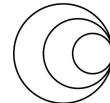


# Day 1: Session 3: Practical approaches - translation of genomics into public health intervention

Tapfumanei Mashe,  
Luria Leslie Founou,  
Francis Chikuse

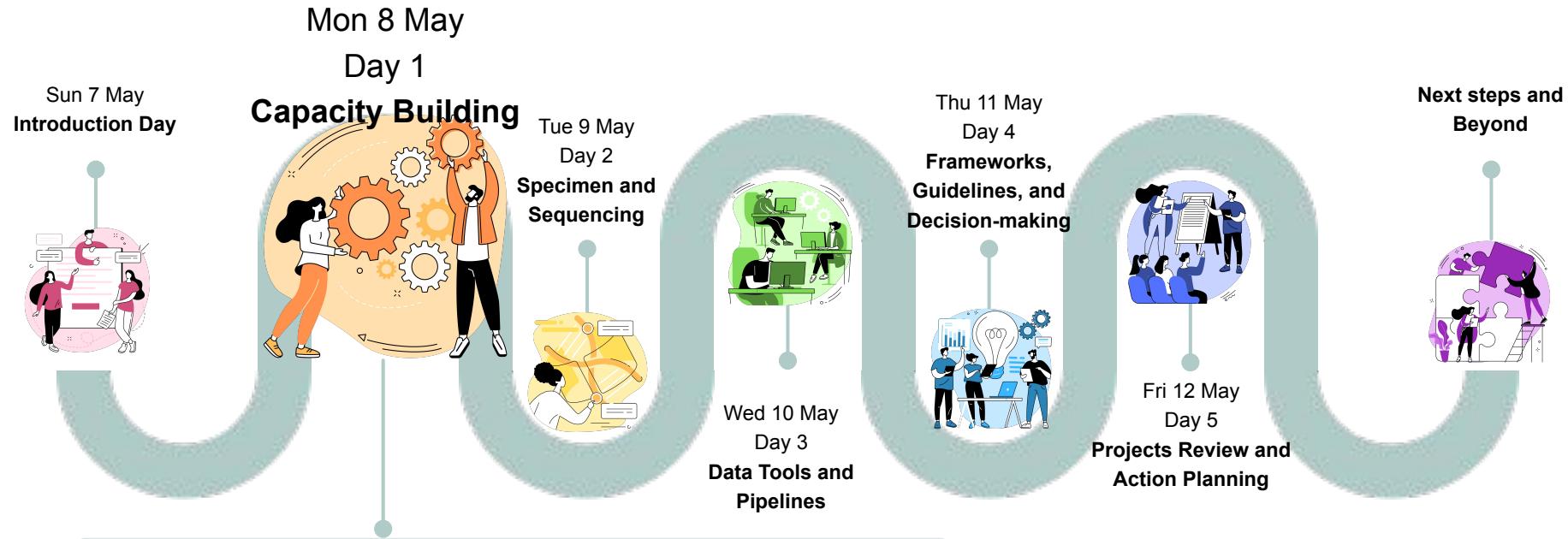


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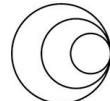
# Course roadmap



Introduction

Overview of basic concepts

Case studies



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# Session objectives and outcomes

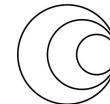
## Objective

To showcase case studies about translation of genomics research into public health interventions including mass vaccination, disease surveillance and drug resistance monitoring

- Monitoring cholera outbreak and vaccination - Tapfumanei
- AMR surveillance - Luria
- The Africa CDC use cases for pathogen genomics - Francis

## Outcomes

Awareness and discussions about how various countries are applying genomics in public health



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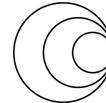
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# Translating genomics research into public health interventions: A Case of Zimbabwe

