European approaches to MDR-GNR prevention and control

Jon Otter, PhD FRCPath
Imperial College Healthcare NHS Trust
Blog: www.ReflectionsIPC.com
Twitter: @jonotter
Email: jon.otter@imperial.nhs.uk
THE END OF ANTIBIOTICS IS NIGH
What’s the problem?

“CRE are nightmare bacteria.”
Dr Tom Frieden, CDC Director

“If we don't take action, then we may all be back in an almost 19th Century environment where infections kill us as a result of routine operations.”
Dame Sally Davies, Chief Medical Officer

“If we fail to act, we are looking at an almost unthinkable scenario where antibiotics no longer work and we are cast back into the dark ages of medicine where treatable infections and injuries will kill once again.”
David Cameron, Prime Minister, UK

“The rise of antibiotic-resistant bacteria, however, represents a serious threat to public health and the economy.”
Barack Obama, President USA
CRE in the UK and US
Evidence-free zone
Guidelines ≠ Policy
DANGER MINES
Acronym minefield

CPE
MDR-GNR
CPC
ESBL
MDR-GNB
CRO
CPE
CRE
CRC
CPE
KPC
CRAB
ESBL
KPC
Asepsis: optimal use of invasive devices; PVC, CVC, UC

Risk assessment
- BBF spillage
- BBF exposure prevention & management

Patient placement
- Resp hygiene
- Linens
- Care equipment

Safe use and disposal of sharps

Safe Injection practices
- Safe lumbar Puncture practices
- Resuscitation safety

Waste disposal

Risks assessment

WHO: www.who.int/csr/resources/publications/EPR_AM2_E7.pdf
MDR-GNR Toolbox

- Antibiotic stewardship
- Hand hygiene
- Cleaning / disinfection
- HCW screening
- Decol.
- Cohorting staff / patients
- Env. screening
- Education
- Note flagging
- Active screening
- Contact precautions

Antibiotic stewardship
Hand hygiene
Cleaning / disinfection
Active screening
Contact precautions
Env. screening
Education
Note flagging
HCW screening
Decol.
Cohorting staff / patients

Who do I screen?

UK PHE CPE Toolkit screening triggers:

a) an inpatient in a hospital abroad, or
b) an inpatient in a UK hospital which has problems with spread of CPE (if known), or
c) a ‘previously’ positive case.

Also consider screening admissions to high-risk units such as ICU, and patients who live overseas.
How do I screen?

- Rectal swab is the best sample
  - Insert no more than 2cm into rectum
  - Twist gently and withdraw
  - Ideally want to see faeces on swab.

- Patient and staff education as to why this is needed in order to overcome taboos

- Alternate specimen is stool sample, but have to wait for the patient to ‘go’
## Does screening and isolation work?

<table>
<thead>
<tr>
<th></th>
<th>All MDROs</th>
<th>MRSA</th>
<th>VRE</th>
<th>ESBLs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline trend</strong></td>
<td>–</td>
<td>↑</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Hygiene intervention</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>step-change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Hygiene intervention</strong></td>
<td>↓</td>
<td>↓</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>trend change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Screening step-change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Screening trend</strong></td>
<td>–</td>
<td>↑</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Rapid vs. conventional</strong></td>
<td>↑</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>step-change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Rapid vs. conventional</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>trend-change</strong></td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

MDR-GNR Toolbox

Antibiotic stewardship
Hand hygiene
Cleaning / disinfection
HCW screening
Decol.
Cohorting staff / patients
Env. screening
Education
Note flagging
Contact precautions
Active screening

Hand hygiene

40%

Median hand hygiene compliance from 95 studies.

MDR-GNR Toolbox

- Antibiotic stewardship
- Hand hygiene
- Cleaning / disinfection
- Active screening
- Contact precautions
- Env. screening
- Education
- Note flagging
- HCW screening
- Decol.
- Cohorting staff / patients

Surface survival

![Graph showing the surface survival of different bacteria](image)

Log (10) cfu / disc

Time / weeks

- **C. difficile**
- **Acinetobacter**
- **K. pneumoniae**

Surface survival – strain variation

K. pneumoniae vs. E. coli

- *K. pneumoniae* seems to be more environmental than *E. coli*.¹,²
- Surface contamination on five standardized sites surrounding patients with ESBL-producing *Klebsiella* spp. (n=48) or ESBL-producing *E. coli* (n=46).¹

Persistent contamination

26.6% of rooms remained contaminated with either MRSA or A. baumannii following 4 rounds of bleach disinfection

Enterobacteriaceae “less environmental”

MDR-GNR cleaning & disinfection checklist

- Clean / declutter
- Monitor cleaning process (e.g. fluorescent markers)
- Enhanced daily disinfection using bleach
- All equipment disinfected before leaving room
- Terminal disinfection using bleach or, ideally, H₂O₂ vapor¹⁻³

MDR-GNR Toolbox

- Hand hygiene
- Cleaning / disinfection
- Active screening
- Contact precautions
- Antibiotic stewardship
- Env. screening
- Education
- Note flagging
- HCW screening
- Cohorting staff / patients
- Decol.
Carbapenem use, Europe

ECDC point prevalence survey 2013.
Antimicrobial stewardship – impact

Evaluating impact of 6 month antimicrobial stewardship intervention on an ICU by comparing bacterial resistance for matched 6 month periods either side of intervention.

