Avian Influenza Surveillance in Kenya

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Overview of Avian Influenza: A Global Health Threat

Avian Influenza (AI) represents a significant global health concern, stemming from highly contagious Influenza Type A viruses that impact bird populations worldwide. Wild aquatic birds serve as natural reservoirs, facilitating potential spillover into poultry and other animal species, posing continuous challenges for public and animal health.

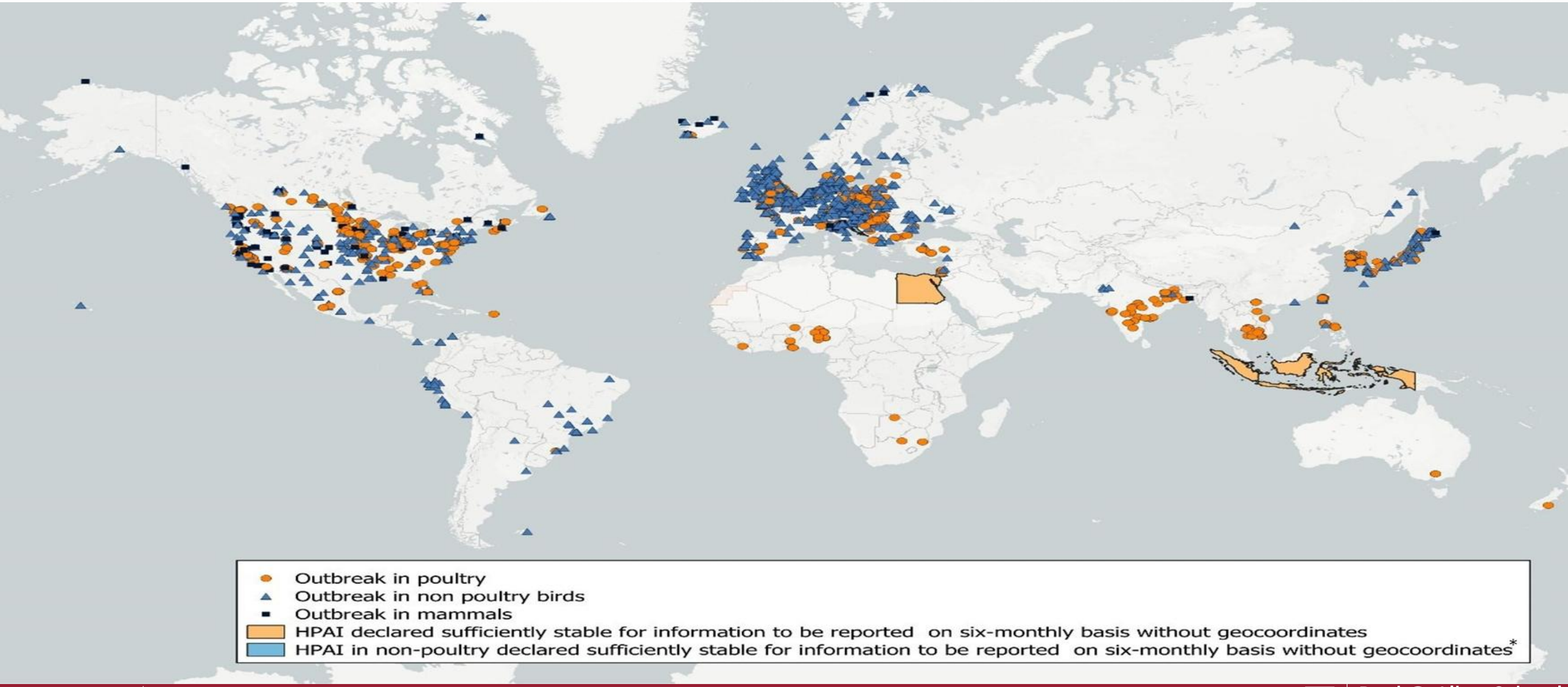
Highly Pathogenic Avian Influenza (HPAI)

Causes severe illness and high mortality rates in birds, leading to significant trade and movement restrictions. HPAI strains are of public health concern due to sporadic human cases, necessitating rigorous surveillance.

