Tackling AMR in the environment – UK Argentina partnering workshop 10-14 Sep 2018

A workshop was held in Buenos Aires with the purpose of

- understanding key challenges around AMR in Argentinian agriculture and more widely, and its impacts on the emergence and spread of resistance in the environment that are also relevant to other low- and middle-income countries (LMICs) (PDF), and
- to consider the research landscape and relevant expertise available in the UK and Argentina.

15 UK academics were selected to attend the workshop following an open competition, where they engaged with 27 Argentinian researchers. Staff from BBSRC, NERC, CONICET and DHSC were in attendance to facilitate the discussions. What follows is a brief report of the workshop; it should not be considered to form part of the funding call documentation.

The workshop comprised

1. a series of talks from each country to demonstrate the research capabilities and expertise within the two countries
2. speed networking to deepen understanding of the research landscape and initialise partnering
3. visits to meat production facilities to better understand animal rearing and waste treatment practices
4. discussion of key issues in AMR in breakout groups
5. identification of areas to collaborate

Talks

The talks are available on the call webpage: https://bbsrc.ukri.org/funding/filter/2018-argentina-antimicrobial-resistance/

1. Productive processes and their interaction with the environment
   Dr Jorge Errecalde, Universidad Nacional de La Plata
2. Facilities in microbiological and genetic analysis
   Dr Alejandro Petroni, INEI – ANLIS “Dr. Carlos G. Malbrán”
3. Facilities in pharmacological environmental analysis
   Ing Carlos Pesce, CIATI
4. AMR research in Argentina
   Dr Gabriel Gutkind, University of Buenos Aires
5. Argentine programme of surveillance of AMR in animal health
   Dr Federico Luna, SENASA
6. AMR research in UK
   Prof Liz Wellington, University of Warwick
7. Priorities for AMR research: a global perspective
   Prof Dominic Moran, University of Edinburgh

Partnering

The UK attendees, primary specialism and their contact details are listed in the annex. Attendees agreed to represent their institutions and wider research networks and readers are therefore invited to contact attendees directly for their observations from the workshop or for partnering purposes.

Farm visits

The locations visited are shown on the map here:
https://drive.google.com/open?id=12H5IcNS7qVzXsdln8PaPOcQtv6pQvWDL&usp=sharing

1. Pig farm at Estancia La Biznaga, Roque Perez

   Owned by Ledesma, this is the largest pig farm in Argentina, with 7000 breeding sows. Pigs are wholly raised in large sheds. There are 25,000 pigs in 12 barns to increase the weight to ~25 kg and 110,000 pigs in a further 60 barns to increase the weight to 125 kg. Solid and liquid waste are separated. The former is composted and both are applied to fields. Large farms are responsible for 30-40% of pig production in Argentina, while 50% of pigs are in farms with <100 sows. All pork is for the domestic market. Antibiotics are mainly injected for pathogies, but some are in feed and water.

2. Feedlot El Trebol, Roque Perez

This is a medium size outdoor feedlot, with ~8000 cattle. Cattle are fattened for their last three months to ~320 kg for the domestic market and ~450 kg for the export market. Antibiotics are used, but not in the feed.

3. Dairy farm, Lobos

   Typical sized dairy farm of 140 hectares with 260 milking cows and 500 cows in total, all grass and silage fed once mature. Antibiotics are given therapeutically and in feed for small heifers. Milk is sold to an Argentinian milk processor, not a multinational.

4. Chicken farm, Capitan Sarmiento

Farm has 100,000 chickens at a time. 70% chickens are slaughtered at 2.5 kg, while 30% are slaughtered at 1.5 kg for the Arab market. Antibiotics are given as therapeutic treatment, not as growth promoters, but to the whole flock, meaning 15-20% of chickens are fed antibiotics at some point. Bedding is replaced every five cycles of chicken rearing, then composted and sold to a fertiliser company.

5. Chicken processing plant, Capitan Sarmiento

200,000 chickens are slaughtered and processed at the plant each day. Granja Tres Arroyos is an Argentine-owned company and the products are exported to 65 countries. Participants were shown the effluent treatment process.

Breakout groups

Breakout groups for the three parts of the scientific scope were formed and brief reports of their discussions follow:

Research to underpin the creation of a theoretical framework for the surveillance and reporting on antimicrobial resistance and use of antibiotics, biocides and metals in agricultural and/or animal husbandry and how this framework might differ when applied to Argentina versus other LMICs.

Knowledge gaps include

- How many antimicrobials are being used
- How to obtain the right information on antimicrobial usage.
- What correlation of resistance is there with human activity?
- The extent of the spread of resistance, for example in dust.

Key questions are

- Who is using which antimicrobials and how much are they using?
- Which factors pose the greatest risk (to increased resistance, in the environment, to human health)?
- What are the drivers of antimicrobial usage?
- How can regulations be implemented in practice?
- What are the resistance routes, for example through the food chain? How are these evolving?

- What transfer of antimicrobials and resistance is occurring between wild animals and those in the food chain?

The group discussed how to achieve official development assistance (ODA) compliance in funding proposals in developing countries widely, not just Argentina. It was noted that

- Argentina and developing countries have a high infection burden in common, for instance in how manure is used.
- Urbanisation is driving rapid changes in farming practices, but biosecurity may not be keeping pace
- There is pressure to use fields for cash crops, encouraging intensification of animal production
- Brazil has similar production systems but the export market provides much greater drivers, whereas Peru has similar drivers to Argentina

Research to support options for animal husbandry and welfare practices that support antibacterial stewardship in agriculture to minimise emergence, transmission and/or exposure risk of resistance in the environment

Knowledge gaps include:

Data on animals in different production systems: more reliable/ complete datasets required:

- on farms and numbers of animals involved in different production systems nationally
- on different antimicrobials being used and their dose rates nationally
- on the timings of treatments and at which part of the animal's life cycle in the production system

It was felt that with many of the production systems in commercial hands, achieving reliable data might be a significant challenge. The relationship between production systems in Argentina and other low and middle income countries in Latin America was considered to be most relevant for pigs and (feedlot) cattle.

