Laboratory Detection, Monitoring and Surveillance of Human and Animal Diseases

*** Emerging AMR and Biological Markers ***

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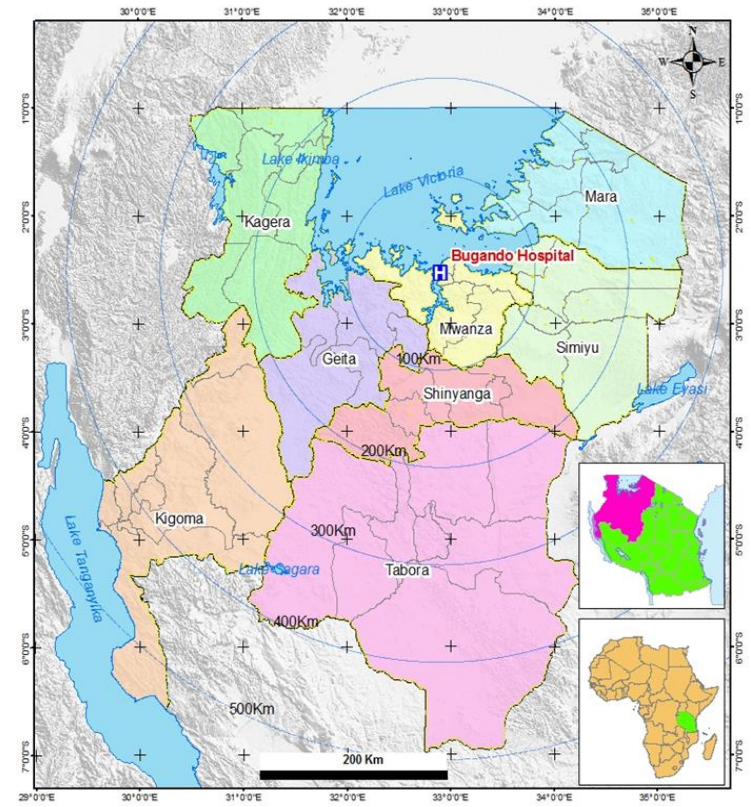
Association of Pathologists of Tanzania 11th Scientific Conference and AGM
20-22th September 2023

Outlines

- Bugando Medical Center (BMC) and CUHAS at glance
- Overview of AMR Surveillance Systems:
  - ➢ The Global and National Action Plans on AMR
  - ➢ The Global and National burden of AMR
  - ➢ Detection, Monitoring and Surveillance of human and animal diseases
    - ✓ Evidence from BSIs, UTIs, SSTIs & Bovine mastitis
    - ✓ Utilization of AMR data
- Conclusions and future prospects

BMC and CUHAS at Glance



- ✓ Bugando Medical Centre is a teaching tertiary hospital for Catholic University of Health and Allied Science)
- ✓ Serves >20m people in the NW-part of Tanzania (1/3rd of country's population), >1000 bed capacity with 1400+ staff
- ✓ One of the nine AMR surveillance sentinel hospitals in Tanzania (contributed to approx. 35% to 45% of national AMR surveillance data from 2020 to 2022)

Jeremiah Seni PhD thesis., 2015 at https://prism.ucalgary.ca/handle/1880/108935; Tanzania Population and Housing Census, 2022; https://www.bugandomedicalcentre.go.tz/index.php

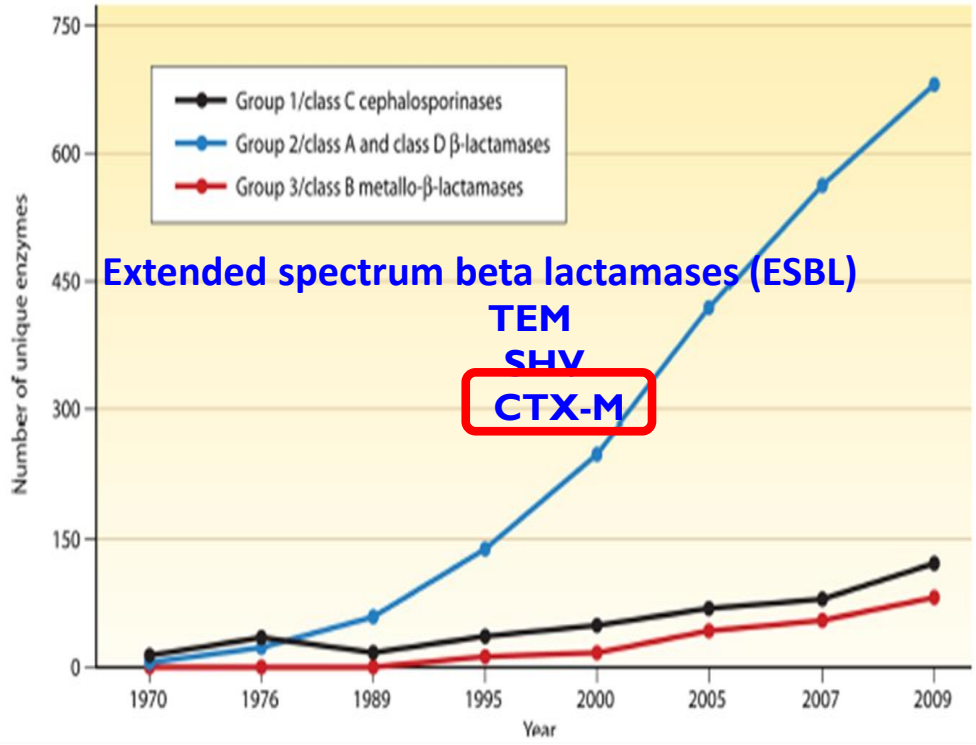

1971-2021
50

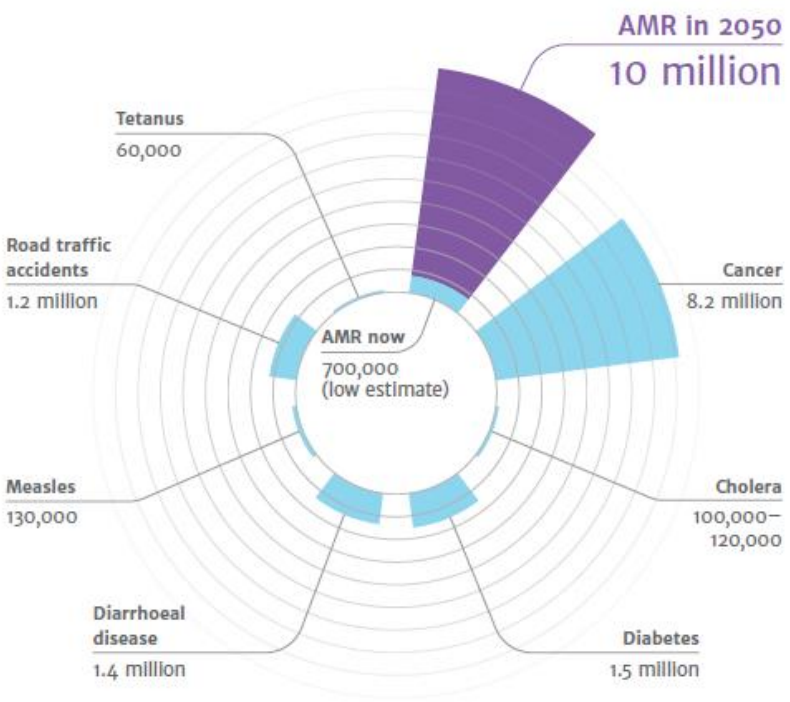

CELEBRATING 20 YEARS
20
ANNIVERSARY
Taking CUHAS
to the Next Level


BUGANDO MEDICAL CENTRE


WEILL BUGANDO
Bugando Medical Centre

The Global Burden of Antimicrobial Resistance





Existence of these resistant 'bugs' in humans, animals & environmental premises complicates further interventional measures !

Bush & Jacoby. AAC. 2010; 54 (3):969-976; WHO., 2014; Jim O'Neill ., 2016

Facts and Figures on the Burden of AMR in Mwanza, Tanzania: 2 decades reflections

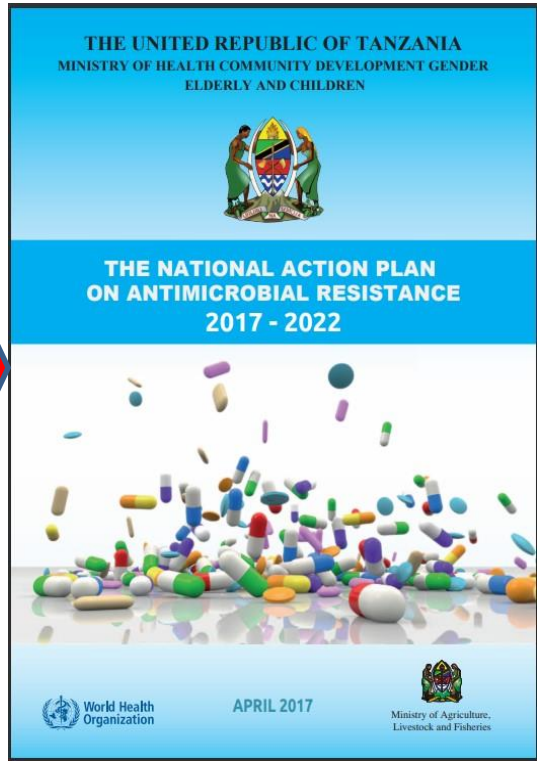
- 6 out of 100 children <5y & 20 out of 100 neonates die of AMR attributable blood stream infections, predominantly by *Klebsiella pneumoniae* ST45 carrying *bla*CTX-M-15 [Mortality is 2x in ESBL vs Non-ESBL infections]

