Antimicrobial resistance, antimicrobial use, and animals

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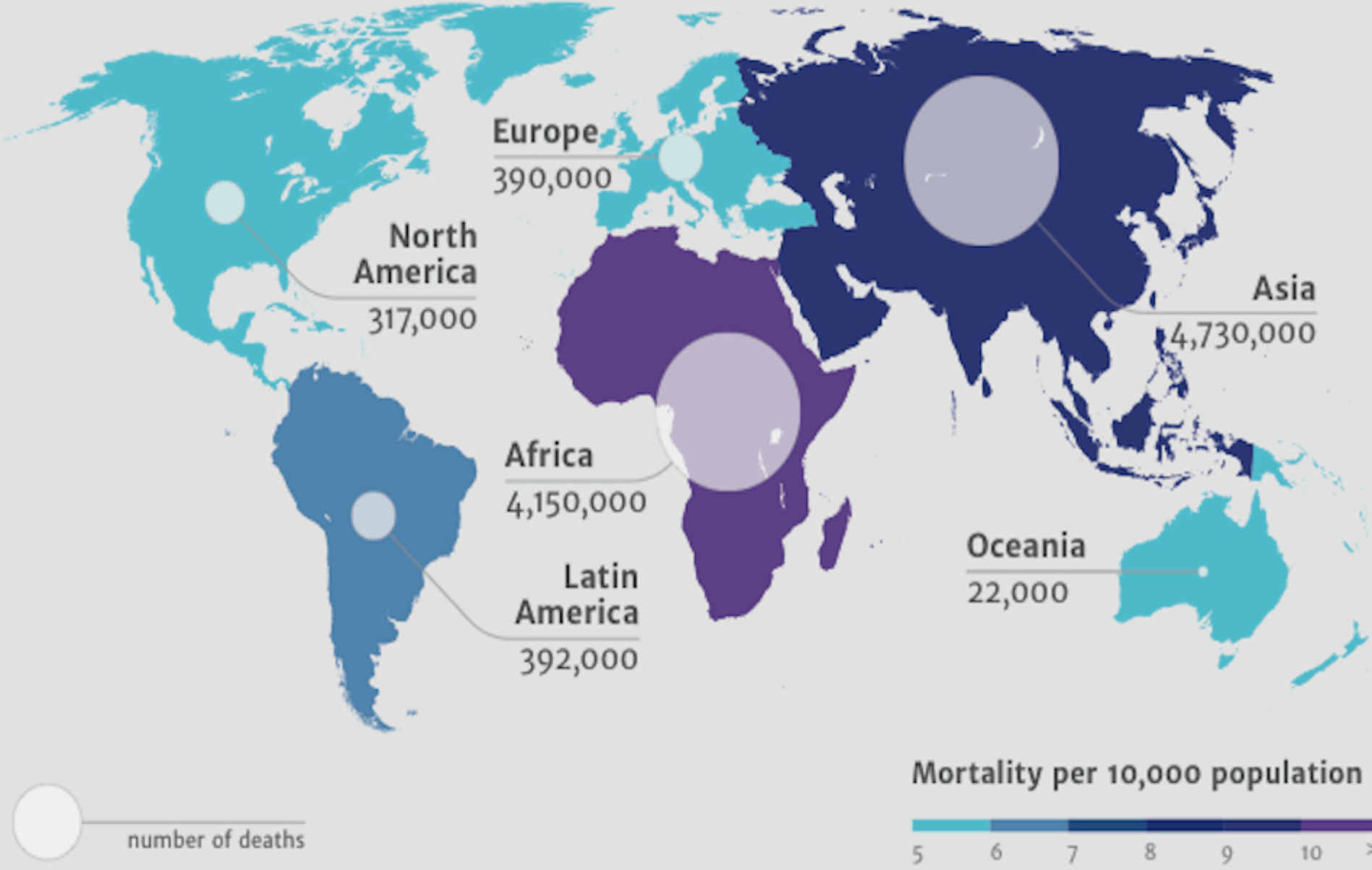
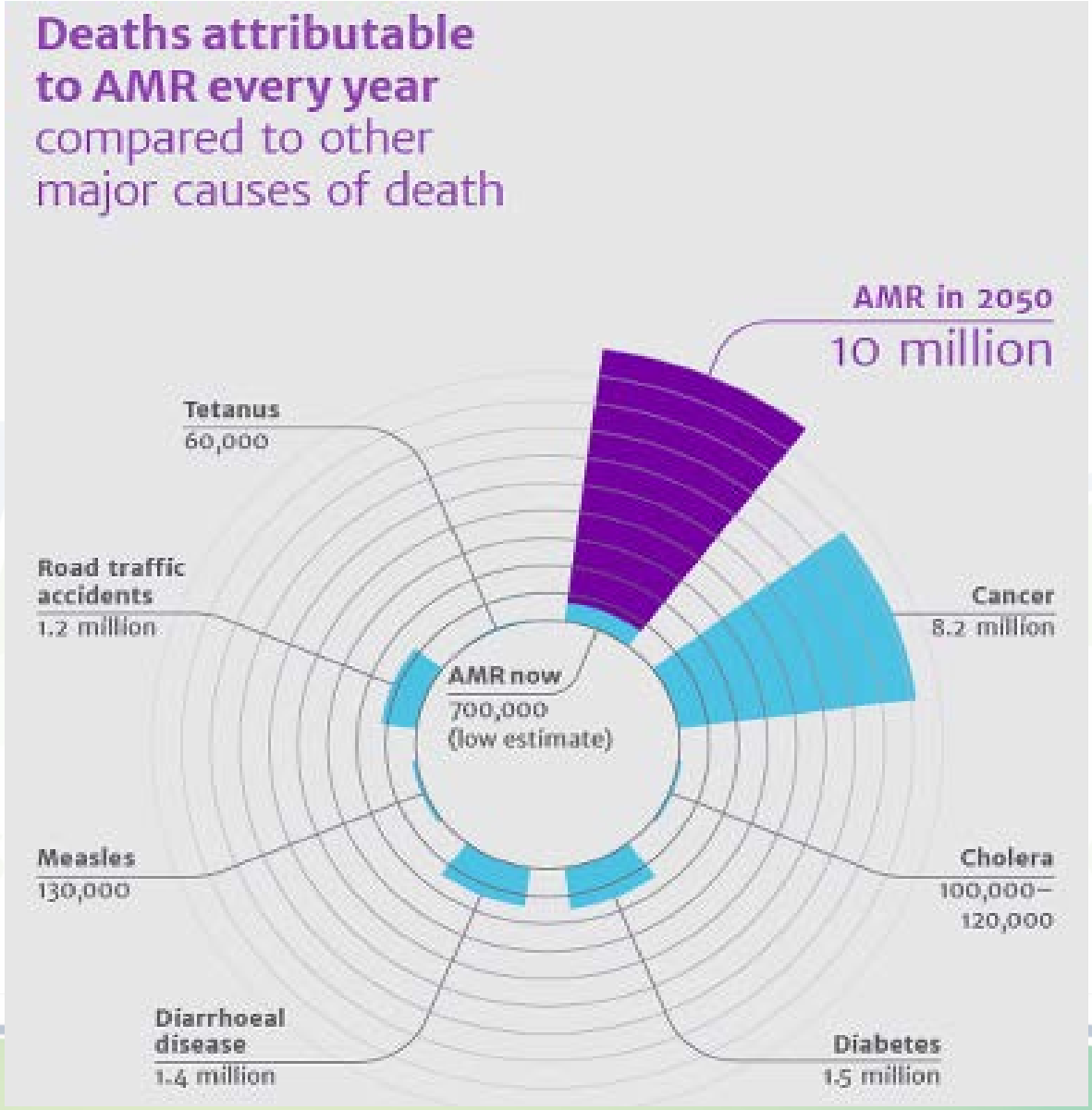
Attributable deaths to AMR by 2050




Deaths attributable to AMR every year
compared to other major causes of death
AMR in 2050
10 million
Tetanus
60,000
Road traffic accidents
1.2 million
Cancer
8.2 million
AMR now
700,000
(low estimate)
Measles
130,000
Cholera
100,000–120,000
Diarrhoeal disease
1.4 million
Diabetes
1.5 million

AMR –'a global crisis'

Creating and Managing a Global Crisis: AMR and CDOs

From discovery to disaster: CDOs- 9 years; AMs- 99 years?

