UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

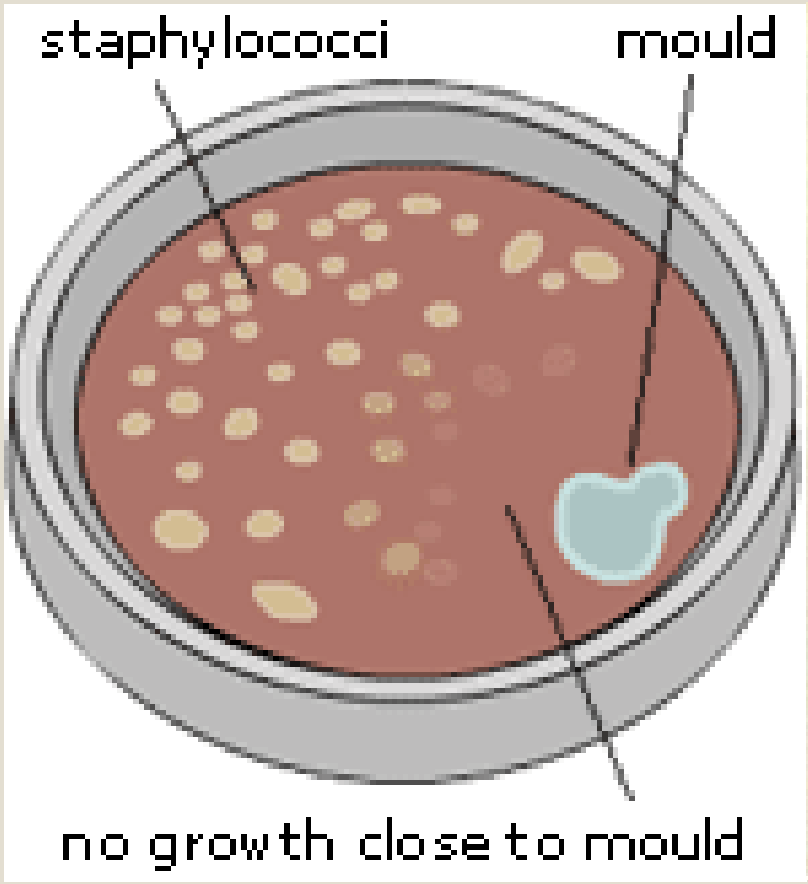
One Health Day: AMR

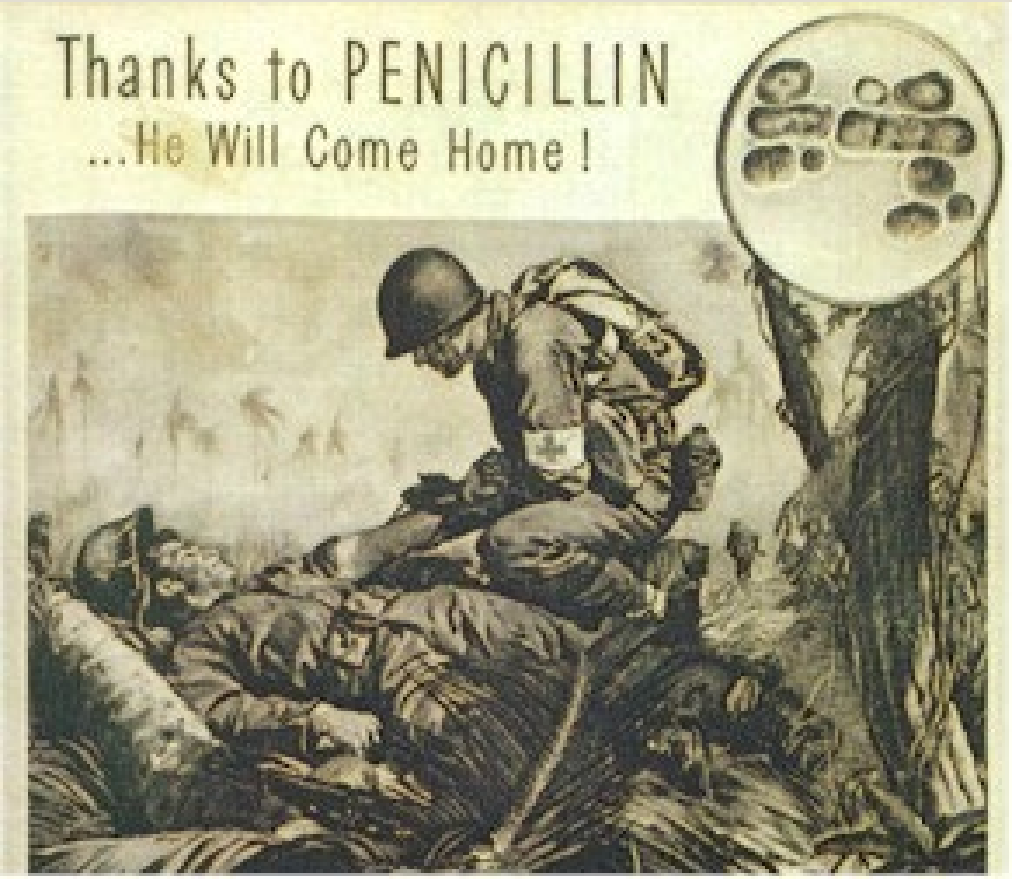