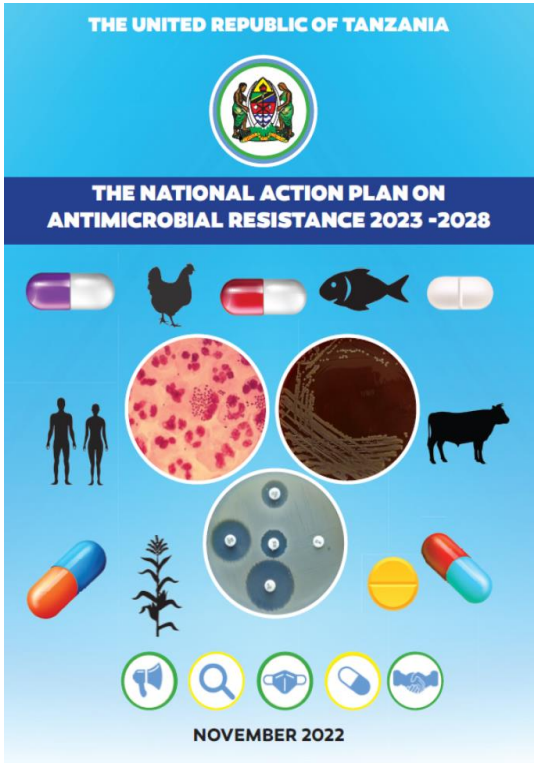
- 17 out 100 pregnant women have UTIs, and ESBL associated UTIs are 2x in hospital versus community associated UTI; asymptomatic bacteriuria is associated with adverse pregnancy outcomes

- Surgical site infections post-caesarian section is approx 10% in Mwanza and is associated with longer duration of hospital stay

Kayange et al., **BMC Pediatr. 2010 Jun 4;10:39. doi: 10.1186/1471-2431-10-39.** ***Seni et al. JGAR 17 (2019) 173–179;*** **Seni et al. BMC Pediatrics (2019) 19:32; Marando et al.,** ***International Journal of Medical Microbiology 308 (2018) 803–811; Mpogoro et al., 2014.*** **Antimicrob Resist Infect Control. 2014 Aug 11;3:25. doi: 10.1186/2047-2994-3-25' Colman Mayomba., CUHAS Dissertation, 2023**

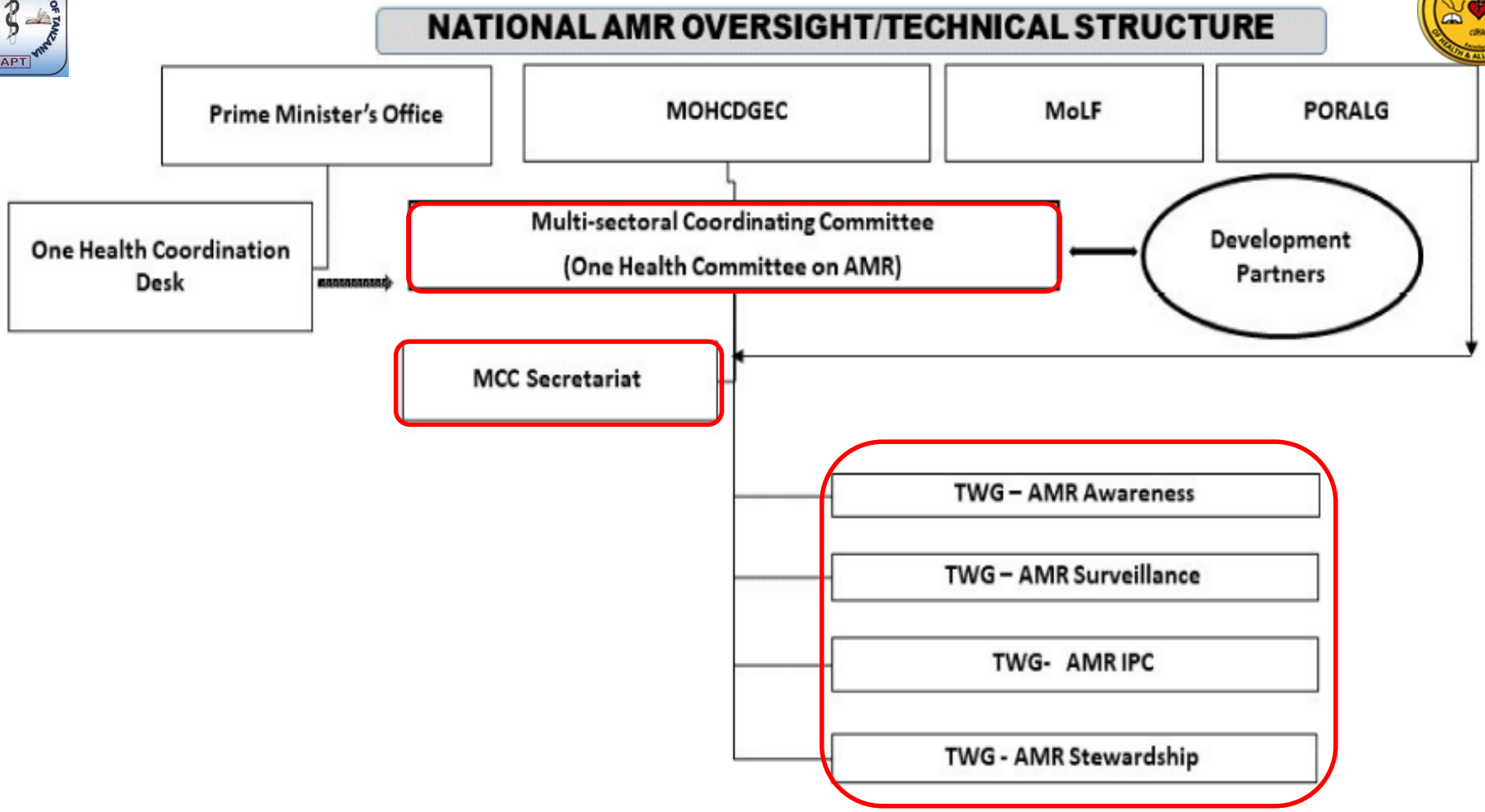
Global Action Plan & Tanzania NAP-AMR





1. Four TWGs
2. Not systematically costed
3. No private sector's involvement
4. Largely at national level

1. Five TWGs
2. Costed using WHO Costing Tool
3. Private sector's involvement
4. Extension to sub-national levels



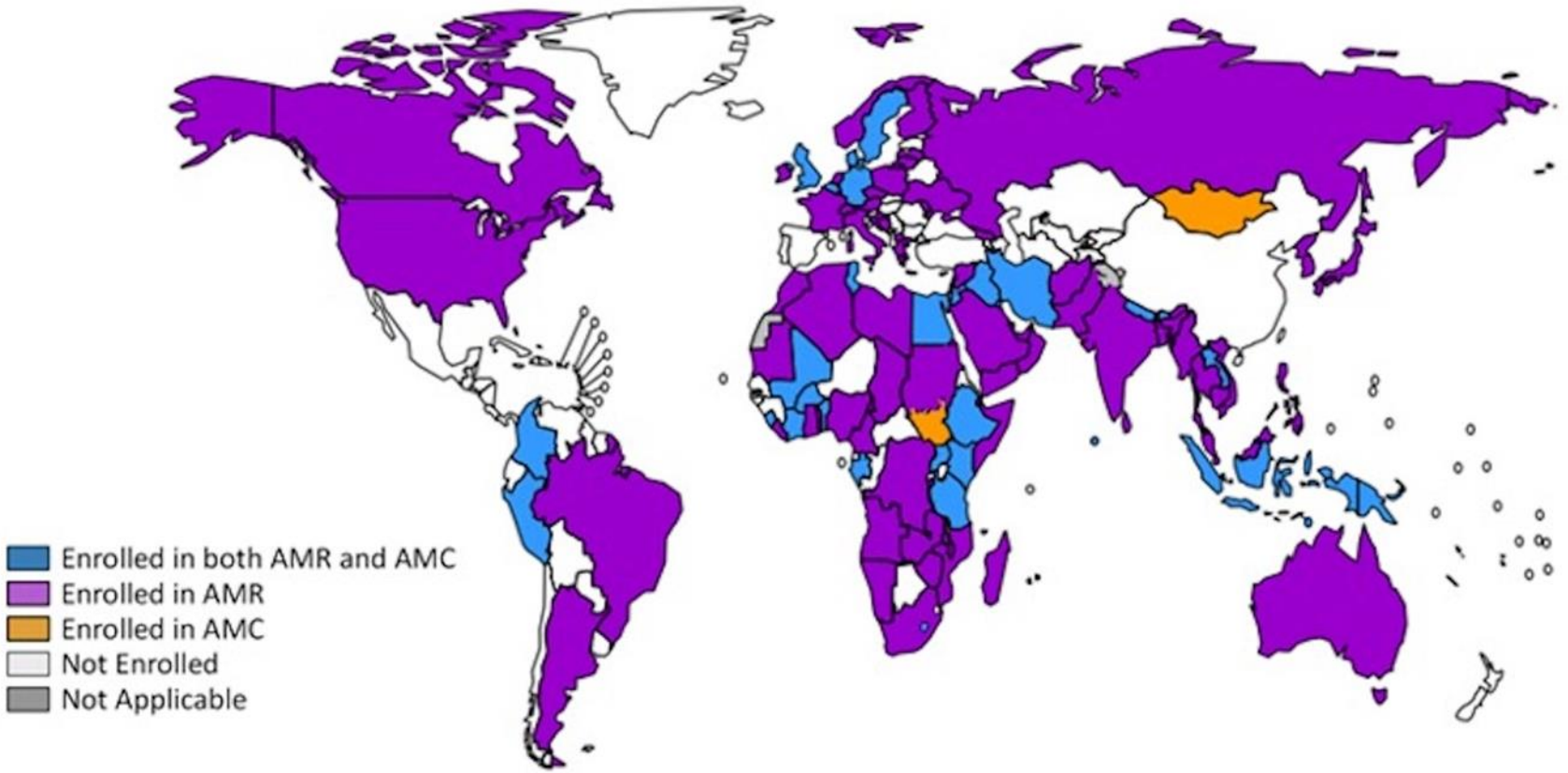
BMC is one of the 13 hospitals implementing AMS and one of the 9 hospitals implementing AMR Surveillance in Tanzania; and it contributes to 35% to 45% of data to the Ministry of Health (NPHL) and WHO-GLASS.

Mdegela et al., 2021 Apr 16;10(4):454. doi: 10.3390/antibiotics10040454.