Assessing the role of agriculture

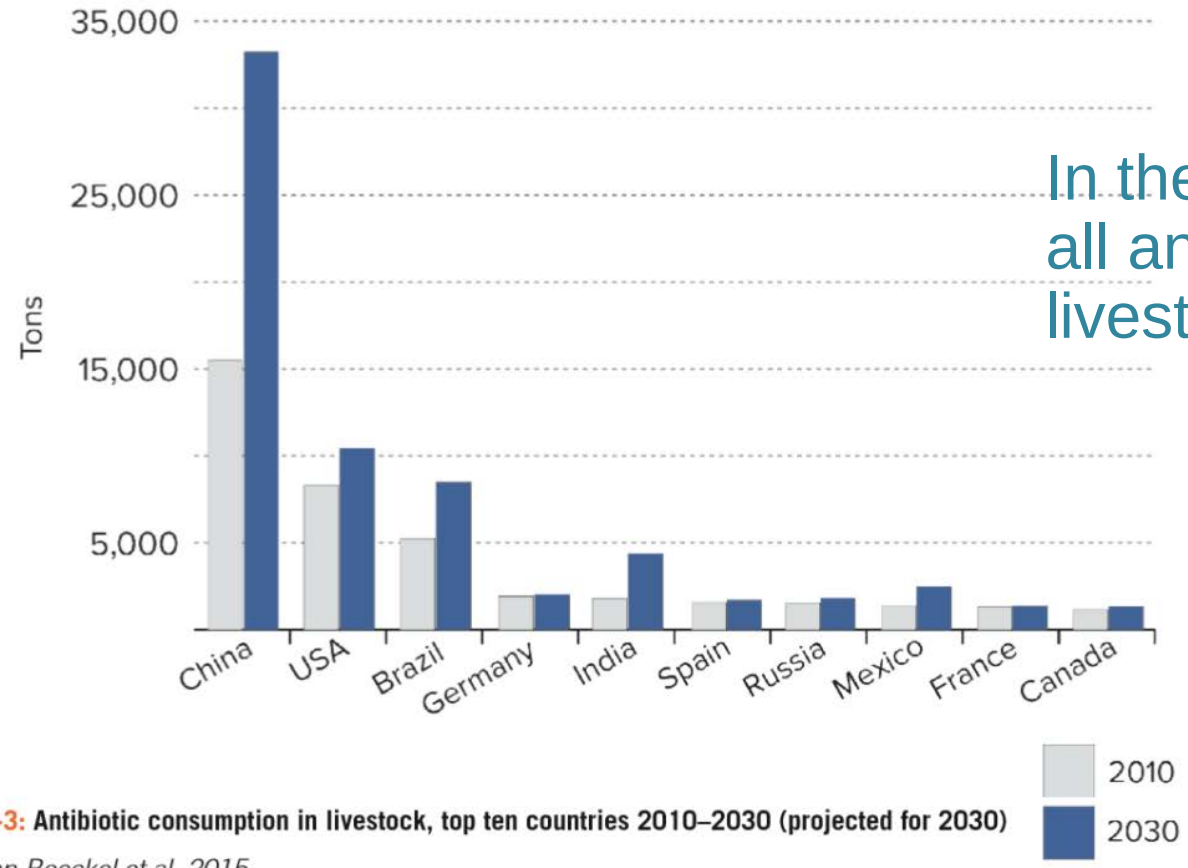


FIGURE ES-3: **Antibiotic consumption in livestock, top ten countries 2010–2030 (projected for 2030)**

Source: Van Boeckel et al. 2015

In the US, >70% of all antibiotic use is in livestock

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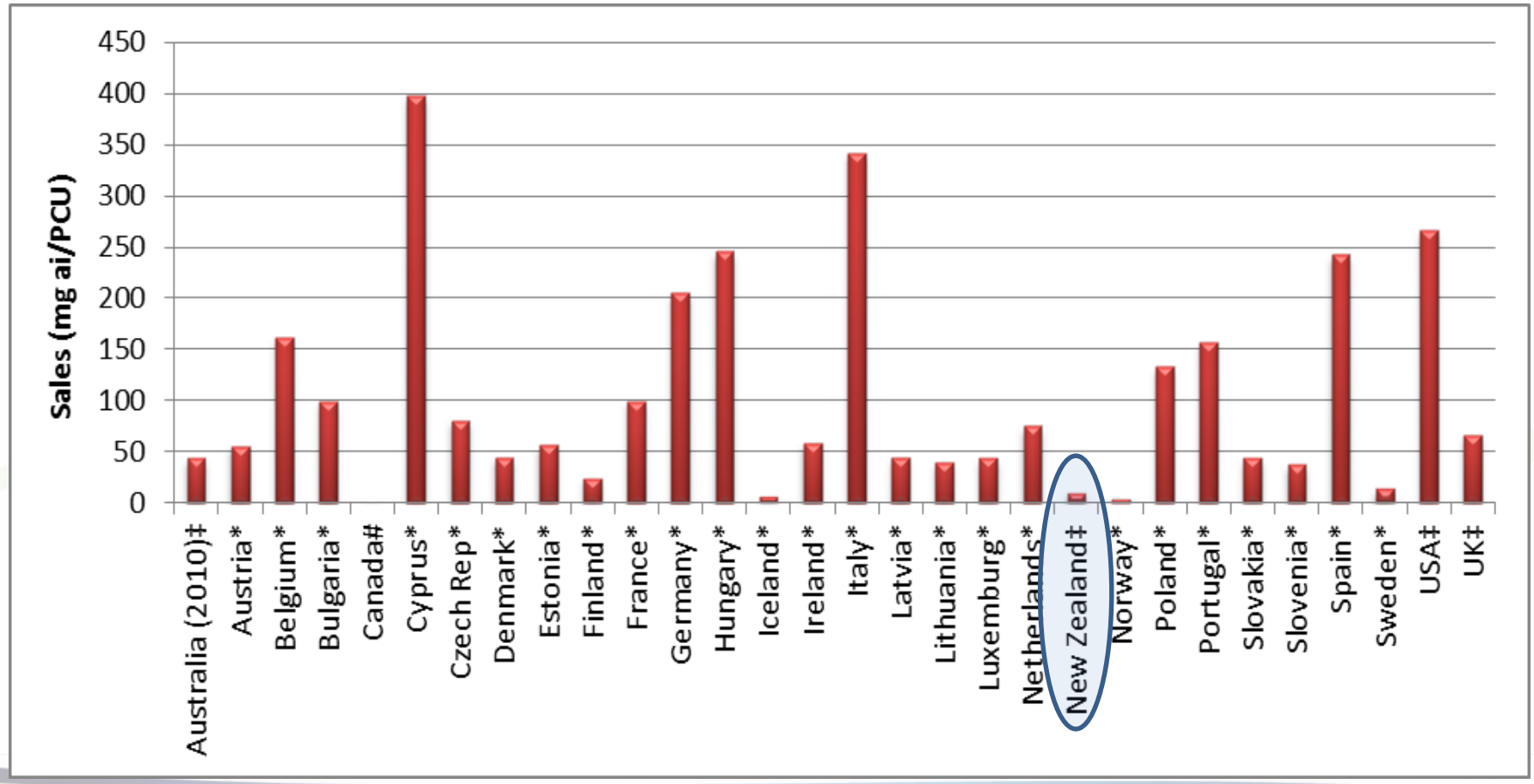
The NZVA's aspirational statement on AMR:

'By 2030, NZ Inc will not need antibiotics for the maintenance of health and welfare in animals'

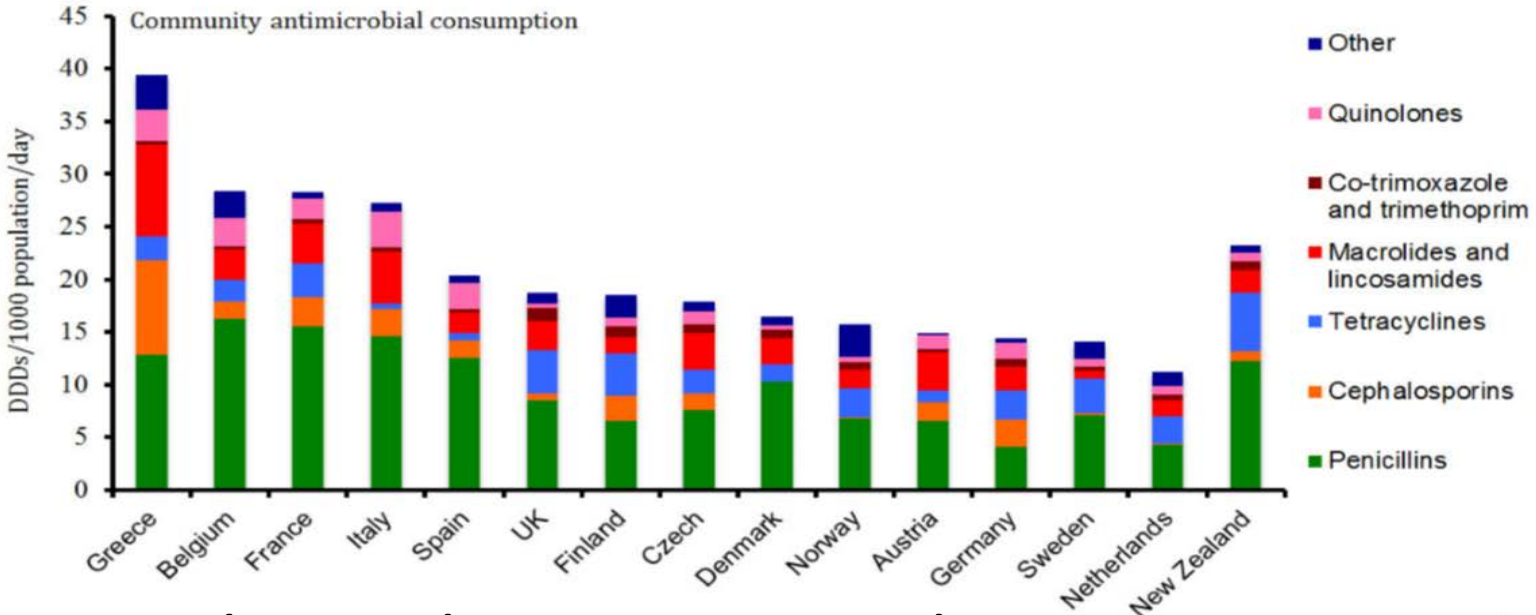
Agricultural use



Hillerton et al; 2017; NZVJ

Human use

Figure 4. Annual per capita consumption of antimicrobials by community-based patients, in various European countries [10] and in New Zealand, during 2010, measured in DDDs/1000 population/day



