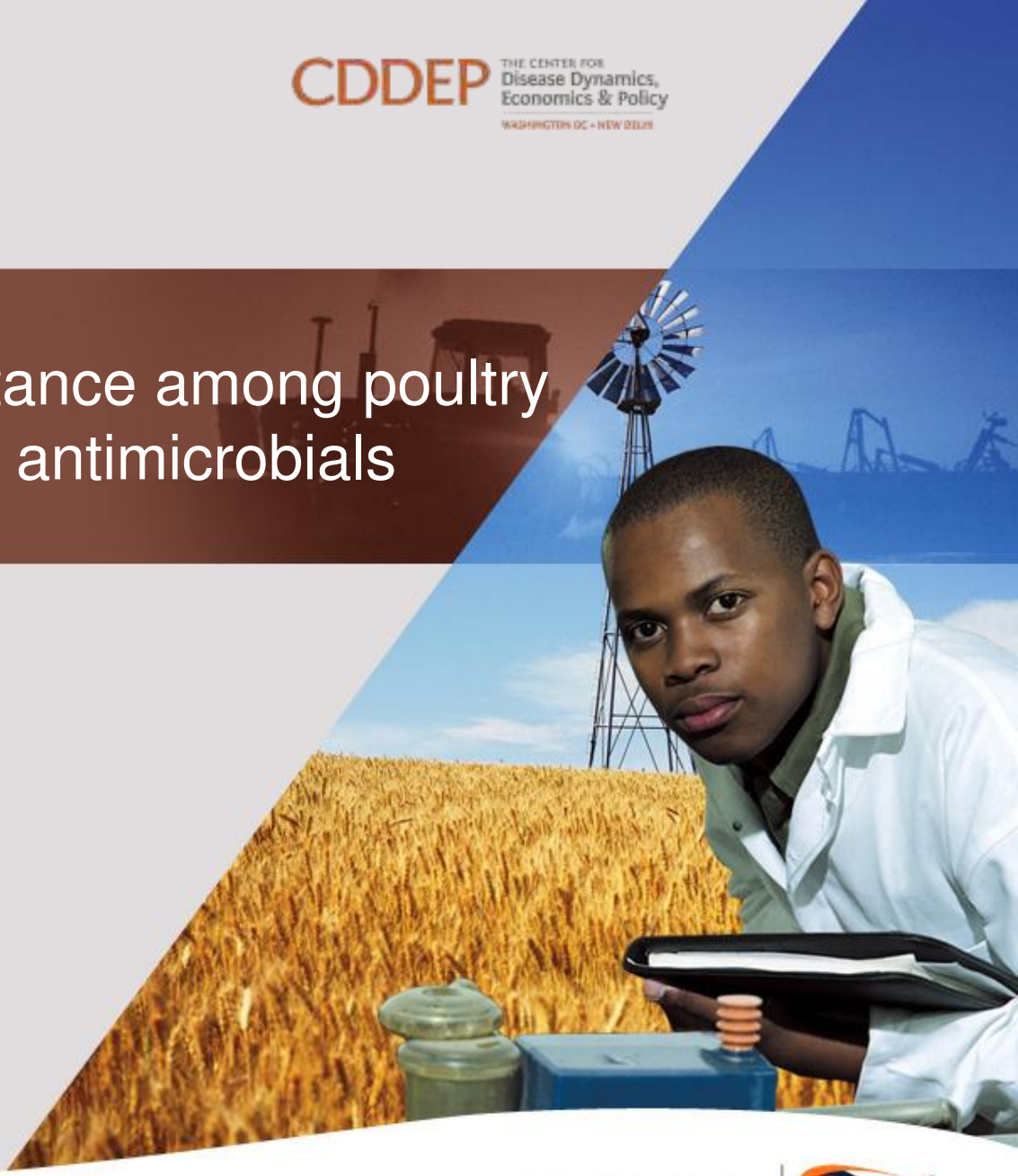
Global Antibiotic Resistance Partnership

CDDEP The Center for Disease Dynamics, Economics & Policy

Antimicrobial drug resistance among poultry isolates from broilers on antimicrobials



