of this study to control of health problems

Epidemiology of Antibiotic Resistance

- The cornerstone of epidemiology is **surveillance**
- Surveillance involves collection of relevant data that inform as to the prevalence of antibiotic resistance

Surveillance of Antibiotic Resistance

- Data needs to be:
 - Collected
 - Stored
 - Analysed
 - Made available
 - Acted upon

Making Use of Surveillance Data

- Guide empirical prescribing
- Determine burden of disease
 - Resources required
 - Future action
- Use surveillance for measuring outcomes of intervention strategies

Different Approaches to the Surveillance of Antibiotic Resistance

- Continuous surveillance
- Point prevalence (“snapshot”) surveys

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Surveillance of Antibiotic Resistance

- Scope:
 - Local/National/International
- Focus:
 - Organism
 - Disease
 - Patient groups

Surveillance of Antibiotic Resistance

- For surveillance to be undertaken, a source of data is required
- Hospital microbiology laboratories routinely identify bacteria isolated from patients and test them for antibiotic susceptibility
- Results stored on laboratory database

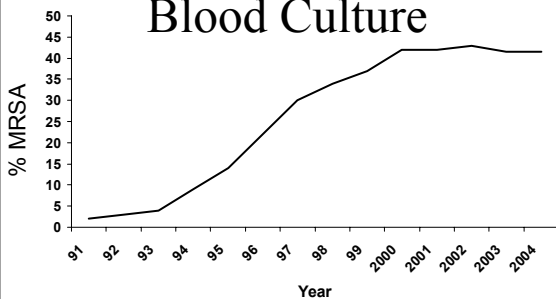
Surveillance of Antibiotic Resistance

- Sentinel laboratories
 - Local testing (collection of data)
 - Centralized testing (collection of isolates)
- Choice of sentinel laboratories
 - Geography
 - Type of hospital
- Standard methods
- Standard panels of antibiotics tested

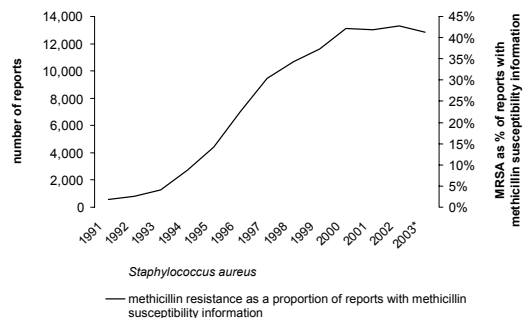
Continuous Surveillance in England and Wales

- Since 1974, hospitals in England & Wales have reported cases of bacteraemia to the HPA
- Since 1989, laboratories have also reported results of susceptibility testing of isolates
- Voluntary scheme

MRSA from Blood Culture



Staphylococcus aureus bacteraemia reports and methicillin susceptibility (England & Wales, 1991 – 2003)



source: routine laboratory reporting to CDSC

* 2002 is provisional data

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Mandatory Reporting of *Staphylococcus aureus* and MRSA

- From April 2001, the Department of Health made it mandatory for all acute NHS trusts in England to report
 - All cases of bacteraemia caused by *S. aureus*
 - The proportion of cases due to MRSA
- Similar schemes in England, Wales, Scotland & N. Ireland

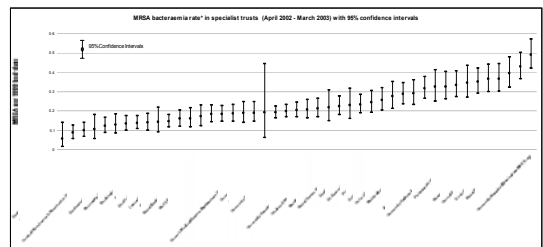
Mandatory Reporting of *Staphylococcus aureus* and MRSA

- Hospital trusts vary in size and in the number and types of patients seen
- Bed occupancy figures used as denominator
 - Trust rates calculated as numbers of MRSA per 1000 occupied bed days

Mandatory Reporting of MRSA Bacteraemia in England, April 2003-March 2004

- Single specialty Trusts
 - 0.09 per 1000 bed days
- General Acute Trusts
 - 0.16 per 1000 bed days
- Specialist Trust
 - 0.24 per 1000 bed days

MRSA bacteraemia rate in specialist Trusts (April 2002 - March 2003)



DoH Press Release: 5 November 2004

Hospital superbug must be halved

Bloodstream infections with the hospital superbug MRSA must be halved in three years, the government has said.

