National Center for Emerging and Zoonotic Infectious Diseases

Characterization of Invasive Salmonellosis in Hospitalized Children with Acute Febrile Illness—Uganda, 2016–2017

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Waterborne Disease Prevention Branch

11th International Conference on Typhoid and Other Invasive Salmonelloses

March 26–28, 2019

Uganda Acute Febrile Illness (AFI) Project

Objectives

- **Establish leading causes of non-malarial acute febrile illness among hospitalized children in Uganda**

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- **Provide guidance for further expansion of relevant diagnostic capacity**

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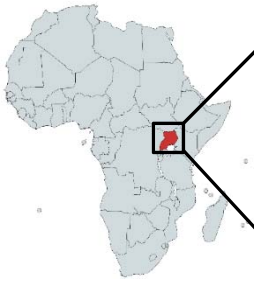
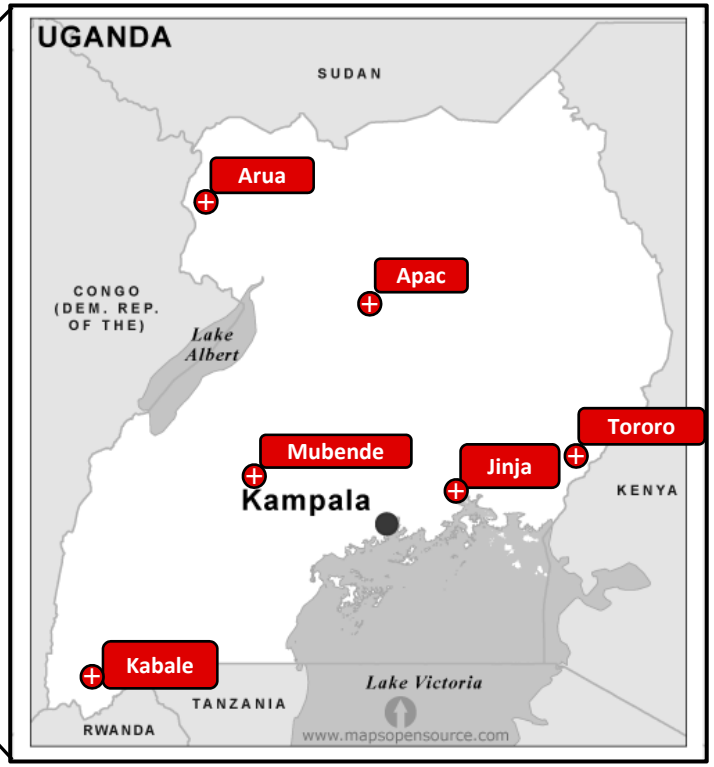
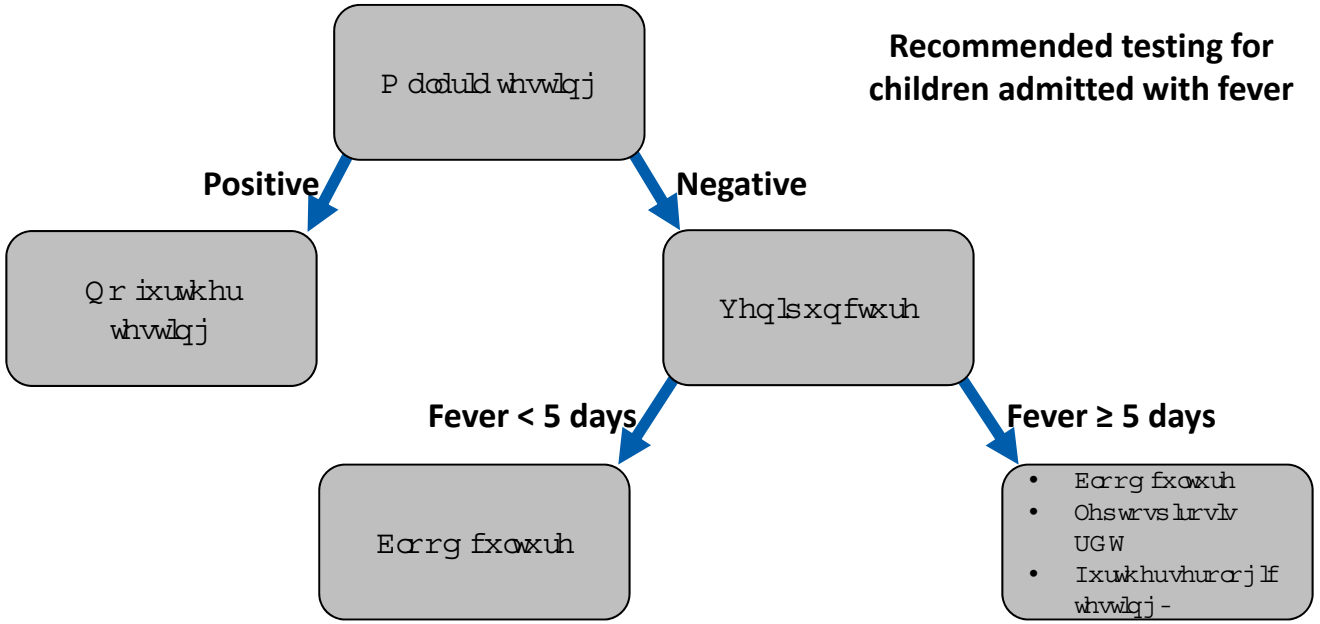
- **Establish leading causes of non-malarial acute febrile illness among hospitalized children in Uganda**
- **Provide guidance for further expansion of relevant diagnostic capacity**
- **Obtain antimicrobial resistance patterns to guide proper use of antimicrobial therapies**

Uganda AFI surveillance sites





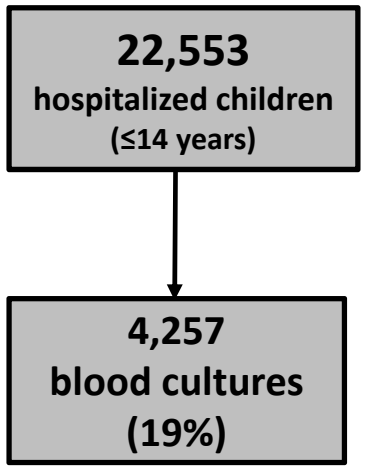


Further serologic testing: arboviruses, *Rickettsia, Borrelia, Brucella

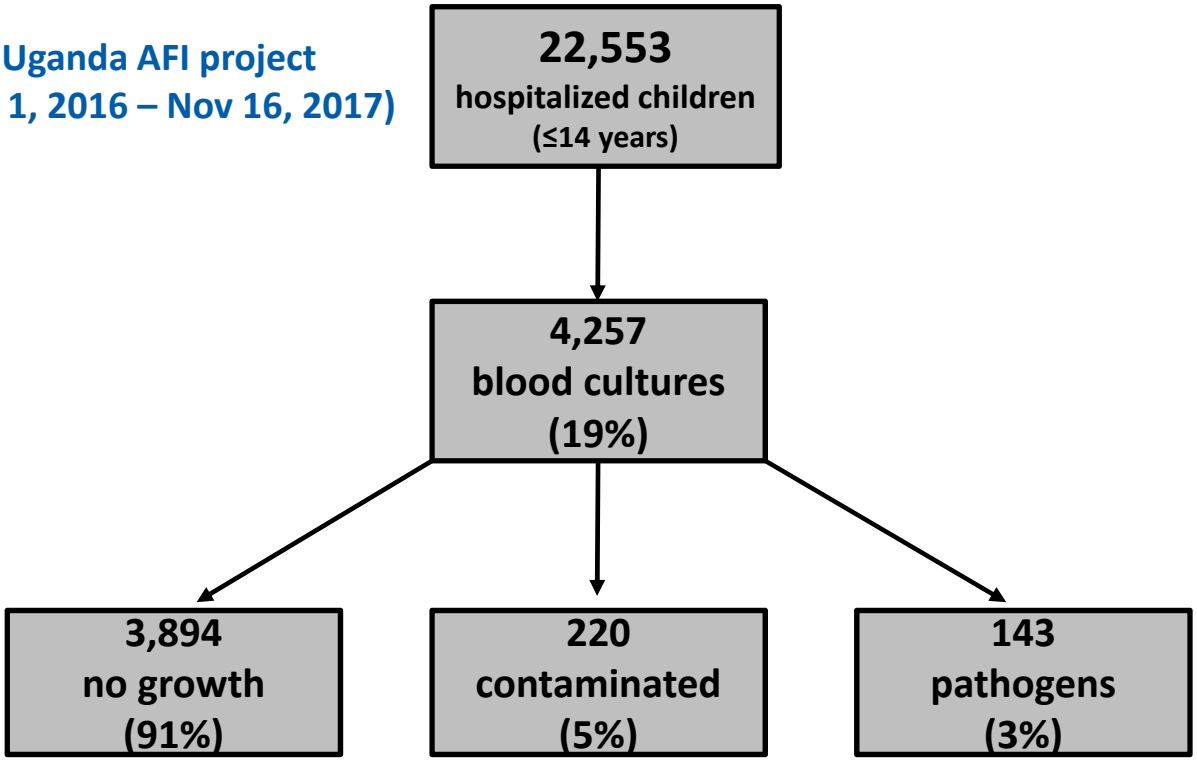
Uganda AFI project
(July 1, 2016 – Nov 16, 2017)

22,553
hospitalized children
(≤14 years)