Key questions are:

The most significant risk was felt to be in broiler production with significant risk in the use and turnover of litter including the limited turnover of litter in each production cycle, the cumulative effects of antimicrobial dosing in re-used litter, the use of composting as a mechanism for detoxification of litter (no supporting data?) and the use of litter as a fertiliser for agricultural and horticultural production. Similar issues were present in intensive (feedlot) cattle production.

- Public perception of animal production systems was having an impact on the nature of the production system but this was slower than in Europe largely due to the current economic circumstances
- Legislation and regulation had been implemented slowly in response to national requirements. Compliance and enforcement could not be guaranteed.
- Less intensive production systems were being tried but there were impacts on costs and the price of goods for consumers and the requirement for producers to remain competitive. Depending on dose rates, more extensive production systems may result in more widespread contamination of the environment.

- There were few doubts that improved husbandry techniques would reduce the use of antimicrobials and therefore reduce the risk of AMR.
- Some bacterial infections were very difficult to deal with and the use of antimicrobials would be required in the future to treat (eg *Camplylobacter*) the key questions surrounded how to minimise risk through different husbandry techniques.

Research to support development of strategies for manure, slurry and waste management that minimises the risk and persistence of antibacterial resistance, antibiotics, biocides and metals in the environment.

Priority problems and research questions related to waste management:

1. Flows and pathways of antibiotics, biocides, metals and microbial load through wastes to the environment on different types and scales of animal production, now and in the future
    - Development of appropriate robust methodologies for each end point that needs to be measured in the different media
    - What is the microbial load on a temporal basis
    - Development of models of transport and environmental dynamics
    - Developing new ways to collect and collate data, including new monitoring technologies
    - What generalizable outputs can be found from comparative case studies across different types of animal production or climatic region
    - What are the different drivers and incentives for farmers in the way they manage farm waste
    - What is the environmental impact and fate of antibiotics, biocides, metals and microbial load at a large scale/far field (away from the immediate farm environment)

    Outputs from this research would be increased understanding and models of flow for different situations that could be used to inform optimal waste management strategies.

2. Effectiveness of current waste management practices and policy
    - Why are current practices in use (expert advice, traditions, etc) and what is the best way to communicate potential changes
    - What is the potential for bioenergy in LMIC countries, taking into account appropriate foodstocks, incentives and costs/benefits to the farmer
    - What is the impact of specific practices in transferring antibiotics, biocides, metals and microbes into the environment via waste streams, for example, hosing the feedlots to reduce dust or discarding milk containing antibiotics into slurry vs feeding to calves
    - What comparable processes from the water sector can be translated into the agricultural sector, for example, the new resolution to manage biosolids in waste water

    Outputs from this research would be risk assessment of practice and new guidelines/best practices to manage waste to reduce the risk of AMR in the environment.

3. New low-cost options for treatment
    - Small scale experiments to provide early stage information about new interventions that might work to reduce the load of antibiotics, biocides, metals and microbes in waste
    - Theoretical studies on feasibility and cost-effectiveness

    Outputs from this research would provide potential avenues for new solutions and further research.

4. Cross-cutting research challenges that would need to be overcome include:
    - The need for new standardised analytical techniques
    - Potential practical issues with sample transport outside those covered by the Nagoya Protocol
    - Ensuring farm-level anonymity in data reporting
    - Engaging the right stakeholders early, e.g. industry associations and INTA, who can shape the research and maximise potential for uptake of findings
    - Criteria for prioritising research areas – quick wins vs potential for most impact
    - Ensuring findings are translatable to LMIC countries

Areas for collaboration

Many of the participants tentatively considered collaborative projects, which are listed below. Inclusion of a project within this list should not be interpreted as confirmation that the project is within the scope of the funding call. Researchers are invited to engage with the contacts shown for each project as appropriate.

Project	UK contact	Argentina contact
A conceptual framework for assessment and communication of risk	Will Gaze	Daniela Centrón, IMPAM Mariano Miyakawa, INTA
Novel vaccines to reduce antibiotic use in intensive agricultural production	Mathew Upton	Pablo Chacana, INTA
Evidence-based approaches to produce markers to advise AMR surveillance programs	Elizabeth Wellington	Josefina Campos, INEI – ANLIS "Dr. Carlos G. Malbrán"
'Ins and Outs' - developing a model to predict efficient interventions to minimise AMR inflows and outputs in small, medium and large animal farming systems	Katja Lehmann	Jorge Errecalde, Universidad Nacional de La Plata
Identification of gaps in antimicrobial use and data to design solutions	Maria Escobar Tello	Lisandro Ruiz, SENASA
Delivering waste management and risk abatement strategies	Rachel Gomes	Gabriel Gutkind, University of Buenos Aires

for antimicrobial resistance and pollutant drivers in the agricultural environment through systems understanding		
AMR in Argentine Broiler Poultry Systems: Risks and Mitigation	Graziella Iossa	Sergio Bruni, Universidad Nacional Del Centro de la Provincia de Buenos Aires

Annex: List of UK academic participants

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