NZVA
New Zealand Veterinary Association

www.nzva.org.nz

My family and other animals: AMR and the role of veterinarians in global health

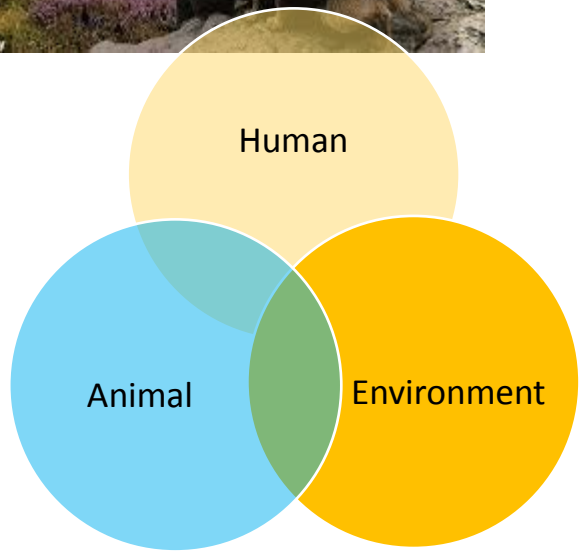
Symposium on Infectious Diseases, March 22-23, 2016, Wellington

Mark Bryan BVMS MACVSc (Epi) MVS (Epi)

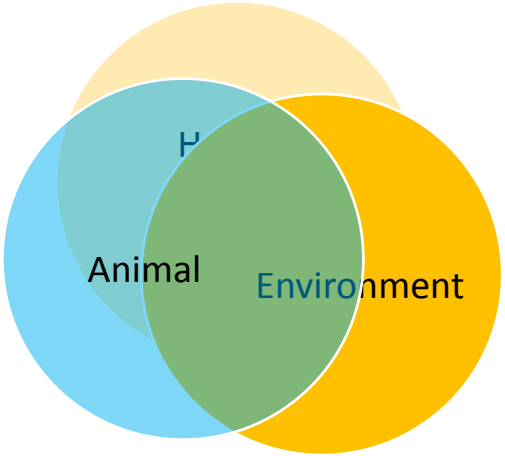
AMRSG; NZVA Board Member

Winton, Southland

Veterinarians typically live at the intersection of the animal- human- environment



Veterinarians typically live at the intersection of the animal- human- environment



Work at this intersection cuts across 4 key disciplines:

- AMR
- Food safety
- Zoonotic disease
- Biosecurity
- *And often exists in a science vacuum*

'Bacteria at home in raw milk

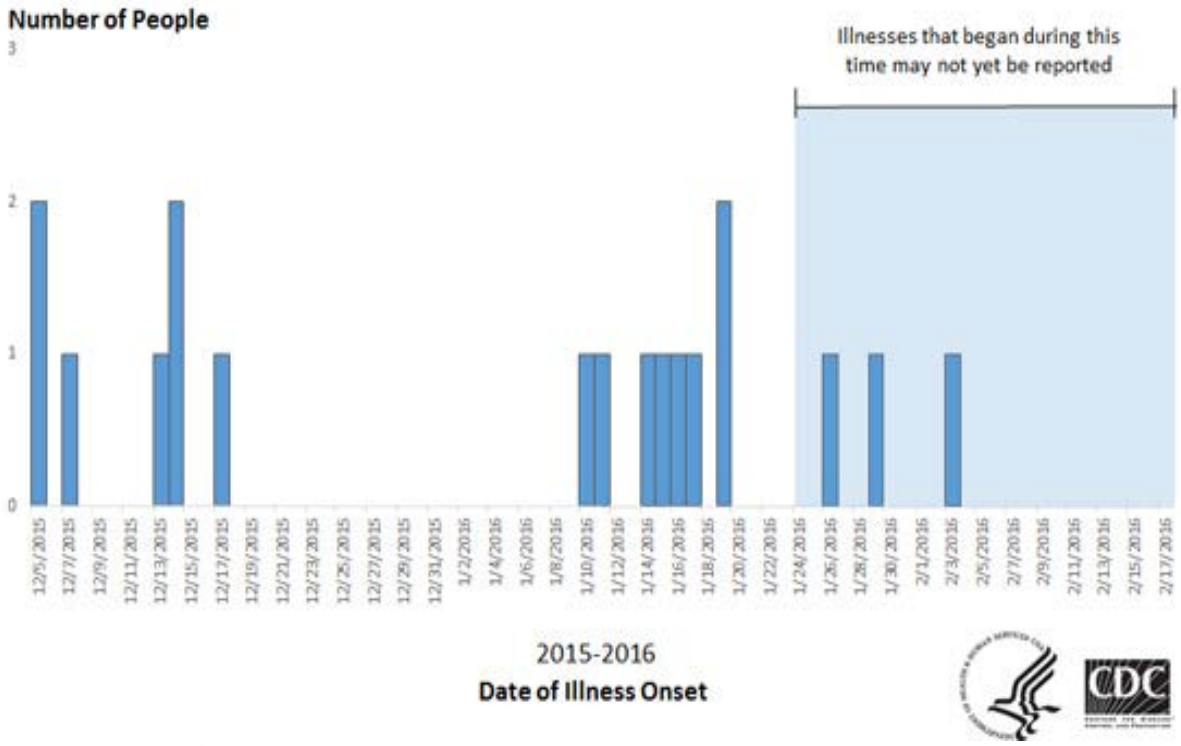
If you love nothing more than slurping on a glass of raw milk, take care – it's considered a "high-risk food" by the Ministry for Primary Industries.
MPI is warning consumers to be careful of unpasteurised milk after a recent spike in people with foodborne illnesses linked to raw milk'

http://readnow.isentia.com/Temp/11229134/492187977.pdf

'"Keeping raw milk refrigerated, heating it to 70C for one minute before drinking and discarding raw milk which has been left out of the fridge at room temperature would reduce the risk", he said'

