ANTIMICROBIAL RESISTANCE IN KENYA; What Surveillance tells us

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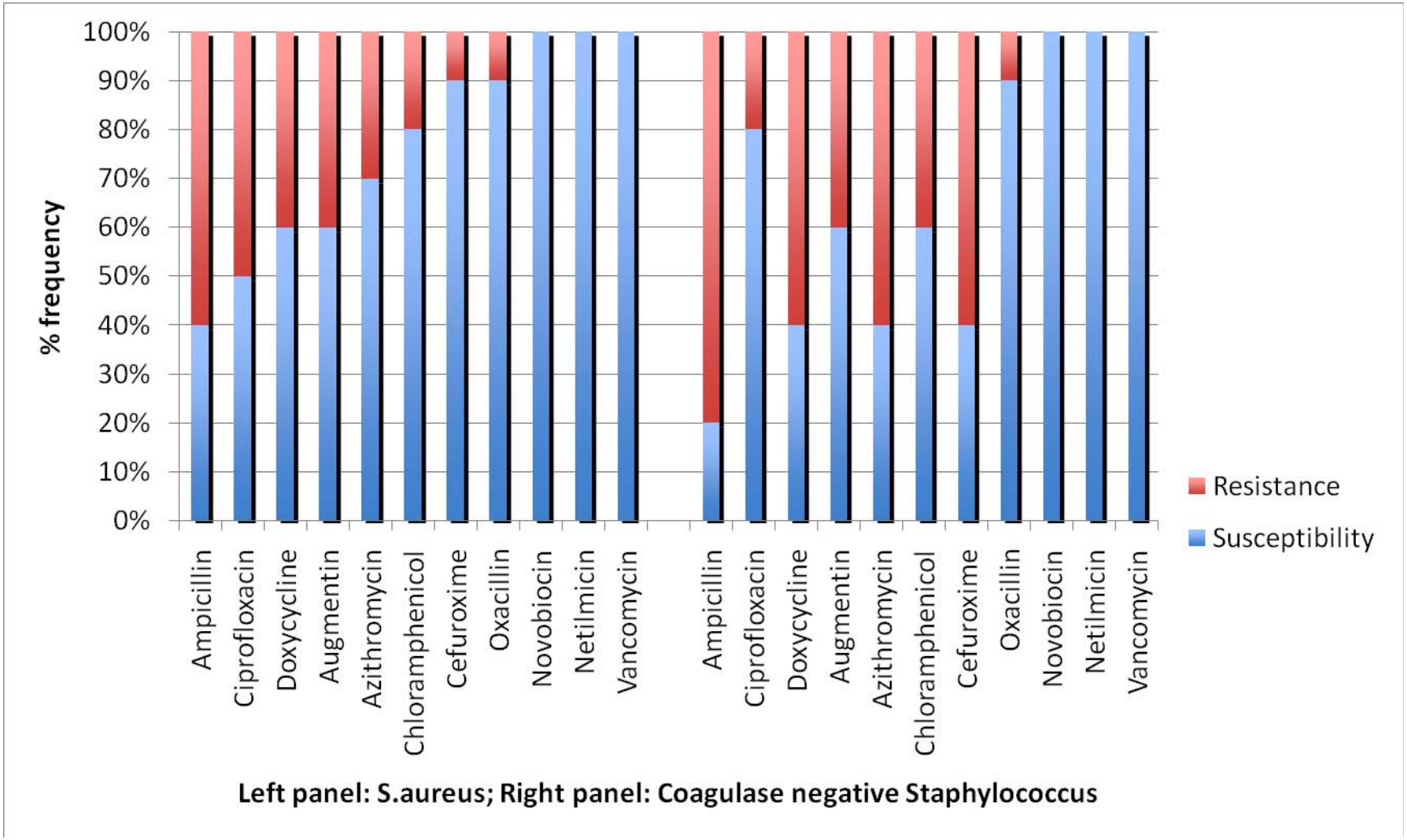
Introduction

- Although no systematic national surveillance is in place, few sentinel studies indicate that problem of antimicrobial resistance is an emerging public health problem
- Over-the-counter sales of pharmaceuticals still common in some retail chemists
- Use in animals restricted to commercial farming but in humans issue is critical
- Reliability of data: Quality assurance in susceptibility testing not widespread

