Genomic Analysis of Lassa Virus during an Increase in Cases in Nigeria in 2018.

*Relevance for Vaccine Development and Design of Targeted Epidemiology Studies.*

Christian Happi
Director, African Centre of Excellence for Genomics of Infectious Diseases
Redeemer’s University, Ede, Nigeria
Recent Collaborations
- Stanford University
- University of Connecticut
- University of Nebraska
- US Department of Defense
- University of Cambridge
- University of Edinburgh
- Lagos State Government
- NCDC
Where we work in West Africa

Sites in Sierra Leone and Nigeria

Augustine Goba
First EVD Sierra Leone
May 25, 2014

Christian Happi
First EVD Nigeria
July 20, 2014
Lassa fever, a poorly understood threat

- Viral hemorrhagic fever, endemic in Nigeria
- 15-60% mortality in hospitalized cases
- Highly genetically diverse
- Primarily transmitted by rodents, but also human-to-human (including nosocomial)
- Poor diagnostics and therapeutics, no vaccine
- CEPI and WHO priority for vaccine development
Lassa fever outbreak, Nigeria 2018

At least 78 dead in Lassa fever outbreak in Nigeria

By Bukola Adebayo, CNN
Updated 2:34 PM ET, Tue March 6, 2018

Why is Nigeria Experiencing a Record-High Outbreak of Lassa Fever?
More people have been diagnosed with the viral disease in the first two months of 2018 than in all of 2017.

Nigeria hit by unprecedented Lassa fever outbreak

Leslie Roberts
See all authors and affiliations
Science 16 Mar 2018:
Vol. 359, Issue 6381, pp. 1201-1202
DOI: 10.1126/science.359.6381.1201

Nigeria Faces Mystifying Spike In Deadly Lassa Fever

JASON BEAUBIEN
A public health emergency

Urgent public health questions to understand the outbreak:

- *Is this a new variant? or more virulent strain?*
- *Is human-to-human transmission increasing?*
- *Are our diagnostics effective?*

PCR confirmed Lassa fever cases at ISTH, Nigeria
Local, real-time genomics response

Distribution of Confirmed Lassa Fever cases, NCDC situation report, March 2018
Genomic data addresses key public health questions

- No evidence of a particular viral strain or mutation
- No evidence of increased or sustained human-to-human transmission
- Multiple introductions of genetically independent viruses similar to known lineages in Nigeria
Genomics improves understanding of Lassa virus populations across Nigeria

Lassa virus genetic diversity in Nigeria is structured geographically, following major rivers
Informing the outbreak response

- Findings shared with Nigerian CDC
- Genomic data released openly for scientific community in real time

Currently, three laboratories at Abuja, Irrua and Lagos are operational and testing samples for Lassa fever by polymerase chain reaction (PCR). Phylogenetic analysis of 49 viruses detected during the 2018 outbreak, provided through ongoing collaborations between Irrua Specialist Teaching Hospital, Bernhard Nocht Institute of Tropical Medicine, African Center of Excellence for Genomics of Infectious Disease (ACEGID), and Redeemer’s University, has shown evidence of multiple, independent introductions of different viruses and viruses similar to previously circulating lineages identified in Nigeria. This is indicative that the main mode of transmission is through spillover from the rodent population, and limited human to human transmission.

WHO report
April 20, 2018
It’s all about the rodent transmission.
Lassa fever Genetic Diversity in Rodents in Abakaliki, Nigeria
Our approach: user-driven tech development

**ENHANCING IN -COUNTRY SEQUENCING**

- Reduces cost to assemble microbial genomes from clinical samples
- Increases sample throughput and shortens time to results

![Graph showing viral genomes assembled](image1.png)

Metsky et al., bioRxiv, 2018
https://doi.org/10.1101/279570

**EMPOWERING IN -COUNTRY DATA ANALYSIS**

- Real-time data upload and analysis
- Robust to internet interruptions
- Promotes collaboration
- Easy to learn and use

![Flowchart of data analysis](image2.png)

DNAanexus
## Our approach: sustainable training and capacity building in Genomics

<table>
<thead>
<tr>
<th>TRAININGS</th>
<th>TOTAL</th>
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<tbody>
<tr>
<td>Total Trainees</td>
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<tr>
<td>Short Courses</td>
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<td>Master’s Degree</td>
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<tr>
<td>Doctoral Degree</td>
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Viral Hemorrhagic Fever Consortium

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