INSTITUT PASTEUR de Dakar

# Rift Valley fever seroprevalence data from previous surveys in Senegal

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WHO CC for Arboviruses and Viral Hemorrhagic Fevers

Virology Department

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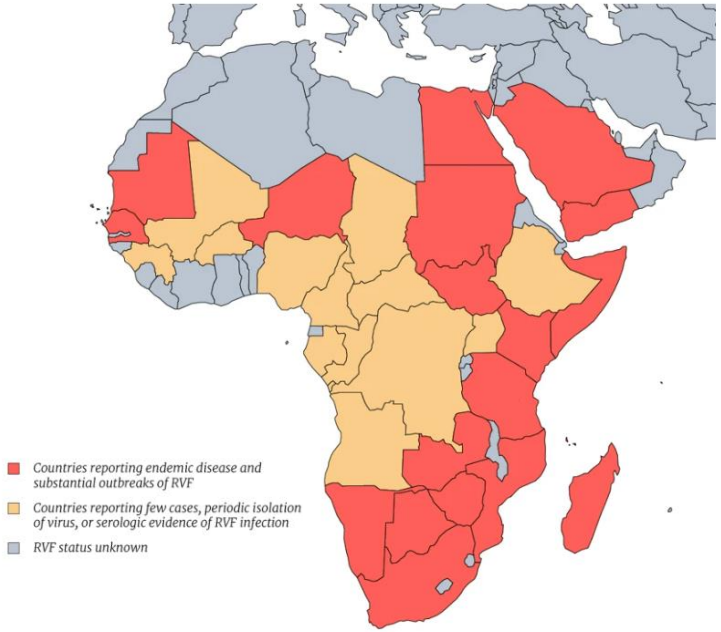
# RVF detection in Senegal

Rift Valley Fever distribution map




The Phenuiviruses | CEPI

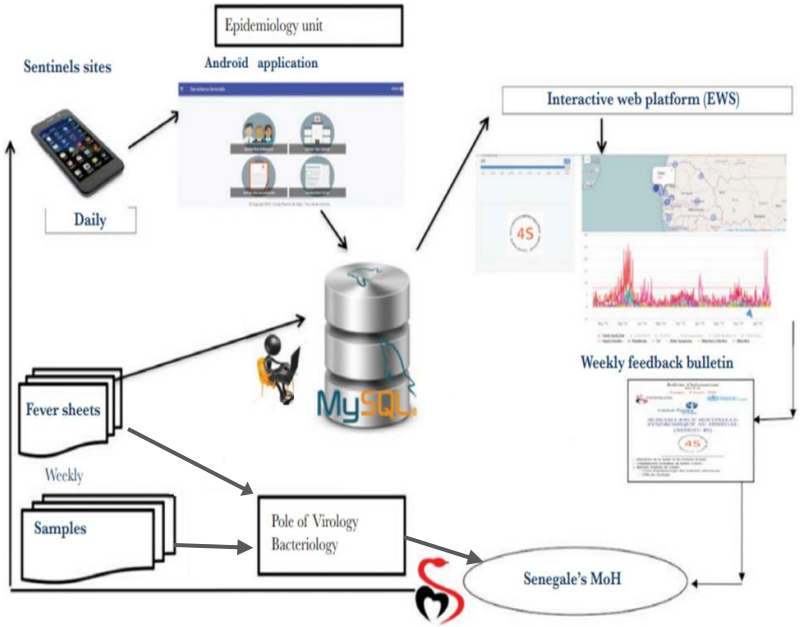
No specific surveillance programs, viral detection through different systems

Yellow Fever Surveillance


VHF cases in Hospitals

Febrile syndrome surveillance in Kedougou


Since 2015, implementation of Sentinel Syndromic Surveillance in Senegal (4S)



# RVF detection in Senegal

- Large outbreak in 1987 (about 1500 cases and more than 200 deaths)
- Sporadic cases/minor outbreaks between 2012 and 2024

➢ 2013-2014 (12 cases, Linguere, Mbour and Kedougou)