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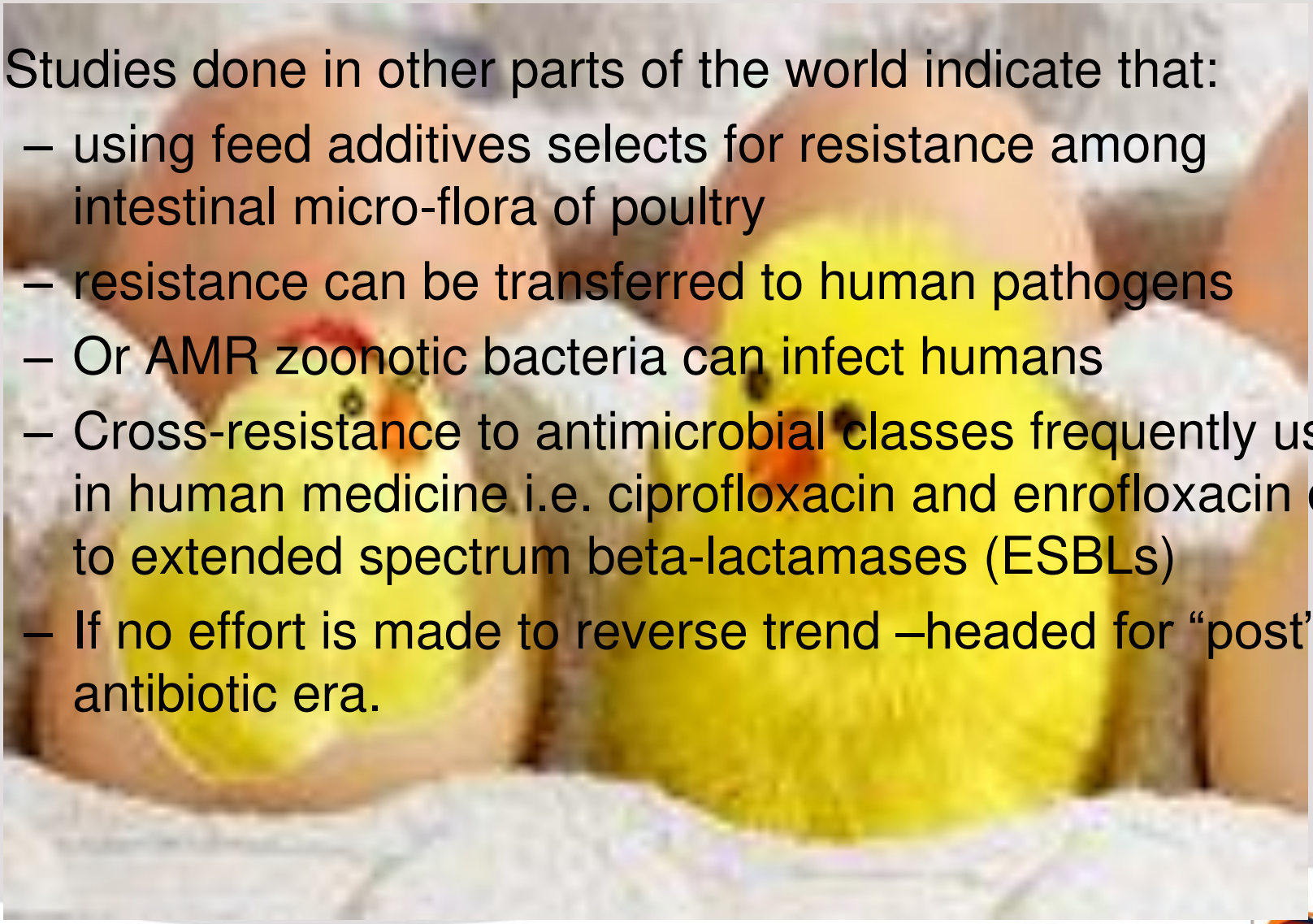
Introduction

- Feeding antimicrobials to broilers as feed additives, is a common practice:
  - Control colibacillosis & respiratory disease
  - Enhance growth (most are Gram positive directed)
  - Etc
- In RSA monitoring of AMR in broilers
  is limited to a few studies and is not ongoing

- Past & recent studies indicate a high level
  of AMR in the intestinal microflora of broilers

Public health concerns: AMR



- Studies done in other parts of the world indicate that:
  - using feed additives selects for resistance among intestinal micro-flora of poultry
  - resistance can be transferred to human pathogens
  - Or AMR zoonotic bacteria can infect humans
  - Cross-resistance to antimicrobial classes frequently used in human medicine i.e. ciprofloxacin and enrofloxacin due to extended spectrum beta-lactamases (ESBLs)
  - If no effort is made to reverse trend –headed for “post” antibiotic era.