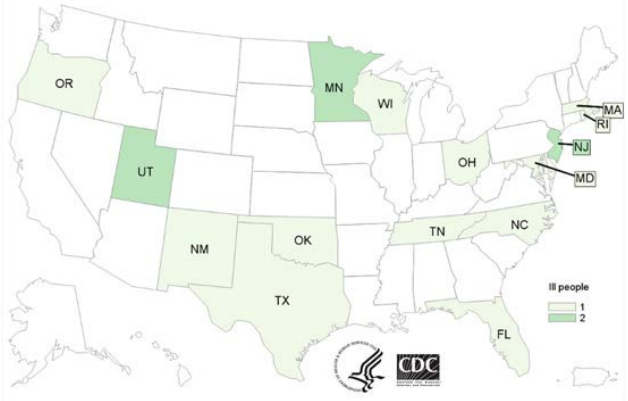
Food –borne disease:

Multistate Outbreak of *Salmonella* Virchow Infections Linked to Garden of Life RAW Meal Organic Shake & Meal Products



At A Glance

- Case Count: 18
- States: 15
- Deaths: 0
- Hospitalizations: 4
- Recall: Yes



Other Ingredients

Organic RAW sprouted protein blend

Organic sprouted brown rice protein, organic moringa (leaf), organic amaranth (sprout), organic buckwheat (sprout), organic millet (pearl & sprout), organic quinoa (sprout), organic chia seed (sprout), organic adzuki bean (sprout), organic flax seed (sprout), organic garbanzo bean (sprout), organic lentil (sprout), organic pumpkin seed (sprout), organic sesame seed (sprout), organic sunflower seed (sprout)

Organic RAW fiber blend

Organic flax meal, organic chia seed

Organic RAW fruit & vegetable blend

Organic spinach (leaf), organic baobab (fruit), organic apple (fruit), organic beet (root), organic broccoli (stalk & flower) organic carrot (root), organic tomato (fruit), organic strawberry (fruit), organic tart cherry (fruit), organic blackberry (fruit), organic green bell pepper (fruit), organic brussels sprout (leaf), organic blueberry (fruit) organic ginger (root), organic garlic (bulb), organic green onion (bulb), organic raspberry (fruit), organic parsley (leaf), organic cauliflower (flower & stem), organic red cabbage (leaf) , organic kale (leaf), organic cucumber (gourd), organic celery (stalk) organic asparagus (flower & stem)

Organic flavor blend

Organic vanilla flavor, organic stevia extract (leaf)

Organic RAW greens blend

Organic spirulina, organic alfalfa grass juice, organic barley grass juice, organic oat grass juice, organic wheat grass juice.

RAW probiotic & enzyme blend

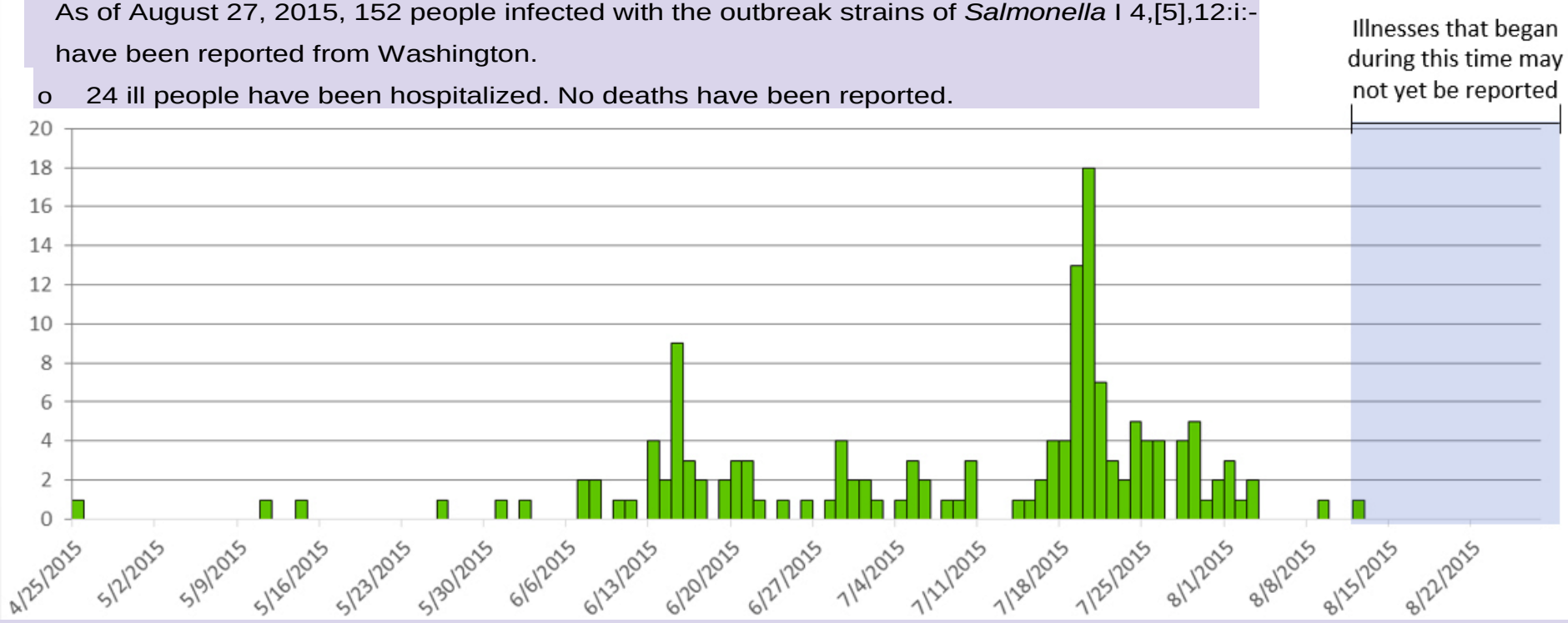
Lipase, protease, aspergillopepsin, beta-glucanase, cellulase, bromelain, phytase, lactase, papain, peptidase, pectinase, xylanase, hemicellulase, [lactobacillus plantarum, lactobacillus bulgaricus] (1.5 billion/ 3 billion CFU)

Contains no soy, dairy, tree nuts, added sugars, filler ingredients, artificial colors, flavors, sweeteners or preservatives.

