Seroprevalence and risk factors of Lassa fever infection in Nasarawa State, Nigeria – 2013

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Outline

• Background
• Methodology
• Results
• Conclusion
• Lassa fever is an epidemic-prone zoonotic viral haemorrhagic disease

• It is caused by Lassa fever virus (LFV) – member of the Arenaviridae family

• Reservoir: Mastomys natalensis, the multimammate, peridomestic rat

• Endemic in Nigeria, Liberia, Sierra Leone, and Guinea

• Circulating in Mali and Cote d’Ivoire
Background 2/3

• In West Africa, 300,000-500,000 cases and 5000 deaths yearly

• Case-fatality rate:
  – 1-2% overall
  – 20% in hospitalized patients
  – 50% during epidemics
  – 70-80% in third trimester pregnancy
  – >90% rate of foetal loss
• Exported to Europe and North America (US, UK, Germany, France)
• Affects both sexes and all age-groups
• Seasonal clustering in the dry months with nosocomial spread
• Transmission
  – Rodent-to-human
  – Human-to-human
Biosafety and surveillance

- No vaccine for prevention
- Treatment only effective if instituted early
- Classified as category A bioweapon by US CDC and NIAID
- Designated Biosafety level 4 (BSL-4)
- Designated a priority disease in the National Technical Guidelines for IDSR
Justification

• IDSR collects limited information
• Limited in-country laboratory capacity
• Many cases are missed
• Knowledge gap in magnitude and geographical pattern of exposure to the virus, risk factors
• Nasarawa is a high risk state that has reported cases of Lassa fever over the years
Objectives

1. To determine the prevalence of LFV IgG and IgM antibodies in the sera of selected residents of Nasarawa State

2. To determine the prevalence of known risk factors to Lassa fever infection in the state

3. To determine the factors associated with testing positive for Lassa fever antibodies in the state
Methodology
Study area

- Nasarawa State – north-central Nigeria
- Population: 1,869,377
  - predominantly farmers
- Land size: 27,271 km²
- Comprises 13 Local Government Areas (LGA) divided into wards
- Lacks laboratory capacity for Lassa fever diagnosis
Map of Nigeria highlighting Nasarawa State
Study design and methods

• Cross-sectional study

• Demographic and risk factor data collected via a pre-tested interviewer-administered questionnaire

• Laboratory methods
  – Blood samples obtained and tested for IgG & IgM antibodies to Lassa fever virus using ELISA technique
Study population

• Residents of Nasarawa State in selected LGAs and wards

• **Inclusion criterion**: having resided in Nasarawa State for one year by day of interview

• **Exclusion criterion**: children less than 5 years of age
Sample size calculation

\[ n = \frac{(Z_{1-\alpha/2})^2 \times p \times q}{d^2} \]

Where:

- \( n \) = minimum sample size
- \( Z_{1-\alpha/2} \) = 1.96, \( p = 0.21^* \)
- \( q = 0.79 \), \( d = 0.04 \)

\( n \approx 398 \)  
(↑420)

*Tomori et al 1988
Sampling technique

- Multistage sampling
- Simple random sampling at state, LGA, ward and household levels
  - State level – 6 LGAs selected out of 13
  - LGA level – 7 wards selected out of 10-13
  - Ward level – 1 household
  - Household – 1 respondent
Data collection

• Socio-demographic and risk factor data collected by trained field assistants:
  – age, sex, occupation, marital status
  – rats in the house, hunting of rodents, food storage

• Blood samples collected by local phlebotomists trained for the purpose

• Samples analyzed at the Institute of Lassa Fever Research and Control, Irrua
Data management 1/2

- Data entered in EpiInfo7™
- Data checked for consistency and cleaned
- Data analysis with EpiInfo7 and Microsoft Excel®
- Univariate analysis:
  - frequencies, proportions, means
- Bivariate analysis:
  - prevalence odds ratio
  - determine factors associated with seropositivity
  - $\chi^2$ test for statistical significance
Ethical considerations

- Ethical approval was obtained from Research Ethics Committee at the Nasarawa State Ministry of Health
- Informed consent was obtained before collecting data from respondents
- Every aspect of research was conducted mindful of best practices
Results
Socio-demographic characteristics

• 420 respondents were interviewed and had their blood taken
• Median age ≈ 35 years (IQR: 25-47.5).
• The male to female ratio was 1.8:1
• 73.4% had attended at least primary school
Clinical history

• None of the respondents had features suggestive of Lassa fever within the past fortnight or even one year by interview date.
## Prevalence of Lassa fever antibodies in Nasarawa State, Jan, 2013