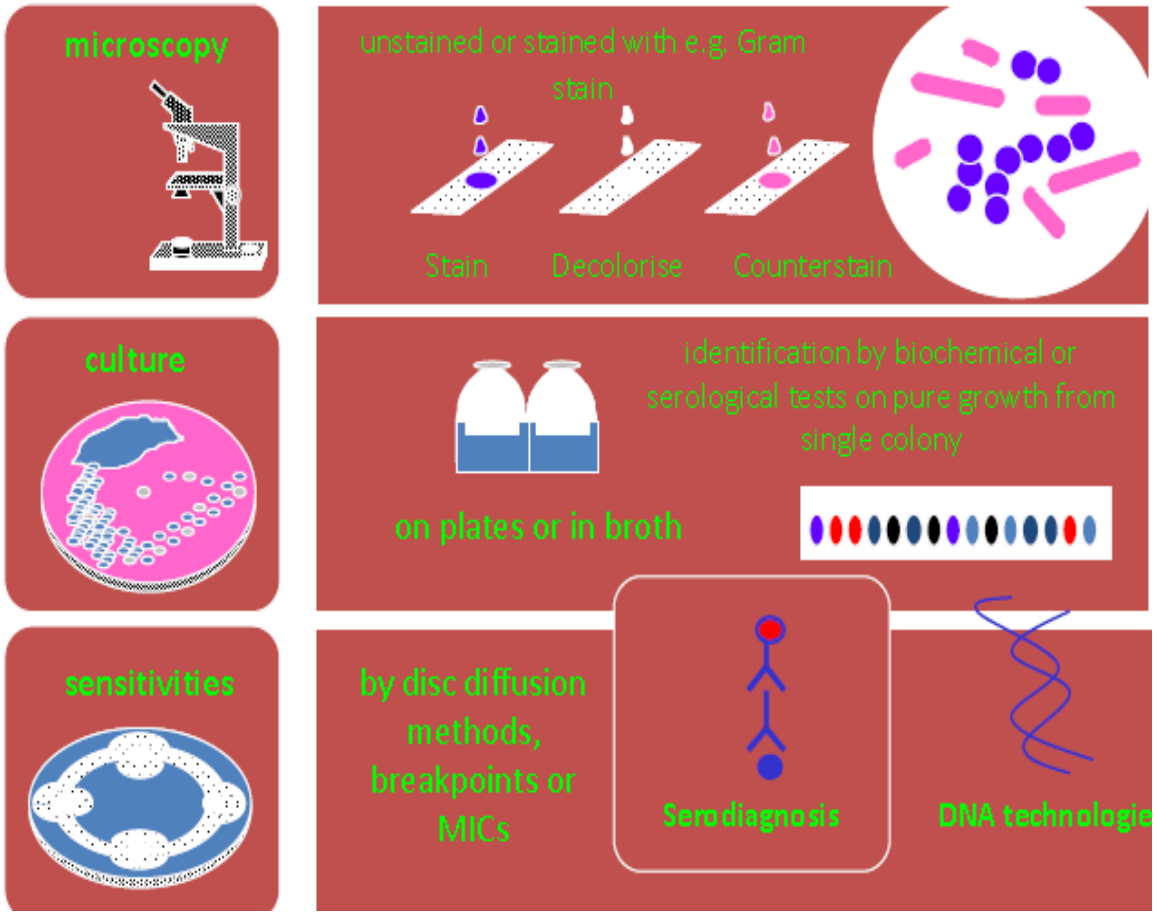
GLASS

Global Antimicrobial Resistance and Use Surveillance System

Countries, territories, and areas enrolled in GLASS-AMR and/or GLASS-AMC by end of 2021

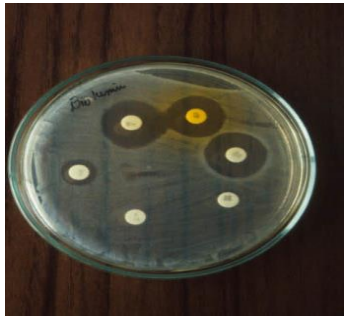


Laboratory procedures and AMR detection



Pre-analytical → **Analytic** → **Post-analytical**

Laboratory procedures and AMR detection



Conventional Invitro Antimicrobial Susceptibility Testing

The VITEK® 2 system

The BD Phoenix system

MALDI-TOF system

Automated machines for Invitro Antimicrobial Susceptibility Testing

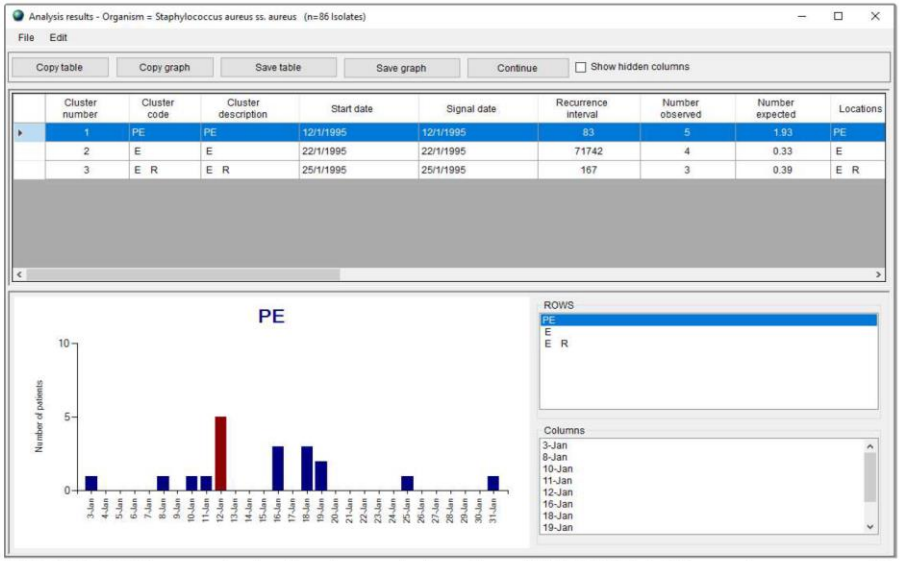
Laboratory procedures and AMR detection

Software

The microbiology laboratory database software

Home / Software

WHONET 2023



WHONET 2023 is a modernized and expanded version of WHONET 5.6. This version supports 44 languages and includes new features for exporting to the **WHO GLASS** data structure. Further information on GLASS can be found using this link.

It includes support for CLSI 2023 M100, M45, M60, M61, as well as EUCAST 2023 bacterial breakpoints. Also included are the most recent CLSI VET01, VET03/04, and VET06 breakpoints.

Download

32-bit installation (159 MB)
64-bit installation (158 MB)

https://whonet.org/software.html

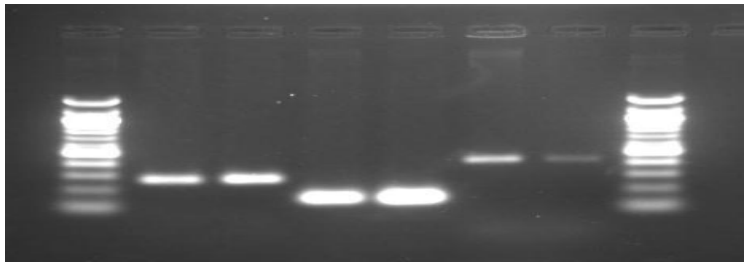
- Free software primary for laboratory-based surveillance of infectious diseases and antimicrobial resistance:

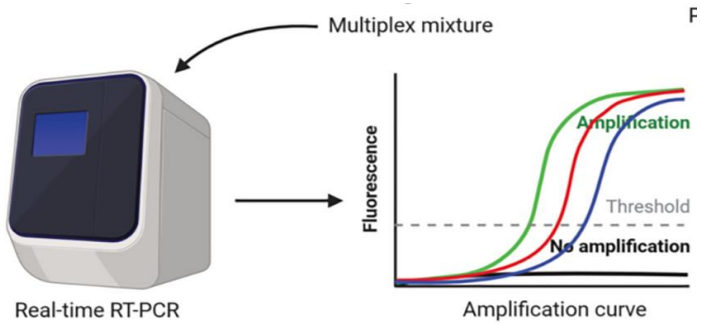
1. *Laboratory configuration*
2. *WHONET data entry.*
3. *WHONET data analysis (specifically in two parameters)*
   - i. ***Isolates listings & summaries***
   - ii. ***%RIS & testing measurements (tables versus other infographics)***
4. *Generation of cumulative antibiograms.*

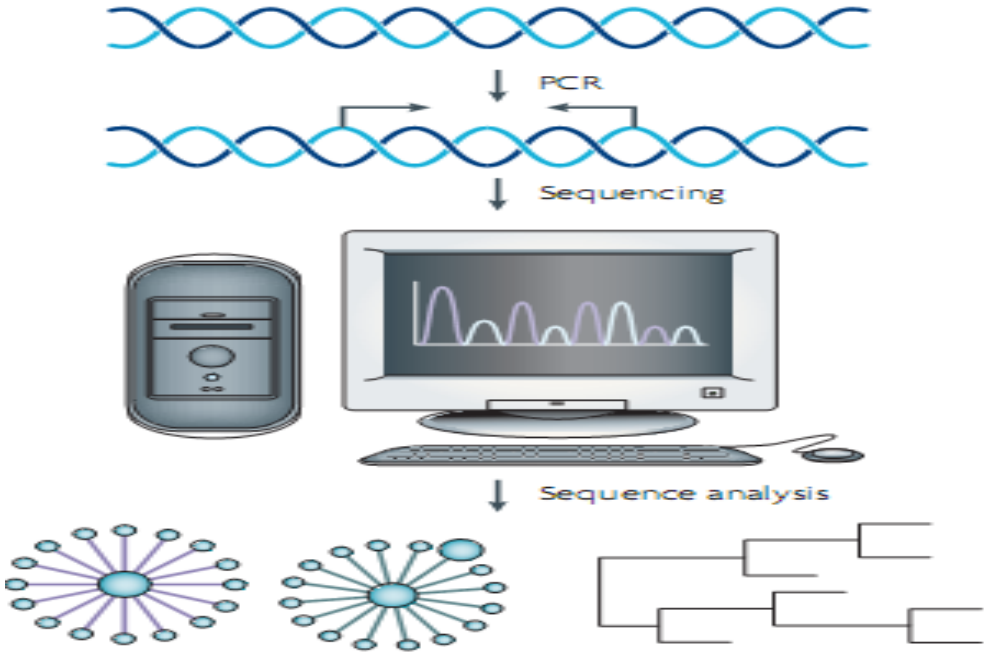
- NB: Backlink Software facilitates the conversion of data from your computer system into WHONET

Laboratory procedures and AMR detection

Bacteria Genotyping and AMR genes detection methods







WHO PRIORITY PATHOGENS LIST FOR R&D OF NEW ANTIBIOTICS

Based on the rising burden of AMR across the world

Priority 1: CRITICAL#

Acinetobacter baumannii, carbapenem-resistant

Pseudomonas aeruginosa, carbapenem-resistant

Enterobacteriaceae*, carbapenem-resistant, 3rd generation cephalosporin-resistant