Vinny Naidoo
Veterinary Science
2021

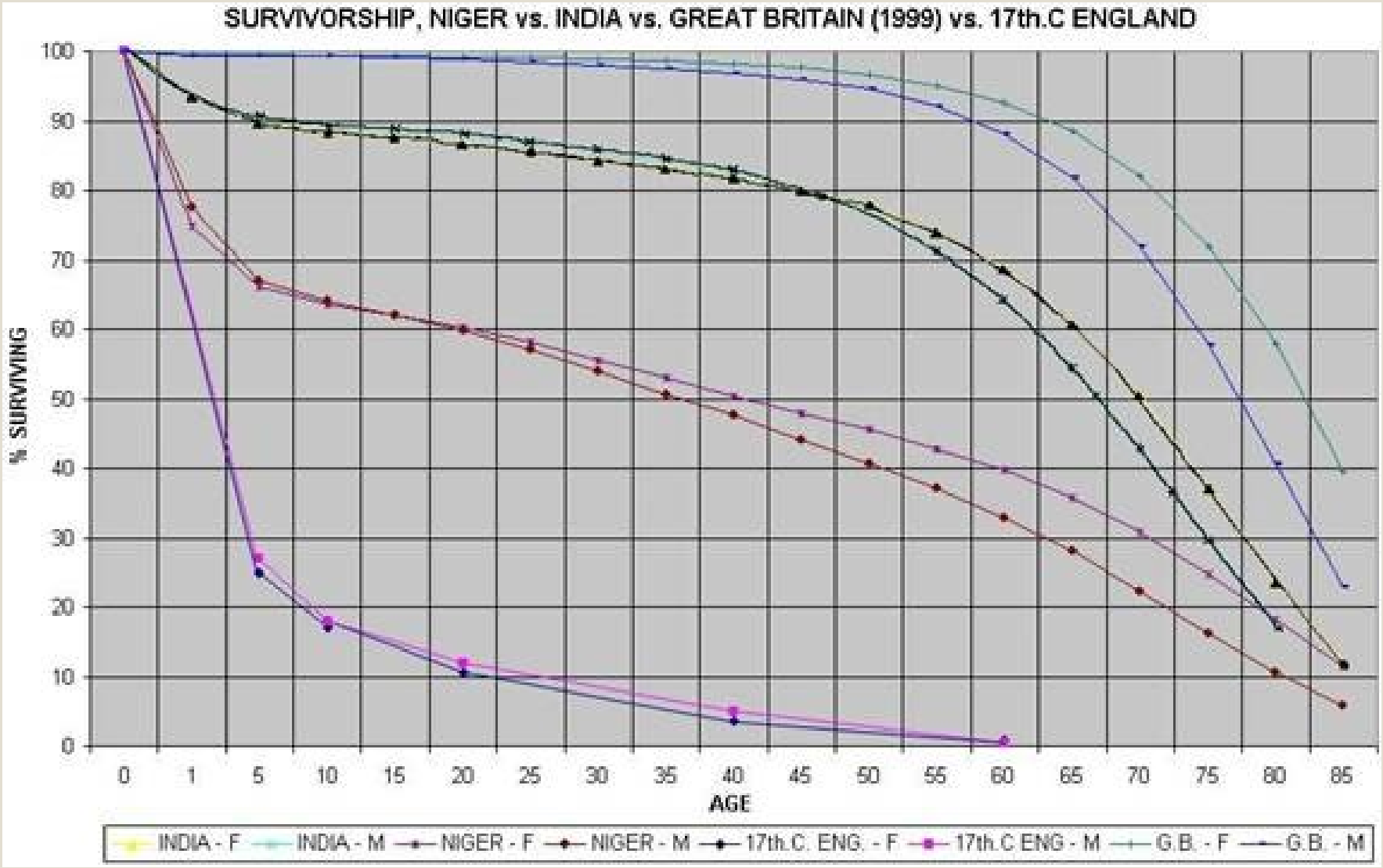
Antibiotics
Antivirals
Antifungals
Antiparasitics