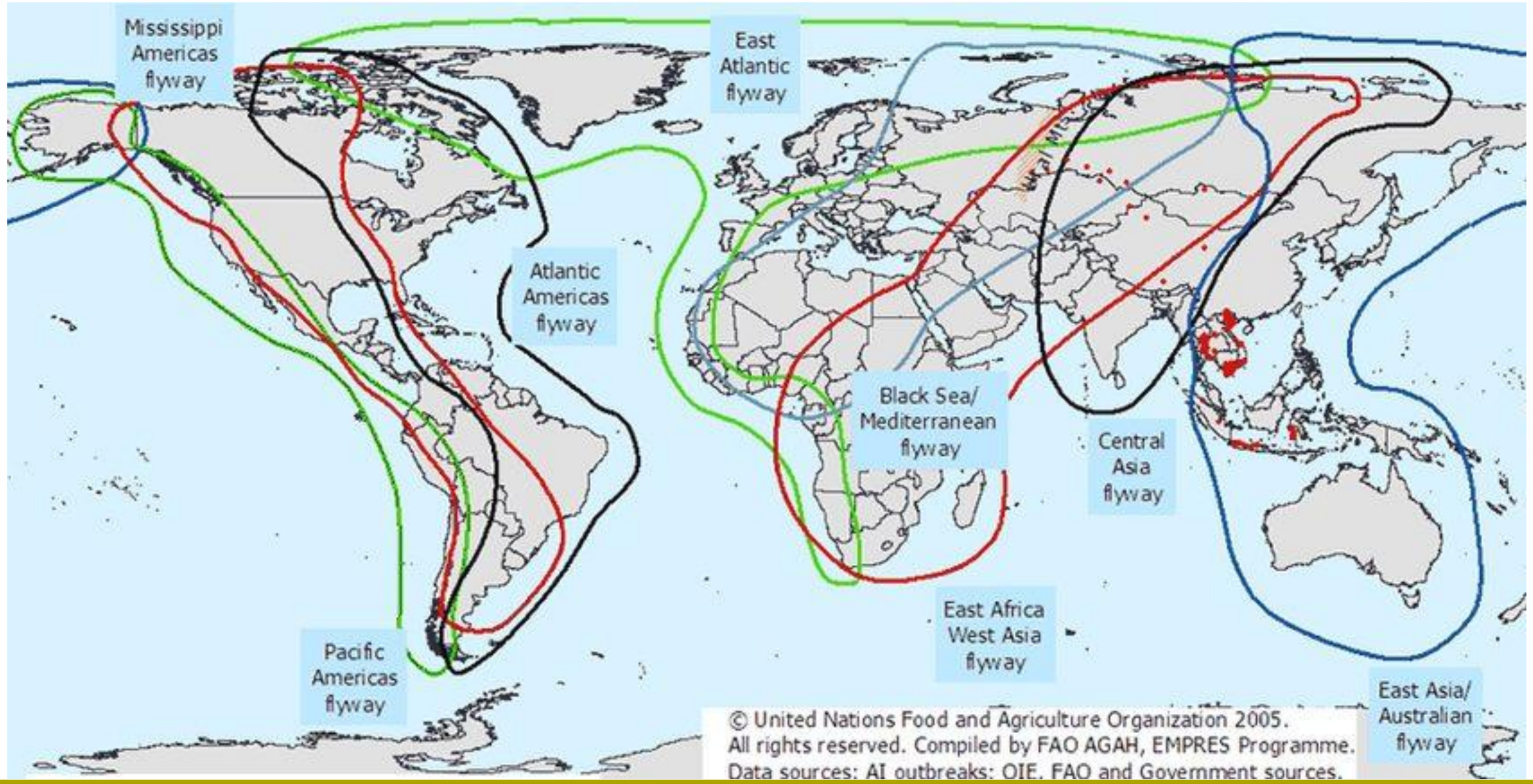
Low Pathogenic Avian Influenza (LPAI)

Often presents with mild or asymptomatic infections in birds. Crucially, LPAI strains have the capacity to mutate into highly pathogenic forms, underlining the importance of continuous monitoring and early detection efforts.

