

Antimicrobial resistance of blood culture isolates from patients attending Goroka Provincial Hospital, Papua New Guinea

Watson Toroi¹, Victor Musyoki², Becky Max¹, Mona Kheng², Temas Ikanofi³, Chani Kudakwashe², May Varasmaite-Keket³, Amrita Ronnachit², Josephine Chanoan¹

¹Goroka Provincial Hospital, Papua New Guinea; ²Burnet Institute, Melbourne, Australia; ³Central Public Health Laboratory, Papua New Guinea



Introduction

- Bloodstream infection (BSI)
 - Presence of microorganism in blood
 - Threat to every organ especially during sepsis due to systematic inflammatory response syndrome (SIRS)

- Etiological agents
 - Bacteria – *E. coli*, *S aureus* (causing >80% of the cases)
 - Fungi – *C. albicans*
 - Parasites – *Plasmodium* species
 - Virus – HIV, Hepatitis



Types of blood stream infection

- Intravascular
- Extravascular

The BSI is associated with:

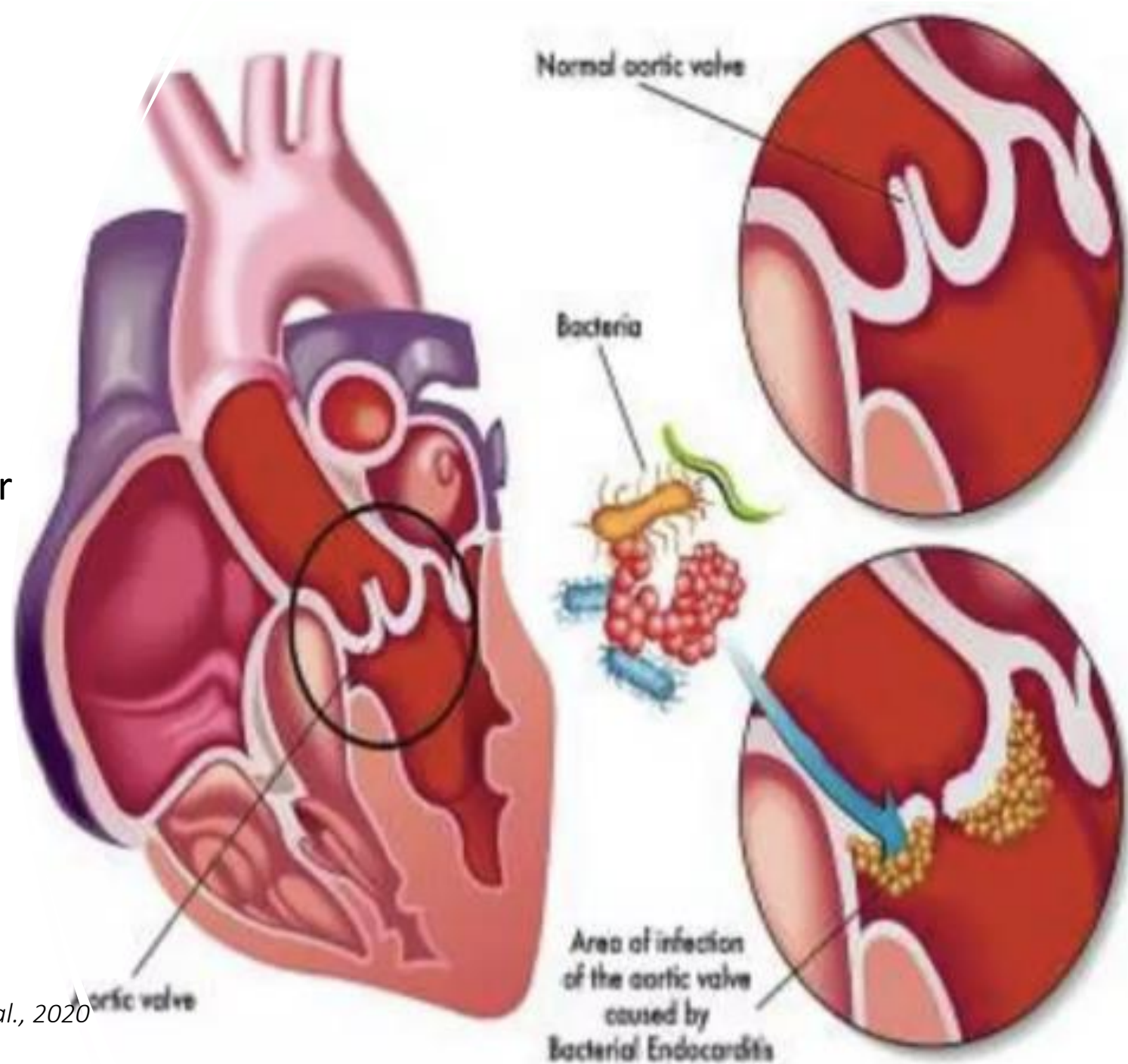
1. Use of immunosuppressive agents
2. Widespread use of broad-spectrum antibiotics
3. Invasive surgical procedures
4. Long hospitalization stay