Tapfumanei Mashe



**World Health Organization**

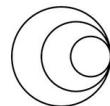
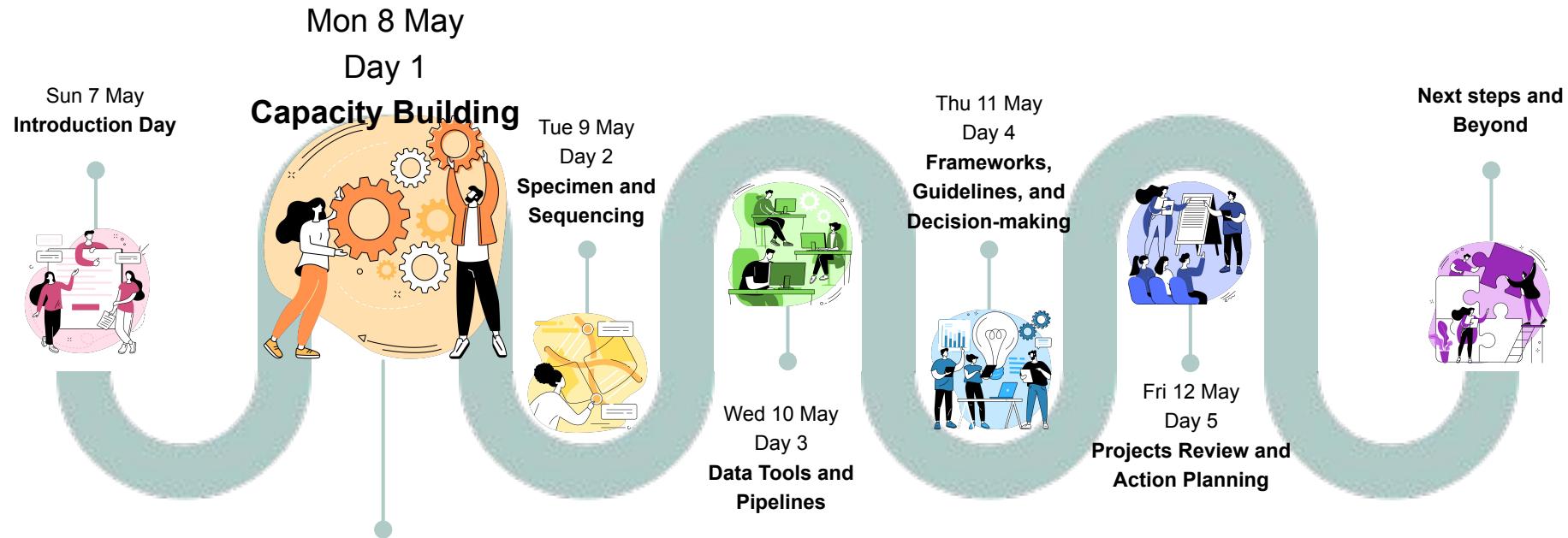


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# Course roadmap



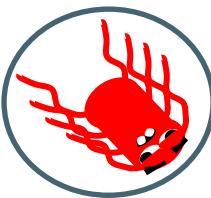
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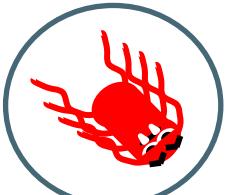
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# Cholera: Case Study 1

