Validity and feasibility of a Pan-Lassa rapid diagnostic test for Lassa fever in Abakaliki, Nigeria: a field evaluation

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Introduction
Lassa fever is a viral haemorrhagic fever with few options for diagnosis and treatment; transmitted by rodents – Mastomys natalensis and by human (body fluids); endemic in Nigeria, Liberia, Guinea and Sierra Leone; a point-of-care bedside test diagnosing Lassa fever, adhering to REASSURED criteria, is not currently available but is urgently needed in West African regions with high Lassa fever burden.

We aimed to assess the validity and feasibility of a rapid diagnostic test (RDT) to confirm Lassa fever in Nigeria.

REASSURED criteria:
Real-time connectivity, ease of specimen collection, affordable, sensitive, specific, user-friendly, rapid and robust, equipment-free or simple, and deliverable to end-users.

Methods
Study design: Prospective study

- Index test: ReLASSTM PanLassa RDT (Zalgens Labs, LCC, Germantown, MD USA 20876 and Aurora, CO, 80013, Germantown, USA US) – Research for Use Only (RUO)
- Reference standard: RT-PCR Altona
- Study population: 2.0 kit is used in AE-FUTHA VU laboratory
- Setting:
  - Ebonyi state: 3 million people, 675,000 people
  - AE-FUTHA (Alex Ekwueme Federal Teaching Hospital, Abakaliki) is a 700 beds tertiary-level hospital
  - Supported by MSF since October 2018

Results

- Recruitment during high season 2022-2023
- 217 participants
- Age: median 33 [22.0-44.3]
- Sex: Female: 49.5%; Male 50.5% (Table 1)

Table 1: Participant characteristics stratified by PCR result

<table>
<thead>
<tr>
<th>Sex</th>
<th>PCR positive (N=105)</th>
<th>PCR negative (N=105)</th>
<th>Total (N=210)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>44 (42%)</td>
<td>61 (58%)</td>
<td>105 (50%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23 (54%)</td>
<td>82 (46%)</td>
<td>105 (50%)</td>
<td></td>
</tr>
</tbody>
</table>

- Marked improvement in sensitivity and user friendliness is needed for the RDT to be adopted clinically.
- There remains an urgent need for better Lassa fever diagnostics to promote safety of in-hospital care and better disease outcomes in low-resource settings.

Conclusions

- The Pan-Lassa RDT is not currently recommended as a diagnostic or screening tool for suspected Lassa fever cases.
- Although the specificity of the Pan-Lassa RDT was high (>90%), sensitivity at bedside using capillary blood was estimated as 4% (95% CI 1–14) at 15 min and 10% (3–22) at 25 min, far below the target of 90%. (Table 2)
- The laboratory-based RDT using plasma showed better sensitivity (46% [32–61] at 15 min and 50% [36–64] at 25 min) but did not reach the target sensitivity.
- Among the PCR-positive participants with Lassa fever, positive RDT results were associated with lower cycle threshold values.
- Personnel conducting the bedside test procedure reported being hindered by the inconvenient use of full PPE and long waiting procedures before a result could be read.

Table 1: Participant characteristics stratified by PCR result

<table>
<thead>
<tr>
<th>Sex</th>
<th>PCR positive (N=2)</th>
<th>PCR negative (N=145)</th>
<th>Total (N=147)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedside (cap) RDT at 15 min</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>2 (90%)</td>
<td>0</td>
<td>2 (90%)</td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>47 (90%)</td>
<td>0</td>
<td>47 (90%)</td>
<td></td>
</tr>
<tr>
<td>Invalid</td>
<td>3 (6%)</td>
<td>0</td>
<td>3 (6%)</td>
<td></td>
</tr>
</tbody>
</table>

- The RDT was performed by trained health-care staff wearing full Personal Protective Equipment (PPE).
- Visual reading was done twice for each test: at 15 and 25 min.
- Sample for RT PCR taken for routine care and by human (body fluids).

Acknowledgements
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