Sareen F et al., 2023

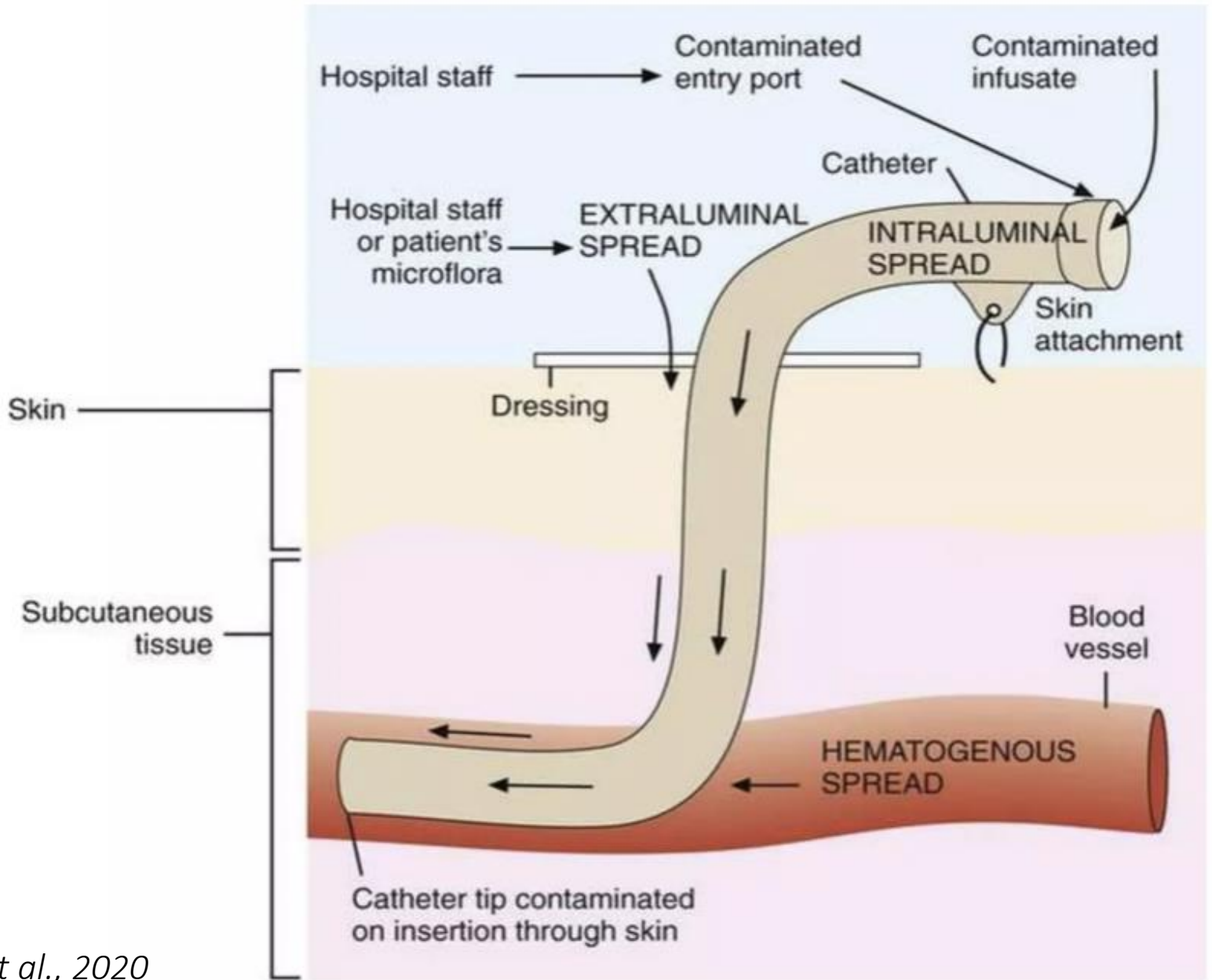
Intravascular Infection

- Originates within the cardiovascular system which include:
 1. Infective endocarditis
 - Infection of the endocardium



