Comprehensive Antimicrobial Stewardship

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Medical Director, Pediatric Antimicrobial Stewardship
Stony Brook Children’s Hospital
Steering Committee Member, CCCAS
• I have none
GOALS & OBJECTIVES

• Outline the problem of antimicrobial resistance
  o Discuss human antimicrobial overuse and what we are doing to address it

• Define the problem of animal antimicrobial overuse and why it is relevant to human health

• What do we mean by a One Health approach to antimicrobial stewardship?
  o what problems does it have the potential to solve?
Estimated minimum number of illnesses and deaths caused annually by antibiotic resistance*: 

At least 2,049,442 illnesses, 23,000 deaths

*bacteria and fungus included in this report

• 2018 estimates revise deaths to >150,000
$\#?\text{THREAT OF 21^{ST} C.}$

- AMR now: 700,000 (low estimate)
- AMR in 2050: 10 million
- Tetanus: 60,000
- Cancer: 8.2 million
- Measles: 130,000
- Road traffic accidents: 1.2 million
- Cholera: 100,000 – 120,000
- Diarrhoeal disease: 1.4 million
- Diabetes: 1.5 million
“If we’re not careful, we will soon be in a post-antibiotic era. For some patients and some microbes, we are already there.”

—Tom Frieden, Former Director of the CDC

# THREAT OF 21ST C.

Attack of the superbugs: July 2041

What if antibiotics stop working?

How the world belatedly responded to antimicrobial resistance. An imagined scenario from 2041

https://www.economist.com/the-world-if/2019/07/06/what-if-antibiotics-stop-working
# Risk factors for community-onset urinary tract infections due to Escherichia coli harbouring extended-spectrum β-lactamases

Esther Calbo\(^1\), Verónica Romani\(^1\), Marion Xercavins\(^2\), Lucia Gómez\(^3\), Carolina Garcia Vidal\(^3\), Salvador Quintana\(^4\), Jordi Vila\(^4\) and Javier Garau\(^5\)

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Received 7 October 2005, revised 13 January 2006, accepted 25 January 2006

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cases (n = 19)</th>
<th>Controls (n = 55)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/female</td>
<td>4/15</td>
<td>12/43</td>
<td>NS</td>
</tr>
<tr>
<td>Mean age (years) (SD)</td>
<td>61.8 (25)</td>
<td>61.3 (23)</td>
<td>NS</td>
</tr>
<tr>
<td>Place of residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>home</td>
<td>17 (89%)</td>
<td>51 (93%)</td>
<td>NS</td>
</tr>
<tr>
<td>long-term care facility</td>
<td>2 (10%)</td>
<td>4 (7%)</td>
<td>NS</td>
</tr>
<tr>
<td>Bacteraemia</td>
<td>1</td>
<td>3</td>
<td>NS</td>
</tr>
<tr>
<td>Charlson score, mean</td>
<td>2.5</td>
<td>1.7</td>
<td>NS</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>5 (26%)</td>
<td>4 (7%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Intravenous treatment (home programme)</td>
<td>4 (21%)</td>
<td>1 (2%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Previous bacterial infection</td>
<td>13 (68%)</td>
<td>18 (33%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Urinary abnormalities</td>
<td>11 (58%)</td>
<td>18 (33%)</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>Oral cefuroxime</td>
<td>12 (63%)</td>
<td>5 (9%)</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

CDC Data
Calbo et al. JAC, 2006
IS THIS HOW WE FIX IT?

Core Elements of Hospital Antibiotic Stewardship Programs
Core Elements of Outpatient Antibiotic Stewardship
NO...BUT THIS IS...?
• CDC gives guidance on structure
  o Committee led by Medical Director (me!), Pharmacy Lead
  o Need institutional buy-in
  o Multiple members on committee—micro, infection control, nursing...nutrition...?

• Various activities to either review use post hoc, or restrict use in advance

• All depend on data!!
  o what you’re using, how you use it, and do interventions move the needle?
# Antimicrobial Drugs Approved for Use in Food-Producing Animals: 2009 Sales and Distribution Data Reported by Drug Class

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Kilograms</th>
<th>Pounds</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOOD-ANIMAL USE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>aminoglycosides</td>
<td>339,678</td>
<td>748,862</td>
<td>2%</td>
</tr>
<tr>
<td>cephalosporins</td>
<td>41,328</td>
<td>91,113</td>
<td>0%</td>
</tr>
<tr>
<td>ionophores</td>
<td>3,740,627</td>
<td>8,246,671</td>
<td>23%</td>
</tr>
<tr>
<td>lincosamides</td>
<td>115,837</td>
<td>255,377</td>
<td>1%</td>
</tr>
<tr>
<td>macrolides</td>
<td>861,985</td>
<td>1,900,352</td>
<td>5%</td>
</tr>
<tr>
<td>penicillins</td>
<td>610,514</td>
<td>1,345,953</td>
<td>4%</td>
</tr>
<tr>
<td>sulfas</td>
<td>517,873</td>
<td>1,141,715</td>
<td>3%</td>
</tr>
<tr>
<td>tetracycline</td>
<td>4,611,892</td>
<td>10,167,481</td>
<td>28%</td>
</tr>
<tr>
<td>NIR</td>
<td>2,227,366</td>
<td>4,910,501</td>
<td>14%</td>
</tr>
<tr>
<td>sub-total</td>
<td>13,067,100</td>
<td>28,808,024</td>
<td>79.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>HUMAN MED USE</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,300,000</td>
<td>7,275,255</td>
<td>20.2%</td>
</tr>
</tbody>
</table>

| **TOTAL**         | 16,367,100| 36,083,279 | 100%       |

Source: FDA
FARM ANTIBIOTIC USE

1. Disease prevention
   - Given to all animals to prevent infection (unhealthy conditions)
   - E.g. Mass administration to entire buildings/herds
   - Or injected into chicken eggs along with vaccines