Thomas et al; NZMJ 23 May 2014, Vol 127 No 1394; ISSN 1175 8716
http://journal.nzma.org.nz/journal/127-1394/6136/

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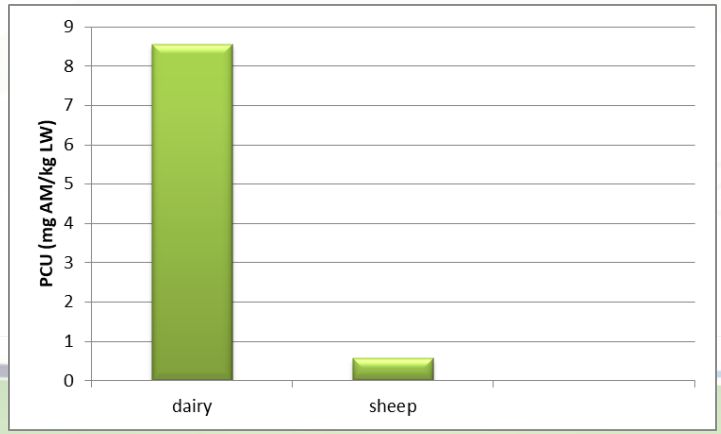
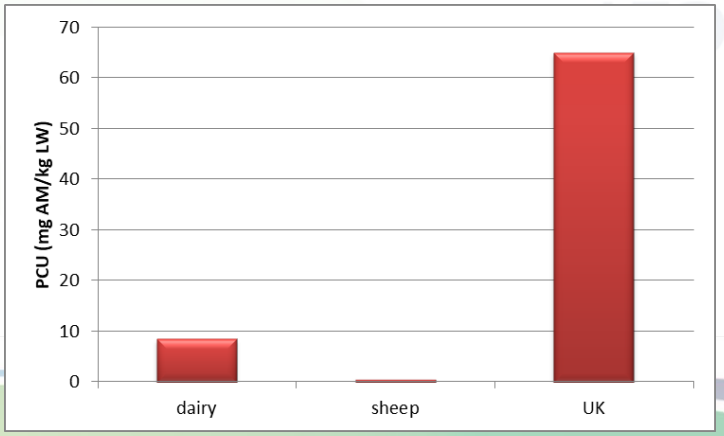
New National Study – 2017

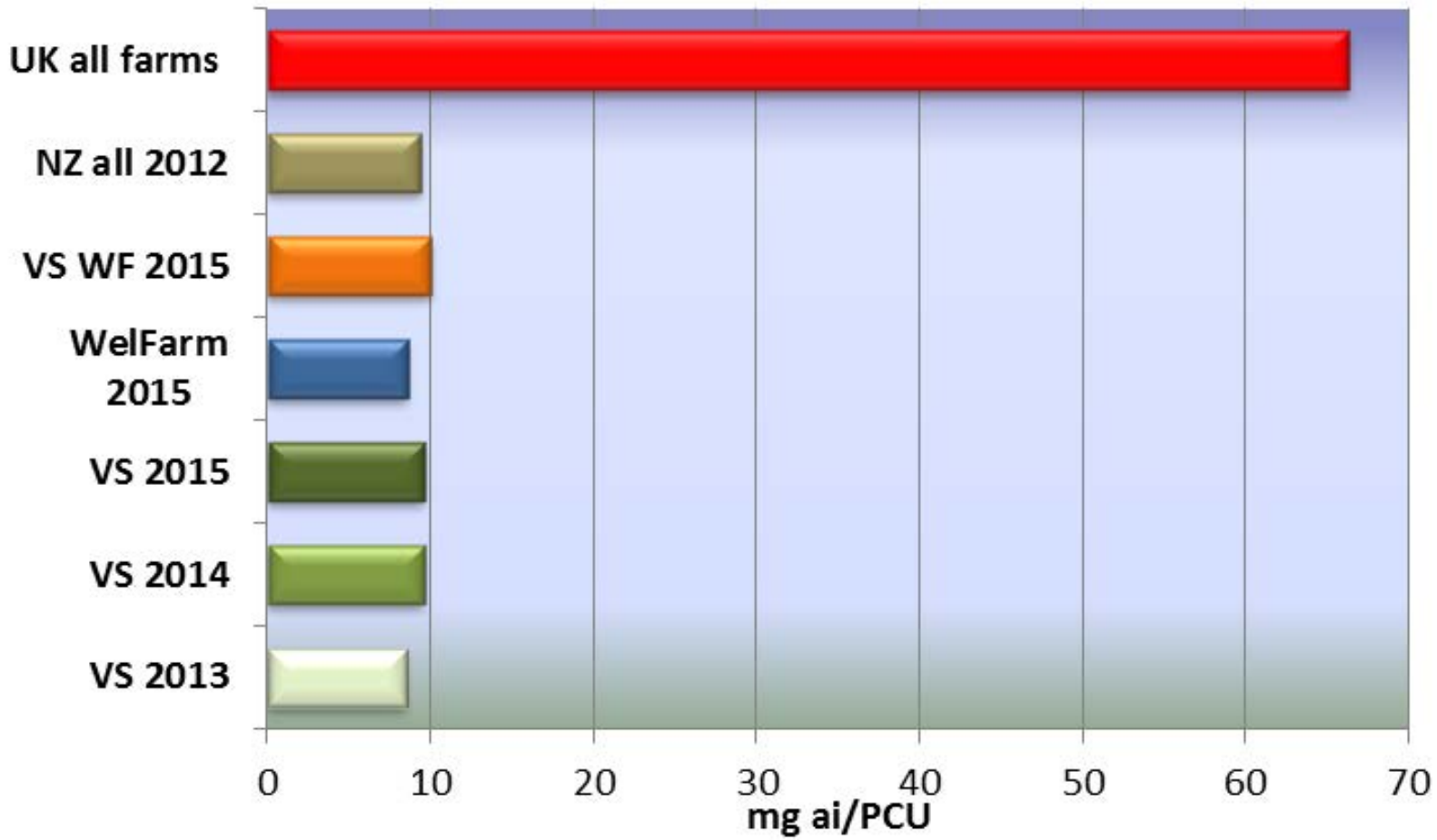
- 1462 dairy farms; 707 general farms
- 623430 cows and R2s; 895,000 red meat

- Dairy PCU **8.54** (regional variation 4.72- 11.91)
- Red meat PCU **0.57** (regional variation 0.33- 0.94)