Current HPAI MAP(31st July) Source- WOAH, Situation Report 73)



Major Flyways of Migratory Birds (2005)



Kenya's Vigilance: Addressing the Avian Influenza Threat

↘ Zoonotic Potential

Direct risk to human health through spillover events.

Avian Influenza is a disease of significant concern in Kenya due to its zoonotic potential and capacity to cause widespread pandemics, making it a notifiable disease within the national and international animal health frameworks.

↘ Pandemic Threat

Capacity for widespread human-to-human transmission, leading to global health crises.

The 2017 H5N8 outbreak in Uganda, affecting both wild birds and poultry, heightened regional concerns regarding the potential introduction and spread of Avian Influenza viruses into Kenya. This event underscored the critical need for proactive measures.

↘ Notifiable Disease

Mandatory reporting to international organizations for global disease control.

Subsequent intensive research studies conducted between 2018 and 2025 have further demonstrated the urgent need for active, routine surveillance systems. Kenya remains at elevated risk due to its extensive trade networks and its position along critical migratory pathways for wild birds, which can serve as vectors for viral introduction.

Strategic Pillars: Kenya's Avian Influenza Surveillance Objectives

The project's overarching goals are designed to build a robust and responsive national surveillance system, critical for safeguarding both animal and public health in Kenya.

01

Monitor Circulating Subtypes

To actively track and identify the specific subtypes of avian influenza viruses present in poultry within Kenya's live bird markets, informing targeted interventions.

02

Environmental Sampling

To detect the presence of avian influenza viruses in poultry environments through systematic sampling of Live Bird Markets (LBMs), providing insights into viral persistence and transmission risks.

03

Outbreak Investigation

To swiftly investigate suspected avian influenza outbreaks in poultry and instances of wild bird die-offs across the country, facilitating rapid response and containment efforts.

04

Enhance Diagnostic & Epidemiologic Capacities

To strengthen national capabilities for AIVs testing and epidemiologic analysis, ensuring Kenya possesses the necessary infrastructure and expertise for effective surveillance.

Pioneering Surveillance: A Timeline of Kenya's AI Project

1. 2018–2020

Initial Project Phase (Phase 1) commenced, focusing surveillance on 7 Live Bird Markets (LBMs) and 5 Wild Birds (WBS) sites, establishing foundational monitoring protocols.

2. Dec. 2020 & Jan. 2021

A crucial planning meeting set the stage for intensified efforts, followed by comprehensive training of surveillance teams to ensure standardized data collection and response.

3. Mar. 2021 & Apr. 2021

Pre-visits to Nairobi sites finalized preparations, leading to the commencement of sampling at 3 key LBM sites across the capital, marking the start of active surveillance.

4. July 2021

The project underwent its first significant expansion, incorporating surveillance activities in Eldoret and Nakuru counties, broadening the geographic scope of monitoring.

5. Oct. 2021

Laboratory testing officially commenced at the National Veterinary Research Laboratory (NVRL), enabling timely analysis and characterization of collected samples.

6. Jan.–Feb. 2023

A dedicated Wild Birds Surveillance campaign was conducted across 6 strategic sites, aligning with peak migratory seasons to identify circulating strains.

7. June 2023

The second phase of expansion brought in Machakos, Makueni, and Busia, further extending the national reach of the surveillance program to critical new areas.

8. Nov. 2023

A follow-up Wild Birds Surveillance was performed in another 6 sites, maintaining consistent monitoring during key migratory periods to inform risk assessments.

