

FIND

LASSA FEVER DIAGNOSTICS

Performance evaluation and
access

◆ Devy Emperador, Senior Scientist
Pandemic Threats Programme
26 October 2022



DIAGNOSTICS IS A KEY PILLAR OF THE LASSA FEVER R&D ROADMAP

Diagnostics can reveal the **true public health burden of Lassa fever** and help find the **right treatment and vaccine strategies**.

Current diagnostics challenges:



No single
reference test
(or gold
standard)



Difficult to
differentiate
Lassa fever
from other
conditions



LASV strain
variability



Limited
number of
facilities



World Health
Organization

Lassa Fever Research and Development (R&D) Roadmap

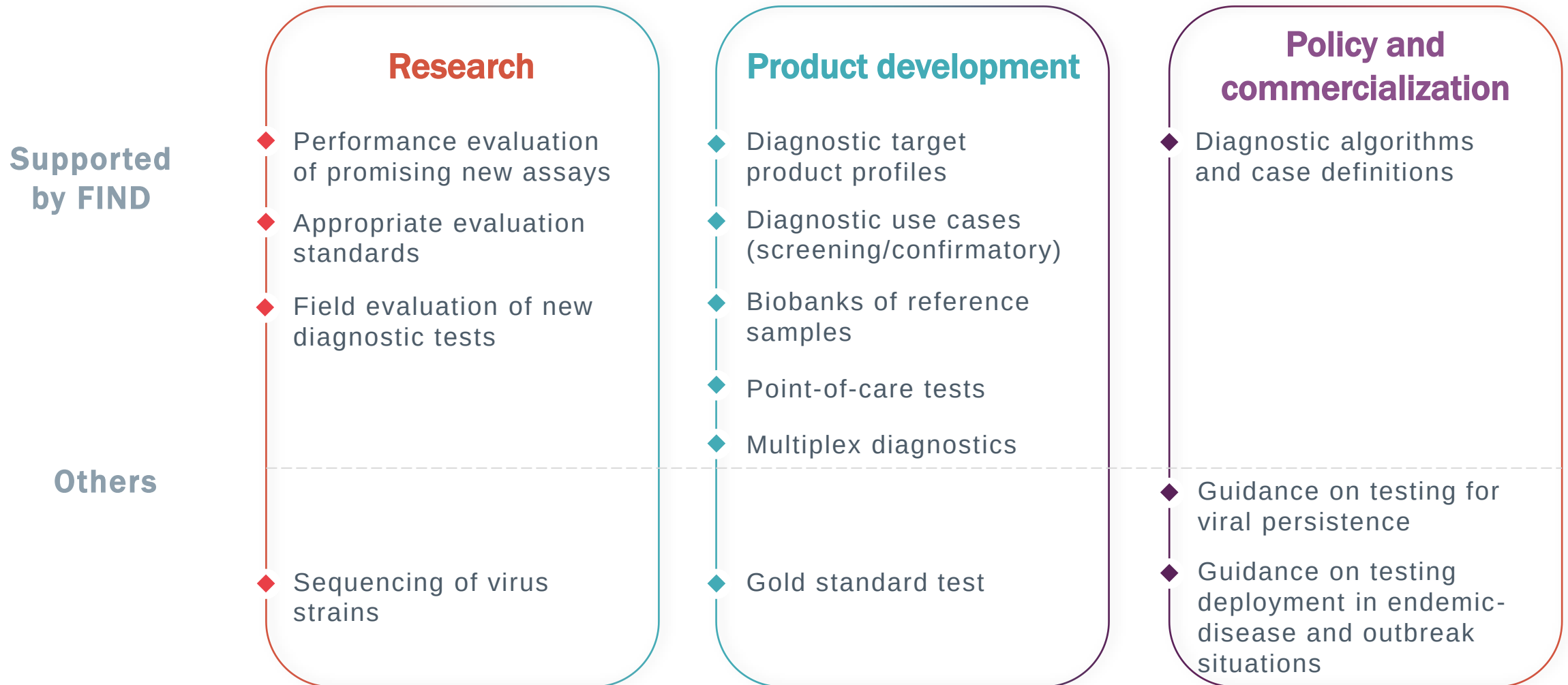
January 2019 – Advanced draft

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R&DBlueprint
Powering research
to prevent epidemics