Indicator organism: *E. coli*

- WHO recommends use of *E. coli* as an indicator organism in resistance studies
- Advantages
- Common bacterium in the intestine.
- Good indicator of AMR in healthy bacterial populations
- Has a wide host range
- Easily accepts and transfers genes coding for AMR
- E.g. Frediani-Wolf (2003) cites studies that show *E. coli* from farmers working with turkeys on antimicrobials carried higher resistance levels than compatriots who worked with pigs not fed antimicrobials

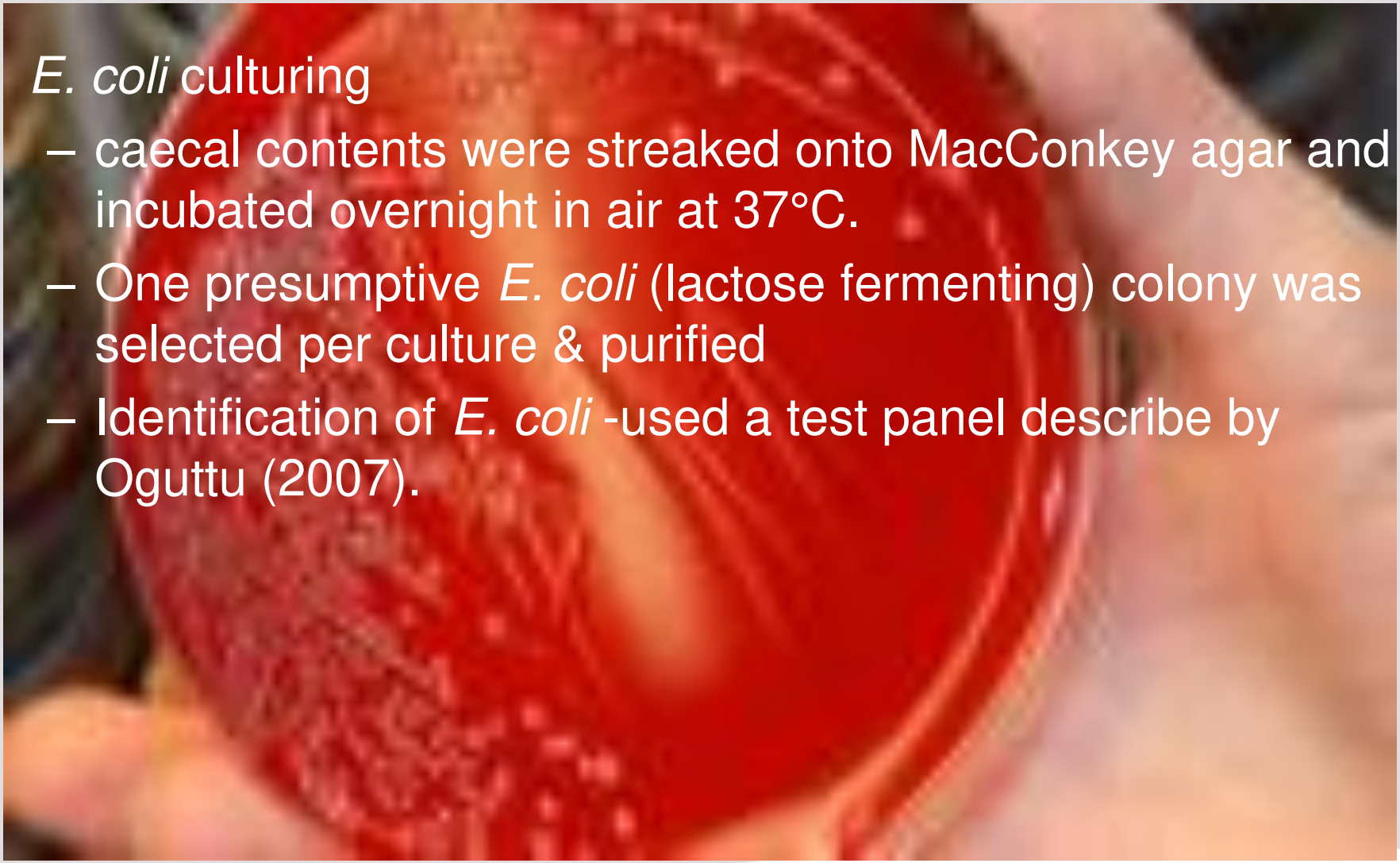
Objectives

- Elucidate the level of AMR among *E. coli* isolates from slaughtered broilers fed antimicrobial feed additives
- Assess the level of resistance to antimicrobials that are important for therapy in human medicine

Material and methods:

- Broilers
  - Six broiler farms from different “grow out cycles” were sampled
  - Samples were taken after 1st inspection stage (± 5 mins after slaughter)
  - 25 to 30 caecae/farm were harvested (tying the ends off and incising off rest of the GIT)
  - Each caecae was placed in labelled, sterile plastic bags and conveyed in cooled polystyrene boxes to the laboratory