Priority 2: HIGH

Enterococcus faecium, vancomycin-resistant

Staphylococcus aureus, methicillin-resistant, vancomycin intermediate and resistant

Helicobacter pylori, clarithromycin-resistant

Campylobacter, fluoroquinolone-resistant

Salmonella *spp.*, fluoroquinolone-resistant

Neisseria gonorrhoeae, 3rd generation cephalosporin-resistant, fluoroquinolone-resistant

Priority 3: MEDIUM

Streptococcus pneumoniae, penicillin-non-susceptible

Haemophilus influenzae, ampicillin-resistant

Shigella *spp.*, fluoroquinolone-resistant

Contents lists available at ScienceDirect

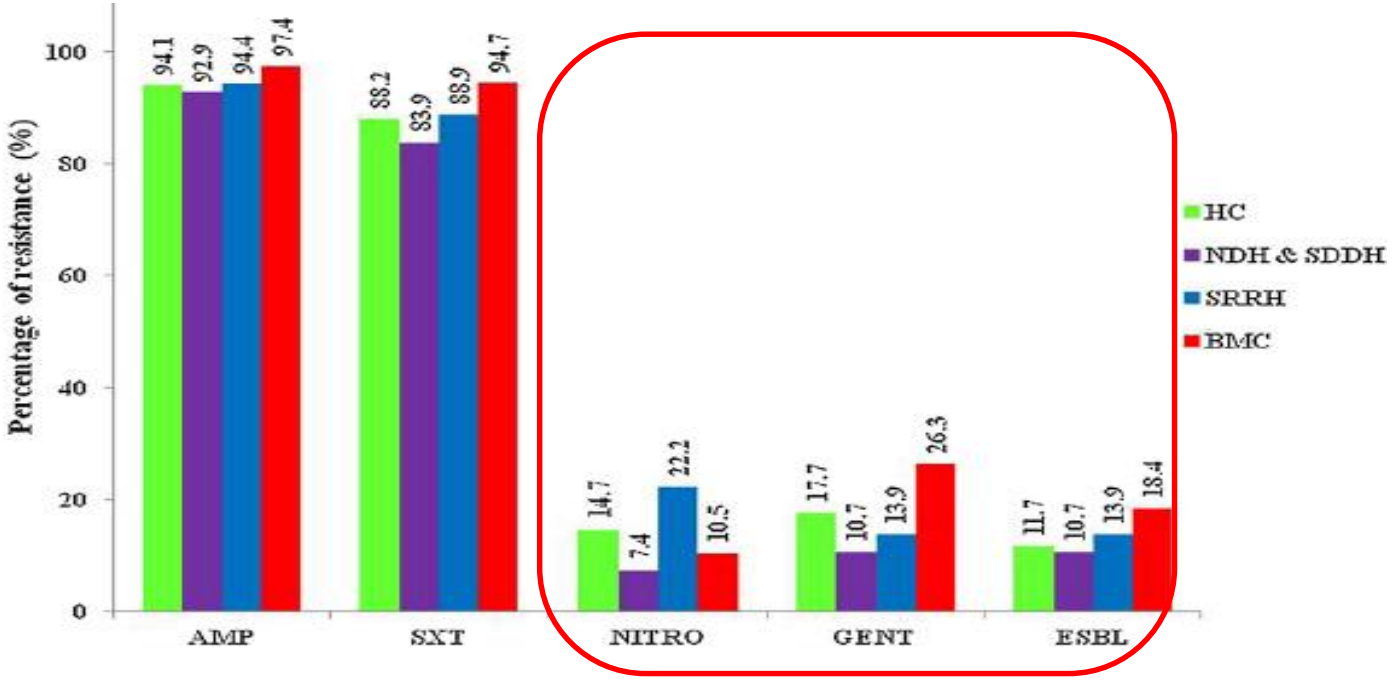
Journal of Global Antimicrobial Resistance

journal homepage: www.elsevier.com/locate/jgar

Multicentre evaluation of significant bacteriuria among pregnant women in the cascade of referral healthcare system in North-western Tanzania: Bacterial pathogens, antimicrobial resistance profiles and predictors

J. Seni[a,b,*], J.N. Tito[a], S.J. Makoye[a], H. Mbena[c], H.S. Alfred[d], F. van der Meer[e,1], J.D.D. Pitout[b,1], S.E. Mshana[a,1], R. DeVinney[b,1]

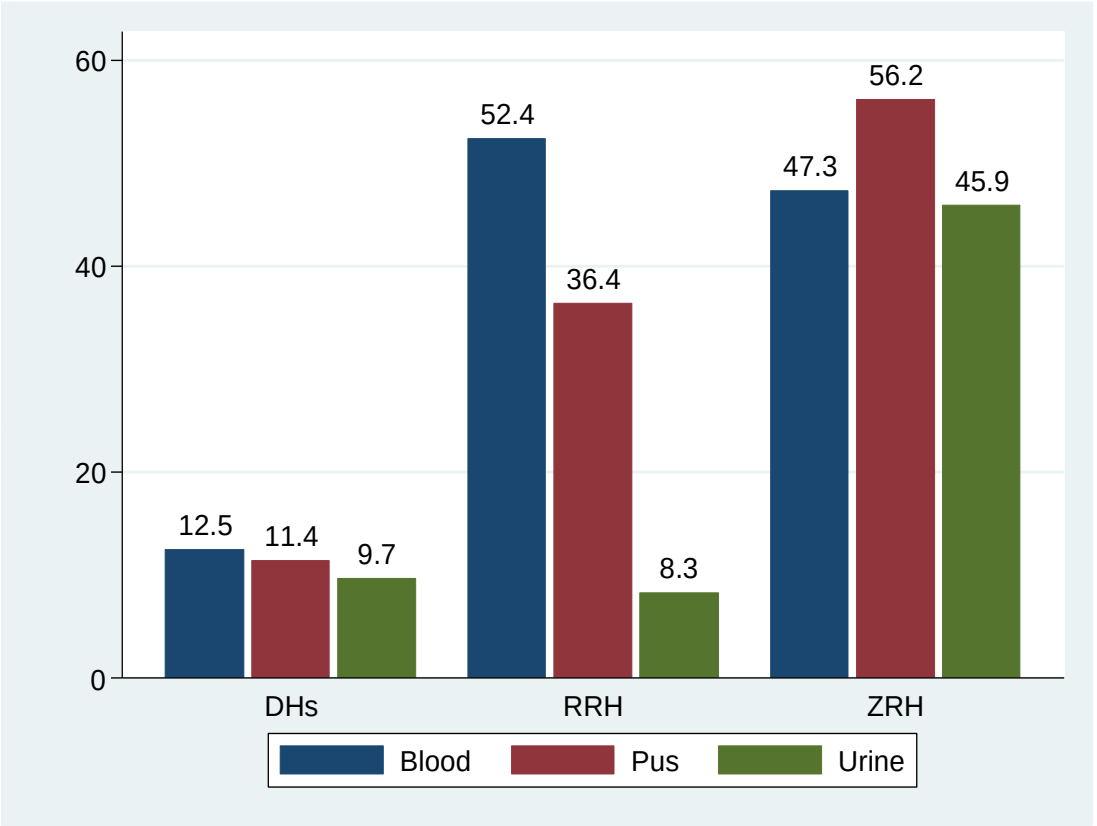
- **The prevalence was 17.7% (323/1828), with a predominance of *Escherichia coli* (164/323; 50.8%), *Klebsiella* spp. (55/323; 17.0%) and *Staphylococcus aureus* (28/323; 8.7%).**



***E. coli* resistance profiles by rank of health care facilities**

Hospital-based AMR Surveillance in Mwanza: Findings from SNAP-AMR Project

- A total of 2316 patients admitted in 5 hospitals were enrolled between June 2019 to June 2020
- Blood stream infections : 13.8% (148/1075); Skin and soft tissues infections: 27.8% (119/428) and Urinary tract infections: 21.8% (249/1144)
- Approximately 38% to 54% of these infections were due to *E. coli* and *Klebsiella pneumoniae complex*



3rd generation cephalosporin resistance in Gram Negative Bacteria by sample types and level of health care facilities

- **Emphasize a critical need to prepare tier-specific treatment guidelines**

National AMR surveillance annual report (January – December 2021)

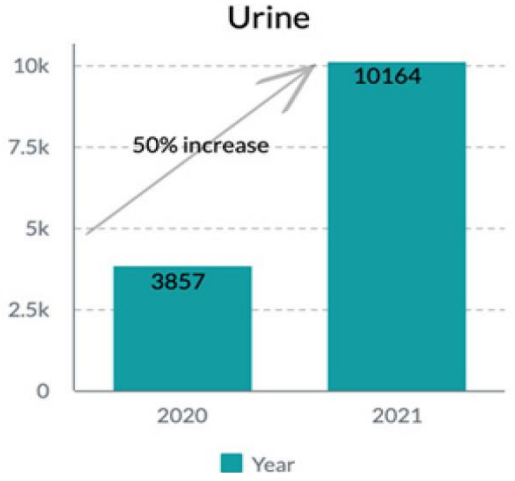
- From **January to December 2021**, a total of **30,295 samples** were recorded in WHONET at the National Public Health Laboratory from 9 sentinel sites (versus **8999 samples** from **July to December 2020**):
  - ✓ Male: 15,566 (51.4%)
  - ✓ Children <5y: 10074 (33.3%)
  - ✓ Urine: 13,767 (45.44%) & Blood: 16,529 (54.6%)

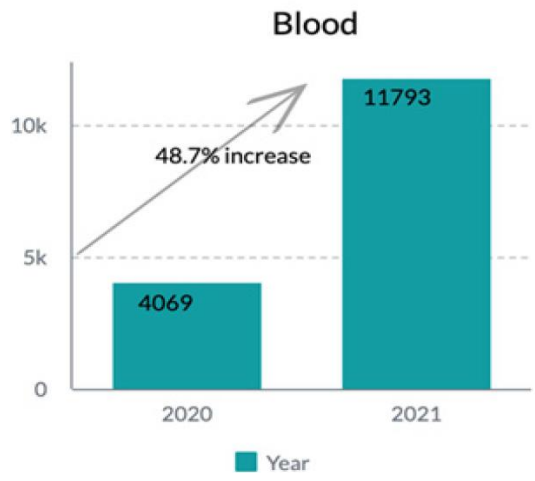
- Of these samples, 1,022 (7.4%) urine samples and 2,119 (12.8%) blood samples were excluded because of repetitions and/or contamination