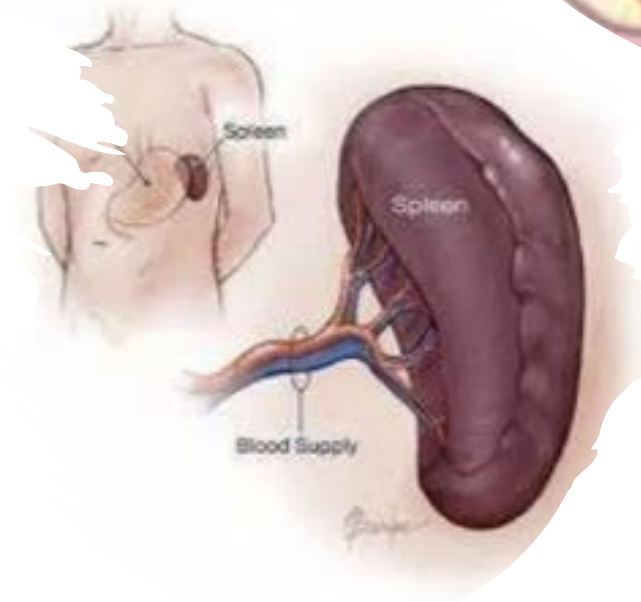
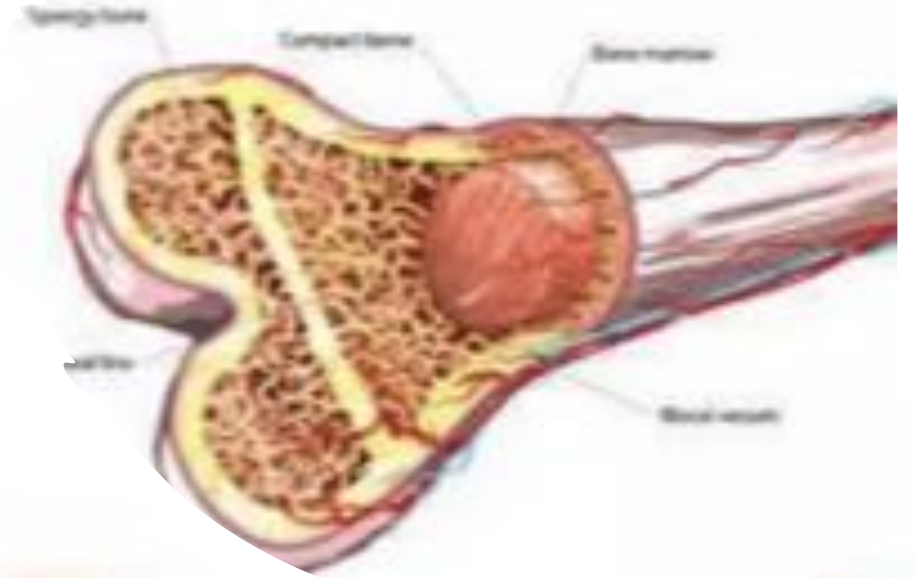
Intravascular Infection.....

2. Intravenous catheter-associated bacteraemia



Extravascular infection

- Infection of the lymphatic system
 - Includes liver, spleen and bone marrow



Management of BSI

- Includes the use of antimicrobial agents



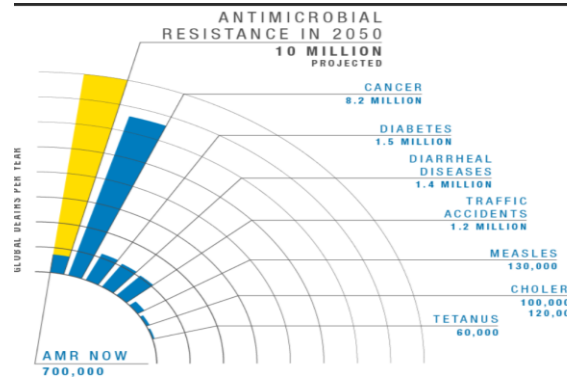
However;

- Antimicrobial resistance is a global public health concern

Global AMR burden

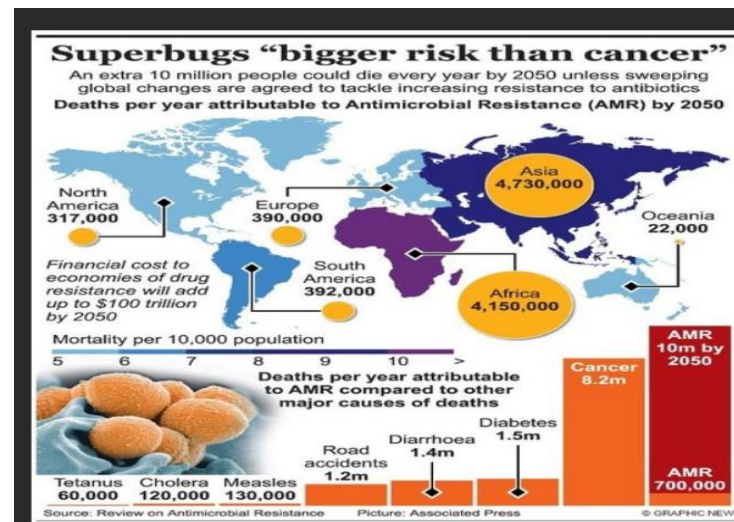
- Globally
 - 5 million deaths associated with AMR
 - Approximately 1.5 million deaths attributed to AMR
 - 2050 projection: 10 million

ARC, 2022



[Emerging and Ebbing Threats | UCSF Magazine](#)

- Little information on BSI due to antibiotic resistant bacteria is available in Pacific nations, including Papua New Guinea



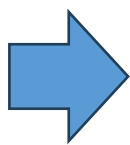
Introduction.....