  - Processing of sample was done the same day.

Material and methods: culturing



- *E. coli* culturing
  - caecal contents were streaked onto MacConkey agar and incubated overnight in air at 37°C.
  - One presumptive *E. coli* (lactose fermenting) colony was selected per culture & purified
  - Identification of *E. coli* -used a test panel describe by Oguttu (2007).

Material and methods:

- Determining MIC
  - Microbroth dilution test described by CLSI (2008).
  - Antimicrobials screened for resistance included:
    - Ceftriaxone,
    - Nalidixic acid,
    - Doxycycline,
    - Sulphamethoxazole,
    - Trimethoprim,
    - Ampicillin,
    - Enrofloxacin and fosfomycin.
- Breakpoint values
  - CLSI and, SVARM & Spanish surveillance programmes

Results and discussion

Table 1: Number of *E. coli* isolates obtained

Source	Number of *E. coli*
Broilers	168

- High AMR levels were observed for antimicrobials used on the farms during study
  - E.g. Dox = 98.2%, sulf = 78.7%, enrf=75.6%,
  - Other studies () done in SA confirm these findings
- High resistance to nalidixic acid (90.5%)
  - Fluoroquinolone-driven: one mutation in the QRDR = resistance to enrofloxacin, ciprofloxacin or norfloxacin.