- **The proportion of UTI and BSI were 27.4% and 16.0%, respectively**

AMR research and surveillance in Tanzania

Hospital	July – December 2020				January – December 2021			
	Blood		Urine		Blood		Urine	
	N	%	N	%	N	%	N	%
Bugando	2369	48.9	2317	47.8	5398	37.5	5225	41.5
MNH	857	17.7	1069	22.1	3398	23.6	2060	16.4
KCMC	1271	26.2	751	15.5	3157	21.9	1681	13.4
Mbeya ZRH	99	2.0	221	4.6	722	5.0	682	5.4
MMH-Zanzibar	NA	NA	NA	NA	360	2.5	728	5.8
BMH	117	2.4	299	6.2	810	5.6	1255	10.0
Maweni RRH	44	0.9	63	1.3	254	1.8	527	4.2
Temeke RRH	16	0.3	1	0.0	59	0.4	157	1.2
Morogoro RRH	73	1.5	123	2.5	252	1.7	275	2.2
Total	**4846**	**100.0**	**4844**	**100.0**	**14410**	**100.0**	**12590**	**100.0**





Note the difference in the frequencies of data submitted to NPHL (above) versus those validated by WHO-GLASS (left)

Source: Tanzania National Action Plan on AMR (2023-2028)

National Antibiogram for isolates from urine and blood samples (January – December 2021)

ALL GRAM NEGATIVE IN URINE(N= 2007)	Number	Ampicillin	Amoxicillin/Clavulanic acid	Piperacillin/Tazobactam	Ceftazidime	Ceftriaxone	Cefotaxime	Cefepime	Imipenem	Meropenem	Amikacin	Gentamicin	Ciprofloxacin	Trimethoprim/Sulfamethoxazole	Nitrofurantoin	Chloramphenicol	Cefoxitin/ Oxacillin	Clindamycin	Erythromycin	Tetracycline
Escherichia coli	1154	8.0	54.0	27.1	42.1	40.3	30.0	37.3	92.1	93.0	86.46	59.2	32.9	16.5	84.2					
Klebsiella pneumoniae	341	3.9	53	17.2	36.6	41.6	30.5	36.1	92.9	89.9	94.20	55.1	49.3	23.1	45.6					
Klebsiella oxytoca	63	2.8	47.7	44.4	59.6	60.4				91.3	93.80	57.4	56.1	30.2	66.7					
Proteus mirabilis	56	29.03	70.45		82.50	82.05		75.86		94.59		67.57	65	35.48	15					
Proteus vulgaris	40	13.04	65.71		68.97	72.41				96.67		75.00	63.33	36.67	34.38					
Klebsiella oxytoca	63	2.8	47.7	44.4	59.6	60.4		52.8		91.3	93.8	57.4	56.1	30.2	66.7					
Citrobacter freundii	139	10.8	30.6	30.8	39.4	37.9	30.0	43.8	91.7	90.2	85.4	44.9	31.6	26.6	66.3					
Pseudomonas aeruginosa	151			46.5	42.3			38.5	57.1	60.2	75.6	58.9	42.1							
GRAM POSITIVE IN URINE (N=394)																				
Staphylococcus aureus	266											57.3	30.3	25.9		57.1	33.9	36.3	9.6	39.2
Enterococcus faecalis	128												16.3		88.6				5.0	
ALL GRAM NEGATIVE IN BLOOD (N=806)																				
Escherichia coli	183	7.1	51.4	19.0	26.2	19.4	13.3	21.5	91.3	93.0	89.4	50.4	30.2	14.9		58.8				
Klebsiella pneumoniae	339	2.50	23.44	26.04	28.07	13.89	17.71	15.02	63.83	88.51	90.70	24.60	53.01	13.25		67.86				
Klebsiella oxytoca	32	5.0	44.4	12.5	21.4	10.5	11.1	9.1	75	70.8	94.40	34.6	28.6	21.7						
Klebsiella aerogenes	40	2.7	58.3	23.1	13.9	5.9		19.40		100	92.30	63.3	42.5	48.1						
Enterobacter cloacae	30	5.9	25.0	29.6	13.6					85.7	75.00	54.5	23.1	57.1						
Acinetobacter sp.	113			66.1	67.0	37.8	21.9	38.8	78.6	74.6	76.20	47.8	69.7	29.2						
Pseudomonas aeruginosa	69			**74.3**	**83.3**			55.6	76.5	78.4	72.10	75.6	80							
ALL GRAM POSITIVE IN BLOOD (N=2753)																				
Staphylococcus aureus	956											53.8	43.6	28.7		82.1	33.7	64.7	16.7	65.0
coagulase negative staphylococcus	1733											36.8	43.6	18.9		79.2	13.1	69.7	7.0	
Enterococces sp	64												13.9			61.1				52.9

≥80%	
50%-79%	
1%-49%	
Not tested	

Source: Tanzania National Action Plan on AMR (2023-2028)

Bugando Medical Centre Antibiogram for isolates from urine samples (January – December 2021)

Gram negative organisms in urine	Number	Ampicillin	Amoxicillin/Clavulanic acid	Ceftazidime	Ceftriaxone	Cefepime	Meropenem	Amikacin	Gentamicin	Ciprofloxacin	Trimethoprim/Sulfamethoxazole	Nitrofurantoin	Gentamicin-High	Clindamycin	Erythromycin	Cefoxitin	Penicillin G
Escherichia coli	531	8.6	85	56.7	47.8	53	99	97.6	65.5	46.5	16.6	89					
Klebsiella pneumoniae ss. pneumoniae	160	3	81	46.8	41.7	45.7	99.3	98.2	50.4	65.4	23.8	53.5					
Acinetobacter sp.	90	40.6	80.8	69.3	68.6	74.4	86.7	83.3	67.5	71.1	49.3	32.9					
Pseudomonas aeruginosa	70	7.7	29.2	41.5		44.8	60	63.2	47.3	43.5	8.7	6.1					
Klebsiella aerogenes	78	1.5	66.7	31.6	26.3	33.3	97.1	92.3	42.9	41.6	15	57.1					
Enterobacter cloacae	31	15.4	80	54.8	51.6	58.1	100		55.2	64.5	25.9	61.3					
Gram positive organisms in Urine sample																	
Enterococcus faecalis	125									37.4	6.3	95.6	60	26.4	11.5		62.1
Staphylococcus aureus ss. aureus	81								50	48.1	29.9	94.3		43.6	16.7	26.2	2.9

KEY: % **Susceptible**	
≥80%	
50%-79.9%	
1%-49.9%	
Not tested	

AMR Surveillance on bacteria species causing skin and soft tissue infections (SSTI) at BMC

- SSTI is not part of priority disease in the AMR surveillance in Tanzania, its inclusion is critical for holistic patients' management.
- SSTI AMR surveillance study was conducted at BMC from Jan-June 2023, involving 614 patients. Pus samples were collected for culture, identification tests and cumulative AST analyzed by WHONET to generated antibiograms
- Most common SSTI types were:
  - ✓ Surgical site infections (25.7%); Chronic wounds (19.7%), and Traumatic wounds (12.4%)
- Laboratory confirmed SSTI was 72.5% (445/614), yielding 586 bacterial isolates.

Bugando Medical Center AMR & AMS Committee Technical Report., April 2022 & Baraka Justine, MSc Dissertation, CUHAS., 2023

SSTIs bacteria antibiograms at BMC

Bacterial species	Number	Ampicillin	Amoxicillin/Clavulanic acid	Piperacillin/Tazobactam	Ceftazidime	Ceftriaxone	Cefepime	Meropenem	Amikacin	Gentamicin	Ciprofloxacin	Trimethoprim/Sulfamethoxazole	Penicillin G	Cefoxitin	Gentamicin-High	Clindamycin	Erythromycin	Chloramphenicol
Gram negative bacteria																		
E. coli	99	9.2	24.0	82.8	38.4	17.3	27.6	92.9	93.9	70.7	29.3	22.2	-	-	-	-	-	-
Klebsiella pneumoniae	93	7.5	29.7	82.8	29.0	15.1	28.3	90.3	98.9	56.9	51.6	27.9						
P. aureginosa	81	-	-	90.0	67.1	-	79.5	80.0	86.4	81.3	72.8	-	-	-	-	-	-	-
Acinetobacter spp**	75	-	-	62.7	41.3	-	38.6	52.0	78.7	41.1	44.0	32	-	-	-	-	-	-
Enterobacter spp ***	29	24.1	28.6	96.6	48.3	31.0	44.8			65.5	65.5	41.4						
Gram positive bacteria																		
S. aureus	99	-	-	-	-	-	-	-	-	87.9	63.6	60.6	1.0	69.6	-	62.2	37.8	97.1
Other GPB	29	-	-	-	-	-	-	-	-	-	44.8	41.7	10.7	-	73.3	-	29.6	71.4

Bugando Medical Center AMR & AMS Committee Technical Report., April 2022 & Baraka Justine, MSc Dissertation, CUHAS., 2023

SSTI AMR phenotypes at BMC

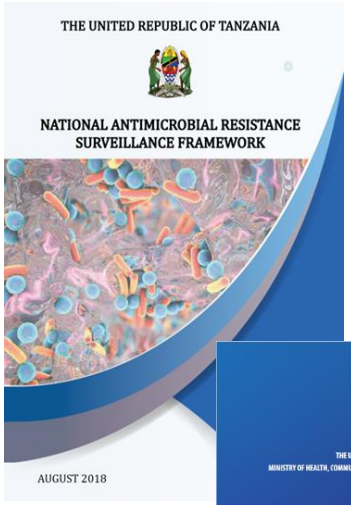
- MRSA (29.4%)
- ESBL (47.3%)
- CarbR (12.94%)
- The overall MDR phenotype was 51.1%, and was significantly more among inpatients [OR (95%CI); p-value] = 1.86 (1.33-2.59); p-value<0.001.
- Source ? Source ? Source ?