World Antimicrobial Awareness Week
18 - 24 November 2021

Penicillin

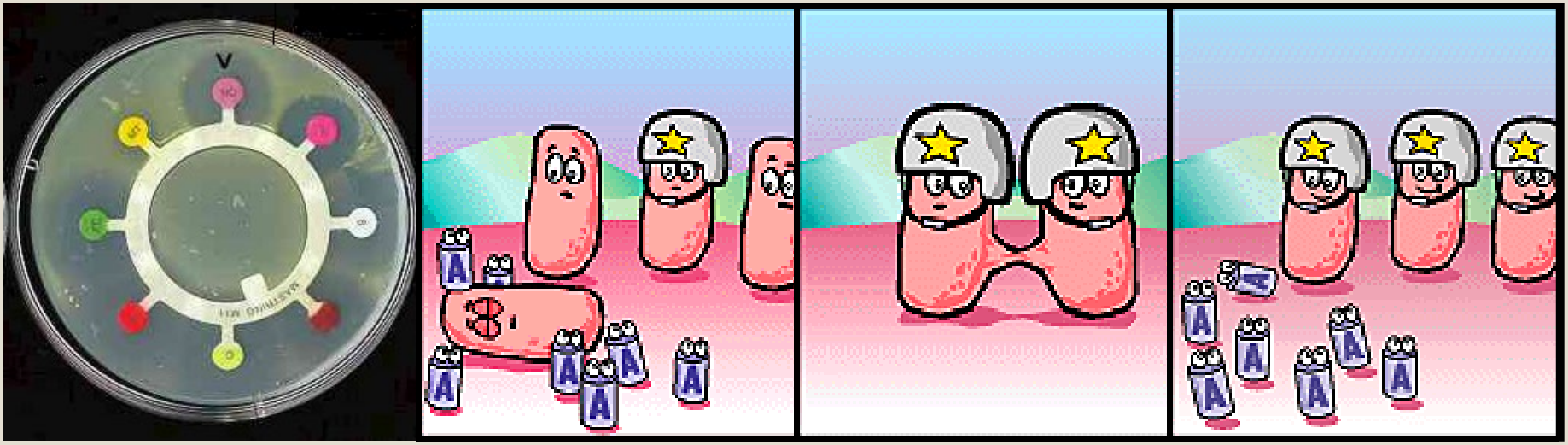

staphylococci
mould
no growth close to mould

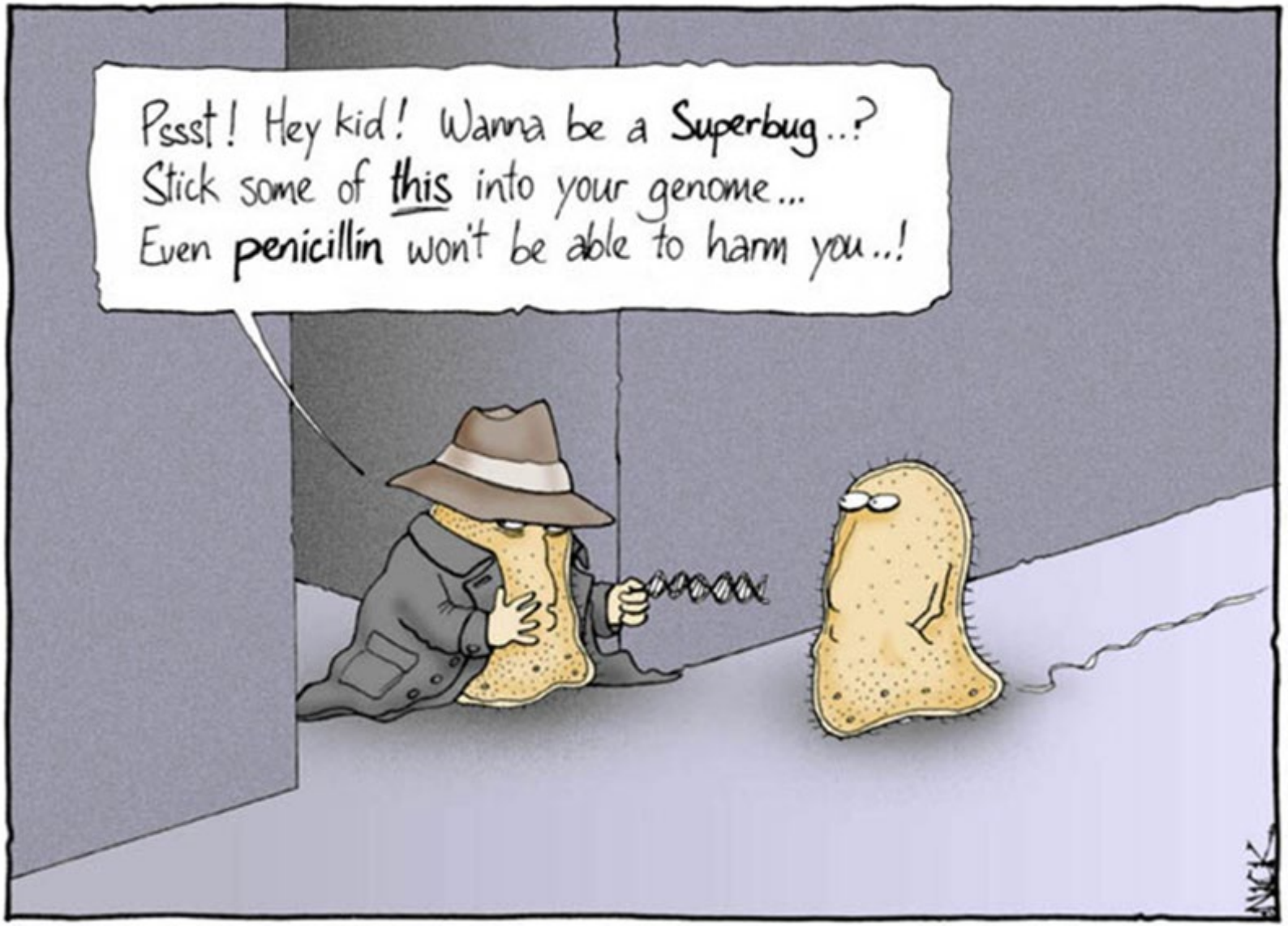

Thanks to PENICILLIN
...He Will Come Home!