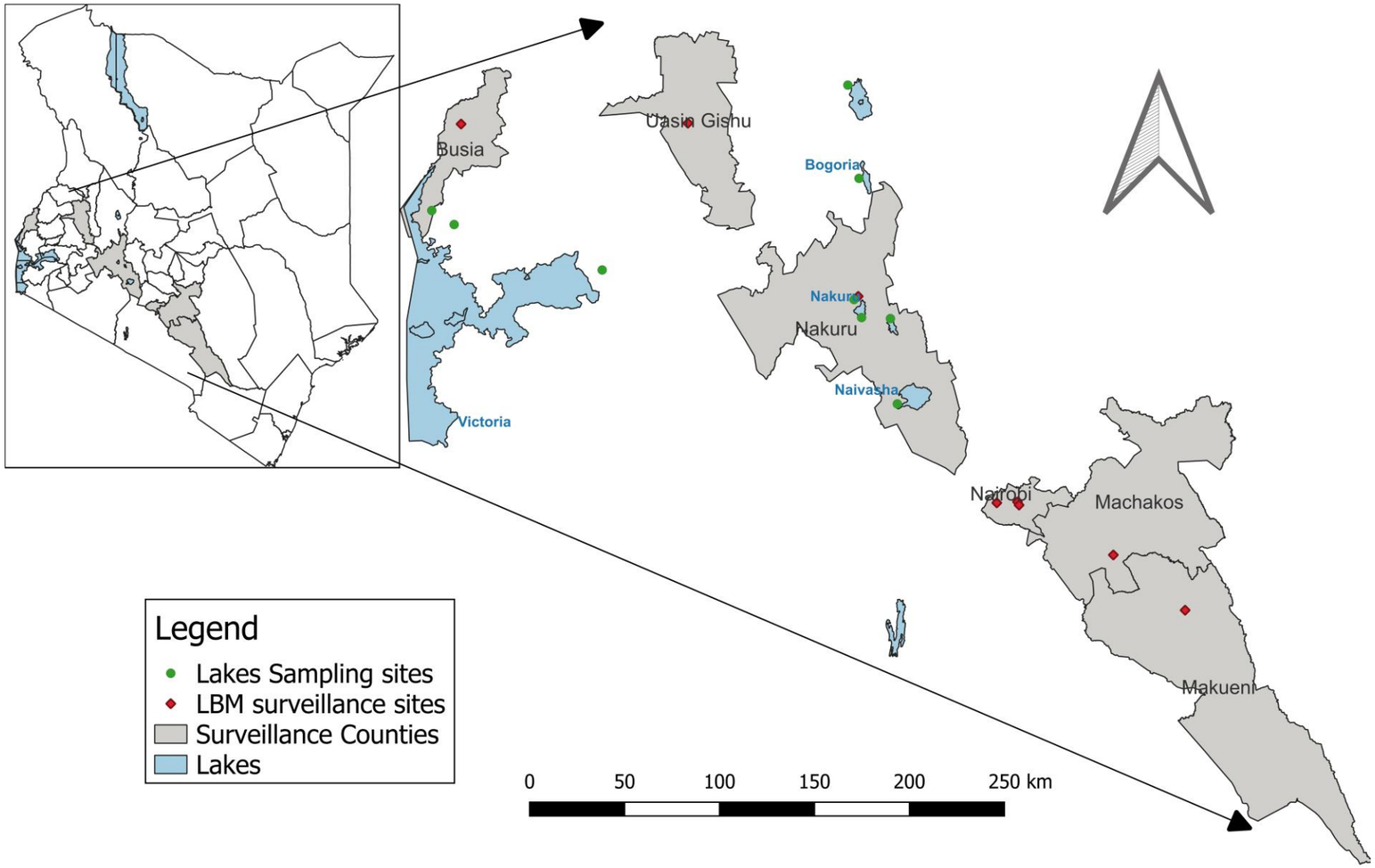
9. Nov. 2024

Wild Birds Surveillance was performed in another 5 sites, maintaining consistent monitoring during key migratory periods to inform risk assessments.