Food –borne disease: pork

As of August 27, 2015, 152 people infected with the outbreak strains of *Salmonella* I 4,[5],12:i:- have been reported from Washington.

- 24 ill people have been hospitalized. No deaths have been reported.



CDC's National Antimicrobial Resistance Monitoring System (NARMS) laboratory conducted antibiotic resistance testing on clinical isolates collected from 10 ill people infected with one of the outbreak strains.

- All 10 isolates (100%) were multidrug resistant. This included resistance to ampicillin, streptomycin, sulfisoxazole, and tetracycline.

AMR- ‘a global crisis’

Creating and Managing a Global Crisis: AMR and CDOs

From discovery to disaster:

- CDOs- 9 years
- AMs- 100 years

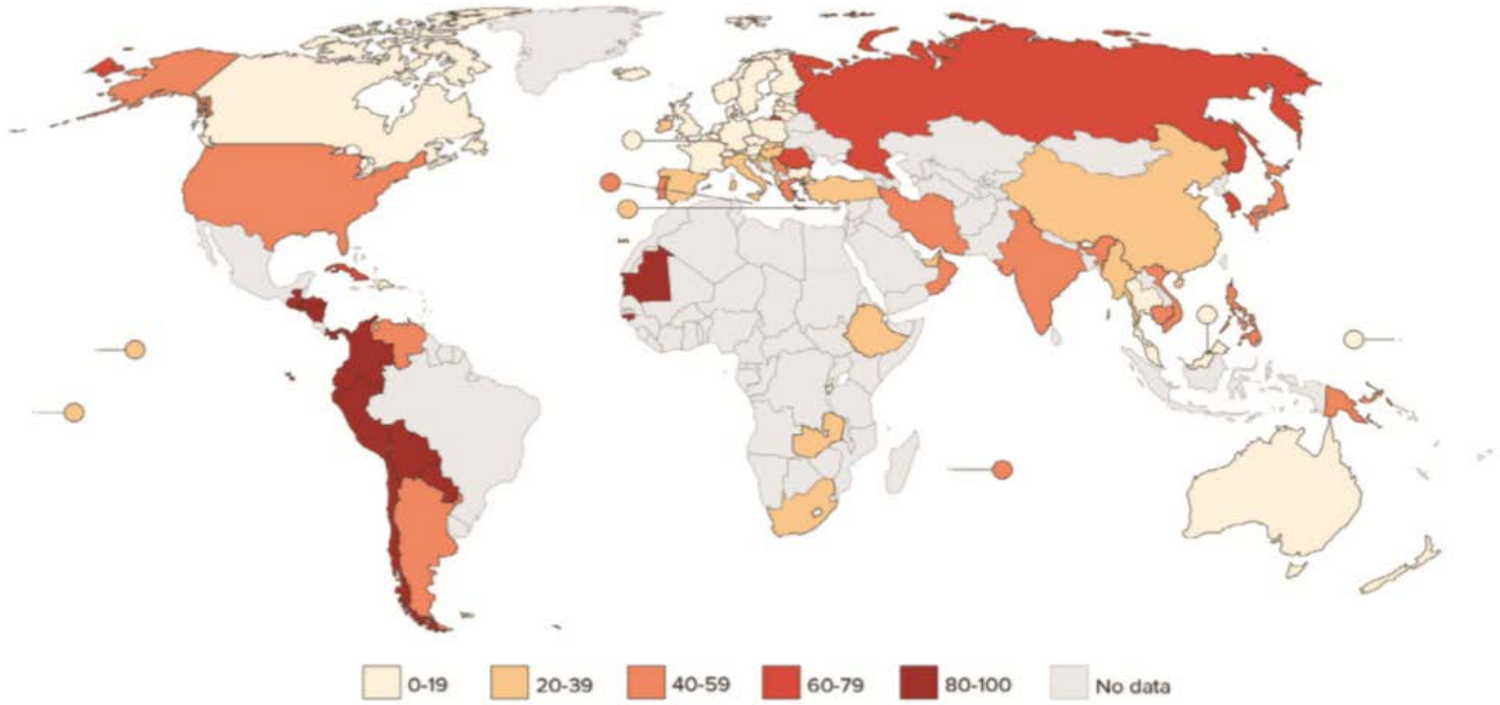


FIGURE 1-1[1]: Percentage of *Staphylococcus aureus* isolates that are methicillin resistant (MRSA), by country (most recent year, 2011–14)

Source: CDDEP 2015, WHO 2014 and PAHO, forthcoming

Where available, data from hospital-associated MRSA and invasive isolates have been used. In their absence, data from community-associated MRSA or all specimen sources are included. Only countries that reported data for at least 30 isolates are shown. Depending on the country, resistance to one or more of the following drugs were used to test for MRSA: Oxacillin, cefoxitin, flucloxacillin, cloxacillin, dicloxacillin, and methicillin. Intermediate-resistant isolates are included as resistant in some calculations, as in the original data source.