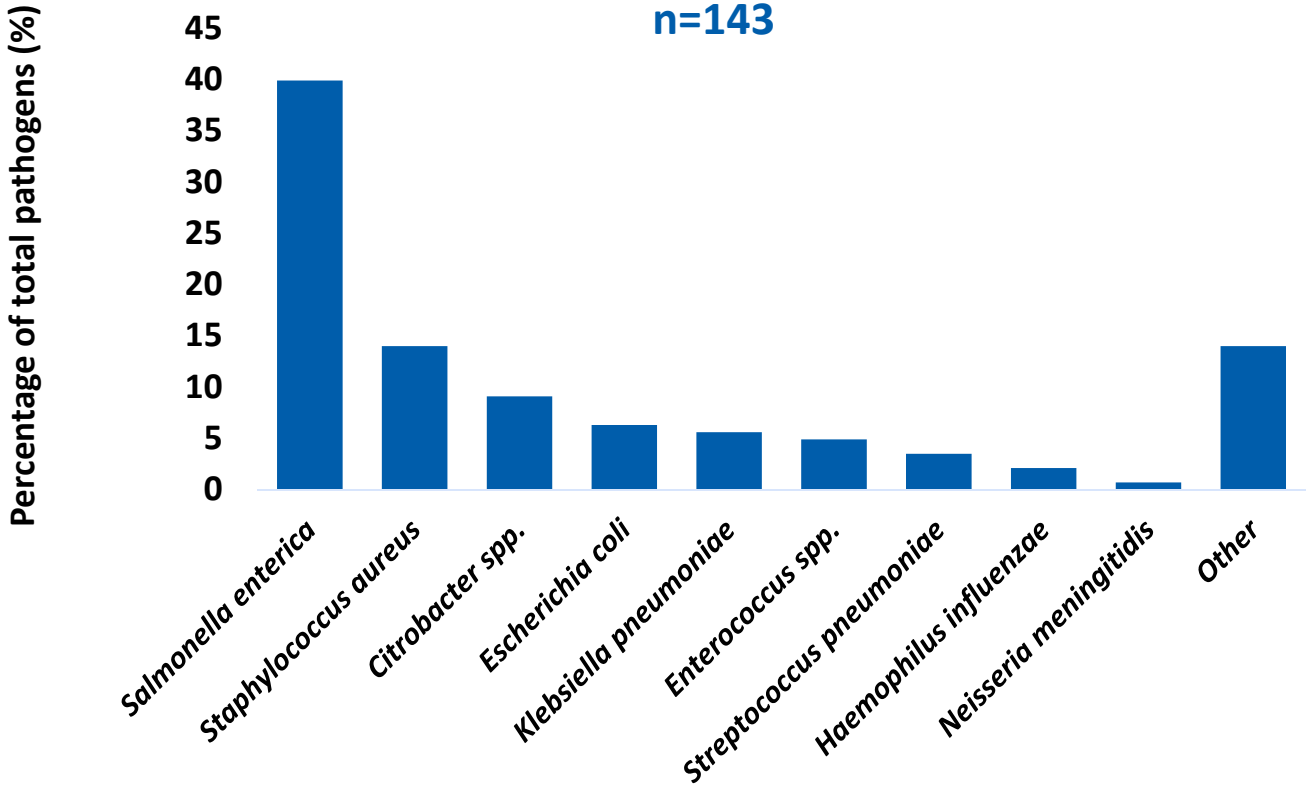
Uganda AFI project
(July 1, 2016 – Nov 16, 2017)



Uganda AFI project
(July 1, 2016 – Nov 16, 2017)



Pathogens identified by blood culture
Uganda AFI Project: Jul 2016 – Nov 2017
n=143



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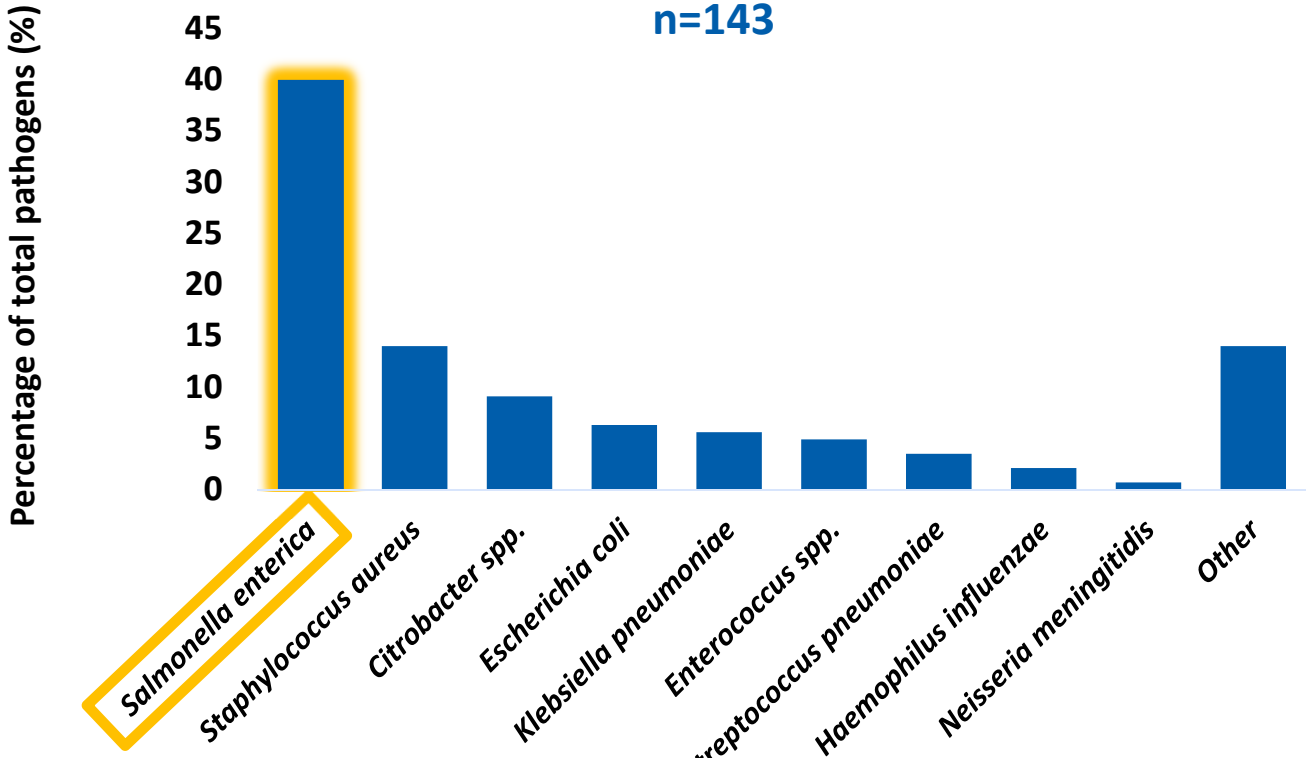
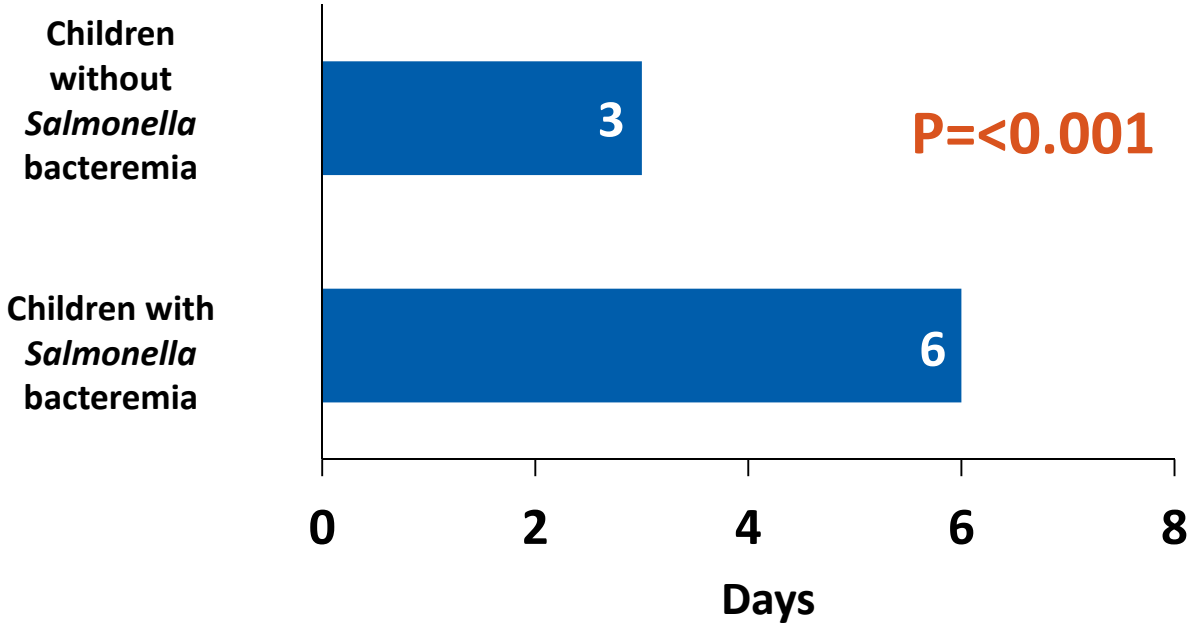


Descriptive characteristics

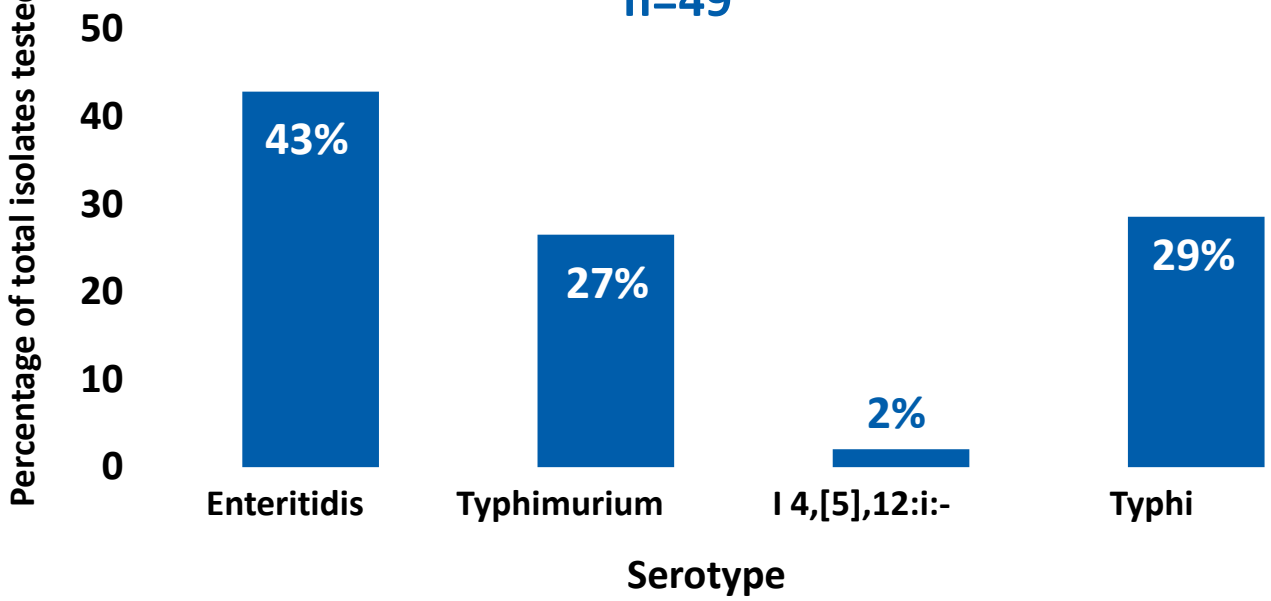
Uganda AFI project: Jul 2016 – Nov 2017

	Children with *Salmonella* bacteremia (n=57)	Children without *Salmonella* bacteremia (n=22,496)	P value
Median age (range)	3 years (0–12)	2 years (0–14)	0.026
Male (%)	40 (70%)	12,627 (57%)	0.04
Death (%)	3 (6%)	843 (4%)	0.537

