Antimicrobial Resistance
No action today: No cure tomorrow!

Dr D Nayar
Mr S Brown
Antimicrobial Stewardship Team
County Durham and Darlington Foundation Trust
Because we humans are big and clever enough to produce and utilize antibiotics and disinfectants, it is easy to convince ourselves that we have banished bacteria to the fringes of existence. Don't you believe it. Bacteria may not build cities or have interesting social lives, but they will be here when the Sun explodes. This is their planet, and we are on it only because they allow us to be.

Bill Bryson
Why worry about Resistance?

- Increasing threat of multi-drug resistant bacteria
- Enormous biomass of microorganisms
- Genetic plasticity
- Antibiotics are microbial products, organisms have seen them before!
- *Excessive antibiotic use
- World wide travel
- *Lax infection control practices

* FIXABLE

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Costs Associated with Increased Bacterial Resistance

- ↑Treatment failures
- ↑Morbidity and mortality
- ↑Risk of hospitalisation
- ↑Length of hospital stays
- ↑Need for expensive and broad spectrum antibiotics
Antimicrobial Resistance

- The number of patients with bloodstream infections has increased each year from 2010 to 2014
  - *E. coli* increased by 15.6%
  - *K. pneumoniae* increased by 20.8%
  - *S. pneumoniae* declined by 25% - likely due to introduction of new pneumococcal vaccine in 2010

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<tr>
<th>Bacteria</th>
<th>Antibiotic resistance (non-susceptibility) metric</th>
<th>Proportion resistant in 2014 (%)</th>
<th>2014 compared to 2010*</th>
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<td><strong>Bloodstream infections</strong></td>
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<td><em>Escherichia coli</em></td>
<td>% NS to ciprofloxacin</td>
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<td>% NS to co-amoxiclav</td>
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<td>% NS to piperacillin/tazobactam</td>
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<td>4.2</td>
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<td><em>Acinetobacter spp.</em></td>
<td>% NS to colistin</td>
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Carbapenem & piperacillin-tazobactam usage & resistance (from ESPAUR 2016)

Other AMR is stable except growth in VRE and *E. coli* & *Klec pneum* to CoAmoxiclav (accounts for 25% of hospitals antibiotic use)
Carbapenem Resistance UK

Year

No. of isolates (not no. patients)

Early cases mainly travel related

Later cases mix of 'home grown' and travel related

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• Since 2014, the UK has cut the amount of antibiotics it uses by more than 7% and sales of antibiotics for use in food-producing animals have dropped by 40%. But the number of drug-resistant bloodstream infections have increased by 35% from 2013 to 2017.
Antimicrobial Stewardship Documents

TARGET Antibiotics Toolkit

Antimicrobial prescribing and stewardship competencies

Antimicrobial stewardship: changing risk-related behaviours in the general population

NICE guideline
Published: 25 January 2017
nice.org.uk/guidance/ng63
The scale of the threat of antimicrobial resistance (AMR) and the case for action was set out in the Annual Report of the Chief Medical Officer published in March 2013 and the UK Five Year Antimicrobial Resistance Strategy 2013-18 sets out actions to address the key challenges to AMR.
Start Smart – Then Focus
Antimicrobial Stewardship Toolkit for English Hospitals

Revised February 2015

ANTIMICROBIAL STEWARDSHIP
Treatment algorithm

Start Smart

Then Focus

DO NOT START ANTIBIOTICS IN THE ABSENCE OF CLINICAL EVIDENCE OF BACTERIAL INFECTION

CLINICAL REVIEW & DECISION AT 48-72 HOURS

1. Take through drug allergy history
2. Advise clinical review and microbiology advice
3. Finally review the patient's notes

Clinical review, check microbiology and make a clear plan. Document the decision
Start Smart Then Focus

ANTIMICROBIAL STEWARDSHIP
Treatment algorithm

Start Smart ➔ Then Focus

DO NOT START ANTIBIOTICS IN
THE ABSENCE OF CLINICAL
EVIDENCE OF BACTERIAL
INFECTION

1. Take thorough drug allergy history
2. Initiate prompt effective antibiotic treatment
   within one hour of diagnosis (or as soon as
   possible) in patients with severe sepsis or
   life-threatening infections
3. Comply with local antimicrobial prescribing
   guidance
4. Document clinical indication (and disease
   severity if appropriate), dose and route on
   drug chart and in clinical notes
5. Include review/stop date or duration
6. Obtain cultures prior to commencing
   therapy where possible (but do not delay
   therapy)