Cholera (2008-09)  
98 592 cases  
4 288 deaths



Cholera (2010-11)  
2 162 cases  
0 deaths



Cholera (2018-19)  
10,730 cases  
69 deaths



Oral rehydration therapy



Antimicrobials



WASH



VACCINATION

1.5 million people vaccinated



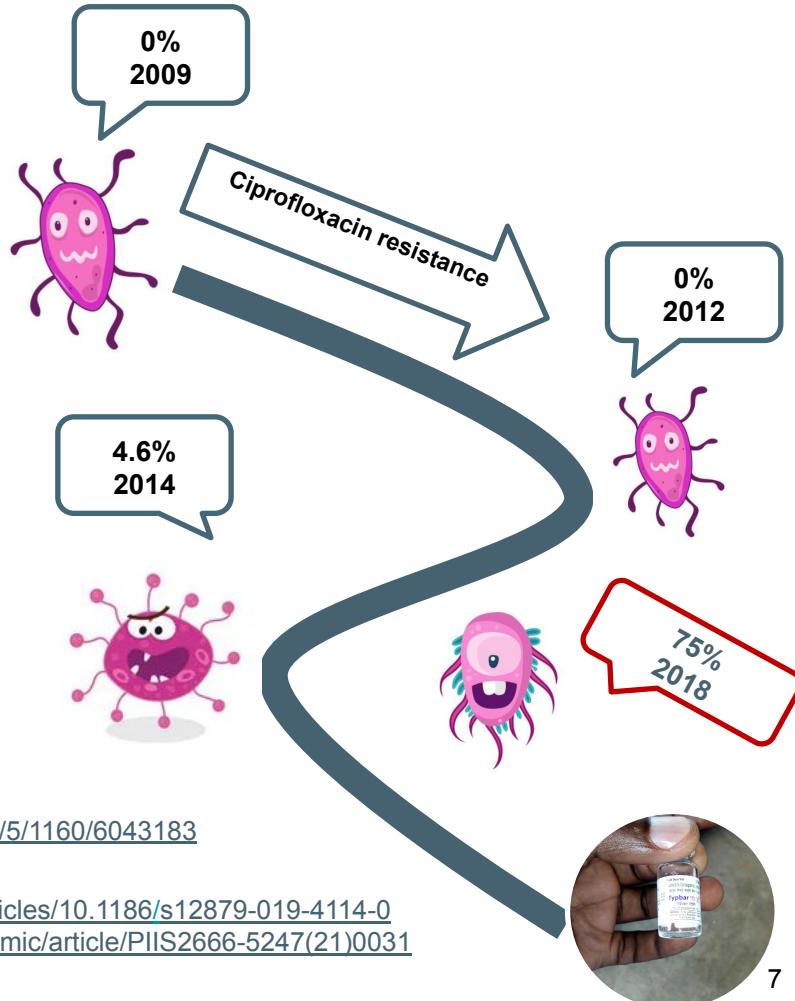
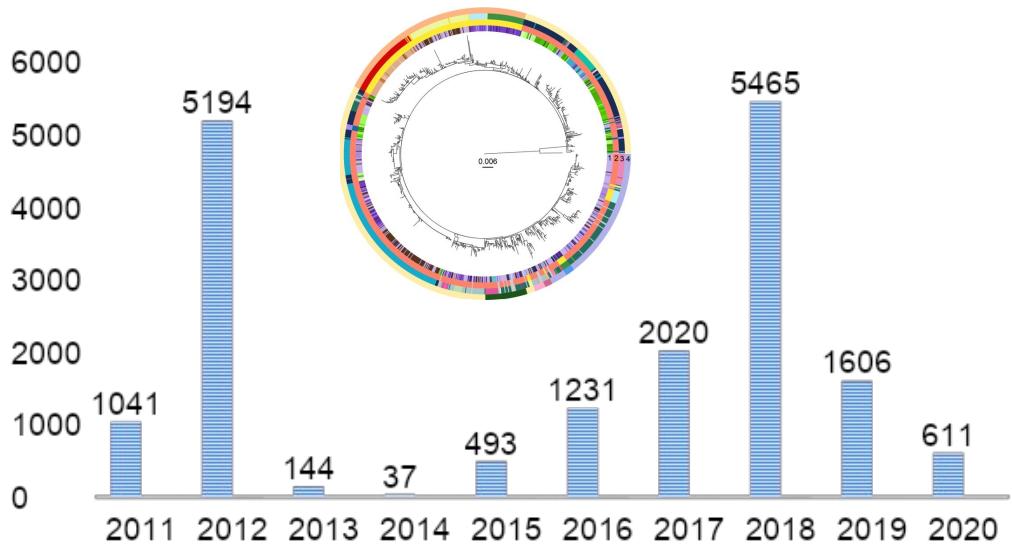
Zimbabwe Cholera outbreaks

Genomic sequencing

Mitigation measures

1. <https://www.nejm.org/doi/full/10.1056/NEJMc2004773>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9887696/>

# Typhoid: Case Study 2



## Mitigation measures

- Antimicrobials
- WASH
- Waste management
- **Vaccination**

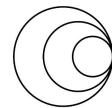
1. <https://academic.oup.com/jac/article/76/5/1160/6043183>
2. <https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-019-4114-0>
3. [https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247\(21\)00311-6/fulltext](https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247(21)00311-6/fulltext)