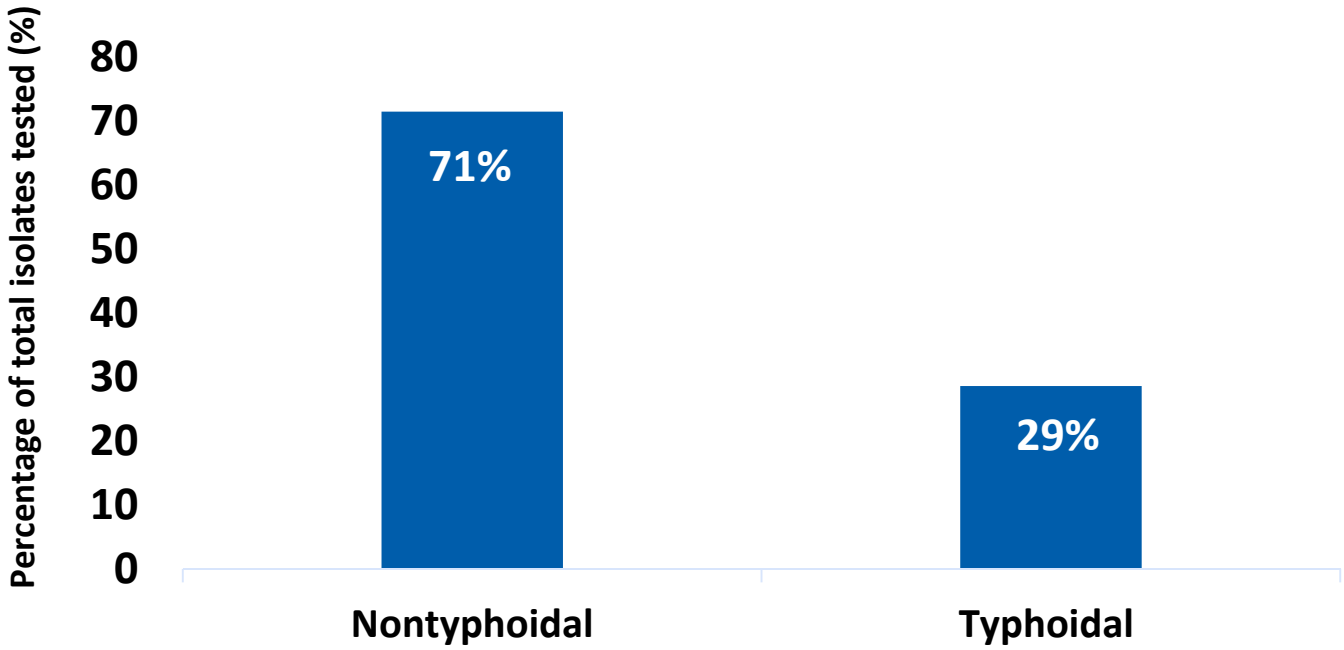
Median length of hospital stay
Uganda AFI Project: Jul 2016 – Nov 2017



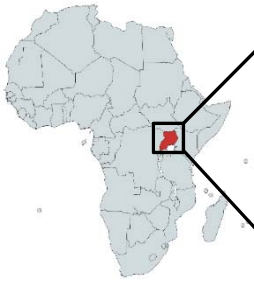
Salmonella serotypes
Uganda AFI Project: Jul 2016 – Nov 2017
n=49

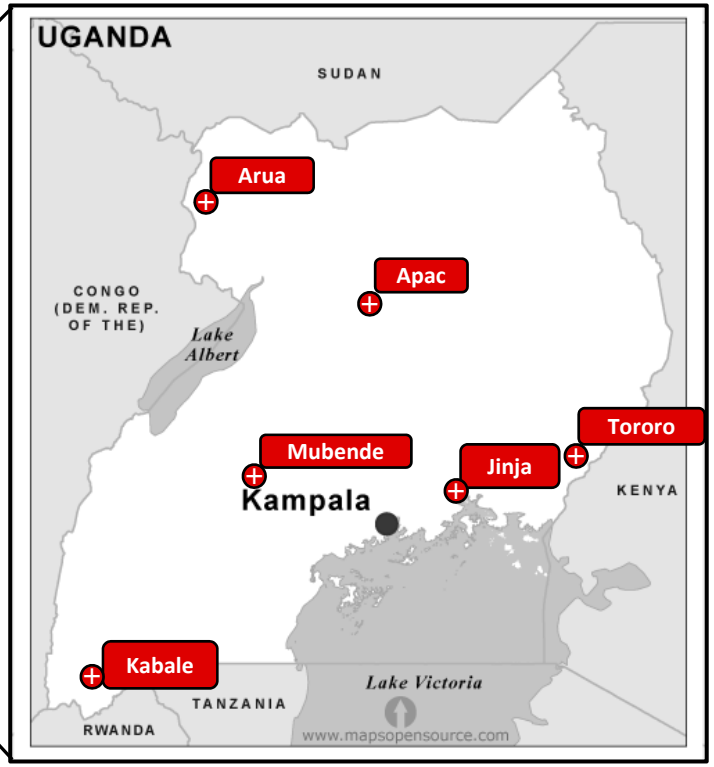


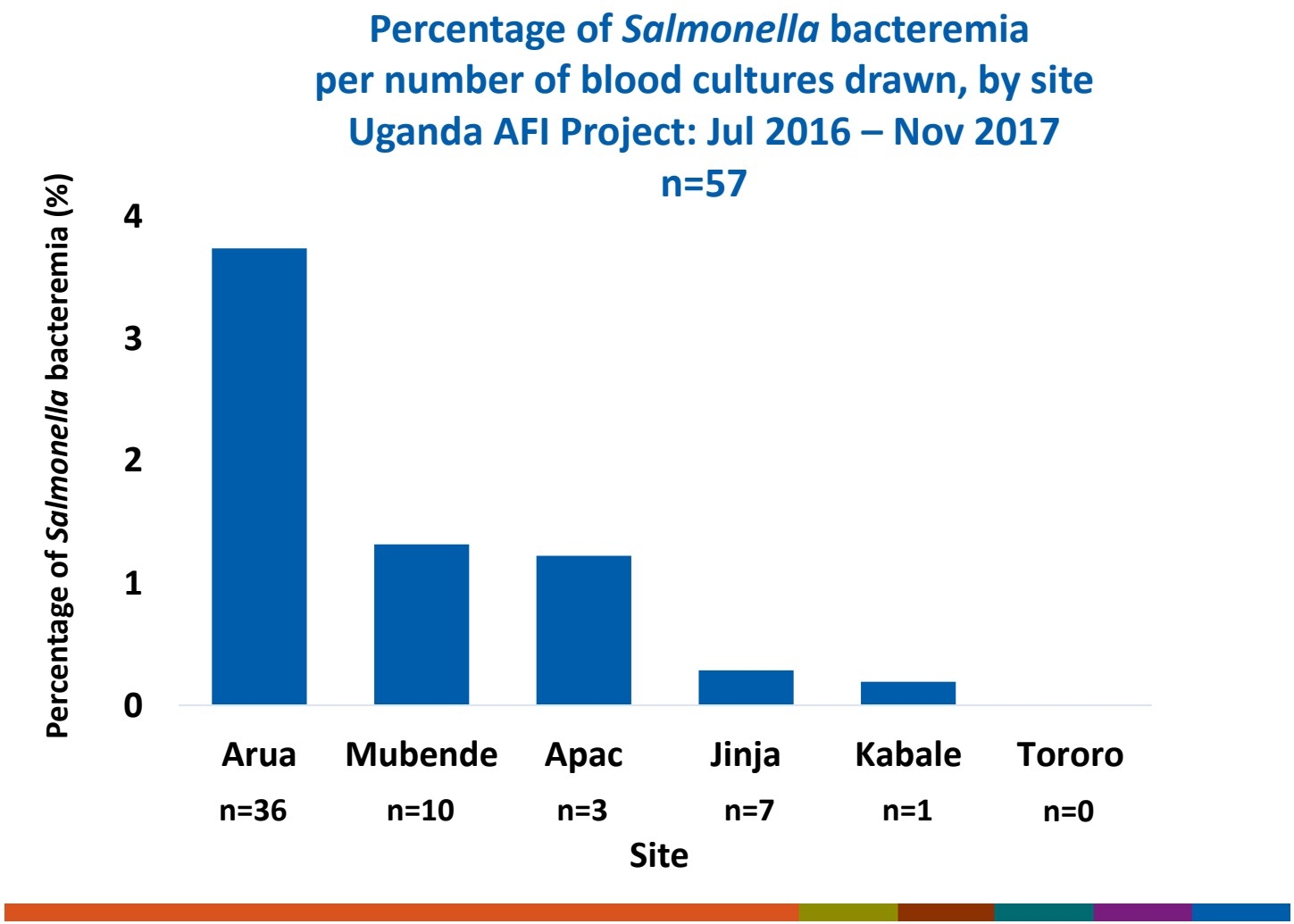
Percentage of nontyphoidal and typhoidal serotypes
Uganda AFI Project: Jul 2016 – Nov 2017
n=49