- Fleming Fund – UK funded project to address AMR in developing countries
 - PNG is a recipient of grant
 - Goroka Provincial Hospital in EHP is among the FFCG AMR surveillance sites
- To monitor AMR;
 - Blood culture-based antimicrobial resistance surveillance of BSI in patients receiving clinical care at Goroka Provincial Hospital, Papua New Guinea

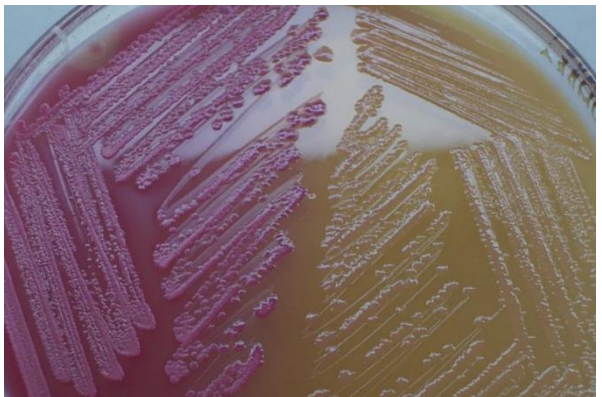
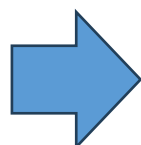


Methods:

Goroka microbiology Lab



Sample ID	Client	Date	Time	Result
20A0112	Happy Hills	2020-10-15	07:51	
20A0111	Happy Hills	2020-10-15	07:51	
20A0110	Happy Hills	2020-10-15	07:51	
20A009	Happy Hills	2020-10-14		
20A008	Happy Hills	2020-10-12		
20A007	Klaymore	2020-09-23		
20A006	Klaymore	2020-09-23		
20A005	Klaymore	2020-09-23		
20A004	Happy Hills	2020-08-13	07:00	
20A002	Happy Hills	2020-07-30	13:41	



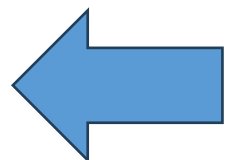
SENAITE

Home / Samples

Samples 1 Add

Active Due Received To be verified Verified Published Cancelled Invalid All Rejected

Progress	Sample ID	Creator	Date Sampled	Client	Client ID	Sample Type
<input type="checkbox"/>	20A0112	Lab Manager 1	2020-10-15 07:51	Happy Hills	HH	Blood culture
<input type="checkbox"/>	20A0111	Lab Manager 1	2020-10-15 07:51	Happy Hills	HH	Blood culture
<input type="checkbox"/>	20A0110	admin	2020-10-15	Happy Hills	HH	Blood culture
<input type="checkbox"/>	20A009	admin	2020-10-14	Happy Hills	HH	Blood culture
<input type="checkbox"/>	20A008	Lab Clerk 1	2020-10-12	Happy Hills	HH	Blood culture
<input type="checkbox"/>	20A007	Lab Manager 1	2020-09-23	Klaymore	KL	Urine
<input type="checkbox"/>	20A006	Lab Manager 1	2020-09-23	Klaymore	KL	Urine
<input type="checkbox"/>	20A005	Lab Manager 1	2020-09-23	Klaymore	KL	Blood culture
<input type="checkbox"/>	20A004	admin	2020-08-13 07:00	Happy Hills	HH	Urine
<input type="checkbox"/>	20A002	admin	2020-07-30 13:41	Happy Hills	HH	Blood culture



Isolate Number: Preliminary

Organism Name: *Citrobacter freundii*

Isolate Classification: Significant / Unknown

Taxonomy Notes: Presumably known as "*Escherichia freundii*", "*Bacterium freundii*", "*Bethesda group*"

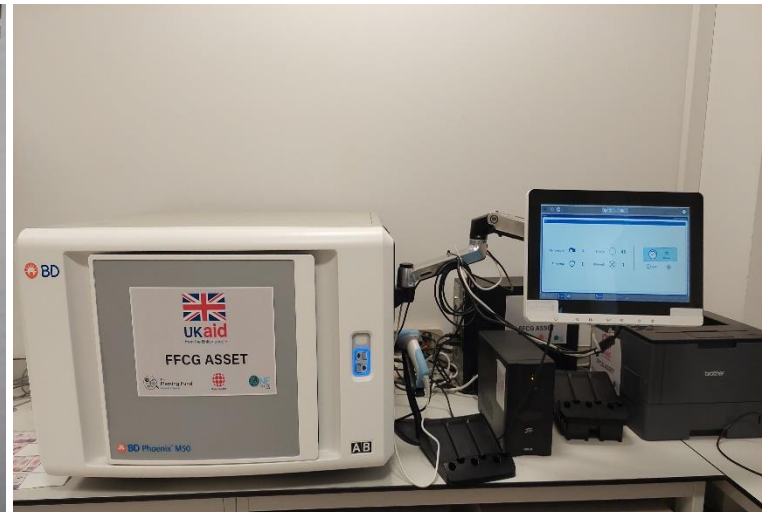
Found in environment. Isolated from human nose, throat, sputum, blood, wounds, meningitis and otitis media