LASSA FEVER R&D ROADMAP: KEY PRIORITY AREAS



FIND ACTIVITIES

DIAGNOSTIC USE CASES FOR LASSA FEVER

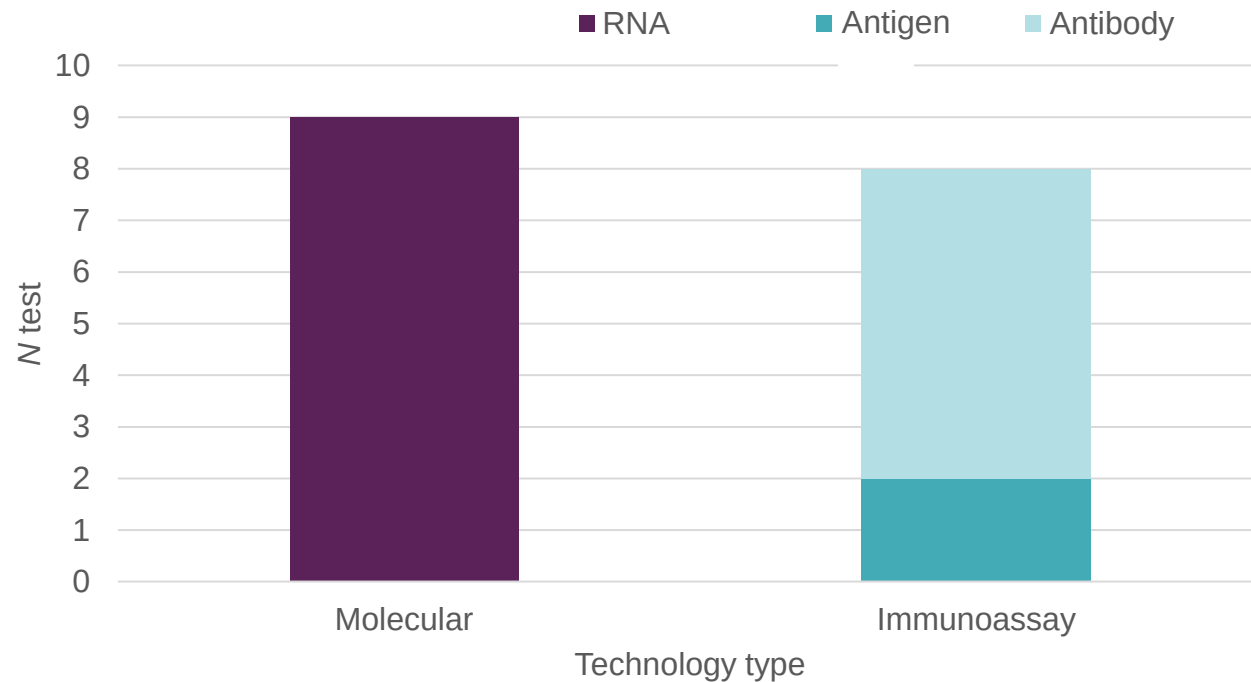


	Level 0	Level 1	Level 2	Level 3	Level 4
Intended use case	• Health posts • Field settings	• Health centres	• District hospitals	• Referral hospitals • Regional hospitals	• National reference labs
Case detection and management			• POC MDx* • POC IA* • RDT*	• MDx*† • POC MDx*† • IA*	• MDx*† • POC MDx*† • IA*†
Surveillance		• RDT*	• POC MDx* • POC IA* • RDT*	• MDx* • POC MDx* • IA*	• MDx*† sequencing • IA*
Outbreak response	• RDT*	• RDT*	• POC MDx* • POC IA* • RDT*	• MDx* • POC MDx* • IA*	• MDx*† • POC MDx*† sequencing • IA*
Clinical trials (vaccine/therapeutics)			• POC MDx* • POC IA*	• MDx*† • POC MDx*† • IA*†	• MDx*† • POC MDx*† sequencing • IA*†

*Requires pan-LASV detection. †Requires pan-VHF differentiation.