CLINICAL REVIEW & DECISION
AT 48-72 HOURS

Clinical review, check microbiology and make
a clear plan. Document this decision

1. STOP
2. IV to oral switch
3. Change antibiotic
4. Continue
5. OPAT

Document Decision & Next
Review Date or
Stop Date

DOCUMENT ALL DECISIONS

* In accordance with surviving sepsis patient safety alert

*According to weight/age in children refer to local formulary or BNFC
*Use appropriate route in line with severity/patient factors
*Outpatient Parenteral Antibiotic Therapy

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TACKLING DRUG-RESISTANT INFECTIONS GLOBALLY: FINAL REPORT AND RECOMMENDATIONS

THE REVIEW ON ANTIMICROBIAL RESISTANCE
CHAIRLED BY JIM O’NEILL
MAY 2016
The future – Jim O’Neil

No (clean-contaminated/dirty) surgery, no chemotherapy (neutropenic sepsis)
Cost will be $100 trillion per year ($100,000,000,000,000)
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News story

Antimicrobial resistance: UK launches 5-year action plan and 20-year vision

The plans outline the UK's contribution to containing and controlling antimicrobial resistance (AMR) in health, animals, the environment and the food chain.

Published 24 January 2019
From: Department of Health and Social Care
• The government has published a 20-year vision and 5-year national action plan for how the UK will contribute to containing and controlling AMR by 2040.

The plans include targets, such as:

• cutting the number of drug-resistant infections by 10% (5,000 infections) by 2025
• reducing the use of antibiotics in humans by 15%
• preventing at least 15,000 patients from contracting infections as a result of their healthcare each year by 2024
Figure 2. UK efforts to tackle AMR include global and domestic activities, identifying drivers of AMR emergence and spread.

**GLOBAL ACTIVITIES**
- Drive global advocacy, governance and political agenda
- Promote access and responsible use
- Improve detection and surveillance
- Reduce the burden of infection in humans and animals
- Promote R&D

**DOMESTIC ACTIVITIES**
- Improve IPC practices
- Optimise prescribing practice
- Improve professional education, training and public engagement
- Improve access to, and use of, surveillance data
- Develop new drugs, treatments and diagnostics
• According to Doron and Davidson (2011) three major goals for antimicrobial stewardship are to:
• optimise therapy for individual patients
• prevent overuse, misuse and abuse
• minimise development of resistance at patient and community levels
• Overuse of antibiotics is one of the main drivers of the increase in resistance, yet between 2000 and 2010, the global consumption of antibiotics increased by 36%.

• The scale of the problem will require a range of approaches, and addressing the unnecessary use of antibiotics is one priority.
• Focus on interventions which build relationships of inter- and intra-disciplinary support, and which break down cultural, social and political barriers to appropriate antibiotic prescribing
County Durham and Darlington NHS Foundation Trust (CDDFT)

- One of the largest hospital and community healthcare providers in the NE
- Serves a population of ~600,000
- 2 acute sites
- 6 community Hospitals, 6 UCCs

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Drivers for Antimicrobial Stewardship at CDDFT

• Breached MRSA/C DIFF Targets 2008
• Poor compliance with antibiotic formulary
• Over use of broad spectrum antibiotics
• Prolonged courses
• Polypharmacy
• Prescribers failing to understand the link between antibiotic use and CDI
• A resistance to change culture and prescribing habits
• No grasp of scale of problem
Antimicrobial Stewardship

- Establish a framework of antimicrobial stewardship
- Aims
  - Reduce HCAI
  - Prevent the emergence and spread of organisms
  - Ensure quality in patient care and safety by prudent prescribing
Antimicrobial Stewardship CDDFT

- Introduced in late 2008
- Robust prescribing policies
  - Evidence based guidelines
  - Clear standards
  - Restrictive
- Education and training
- Establish an Antimicrobial Management Team
- Engagement with clinical teams and senior managers
- Framework of assurance – regular audit and feedback

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Strategies

• Restrictive
  – Antibiotic Formulary policy status
  – Restriction of broad spectrum antibiotics
  – Traffic light process for antibiotics
  – Restricted Carbapenems
  – Restricted new antibiotics, e.g. Dapto, newer Ceph