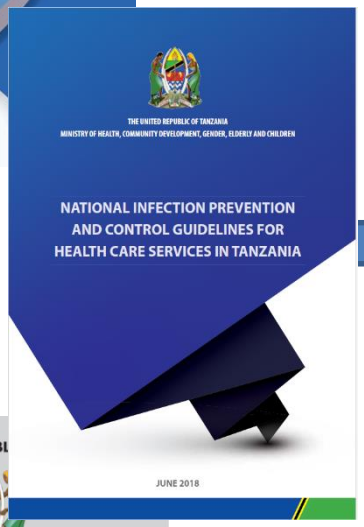
Organism	ESBL (n=142/300)	CarbR (n=59/456)	GNB MDR (n=233/456)
E. coli	64	4	80
K. pneumoniae	56	6	61
Acinetobacter spp.	N/A	35	45
Enterobacter spp.	11	1	13
P. aureginosa	-	12	12
M. morganii	3	0	10
P. mirabilis	1	1	3
Citrobacter spp.	0	0	2
Unidentified GNB	3	0	3
K. oxytoca	2	0	2
Providencia spp.	1	0	1
S. marcescens	1	0	1

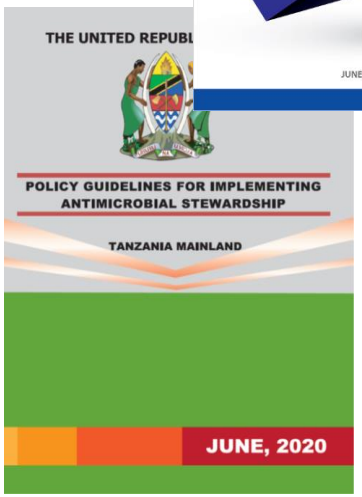
A critical need for AMR containment through IPC

Bugando Medical Center AMR & AMS Committee Technical Report., April 2022 & Baraka Justine, MSc Dissertation, CUHAS., 2023

Significance of AMR, AMU & IPC surveillance data in Tanzania (1/4): Specific management of patients

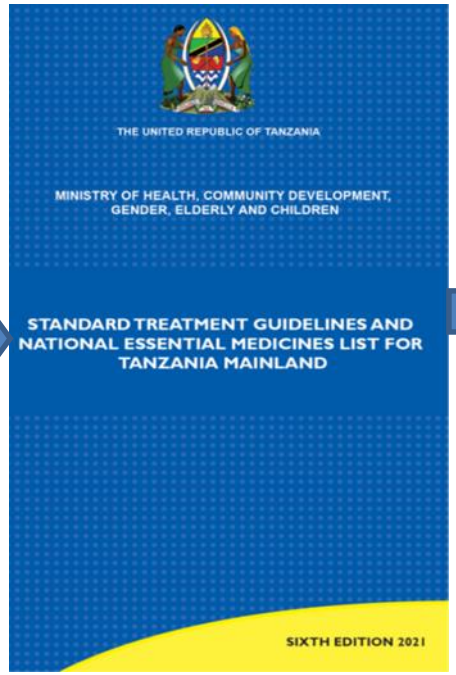




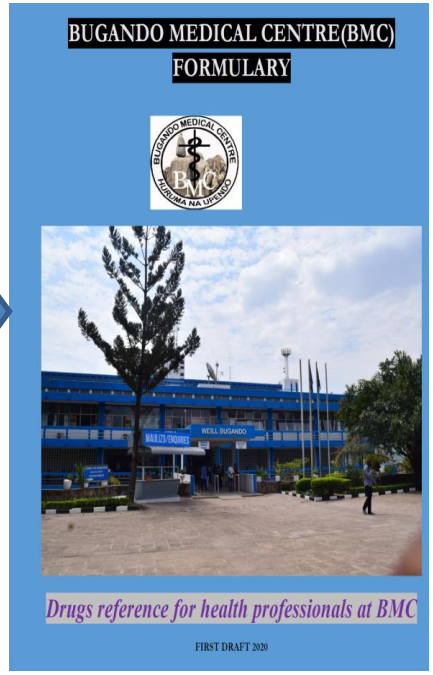


Surveillance data

National level



Hospital level

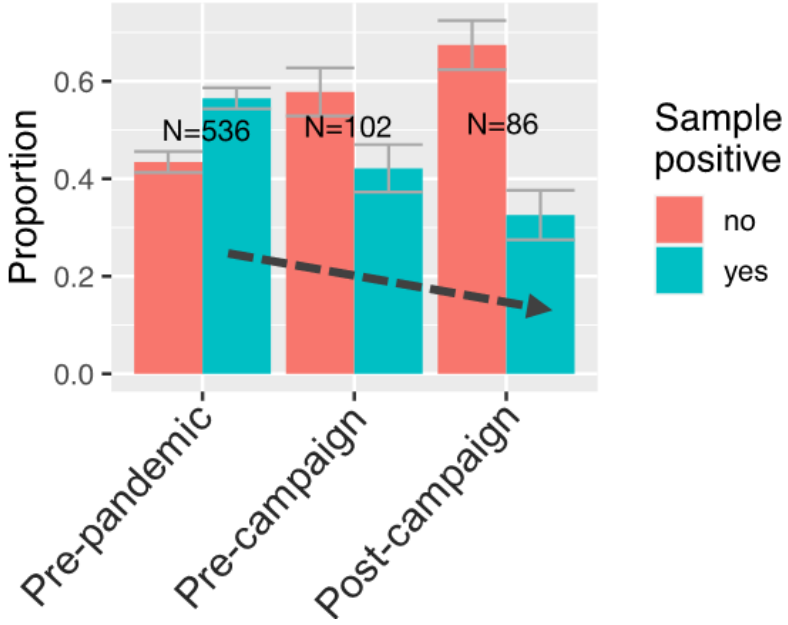


Patients

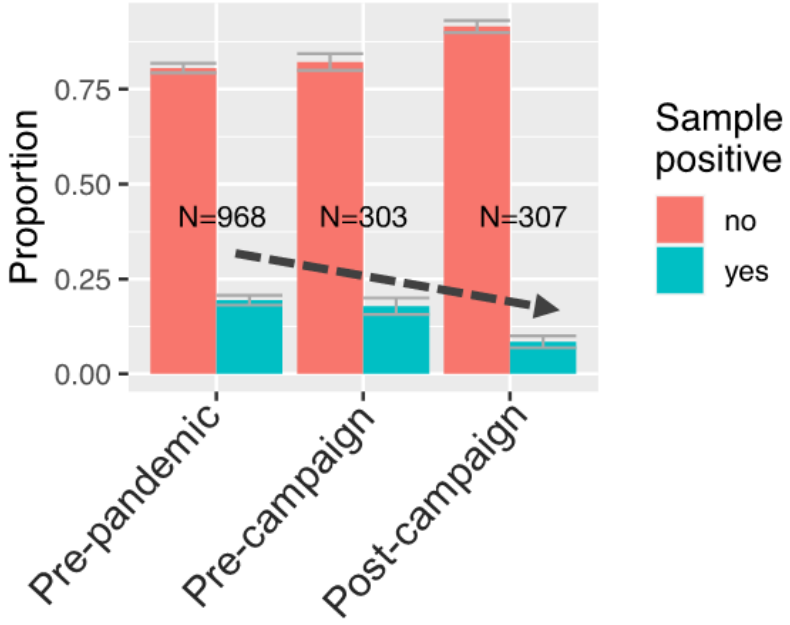
Significance of surveillance data in Tanzania (2/4): MDR bacteria containment

ESBL producing gram negative bacteria in the environmental premises in Neonatal ICU: SNAP-AMR Project

KCMC



BMC



Significance of surveillance data in Tanzania (3/4): Timely detection and containment of outbreaks

Int J Antimicrob Agents. 2011 Sep;38(3):265-9. doi: 10.1016/j.ijantimicag.2011.05.009. Epub 2011 Jul 12.

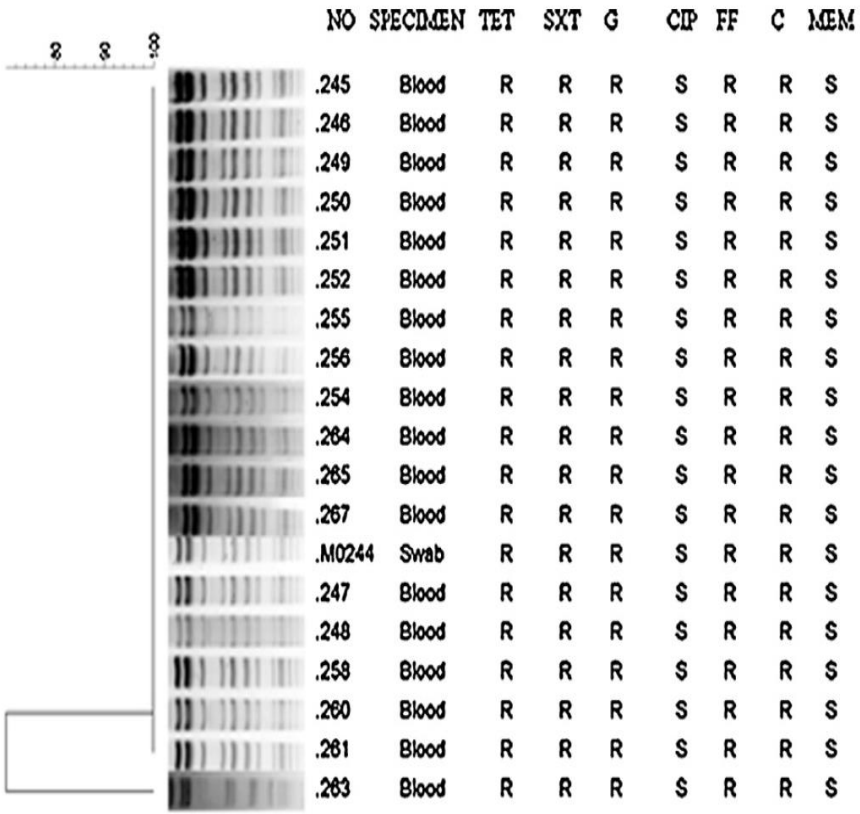
Outbreak of a novel Enterobacter sp. carrying blaCTX-M-15 in a neonatal unit of a tertiary care hospital in Tanzania.

Mshana SE, Gerwing L, Minde M, Hain T, Domann E, Lyamuya E, Chakraborty T, Imirzalioglu C.

Weill Bugando University College of Health Sciences, P.O. Box 1464, Mwanza, Tanzania.

- December 2009
- 23 neonates
- Similar resistant pattern **(clonal spread!!)**
- Mortality 26%
- *Enterobacter spp* isolated, resistant to all 3rd generation Cephalosporins
- Sensitive to meropenem.