Results and discussion

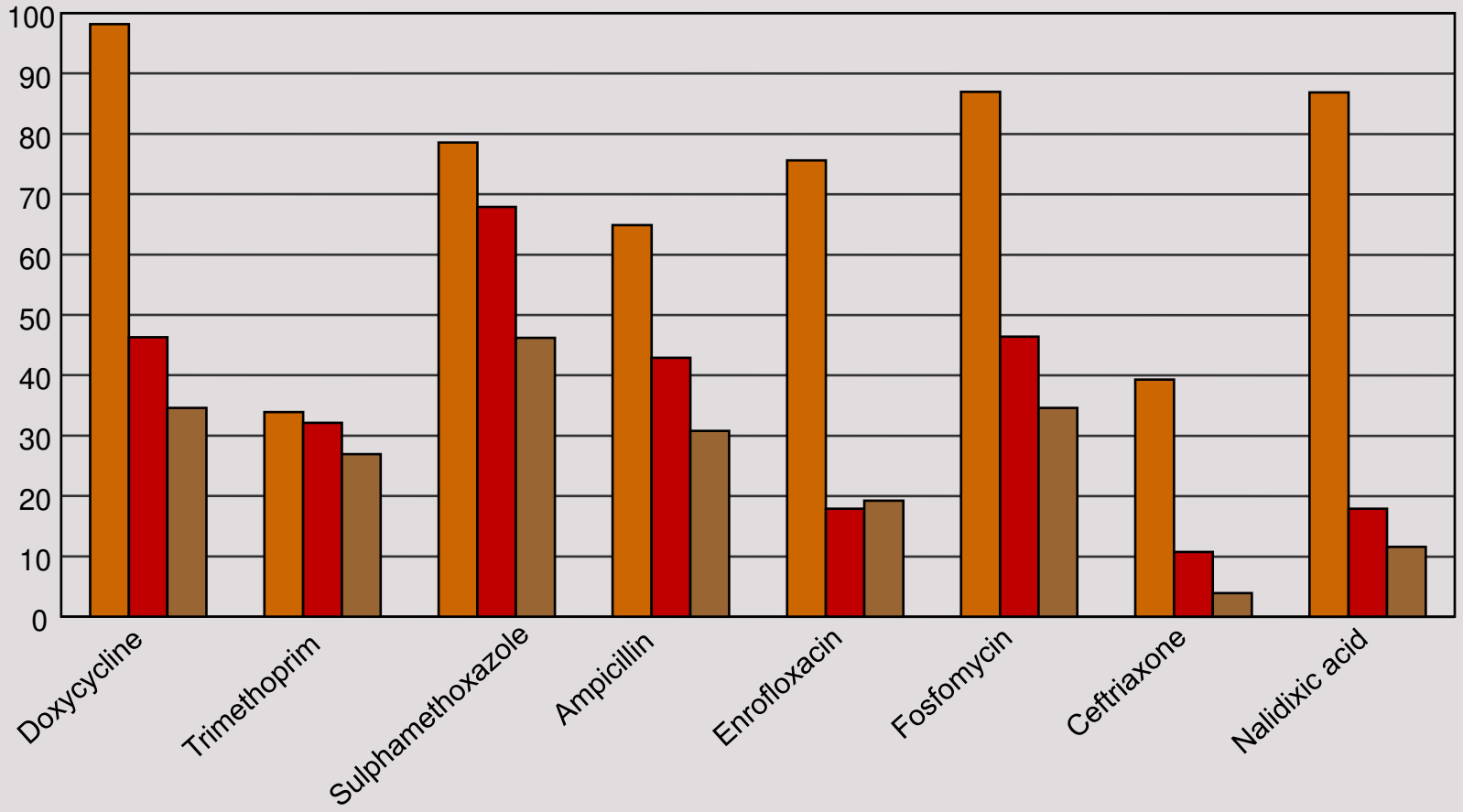


Figure 1: Percentage AMR of *E. coli* from broilers (n=168), abattoir workers (n=28) and human controls (n=26) to antimicrobial drugs tested in this study

Broilers **Abattoir workers** **Control humans**

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Results and discussion:

- Ceftriaxone is not used by the poultry industry, hence 39.3% resistance to ceftriaxone was NOT expected
- Possible cause for this resistance:
  - Isolates could ESBLs positive
    - *E. coli* isolate with MIC levels above 1ug/mL tend to be ESBLs positive
  - Cross resistance due to use of penicillins and other cephalosporins
    - Known to stimulate this plasmid transferred resistance.
  - Resistance to ESBLs, suphonamides and tetracyclines can transferred on the same gene cassette.