• Proactive
  – Rolling programme of audit and feedback
  – Antibiotic ward rounds by microbiologists and antibiotic pharmacists
  – Education and training
  – Ward based pharmacists to offer “inside intelligence”
  – Web/App based Antibiotic formulary
  – Exec led walkrounds
  – New medication chart, now EPMA
  – Point of care, real time decision support

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Education of Trust prescribers

- Prescribed only when clinical indication of a bacterial infection
  - Carry out appropriate investigations
  - Send appropriate samples
  - Remove focus of infection if possible
- State the diagnosis in clinical record
- Plan of treatment
  - Chosen antibiotic and intended duration
  - Clinical parameters for monitoring treatment

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Antibiotic Prescribing

- Select antibiotic in accordance with guidance
- Apply a stop or review date
- IV to Oral switch
  - first dose does not have to be given IV
- Single dose surgical prophylaxis
- Review Antibiotics daily
  - Change those which do not comply
  - Stop Unnecessary prescriptions
  - Narrow spectrum where possible
  - Check on micro specimens and document results

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Antimicrobial Stewardship: The beginning

Poor compliance

- Lack of an assurance framework, 2008
- Polypharmacy
- Broad spectrum
- Prolonged courses
- Resistance to change

Restrictive

- Establish a Framework of Antimicrobial Stewardship 2009
- Antibiotic Formulary policy status
- Restriction of broad spectrum antibiotics
- Education and training

Proactive

- Rolling programme of audit and feedback
- Antibiotic ward rounds

Proactive

- Ward based pharmacists to offer “inside intelligence”
- Web/App based Antibiotic formulary
- New medication chart
- Audit data at Board level
- MD and DIPC at AMT

Executive

- Exec led walkrounds
- Control of High Risk Antibiotics
- Antibiotic Consumption Data

All the way to the top

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**Smartphone App - Microguide**

**County Durham and Darlington NHS Foundation Trust**

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**Respiratory**

**LRTI not pneumonia or Exacerbation of COPD/Asthma**

- **LRTI:** NICE guidance in Respiratory Tract Infections recommends antibiotics should generally only be used in patients who are systemically unwell or with symptoms or signs of serious complications or those at high risk of serious complications due to pre-existing comorbidity such as significant heart, lung, renal, liver or neuromuscular disease, immunosuppression, cystic fibrosis and young children who were born prematurely. In addition antibiotics may be indicated in patients over 65 years of age with two or more of, or if older than 80 years one or more of: hospitalisation in the previous year, type 1 or 2 diabetes, history of congestive heart failure, current use of glucocorticoids.

**First Line**

- Amoxicillin: 500mg PO TDS
- Doxycycline: 200mg PO STAT then 100mg OD

**Severe**

- Amoxicillin: 1g IV TDS
- Penicillin Allergy: Discuss with Consultant Microbiologist

**Duration**

- Treat for 5-7 days

**Notes**

- Co-amoxiclav is NOT recommended for the empirical treatment of a lower respiratory tract infection or an infective exacerbation of COPD
- Ciprofloxacin is NOT appropriate for empirical treatment of a chest infection.
- Doxycycline is effective against M. catarrhalis. May increase Doxycycline dose to 100mg 12 hourly short term
Antibiotic Review Tasks – Reminder for Doctors

1. All IV antibiotics should have a review task attached – it should not be deselected at the point of prescribing
## Compliant with choice

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## % Antibiotic Review

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</table>
CDDFT Post 48hr cases of *C diff* Apr 2007- Mar 2019

Enhanced infection control measures and Introduction of Antimicrobial Stewardship

Enhanced infection control measures and Reinvigoration of Antimicrobial Stewardship

Financial Year

- 2007/08
- 2008/09
- 2009/10
- 2010/11
- 2011/12
- 2012/13
- 2013/14
- 2014/15
- 2015/16
- 2016/17
- 2017/18
- 2018/19

Number of cases
Total Antibiotic Use CQUIN
Total Antibiotic Use CQUIN
## Tazocin Resistance CDDFT