Establishing Capacity for Pathogen Genomics  
Addis Ababa, Ethiopia, May 2023



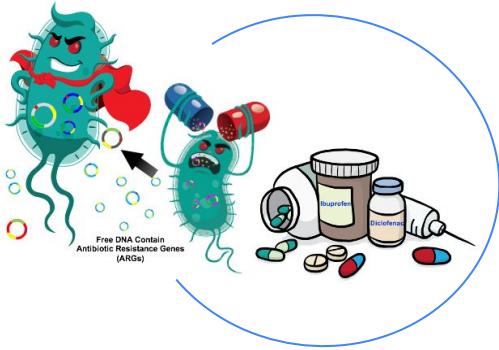
World Health Organization



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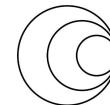


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# Genomics for Antimicrobial Resistance Surveillance in Africa

Luria Leslie Founou



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# Antimicrobial resistance – global public health threat



Establishing Capacity for Pathogen Genomics  
Addis Ababa, Ethiopia, May 2023

## AMR (Anti-Microbial Resistance)

### A silent pandemic

(Projections if Action Not Taken)

2019

Claimed  
1.2 Mn lives  
globally

2030

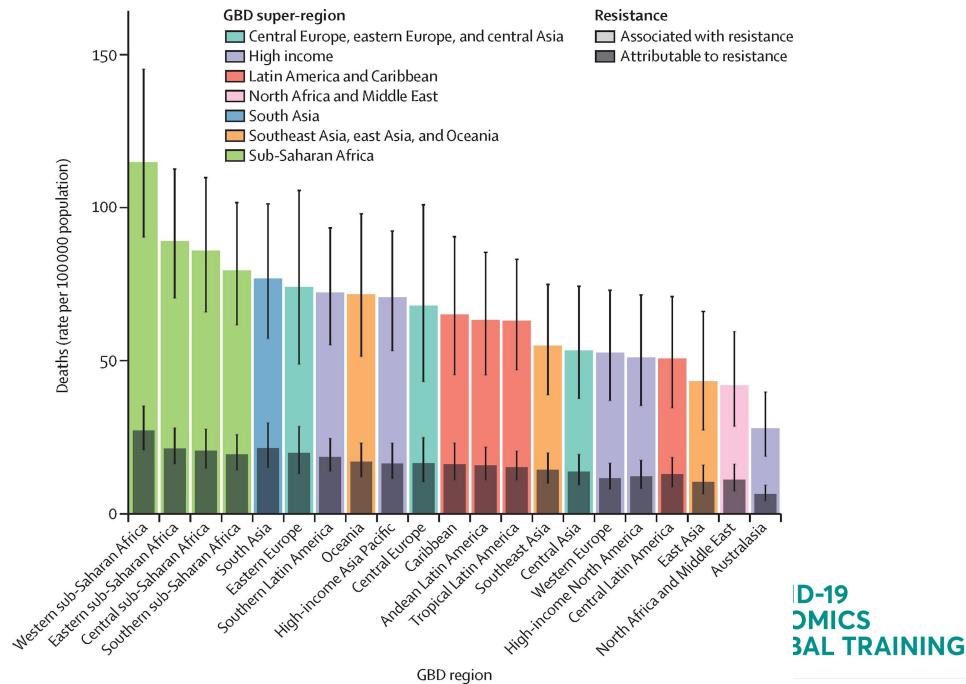
Force up to  
24 Mn people  
into extreme  
poverty

2050

10 Mn yearly deaths  
Catastrophic damage  
to global economy  
Fall in global GDP  
by 2% - 3.5%



- In 2019, leading cause of deaths worldwide
  - **1.27 million deaths** directly attributable to bacterial AMR
  - **AMR > HIV+Malaria**
- Affect animals, humans and the environment □ One Health issue



The Review on Antimicrobial Resistance. 2022.

Murray et al., 2022. Lancet.