SURVIVORSHIP, NIGER vs. INDIA vs. GREAT BRITAIN (1999) vs. 17th.C ENGLAND
% SURVIVING
100
90
80
70
60
50
40
30
20
10
0
0
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
AGE
INDIA - F
INDIA - M
NIGER - F
NIGER - M
17th.C. ENG. - F
17th.C ENG - M
G.B. - F
G.B. - M

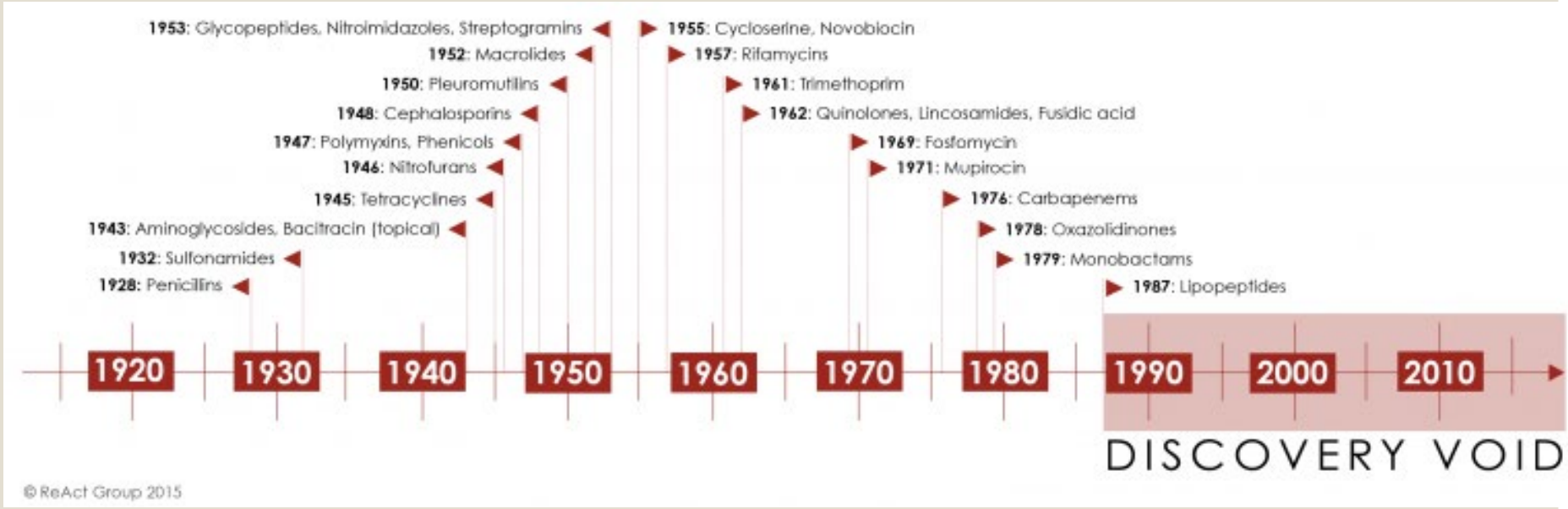
Resistance

- When the dose required to kill is either
  - Not safe to use
    - Aminoglycosides
  - Not physiologically possible
    - Penicillins





It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.


1953: Glycopeptides, Nitroimidazoles, Streptogramins
1952: Macrolides
1950: Pleuromutilins
1948: Cephalosporins
1947: Polymyxins, Phenicols
1946: Nitrofurans
1945: Tetracyclines
1943: Aminoglycosides, Bacitracin (topical)
1932: Sulfonamides
1928: Penicillins
1955: Cycloserine, Novobiocin
1957: Rifamycins
1961: Trimethoprim
1962: Quinolones, Lincosamides, Fusidic acid
1969: Fosfomycin
1971: Mupirocin
1976: Carbapenems
1978: Oxazolidinones
1979: Monobactams
1987: Lipopeptides
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
DISCOVERY VOID
© ReAct Group 2015

