



Antimicrobial use in poultry: Emerging public health problem

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CPD- Diagnosis and Treatment of Poultry Diseases

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AMR cont...



- * **Antibiotics** -
 - * Natural or synthetic drugs which inhibit or kill bacteria or fungus.
 - * Modes of action of antibiotics
 - * -Inhibition of nucleic acid synthesis
 - * i) Fluoroquinolones (e.g. enrofloxacin
 - * norfloxacin etc)
 - * ii) Rifampin)
 - * -Inhibition of metabolic pathways
 - * (e.g Sulfonamide/Trimethoprim)



-Disruption of cell membrane

(e.g. Polymixins & daptomycin)

-Inhibition of protein synthesis

(e.g OTC. aminoglycosides (e.g. streptomycin),
chloramphenicol)

What are the main uses of antimicrobials in poultry?

1. Specific therapy against known bacteria infections
2. Prophylaxis – e.g. poor hygiene environment



Undesirable effects of AB



- * **Rationale usage**

- Antimicrobial agent preparations use in Kenya is not controlled
- Usage should be restricted to specific therapy after confirmatory diagnosis of the underlying bacterial infection
- **Prophylaxis usage should be discouraged at all times**

- * **What is antimicrobial resistance?**

- This is the ability of bacteria to survive exposure to one or more antimicrobials to which they would normally be susceptible.
- The gains in the use of antimicrobials is under threat due to frequent emerging resistance of cheap and effective 'first choice or first line' drugs.



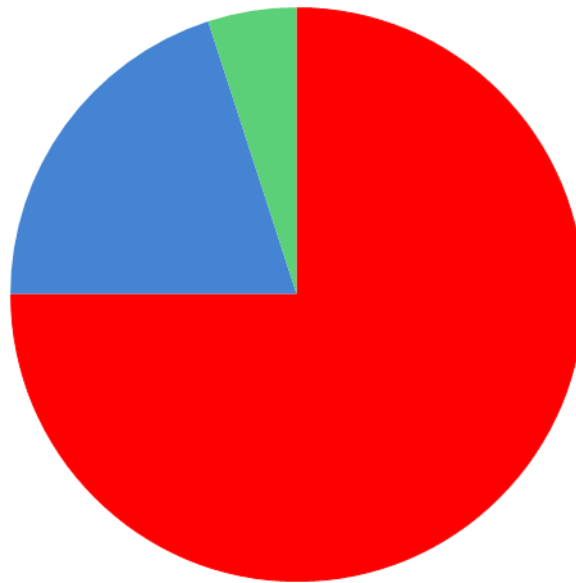
- * **Sequalae of increased AMR**
- * - Delays in clinical recovery by patients (prolonged illness).
- * - Increased cost in therapy
- * - Greater risks of death or loss of production
- * - Alternative AB not available and more resources for research in new antimicrobial agents
- * **How do bacteria become resistant to antibiotics?**
- * i) Natural – e.g. *E.coli* is resistant to penicillin
- * ii) Acquired resistance – due to *de novo* mutation or acquisition of resistance genes from other bacteria



Usage of antimicrobials in food animals in Kenya (Adapted from Mitema et al 2001)



AB Consumption



■ Large Animals = 75%

■ Poultry = 20 %

■ Large animals + Poultry = 5%





AMR cont....



- * **What are the mechanisms of acquired resistance?**
 - Bacteria produces enzymes that destroy antimicrobials
 - Bacteria expresses efflux system that prevent antibiotic from reaching its intracellular target
 - Bacteria modifies the drug's target site
- * - Drug undergoes an alternative metabolic pathway
- * by bacteria
- * **How do bacteria acquire new genetic material?**
 - * ● Conjugation (mating)
 - * ● Transformation
 - * ● Transduction
 - * ● Acquisition of mobile genetic elements like transposons, integrons or gene cassettes



AMR cont..



Where are the resistant genes located?

- Bacterial chromosomal DNA
- Plasmids (extra chromosomal DNA)

Why has antimicrobial resistance become an emerging issue?



AMR milestones



* **Table 1: Milestone in the development of antimicrobial resistance**

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* Antimicrobial agent	Discovery	Clinical use	AR dev
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* Penicillin	1940	1943	1940
* Streptomycin	1944	1947	1947,1956
* Tetracycline	1948	1952	1956
* Erythromycin	1952	1955	1956
* Vancomycin	1956	1972	1987
* Nalidixic acid	1960	1962	1966
* Gentamicin	1963	1967	1970
* Fluoroquinolones	1978	1982	1986

*

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* Adapted from Schwarz and Chaslus-Dancla(2001)



Antibiotics cont...