Isolate AST Results	MIC or Concentration	Interp	Expert SR	Final SR	Rule Number	Drug Test Group
Amikacin	8	R	R	R		A
Amoxicillin-Clavulanic acid	>320	R	R	R		A
Ampicillin	>8	R	R	R		A
Cefazolin	>8	R	R	R		A
Ceftriaxone	>8	R	R	R		A
Ceftazidime-Avibactam	<=0.254	R	R	R		A
Ceftioxcid	>4	R	R	R		A
Colistin	>4	R	R	R	2000	N
Ciprofloxacin	1	R	R	R		A
Clarithromycin	<=0.25	X	X	X		A
Erythromycin	<=0.25	S	S	S		A
Gentamicin	>4	R	R	R		A
Imipenem	1	S	S	S		A
Levofloxacin	1	I	R	R	749	A
Mergentam	<=0.125	R	R	R		A
Piperacillin-Tazobactam	>164	R	R	R		A
Tetracycline	8	R	R	R		A
Vancomycin	2	R	R	R		A
Trimethoprim-Sulfamethoxazole	>4.76	R	R	R		A

Expert Triggered Rules

Rule 1410: Automatic. This isolate may be an ESBL producer. Alert clinician and infection prevention practitioner. Verify results if uncommon.

Rule 975: Automatic. Amoxicillin is often given in combination with other agents, either to support the activity of the amoxicillin or to broaden the spectrum of therapy. In systemic infections, the amoxicillin must be supported by other active therapy.



Methods.....

Panel	Antibiotics contained and disc abbreviation
STAPH	Penicillin (PEN1) Cefoxitin (FOX30) Chloramphenicol (C30) Erythromycin (E15) Sulfa/trimethoprim (SXT25) Tetracycline (TE30)
ENC	Penicillin (PEN1) Ampicillin (AMP2) Nitrofurantoin (100) Vancomycin (VA5)
GNR	Amoxy+clavulanate (AMC30) Ceftriaxone (CRO30) Gentamicin (CN10) Ciprofloxacin (CIP5) Nitrofurantoin (F100) Sulfa/trimethoprim(SXT25)
MRGN	Tobramycin (TOB10) Meropenem (MEM10) Ceftazidime (CAZ10) Piperacillin/tazo (30/6) Amikacin (AK30) Chloramphenicol (C30)
SSV	Ampicillin (AMP10) Ceftriaxone (CRO30) Sulfa/trimethoprim (SXT25) Chloramphenicol (C30) Pefloxacin (PEF5) Azithromycin (15ug)
HAEM	Penicillin (PEN1) Tetracycline (TE30) Sulfa/trimethoprim (SXT25) Chloramphenicol (C30) Ceftriaxone (CRO30)
STREP	Penicillin (PEN1) Oxacillin (OX1) Erythromycin (E15) Tetracycline (TE30) Sulfa/trimeth(SXT25) Chloramphenicol (C30)

Eucast Version12

https://www.eucast.org/clinical_breakpoints

Methods.....

- Demographic, clinical, bacterial identification and antimicrobial susceptibility testing data from blood specimens collected between April 2022 and July 2023 was retrieved from Senaite Laboratory Information Management System (LIMS)
- Data analysis was done using WHONET and R statistical software version 4.3.1

	Breakpoints	Number
	S >= 20	
	16 - 20	
	15 - 20	
	14 - 22	
	13 - 14	
	11 - 12	
	S >= 29	
	11 - 15	
	S >= 15	