Uganda AFI surveillance sites



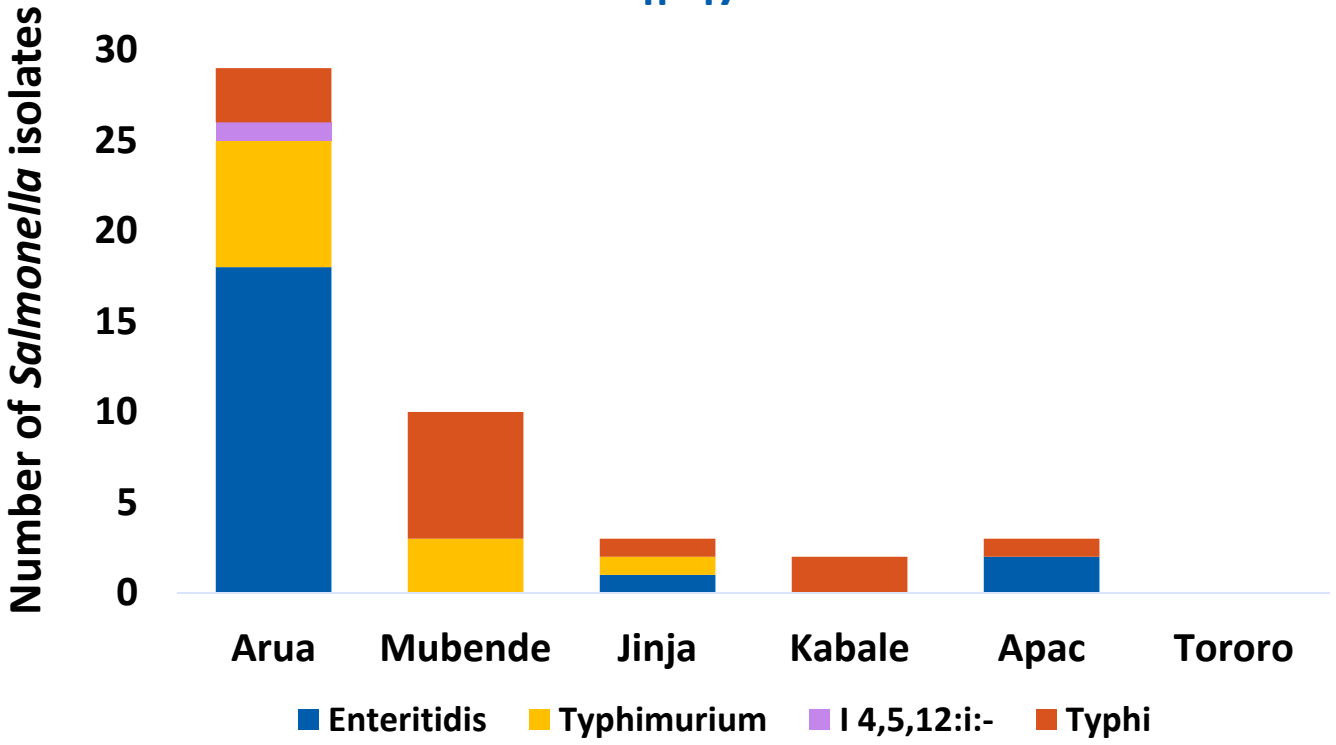



Percentage of Salmonella bacteremia
per number of blood cultures drawn, by site
Uganda AFI Project: Jul 2016 – Nov 2017
n=57
Percentage of Salmonella bacteremia (%)
4
3
2
1
0
Arua
n=36
Mubende
n=10
Apac
n=3
Jinja
n=7
Kabale
n=1
Tororo
n=0
Site

Salmonella serotypes by site

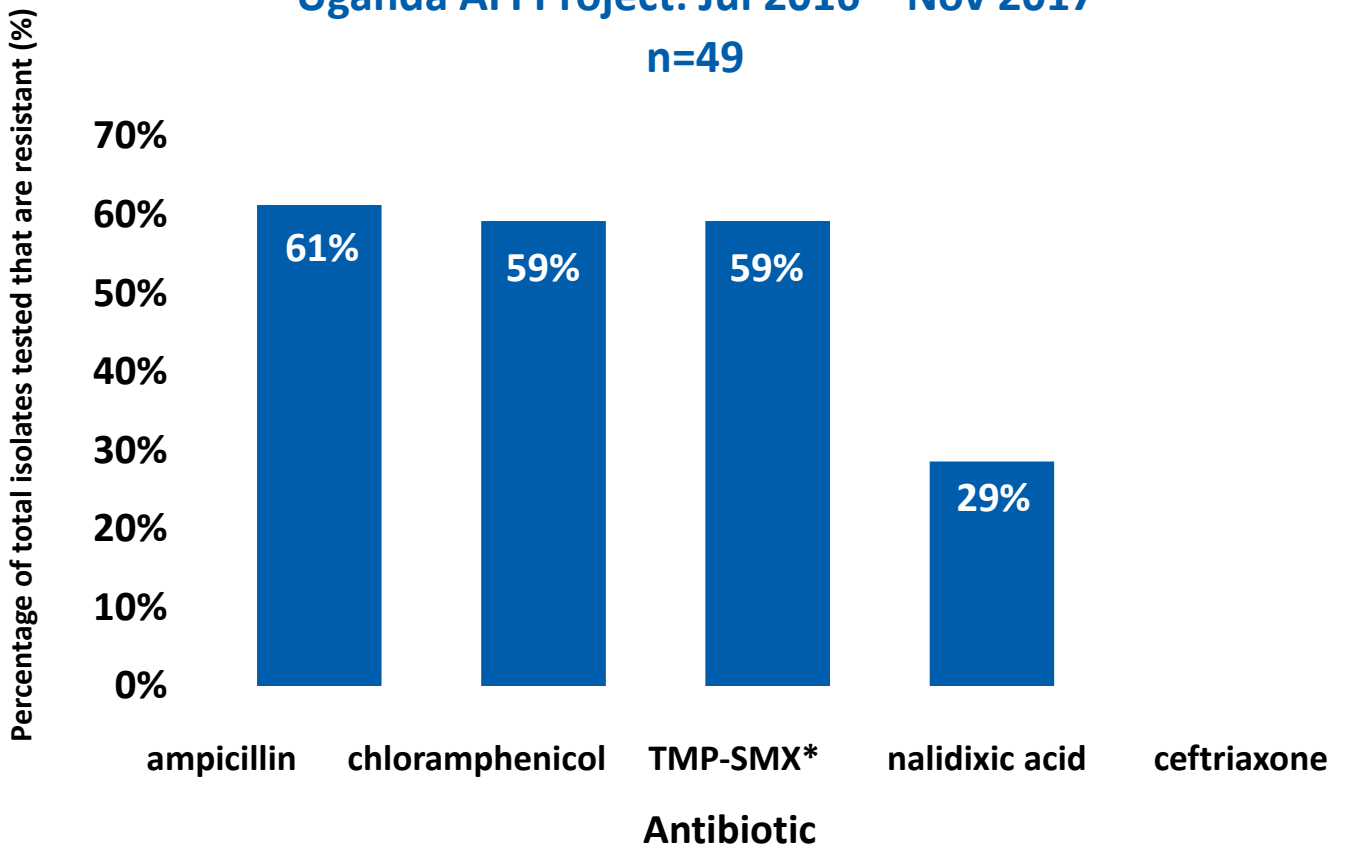
Uganda AFI Project: Jul 2016 – Nov 2017

n=47



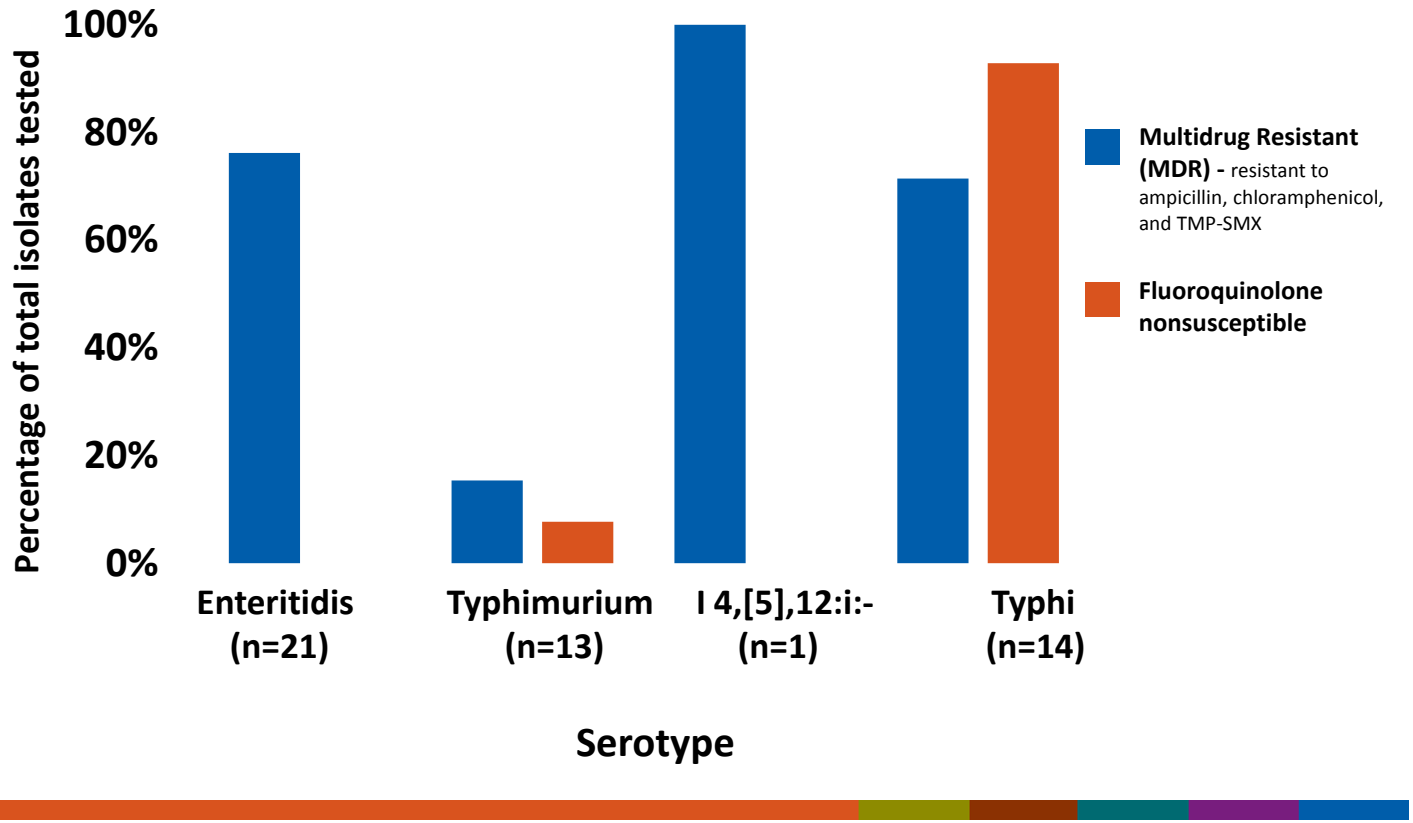
Antimicrobial Resistance

Antimicrobial resistance of *Salmonella* isolates
Uganda AFI Project: Jul 2016 – Nov 2017
n=49