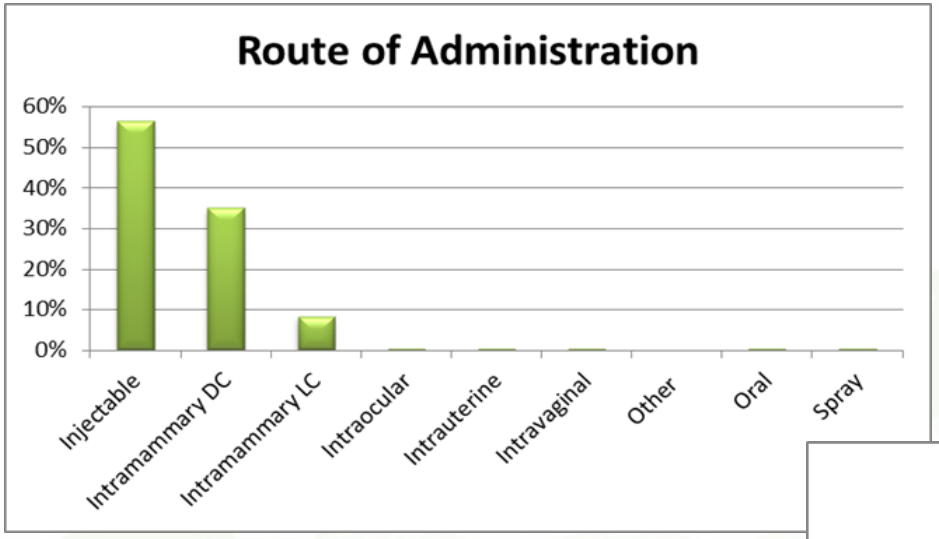


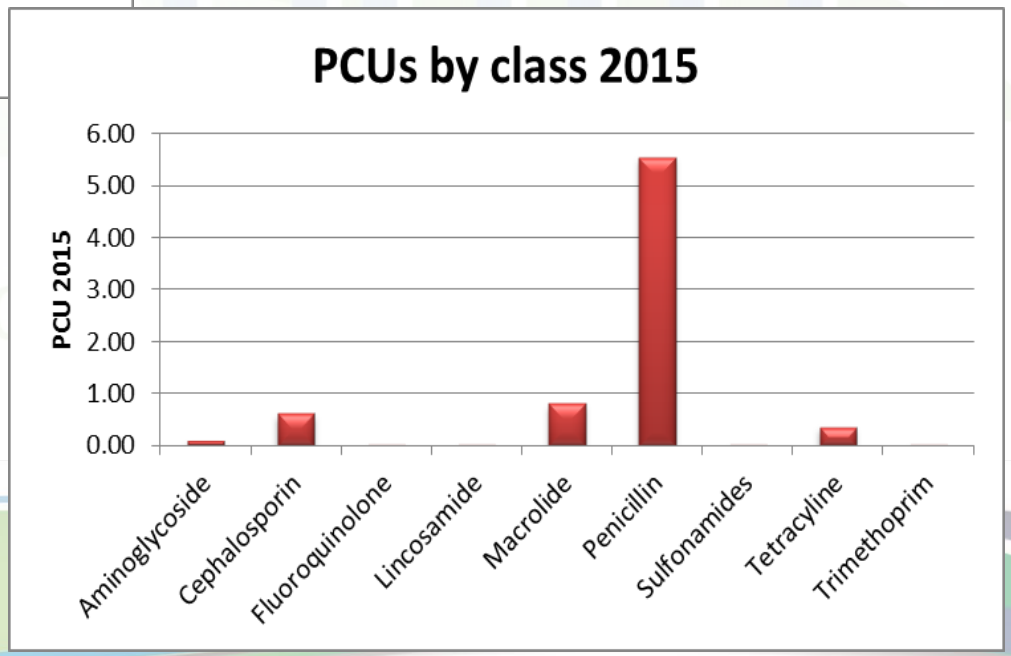


Other comparative data



Where does it all go?





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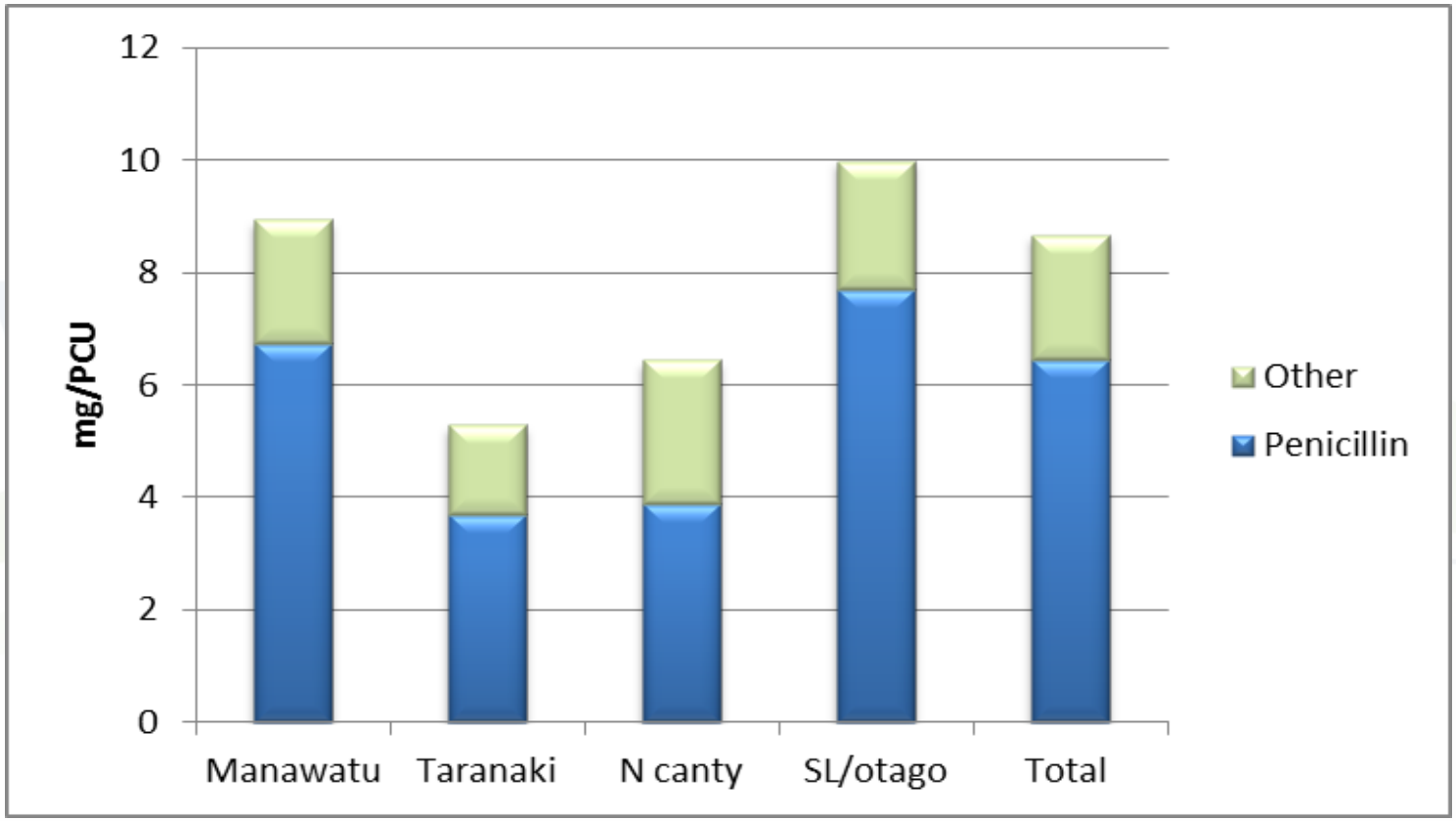
AM use (sales) (total, class) by region



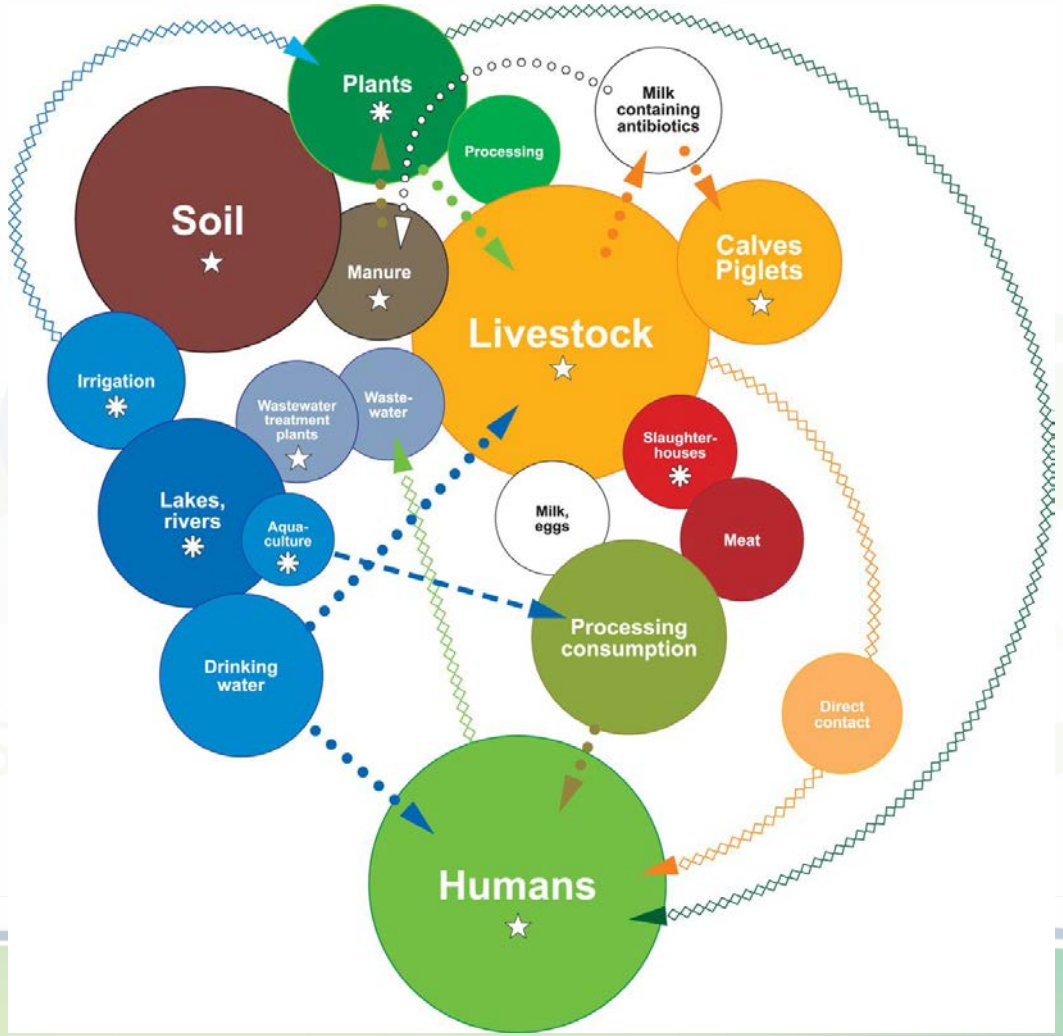
($p<0.01$)

The NZVA's position on DCAT:

The NZVA recognises that the use of DCAT in non- infected cows is no longer appropriate in an era of effective alternatives such as internal teat sealants (ITS) and improved management practices.