PFGE **Antibiogram patterns**



NO	SPECIMEN	TET	SXT	G	CIP	FF	C	MEM
.245	Blood	R	R	R	S	R	R	S
.246	Blood	R	R	R	S	R	R	S
.249	Blood	R	R	R	S	R	R	S
.250	Blood	R	R	R	S	R	R	S
.251	Blood	R	R	R	S	R	R	S
.252	Blood	R	R	R	S	R	R	S
.255	Blood	R	R	R	S	R	R	S
.256	Blood	R	R	R	S	R	R	S
.254	Blood	R	R	R	S	R	R	S
.264	Blood	R	R	R	S	R	R	S
.265	Blood	R	R	R	S	R	R	S
.267	Blood	R	R	R	S	R	R	S
.M0244	Swab	R	R	R	S	R	R	S
.247	Blood	R	R	R	S	R	R	S
.248	Blood	R	R	R	S	R	R	S
.258	Blood	R	R	R	S	R	R	S
.260	Blood	R	R	R	S	R	R	S
.261	Blood	R	R	R	S	R	R	S
.263	Blood	R	R	R	S	R	R	S

Significance of surveillance data in Tanzania (3/4): Timely detection and containment of outbreaks cont...

Nelson et al. BMC Research Notes 2014, 7:279
http://www.biomedcentral.com/1756-0500/7/279

BMC Research Notes

RESEARCH ARTICLE Open Access

Evaluation of existence and transmission of extended spectrum beta lactamase producing bacteria from post-delivery women to neonates at Bugando Medical Center, Mwanza-Tanzania

Edwin Nelson[1†], Juma Kayega[1†], Jeremiah Seni[1*], Martha F Mushi[1], Benson R Kidenya[2], Adolfine Hokororo[3], Antke Zuechner[3], Albert Kihunrwa[4] and Stephen E Mshana[1]

- ESBL carriage among women: 15% (17/113) and neonates: 25.4% (32/126).
- The acquisition of ESBL isolates among neonates on day 1 was 60.0%
- No phenotypic similarity between ESBL strains from women-neonate pair

Contents lists available at ScienceDirect

International Journal of Medical Microbiology

journal homepage: www.elsevier.com/locate/ijmm

Predictors of the extended-spectrum-beta lactamases producing Enterobacteriaceae neonatal sepsis at a tertiary hospital, Tanzania

Rehema Marando[a], Jeremiah Seni[b], Mariam M. Mirambo[b], Linda Falgenhauer[c,d], Nyambura Moremi[b], Martha F. Mushi[b], Neema Kayange[a], Festo Manyama[a], Can Imirzalioglu[c,d], Trinad Chakraborty[c,d], Stephen E. Mshana[b,*]

- Neonatal ESBL-PE sepsis was detected in 10.5% (32/304) & 18% mortality
- Predicted by NICU admission, maternal & neonatal ESBL colonisation
- Virulent *Klebsiella pneumoniae* ST45 carrying blaCTX-M-15 implicated

scientific reports

OPEN

The hospital environment versus carriage: transmission pathways for third-generation cephalosporin-resistant bacteria in blood in neonates in a low-resource country healthcare setting

Dory Kovacs[1,2], Vitus Silago[2], Delfina R. Msanga[3], Stephen E. Mshana[2], Jeremiah Seni[2], Katarina Oravcova[1] & Louise Matthews[1]

- 200 neonatal blood and rectal samples, and 400 environmental samples.
- CephR BSI in 55/59 cases
- 4/28 positive BSI-rectal pair had similar AST profiles
- Environmental isolates were similar to BSI and carriage isolates

Gram negative bacteria Carbapenem resistant sepsis at BMC from 01st to 31st January 2023.

Sno	FileNo	AccssnDate	Age	Sex	Ward/Clin	*Bacteria_1*	CIPRO	TMP-SXT	AMIK	GENT	CRO	CAZ	MEM	CEF	TZP
1	302561	06JAN2023	9d	F	PREM/Ward C2	*Acinetobacter baumanii*	R	R	R	R	R	R	R	R	NT
2	277322	09 JAN23	4m	F	Ward E5	*Acinetobacter baumanii*	R	R	S	R	R	R	R	R	NT
3			3d	F		*Acinetobacter baumanii*	R	R	R	R	R	R	R	R	NT
4	305296	13JAN2023	1y	M	Ward H2/EMD	*Acinetobacter baumanii*	R	NT	S	R	R	R	R	R	NT
5	305276	14JAN2023	3d	F	PREM/Ward C2	*Acinetobacter baumanii*	R	NT	S	R	R	R	R	R	NT
6	306700	24JAN2023	1d	F	Neonatal ICU	*Klebsiella pneumoniae*	I	R	S	R	R	R	R	R	S
7			10y	F	Baylor/Paed OPD	*Escherichia coli*	R	R	S	R	R	R	R	R	I
8			21d	M	PREM/Ward C2	*Acinetobacter baumanii*	R	S	R	R	R	R	R	R	R
9	307558	27JAN2023	2d	M	Ward H2/EMD	*Acinetobacter species*	S	R	S	S	R	S	R	S	NT
10	307853	29JAN2023	1d	M	Neonatal ICU	*Klebsiella pneumoniae*	R	R	S	R	R	R	I	R	S

- A total of 24 patients were prescribed meropemen in this period (out of 208 patients admitted); the majority of patients (22/24) had culture tests done
- Half of the patients had co-existing congenital anomalies namely gastroschisis/omphalocele (n=6), tracheoaesphageal fistula (n=3), spinal bifida (n=2) and others (n=1): **dual burden**
- *Note the confinement of CarbR Klebsiella pneumoniae* in NICU versus of CarbR *Acinetobacter baumanii* in different wards; and a quarter of patients (6/24) died.

BMC AMR & AMS Committee Technical Report., April 2022; Marando et al., Int J Med Microbiol. 2018 Oct;308(7):803-811.

Significance of surveillance data in Tanzania (4/4): Tracking dominant bacteria genotypes using One-Health approach

Global dissemination of *E. coli* ST131 clone

ST 131 sublineage:

H30-R or Clade C1 (FQ-R)

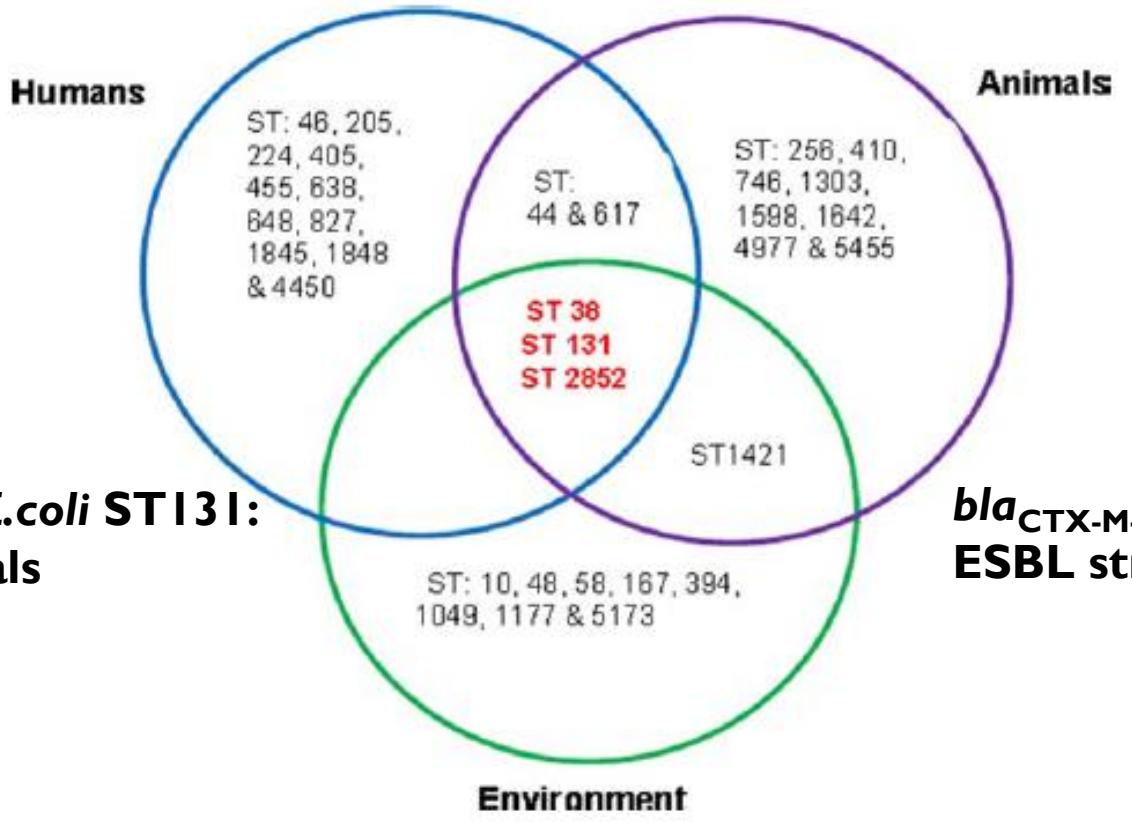
ST 131 sublineage:

H30-Rx or Clade C2 (FQ-R & CTX-M-15)

Associated with UTI & sepsis

Nicolas-Chanoine et al., Clin Microbiol Rev 2014, 27(3):543-574.

Significance of surveillance data in Tanzania (4/4): Tracking dominant bacteria genotypes using One-Health approach cont.....



