Livestock’s contribution to antimicrobial resistance in low- and middle-income countries

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AMR in context

- Unprecedented international concern
  National Action Plans
- Quintessential *One Health* issue
  people – animals – environment
- Global phenomenon
- Diverse views on antimicrobial use in livestock production
- Threat to sustainable food production
- Impact on poverty and economic growth
Why livestock in LMICs?

- Rapid sector growth
  pigs – chickens – dairy
- Large share of antibiotic use
- Important livelihood roles of livestock in LMICs
- Conflict: inappropriate use AND poor access to effective antibiotics
- Weak regulation and implementation
- Neglected research area
Key knowledge gaps

- Current and projected consumption of antibiotics in animal agriculture
- Transmission pathways of antibiotic resistance determinants among livestock, people and environments?
- What interventions can be effective in diverse settings?

A weak evidence base makes identifying effective actions difficult
Antibiotic use in livestock

- Total consumption in the livestock sector in 2010 estimated at 63,151 tons
- Global antimicrobial consumption will rise by 67% by 2030
- It will nearly double in BRICS (Brazil, Russia, India, China, and South Africa) countries

Source: Van Boeckel et al. (2015)
Global antimicrobial consumption in livestock
(mg per 10km pixel)

Antibiotic use in livestock

Source: Van Boeckel et al. (2015)
Chicken systems

Extensive chicken production

Intensive chicken production

Source: Gilbert et al. (2016)
Predicting future livestock systems

Log per-capita GDP (US$/person/year) From World Bank data

Proportion of extensively raised chickens

2000
log GDP per capita c. $ 2.9
% extensive c. 83 %

2030
log GDP per capita c. $ 3.8
% extensive c. 18 %

Chicken production in China
• Breakdown by antibiotic group
• Collect national data on use by livestock system: top-down vs bottom-up
• Link use to livestock sector scenarios
  Shared Socioeconomic Pathways (SSPs)
• Model the global impact of interventions
Biology of AMR transmission

Escherichia coli

Methicillin resistance history (%mecA)

Staphylococcus aureus CC398

Number of events


Source: Ward et al. (2016)

Pilot study
Pilot study

Initial screening for antibiotic resistance in commensal *E. coli*

Source: Bettridge et al. (2016)
Interventions to mitigate AMR

- Reduce overall consumption in livestock production
- Better target antibiotic use
- Reduce antibiotic residues
- Reduce transmission of AMR genetic determinants
- Understanding incentives and behaviour
- Measuring impact of interventions (use, residues, AMR genes)
- Benefit-cost analysis of interventions

Source: Chantziaras et al. (2014)
Interventions to mitigate AMR

**Policies**
(Governments)
- Public policies and policy instruments, monitoring, surveillance, targets, prescriptions, labeling requirements

**Institutions**
(Society)
- Private standard setting, consumer demand, drug quality control

**Private benefits**
(Farmers)
- Direct economic incentives, (n.b. market distortions)

HICs

LMICs
AMR is clearly a One Health issue – livestock and environment have a big role to play in finding solutions

Livestock sector has a potentially massive role to play in AMR mitigation

Global problem – but solutions must be found at national and farm levels

One size won’t fit all – HIC solutions won’t necessarily be directly appropriate in LMICs