The NZVA's aspirational statement on AMR:

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

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

Why did we say this?

- To raise awareness of this issue
- To help reset the agenda
- To recognise that we (vets) are involved too
- To take a leadership role in the AMR space
- Because NZ Agri are already low users
- Because NZ Inc could have a fantastic marketing position
- To be aspirational
- Because we're not bankers

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

What it ***did not*** say:

- We will not *have* any antibiotics in 2030
- We will not *use* any antibiotics in 2030
- We will not use antibiotics to *treat disease*
- We invite you (someone) to restrict and/or control our antibiotic use
- AMR is the veterinary profession's fault

Assessing the role of agriculture

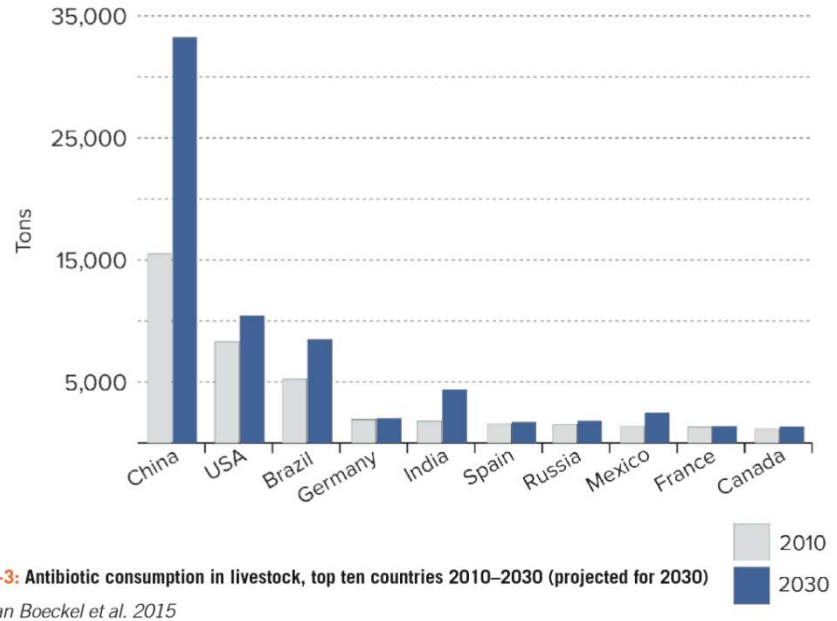


FIGURE ES-3: Antibiotic consumption in livestock, top ten countries 2010–2030 (projected for 2030)

Source: Van Boeckel et al. 2015

In the US, >60% of all antibiotic use is in livestock

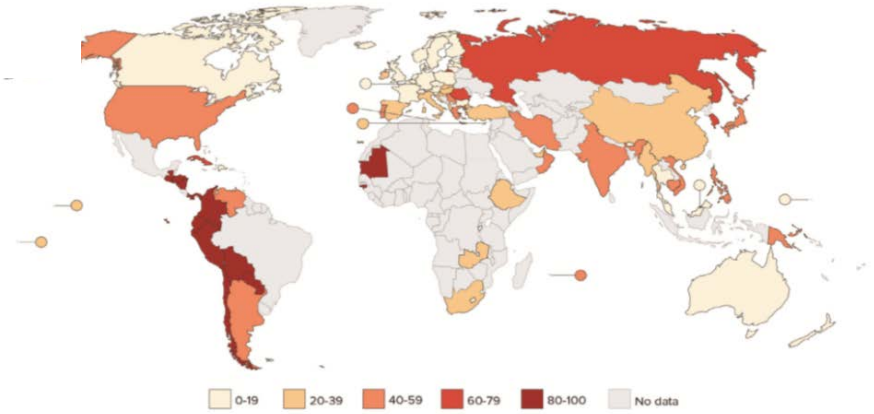


FIGURE 1-1[1]: Percentage of *Staphylococcus aureus* isolates that are methicillin resistant (MRSA), by country (most recent year, 2011–14)

Source: CDDEP 2015, WHO 2014 and PAHO, forthcoming

Where available, data from hospital-associated MRSA and invasive isolates have been used. In their absence, data from community-associated MRSA or all specimen sources are included. Only countries that reported data for at least 30 isolates are shown. Depending on the country, resistance to one or more of the following drugs were used to test for MRSA: Oxacillin, cefoxitin, flucloxacillin, cloxacillin, dicloxacillin, and methicillin. Intermediate-resistant isolates are included as resistant in some calculations, as in the original data source.

