Lessons from surveillance of MRSA bacteraemia in UK

Professor Barry Cookson
Agenda

• Surveillance process
• Different types of MRSA Surveillance
• Description of systems and findings
• Lessons learnt
Surveillance Cycle
producing information for action

Surveillance Cycle

Policy and Practices Audit Cycle

“Process Surveillance”
HAI and Antimicrobial Resistance
Interacting Cycles

Surveillance Cycle

Information Distribute
Data Collection & Analysis
Prioritise Surveillance Goals

Action

Audit Cycle

Policy and Practices Audit Cycle

Review

Policy based on Guidelines
Protocols For Practices

Audit

Decide when to re audit or re-survey
Purposes of Surveillance for Infection Control

• Detect changes in disease patterns and enable early investigation and application of prevention measures
• Evaluate prevention and control activities
• Provide information to help plan services and allocate resources
• To identify at risk patient groups
Typical «Low Grade HCAI Pathogens» (e.g. MRSA)
An Iceburg Phenomenon

- Bloodstream Infections
- Other Infections
- Colonisation
- Undetected Colonisation

Clinical specimens
Screening
English MRSA Surveillance

• Prevalence Surveys
  – Very small numbers of blood cultures
• Referred strains for typing
  – Biased samples from potentially all laboratories
  – Varied bloodstream proportions (<2000: 5%: >2010 ~50%)
• Surveillance networks
  – BSAC and EARSNet sentinel schemes
• Voluntary laboratory bloodstream referrals
  (~1983 – now: “COSURV”)
• Voluntary National Nosocomial Surveillance Scheme (1997-2002)
• Mandatory bloodstream referrals (2002 – Now)
UK 2006 Prevalence Survey

• Higher in older age groups
  – >65y: 8.7% (64% of population) (1993: 50%)
  – <65y: 5.6%

• 1.2% Infections caused by MRSA

• 1.7% had *C. difficile*
  – <65y: 0.7%
  – >65y: 2.3%
Number of incidents referred per region per quarter: Marples and co-workers, LHCAI
EMRSA Incidents in 1995

EMRSA- 3
EMRSA-15
EMRSA-16

All are distinct clones by MLST/SCCmec
Initial reported route of EMRSA-16 introduction in 22 of 136 affected hospitals

Jan 1992 - Sept 1994

Murchan et al, J Clin Microbiol 2004; 57: 345-346
Hospitals affected each month by EMRSA-3, EMRSA-15, or EMRSA-16

95% of S. aureus BSIs due to E-15 and E-16

Year


Number of Hospitals

0 25 50 75 100 125 150

EMRSA –15
EMRSA –16
EMRSA–3

CPHL-Laboratory of HCAI

1998–2000 (EARSS)
* E-16 decline precedes the MRSAB decline from mid 2000s
* No evidence E15 easier to control or less invasive

- UK MRSA very clonal with a >80% due to EMRSA-15 or -16
- EMRSA-16 in decline, EMRSA-15 dominates

HARMONY European Network

Five International EU EMRSA clones:

A - “Iberian clone”:
   Belgium EC-1: Finland E7, 10: France A, B, C:
   N. German I: Spain E1: Sweden: Portugal

B - Belgium EC-3: Finland E1

C - UK E3: South German II: Slovenia: Finland: Belgium

D - UK E16: Sweden II (via Cyprus): Denmark: Finland E5:
   Belgium, German, Belgium, USA, Spain,

E - UK EMRSA –15: Germany: Belgium
HARMONY – imported strain experiences

- **Finland**: E-3 related and E-16: intra-city restriction: low inter-hospital transfer rates. Community strains emerging
- **Sweden**: Polish strain in Stockholm, E-16 in Gottenburg. Most patients in side or two-bedded rooms. “Found the weak parts of the system.”: poor policy implementation.
  Bed occupancy now rising (and MRSA)
- **The Netherlands**: E-15 and E-16 spread rapidly intra-wards again finding the less compliant areas ("never seen anything like the speed"). Control possible with search and destroy
- **Staffing shortages reported in all countries**
Challenge of Community MRSA