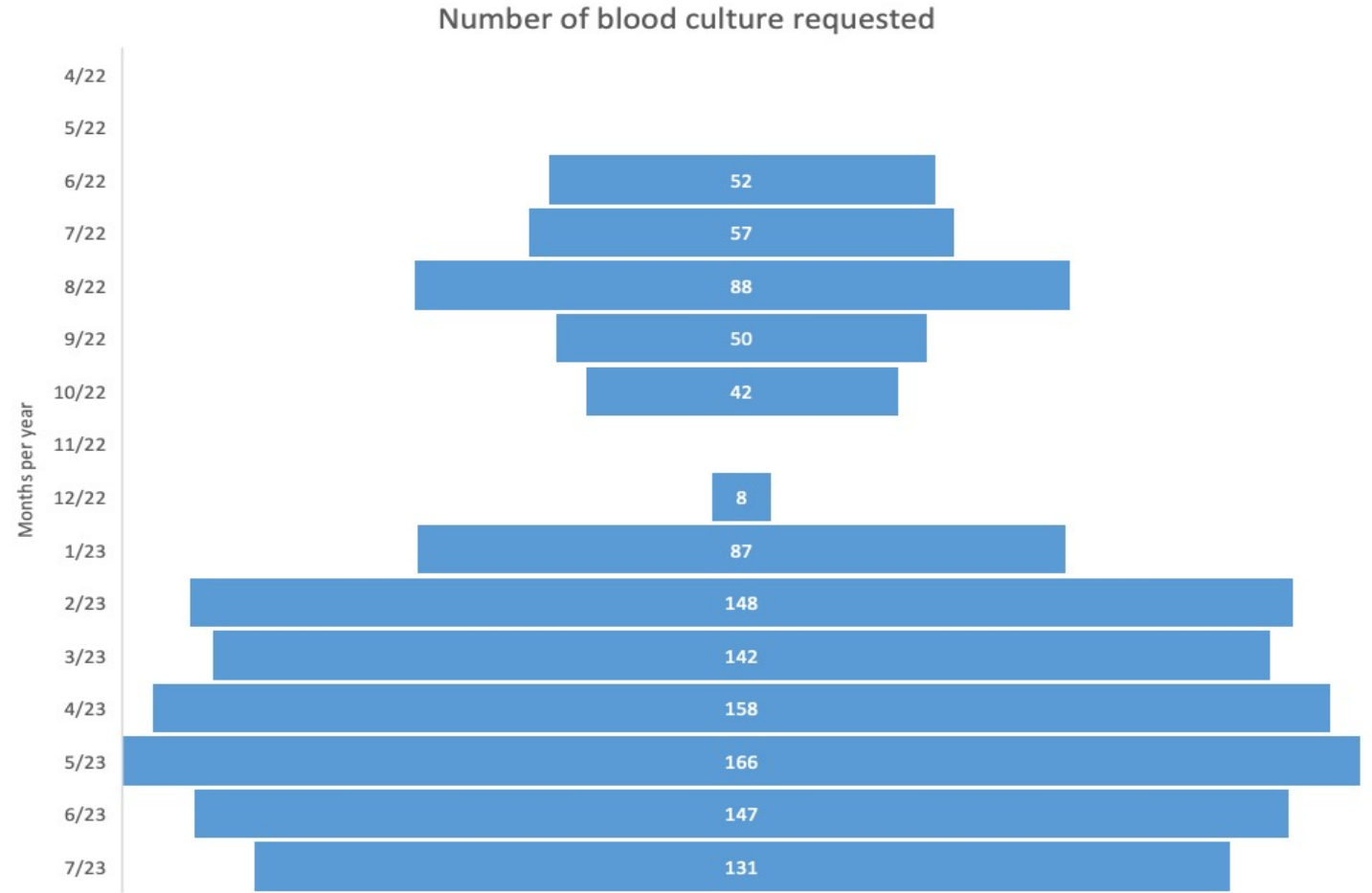
Resistant

FEN VAN SXT AMC CIP

```
data, n = np
dens$y
d == TRUE)
plot(0., 0
ylab
(orientati == ysc)
dx2 <- (dx - min(dx)) / max(dx)
x[1.]
dy2 <- (dy - min(dy)) / max(dy)
y[1.]
seqbelow <- rep(y[1.], length(
Fill == T)
nfnshade(dx2, seqbelow.
```

Results

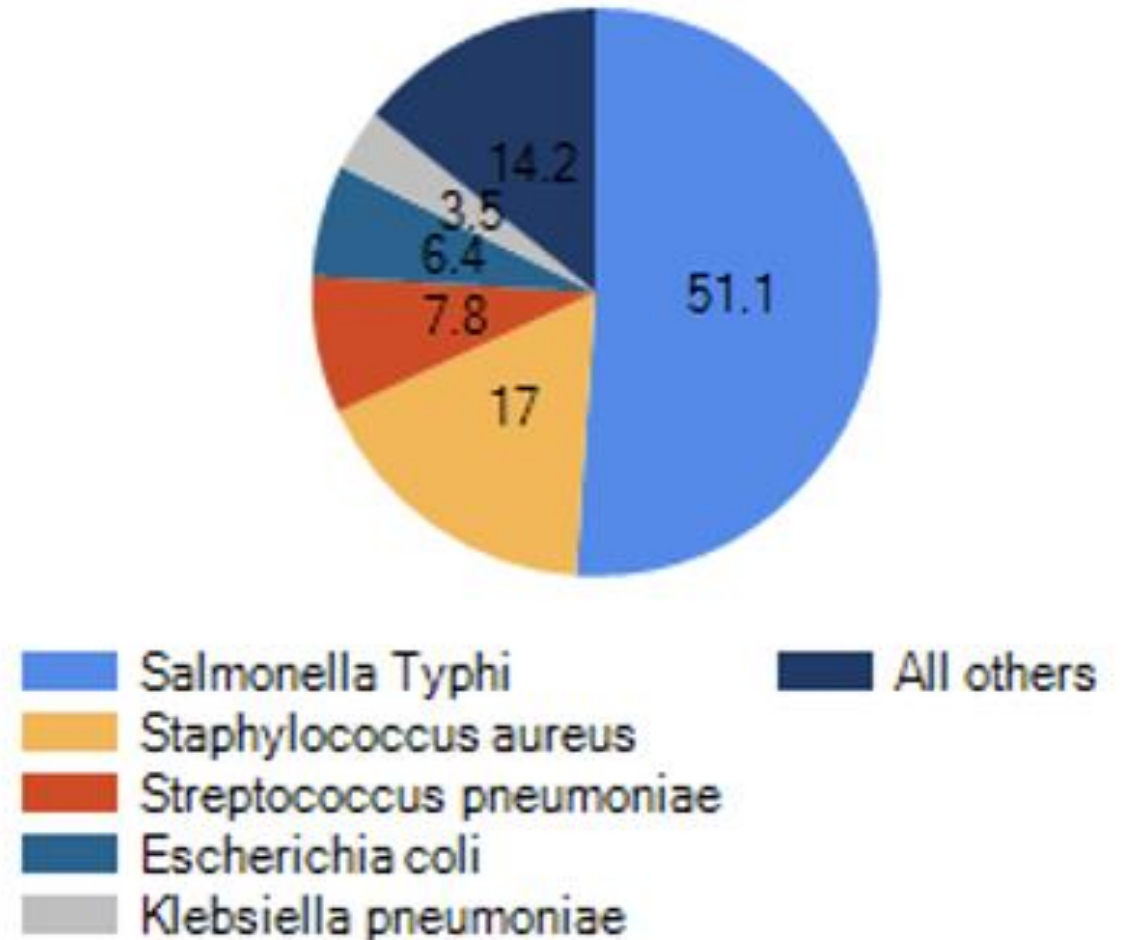
- Among the 1,276 patients screened for BSI
 - 51% (646) were male
 - Median age was 19 years (IQR 6-33)
- Increased utilization of blood culture system
 - 2023