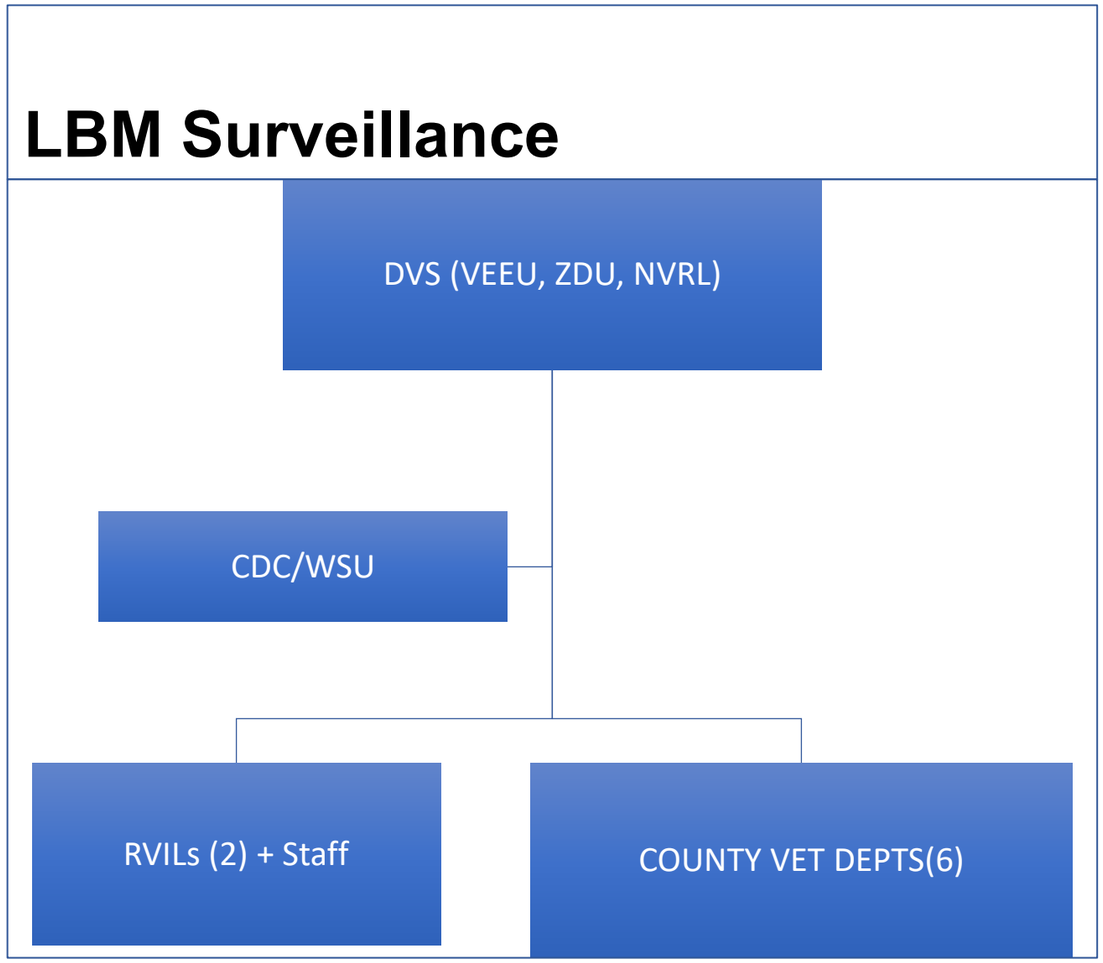
10. Up to Sept 2025

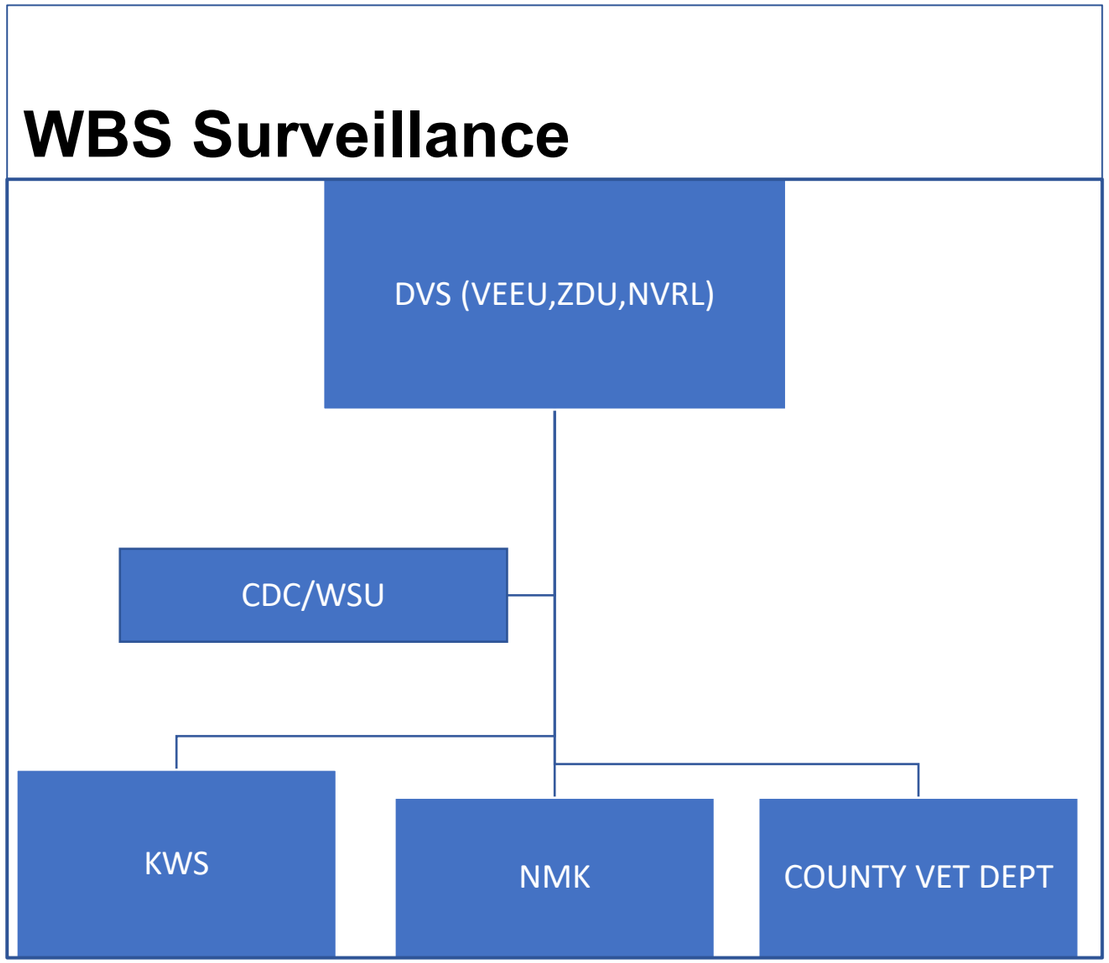
Continued surveillance

Avian Influenza Surveillance Footprint



Surveillance Organization





Burma

Kariakor

Kawangware

Eldoret

Nakuru

Busia






Machakos

Makueni

Environmental Sampling

Sampling

- Collection of samples
  - Oropharyngeal swabs
  - Environmental swabs
    - Cages
    - Slaughter area
- Collection of epi-data

WILD BIRD SURVEILLANCE

Guardians of the Skies: Monitoring Wild Bird Populations

Wild bird surveillance forms a critical component of Kenya's Avian Influenza monitoring strategy, targeting natural reservoirs and potential long-distance viral spread through migratory patterns.

- *Conducted annually or biannually, strategically timed to capture peak activity periods.*
- *Activities are carefully aligned with the peak migratory bird season in Kenya (November to April) to maximize detection of incoming strains.*
- *Samples are collected from freshly voided feces, providing non-invasive insights into active viral shedding among wild bird populations.*
- *Specimens are immediately stored in vials containing Viral Transport Medium (VTM) to preserve viral integrity until laboratory analysis.*
- *All collected specimens are efficiently shipped to the National Veterinary Reference Laboratories (NVRL) for prompt and comprehensive analysis.*

Wild bird surveillance provides early warning signs of novel or re-emerging AIVs, enabling proactive public health interventions.

From Field to Lab: Ensuring Rigorous Sample Analysis

Swift Sample Shipment

All collected samples are immediately prepared and shipped to the National Veterinary Research Laboratory (NVRL) within a critical 24-hour window to maintain viral viability and integrity.