e.g. - Use of obsolete methods in AST, modified Stokes, poor quality disks, etc

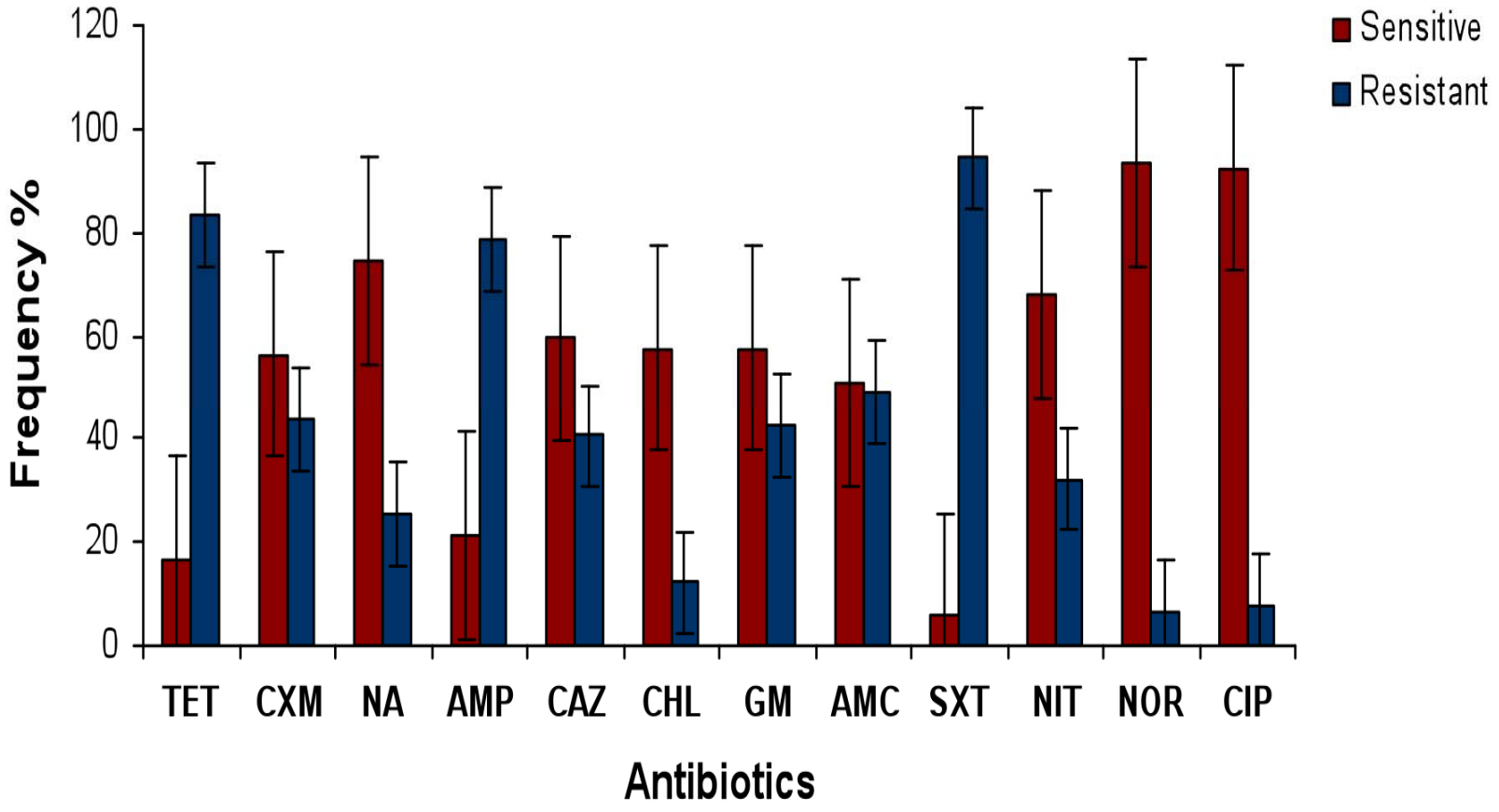
Data from sentinel surveillance on antimicrobial resistance in health facilities