➢ 2020 (9 cases, Matam, Fatick, Richard Toll and Dakar)

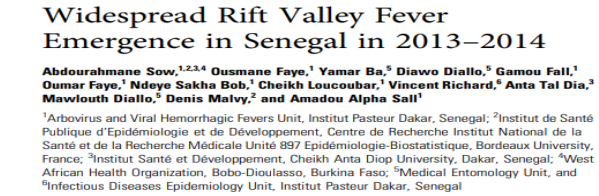
➢ 2022 (4 cases, Podor, Matam and Dakar),

**Median age and the sex ratio (M/F)** :

- 23 years (13 to 32 years) and 1,75 (2013-14)
- 26 years (17–40) years and 3.5 (2020)
- 35 years (19 to 56) and 1 (2022)

**Severe symptoms**

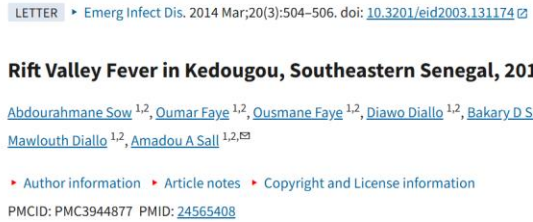
- Encephalitis 40% and macular retinitis with edema 20% in 2013-14
- No severe symptoms in 2020 and 2022
- No death



Widespread Rift Valley Fever Emergence in Senegal in 2013–2014

Abdourahmane Sow,[1,2,3,4] Ousmane Faye,[1] Yamar Ba,[5] Diawo Diallo,[5] Gamou Fall,[1] Oumar Faye,[1] Ndeye Sakha Bob,[1] Cheikh Loucoubar,[1] Vincent Richard,[6] Anta Tal Dia,[3] Mawlouth Diallo,[5] Denis Malvy,[2] and Amadou Alpha Sall[1]

[1]Arbovirus and Viral Hemorrhagic Fevers Unit, Institut Pasteur Dakar, Senegal; [2]Institut de Santé Publique d'Epidémiologie et de Développement, Centre de Recherche Institut National de la Santé et de la Recherche Médicale Unité 897 Epidémiologie-Biostatistique, Bordeaux University, France; [3]Institut Santé et Développement, Cheikh Anta Diop University, Dakar, Senegal; [4]West African Health Organization, Bobo-Dioulasso, Burkina Faso; [5]Medical Entomology Unit, and [6]Infectious Diseases Epidemiology Unit, Institut Pasteur Dakar, Senegal



LETTER ▸ Emerg Infect Dis. 2014 Mar;20(3):504–506. doi: 10.3201/eid2003.131174

**Rift Valley Fever in Kedougou, Southeastern Senegal, 2012**

Abdourahmane Sow [1,2], Oumar Faye [1,2], Ousmane Faye [1,2], Diawo Diallo [1,2], Bakary D Sadio [1,2], Scott C Weaver [1,2], Mawlouth Diallo [1,2], Amadou A Sall [1,2,✉]

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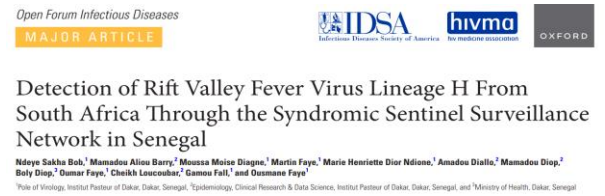
PMCID: PMC3944877 PMID: 24565408



Open Forum Infectious Diseases

MAJOR ARTICLE

Detection of Rift Valley Fever Virus Lineage H From South Africa Through the Syndromic Sentinel Surveillance Network in Senegal

Ndeye Sakha Bob,[1] Mamadou Aliou Barry,[2] Moussa Moise Diagne,[1] Martin Faye,[1] Marie Henriette Dior Ndione,[1] Amadou Diallo,[2] Mamadou Diop,[2] Boly Diop,[3] Oumar Faye,[1] Cheikh Loucoubar,[2] Gamou Fall,[1] and Ousmane Faye[1]