*E coli* Bacteraemia’s April – June 2016

<table>
<thead>
<tr>
<th>Month</th>
<th>No of Specimens</th>
<th>Tazocin S</th>
<th>Tazocin I</th>
<th>Tazocin R</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>27</td>
<td>22 (81.4%)</td>
<td>1 (3.7%)</td>
<td>4 (14.8%)</td>
</tr>
<tr>
<td>May</td>
<td>25</td>
<td>15 (60%)</td>
<td>4 (16%)</td>
<td>6 (24%)</td>
</tr>
<tr>
<td>June</td>
<td>24</td>
<td>22 (91.6%)</td>
<td>0 (0%)</td>
<td>2 (8.3%)</td>
</tr>
<tr>
<td>Totals</td>
<td>76</td>
<td>59 (77.6%)</td>
<td>5 (6.6%)</td>
<td>12 (15.8%)</td>
</tr>
</tbody>
</table>

Taz R + Taz I = isolates with reduced susceptibility to Tazocin: 12 + 5 = **17 (22.4%)**
Rolling quarterly average proportion of piperacillin/tazobactam resistant E. coli blood specimens; by quarter

Recent trend:

<table>
<thead>
<tr>
<th>Period</th>
<th>Count</th>
<th>Value</th>
<th>Lower CI</th>
<th>Upper CI</th>
<th>Non-teaching trust</th>
<th>England</th>
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<tr>
<td>2016 Q4</td>
<td>12</td>
<td>15.5%</td>
<td>-</td>
<td>-</td>
<td>9.1%*</td>
<td>9.3%*</td>
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<tr>
<td>2017 Q1</td>
<td>14</td>
<td>17.0%</td>
<td>-</td>
<td>-</td>
<td>9.2%*</td>
<td>9.3%*</td>
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<tr>
<td>2017 Q2</td>
<td>15</td>
<td>17.5%</td>
<td>-</td>
<td>-</td>
<td>9.1%*</td>
<td>9.2%*</td>
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<tr>
<td>2017 Q3</td>
<td>14</td>
<td>17.3%</td>
<td>-</td>
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<td>8.9%*</td>
<td>9.1%*</td>
</tr>
<tr>
<td>2017 Q4</td>
<td>14</td>
<td>17.4%</td>
<td>-</td>
<td>-</td>
<td>9.0%*</td>
<td>9.4%*</td>
</tr>
<tr>
<td>2018 Q1</td>
<td>13</td>
<td>16.6%</td>
<td>-</td>
<td>-</td>
<td>9.0%*</td>
<td>9.3%*</td>
</tr>
<tr>
<td>2018 Q2</td>
<td>11</td>
<td>14.3%</td>
<td>-</td>
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<td>9.1%*</td>
<td>9.5%*</td>
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<tr>
<td>2018 Q3</td>
<td>10</td>
<td>13.0%</td>
<td>-</td>
<td>-</td>
<td>9.1%*</td>
<td>9.4%*</td>
</tr>
<tr>
<td>2018 Q4</td>
<td>8</td>
<td>9.9%</td>
<td>-</td>
<td>-</td>
<td>9.0%*</td>
<td>9.0%*</td>
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</table>

Source: Routine voluntary laboratory surveillance reports to Public Health England via the second generation surveillance system (SGSS); Antimicrobial testing data module
9 years of Stewardship

Evolving….with plenty of challenges…….
Antimicrobial Stewardship: Ongoing strategies.....

- Education and training
- Resources
- Restrictive
- Enabling Interventions
- Exec led walkrounds

Antibiotic Formulary policy status – updated annually

Abx App
Case Based learning for prescribers
Jr Dr Volunteers for AMT/AUDITS

EEAD annually
Social media: FB/Twitter
Abx Guardian

Restriction of broad spectrum antibiotics, esp Meropenem
Tazocin shortage – Diversified Formulary

Ward based pharmacists to offer “inside intelligence”

Web/App based Antibiotic formulary
New medication chart-EPMA

Targeted Audits
CQUIN: Antibiotic Consumption Data AND reductions

All the way to the top
Audit /CQUIN data at Board level
MD and DIPC at AMT
County wide Joint Ac Trust+CCG AMR/HCAI Working group established

www.cddft.nhs.uk
Serious Infections CQUIN

• **Part A** _Timely identification of sepsis in emergency departments and acute inpatient settings_
  - % of patients who met the criteria for sepsis screening and were screened for sepsis

• **Part B** _Timely treatment for sepsis in emergency departments and acute inpatient settings_
  - % of patients who were found to have sepsis in sample above and received IV antibiotics within 1 hour of diagnosis.

• **Part C** _Antibiotic review_
  - Empiric review of antibiotic prescriptions between 24-72 hours of patients with sepsis who are still inpatients at 72 hours.