Antibiotic susceptibility for *Staphylococcus aureus* isolated from wound sepsis

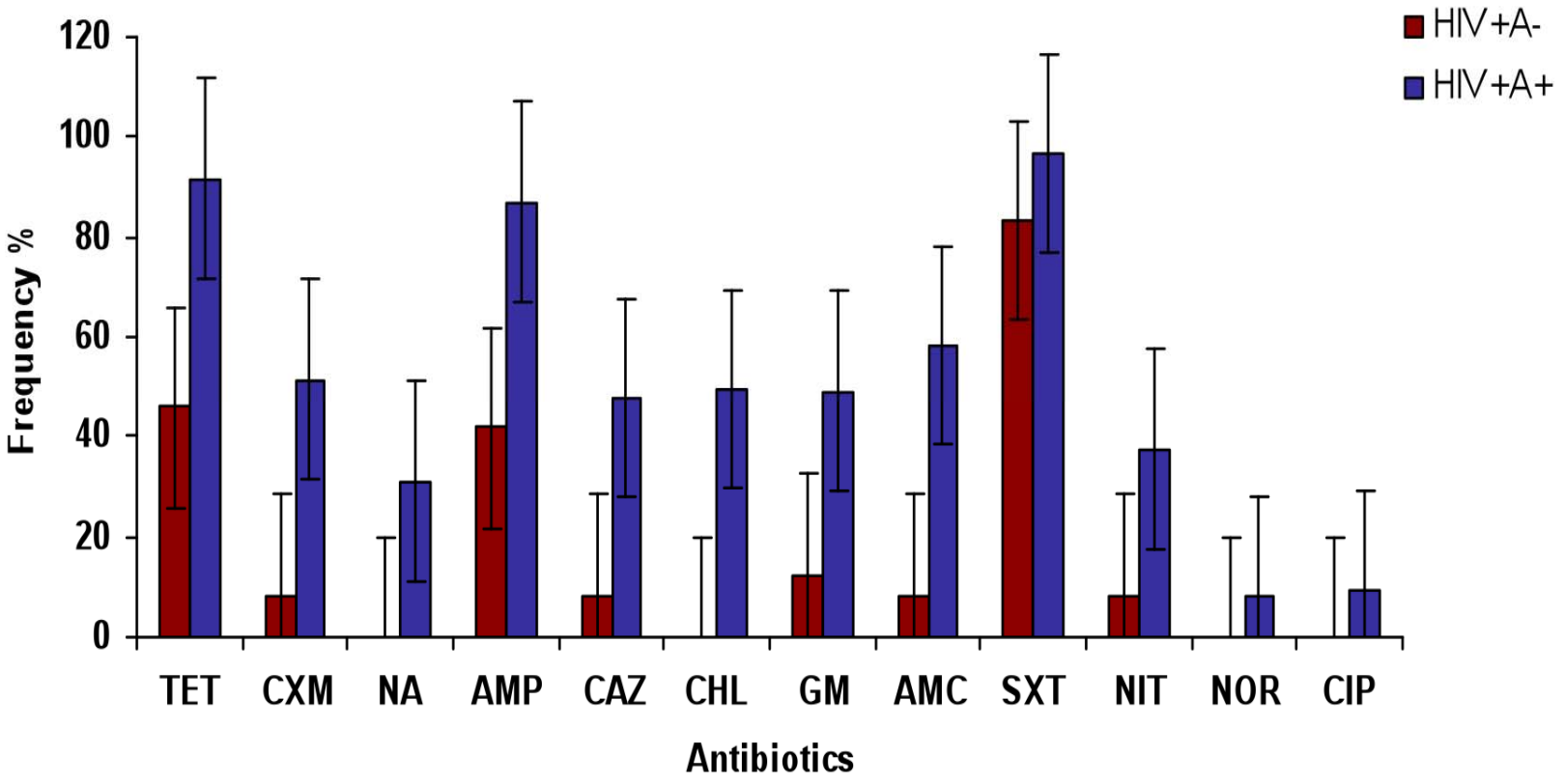


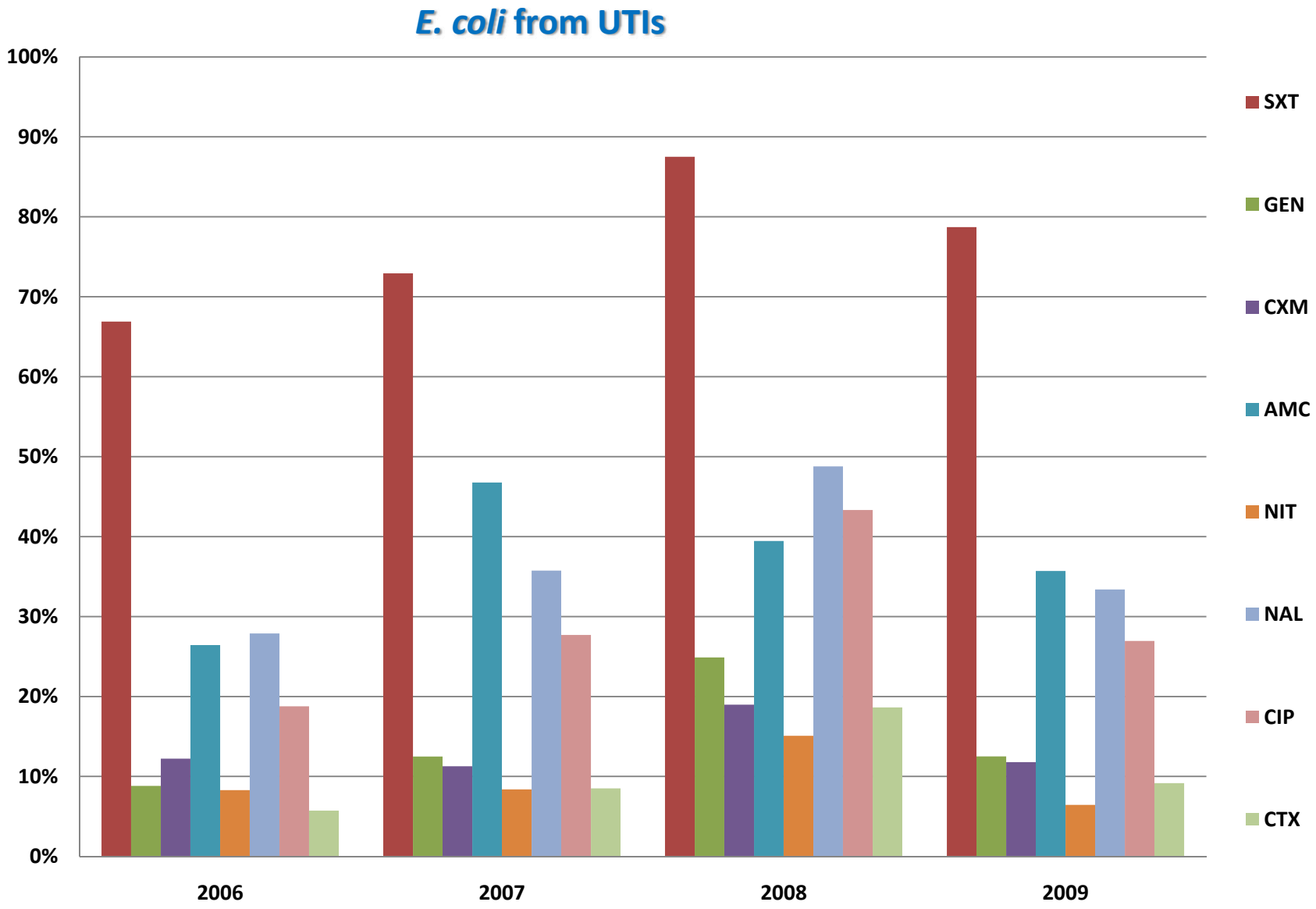
Left panel: S.aureus; Right panel: Coagulase negative Staphylococcus