[https://doi.org/10.1016/S0140-6736\(21\)02724-0](https://doi.org/10.1016/S0140-6736(21)02724-0)

# AMR Surveillance in the food chain

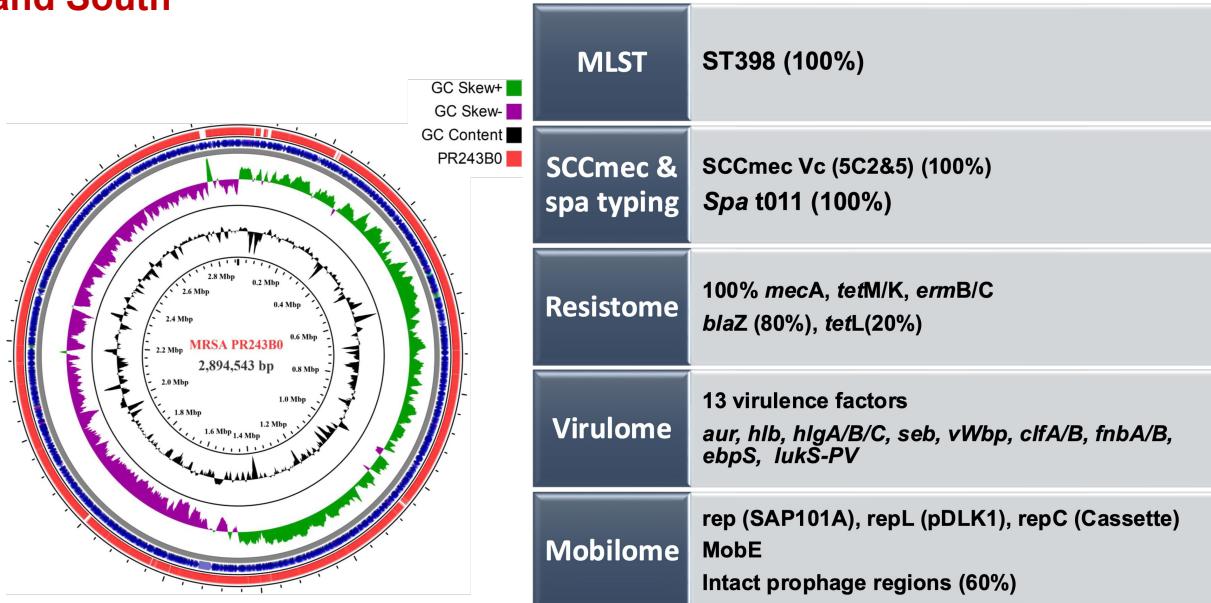
Establishing Capacity for Pathogen Genomics  
Addis Ababa, Ethiopia, May 2023

## 1st report of LA-MRSA in Cameroon and South Africa

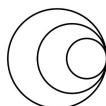
Founou LL, et al., 2019. Zoonoses Public Health  
doi: 10.1111/zph.12586



Credit: CEDBCAM-RI



- Pigs and exposed workers
- Methicillin resistant *Staphylococcus aureus*
- Abattoirs in Cameroon and South Africa



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# MDR/ESBL *Enterobacteriales* in mothers and neonates

Transmission dynamics of *E. coli* and *K. pneumoniae* in a maternity ward in Cameroon



Axelle Njeuna

Master student  
(2022)

Mothers	Neonates
<ul style="list-style-type: none"><li>ESBL-PE: 47% (183/389)</li></ul>	<ul style="list-style-type: none"><li>ESBL-PE: 17% (59/347)</li></ul>
<ul style="list-style-type: none"><li><i>E. coli</i> (52%) &amp; <i>K. pneumoniae</i> (47%)</li></ul>	<ul style="list-style-type: none"><li><i>E. coli</i> (63%) &amp; <i>K. pneumoniae</i> (36%)</li></ul>
<ul style="list-style-type: none"><li>ESBL-NF: 4.4% (17/389)</li></ul>	<ul style="list-style-type: none"><li>ESBL-NF: 9.8% (34/347)</li></ul>

Horizontal transmission important transmission routes of ESBL-PE in maternity wards that should not be neglected