By 2020, DCAT (Dry Cow Antimicrobial Therapy) will only be used in the treatment of existing intramammary infections

Pathway map of AMA and AMR dissemination within agriculture, the environment, and the food processing industry.



Sophie Thanner et al. mBio 2016; doi:10.1128/mBio.02227-15

Take home points

- Current NZ Ag ~8-9PCU
- Third lowest globally
- Beta Lactams (not Cephs) and Zn Bacitracin largest actives
- No use of AMs for growth promotion since 1999
- Goal of 4PCU by 2025- reduction in DCAT, ZnB
- Zero (<2) by 2030

Antibiotics and Resistance

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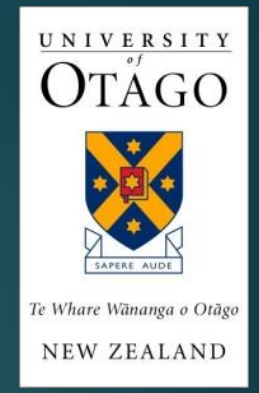
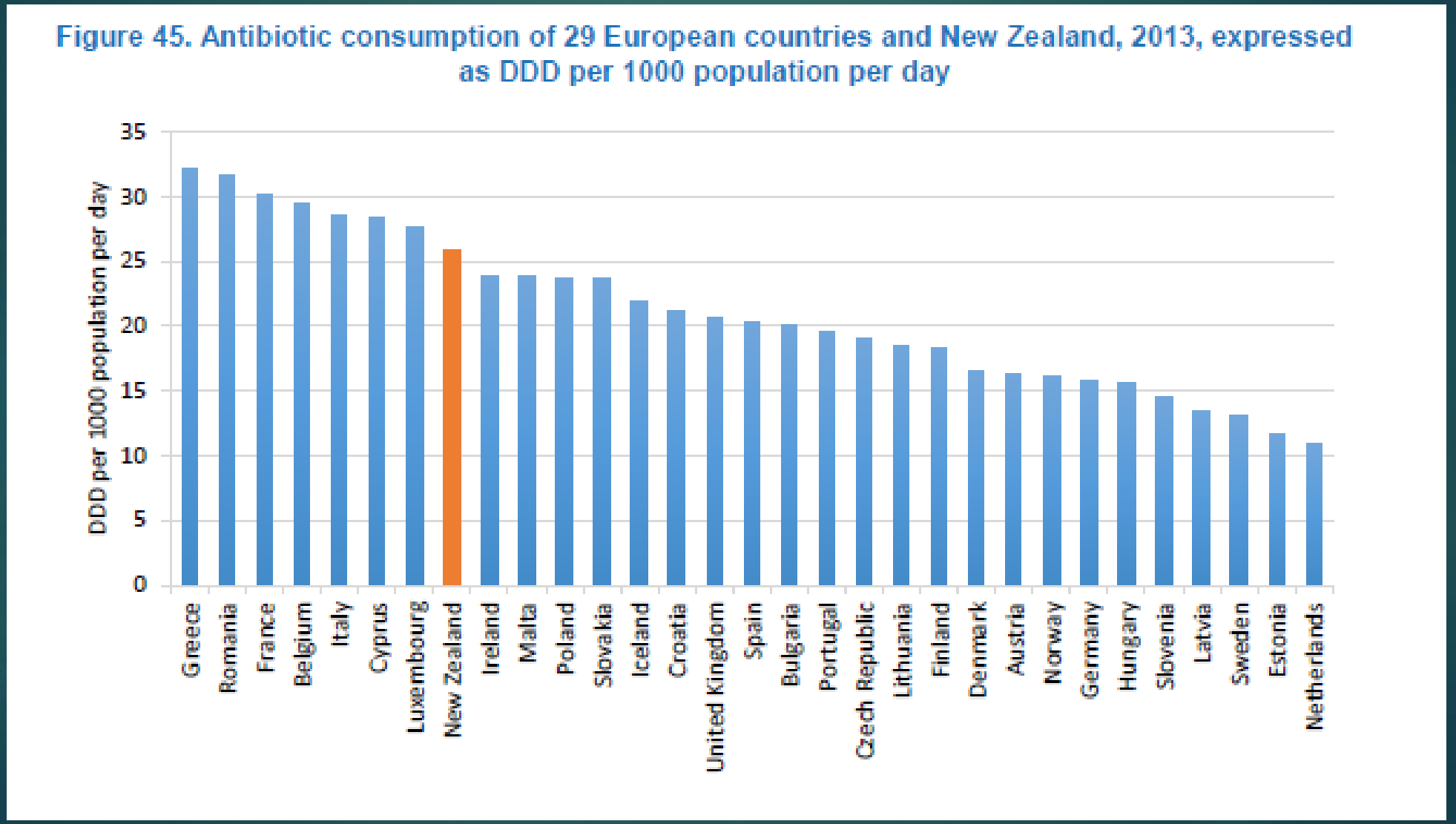


Antimicrobial usage in New Zealand



Antimicrobial usage in NZ secondary and tertiary public hospitals

Table 1: Antibacterial use (DDDs/1000 occupied bed days) in New Zealand, Australia and England (2012–2013)

2012–2013 Antibacterial use (DDD/1,000 occupied bed days)	New Zealand					Australia[4]	England[3]
	ADHB[a]	CDHB[b]	CCDHB[c]	CMDHB[d]	WDHB[e]	NAUSP mean	NHS mean
Total antibacterials	735	707	798	704	727	942	1,297
Quinolones	20	48	28	35	32	43	~50
Cephalosporins	125	120	197	99	178	183	~50
Carbapenems	21	14	20	15	10	21	~30
Piperacillin-tazobactam	1.6	8	19	1.1	2.5	42.7	~43

Comprised Auckland City Hospital[a], Christchurch, Christchurch Women's, Burwood and The Princess Margaret Hospitals[b], Wellington and Kenepuru Hospital[c], Middlemore Hospital[d], and North Shore and Waitakere Hospitals[e].

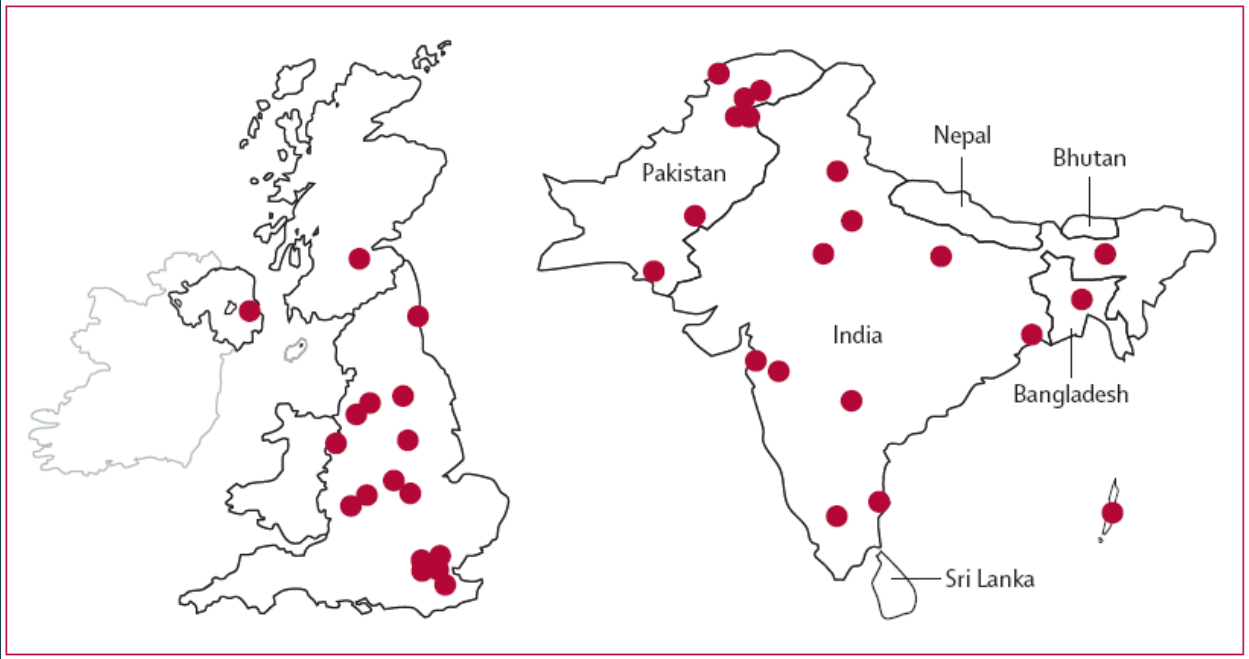


Figure 5: Distribution of NDM-1-producing Enterobacteriaceae strains in Bangladesh, Indian, Pakistan, and the UK