Antimicrobial susceptibility of *E. coli* from adults with diarhoea at Mbagathi District Hospital (MDH) (N=264)



Prevalence of resistant *E. coli* strains isolated from PLWHA





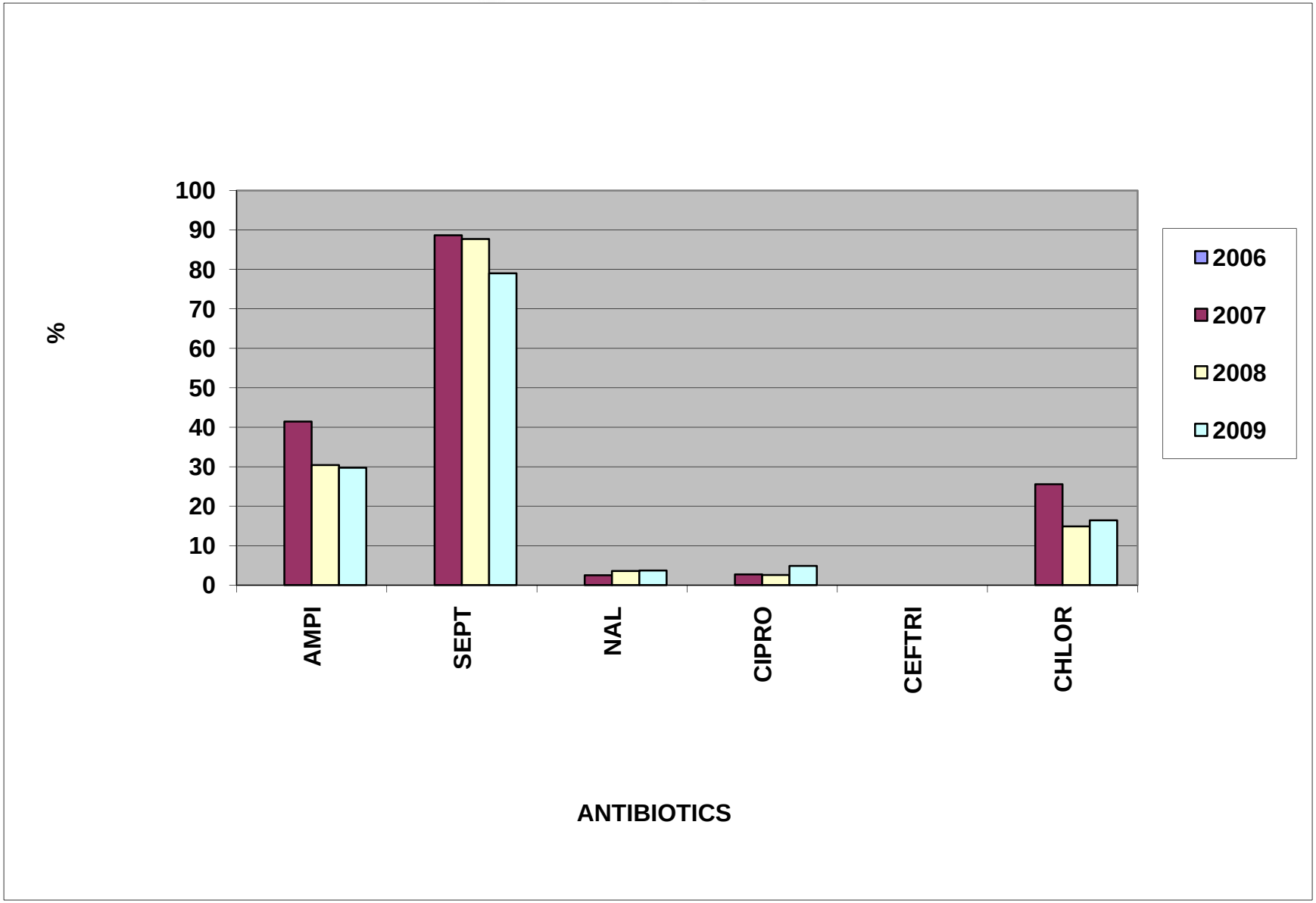
Courtesy: Aga Khan University Hospital

E. coli from children with diarrhoea

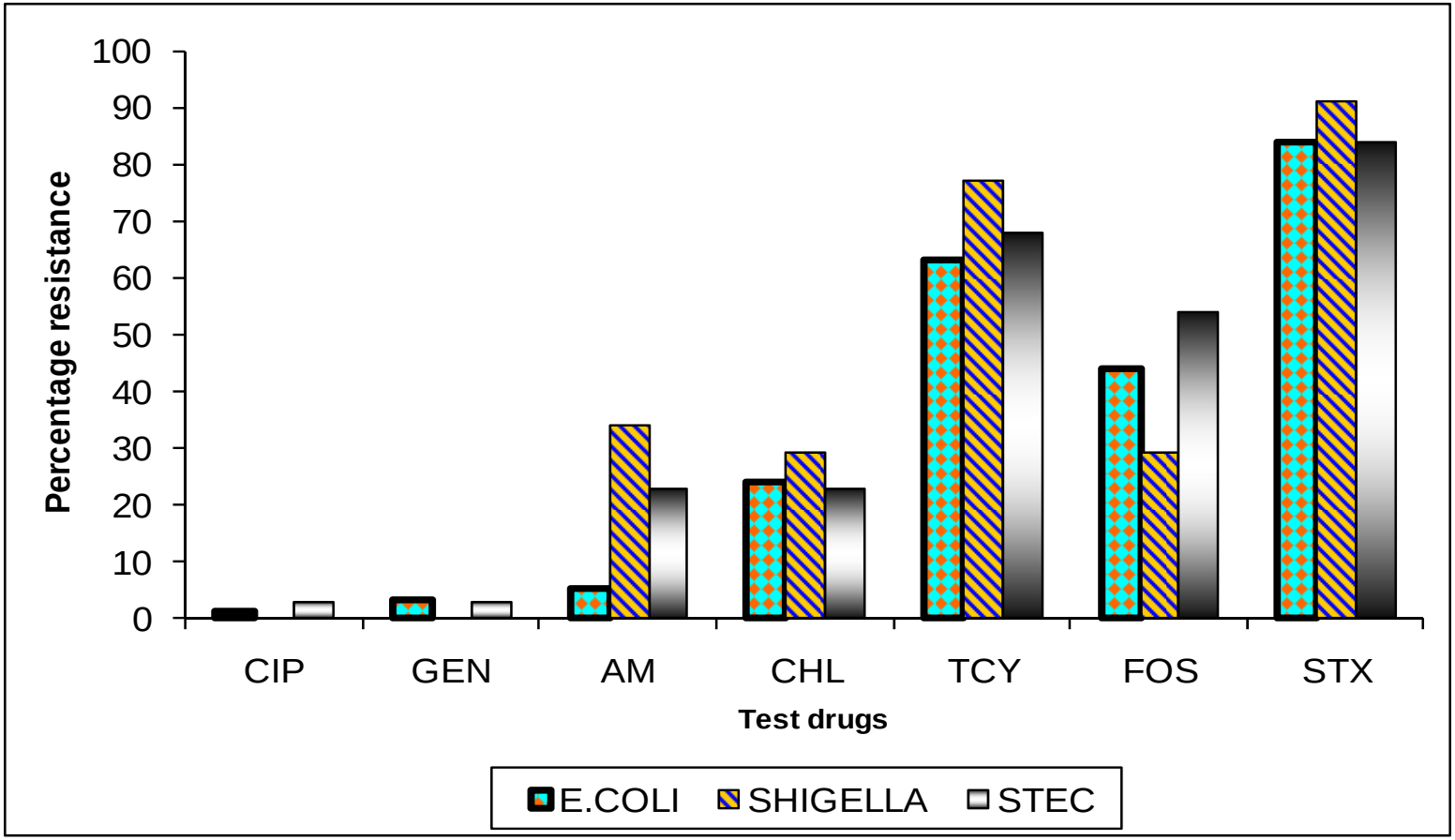
Minimum inhibitory concentrations (MIC) of each of 10 antimicrobial agents for the E.coli isolates from children

Agent	MIC (ug/ml) Range	Mode	MIC_{50}	MIC_{90}	Resistance (%of isolates)
ISOLATES FROM CHILDREN (N=168)					
Amoxycillin	1-128	128	128	128	74
Augmentin	0.5-64	8	8	32	22
Ceftazidime	0.06-16	0.25	0.25	1	0
Cefuroxime	2-64	8	8	16	42
Chloramphenicol	0.5-64	8	8	64	40
Ciprofloxacin	0.004-1	0.015	0.015	0.03	0
C0-trimoxazole	0.02-64	6.4	2.56	6.4	63
Gentamicin	0.25-32	0.5	1	8	27
Nalidixic acid	1-64	4	4	8	2
Tetracycline	1-128	128	64	128	71