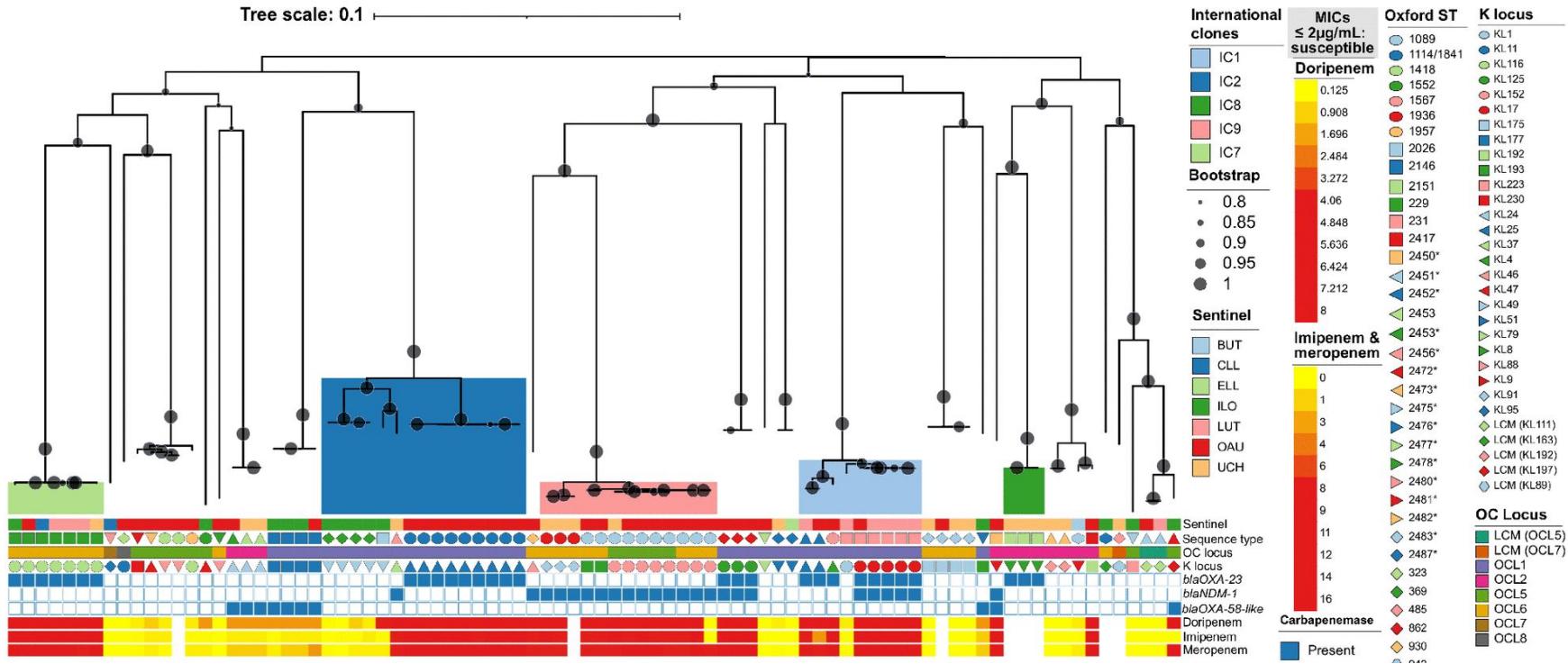
Njeuna, Founou et al., Unpublished data

Establishing Capacity for Pathogen Genomics

Addis Ababa, Ethiopia

ID Code	Bacteria	Source	ESBL	MDR	Collection Date
PO289B	<i>E. coli</i>	Mother	No	Yes	20/03/2022
N2249A	<i>E. coli</i>	Newborn	No	No	09/03/2022
N2247	<i>E. coli</i>	Newborn	No	No	08/03/2022
N2246	<i>E. coli</i>	Newborn	No	No	08/03/2022
PO284A	<i>E. coli</i>	Mother	No	Yes	18/03/2022
N2235	<i>E. coli</i>	Newborn	No	Yes	06/03/2022
PO285	<i>E. coli</i>	Mother	No	No	18/03/2022
PO286C	<i>E. coli</i>	Mother	No	Yes	02/03/2022
PO276B	<i>E. coli</i>	Mother	Yes	Yes	16/03/2022
PO277A	<i>E. coli</i>	Mother	Yes	Yes	16/03/2022
PO276A	<i>E. coli</i>	Mother	Yes	Yes	16/03/2022
PO289A	<i>E. coli</i>	Mother	Yes	Yes	20/03/2022
PO228	<i>E. coli</i>	Mother	Yes	Yes	02/03/2022
PO224	<i>E. coli</i>	Mother	Yes	Yes	28/02/2022
PO230A	<i>E. coli</i>	Mother	No	No	02/03/2022
PO229	<i>E. coli</i>	Mother	No	Yes	02/03/2022
POOL 9B	<i>E. coli</i>	Environment	No	No	24/03/2022
N2231A	<i>E. coli</i>	Newborn	No	No	04/03/2022
PO242A	<i>E. coli</i>	Mother	No	Yes	06/03/2022
PO225A	<i>E. coli</i>	Mother	No	No	01/03/2022
PO208B	<i>E. coli</i>	Mother	No	No	24/02/2022
PO206	<i>E. coli</i>	Mother	No	No	22/02/2022
PO213C	<i>E. coli</i>	Mother	No	No	26/02/2022
PO210B	<i>E. coli</i>	Mother	No	Yes	26/02/2022
PO212B	<i>E. coli</i>	Mother	No	Yes	28/02/2022
PO200B	<i>E. coli</i>	Mother	No	No	21/02/2022
PO295C	<i>E. coli</i>	Mother	Yes	Yes	22/03/2022
PO234B	<i>E. coli</i>	Mother	No	Yes	06/03/2022
PO234A	<i>E. coli</i>	Mother	No	Yes	06/03/2022