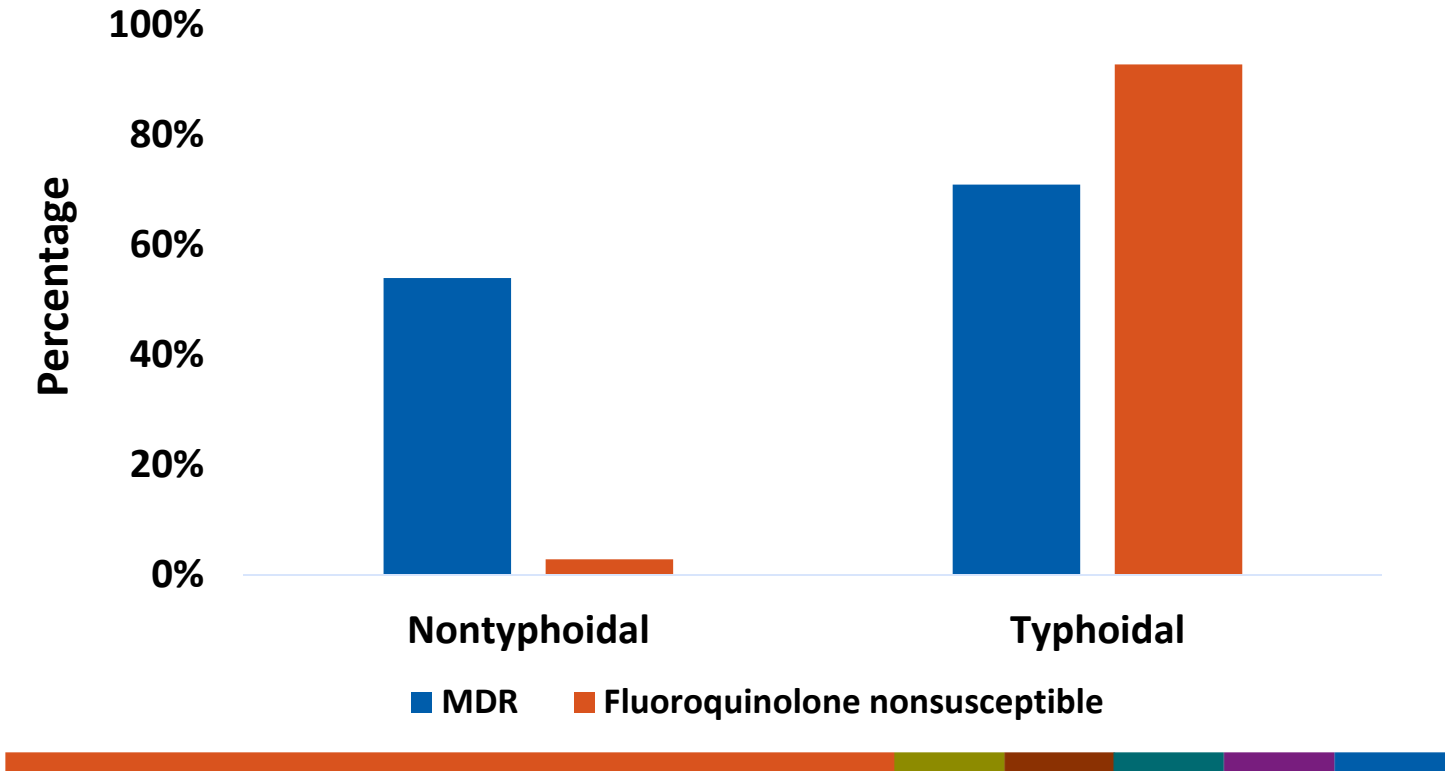


*trimethoprim-sulfamethoxazole (TMP-SMX)

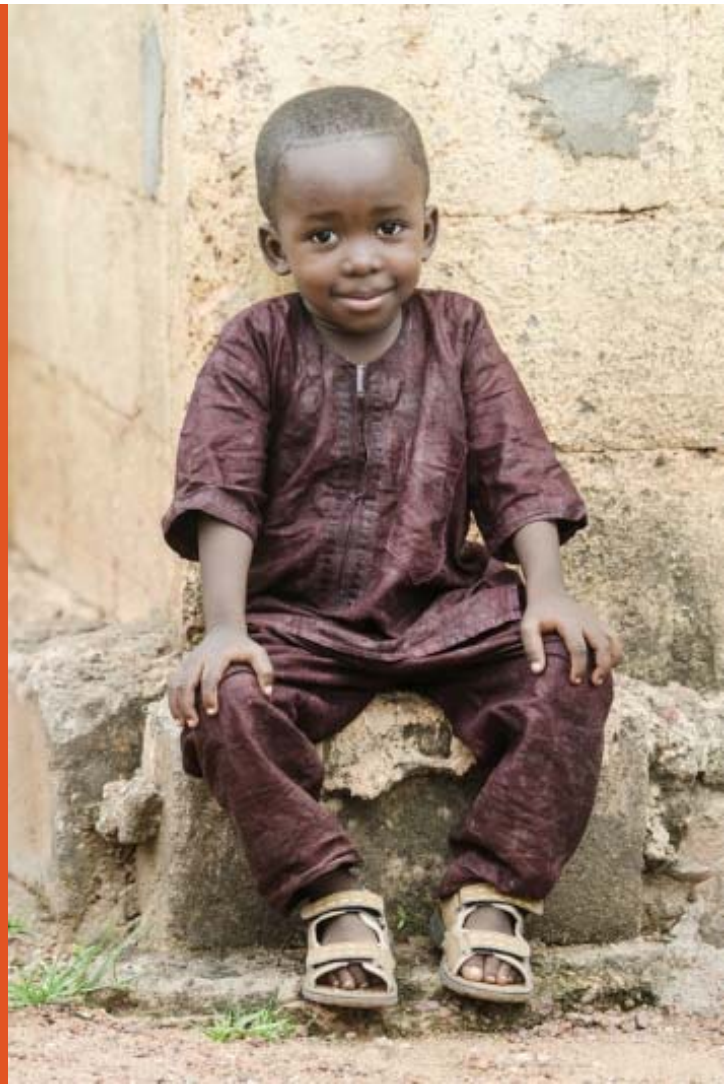
Antimicrobial resistance patterns by serotype
Uganda AFI Project: Jul 2016 – Nov 2017
n=49



Antimicrobial resistance patterns, grouped as nontyphoidal or typhoidal
Uganda AFI Project: Jul 2016 – Nov 2017
n=49



Discussion



Limitations

- **Blood culture collection proportions**

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  - **Staffing**
  - **Stockouts**
  - **Clinician discretion**

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- Blood culture collection proportions
  - Staffing
  - Stockouts
  - Clinician discretion
- Laboratory challenges

Conclusions

- ***Salmonella*** **is the most commonly detected cause of bacteremia in febrile hospitalized children in Uganda**

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- **71% of *Salmonella* serotypes causing bacteremia were identified as nontyphoidal**

Conclusions

- ***Salmonella*** **is the most commonly detected cause of bacteremia in febrile hospitalized children in Uganda**
- **71% of *Salmonella* serotypes causing bacteremia were identified as nontyphoidal**
- **Antimicrobial resistance continues to threaten our ability to properly treat invasive *Salmonella* infections**

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Jinja Regional Referral Hospital

Kabale Regional Referral Hospital

Mubende Regional Referral Hospital

Tororo District Hospital

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.


HOMELAND GUEST INN
Questions?

Extra Slides

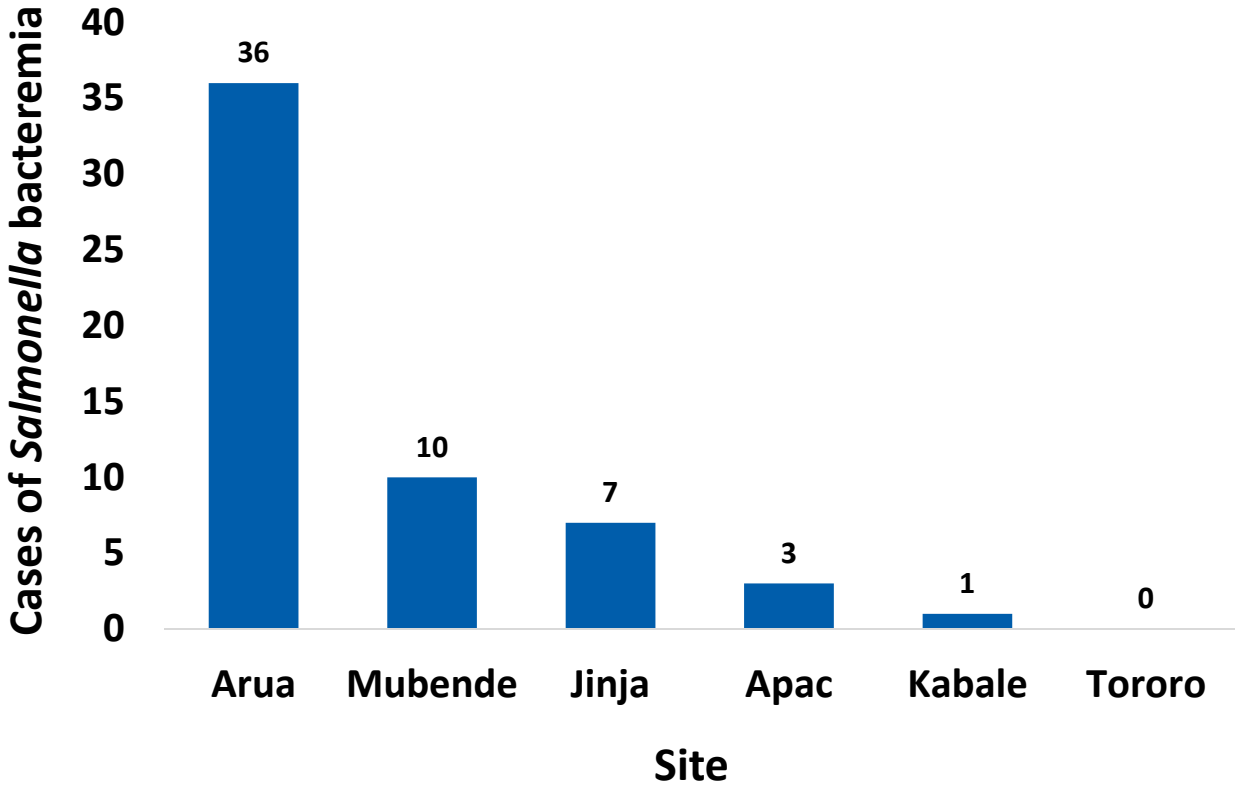
Risk factors previously associated with iNTS