<table>
<thead>
<tr>
<th>Antibody</th>
<th>Frequency (%), n=420</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Either IgG or IgM</td>
<td>76 (18.1)</td>
<td>14.6-22.2</td>
</tr>
<tr>
<td>IgG only</td>
<td>32 (7.6)</td>
<td>5.4-10.7</td>
</tr>
<tr>
<td>IgM only</td>
<td>46 (11.0)</td>
<td>8.2-14.4</td>
</tr>
<tr>
<td>Both IgG &amp; IgM</td>
<td>3 (0.7)</td>
<td>0.2-2.3</td>
</tr>
</tbody>
</table>
IgG seroprevalence by age group in Nasarawa State, Jan 2013

P=0.019
IgM seroprevalence by age group in Nasarawa State, Jan 2013

P = 0.0014
Seroprevalence by occupation in Nasarawa State, Jan 2013

Occupation

- Housewife
- Student
- Civil servant
- Businessman/trader
- Farmer
- Others

Prevalence of antibodies (%)

Prevalence of antibodies for IgG

Prevalence of antibodies for IgM

IgG

IgM
Seroprevalence by educational level in Nasarawa State, Jan 2013

Seroprevalence (%) by educational level attained:

- None
- Primary
- Secondary
- Tertiary

IgM and IgG levels compared across educational levels.
Seroprevalence by LGA in Nasarawa State, Jan 2013

Seroprevalence (%) vs LGA

LGA: Wamba, Karu, Keffi, Awe, Lafia, Nasarawa

IgM and IgG levels shown for each LGA.
Prevalence of risk factors of Lassa fever infection in Nasarawa State, Jan 2013

- Presence of rats in the house or immediate surroundings
- Drying food materials in the open
- Living in mud houses
- Consuming rats as protein source
- Leaving containers of food stuff uncovered
- Hunting rats

Risk factors

Percentage

0 50 100

0 50 100

28
### Factors associated with Lassa virus infection 1/2

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Seropositive</th>
<th>Seronegative</th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Presence of rats in homes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>74</td>
<td>317</td>
<td>2.10 (0.48-9.25)</td>
<td>0.32</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hunting rats</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>31</td>
<td>123</td>
<td>1.22 (0.73-2.04)</td>
<td>0.43</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
<td>219</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Consuming rats as protein</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>42</td>
<td>199</td>
<td>0.93 (0.56-1.56)</td>
<td>0.78</td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>141</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Factors associated with Lassa virus infection 2/2

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Seropositive</th>
<th>Seronegative</th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying food stuff in the open</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60</td>
<td>285</td>
<td>0.72 (0.38-1.36)</td>
<td>0.30</td>
</tr>
<tr>
<td>No</td>
<td>15</td>
<td>51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaving food stuff containers uncovered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>26</td>
<td>133</td>
<td>0.79 (0.47-1.33)</td>
<td>0.38</td>
</tr>
<tr>
<td>No</td>
<td>50</td>
<td>202</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building material of homes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mud</td>
<td>58</td>
<td>247</td>
<td>1.11 (0.62-2.02)</td>
<td>0.73</td>
</tr>
<tr>
<td>Cement</td>
<td>18</td>
<td>85</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion

• Seroprevalence close to previous national prevalence (21%)
• None of the seropositives had clinical history of Lassa fever
• IgM prevalence unexpectedly high, why?
• Nasarawa LGA: least IgG, highest IgM why?
• Known risk factors highly prevalent in the state
• None of the risk factors was statistically significant at 95% confidence level
Conclusion

- The seroprevalence of Lassa fever in Nasarawa State was found to be 18.1%
- The known risk factors for infection were found to be highly prevalent
- None of the risk factors was found to be statistically significantly associated with serological evidence of infection
THANK YOU
Prevalence of risk factors for Lassa fever infection in Nasarawa State, Jan 2013

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Prevalence (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of rats in the house or immediate surroundings</td>
<td>95.2 (92.5-97.0)</td>
</tr>
<tr>
<td>Hunting rats</td>
<td>36.7 (32.3-41.6)</td>
</tr>
<tr>
<td>Consuming rats as protein source</td>
<td>58.1 (53.2-62.9)</td>
</tr>
<tr>
<td>Leaving containers of food stuff uncovered</td>
<td>38.3 (33.7-43.2)</td>
</tr>
<tr>
<td>Drying food materials in the open</td>
<td>84 (80.1-87.4)</td>
</tr>
<tr>
<td>Living in mud houses</td>
<td>75 (70.5-79.1)</td>
</tr>
</tbody>
</table>
Discussion

• Seroprevalence close to previous national prevalence (21%)
• IgM prevalence higher than IgG, why?
• Nasarawa LGA: least IgG, highest IgM; why?
• Known risk factors are highly prevalent in the state
• None of the risk factors was statistically significant at 95% confidence level