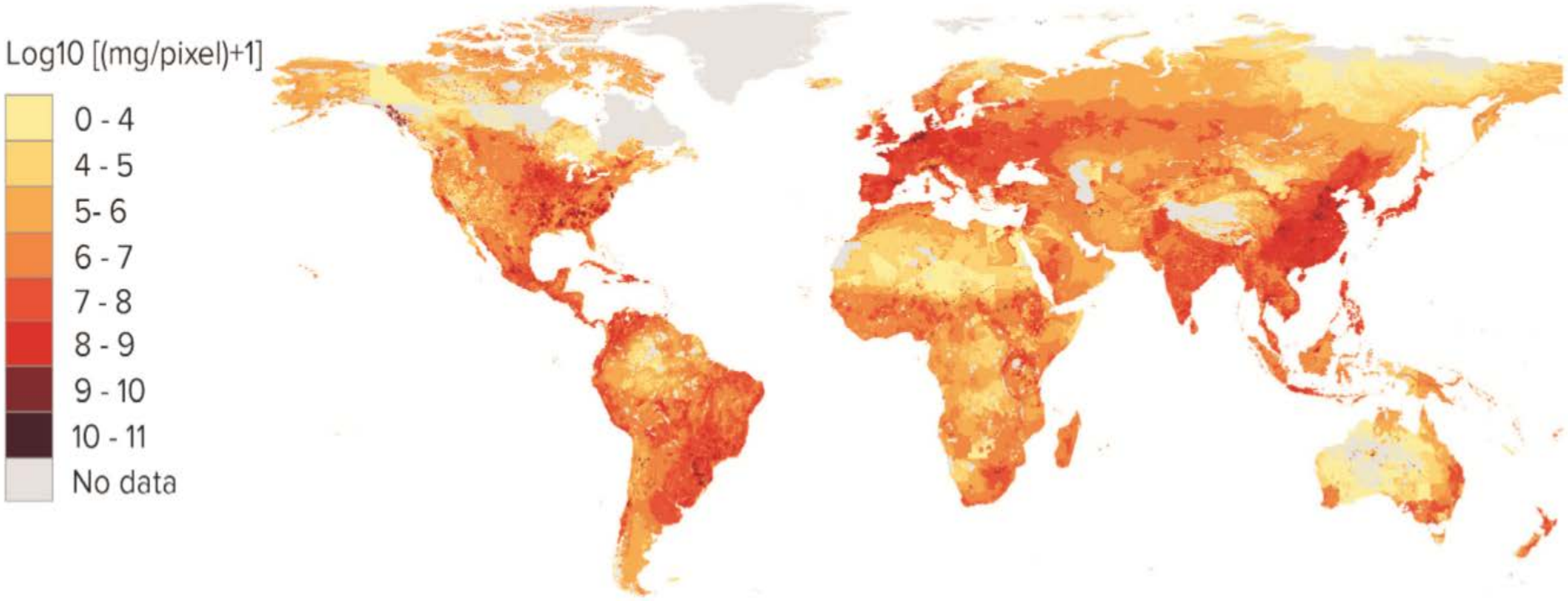


FIGURE 3-1: Global antibiotic consumption in livestock (milligrams per 10 km² pixels) 2010