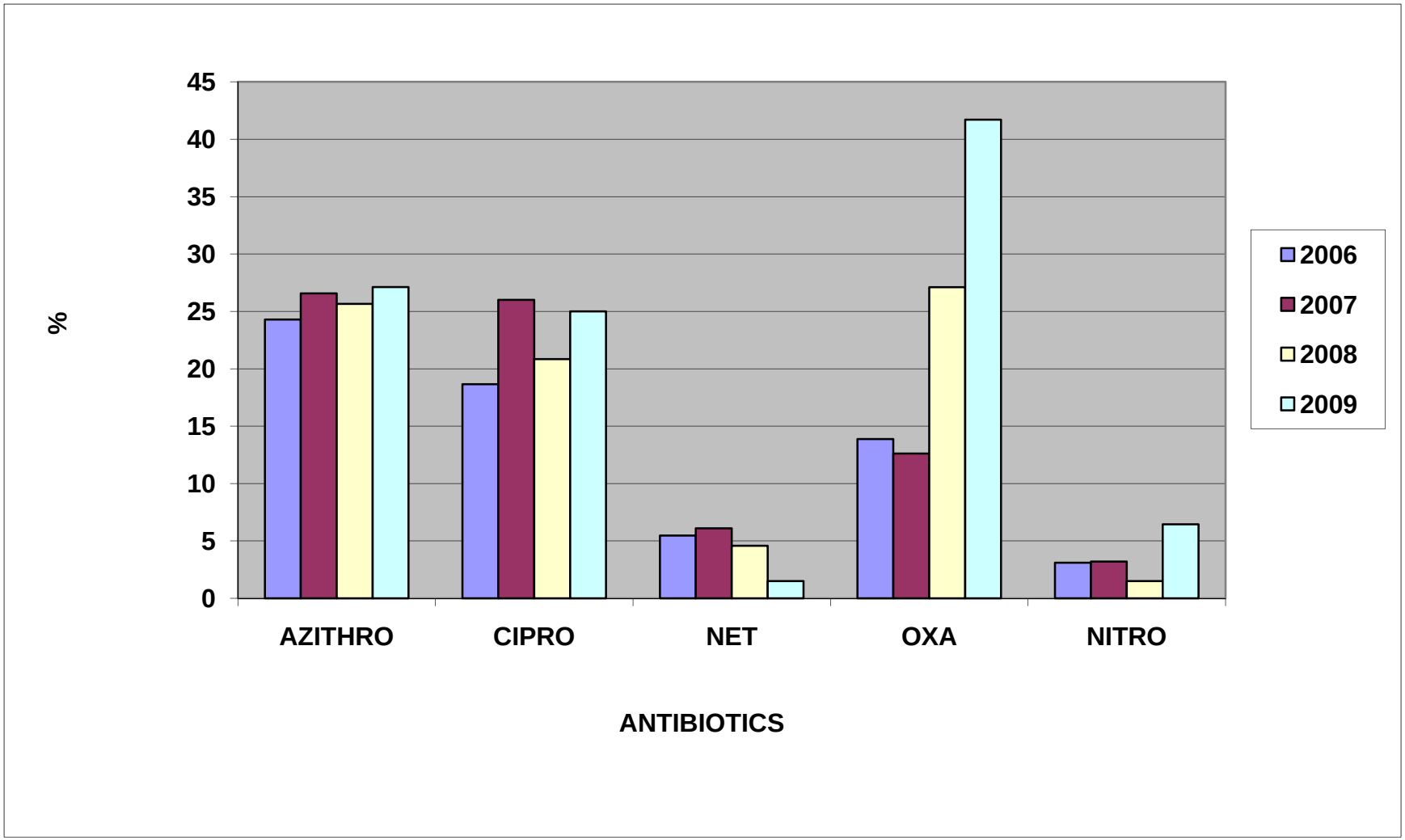
Shigella spp n=112



Antibiotic resistance patterns of E. coli, Shigella and STEC to various test drugs; 2006-2007



Staphylococcus aureus, n=282



Invasive non-typhoidal Salmonella (NTS) 1994-1996

Antibiotic	MIC range		Mode	MIC90	%R
Ampicillin	0.5-128		64	64	48
Augmentin	0.5-64	0.5	16	8	
Cefuroxime	2-128		8	32	30
Cefotaxime	0.125-16		0.25	2	0
Cotrimoxazole	0.25-64		0.5	32	46
Chloramphenicol	1-32		4	32	26
Tetracycline	0.5-64	64	128	66	
Streptomycin	2-128		8	128	49
Nalidixic acid	1-4		1	3	0
Ciprofloxacin	0.015-0.25		0.03	0.125	0

MICs for NTS, 1997-2000

Antibiotic	MIC range	Mode MIC	MIC_{90}	%R
Ampicillin	0.75->256	>256	>256	65
Augmentin	0.5-32	0.75	16	2
Cefuroxime	2-128	3	12	28
Cefotaxime	0.125-16	0.25	2	0
Cotrimoxazole	0.03->32	>32	>32	60
Chloramphenicol	2->256	>256	>256	85
Tetracycline	0.75-192	1	64	48
Nalidixic acid	1->256	3	>256	11
Ciprofloxacin	0.006-0.25	0.023	0.125	0

MICs for NTS, 2002-2006 (n=243)