• Recent PVL-related MRSA HCAI fatalities
• Increasing problems in US and parts of Europe
• Spread occurring within US Hospitals as occurred in Western Australia
• England has several different clones not all positive for Panton Valentine Leucocidin: all have SCCmecIV
• Ciprofloxacin resistant CA MRSA emerging!
• Porcine MRSA problems (NL, BE, DK, DE)
Number of Community Acquired PVL-\textit{S. aureus} identified by the HPA Staphylococcus Reference Unit

Fall mainly due to one centre testing own in 2010

14-fold increase: doubled in last six years

* 2003 is provisional data
Reported sources of HAB by specialty
NINSS 1997-2002

Sources varied by specialty:
device-related sources accounted for half of the bacteraemia
Mandatory & Voluntary Surveillance
MRSAB: 1999-2008

TARGETS SET
## Trigger Factors?

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<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>April 2001</td>
<td>Mandatory Acute Hospital MRSA bacteraemia surveillance: no 48h cut off: no transfer recording</td>
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<tr>
<td>July 2003</td>
<td>Director IPC created</td>
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<td>July 2004</td>
<td>Matrons Charter</td>
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<tr>
<td>July 2004</td>
<td>Target for reduction of MRSA bacteraemia: 2003-04 halved by 07-08</td>
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<tr>
<td>Sept 2004</td>
<td>clean<em>your</em>hands campaign</td>
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<tr>
<td>Oct 2004</td>
<td>Towards Cleaner Hospitals</td>
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<tr>
<td>June 2005</td>
<td>Saving Lives published: Seven Bundles followed</td>
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<tr>
<td>Oct 2005</td>
<td>Enhanced MRSA bacteraemia surveillance: CE Responsible</td>
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<td>Oct 2006</td>
<td>Code of Practice to prevent HCAI published as part of the Health Act: The STICK</td>
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<tr>
<td>2006</td>
<td>Improvement Teams: varied why went in and what done: The CARROT</td>
</tr>
<tr>
<td>May 2007</td>
<td>Healthcare Commission inspection programme: against Code</td>
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NAO 2008 Report: MRSAB Trends

2003-04  2007-08  2008-09
7700       12% of Trusts Increased
12% of Trusts Increased
25% >80% Reductions

Number of MRSA bloodstream infections

- MRSA bloodstream infection target introduced Nov 2004
- Enhanced surveillance introduced

Quarter: April/June 02, July/Sept 02, Oct/Dec 02, Jan/Mar 03, April/June 03, July/Sept 03, Oct/Dec 03, Jan/Mar 04, April/June 04, July/Sept 04, Oct/Dec 04, Jan/Mar 05, April/June 05, July/Sept 05, Oct/Dec 05, Jan/Mar 06, April/June 06, July/Sept 06, Oct/Dec 06, Jan/Mar 07, April/June 07, July/Sept 07, Oct/Dec 07, Jan/Mar 08, April/June 08, July/Sept 08
MRSA bacteraemia annual reports in England by region, January 2002 to December 2007

Most General Medicine, Surgery, Elderly Care
15% ICU/Hugh Dependency Wards
8% Dialysis Treatment
Mandatory Reporting >2010
Reviewing still!

• “Reduction” moves to “Objectives”
• Current Objectives!
  – Aim for consistency across hospitals
  – So benefiting from better performing ones
• The challenge relates to their baseline rates
  – All organisations to meet the median level
  – Reduce to median OR by 20% whichever is greater
• Issues: if better than median reduce to the best performing quartile OR by 20%, whichever is less
• Median recalculated each year
Are the MRSA Bacteraemia data to be believed?

- CE made responsible for locking the data down
- Many checks e.g. HCC, CQC
- No significant reductions in blood cultures taken
- Death reporting (ONS) data also decreased
MRSA bacteraemia (MRSAB) rate in specialist Trusts (April 2002 - March 2003)

Large variation within a country: opportunities from learning within the same healthcare system
Healthcare Commission Analysis of Healthcare Associated Infection 2006

Rates of MRSA bacteraemia (MRSAB)
- Lower if better hand hygiene parameters
- Higher if single rooms to isolate patients were less available

Healthcare Commission Analysis

Lower MRSAB and C difficile infection (CDI) rates:
  - Better bed management parameters
  - Inclusion of infection control in appraisal and personal development plans