Initial Molecular Testing

Upon arrival, samples undergo initial molecular testing using real-time reverse transcription polymerase chain reaction (rRT-PCR) to detect Flu A, H5, H7, and H9 subtypes. Further characterization is conducted in collaboration with the US CDC.

Secure Sample Archiving

Post-testing, all samples are securely archived for future reference, retesting, or advanced research purposes, contributing to long-term epidemiological studies and outbreak response preparedness.

Precision in Diagnosis: The AIVs Laboratory Workflow

The laboratory workflow is a meticulously designed sequence of steps, ensuring high-fidelity detection and subtyping of Avian Influenza viruses for rapid and accurate diagnostic outcomes.

RNA Extraction

Viral RNA is meticulously extracted from the samples using the Qiagen Viral RNA Mini Kit, a critical first step to isolate genetic material for downstream analysis.

Influenza A Screening

Extracted RNA undergoes quantitative real-time PCR (qRT-PCR) targeting the conserved Influenza A Matrix (M) gene. This screening step identifies the presence of any influenza A virus.

Subtype Identification

Samples confirmed positive for Influenza A are then subjected to specific qRT-PCR assays to identify and differentiate key subtypes, including H5, H7, and H9, crucial for risk assessment.

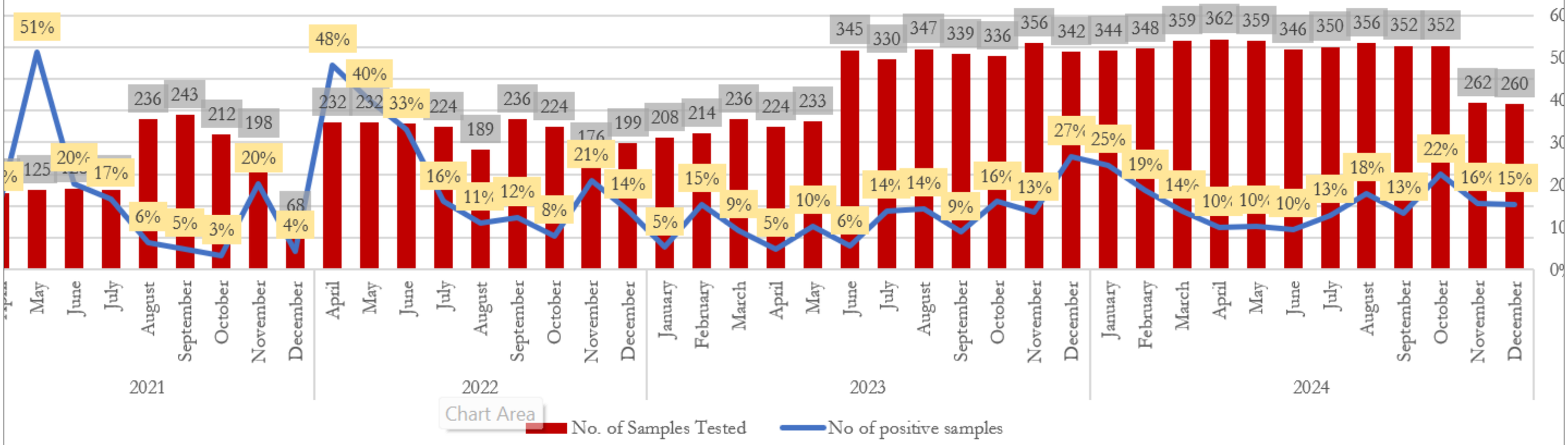
Expected Outcome

The culmination of this workflow is the definitive detection of Flu A positive samples and a clear understanding of the subtype distribution, providing vital epidemiological data for public health action.