IA: immunoassay (e.g. ELISA); LASV: Lassa virus; MDx: molecular diagnostics (e.g. reverse transcriptase PCR); POC: point-of-care or near-patient; RDT: rapid diagnostic test (e.g. lateral flow immunoassay); VHF: Viral haemorrhagic fever

LANDSCAPE OF COMMERCIALY AVAILABLE TESTS



Key findings

Few commercially available tests on the market (N=17)

Among immunoassays:

- Antibody tests: anti-LASV IgM/IgG against NP, pre-fusion GP
- Antigen tests: target NP

Several tests can detect multiple LASV lineages

Few tests (n=2) with regulatory approval

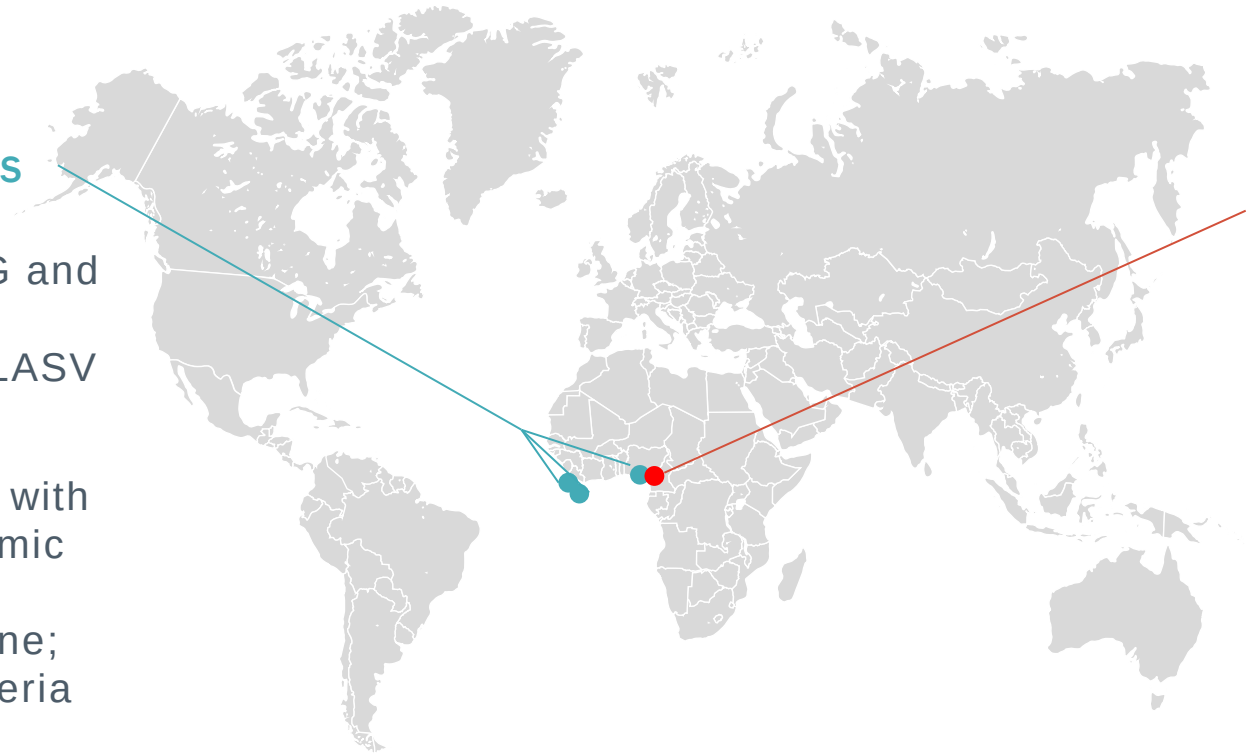
Update study, extending the landscape provided in the previously mentioned article:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6407552/>

FIND ACTIVITIES

PERFORMANCE EVALUATION OF LASSA FEVER IMMUNOASSAYS

EVALUATION OF LASSA FEVER IGG/IGM ASSAYS

- Lab evaluation of 5 IgG and 4 IgM serology assays compared to US CDC LASV IgG/IgM ELISA
- Evaluations conducted with partners in LASV endemic countries (IgG study: Nigeria and Sierra Leone; IgM study: Liberia, Nigeria and Sierra Leone)
- Status: IgG study completed; IgM study close to completion