Higher rates:
  - Protected time for infection control training for all healthcare workers
  - May be an example of “reactive practice”
The World’s First National Hand Hygiene Improvement Campaign

- Rolled out to all 187 acute NHS hospitals Dec 2004 to June 2005
- 4 year campaign
Conclusions NOSEC Study
Stone et al, BMJ in press
• Will be published in BMJ 5th May 2012
Lessons Learnt (1)

• Mandation, Chief Executives held responsible and targets were important for England
• Strive to make infection prevention and control EVERYONE’s duty of care
• Consider legislation if all else fails to improve safety culture and infection prevention and control and antimicrobial stewardship
• Must have checks in place so “gaming” does not destroy data credibility
  – External inspection
  – Parallel systems e.g. death notification, sentinel networks
Lesson (2)

- MRSA BSIs are the tip of the iceberg: consider other surveillance to inform ICP e.g. SSI
- Use all the data at your fingertips: surveillance is an art as well as a science!
- Sustaining is difficult
  - Timely feed-back of information
  - Mutual reward theory
- Balance benefits of national surveillance with priorities of local surveillance
- Benchmarking potentially dangerous: customers need to “own” the approach: reports on www need to explain the many caveats
Lesson (3)

• Lost opportunities: try to plan studies prospectively to interact surveillance with process surveillance and intervention activities
• Design complex interventions using ORION, STROBE, CONSORT
• “Honest brokers” do not be seen as anyone’s “lackeys”
CA MRSA Risk Assessment to inform Prevention and Control Strategies

- Surveillance information
  - If no data or gaps consider funding or encouraging keen hospitals or CMM/ID HCWs
  - What data are there for infections in hospitals?
  - PPS/Incidence in BSIs and other infections?
  - Specific surveys e.g. in community or A&E e.g. SSSI or on admission?
  - Are there isolate data accompanying these
    - No of strains and sources
    - AST markers to distinguish from local HAI MRSA e.g. ciprofloxacin resistance useful
    - PVL in strains
PVL may not be sole virulence factor

- Pathogenicity associated with PVL-SA may be associated with other factors:
  - Arginine Catabolism Mobile Element (ACME)
  - α-toxin
  - regulation of gene expression
  - newly described cytolytic peptides
CA MRSA Strategy continued

- **Source or Reservoirs?**
  - Link with typing and virulence marker data
  - Half of serious skin infections are not PVL in England
  - Within 48h admission
  - Abroad and where?
  - Consider staff as a possible risk e.g. South Sea islands
  - Consider “5cs”s
CDC guidance: risk factors for PVL-related infection

the "5 C's”:

1. Contaminated items e.g. towels, worn out saunas, gym, drug abusers, IV or gym equipment
2. Close contact
3. Crowding
4. Cleanliness
5. Cuts and other Compromised skin integrity

Can combine e.g. close contact sports may have poor hygiene e.g. sharing towels or poor laundry, abrasion and cuts

Anticipate e.g. sporting events such as Olympics many countries visiting and close contact sports
Northern America

• Following settings have been identified as higher risk for transmission from an individual colonised or infected with CA-MRSA:
  – Households
  – Close contact sports e.g.: wrestling, American football, rugby, judo
  – military training camps
  – Gyms
  – Prisons
CA MRSA Risk Assessment to inform Prevention and Control Strategies

– Ditto from referrals for typing?
– Burden of disease proportion of SA and MRSA, per bed days, over time?
– Pets and Livestock Associated issues interact with veterinary laboratories
– Veterinary workers and staff with close contact with at risk animals
CA MRSA Strategy continued

• Pick up CA MRSA spreading in hospitals early: ensure have good MRSA prevention and control in place (IPC and ASP)

• Have good public health measures in the community so at risk areas are “secure”

• Review these regularly ensuring surveillance and process surveillance cycles are interacting
Culture!

• Views differ
  – We will defeat the staphylococcus MSSA PVL too!
  – How much skin disease with PVL negative MSSA strains?
  – Consider burden of disease: severe disease if rare and skin and soft tissue infection common in PVL MSSA then consider expense of family screening and increased resistance to topical disinfectants and oral agents