[1]Pole of Virology, Institut Pasteur of Dakar, Dakar, Senegal, [2]Epidemiology, Clinical Research & Data Science, Institut Pasteur of Dakar, Dakar, Senegal, and [3]Ministry of Health, Dakar, Senegal

viruses MDPI

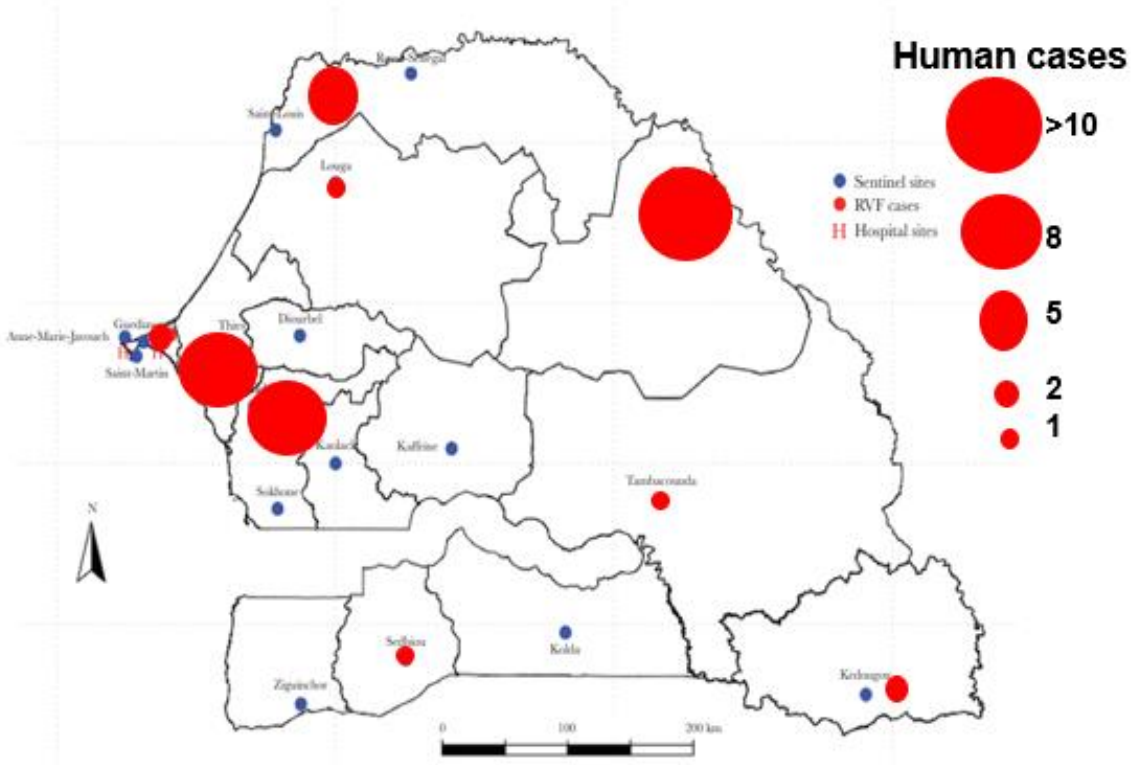
Article

**Re-Emergence of Rift Valley Fever Virus Lineage H in Senegal in 2022: In Vitro Characterization and Impact on Its Global Emergence in West Africa**

Ousseynou Sene [1,*], Samba Niang Sagne [2], Ndeye Sakha Bob [1], Moundhir Mhamadi [3], Idrissa Dieng [1], Aboubacry Gaye [2], Haoua Ba [1], Moussa Dia [1], Elisabeth Thérèse Faye [1], Sokhna Mayemouna Diop [1], Yoro Sall [4], Boly Diop [4], Mamadou Ndiaye [4], Cheikh Loucoubar [2], Etienne Simon-Lorière [5], Anavaj Sakuntabhai [6,7,8], Ousmane Faye [1], Amadou Alpha Sall [1], Diawo Diallo [9], Ndongo Dia [1], Oumar Faye [1], Moussa Moise Diagne [1], Malick Fall [10], Marie Henriette Dior Ndione [1], Mamadou Aliou Barry [2] and Gamou Fall [1]