PO227A	<i>E. coli</i>	Mother	No	No	02/03/2022
N2281	<i>E. coli</i>	Newborn	No	No	18/03/2022
PO200A	<i>E. coli</i>	Mother	No	No	21/02/2022
PO233A	<i>E. coli</i>	Mother	No	No	06/03/2022
PO214	<i>E. coli</i>	Mother	No	No	26/02/2022
PO202	<i>E. coli</i>	Mother	No	No	21/02/2022
PO237A	<i>E. coli</i>	Mother	No	Yes	06/03/2022
PO281	<i>E. coli</i>	Mother	Yes	Yes	18/03/2022
PO246A	<i>E. coli</i>	Mother	Yes	Yes	08/03/2022
PO235A	<i>E. coli</i>	Mother	Yes	Yes	06/03/2022
PO236	<i>E. coli</i>	Mother	No	No	06/03/2022
PO233B	<i>E. coli</i>	Mother	Yes	Yes	06/03/2022
PO298A	<i>E. coli</i>	Mother	Yes	Yes	24/03/2022
PO299A	<i>E. coli</i>	Mother	Yes	Yes	24/03/2022
PO280A	<i>E. coli</i>	Mother	Yes	Yes	18/03/2022
PO282	<i>E. coli</i>	Mother	Yes	Yes	18/03/2022
PO253A	<i>E. coli</i>	Mother	Yes	Yes	10/03/2022
PO254A	<i>E. coli</i>	Mother	Yes	Yes	10/03/2022
PO48	<i>E. coli</i>	Mother	Yes	No	12/03/2022
PO223A	<i>E. coli</i>	Mother	Yes	No	01/03/2022
PO222	<i>E. coli</i>	Mother	Yes	No	01/03/2022
PO237B	<i>E. coli</i>	Mother	Yes	Yes	06/03/2022
N2260	<i>E. coli</i>	Newborn	No	Yes	25/03/2022
N2264A	<i>E. coli</i>	Newborn	No	Yes	12/03/2022
PO219A	<i>E. coli</i>	Mother	Yes	Yes	28/02/2022
PO221A	<i>E. coli</i>	Mother	No	Yes	28/02/2022
PO218A	<i>E. coli</i>	Mother	Yes	Yes	28/02/2022
PO209A	<i>E. coli</i>	Mother	Yes	Yes	24/02/2022

# Acinetobacter ICU Outbreak



Investigating hospital outbreaks of  
resistant bacteria in Nigeria

Erkison Ewomazino Odih et al. 2023. *mSphere*.  
Doi: <https://doi.org/10.1128/mSphere.00098-23>