2. Outbreak containment
   - Given to animals near a sick animal to prevent an infection spreading to the herd

3. Treatment of sick animals

- Growth Promotion no longer permitted as a use*
**So What?**

**Antibiotic Resistance**

From the farm to the table

**Resistance**

All animals carry **bacteria** in their intestines

- **Antibiotics** are given to animals
- Antibiotics kill most bacteria
- But resistant bacteria survive and multiply

**Spread**

Resistant bacteria can spread to...

- Animal products
- Produce through contaminated water or soil
- Prepared food through contaminated surfaces
- The environment when animals poop
Resistant bacteria found on food or in the environment can spread to people but not just about the bacteria

Unmetabolized antimicrobials get into soil and ground water through urine and manure
  → resistance in environmental organisms

1 in 5 resistant infections in humans originated from antibiotic use in animals (CDC, 2013)
Swine Farming Is a Risk Factor for Infection With and High Prevalence of Carriage of Multidrug-Resistant *Staphylococcus aureus*  

Shylo E. Wardyn, Brett M. Forshey, Sarah A. Farina, Ashley E. Kates, Rajeshwari Nair, Megan K. Quick, James Y. Wu, Blake M. Hanson, Sean M. O'Malley, Hannah W. Shows ...

*Clinical Infectious Diseases, Volume 61, Issue 1, 1 July 2015, Pages 59–66, https://doi.org/10.1093/cid/civ234*

**Published:** 29 April 2015  **Article history ▼**

- Swine Farmers 6-8x more likely to be colonized with same strain as pigs
- Resistance patterns show drug-resistance came from the pigs
work from my lab has shown that, first, the “livestock-associated” strain of methicillin-resistant S. aureus (MRSA) that was found originally in Europe and then in Canada, ST398, is in the United States in pigs and farmers; that it’s present here in raw meat products; that “LA” S. aureus can be found not only in the agriculture-intensive Midwest, but also in tiny pig states like Connecticut. With collaborators, we’ve also shown that ST398 can be found in unexpected places, like Manhattan.

Nontherapeutic Use of Antimicrobial Agents in Animal Agriculture: Implications for Pediatrics
One Health recognizes that the health of people is connected to the health of animals and the environment. It is a collaborative, multisectoral, and transdisciplinary approach—working at the local, regional, national, and global levels—with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.

A One Health approach is important because 6 out of every 10 infectious diseases in humans are spread from animals.
New York State Department of Health Unveils Comprehensive Strategy to Combat Antimicrobial Resistance In NYS

NYSDOH launches Antimicrobial Resistance Prevention and Control Taskforce to lead coordinated response to protect New Yorkers

TOO BIG FOR ONE GROUP TO FIX
TOO BIG FOR ONE GROUP TO FIX?

The Joint Commission
• FDA Guidance 213 on veterinary antibiotic use
  o Voluntary guidance to manufacturers around use conditions
• USDA Veterinary Feed Directive (1/1/2017)
  o Removed most antibiotics from OTC lists, required prescriptions
  o Still allowed to be in food and water
  o No longer allowed to be used for “growth promotion” so now Rx’s are being written for “disease prevention”
• USDA/FDA is unable to regulate as needed
NEWS RELEASE

For immediate release: June 3, 2019

For more information:
Blair Horner, NYPIRG, bhorner@nypirg.org, 518-436-0876 x257
Zameena Mejia, Senator Brian Kavanagh’s office, zmejia@nysenate.gov, 347-277-2346
Justin Wilcox, Assemblywoman Jamie Romeo’s office, wilcoxj@nyassembly.gov, 518-455-5373
Michael McCauley, Consumer Reports, mmcccauley@consumer.org, 415-902-9537

LEGISLATORS AND OVER 70 GROUPS CALL FOR PASSAGE OF BILL THAT WILL REDUCE THREAT OF ANTIBIOTIC-RESISTANT “SUPERBUGS”

Senator Kavanagh, Assemblywoman Romeo and Advocates Urge Action and Protect the Public’s Health

(Albany) — Senator Brian Kavanagh and Assemblywoman Jamie Romeo joined NYPIRG and over 70 national and state environmental, health, and consumer organizations today to call on the State Legislature and the Governor to take action against the immediate and growing threat to the public’s health posed by antibiotic-resistant “superbugs.”
What you need to know: Why New York is more worried about ‘superbugs’

Reason for concern

Lawmakers and advocates gathered in Albany on Monday to urge the passage of a bill that would reduce the use of antibiotics in food-producing animals. (Photo: Chad Arnold)

We’ll see where this takes us…
McDonald's Says It Won't Be Serving Chicken Raised On Antibiotics

KFC: Mission Accomplished on Antibiotics

January 24, 2019 | Lena Brook

With this commitment, the popular fast-food restaurant is helping to transform antibiotic use practices in the chicken industry.

Chain Reaction: How Top Restaurants Rate on Reducing Antibiotics in Their Meat Supply

We’ll see where this takes us...