# Surveillance, RVF detection in Senegal, 2012-2024

**Geographic distribution of RVF human cases in Senegal, 2012-2024**




RVF lineages A, H and K detected during these outbreaks

Same lineages caused large outbreaks and deaths in Mauritania

While only sporadics cases or minor epidemics without deaths were detected in Senegal

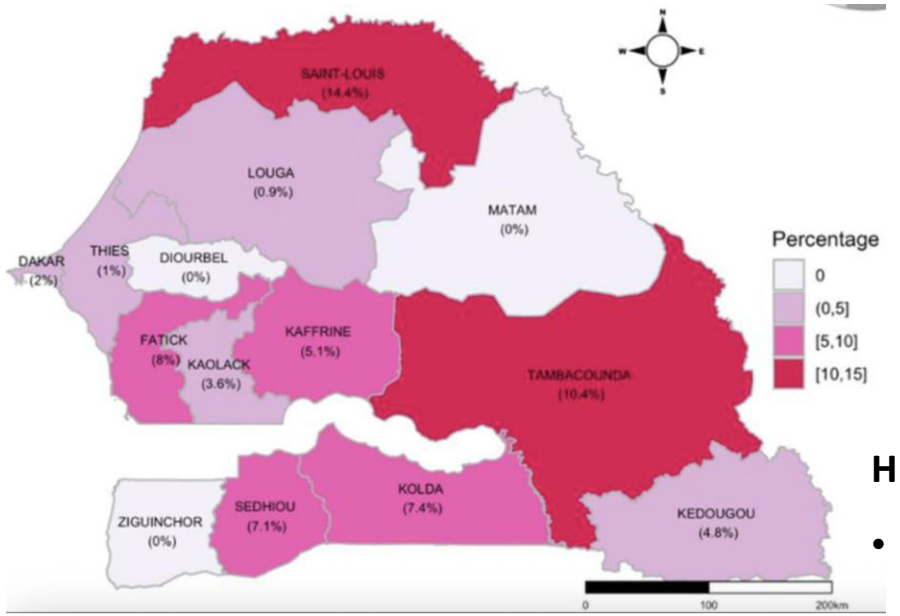
Different epidemiological profiles that could be explained by several factors including host susceptibility, viral genetic diversity, climatic and environmental factors, vector ecology etc.

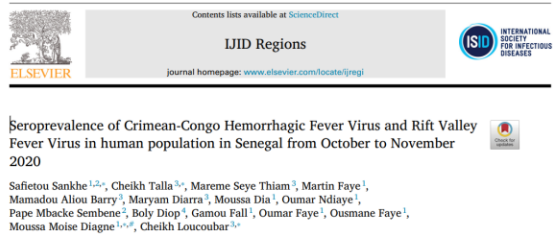
Different seroprevalence studies
to assess population past exposure to RVFV

# 1.SECTION
# RVF seroprevalence in general populations

# RVF seroprevalence in humans

Nationwide Covid-19 serosurvey used for RVF, from October to November 2020



Contents lists available at ScienceDirect

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Seroprevalence of Crimean-Congo Hemorrhagic Fever Virus and Rift Valley Fever Virus in human population in Senegal from October to November 2020

Safietou Sankhe[1,2,*], Cheikh Talla[3,*], Mareme Seye Thiam[3], Martin Faye[1], Mamadou Aliou Barry[3], Maryam Diarra[3], Moussa Dia[1], Oumar Ndiaye[1], Pape Mbacke Sembene[2], Boly Diop[4], Gamou Fall[1], Oumar Faye[1], Ousmane Faye[1], Moussa Moise Diagne[1,*,#], Cheikh Loucoubar[3,*]

**Higher Seroprevalence in** :

- Saint-Louis (14%) and Tambacounda (10%)
- Males with 5.3% (3% in females)
- participants over 30 years old most affected (increasing with age)