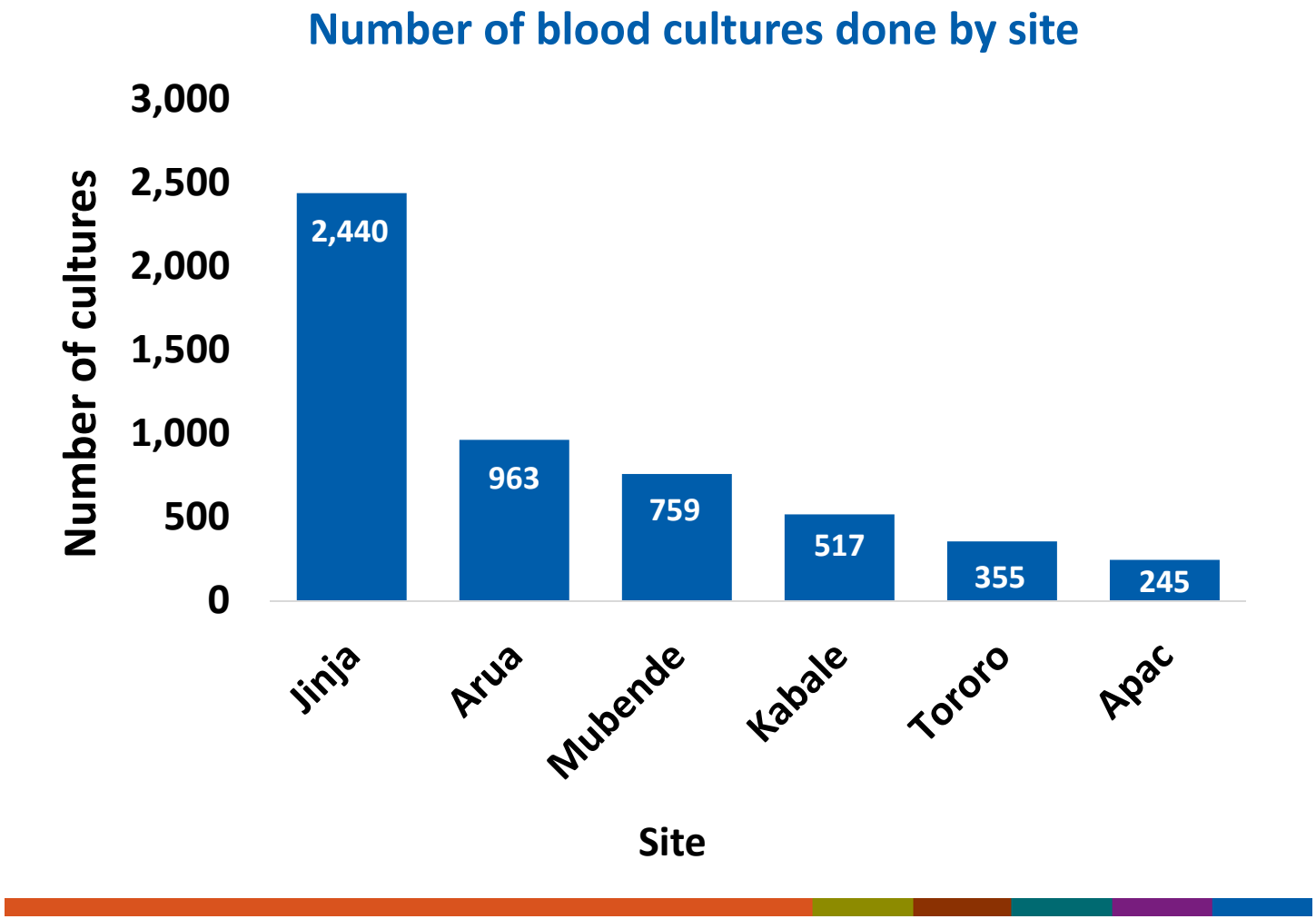
- **HIV infection**
- **Malnutrition**
- **Malaria**
- **Young age**
- **Anemia**
- **Rural setting**

Contaminants

- CONS
- Corynebacterium
- Bacillus
- Micrococcus
- Strep viridans
- "bloodcultureresult" = 2 “contaminant” with no organism identified

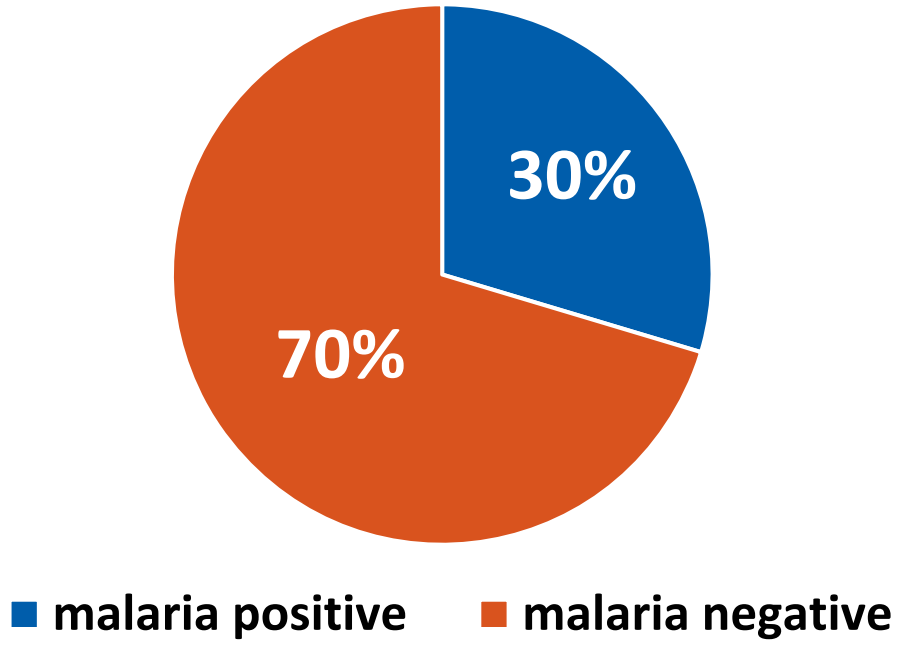
Number of children with *Salmonella* bacteremia by site (Uganda AFI project: Jul 2016 – Nov 2017) n=57



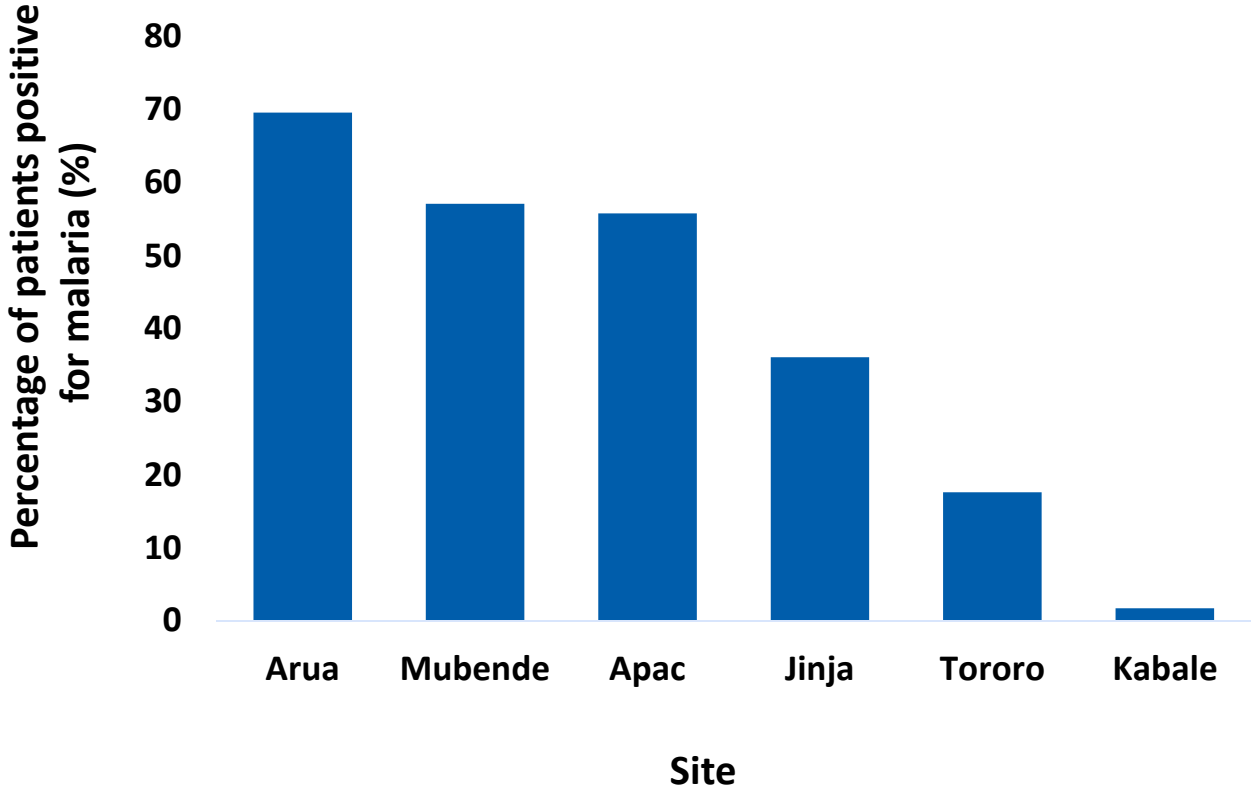

Number of blood cultures done by site
Number of cultures
3,000
2,500
2,000
1,500
1,000
500
0
2,440
963
759
517
355
245
Jinja
Arua
Mubende
Kabale
Tororo
Apac
Site

Malaria

Proportion of *Salmonella* bacteremia patients positive for malaria
Uganda AFI Project: Jul 2016 – Nov 2017
n=54

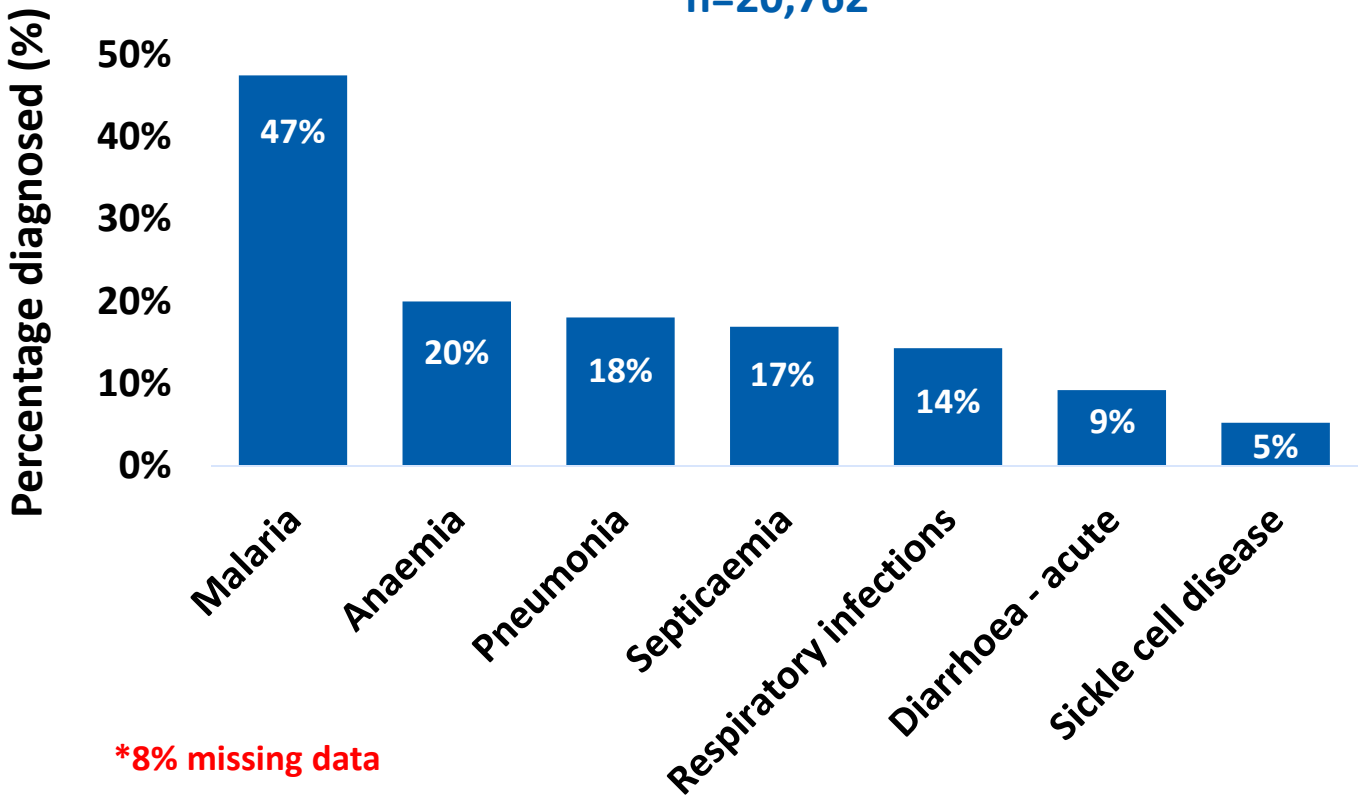


Proportion of tested patients positive for malaria, by site
Uganda AFI Project: Jul 2016 – Nov 2017
n=19,882