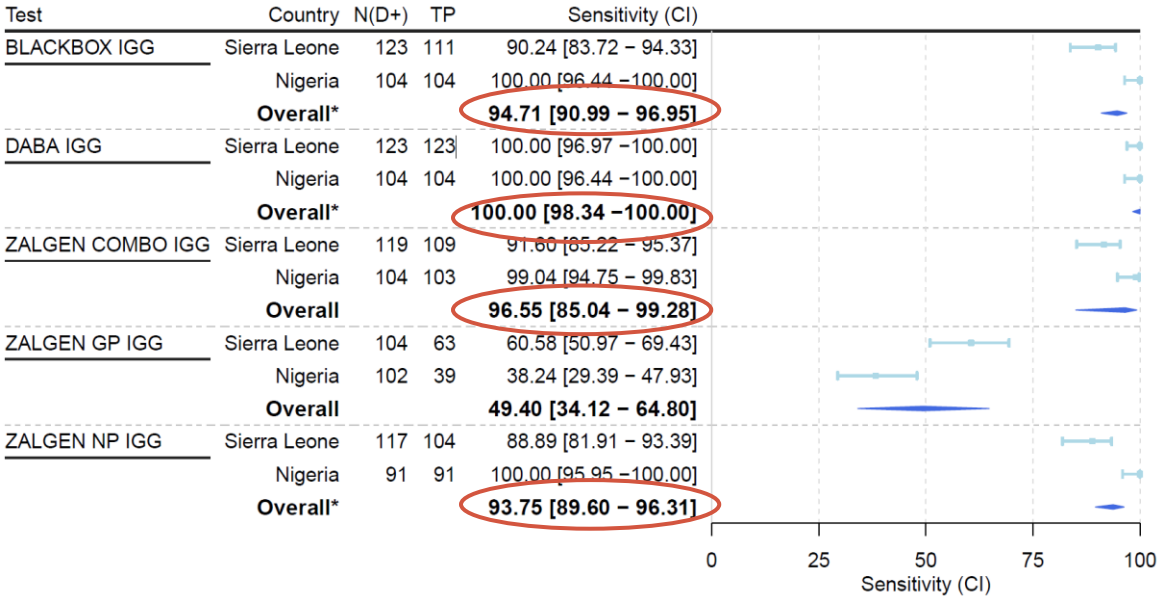


EVALUATION OF LASSA RDT

- Lab evaluation of ReLASV Pan-Lassa antigen test at one site in Nigeria
- Status: ongoing (results analysis expected by the end of 2022)