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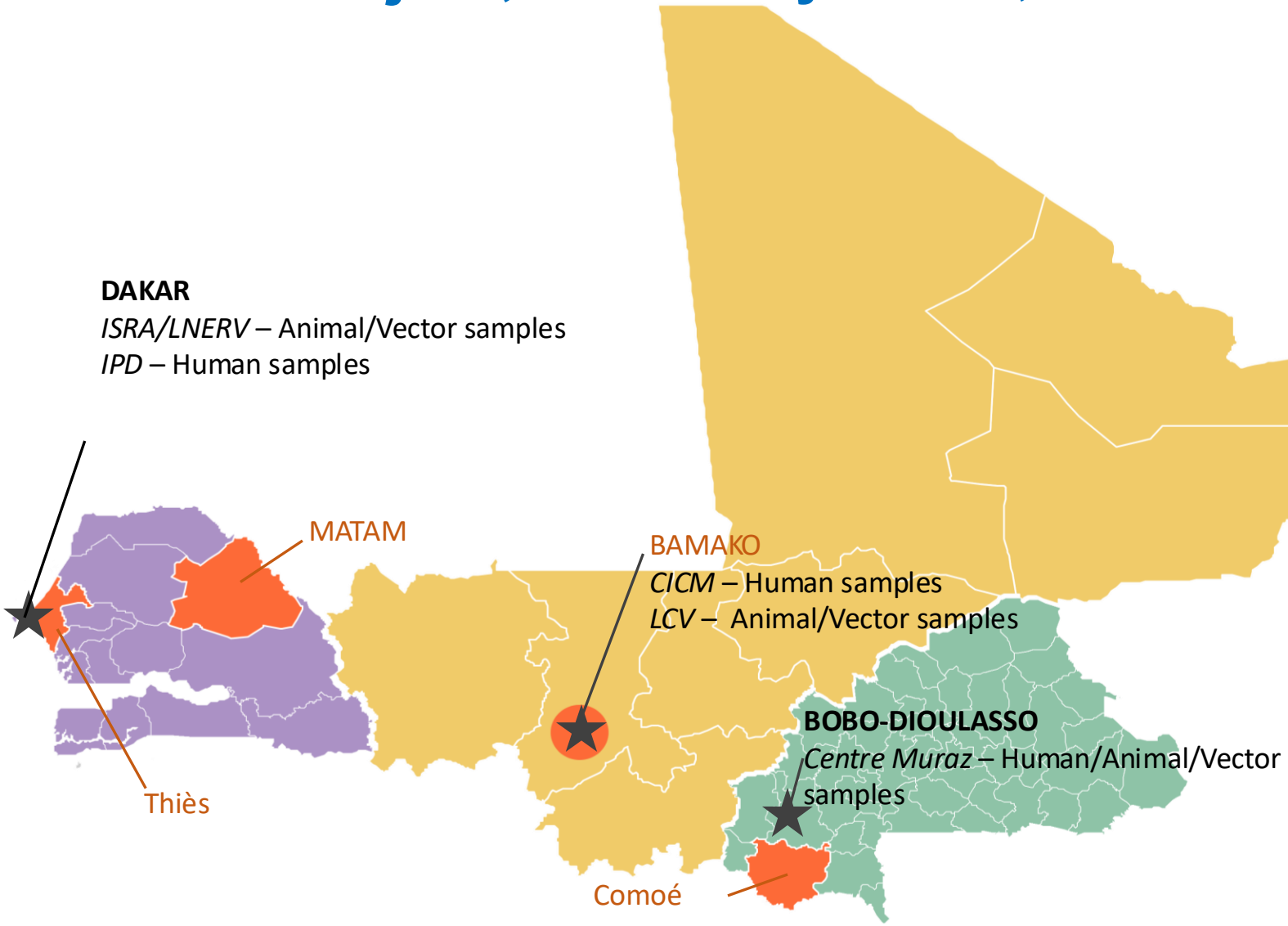