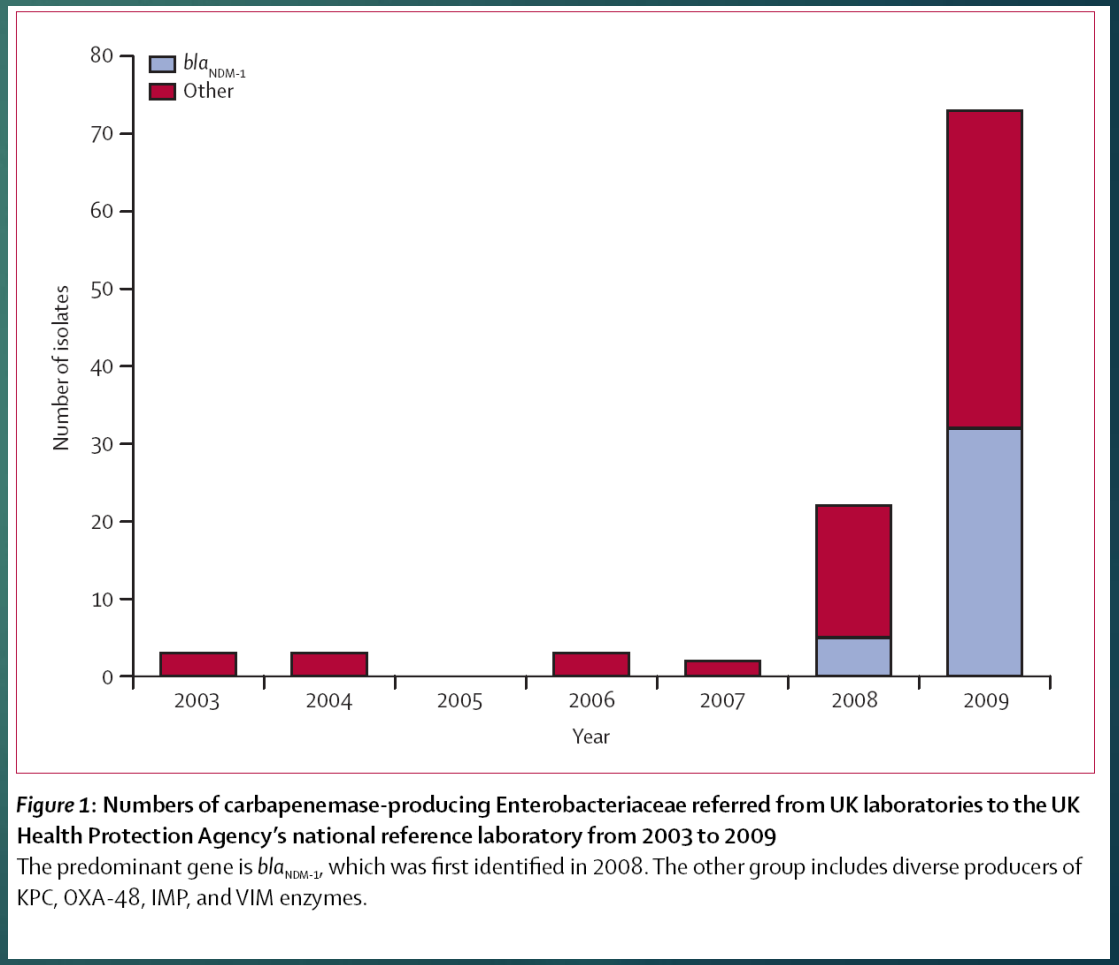


***Figure 1*: Numbers of carbapenemase-producing Enterobacteriaceae referred from UK laboratories to the UK Health Protection Agency's national reference laboratory from 2003 to 2009**

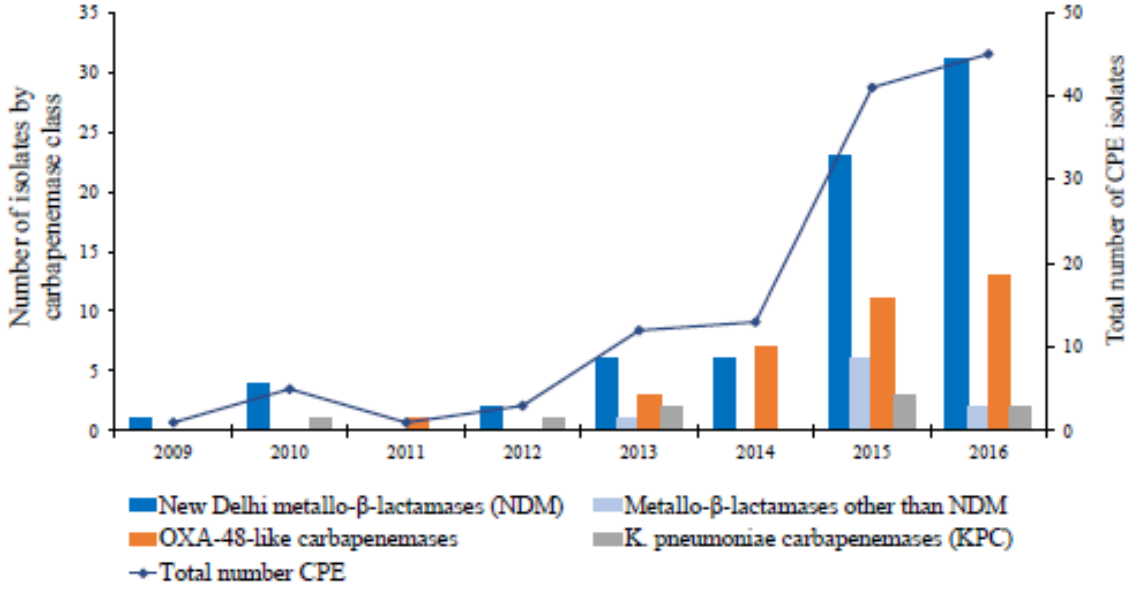
The predominant gene is bla_{NDM-1}, which was first identified in 2008. The other group includes diverse producers of KPC, OXA-48, IMP, and VIM enzymes.

Importing Resistant strains

CPE NZ 2016 - 34 (75.6%) isolated from screening

11 CPE from clinical specimens, 10 (90.9%) were from urine.

Figure 1. Number of carbapenemase-producing Enterobacteriaceae (CPE) isolates identified in New Zealand, by carbapenemase class, each year from 2009 to 2016



Note: Multiple, distinct CPE isolates from the same patient are included, but duplicate isolates of the same species with the same type of carbapenemase from the same patient are excluded. In 2016, there were three CPE isolates that carried the genes encoding for an NDM and an OXA-48-like carbapenemase. These three isolates are counted in the number of isolates for both these carbapenemase classes.

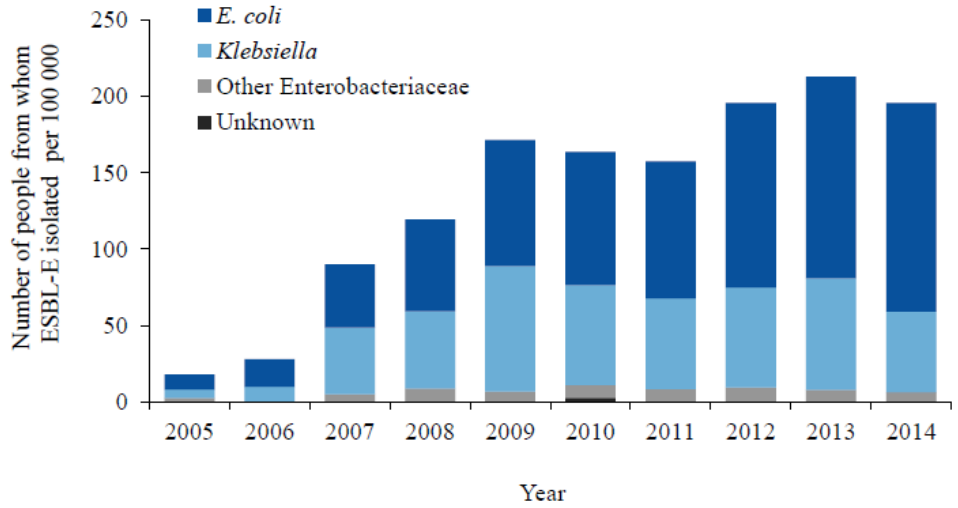
Source of CPE strains in New Zealand

Table 2. Probable place of acquisition of carbapenemase-producing Enterobacteriaceae, 2016