Health Secretary John Reid tasked NHS hospitals with achieving a year on year reduction up to and beyond March 2008.

MRSA Bacteraemia Surveillance in Wales, Oct 2001-Des 2003

- 13 Trusts (Overall MRSA rate, 43%)
- General surgery 59.8%
- ITU 57.9%
- Haematology 46.8%
- General Med 41.5%
- Trauma/orthopaedics 36.6%
- Paediatrics 6.3%

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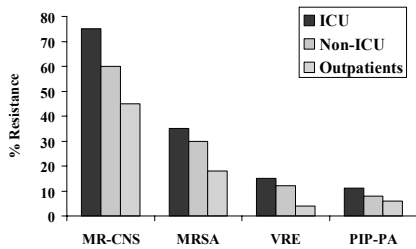
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Resistance Rates in Hospital Units (Fridkin *et al.* CID 29:245-52, 1999)



9th June 2006

MANDATORY SURVEILLANCE OF METHICILLIN RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) BACTERAEMIAS

Dear Colleague

We are writing to inform you of changes to the mandatory surveillance system for *Staphylococcus aureus* since our previous communication on 9 June 2003. These changes will provide a better evidence base for national policy and will help you better interpret your local situation so that you can take appropriate targeted action to control these infections.



Mandatory Enhanced MRSA Bacteraemia Surveillance Scheme – Electronic Reporting

We have asked the Health Protection Agency to develop a new enhanced reporting system for MRSA bacteraemia surveillance, which will allow the capture of more comprehensive data on MRSA. We believe this enhanced system will be helpful in giving Trusts a more accurate picture of their performance and in building up a better evidence base for prevention of infections. 21 Trusts are already using this system on a pilot basis in preparation for rolling out to all acute Trusts by October. A more detailed description of the aims and content of this enhanced reporting scheme for MRSA is given in the Annex.

MRSA in the Community

- MRSA classically a HOSPITAL problem
- Concern that MRSA would “escape” into the community (via nursing homes?)
- Evidence of emergence of MRSA in community unrelated to the hospital environment

CDC

August 20, 1999 / Vol. 48 / No. 32

MMWRTM MORBIDITY AND MORTALITY WEEKLY REPORT

- 708 Carbon Monoxide Poisoning Deaths Associated with Camping
- 707 Community-Acquired Methicillin-Resistant *Staphylococcus aureus*
- 710 Gastrointestinal Escherichia coli O157 — Arizona
- 714 Iron Deficiency Anemia in Alaska Native Children — Hooper Bay
- 717 Potential Hepatitis A Exposure — North Carolina
- 717 Notices to Readers

Vol. 48 / No. 32

MMWR

707

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

Community MRSA

- Commonly resistant to few antibiotics
- DNA profiles distinct from hospital strains
- Presence of Panton-Valentine Leucocidin (PVL)

What does C-MRSA cause?