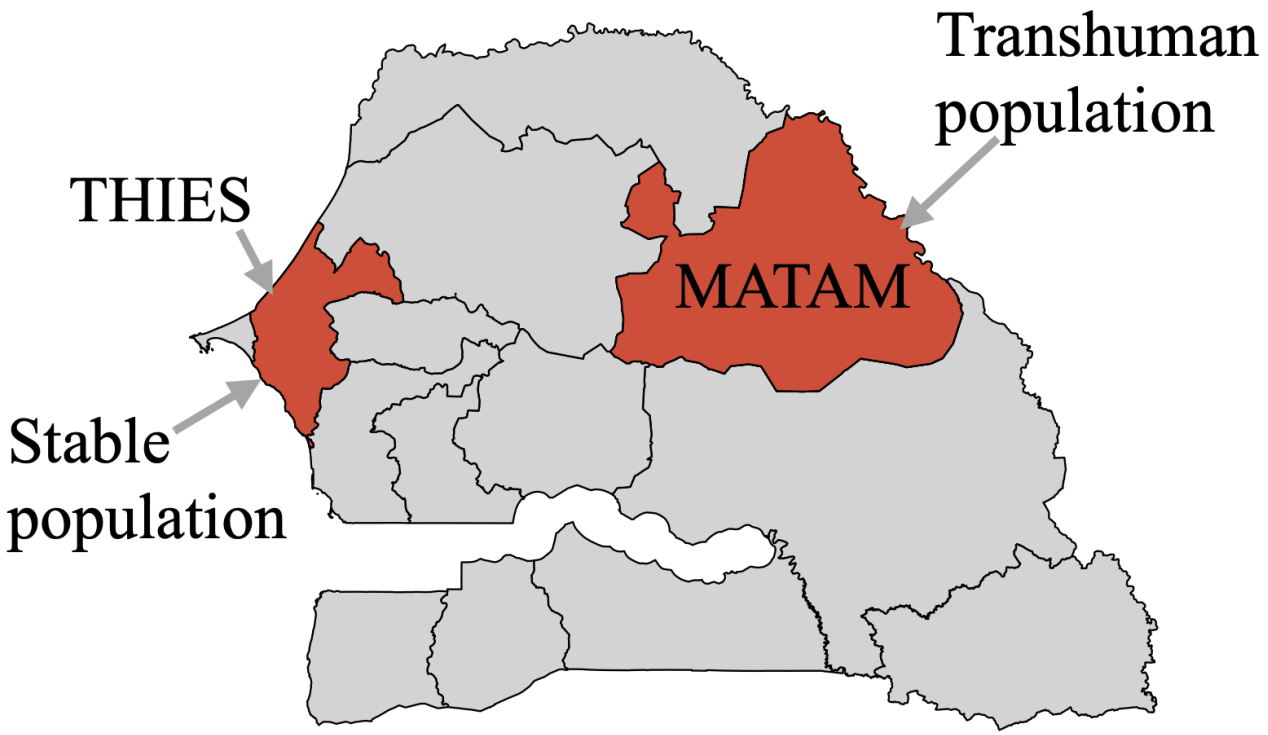
# 2.SECTION
# RVF seroprevalence in high risk populations