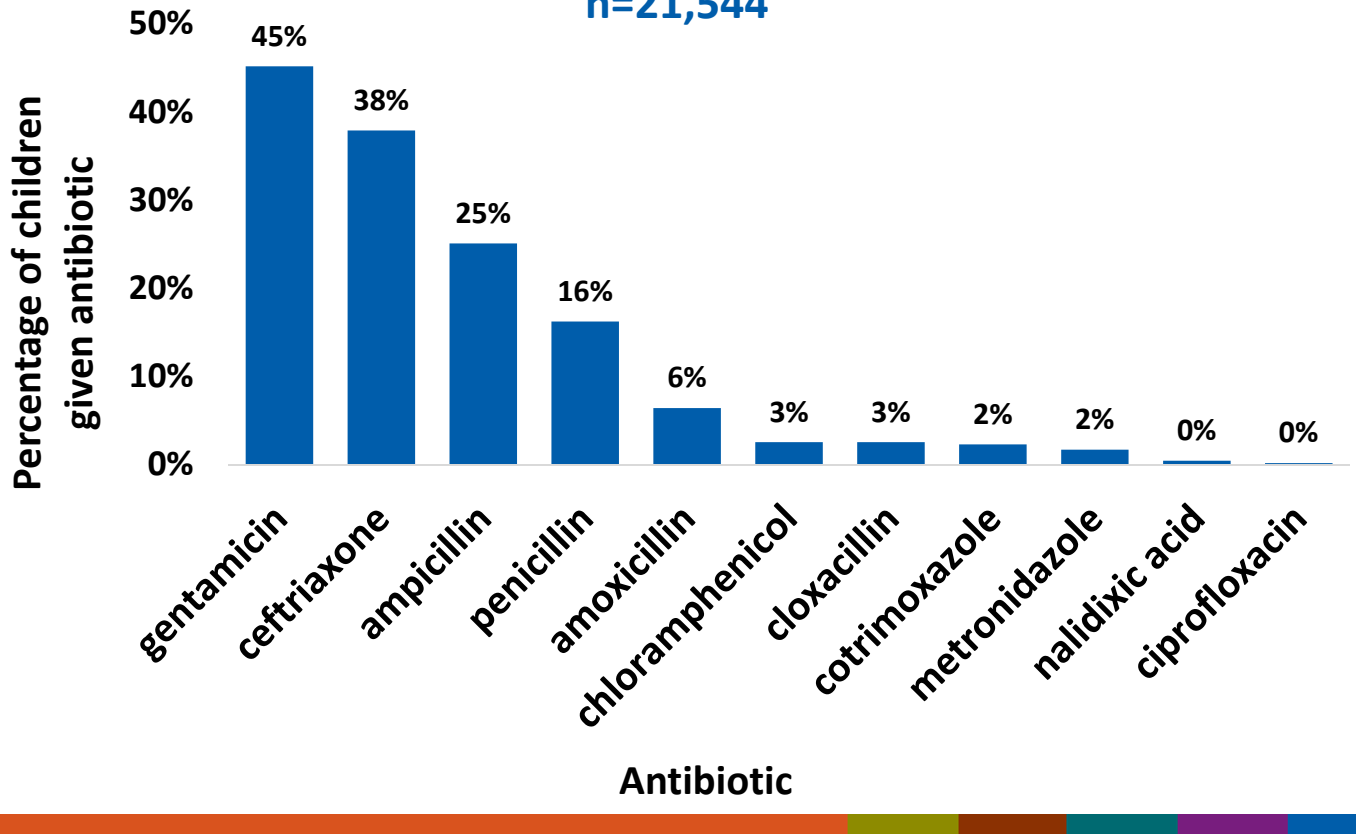
Diagnoses/Antibiotics

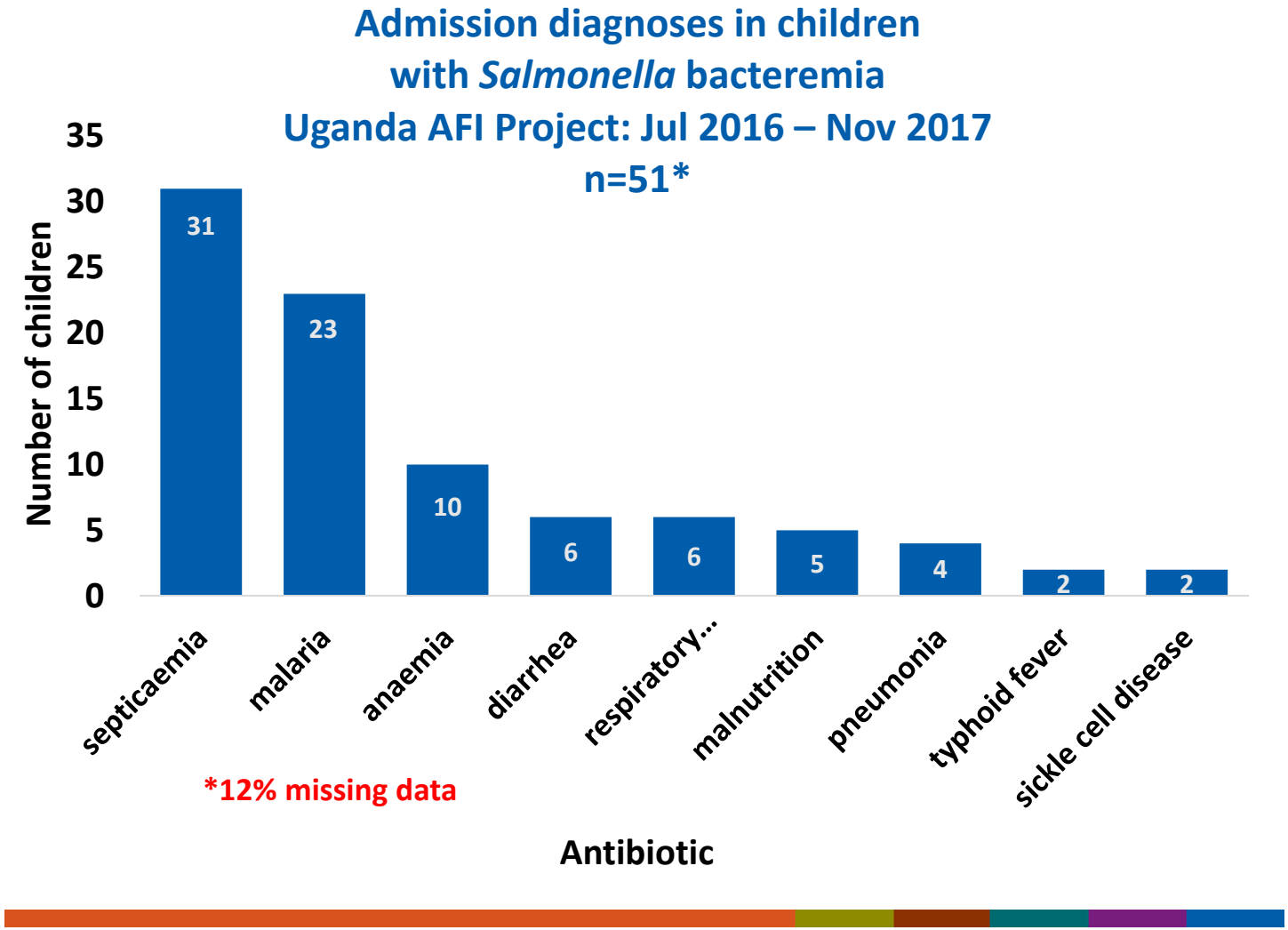
Most common admission diagnoses of all children
Uganda AFI Project: Jul 2016 – Nov 2017
n=20,762*