Results and discussion

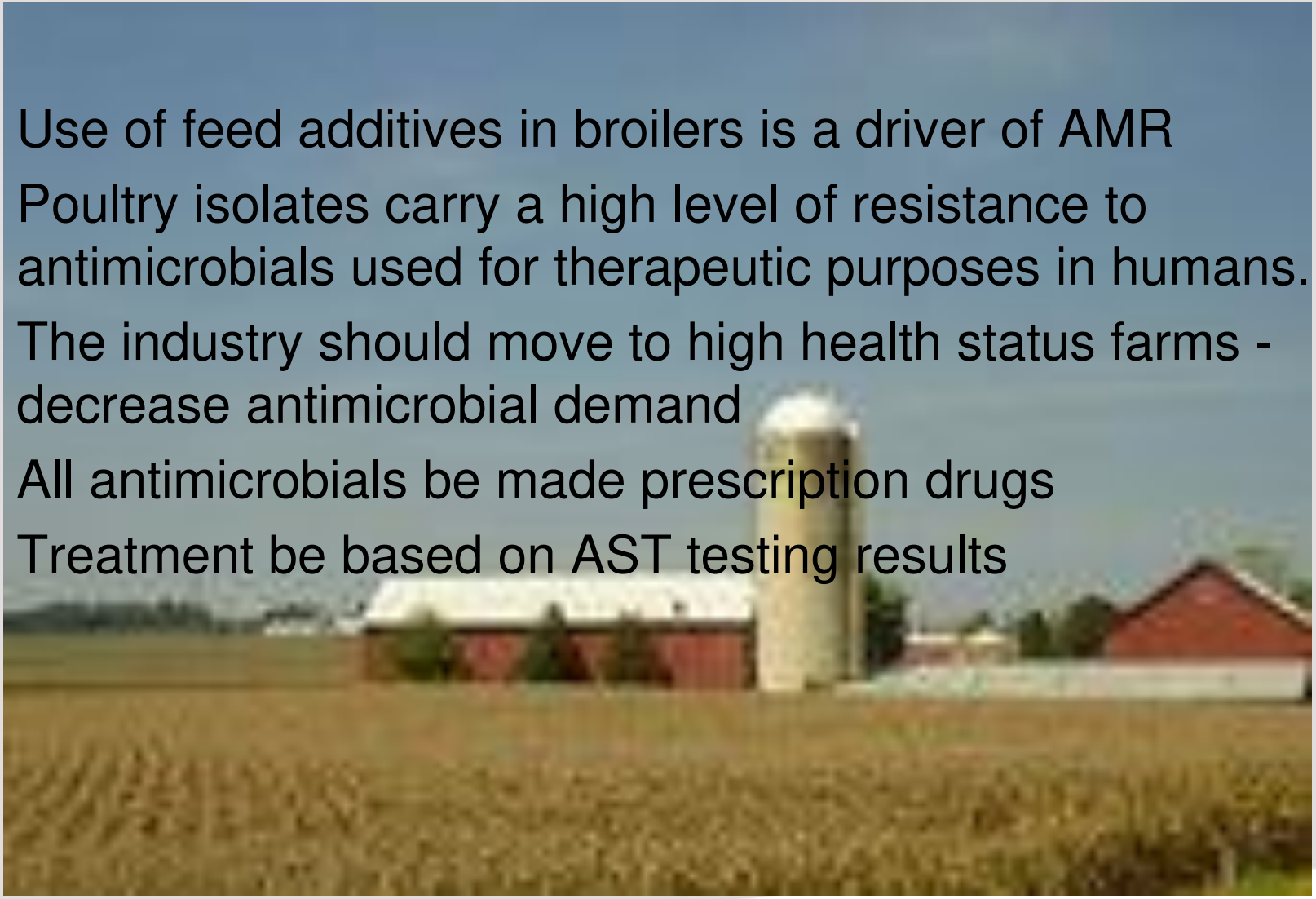
- Table 2: MIC50 and MIC90 values of *E. coli*

Antibiotics	All farms	
	MIC50	MIC90
doxycycline	**64**	**128**
trimethoprim	0.5	16
sulphamethoxazole	**2048**	2048
ampicillin	32	32
enrofloxacin	**2**	**8**
fosfomycin	256	256
ceftriaxone	1	16
nalidixic acid	128	128

Results and discussion

- With exception of trimethoprim that had MIC50 below the cut off point most isolates had MIC50 & MIC90 greater than cut off point for different drugs (table 2)
- Why high levels of resistance when production system is an all-in all-out with thorough cleaning and disinfection before restocking?
  - Attributed to ability of bacteria to develop resistance within 24-48 hrs of treatment (Gows *et al.,* 2000)
- How does AMR observed here compare to has been observed in other countries?
  - Same as observed in Europe before use of antimicrobials as feed additives was banned.

Conclusion and recommendations:



- Use of feed additives in broilers is a driver of AMR
- Poultry isolates carry a high level of resistance to antimicrobials used for therapeutic purposes in humans.
- The industry should move to high health status farms - decrease antimicrobial demand
- All antimicrobials be made prescription drugs
- Treatment be based on AST testing results

Reference

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End:

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- Thank you