Carbapenemase type and subtype	Number of isolates[1]						
	Probable region of acquisition						
	India	Other parts of Asia[2]	Europe	Middle East	New Zealand	Unknown[3]	Total
KPC	**0**	**1**	**0**	**0**	**1**	**0**	**2**
KPC-2	0	1	0	0	1	0	2
NDM	**23**	**2**	**1**	**0**	**3**	**2**	**31**
NDM-1	8	1	0	0	1[4]	0	10
NDM-4	1	0	0	0	0	0	1
NDM-5	14	1	1	0	2	2[5]	20
NDM-7	1	0	0	0	0	0	1
IMP	**0**	**0**	**0**	**0**	**1**	**1**	**2**
IMP-4	0	0	0	0	0	1	1
IMP-8	0	0	0	0	1	0	1
OXA-48-like	**7**	**0**	**0**	**1**	**3**	**2**	**13**
OXA-48	0	0	0	0	0	1	1
OXA-162	0	0	0	1	0	0	1
OXA-181	4	0	0	0	1	1[5]	6
OXA-232	3	0	0	0	2[6]	0	5
Total	**27**[7]	**3**	**1**	**1**	**8**	**5**	**45**[7]

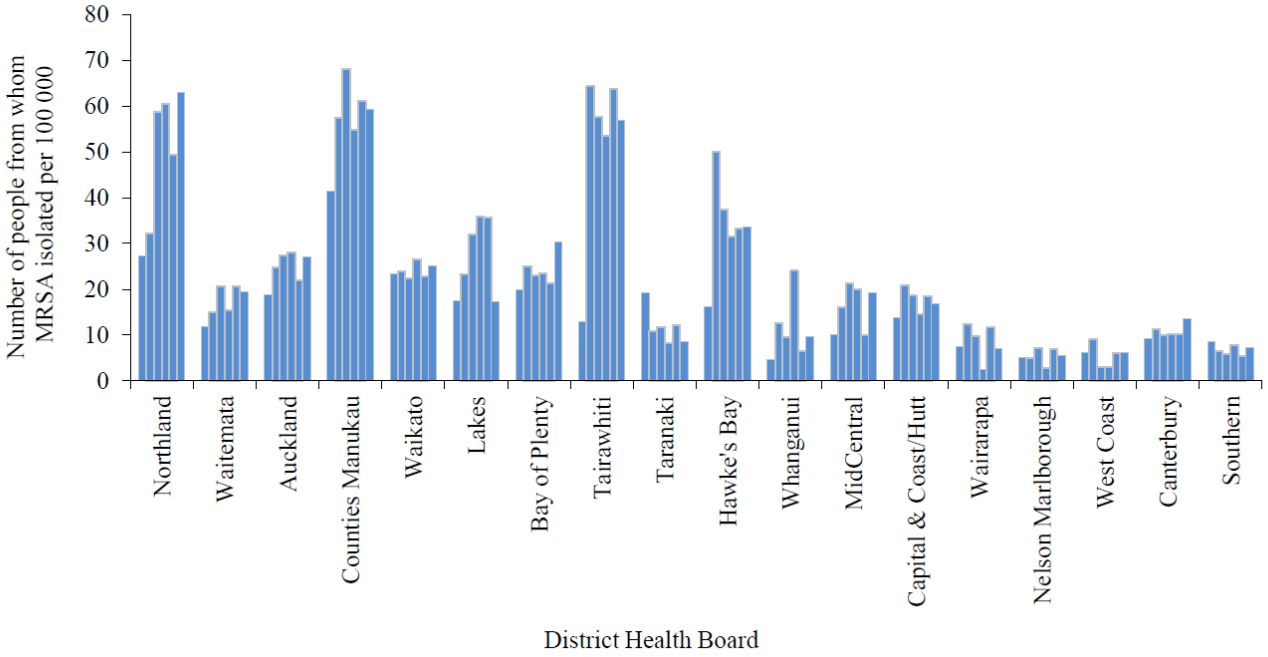
Footnotes on next page

Figure 1. ESBL-producing Enterobacteriaceae incidence rates, 2005-2014



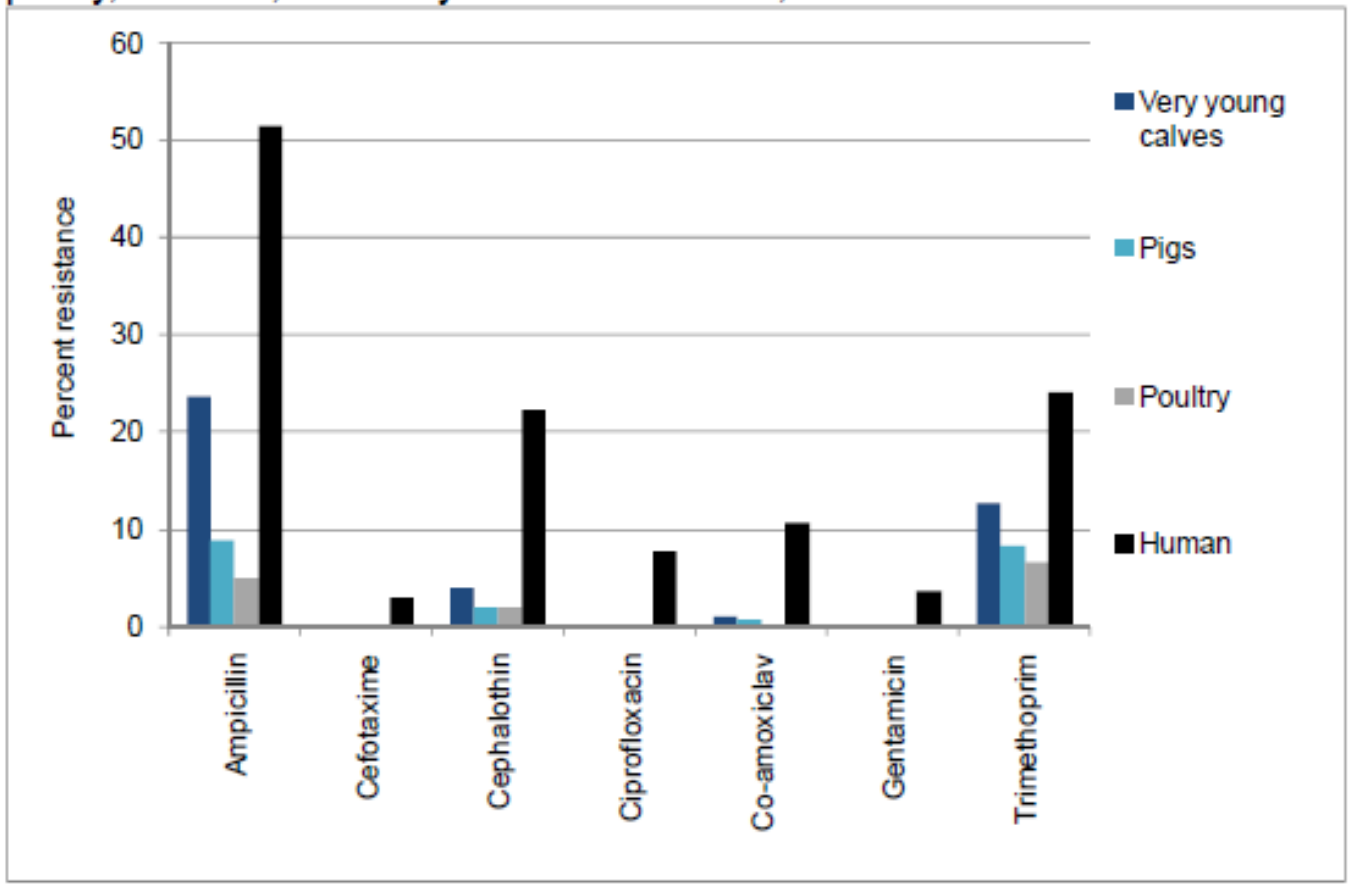
Data for 2005 are based on continuous surveillance of all ESBL-E isolations. Data for 2006 to 2014 are annualised and based on 4-week or 1-month surveys conducted in these years. The 2006 survey only included urinary *E. coli* and *Klebsiella*, therefore the data for 2006 is not directly comparable with that for other years. The category 'Unknown' in 2010 represents people identified with an ESBL-E during the survey period but from whom no isolate was referred to ESR and the species was not reported.

Figure 4. MRSA period-prevalence rates by district health board, 2010-2015



Spread from animals ?