Source: Van Boeckel et al. 2015

NZVA
New Zealand Veterinary Association

Hillerton et al, 2016; NZVJ, accepted for publication

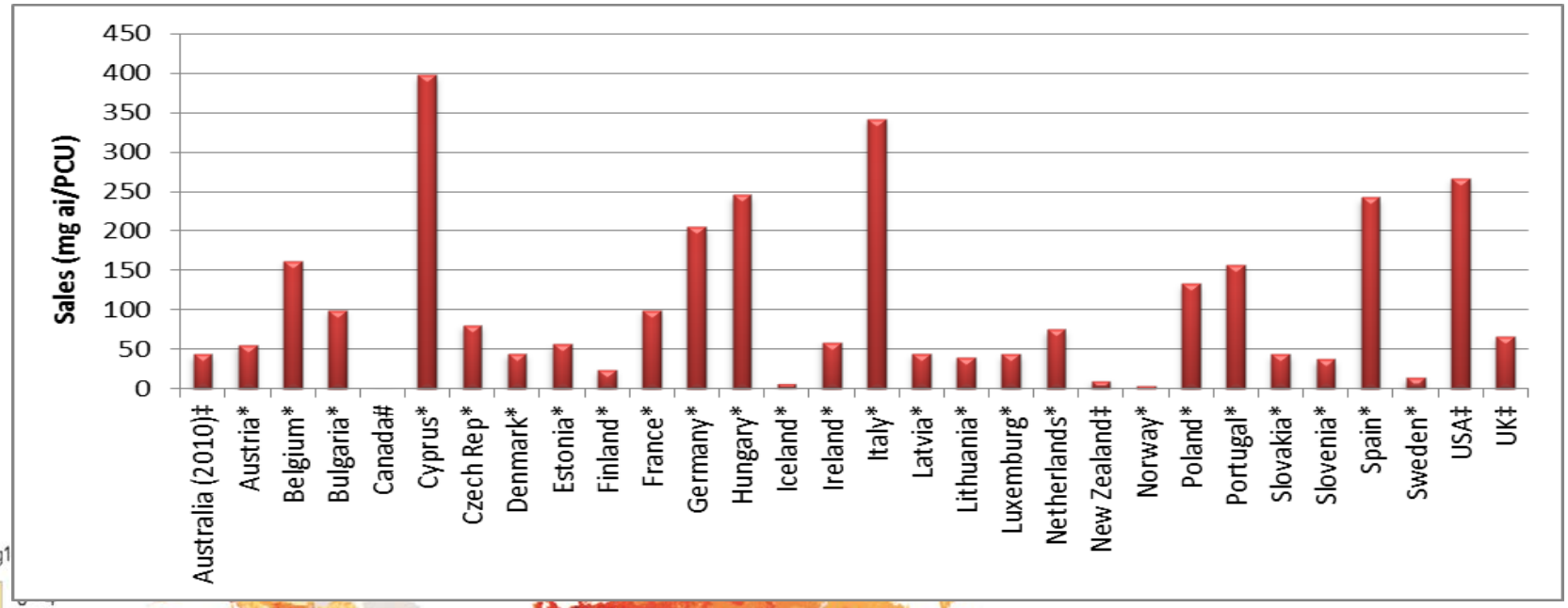


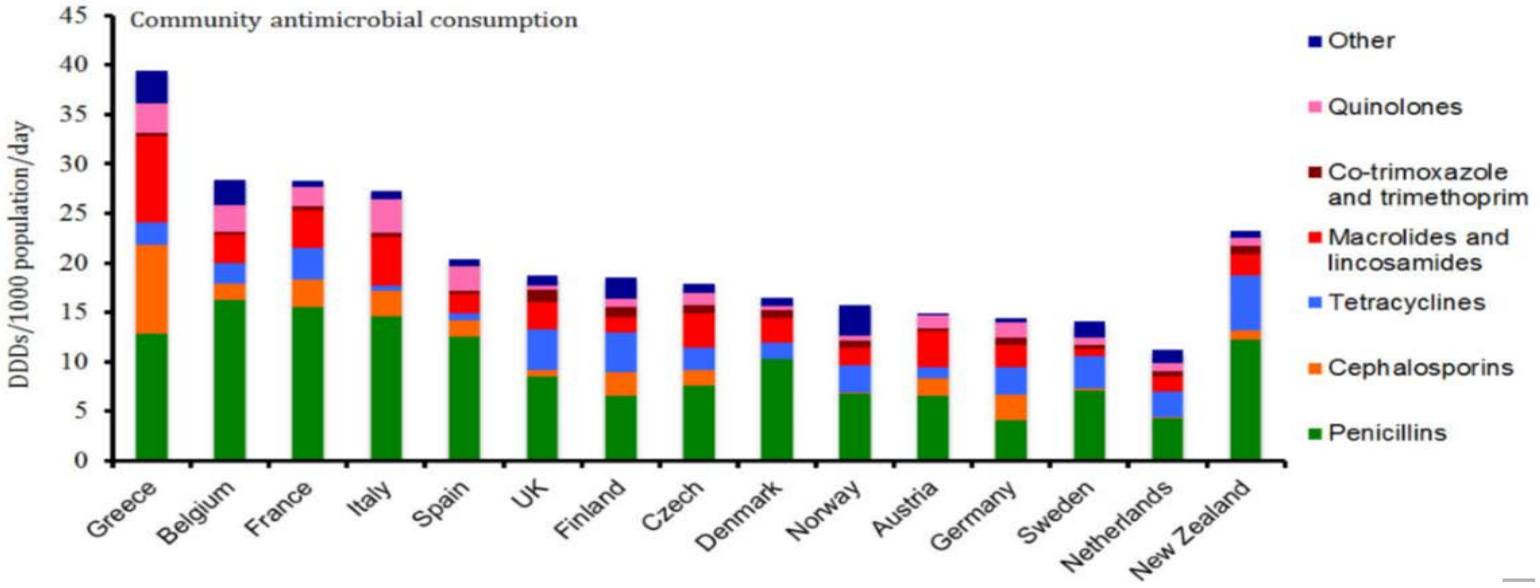
FIGURE 3-1: Global antibiotic consumption in livestock (milligrams per 10 km² pixels) 2010

Source: Van Boeckel et al. 2015

CDDEP THE CENTER FOR Disease Dynamics, Economics & Policy
WASHINGTON DC • NEW DELHI