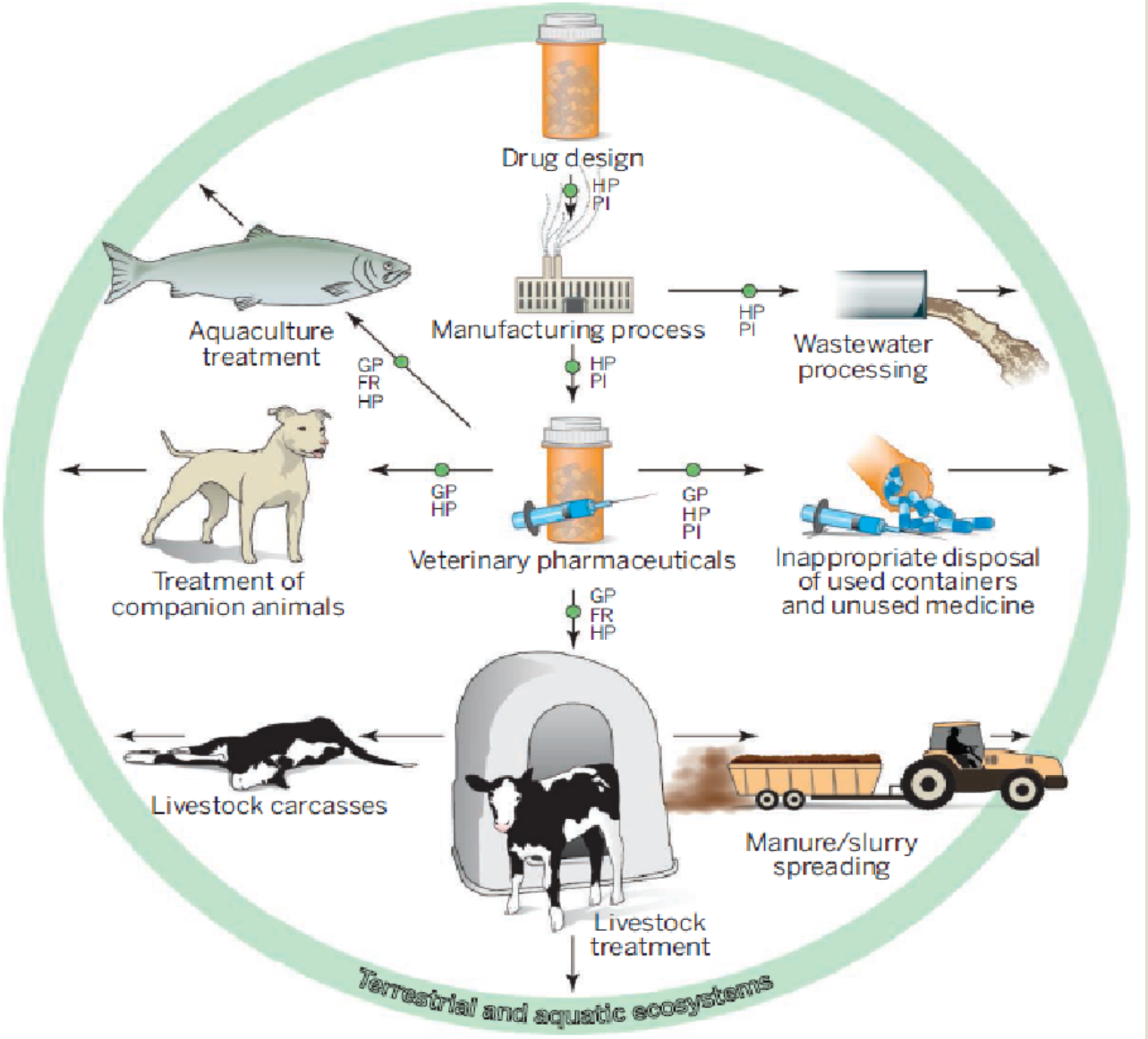


ILLUSTRATION: P. HUEY/SCIENCE

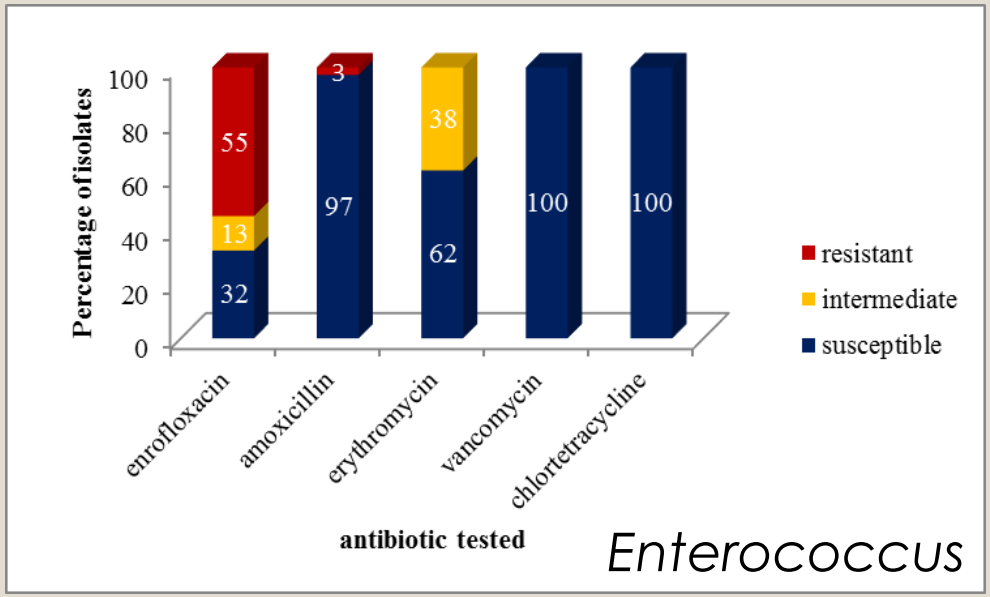
Major pathways of release of veterinary pharmaceuticals into the environment. Green dots represent control points where environmental contamination can be prevented or minimized. GP, general public; FR, food retailers; HP, health professionals and scientists, including veterinarians, pharmacologists, farmers, animal scientists, ecologists, and environmental scientists; PI, pharmaceutical industry. Based in part on (*4*).