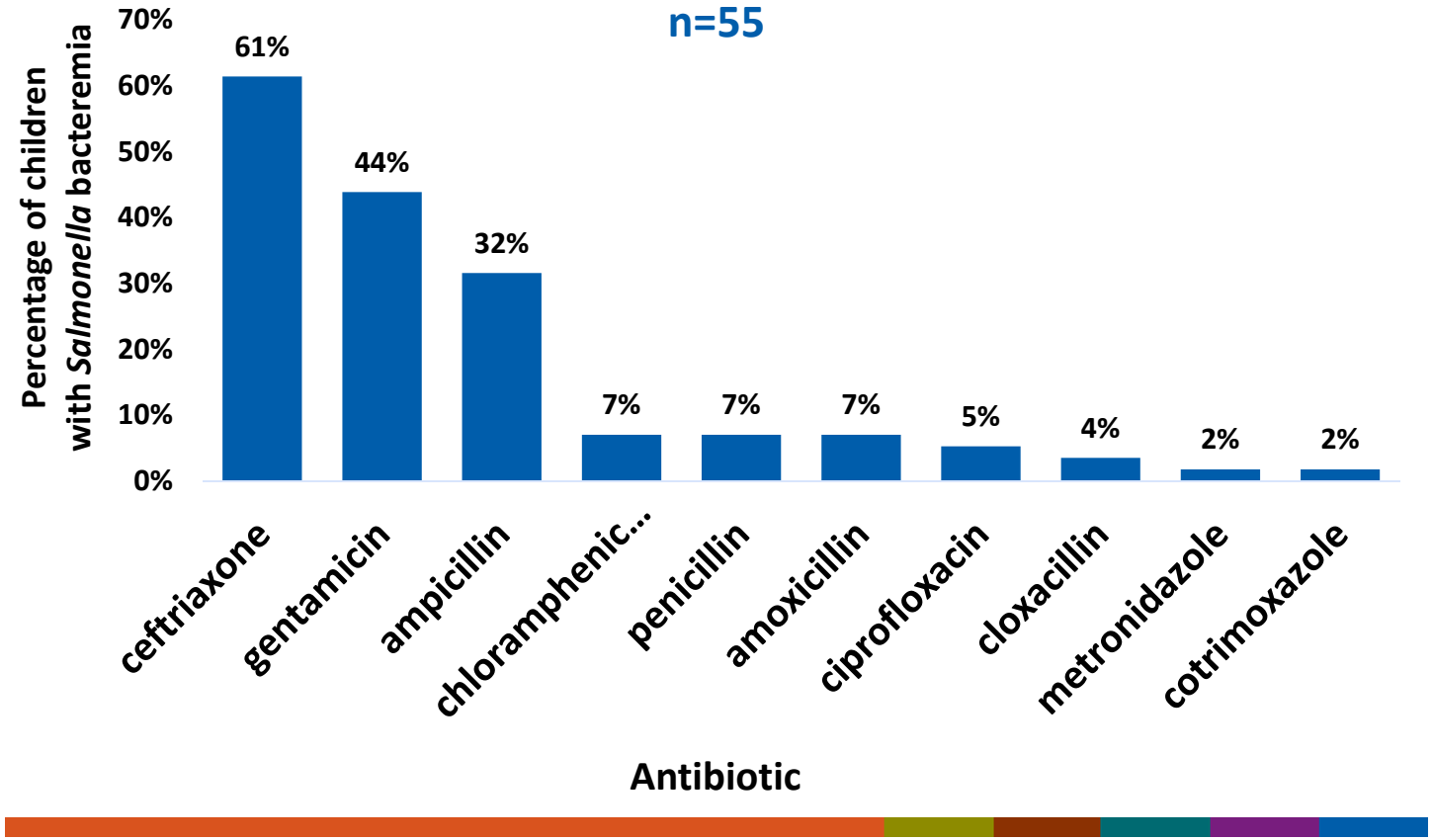
*8% missing data

Most common antibacterial medications given to all hospitalized children
Uganda AFI Project: Jul 2016 – Nov 2017
n=21,544




Admission diagnoses in children
with Salmonella bacteremia
Uganda AFI Project: Jul 2016 – Nov 2017
n=51*
Number of children
35
30
25
20
15
10
5
0
31
23
10
6
6
5
4
2
2
septicaemia
malaria
anaemia
diarrhea
respiratory...
malnutrition
pneumonia
typhoid fever
sickle cell disease
*12% missing data
Antibiotic

Antibacterial medications received by children with *Salmonella* bacteremia
Uganda AFI Project: Jul 2016 – Nov 2017
n=55



Salmonella deaths

Description of deaths with *Salmonella* bacteremia

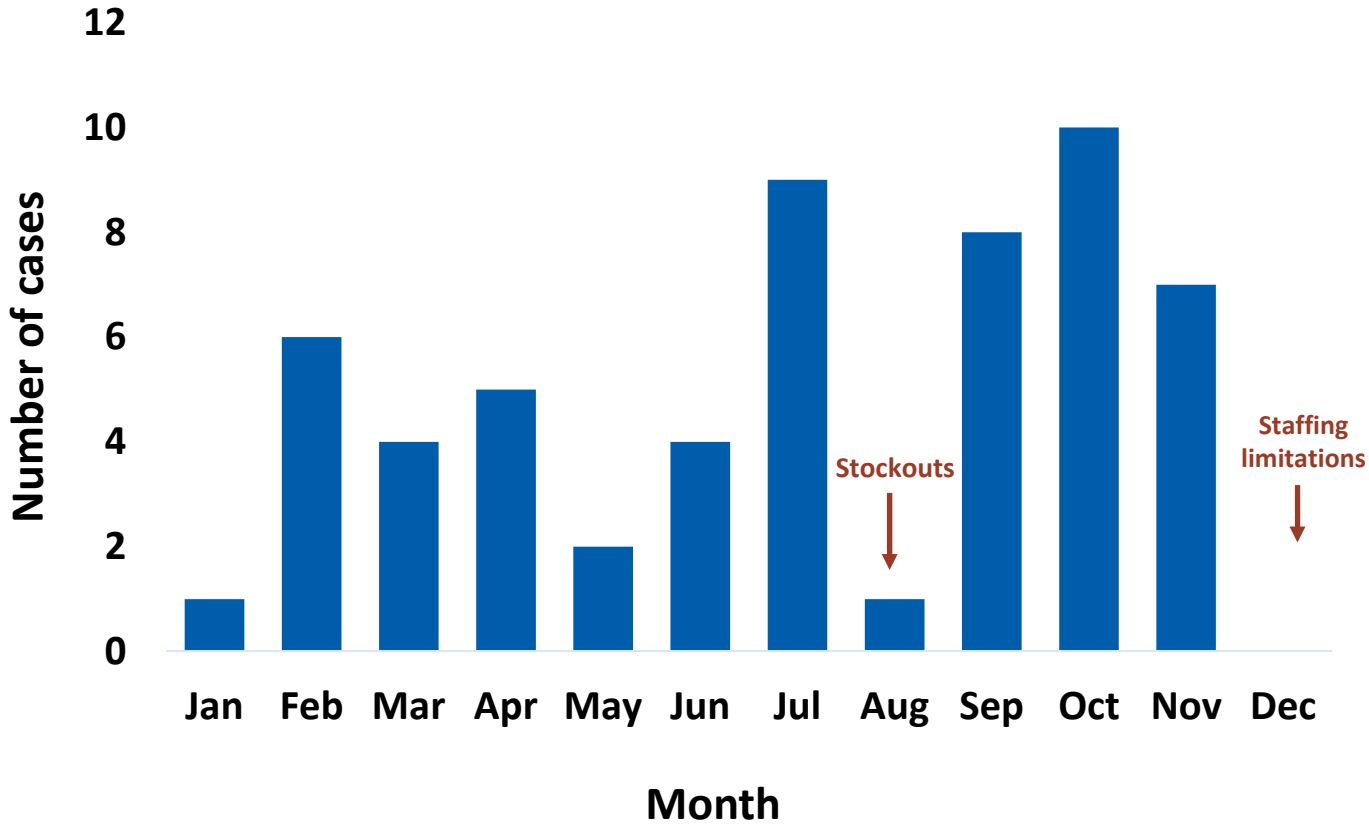
Age in years	Sex	Location	Length of stay in days	Lab test positive for malaria	Diagnoses	Medications given
7	Male	Arua	16	Yes	Severe malaria Sickle cell disease Anemia Respiratory infection	artesunate IV penicillin IV amoxicillin oral
1	Male	Arua	6	Yes	Severe malaria Septicaemia	artesunate IV
3	Male	Jinja	1	No	Pneumonia	artesunate IV gentamicin ampicillin

Antimicrobial susceptibility patterns of children who died with *Salmonella* bacteremia

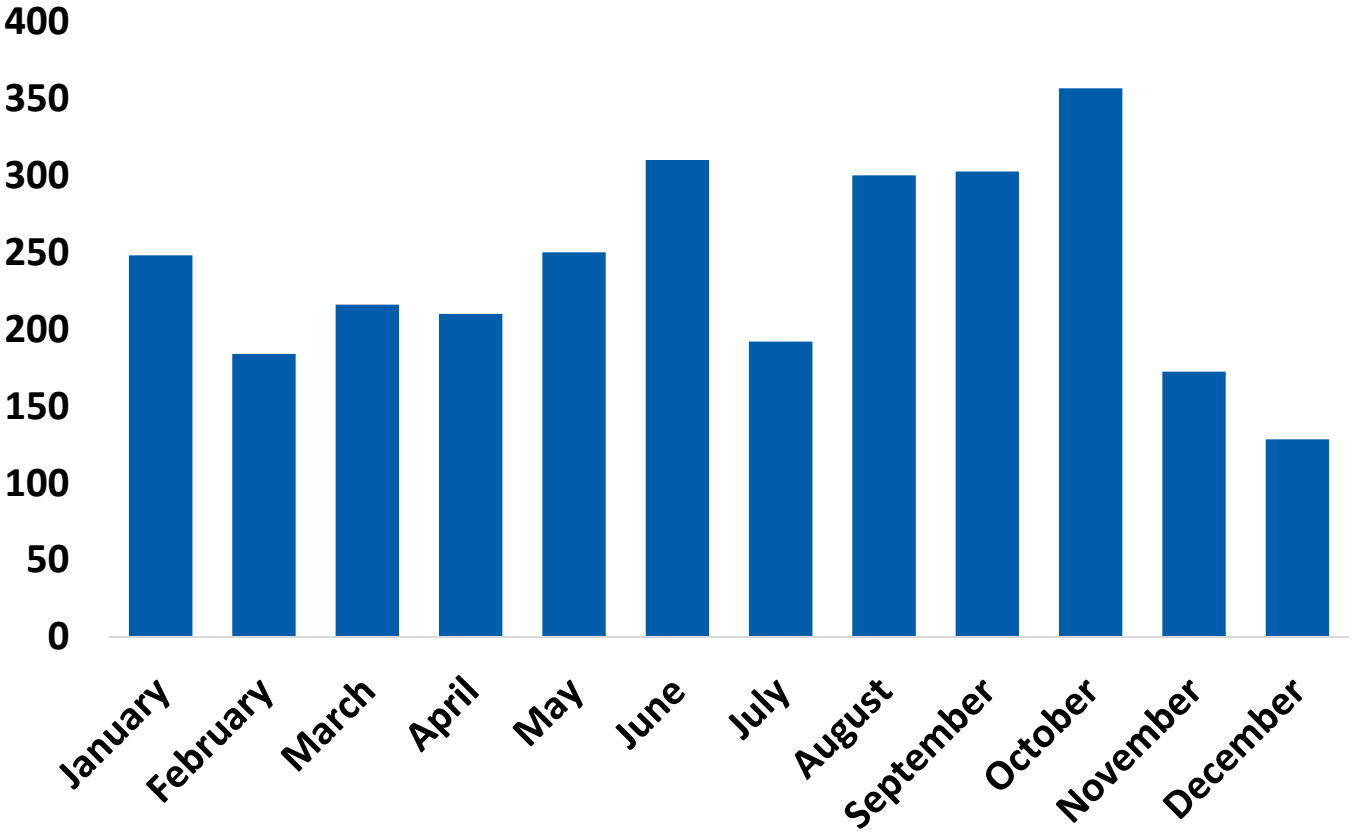
	ampicillin	cotrimoxazole	ciprofloxacin	ceftriaxone
Child 1	resistant	resistant	susceptible	resistant
Child 2	susceptible		susceptible	
Child 3	susceptible	resistant	susceptible	intermediate

Seasonality

Salmonella cases by month



Children included in Uganda AFI project in Arua, by month (average)



Number of children diagnosed with *Salmonella* bacteremia in Arua, by month (average)