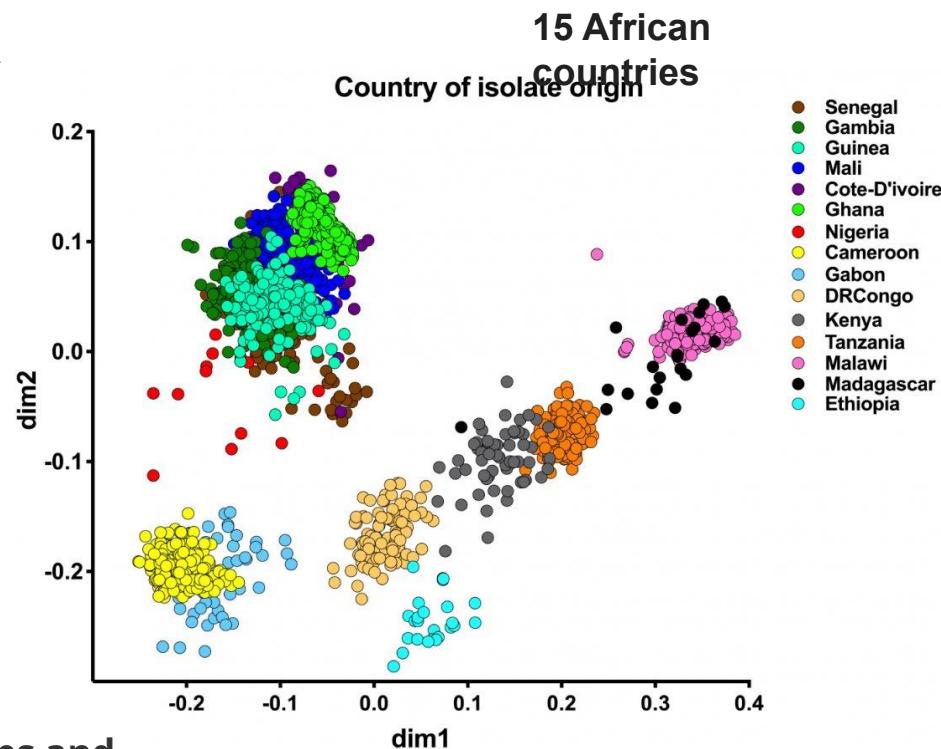
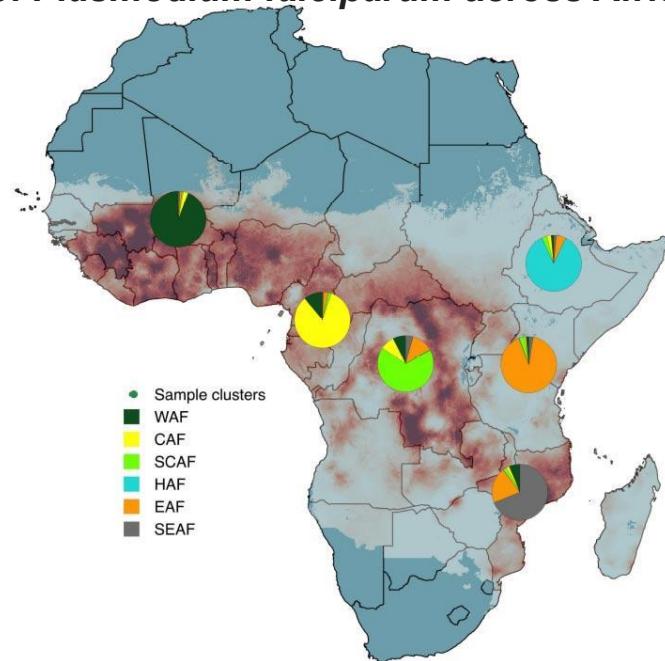
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# Malaria — Tracking drug resistance in Africa

Understanding genomic variation and population structure of *Plasmodium falciparum* across Africa



Drug resistance is emerging in different locations and moving by various routes across Africa

Alfred Amambua-Ngwa et al., 2019.  
Science. doi: 10.1126/science.aav5427.



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