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Antimicrobial Resistance and the Governance of Water Resources in South Africa

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Introduction

- The use of antibiotics has grown also in South Africa.
- The antimicrobials are used:
 - ✓ In food production (farming), Processing and Preservation.
 - ✓ To enhance human health (medicine, vaccines, etc).
- Resistance and susceptibility of harmful (disease causing) microorganisms to antibiotics is a concern also in RSA.
- Studies have signaled the urgency to curb AMR or ABR.

Main aim

To share results of the studies conducted in South Africa:



**A case study
of the Vaal
Catchment**

**Political and
strategic
intervention
taken**

**Gaps to be
filled**

Antibiotics Human Use in S. Africa

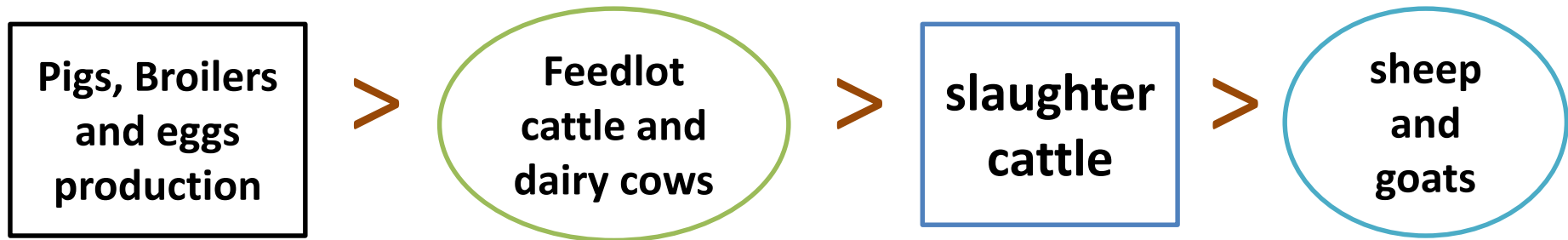
Top 50 most prescribed drugs in the public health sector

	Product	Drug	Class	Prescriptions
1	RIDAQ	Hydrochlorothiazide	Hypertension	12 119 557
2	AUSTELL-PARACETAMO	Paracetamol 500 mg	Analgesic	10 712 781
3	PHARMAPRESS	Enalapril maleate & Hydrochlorothiazide	Hypertension	9 751 575
4	VITAMIN B CO (UNB)	Vitamins	Vitamins	7 335 796
5	CO-TRIMOXAZOLE (UN)	Co-trimoxazole	ARV	6 555.480
6	PACIMOL	Paracetamol 500 mg	Analgesic	6 424 452
7	METHYL SALICYL (UN)	Methyl salicylate	NSAID	5 759 858
8	METFORMIN	Metformin Hydrochloride	Diabetic	5 543 892
9	AMOXYCILLIN	Amoxicillin	Antibiotic	5320.452
10	PARACETAMOL (UNB)	Paracetamol 500 mg	Analgesic	5 243709

- Antibiotics are in the top 10 drugs prescribed in South Africa 's public health sector, **e.g., Amoxicillin**
- This has put our water resources under threat.

Antibiotics Use in Animals in S. Africa

- There are 64 registered Antimicrobial products in South Africa.
 - Mixed with animal feed or dissolved in water to increase animal growth.
 - The list included (in 2004) those banned by WHO (*tylosin*, *spiramycin*, *bacitracin* and *virginiamycin*).
- Antibiotic use in animals is in the order:



Prevalence of Resistance to Antibiotics in Farming

Pigs, Broilers
and eggs
production



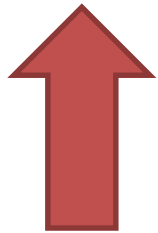
Feedlot
cattle and
dairy cows



slaughter
cattle



sheep
and
goats



Higher

* *E. Coli*

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REVIEW ARTICLE

Antibiotic resistance via the food chain: fact or fiction?

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Antibiotics in the Aquatic Environment

- Antibiotics enter the aquatic environment via four possible routes of discharge;
 - Municipal wastewater treatment plants,
 - Hospital & manufacturers production waste,
 - Runoff & waste from agricultural and veterinary pharmaceuticals,
 - Runoff from settlements.
- Aquatic systems or surface waters could act as reservoirs for antimicrobial resistant microbes (AMRMs) and genes (AMRGs).