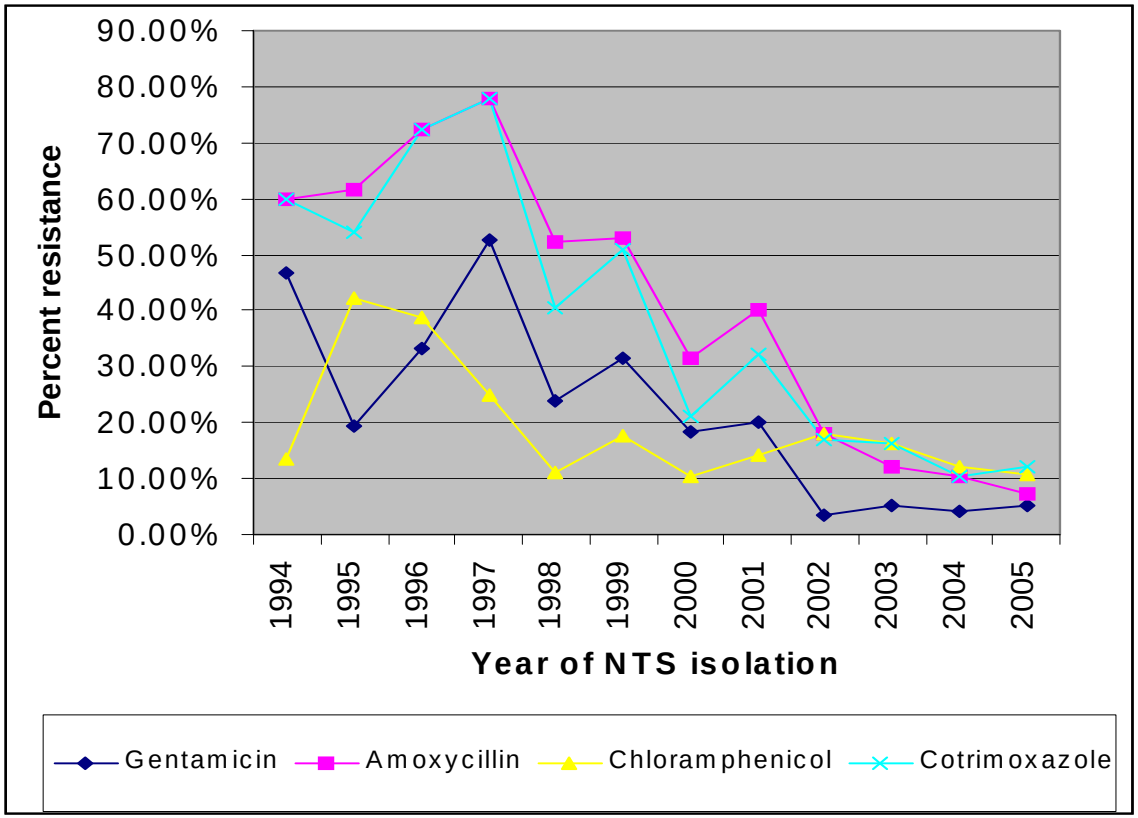
Antimicrobial Agent	MIC (µg/ml) Range	Mode	MIC50	MIC90	% R
Ampicillin	0.25->256	>256	82	64	48
Co-amoxyclav	0.75->256	4	1	16	8
Cefuroxime	2->256	>256	8	32	30
Ceftriaxone	0.094-16	0.064	0.5	2	0
Gentamicin	0.06->256	4	1	8	16
Co-trimoxazole	0.064->32	>32	8	32	46
Chloramphe	0.19->256	>256	4	32	26
Tetracycline	0.064->256	3	16	128	49
Nalidixic acid	1.5->2563	3	3	12	
Ciprofloxacin	0.064-4	0.16	0.06	0.125	0

Kariuki et al. J Med Micro 2006; 55:585

NTS from Kilifi 2002-2005 (n=54)

Antimicrobial Agent	MIC (µg/ml) Range	Mode	MIC50	MIC90	% R
Ampicillin	0.5->256	2	2	4	11
Co-amoxiclav	0.38-18	1	1	3	4
Ceftriaxone	0.023-0.4	0.047	0.047	0.064	0
Gentamicin	0.094->8	0.19	0.25	2	4
Co-trimoxazole	0.047->32	0.19	0.19	32	13
Chloramph.	0.38->256	2	2	3	6
Tetracycline	1.5->256	3	3	4	6
Nalidixic acid	1.5-6	3	3	4	0
Ciprofloxacin	0.006-0.06	0.016	0.012	0.016	0

10-yr Trend in resistance – Rural Kilifi



Trends in resistance during the 12-year study. Chi-squared and p-values, respectively, for trend by year analysis for resistance were chloramphenicol (χ^2= 3.794; p=0.051), gentamicin (χ^2= 7.958; p=0.005), co-trimoxazole (χ^2= 16.358; p< 0.001) and amoxycillin (χ^2= 20.977; p< 0.001).