- AMR by itself is not new, however the rate of increase is alarming compared to the world's ability to contain it or have new antimicrobial drugs
- There is dramatic upsurge in the spread of drug-resistant microbes
- AMR has thus become a “public health issue worldwide”
- Bacteria that are resistant to antimicrobials pose a threat to both human and animal health
- Essential life-saving antibiotics or Critically Important Antibiotics (CIA) (e.g. fluoroquinolones, 3rd and 4th generation + cephalosporins become less effective against bacteria resulting in fewer alternatives available for successful treatment of bacterial infections.



Antibiotics cont...



- * -The misuse and overuse of antibiotics in reduced many cheap and common types ineffective against some bacteria
- * - Failures in clinical efficacy by antibiotics may lead to
 - * i) Prolonged illness – death and loss of production
 - * ii) Switching to second or third line drugs which are always much more expensive and sometimes much toxic
- * - Current trend of AMR development suggests that some bacterial infections will have no effective therapy within the next ten years.



Antibiotics cont...



Why is AMR important in food animal production?

Antibiotic use -

-Human medicine - Contributes to over 70 % use

-Veterinary medicine (food animals, fish) – less than 25 %

-Agronomic usage – less than 3 %

- * Recent studies have implicated the rise in resistance of these bacteria to increased use of antibiotics in veterinary medicine and agriculture.



- * **What factors are likely to contribute to over usage of antimicrobials agents in poultry productions?**
- *
 1. Lack of adequate knowledge on AMR by some cadre of livestock personnel
 2. Empirical therapy based on clinical investigations rather than isolation, typing and of the pathogen
 3. Availability of antibiotics over the counter
 4. Insufficient regulatory and poor law enforcement
 5. Industry may influence prescription patterns of some antibiotics



AMR cont...



- Several studies have demonstrated association between the use of antimicrobials in food animals and development of resistance e.g.. Fluoroquinolone resistant Salmonella and Campylobacter from animals and humans following use of fluoroquinolone in poultry
- FDA banned use of fluoroquinolone in poultry in 2002
- In Kenya, reports have shown a correlation of antimicrobial use and resistance development
- VRE was shown to be due to the use of avoparcin as a growth promotant in animals in Europe. This has not been reported in Kenya since growth promoters are not marketed in the country



Overview of AMR in Kenya



- * 1. Mitema, E. S. Kikvi, G. M., Wegener, H.C. and Stohr K. (2001). An assessment of antimicrobial consumption in food producing animals in Kenya. *J. Vet. Pharmacol. Ther* 24: 385
- * 2. Kikvi, G. M, Ombui, J. N, **Mitema, E. S**, Schwarz, S and Kehrenberg, C (2008). Linked plasmid-borne streptomycin and sulphonamide resistance genes in *Escherichia coli* from food animals in Kenya. *Bulletin An. Hlth*: 56, 56-66
- * 3. Kikvi, G. M.; Schwarz, S.; Ombui J. N. ; **Mitema E. S** and Krehrenberg. K (2007). Streptomycin and chloramphenicol resistance genes in *Escherichia coli* from cattle, pigs and chicken from Kenya. *Microbial Drug Res.* 13 (1), p
- * 4. Kikvi, G. M., Ole-Mapenay, I. M. **Mitema, E. S.** Ombui J. N. (2006). Antimicrobial resistance in *Escherichia coli* isolates from cattle, swine and chickens in Kenya. *I. Vet J*