- Primarily: skin and soft tissue infections
- More rarely: severe invasive disease
 - Necrotising pneumonia, bacteraemia, septic arthritis, endocarditis,
- *At risk groups*
- Children
- Sports teams
- Military recruits
- Prison inmates

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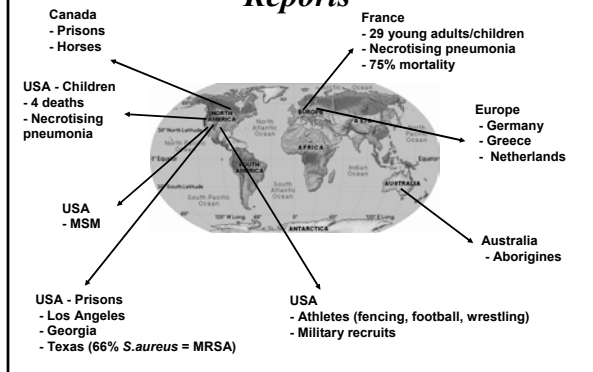
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Community-MRSA – Worldwide Reports



Surveillance of Antimicrobial Resistance in the Community

- Most surveillance studies use data from hospital microbiology laboratories
- Most data refers to hospitalised patients
- The majority of antibiotic use is in the community
- How do we undertake surveillance in the community?

Surveillance of Antimicrobial Resistance in the Community

- GPs prescribe antibiotics empirically
- GPs do not routinely sample patients for microbiological investigation (unless repeated treatment failure)

Surveillance of Antimicrobial Resistance in the Community

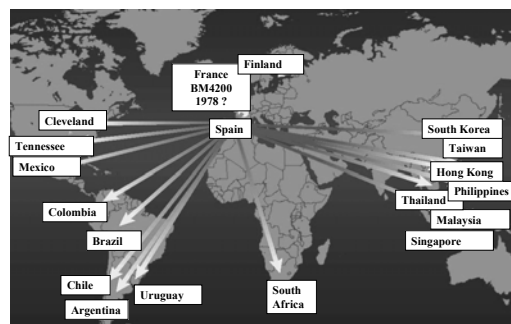
- Community surveillance via GPs?
 - Time factor (extended consultation times)
 - Would results be used just for surveillance or for patient management?)
 - Would patients need to give informed consent?
 - Resources (increased costs for GPs, specimen transport, increased laboratory workloads; source of funding? etc)

Q. Is International Surveillance Important ?

A. Yes !

- Individuals infected or colonised with resistant pathogens may travel from one country (or continent) to another.

Global Spread of a Multi-resistant Pneumococcal (serotype 23F) Clone



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International Clones of Multi-resistant Pneumococci

- Using MLST, 26 clones of multi-resistant pneumococci have been recognised
- Classified by the Pneumococcal Molecular Epidemiology Network (PMEN)

PMEN Clones of Pneumococci in the UK

- All invasive pneumococci collected from a hospital in Berkshire between Jan 2000 and March 2001
- 56 patients
- 18 resistant isolates found
 - 14 ery-R were England¹⁴-9 clone
 - 3 pen-R were Spain^{9V}-3 clone
 - 1 multi-R was Spain^{6B}-2 clone

EARSS

- European Antimicrobial Resistance Surveillance System
- Member states of EU plus Iceland, Norway & Switzerland
- Sentinel laboratories in each country
- Two national coordinators for each country
- Resistance in nosocomial *S. aureus* bacteraemia and invasive *S. pneumoniae* from the community
- <http://www.earss.rivm.nl>

EARSS 2002: MRSA Rates

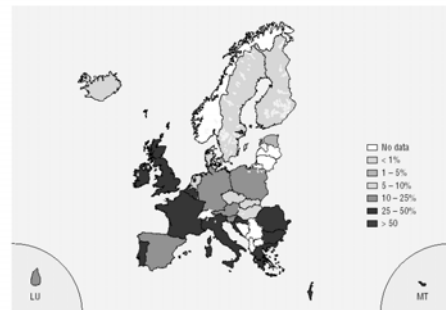
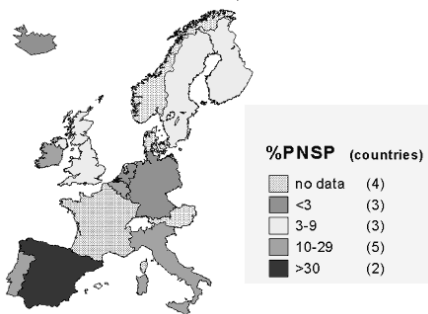
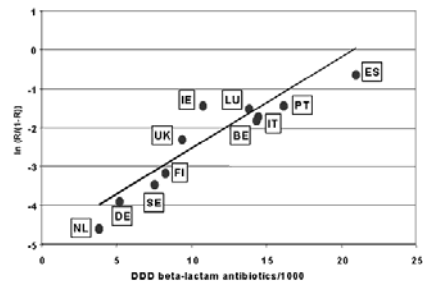