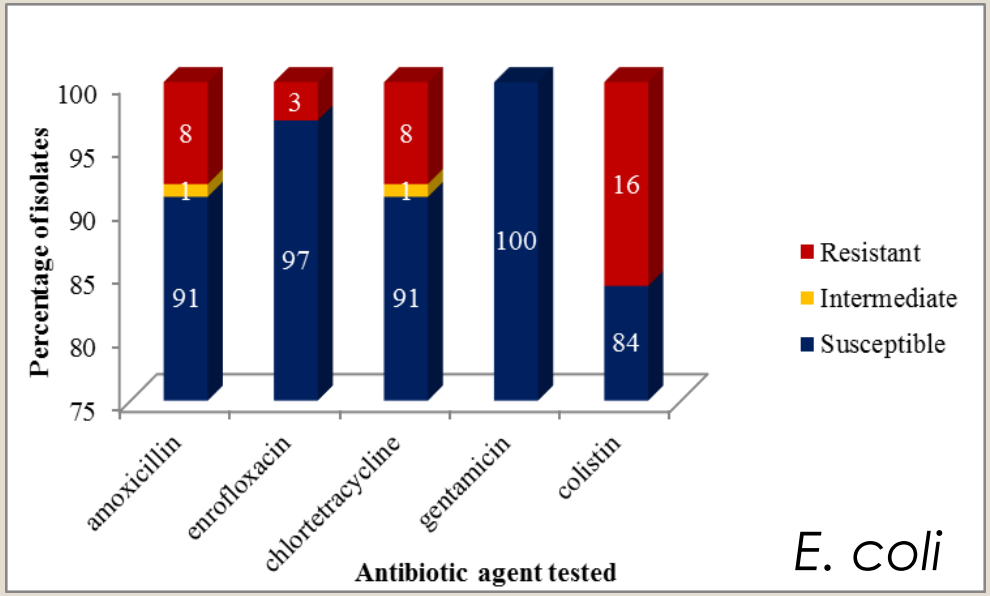
Role of Rural Farmers

- Do farmers in a rural area know how to use antimicrobials
- Is there potential overuse
- Is food safety taken into consideration
- Is there high levels of resistance in faecal *E. coli* and Enterococcus in rural cattle

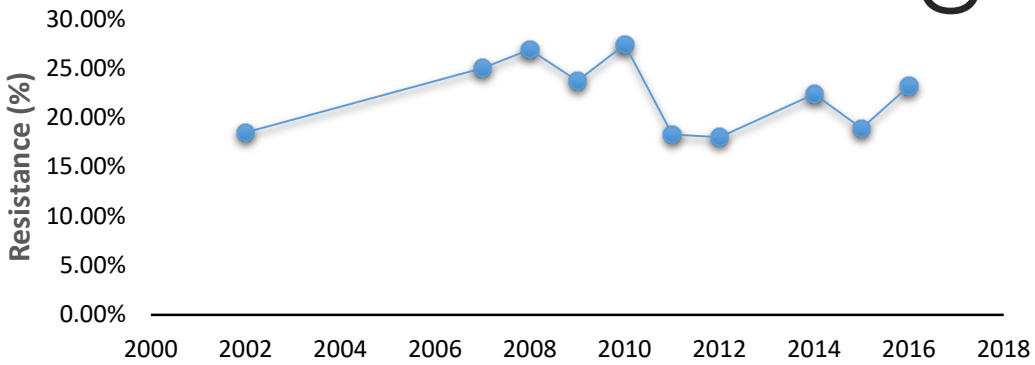
Mupfunya, C.R., Qekwana, D0.N. and Naidoo, V., 2021. Antimicrobial use practices and resistance in indicator bacteria in communal cattle in the Mnisi community, Mpumalanga, South Africa. *Veterinary medicine and science*, *7*(1), pp.112-121.

	Number	Percentage
Aware what an antimicrobial agent is	(n=70)	
No	69	99
Yes	1	1
Could give an example of an antibiotic	0	0
Antibiotics farmers used in the last year	(n=70)	
Terramycin®	60	86
Hitet®	30	43
Source of drugs	(n=67)	
Corporative	23	34
Local animal clinic	40	60
Veterinarian	6	9
Animal health technicians	0	0
Villagers that sell drugs	0	0


Percentage of isolates
100
80
60
40
20
0
55
13
32
3
97
38
62
100
100
enrofloxacin
amoxicillin
erythromycin
vancomycin
chlortetracycline
antibiotic tested
resistant
intermediate
susceptible
Enterococcus


Percentage of isolates
100
95
90
85
80
75
8
1
91
3
97
8
1
91
100
16
84
amoxicillin
enrofloxacin
chlortetracycline
gentamicin
colistin
Antibiotic agent tested
Resistant
Intermediate
Susceptible
E. coli

Impact of Commercial Agriculture



Antimicrobial	Year										Total
	02	07	08	09	10	11	12	14	15	16	
Macrolides	0.0	42.9	45.4	42.1	67.9	25.0	23.4	33.7	36.5	33.3	37.0
Sulphonamides	0.0	14.9	9.0	5.1	7.1	25.0	4.2	11.6	7.1	28.0	9.1
Aminoglycosides	40.0	58.7	59.7	43.6	78.6	50.0	43.3	21.7	20.2	-	45.6
Penicillins	18.2	14.8	10.3	4.2	2.4	7.7	3.1	6.2	5.7	4.6	6.9
Tetracyclines	20.0	37.0	28.4	15.4	14.3	0.0	29.8	18.8	13.1	32.4	22.8
Fluoroquinolones	30.0	39.5	42.3	33.2	39.3	29.2	27.9	40.2	40.7	57.0	37.8
Lincosamides	-	15.6	6.7	11.5	3.6	0.0	3.0	4.4	5.5	0.0	6.7
Cephalosporins	0.0	17.0	23.7	29.6	28.9	20.0	12.7	26.2	14.8	12.6	20.1
Polymixins	10.0	6.7	3.6	2.3	0.0	0.0	0.0	0.0	-	-	2.6
Phenicol	-	-	-	25.0	0.0	0.0	42.5	2.4	6.1	0.0	15.4
Total											22.5