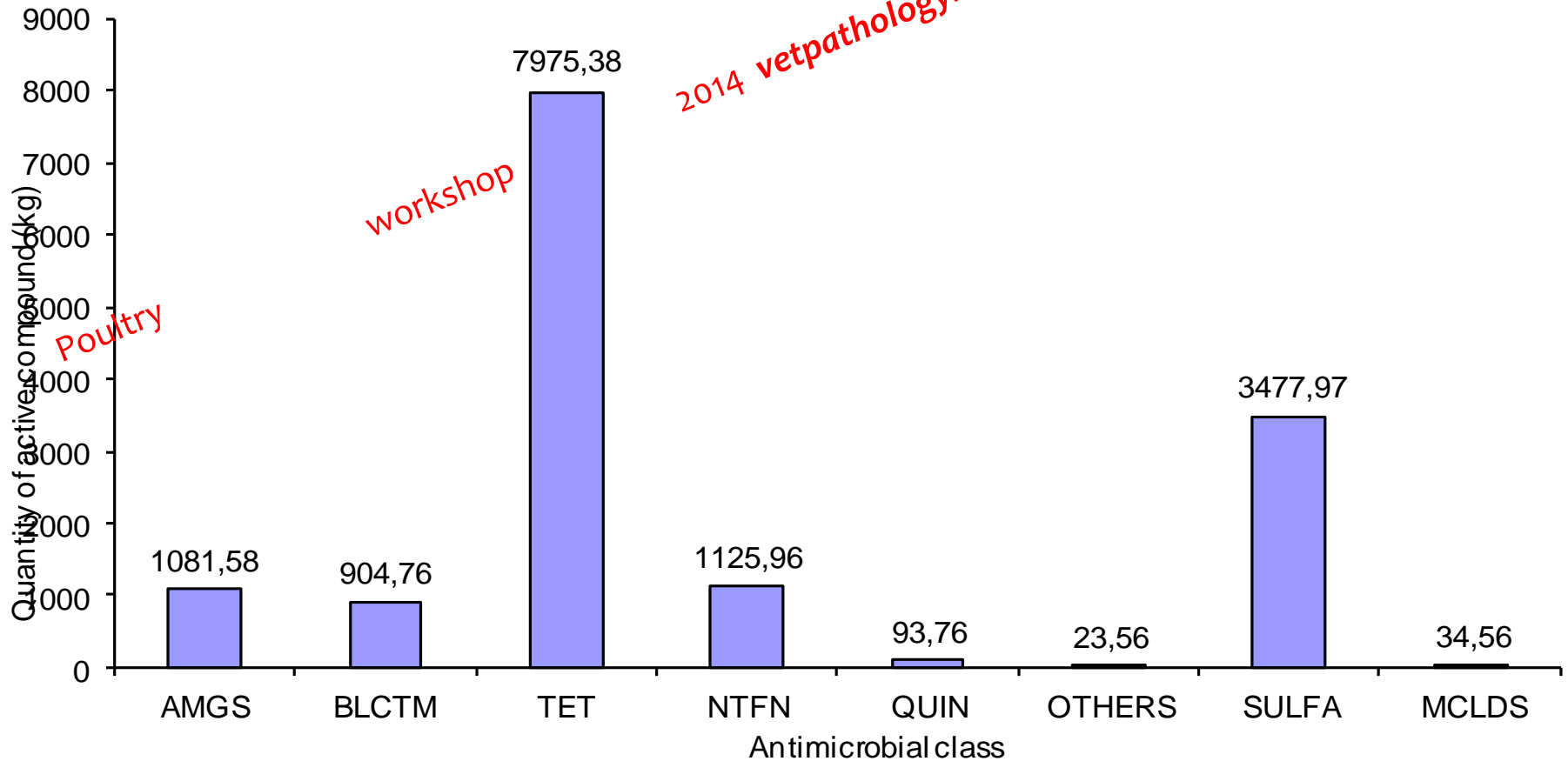
AMR overview in Kenya cont...



- * **5. Mitema, E. S. (2010).** The role of unregulated sale and dispensing of antimicrobial agents on the development of antimicrobial resistance in developing countries. In: Antimicrobial resistance in developing countries, A. de J. Sosa edit. Springer, NY,
 - * p 403-411
- * **6. Karuiki et. al. (2013).** Improving food safety in meat value chains in Kenya. Food Protection Trends, May-June, 172-179
- * **7. Kikuvi, G. M. and Mitema, E. S.(2010).** Serotypes and antimicrobial resistance of salmonella isolates from pigs at slaughter in Kenya. JIDC
- * **8. Mitema, E. S. (2009).** Improved management of drugs, hormones and pesticides in Africa. Onderstepoort J Vet Res 76: 155 - 159



Fig I: Mean antimicrobial consumption (kg) per year in food producing animals in Kenya during the 1995 to 1999 period (Mitema et 2001)