Results....

- Out of the total (n = 1276) blood specimens processed
 - 141 (11%) were positive for bacterial pathogens

Blood (%) (n=141)

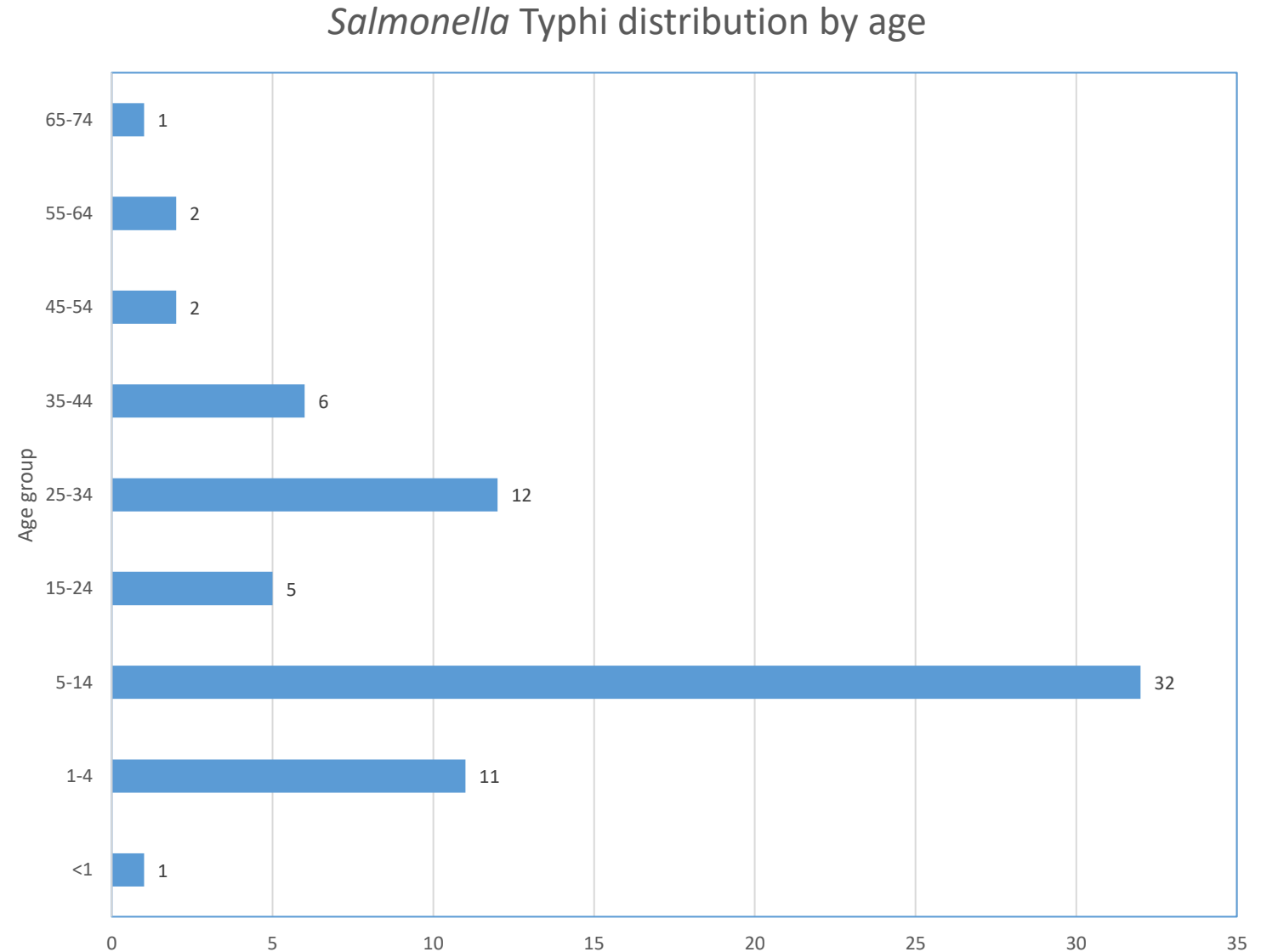


Results.....

- *Salmonella enterica* serovar Typhi (72, 51%) and Methicillin-resistant *Staphylococcus aureus* (14, 10%) were the most frequently isolated bacteria and showed high susceptibility to conventional first-line antibiotics (93–100%)
 - Nearly half of the isolates (43%) of *Salmonella* Typhi were resistant to chloramphenicol
- 6 isolates (n=12) (*E. coli*, 2 and *K. pneumoniae*, 4) were ceftriaxone-resistant-ESBL

Results.....

- Patients with *S. Typhi* did not differ significantly in age compared to patients presenting with BSI as a result of other bacteria, including MRSA ($P>0.05$)
 - Increase in Isolation of *S. Typhi* <10 years
- Isolation rate of *S. Typhi* and MRSA was significantly high in the paediatric ward (93%) and the emergency ward (15%), respectively ($P<0.05$)



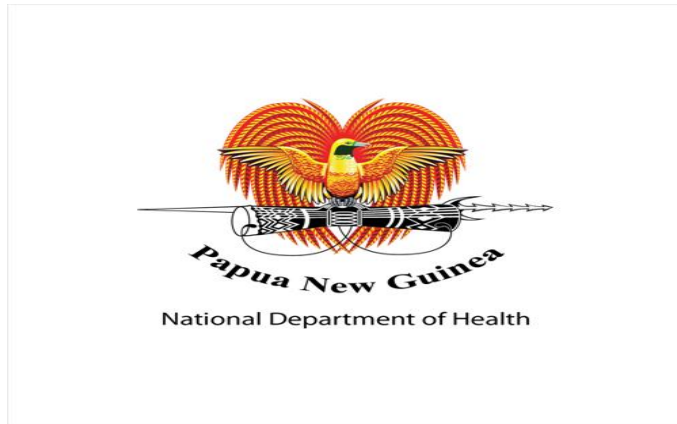
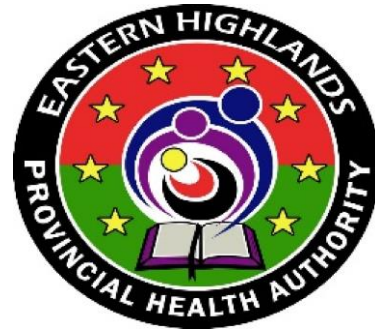
Conclusion and recommendation

- *Salmonella enterica* serovar Typhi, resistant to chloramphenicol, was the predominant cause of bloodstream infection, especially among infants and children <10 years of age, posing a threat to patient management.