The Vaal Catchment(s) in South Africa as a Study Area (case study)

- **Why the Vaal catchment?**
 - ✓ Gauteng water supply depends on this system. This system also receives water from Lesotho Highlands (by water transfer scheme).
 - ✓ Gauteng Province is the main economic hub in the Southern Africa regions and South Africa.
 - ✓ JHB and Pretoria are densely populated and highly industrialised
- **So production and use of antibiotics suppose to be high in Gauteng.**

Case study - Antimicrobial resistance analysis in a water resources in the Vaal System

- Antibiotic resistant bacteria were collected from all 5 rivers
 - ✓ *and some were resistant to multiple antibiotics*
 - ✓ *Some of them are known opportunistic pathogens.*
- These preliminary data suggest human health risks exist if:
 - ✓ *the water is directly consumed*
 - ✓ *or used for recreation*



Case study – Antimicrobial resistance analysis in raw and drinking water

Substance	Classification	Source water ($\mu\text{g}/\ell$)	Final water ($\mu\text{g}/\ell$)	Distribution system ($\mu\text{g}/\ell$)
Chloramphenicol	Antibiotic	0.00346	0.00328	0.00266
Erythromycin	Antibiotic	0.21200	N/D	N/D
Trimethoprim	Antibiotic	0.02280	0.00800	0.00212

Figure: Antimicrobials detected in **water source**, **final water** and **the distribution system**. (*N/D = not detected or below the lower level of detection [LOD]*)

Case study - Antibiotic Susceptibility Patterns of the HPC isolates from Water

Site	Isolate	Gram	AMP	KF	Ery	Chl	CIP	Kan	Neo	Strep	Van	
Raw	A1-1R	-	S	S	S	S	S	S	S	R	-	
	A1-3R	-	S	S	I	S	S	S	S	S	-	
	A1-5R	-	R	R	S	S	S	S	S	S	-	
	A1-6R	+	S	S	S	S	S	S	S	S	S	
	A1-7R	-	I	R	R	S	S	S	S	I	-	
	A1-10R	-	R	I	S	S	S	S	S	S	-	
	A1-13R	-	S	S	S	S	S	S	S	S	-	
	Final	AF1-1F	-	R	R	R	I	S	S	S	S	-
		AF1-2F	+	S	S	S	S	S	S	S	S	S
AF1-3F		+	S	S	S	S	S	S	S	S	S	

AMP- Ampicillin; KF – Cephalothin; Ery- Erythromycin; Chl - Chloramphenicol ; CIP- Ciprofloxacin; Kan – Kanamycin; Neo- Neomycin ; Strep- Streptomycin; Van- Vancomycin

(R = resistance, S = Susceptible, I = Intermediate resistant)

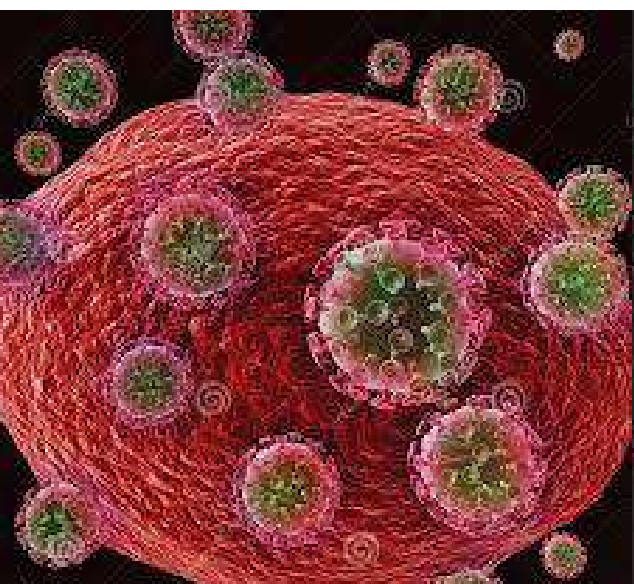
National AMR strategy framework and implementation plan

- SA faces a burden of diseases:
 - HIV/AIDS epidemic,
 - other infectious diseases,
 - non communicable diseases)