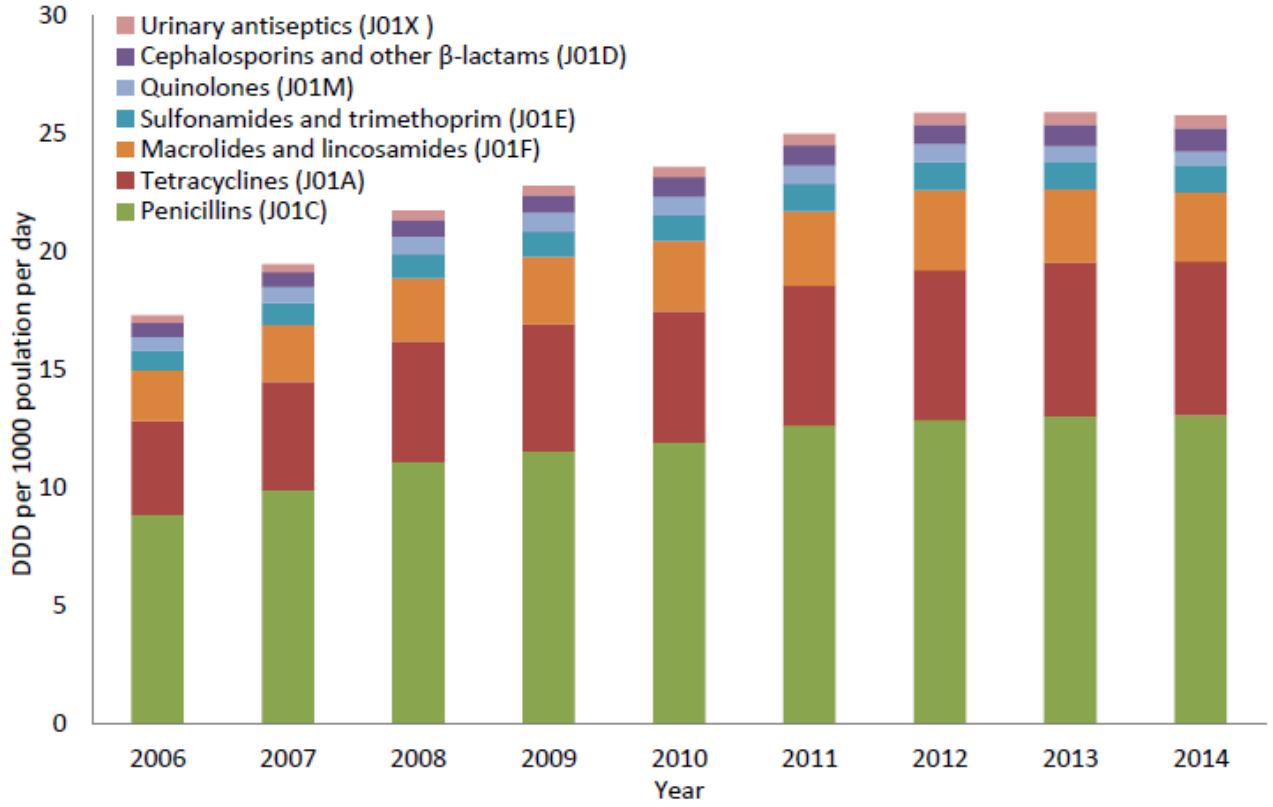
Figure 1. Comparison of resistance among *Escherichia coli* from very young calves, pigs, poultry, 2009-2010, and urinary isolates from humans, 2009[1]



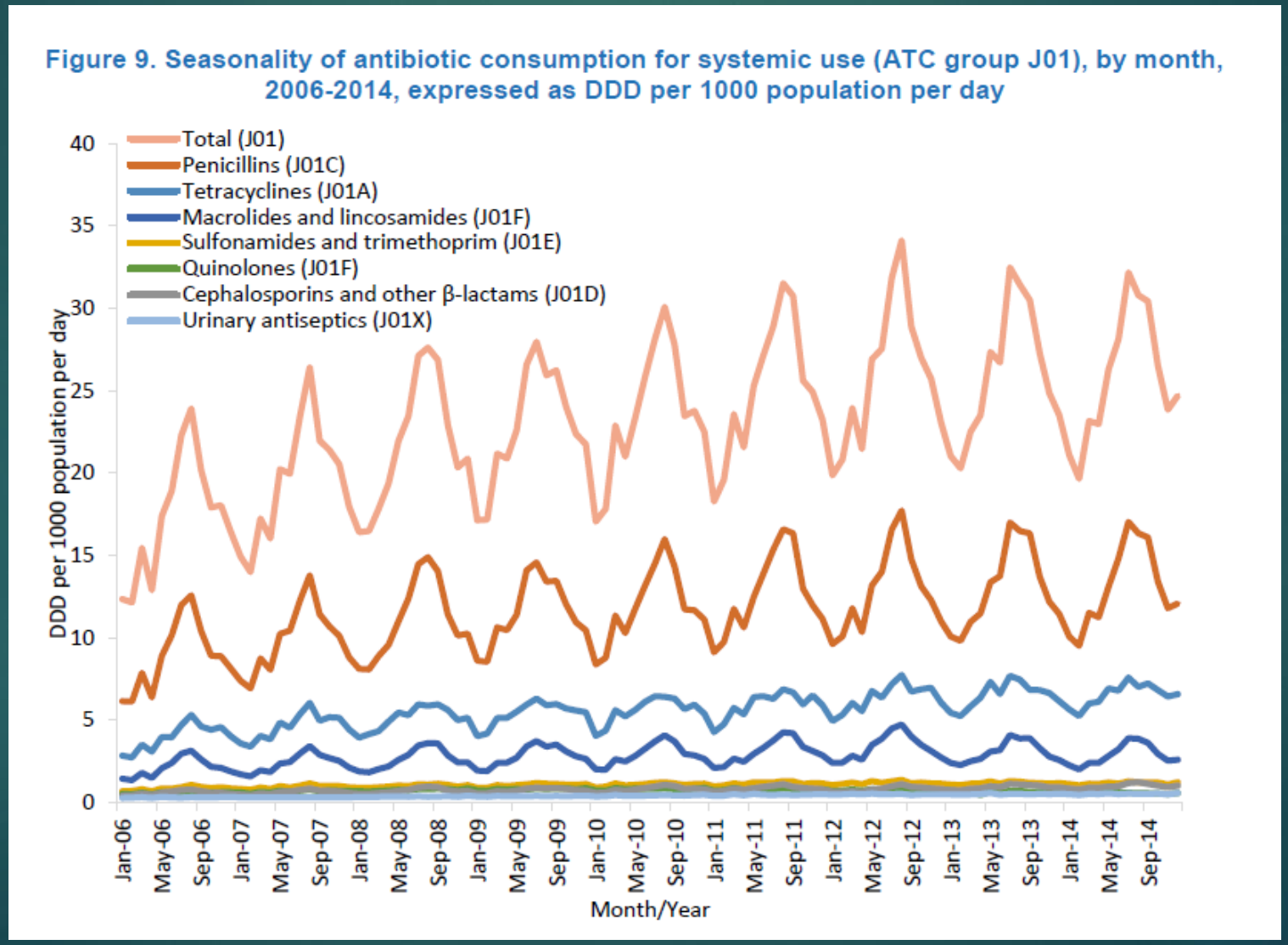
1 The human *E. coli* data is based on resistance data collected from diagnostic laboratories throughout New Zealand and is available at http://www.surv.esr.cri.nz/antimicrobial/general_antimicrobial_susceptibility.php.

Antimicrobial usage in NZ 2006-2014

Figure 1. Antibiotic consumption for systemic use (ATC group J01), 2006–2014, expressed as DDD per 1000 population per day



Antimicrobial usage in NZ by season



Antimicrobial Resistance Action Planning Group March 2017

Both the WHO Global Action Plan (WHO 2015) and the recommendations of the Jim O'Neill Review on Antimicrobial Resistance (2016) will inform the New Zealand National AMR Action Plan.

New Zealand has identified the following five objectives for the action plan to focus on.

1. Improve awareness and understanding of antimicrobial resistance (AMR), including the implications and actions required to combat antimicrobial resistance, through effective communication, education and training.
2. Strengthen the knowledge and evidence base about AMR through research and surveillance.
3. Improve infection prevention and control measures across human health and animal care settings to prevent infection and the transmission of micro-organisms.
4. Optimise the use of antimicrobial medicines for human, animal and plant health, which includes maintaining and enhancing the regulation of animal and plant antimicrobials.
5. Establish and support clear governance, collaboration and investment arrangements so that the approach to minimising AMR is sustainable.

The following sections set out the context and identify priority areas for action for each of these objectives in turn.

Priority areas for action

- Establish a sustainable national governance structure to coordinate all efforts to minimise AMR
- Ensure that investment in initiatives to control AMR is sustainable. This includes ongoing investment in surveillance, communication, stewardship and infection prevention and control
- Establish the necessary national and international linkages and collaborations to implement the action plan effectively

Governance for prescription of antimicrobial agents in humans

- Individualized Prescription by registered professional
  - Doctors – very limited restriction
  - Nurses - within scope of practice
  - Pharmacists – within scope of practice
- Ongoing continuing medical education
- Guidelines
  - BPAC
  - Hospital
    - Restrictive
    - Guideline based
- Prescription filled by Pharmacy
- Quality assurance
  - Professionalism – interaction with the patient
  - Feedback - traffic lights system

What time frame do we have?

- Let's do more than write reports
- No one thing is likely to make a difference – need a bundle approach
- Create the mood for change among the public and practitioners
- Road map for action
- Pick some low hanging fruit
  - Advice to travelers
  - Provide feed back to prescribers eg traffic light system
- Test some interventions

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KEEP
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Antimicrobial
Stewardship

Spread of resistance organisms

- Importing them
  - Travelling
  - Travelers
  - Animals
- Generating our own
  - Quinolone resistance
  - Fusidic acid resistance
  - Mupirocin resistance
- Spreading them around
  - Hospitals
  - Nursing homes
  - Hospitals
  - Animals
  - Food