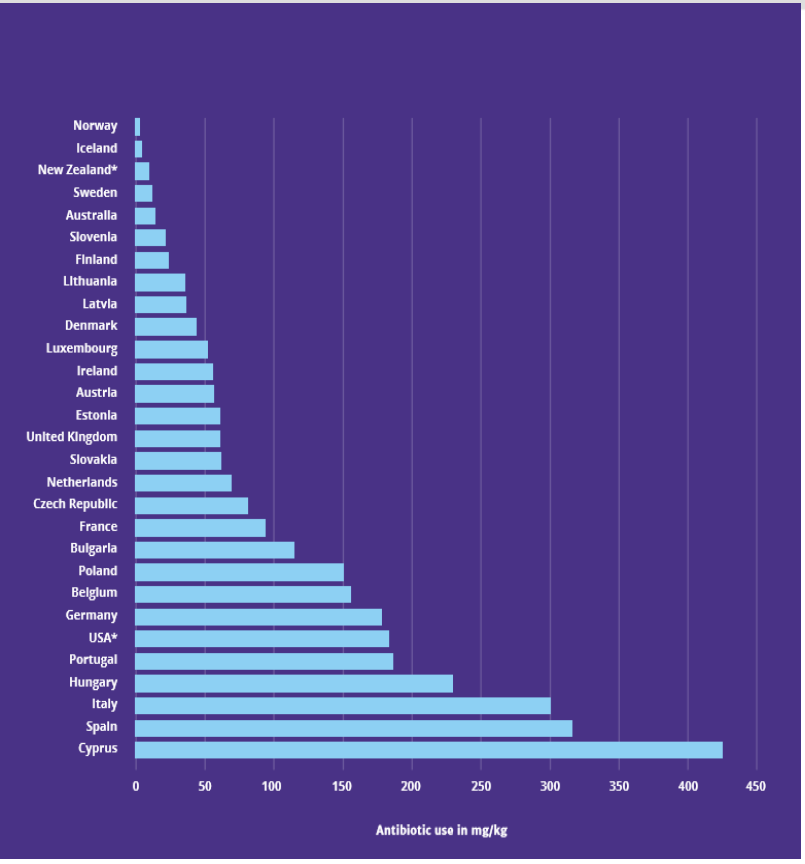
NZVA
New Zealand Veterinary Association

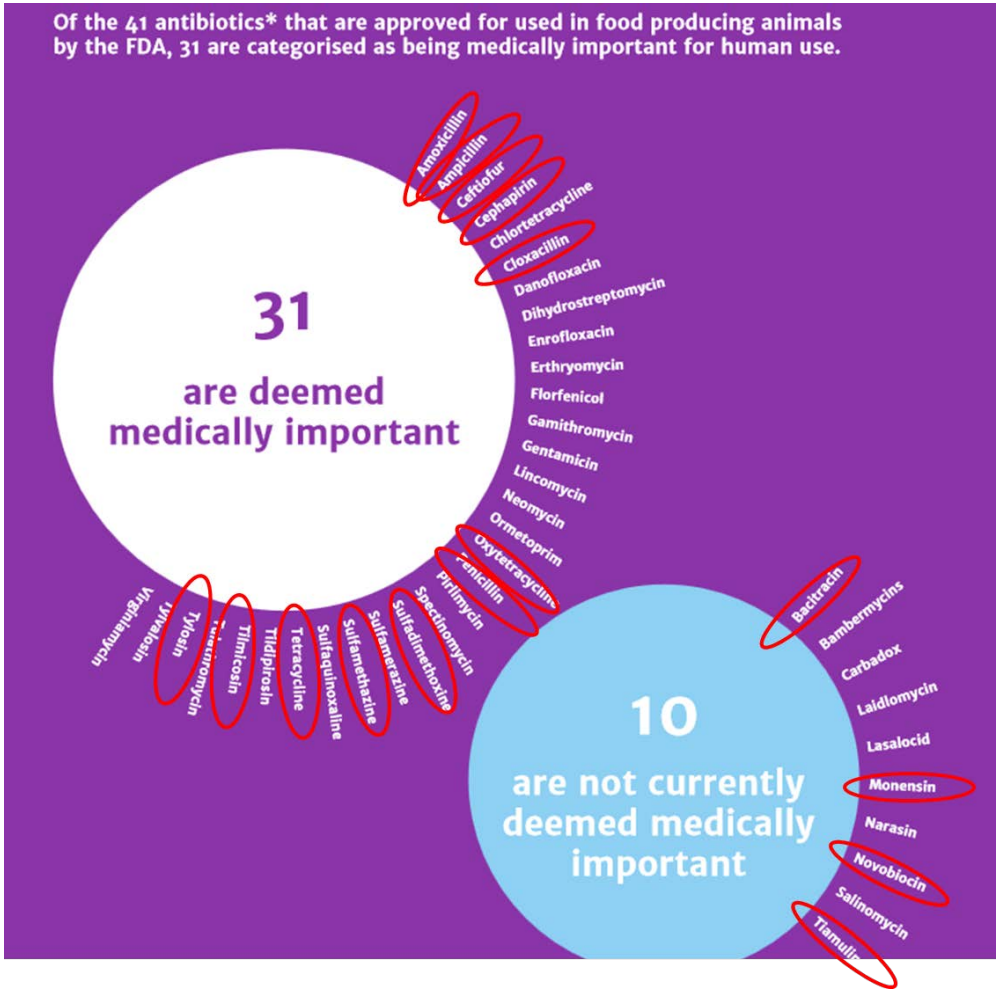
Figure 4. Annual per capita consumption of antimicrobials by community-based patients, in various European countries [10] and in New Zealand, during 2010, measured in DDDs/1000 population/day



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

Is the AM class important?



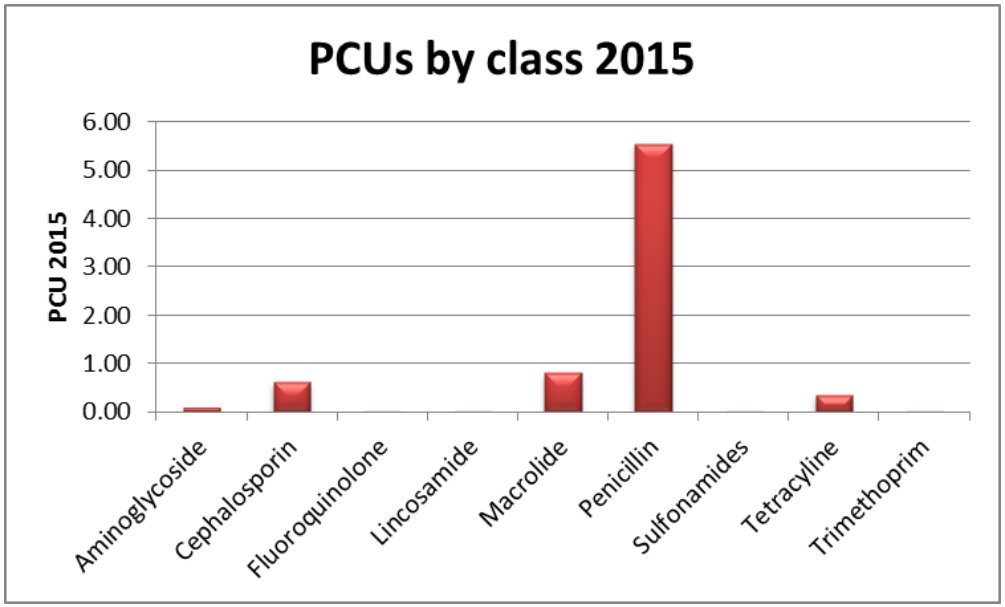


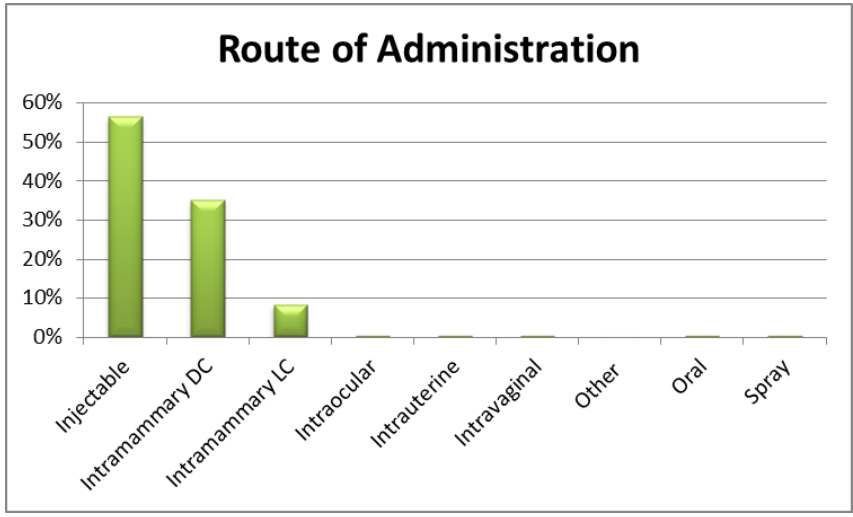
Antimicrobials In Agriculture And The Environment: Reducing Unnecessary Use And Waste

The Review On Antimicrobial Resistance Chaired By Jim O'neill

December 2015

NZ dairy?