Kariuki et al. Int. J. Antmicrob Agents *2006; 28:166*

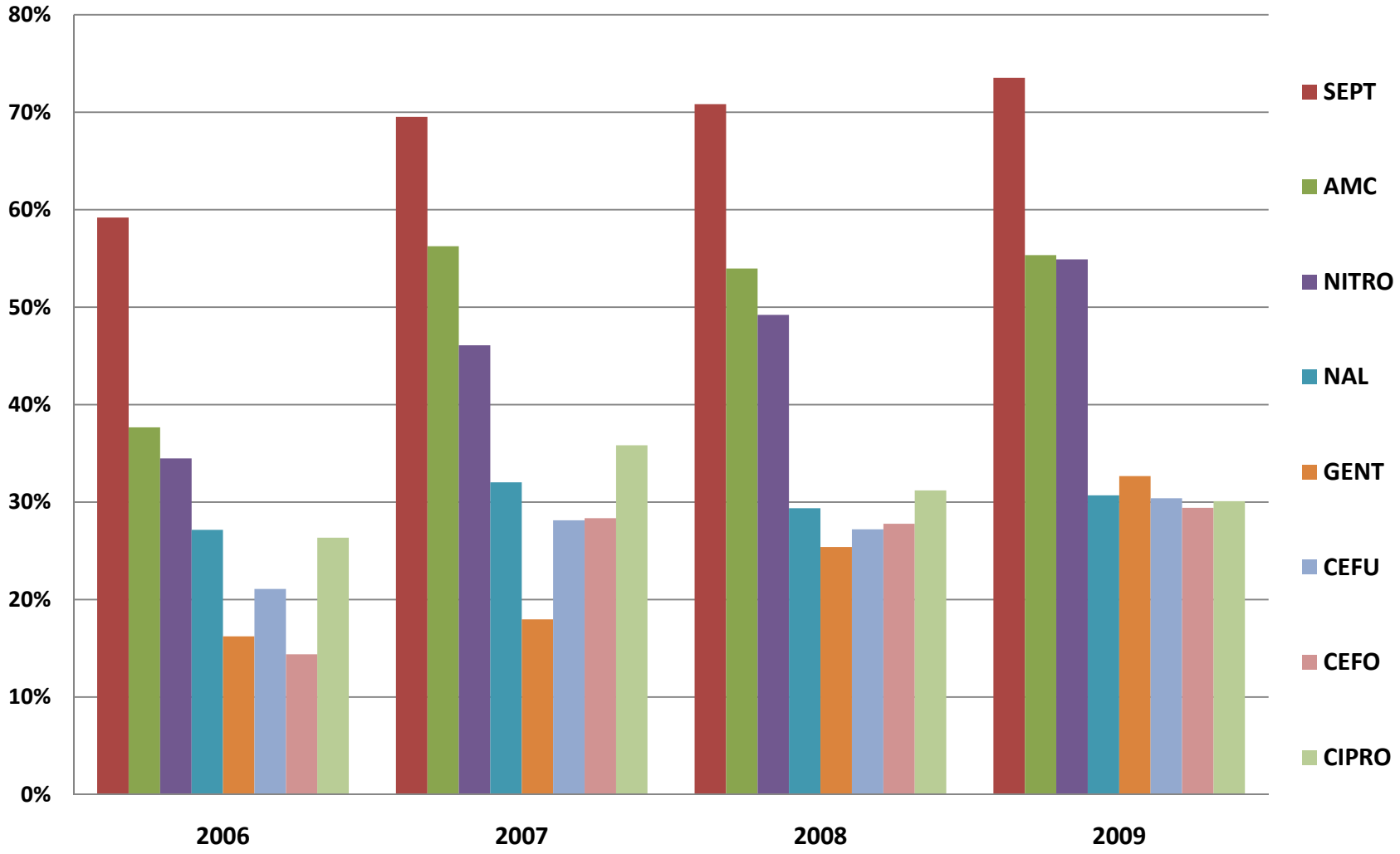
Typhoid fever 2000-2005

Antibiotic	MIC range	Mode MIC	MIC90	%R
Ampicillin	0.5- >256	>256	>256	85
Augmentin	0.5-4	4	4	0
Cefotaxime	0.047-.125	0.125	0.125	0
Cotrim	0.019->32	>32	>32	85
Chloramphe	2->256	>256	>256	85
Gentamicin	0.5-1	1	1	0
Tetracycline	1->256	>256	>256	85
Nalidixic acid	2->256	12	36	22
Ciprofloxacin	0.016- 1.5	0.25	0.5	12

MICs for Quinolones n=140

	MICs (μg/mL)	
	Mode	**Range**
Non-MDR*	***S*. Typhi**	
Nalidixic Acid	**2**	**1-4**
Ciprofloxacin	**0.016**	**0.016 – 0.032**
MDR *S*. Typhi		
Nalidixic Acid	**8**	**8-16**
Ciprofloxacin	**0.25**	**0.25 – 0.38**

Klebsiella spp resistance patterns



Courtesy: Aga Khan University Hospital

Vibrio cholerae ser inaba, 2005-2007
n=65

	% SUSCEPTIBILITY		
ANTIBIOTIC	**% S**	**%I**	**%R**
NA	96	0	4
W	5.7	2.9	88.6
C	57.1	34.3	8.6
RL	2.9	0	97.1
CIP	100	0	0
TE	97.1	2.9	0
AMP	88.6	2.9	8.5
Fx	5.7	0	94.3

Challenges

- Funding issues versus Government priorities in Public Health a challenge
- Materials e.g. media, antibiotic discs, petri dishes etc inadequate
- Equipment such as autoclaves, incubators and microscopes inadequate
- Collection of specimens not well supervised
- Several labs still require training support for their staff in order to undertake quality AST and surveillance.
- National/Regional surveillance still not fully achieved

Achievements

- Participation in EQAS through WHO/CDC programme annually.
- KEMRI, AMREF, UoN, Kenyatta National Hospital
- Kilifi WT, Gertrudes Children's Hospital
- Aga Khan Hospital in Nairobi and Mombasa
- Internal QA for each laboratory has been set up – all use CLSI recommended standards for AST including using ATCC QC strains.
- GSS Regional Training has helped to create awareness, regular informal consultation between the laboratories has been ongoing.

Conclusion

- More sentinel sites need to be facilitated to start surveillance.
- Partnerships between these sites and WHO/CDC will be crucial in providing training and co-funding activities
- Strengthen local training initiatives by expanding GSS and ASM activities in the region.
- Curriculum reviews at medical schools in Kenya to include emphasis on surveillance and monitoring usage and resistance
- Expanding EQAS and internal QA programs and reviews will play a big role