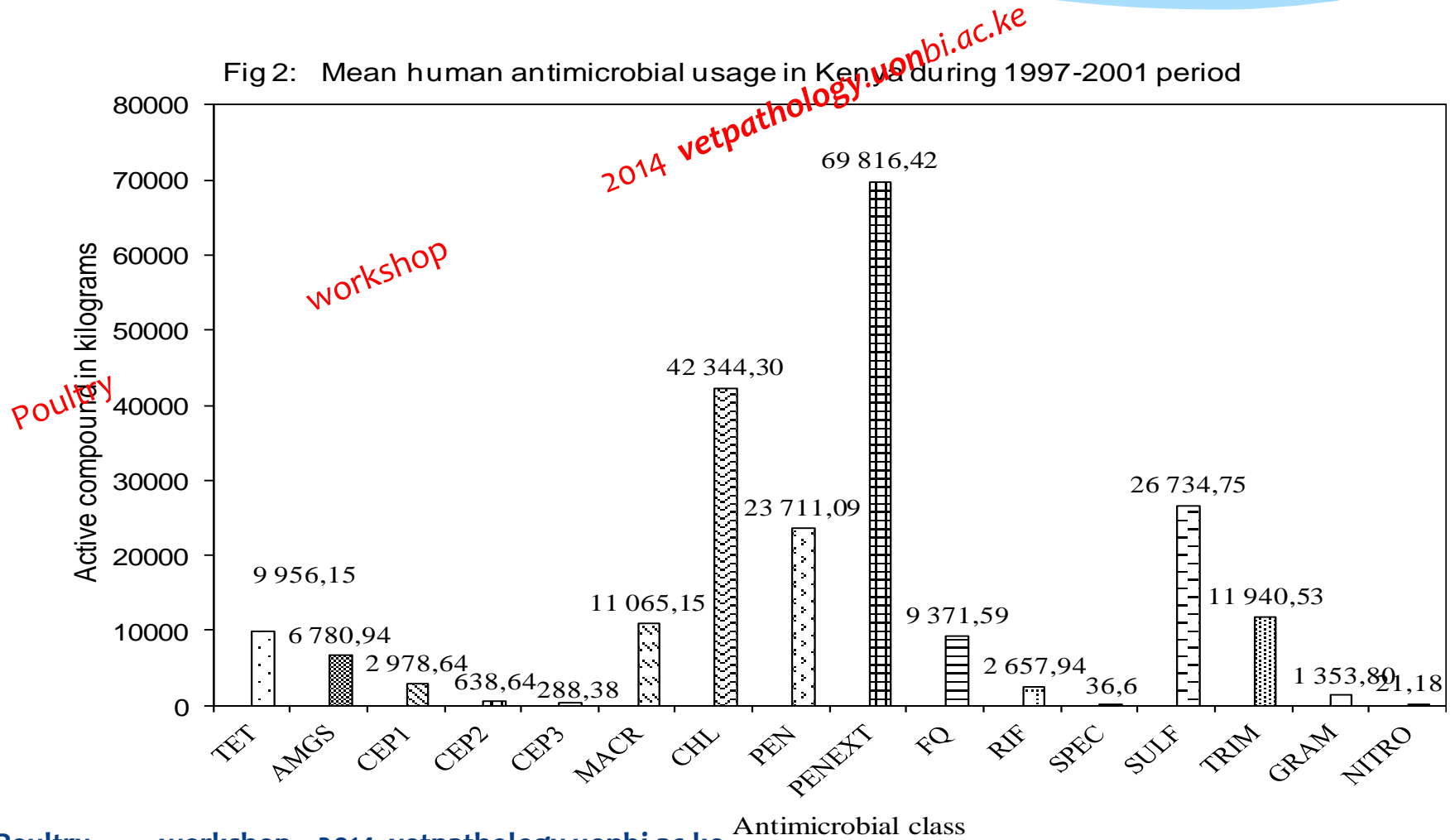




Mitema and Kikuvi 2004



Fig 2: Mean human antimicrobial usage in Kenya during 1997-2001 period



Poultry

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Antimicrobial class



Current on going AMR investigations



- * 1. Enterococcus spp phenotype and genotype resistance to commonly used antibiotics - Vancomycin, Erythromycin etc
- * 2. MRSA and MRSP in dogs



Conclusions



What is the way forward and recommendation

1. Prudent use of antimicrobial drugs in livestock production including poultry
2. Programmes to monitor the occurrence and development of antimicrobial resistance are highly desirable in Kenya and other countries
3. Effective infection control and hygienic practices should be implemented in poultry production management systems
4. Use of life-saving antimicrobial agents (3rd, 4th generation fluoroquinolones and cephalosporins) should be only after antimicrobial susceptibility tests (AST).



Thank you



*Q and A