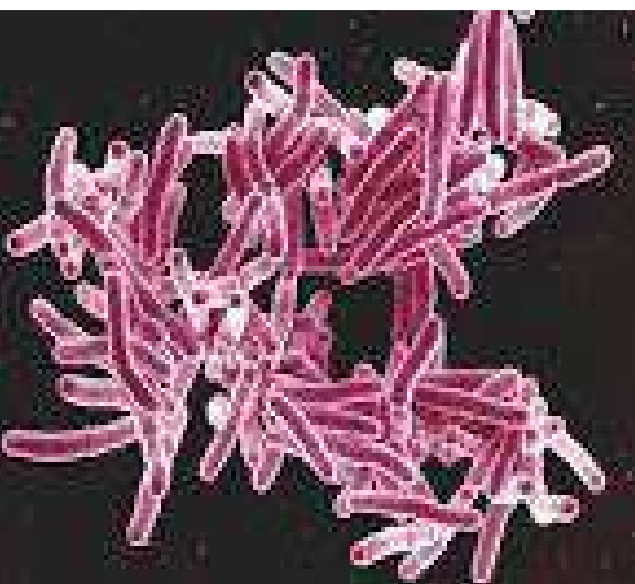


+ **thus AMR is an added threat**

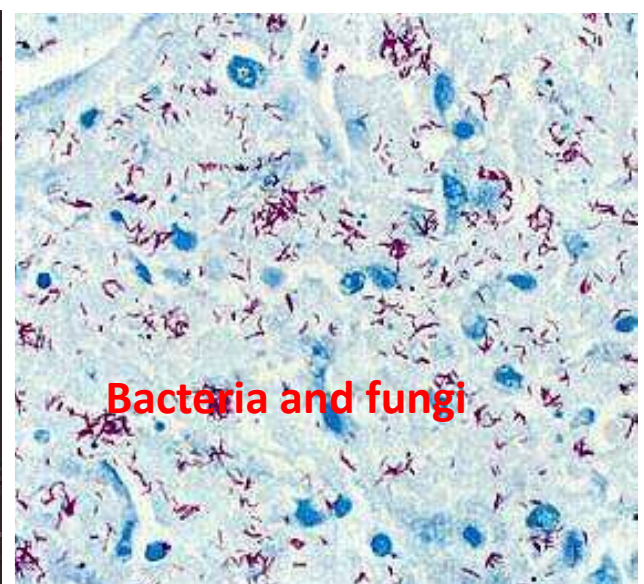
Drug resistant HIV DRHIV



Multidrug resistant TB (MDR TB)



Multi drug resistant organisms (MDR)



AMR Strategic in S. Africa

A national AMR strategy framework (2014- 2019) and implementation plan has been developed -

as means to complement international efforts towards containment of AMR.

Some of key issues addressed are:

- Establishing governance structure at Op. level;
- Optimizing surveillance & early detection of AMR,
- Enhance Infection prevention & control,
- Prevent and control spread of AMR,
- Institutionalize AMR **stewardship**
- Legislation & Policy reform,
- Effective Communication,
- Research and Development
- M & E

Stat. Enablers

- Global Antibiotic Resistance Partnership (**GARP**) in South Africa (**GARP-SA**)
- South African Antibiotic Stewardship Programme (**SAASP**)
- Expanded Programme on Immunisation (**EPI**)

ANTIMICROBIAL RESISTANCE
NATIONAL STRATEGY FRAMEWORK

2014-2019

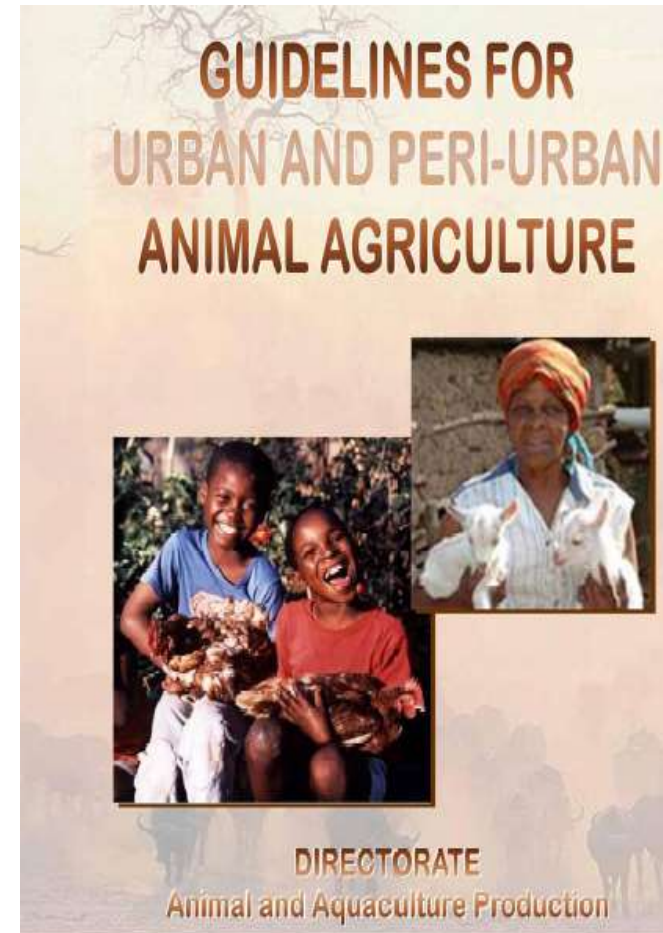
Examples of Legislations Affected by the Reform

What legislations would apply?

- Animal Diseases Act, 1984 (Act No. 35 of 1984)
- Animal Identification Act, 2002 (Act No. 6 of 2002)
- Animal Improvement Act, 1998 (Act No. 62 of 1998)
- Animal Protection Act, 1962 (Act No. 71 of 1962)
- The National Environmental Management Act (Act No. 107 of 1998)

In addition to this, **most municipalities have ordinances** that they use or apply:

- ✓ Mostly linked to animal health and welfare,
- ✓ public health and



Conclusions

- Antimicrobial resistance has become a leading threat to human health, yet most national efforts largely overlook the linkages connected to water systems.
- The a need to standerdise to standardize labs methods and data in RSA.
- The driving factors behind AMR should be addressed holistically,
- Regional (SADC) approaches should be adopted to attain sustainable management of AMR.
- Partnerships and collaborations are needed (R&D, implementation, policy reform, communication, etc.



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COMMISSION

THANK YOU