Figure 5.5. *Staphylococcus aureus*: invasive isolates resistant to methicillin (MRSA) in 2002

Penicillin Non-susceptible Pneumococci, 1998-99



Correlation Between Out-Patient Sales of β -lactam Antibiotics and Penicillin Resistance in Pneumococci



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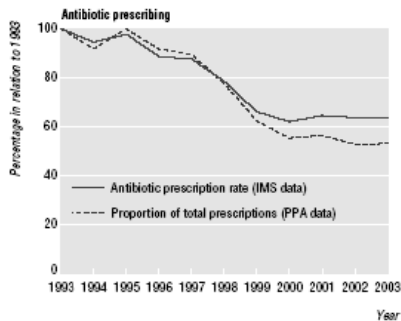
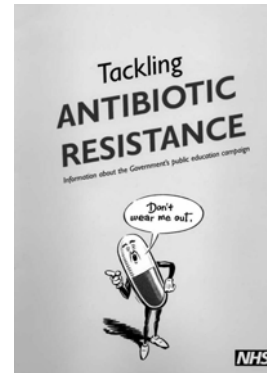
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Strategies to Reduce Antibiotic Resistance

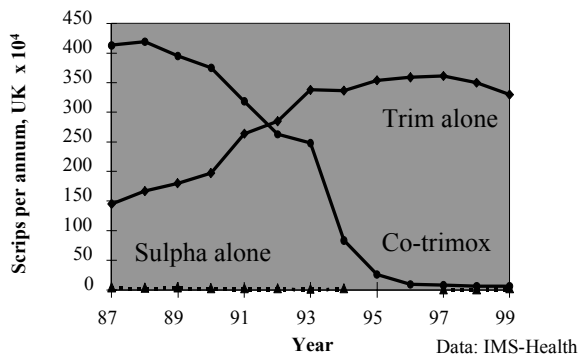
- Antibiotic use appears to be a driving force for emergence of resistance
 - Less antibiotic use
 - Better tailored use



Macrolide-Resistance in Finland

- Reduced use from 1992 onwards was associated with reduced resistance in group A streptococci from 1994 onwards
- Erythromycin resistance in *S. pneumoniae* in Finland rose from 0.6% in 1990 to 2.4% in 1995

Declining sulphonamide use, UK



Sulphonamide resistance in *E. coli* in London

Year	No	% Resistant
1991	360	39.2
1999	365	45.8

Enne *et al* 2000

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Strategies to Reduce Antibiotic Resistance

- Not going to be easy!

Strategies to Reduce Antibiotic Resistance

- Prevention of cross-infection
- Vaccines (e.g. pneumococci)
- Development of new antibiotics

Strategies to Reduce Antibiotic Resistance

- Continued surveillance will be essential

The Next Few Teleclasses

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Infection Surveillance in the UK

... with Dr. Allan Johnson, NHS

July 27

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Deb SBS www.debsbs.com

Dermal Absorption of Alcohol Disinfectants

... with Dr. Axel Kramer, Germany

August 17

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Control Nurses www.nzino.org

The Spectre of a Flu Pandemic – Is It Inevitable?

... with Dr. Lance Jennings, New Zealand

August 24

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Virox Technologies Inc
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***How to Assess Risk of Disease Transmission When
There is a Failure to Follow Recommended
Disinfection and Sterilization Principles***

... with Dr. William Rutala, UNC

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