## COHWA Project, funded by DTRA, 2020-24



# RVF seroprevalence in humans




**Targeted population**: high-risk populations, livestock breeders, slaughterhouse staff, etc.

- Populations: transhumance / stable
- Lifestyle: Urban / Rural
- Sampling during dry and rainy seasons

**Matam (North-Eastern)**:
At the border with Mali and Mauritania (where RVF is endemic), where there are lot of human and animal movements.

**Thies (Western)**:
High livestock density and a history of zoonotic outbreaks.

**Results**: Seroprevalence was significantly higher ($p < 0.001$ ) in:

- **Matam (19.27%)** than in **Thies (11.17%)**
- **Males**
- Participants **over 45 years old** (increasing with age)

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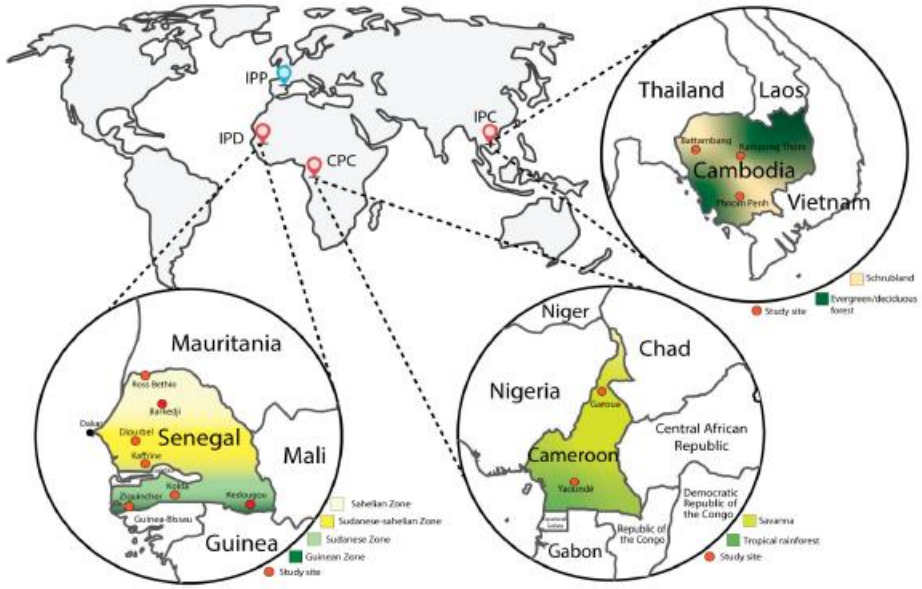
# Arbosen project, funded by NIH, 2020-25

## 3.SECTION
## RVF transmission dynamics in high and low risk populations

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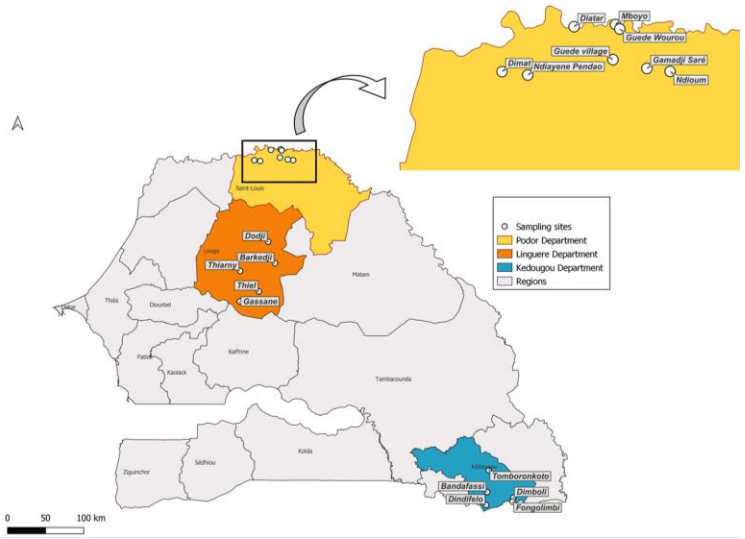
# RVF transmission dynamics

**Three different ecological zones, Podor, Barkedji and Kedougou**




**Podor (Northern)**: sylvo-pastoral area, at the border with Mauritania where RVF is highly endemic

**Barkedji (Central)**: sylvo-pastoral area, favorable for RVF circulation

**Kedougou, South-East:** Deforestation for cultivation, gold mining activities, scarce data on RVF

**Sample collection before, during and after rainy season, between 2022 and 2024**

**Humans**: healthy high-risk (butchers, breeders etc.) and low-risk (rare or no exposition to livestock) populations, 2-70 yrs old
Participants were classified based on livestock exposure frequency :

- Daily exposure: high risk
- Weekly exposure: intermediate risk
- Rare exposure: low risk
- No exposure