- There is a need for routine surveillance to monitor the spread of resistant strains and strengthen Infection prevention and control

References

- Sohana Mina, Zahid Hassan et al., The prevalence of Multi-Drug Resistant *Salmonella* Typhi isolated from Blood Sample. *Microbiology Insights*; (2023). DOI: 10.1177/11786361221150760
- Fatima S, Ishaq Z, Irfan M, AlAsmari AF, Achakzai JK, Zaheer T, Ali A and Akbar A. Whole-genome sequencing of multidrug resistance *Salmonella* Typhi clinical strains isolated from Balochistan, Pakistan. *Front. Public Health* 11:1151805 (2023). doi: 10.3389/fpubh.2023.1151805
- Timsit, JF., Ruppé, E., Barbier, F. *et al.* Bloodstream infections in critically ill patients: an expert statement. *Intensive Care Med* **46**, 266–284 (2020). <https://doi.org/10.1007/s00134-020-05950-6>
- Zakir, M.; Khan, M.; Umar, M.I.; Murtaza, G.; Ashraf, M.; Shamim, S. Emerging Trends of Multidrug-Resistant (MDR) and Extensively Drug-Resistant (XDR) *Salmonella* Typhi in a Tertiary Care Hospital of Lahore, Pakistan. *Microorganisms* **2021**, *9*, 2484. <https://doi.org/10.3390/microorganisms9122484>
- Antimicrobial Resistance collaborators; Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis; *Lancet*; 2022,

Acknowledgements





THANK YOU