Hou et al. PLoS ONE 2014;9:e101447; * = significant difference before vs. after.
MDR-GNR Toolbox

- Antibiotic stewardship
- Hand hygiene
- Cleaning / disinfection
- Active screening
- Contact precautions
- HCW screening
- Decol.
- Cohorting staff / patients
- Env. screening
- Education
- Note flagging

Deisolation?

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Setting</th>
<th>N pts</th>
<th>Organism</th>
<th>Duration of colonization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird¹</td>
<td>1998</td>
<td>Elderly care facilities, Scotland</td>
<td>38</td>
<td>ESBL <em>K. pneumoniae</em></td>
<td>Mean 160 days (range 7-548)</td>
</tr>
<tr>
<td>Pacio²</td>
<td>2003</td>
<td>Long term care facility, USA</td>
<td>8</td>
<td>Resistant Gram-negative rods</td>
<td>Median 77 days (range 47-189)</td>
</tr>
<tr>
<td>Zahar³</td>
<td>2010</td>
<td>Paediatric hospital, France</td>
<td>62</td>
<td>ESBL Enterobacteriaceae</td>
<td>Median 132 days (range 65-228)</td>
</tr>
<tr>
<td>O'Fallon⁴</td>
<td>2009</td>
<td>Long term care facility, USA</td>
<td>33</td>
<td>Resistant Gram-negative rods</td>
<td>Median 144 days (range 41-349)</td>
</tr>
<tr>
<td>Zimmerman⁵</td>
<td>2013</td>
<td>Patients discharged from hospital, Israel</td>
<td>97</td>
<td>CRE</td>
<td>Mean 387 days</td>
</tr>
</tbody>
</table>

"Selective" digestive decontamination

20 CRE colonized patients in each arm given gentamicin + polymyxin (SDD arm) or placebo (Control arm)

ANTIBIOTICS = ‘A’ BOMBS
Decolonisation using faecal microbiota transplantation (FMT)

- 82 year old colonised with CRE.
- Carriage was delaying her admission to a nursing home.
- Single dose of FMT decolonised her at 7 and 14 days.

Chlorhexidine – efficacy

Impact of chlorhexidine gluconate (CHG) daily bathing on skin colonization with KPC-producing *K. pneumoniae* in 64 long-term acute care patients.

Chlorhexidine – reduced susceptibility

Proportion of BSI isolates with reduced susceptibility to chlorhexidine on units using chlorhexidine gluconate (CHG) daily bathing (n=28) or not (n=94).

Which do you consider to be the most important measure to prevent transmission?

Data from around 150 webinar participants, mainly in the US, 2014.
<table>
<thead>
<tr>
<th>Type</th>
<th>n studies</th>
<th>Failure rate</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundled intervention</td>
<td>75</td>
<td>28%</td>
<td>1.9</td>
</tr>
<tr>
<td>Single intervention</td>
<td>11</td>
<td>45%</td>
<td></td>
</tr>
</tbody>
</table>
What works? NIH

- Hand hygiene
- Active surveillance
- Isolation & cohorting
- Cleaning & disinfection

Also:
- Daily chlorhexidine baths
- ‘Enforcers’ for hand hygiene compliance
- Communication with all staff
- Hydrogen peroxide vapor
- Characterisation of outbreak strains (WGS)

What works? Israel

* Physical segregation of CRE carriers; cohorted staff; appointed taskforce.

Summary

1. Enterobacteriaceae (mainly *K. pneumoniae*) and non-fermenters (mainly *A. baumannii*) have fundamental differences in their epidemiology – and require a different approach to control.

2. We still don’t really know what works to control MDR-GNR.

3. A “kitchen sink” approach (aka bundle) should be deployed!

4. Effective strategies should include:
   - Hand hygiene
   - Screening & contact precautions
   - Antimicrobial stewardship
   - Cleaning & disinfection
European approaches to MDR-GNR prevention and control

Jon Otter, PhD FRCPath
Imperial College Healthcare NHS Trust
Twitter: @jonotter
Email: jon.otter@imperial.nhs.uk