• **Part D** _Reduction in antibiotic consumption per 1,000 admissions_
  - Total – 2%
  - Carbapenems – 1%
  - Piperacillin/Tazobactam – 2%

www.cddft.nhs.uk
Education/Interventions we use

- Feedback of audit date – ward level and Care group Level

- Series of engagement events by site - EEAD/ Abx Awareness weeks/ Walkrounds
  - With all medical and nursing teams:
    - what they learned from these infections
    - How they have changed their practice
    - What obstacles still exist to embedding the learning of these lessons
    - What more support can / should be offered to avoid infections in the future?

- Programme of Executive walkabouts (DIPC, MD, IP&C Drs. & Nurses) to:
  - reinforce good practice,
  - troubleshoot problems and
  - listen to front line clinicians on challenges they face and solutions they would like to explore
Become an Antibiotic Guardian Champion

• European Antibiotic Awareness Day (EAAD) takes place annually on 18 November

• As an Antibiotic Guardian, choose a simple action based pledge and encourage others to join you in protecting antibiotics against the growing threat of antibiotic resistance at: www.antibioticguardian.com

• Resources and promotional materials to support local activities for Antibiotic Guardian and EAAD are available via http://bit.ly/EAAD2014

• The Antibiotic Guardian campaign was established by PHE to improve public and professional knowledge and stimulate engagement on tackling antibiotic resistance

• Public Health England is leading the co-ordination of EAAD activities in England in collaboration with VMD, Department of Health, devolved administrations, and other professional organisations

www.cddft.nhs.uk
Strategies for ongoing Stewardship

- Re-invigorate trust wide programme/strategy of Reduction of AMR
- Enabling interventions
- Behaviour science strategies
- Antibiotic stewardship decision making support – POC testing, SMART solutions
- Whole Health economy approach to reducing AMR/ HCAIs
- CDDFT has already engaged with Commissioners and we had a group set up to address AMR/HCAI agenda and formulate a pioneering programme of “Joint up Working” – need to revisit this
- Share learning across the system
- Include social care in the planning/strategy and sharing from lessons jointly

www.cddft.nhs.uk
HRO Mind Map based on Weick and Sutcliffe (2007)

**Containment of unexpected events:**
- Deference to expertise
- Redundancy
- Oscillation between hierarchical and flat/decentralised structures
- Training and competence
- Procedures for 'unexpected' events

**Just culture:**
- Encouragement to report without fear of blame
- Individual accountability
- Ability to abandon work on safety grounds
- Open discussion of errors

**Problem anticipation:**
- Preoccupation with failure
- Reluctance to simplify
- Sensitivity to operations

**Definition:**
- Tight coupling
- Catastrophic consequences
- Interactive complexity

**High Reliability Organisations**

**Learning Orientation:**
- Continuous technical training
- Open communication
- Root Cause Analysis of accidents/incidents
- Procedures reviewed in line with knowledge base

**Mindful Leadership:**
- Bottom-up communication of bad news
- Proactive audits
- Management by exception
- Safety-production balance
- Engagement with front-line staff
- Investment of resources
Conclusion

• Implementation can be a challenge
• Our experience suggests that barriers to success can be overcome with resource input and stakeholder “buy-in”.
• Sustained efforts and perseverance can lead to sustained improvement.
• Well targeted but ineffective interventions and effective but poorly targeted strategies are equally futile.

• Both the message and the media are key elements. A multifaceted approach is needed to increase the public’s understanding of antibiotic resistance and to change expectations about use of antibiotics. The key elements should include a public relations campaign, clinic based education, and community outreach activities.
ANY QUESTIONS?

Stop Antibiotic Resistance

Bacteria are becoming resistant to antibiotics. Keep antibiotics working for serious infections.

The best way to treat common colds, coughs or sore throats is plenty of fluids, rest and painkillers if needed, not antibiotics. For more information, or if you are worried, talk to your pharmacist or doctor.

Sign up and become an antibiotic guardian

www.antibioticguardian.com

www.cddft.nhs.uk
Acknowledgements

• Antibiotic Pharmacist team – Stuart Brown, Jill Ross and Niamh Gormley
• Consultant colleagues - Dr Aldridge, Malkin, Raviprakash, Ftika and Molyneux
• ICT – Trish Gordon and team
• Executive Board Members – DIPC Mr Scanlon, MD Mr Cundall, CEO S Jacques, Chairman Paul Keane