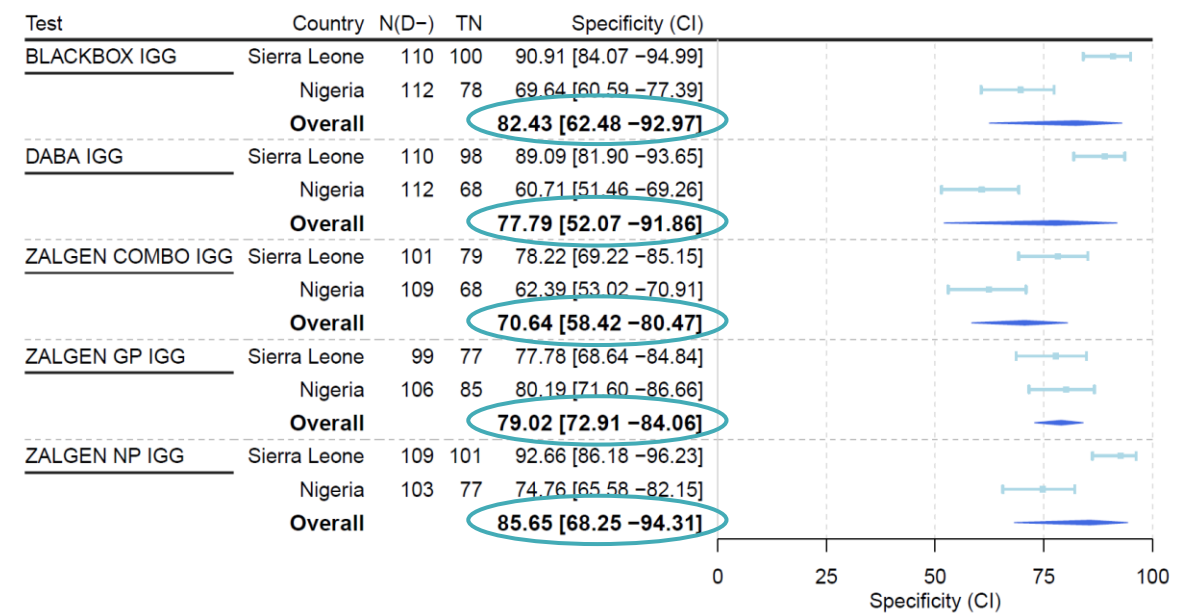
RESULTS

PROMISING IgG PERFORMANCE COMPARED TO REFERENCE TEST



POSITIVE RESULTS IN TERMS OF SENSITIVITY

- Sensitivity/PPA >90% in 4/5 assays
- Ideal: ≥90%



MIXED RESULTS IN TERMS OF SPECIFICITY

- Specificity/NPA <95%
- Ideal: ≥95%

SUPPORTING QUALITY ASSESSMENT AND RESEARCH



PCR reference material (NIBSC)

- Reference panel for Lassa virus RNA (lineage II, III, V, VII)
- WHO international standard for Lassa virus RNA (lineage IV)

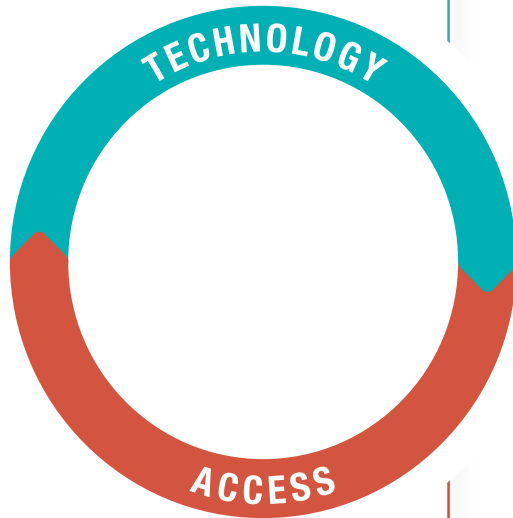


Lassa biobank in Nigeria

- Sample collection for suspected LASV cases in Owo, Nigeria (200 people)
- Status: enrollment completed. Follow-ups to be completed by November 2022. Opening soon for sample requests.

LOOKING AHEAD

REMAINING CHALLENGES FOR LASSA FEVER DIAGNOSTICS



- WHO-endorsed target product profile for LASV diagnostics
- Further evaluation studies on PCR tests detecting multiple LASV lineages
- Continued development of point-of-care tests
- Understand kinetics of LASV antigen and immune profile in humans



- Capacity strengthening of national and regional labs to conduct PCR and serology testing
- Clarify regulatory requirements at national and global level to ensure access to quality tests
- Promote local manufacturing of quality tests (molecular/antibody)
- Test procurement mechanisms at national and global levels