**Animals**: sheep, cattles and goats (transhumant and sentinel herds)

**Mosquitoes** : Collect of mosquitoes, pooling by species, sex and host of origin

Livestock sampling

CDC light trap supplemented with $CO_2$, BG-Sentinel-2 traps and foldable mosquito net traps

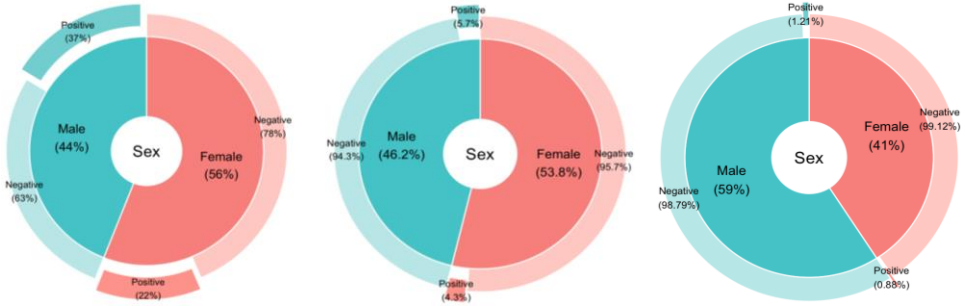
# RVF seroprevalence in humans: results

## RVF overall seroprevalence

- Podor: 28,5%
- Barkedji: 4,90%
- Kedougou: 1,07%

North to South RVF seroprevalence gradient

## RVF Seroprevalence By Sex




Males more affected

## RVF Seroprevalence By age

Different profiles in the 3 areas
**Podor**: participants over 20 years olds were affected (with significant increasing with age)
**Barkedji**: all age groups were affected while in **Kedougou** only the are group 40-60 was affected

## RVF Seroprevalence By exposure level to Livestock

Different profiles: contact with livestock remains the main mode

Contact with vectors plays also important role in the transmission in Podor and Barkedji

➡ Serocatalytic modelling to reconstruct circulation history of RVF in Podor: 3 mains outbreaks found!
**RVFV data** best explained by infrequent but large **outbreaks in Northern Senegal (Podor)**

# RVF seroprevalence in animals

**Seroprevalence in sentinel herds**

Seroprevalence significantly higher for caprine, comparable between males and females and between Barkedji and Kedougou

Seroconversion dynamics: new infections during mainly dry season (Barkedji) and rainy season (Kedougou)

**Seroprevalence in transhumant herds**

Seroprevalence comparable between Podor, Barkedji and Kedougou
Significantly higher in bovine, comparable between males and females

# RVF and vectors

***Main RVF vectors***
*Cx poicilipes*
*Ae vexans*
*Ae dalzieli*
*Ae ochraeus*
*Ma africana*
*Ma uniformis*

No detection of RVFV
North-South gradient of the relative abundance of the main vectors

Correlation with seroprevlence in humans

# Conclusions

- Overall, RVF seroprevalence in humans is higher in Northern Senegal (rare but large outbreaks), males in all areas and in participants over 20 years old (with significant increasing with age) in many areas

- RVF seroprevalence in animals is comparable in the different regions investigated, but different seroconversion dynamics

- North-South gradient of the relative abundance of the main RVF vectors.

- In Podor and Barkedji, all risk groups are infected (transmission occurs through contact with animals and mosquito bites). In Kedougou, transmission appears to occur mainly through contact with animals, which could probably be correlated with the rarity of the main vectors of RVF in the region.

- Enzootic and regular circulation of RVF in Senegal with different transmission profiles. Emphasizes the need to reinforce surveillance, consolidate seroprevalence data (one health approach and stratification) and adapt strategies for a better disease prevention and control.

# Acknowledgements

INSTITUT PASTEUR de Dakar

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Grant office

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Institut Pasteur

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NIH National Institutes of Health

CREID Centers for Research in Emerging Infectious Disease

PennState College of Medicine

PennState Huck Institutes of the Life Sciences

USAMRIID United States Army Medical Research Institute of Infectious Diseases
Biodefense solutions to protect our nation

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