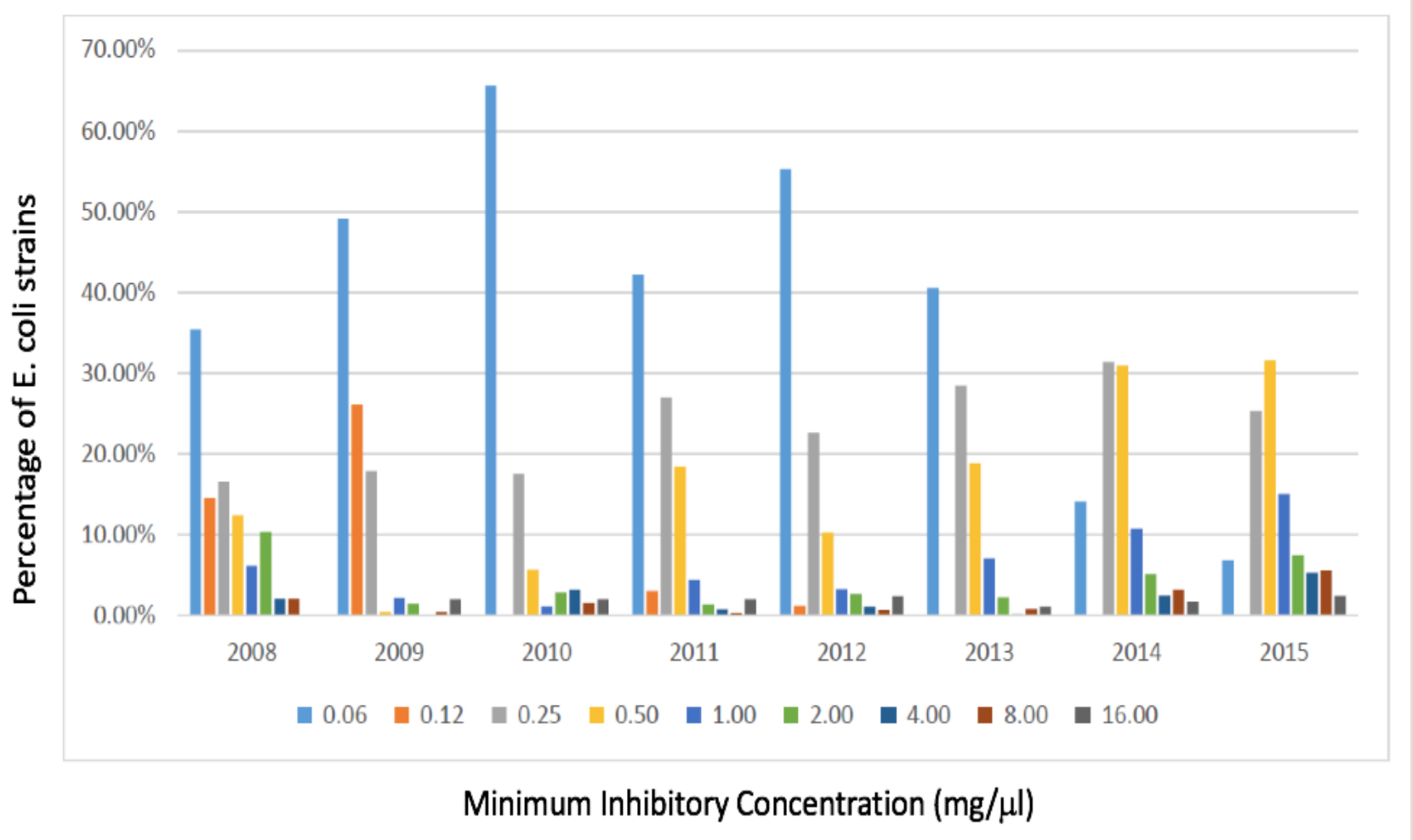
SAVC
SOUTH AFRICAN VETERINARY COUNCIL

Colistin use by veterinarians

Dear Member

It is recommended that Colistin not be used in food producing animals at all, unless the veterinarian can justify its use at the hand of a sensitivity test and as a very last resort to treat an animal. Any conduct to the contrary would be regarded by Council as unprofessional conduct.

Colistin Resistance



Perreten V, Strauss C, Collaud A, Gerber D. Colistin resistance gene mcr-1 in avian-pathogenic Escherichia coli in South Africa. Antimicrobial agents and chemotherapy. 2016 Jun 20;60(7):4414-5.

E. coli surveillance in chickens

Antimicrobials		Carcasses samples		Environment samples		Control
		2019 (N=122)	2020 (N=106)	2019 (N=112)	2020 (N=98)	(N=17)
Classes	**Drug compounds**	**Proportions (%)**	**Proportions (%)**	**Proportions (%)**	**Proportions (%)**	**Proportions (%)**
Aminoglycosides	Gentamicin	9.8	4.7	3.6	1	0
β-lactams	Ampicillin	32	37.7	39.3	36.7	11.8
	Aztreonam	4.9	21.7	4.5	18.4	0
	Cefotaxime	8.2	36.8	8.9	27.6	0
	Ceftazidime	8.2	36.8	9.8	25.5	0
	Cefepime	4.1	19.8	4.5	13.3	0
	Cefuroxime	4.1	30.2	4.5	21.4	0
	Meropenem	0	0	0	0	0
β-lactam + β-lactamase inhibitors	Amp/Sul	4.1	8.5	8.9	5.1	0
	Amox/Clav	4.9	23.6	6.2	19.4	5.9
	Piper/Tazo	0	0	0	0	0
Quinolones	Ciprofloxacin	15.6	18.9	16.1	9.2	11.8
	Nalidixic Acid	47.5	43.4	33	21.4	11.8
	Norfloxacin	13.1	11.3	14.3	3.1	11.8
Polymyxin	Colistin	0	0	0	0	0
Tetracycline	Tigecycline	0	0	0	0	0
Potentiated sulphonamide	Trim/Sulf	33.6	22.6	30.4	30.6	11.8