Total (dairy) mg/PCU 7.4-8.4 pa

Total (NZ) mg/PCU 9.4 pa

UK Dairy mg/PCU ~65 pa

- Bryan et al 2016

Human- animal- environment intersection

Radically improve the surveillance of antibiotic use in agriculture and antimicrobial manufacturing waste

We need to radically improve the surveillance of antibiotic use in agriculture and the impact this and manufacturing have on resistant bacteria in animals, humans and the environment[67]. The welcome announcement by the UK Government of 265 million GBP for the Fleming Fund to help improve surveillance in low and middle-income countries will help to achieve this goal. However, further international action is needed.

Not only will improved surveillance give us more information about where the biggest problems lie, both in unnecessary use and resistance, it will also help to inform and enforce global targets for reducing antibiotic use in food production, to ensure that any commitments made are being achieved. On the manufacturing side it will also help inform and improve the leve at which a minimum standard is set.

As well as helping to achieve the two proposals we mention, surveillance of resistant bacteria in animals and the environment, along with the impact on the health of patients, needs to be more coordinated in order to improve our process of tracking the causes of resistant infections.

www.nature.com/scientificreports

SCIENTIFIC REPORTS

OPEN

November 2015
26 January 2016
6 February 2016

Appearance of β-lactam Resistance Genes in Agricultural Soils and Clinical Isolates over the 20th Century

David W. Graham[1], Charles W. Knapp[2], Bent T. Christensen[3], Seánín McCluskey[2] & Jan Dolfing[1]

Debate exists about whether agricultural versus medical antibiotic use drives increasing antibiotic resistance (AR) across nature. Both sectors have been inconsistent at antibiotic stewardship, but it is unclear which sector has most influenced acquired AR on broad scales. Using qPCR and soils archived since 1923 at Askov Experimental Station in Denmark, we quantified four broad-spectrum β-lactam AR genes (ARG; bla_{TEM}, bla_{SHV}, bla_{OXA} and bla_{CTX-M}) and class-1 integron genes (*int*1) in soils from manured (M) versus inorganic fertilised (IF) fields. "Total" β-lactam ARG levels were significantly higher in M versus IF in soils post-1940 (paired-t test; $p < 0.001$). However, dominant individual ARGs varied over time; bla_{TEM} and bla_{SHV} between 1963 and 1974, bla_{OXA} slightly later, and bla_{CTX-M} since 1988. These dates roughly parallel first reporting of these genes in clinical isolates, suggesting ARGs in animal manure and humans are historically interconnected. Archive data further show when non-therapeutic antibiotic use was banned in Denmark, bla_{CTX-M} levels declined in M soils, suggesting accumulated soil ARGs can be reduced by prudent antibiotic stewardship. Conversely, *int*1 levels have continued to increase in M soils since 1990, implying direct manure application to soils should be scrutinized as part

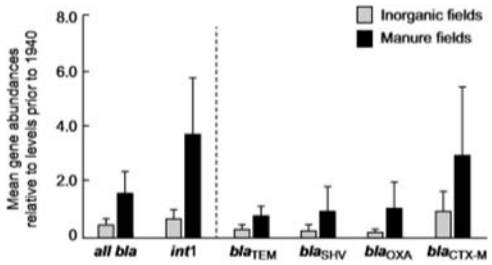


Figure 2. Mean relative abundances of the sum of all four *bla* genes, *int*1, bla_{TEM}, bla_{SHV}, bla_{OXA}, and bla_{CTX-M} in post-1940 archived soils that have received continue manure (M) or inorganic fertiliser (IF) application since 1894. Data are mean ratios of each gene indicator (normalised to 16S-rRNA bacterial levels) in each sample relative to levels determined from 1923 and 1938 samples (n = 9 or 10). Error bars refer to 95% confidence levels in the means.

Antimicrobials In Agriculture And The Environment: Reducing Unnecessary Use And Waste

The Review On Antimicrobial Resistance Chaired By Jim O'neill

December 2015

Communicating the science- why do people not get it?

- Consumers are not scientists

- Consumers wonder why scientists believe science more than they believe consumers (Lonergan 2015)

    - BSE- failure of science communication
    - Inductions- failure of strategic foresight
    - β–agonists- failure of ‘consumer empathy’

Summary

- Multi-disciplinary work is key now and will be more so in the future- eg MPI/MOH/etc
- Best outcomes will be where veterinary and medical and social science join together (RHANZ)
- Vets need to work beyond their core calling and continue to lead in their space
- Communication with consumers/non- scientists is key
- Finally, if we ever need to accentuate the crisis, hand over to the bankers




Acknowledgements:

- NZVA board members; Julie Hood
- NZVA AMRSG –
  - Eric Hillerton, Callum Irvine, Steve Merchant, Nigel French, Dennis Scott
- AMR advisors-
  - Guy Lonergan, Texas Tech University
  - Stephen Page, University of Sydney

Markb@thevets.co.nz