FIND

MANY THANKS

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MOLECULAR TESTS

LASSA FEVER DIAGNOSTIC LANDSCAPE - DETAILED

Assay Type	Developer	Assay/System	Regulatory status	Product Links	Assay Cost	Sample Type	Assay Target	LOD
MDx kit	Aldatu Biosciences (US)	PANDAA qDx LASV	RUO	https://www.aldatubio.com/product/pan-daa-qdx-lasv/	-	no info	LASV specific RNA	10 copies/mL
MDx kit	Altona Diagnostics GmbH (DE)	RealStar® Lassa Virus RT-PCR Kit 2.0	CE-IVD, RUO	https://www.altona-diagnostics.com/en/products/reagents-140/reagents/realstar-real-time-pcr-reagents/realstar-lassavirus-rt-pcr-kit-ruo.html	€ 720, 96 rxn	blood	LASV L-gene, GPC-gene	L-gene: 3.14 copies/μl GPC-gene: 1.00 copies/μl
MDx kit	BioSB/LifeRiver Biotech (US) Shanghai ZJ Bio-Tech Co., Ltd (China)	Lassa Virus (LV) Real Time RT-PCR Kit	CE-IVD	http://www.biosb.com/wp-content/uploads/QR-0222-01-Lassa-Virus-LV-Real-Time-RT-PCR-Kit.pdf	-	serum, feces, urine or body fluid sample	LASV specific RNA	1×10 ³ copies/ml
MDx kit	genesig (UK) (Primerdesign Ltd)	Primerdesign™ Ltd Lassa virus Josiah GP gene genesig® Standard Kit	RUO	https://www.genesig.com/assets/files/las-v_josiah_std.pdf	-	no info	Lassa virus (LASV) specific RNA, LASV-Josiah genome	<100 copies/mL
MDx kit	genesig (UK) (Primerdesign Ltd)	Primerdesign™ Ltd Lassa virus Josiah GP gene genesig® Advanced Kit	RUO	https://www.genesig.com/assets/files/las-v_josiah.pdf	-	no info	Lassa virus (LASV) specific RNA, LASV-Josiah genome	<100 copies/mL
MDx kit	Genekam Biotechnology (DE)	Lassa virus	RUO	http://genekam.de/realtime-pcr-kits/Lassa-virus	€ 599	no info	detection of LASV	no info
MDx kit	Genekam Biotechnology (DE)	Lassa virus (free genesequencing)	RUO	http://genekam.de/rna-viruses/Lassa_virus_(free_genesequencing)	-	no info	LASV specific RNA	no info
MDx multiplex platform	Biofire Defense (US)	FilmArray Global Fever Panel - RUO	RUO	https://www.biofiredefense.com/wp-content/uploads/2018/08/FilmArray-Global-Fever-Panel-RUO-InfoSheet-MRKT-PRT-0299.pdf	-	whole blood	LASV specific RNA	no info
MDx kit multiplex platform	Luminex/GenArray Inc. (US)	xMAP® MultiFLEX® Febrile Agent Panel 3	RUO	https://www.luminexcorp.com/research/applied-markets/xmap-multiflex-bioassays/	-		5 agents: Chikungunya, JapEnceph. Lassa, Lepto, Malaria (4)	<10 copies per rxn

IMMUNOASSAYS

LASSA FEVER DIAGNOSTIC LANDSCAPE - DETAILED

Assay Type	Developer	Assay/System	Regulatory status	Product Links	Assay Cost	Sample Type	Assay Target	LOD
ELISA	Diagnosics Development Laboratory, Bernhard Nocht Institute for Tropical Medicine (DE)	BLACKBOX® LASV IgG/IgM ELISA Kit	RUO	https://www.european-virus-archive.com/evag-portal/product-categories/detection-kit-ruo		serum	Detection of human IgG/IgM to LASV protein	-
ELISA	Zalgen Labs (US)	ReLASV® Pan-Lassa NP IgG/IgM ELISA Test Kit	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1690, 2x 96-well plate	Serum, EDTA plasma, or citrated plasma	Detection of human IgG/IgM to LASV nucleoprotein (NP) antigen for lineage II, III and IV	-
ELISA	Zalgen Labs (US)	ReLASV® Pan-Lassa GP IgG/IgM ELISA Test Kit	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1600, 2x 96-well plate	Serum, EDTA plasma, or citrated plasma	Detection of human IgG/IgM to LASV glycoprotein (GP) antigen for lineage II, III and IV	-
ELISA	Zalgen Labs (US)	ReLASV® Pan-Lassa pre-fusion GP IgG/IgM ELISA Test Kit	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1600, 2x 96-well plate	Serum, EDTA plasma, or citrated plasma	Detection of neutralizing human IgG/IgM to LASV glycoprotein (GP) antigen for lineage II, III and IV	-
ELISA	Zalgen Labs (US)	ReLASV® Pan-Lassa NP/pre-fusion GP IgG/IgM ELISA Test Kit	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1600, 2x 96-well plate	Serum, EDTA plasma, or citrated plasma	Detection of human IgG/IgM to LASV glycoprotein (GP) and nucleoprotein antigen for lineage II, III and IV	-
ELISA	Zalgen Labs (US)	ReLASV® Pan-Lassa Antigen ELISA Test Kit	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$840, 1x 96-well plate	Serum, EDTA plasma, or citrated plasma	Detection of LASV lineage II, III and IV nucleoprotein (NP) antigen	-
RDT	Zalgen Labs (US)	ReLASV® Antigen Rapid Test	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1050, 50 strips	FS or VP whole blood, serum	Detection of LASV nucleoprotein (NP) antigen for lineage IV only	-
RDT	Zalgen Labs (US)	ReLASV® Pan-Lassa Antigen Rapid Test	RUO	http://www.zalgen.com/hemorrhagic-fever-tests	\$1250, 50 strips	FS or VP whole blood, plasma	Detection of LASV nucleoprotein (NP) antigens for lineages II, III, IV	-