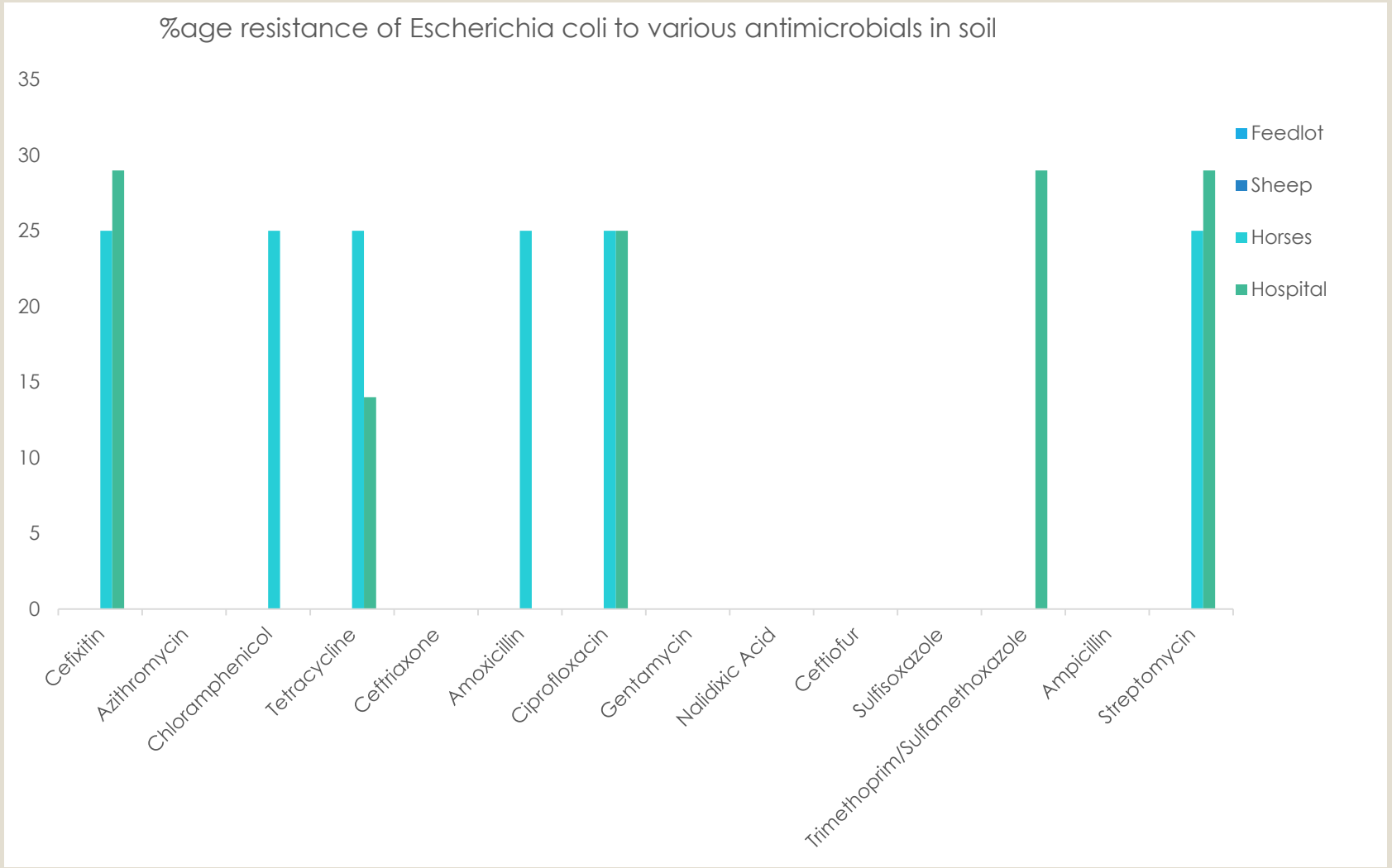
I Hassan, PhD Study, FVS

Colistin susceptibility in Porcine E coli

Source	MicroScan®		Broth microdilution	
	Resistance	Susceptible	Resistance	Susceptible
Human	88% (n=96)	7%	90% (n=84)	10%
Porcine	20% (n=89)	15%	83% (n=5)	16%
Environmental	35% (n=25)	35%	100% (n=9)	0%

Molecular epidemiology and mechanisms of colistin and carbapenem resistance in *Enterobacteriaceae* from clinical isolates, the environment and porcine samples in Pretoria, South Africa By D Bogoshi (FHS)

E coli in soil at Onderstepoort



Conclusion

- AMR is of major concern
- New drugs are not forthcoming
- Mitigation is the only solution
  - Prudent use
  - Prudent disposal
  - Alternate non-microbial substances
  - Vaccinations