The global clone *E.coli* ST131: Humans >> Animals

$bla_{CTX\text{-}M\text{-}15}$ >75% of ESBL strains

A need for strengthening AMR surveillance using One Health approach

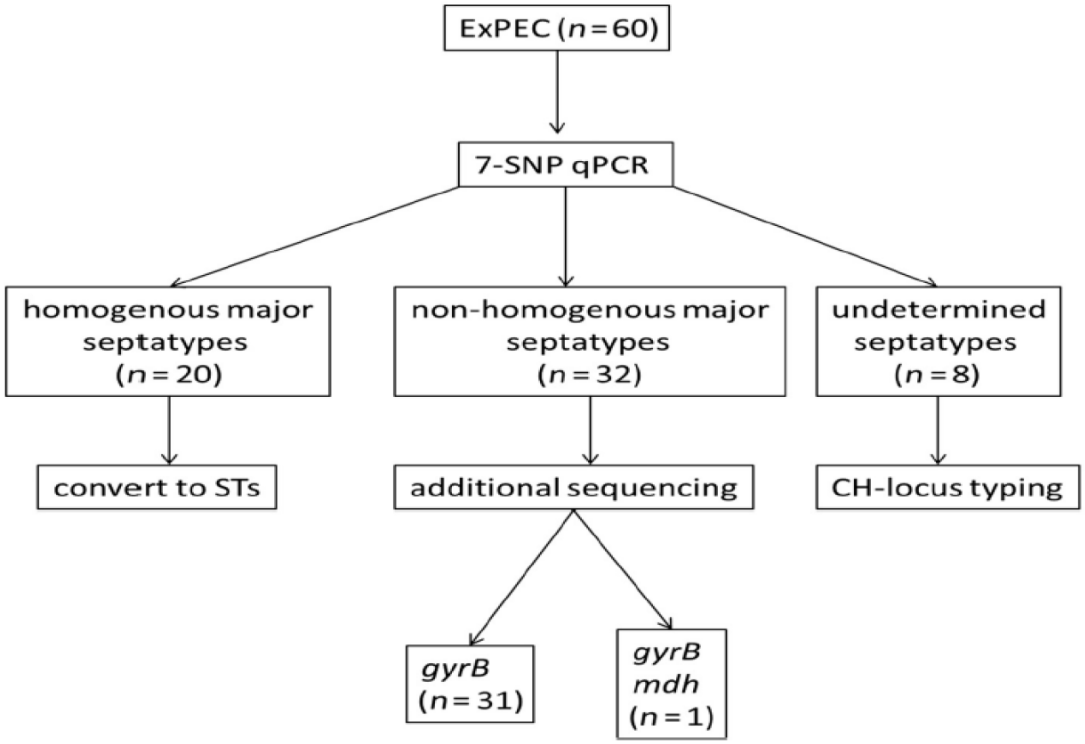
Seni et al., Zoonoses Public Health. 2018 Feb;65(1):1-10

Significance of surveillance data in Tanzania (4/4): Tracking dominant bacteria genotypes using One-Health approach cont……

Clinical Studies

The population structure of clinical extra-intestinal *Escherichia coli* in a teaching hospital from Nigeria

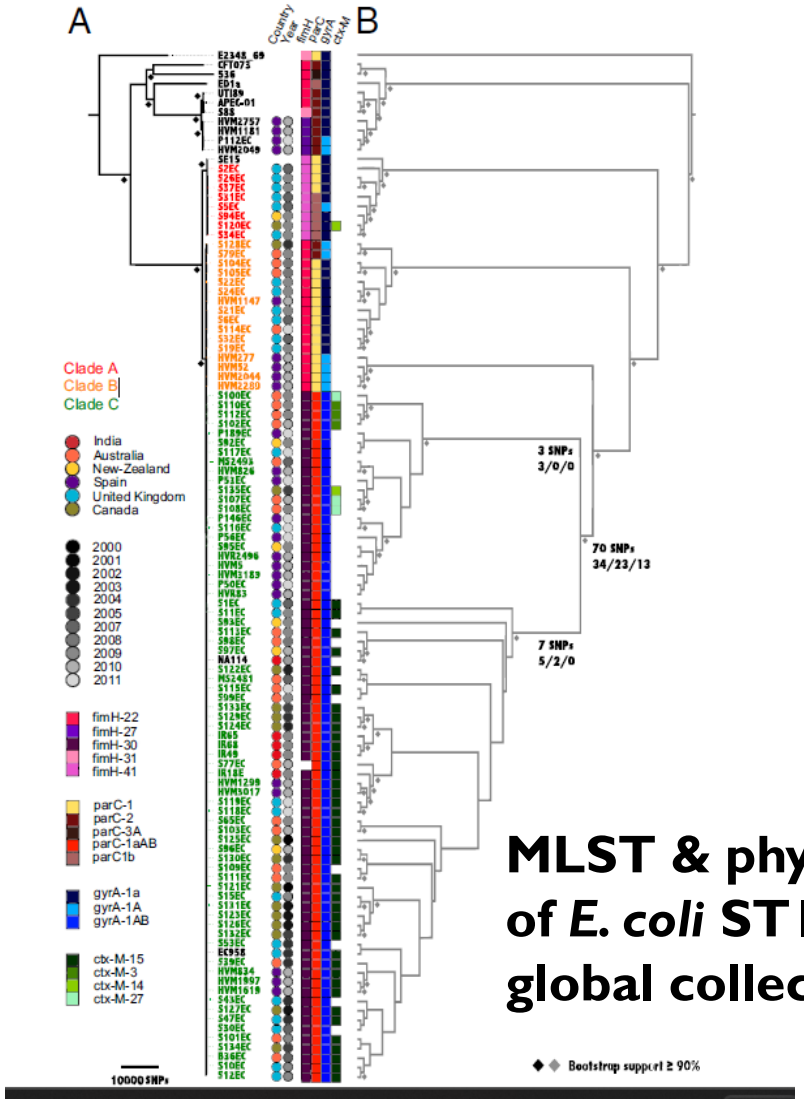
Jeremiah Seni [a,b,1], Giselle Peirano [c,d,1], Kenneth Okwong Okon [e,1], Yusuf Bara Jibrin [f], Alkali Mohammed [f], Stephen E. Mshana [a,2], Rebekah DeVinney [b,2], Johann D.D. Pitout [b,c,d,g,*,2]

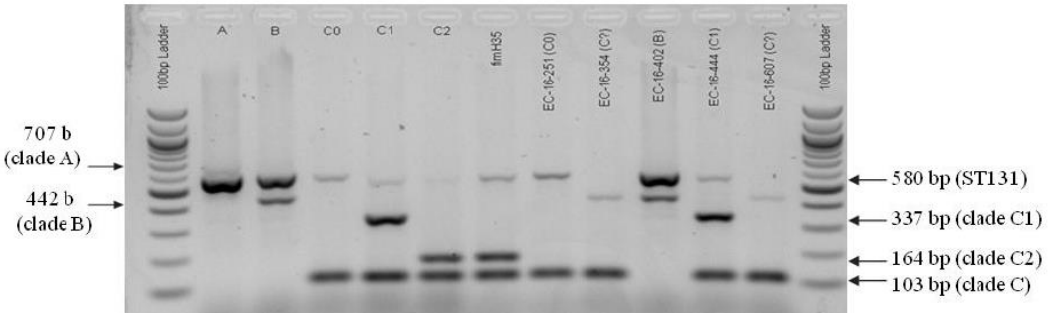


- All dominant clones of extrapathogenic *E. coli*: ST69, ST73, ST95 & ST 131 were directly typed by 7SNP-RT PCR
- Nigeria & Tanzania
- How does this compare to MLST and WGS?

Seni et al., Diagn Microbiol Infect Dis. 2018 Sep;92(1):46-49; Seni et al., Eur J Clin Microbiol Infect Dis. 2021 May 19

Significance of surveillance data in Tanzania (4/4): Tracking dominant bacteria genotypes using One-Health approach cont……





Multiplex PCR for *E. coli* ST131 clades characterisation in Nigeria & Tanzania

Seni et al., Diagn Microbiol Infect Dis. 2018 Sep;92(1):46-49;
Seni et al., Eur J Clin Microbiol Infect Dis. 2021 May 19

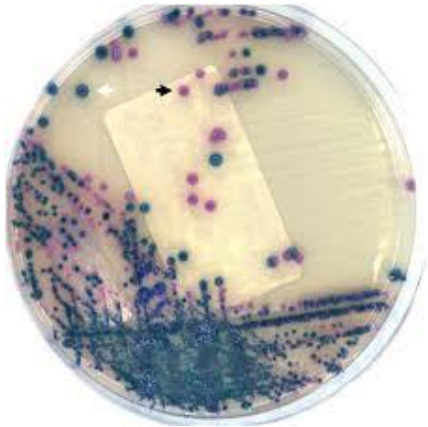
MLST & phylogenetic analysis of *E. coli* ST131 clades from global collections

- ***E. coli* ST 131 Clade C1 (FQ-R)**
- ***E. coli* ST 131 Clade C1 (FQ-R & CTX-M-15)**

Petty et al., Proc Natl Acad Sci U S A. 2014 Apr 15;111(15):5694-9

Significance of surveillance data in Tanzania (4/4): Tracking dominant bacteria genotypes using One-Health approach cont……

Blood agar



CHROMagar™ StrepB;

- **GBS project in pregnant women and cows with mastitis in Mwanza, Tanzania: Feb - June 2021**
  - ✓ *S. agalactiae* colonization was 24.5% (214/872) among pregnant women, and was higher in HIV+ than HIV- [63.1% (70/111) versus 18.9% (144/761)], respectively; OR (95% CI)=7.33 (4.77–11.29, p-value<0.001).
  - ✓ Bovine mastititis due to *S. agalactiae* was 22.5% (114/505), and exotic breed (p-value=0.010) and zero-grazing (p-value=0.034) were risk factors
  - ✓ Isolates were highly sensitive to ampicillin (99.2%-100%), erythromycin (76.3% to 87.7%) and clindamycin (81.6 50 - 84.4%).
- **Serotyping/genotyping of these isolates is on-going to guide future preventive and vaccination strategies.**

Conclusions and Future prospects

- AMR surveillance in Tanzania is progressing well and the contribution of BMC is remarkable

- The burden of AMR is associated with negative impacts, and is calling for laboratory guided antimicrobial therapies.

- Significant progress has been made in the generation and utilisation of AMR surveillance data (human sector > animal sector), we look forward to:
  - ✓ Extending AMR surveillance to sub-national levels
  - ✓ Strengthening of AMR surveillance in veterinary sector
  - ✓ Engagement of private sectors
  - ✓ Expand the scope of AMR surveillance to include SSTI (apart from existing UTI and STI), and integrate the SSTI AMR surveillance with the DHIS2 (linkage of clinical data with laboratory data!)
  - ✓ Harnessing the power of genomic AMR surveillance is very critical

Acknowledgements

World Health Organization
Food and Agriculture Organization of the United Nations
World Organisation for Animal Health
Founded as OIE
USAID | TANZANIA
FROM THE AMERICAN PEOPLE
AMERICAN SOCIETY FOR MICROBIOLOGY
The Fleming Fund
African Union
AFRICA CDC
ASLM
AFRICAN SOCIETY FOR LABORATORY MEDICINE
MRC Medical Research Council
NHS
National Institute for Health Research

Thank you/Asante sana