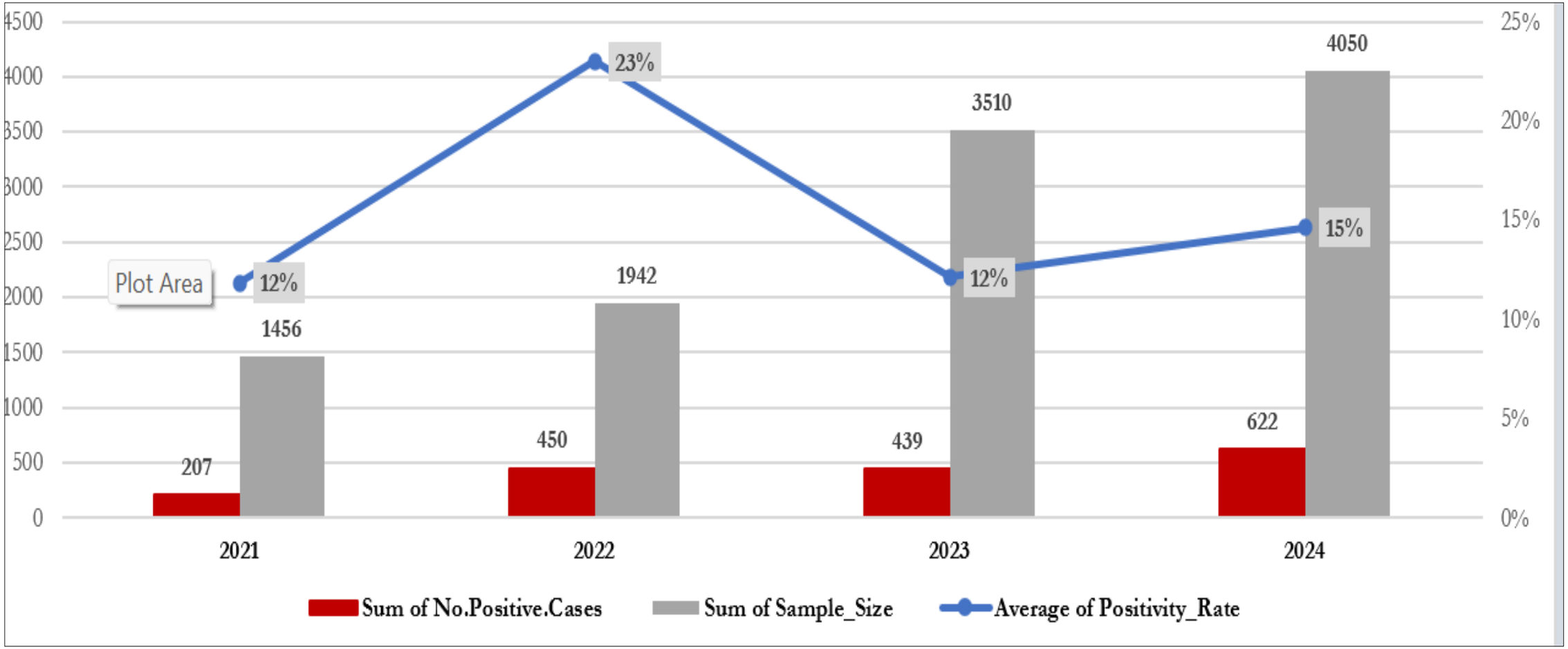
RESULTS

AVIAN INFLUENZA SURVEILLANCE DASHBOARD

Total Samples: 10958	Positive Samples: 1718	Negative Samples: 9240



Flu A Positivity 2021-2024



Flu A positivity 2025

Month(2025)	Total samples	Flu A positive samples	% Positivity
January	260	57	21.92%
February	248	68	27.41%
March	246	83	33.74%
April	244	41	16.80%
June	240	51	21.25%

Wild Birds Surveillance Results -2023

Surveillance sites	Total samples collected (2023)	Total Flu A Positives (% per site)	H9 Positives (% per site)	H9 Negatives (% per site)
Lake Naivasha	975	14(1.44%)	13(1.33%)	1(0.1%)
Lake Nakuru	911	4(0.44%)	1(0.12%)	3(0.33%)
Lake Victoria	1099	2(0.18%)	2(0.18)	0
Lake Bogoria	508	0	0	0
Lake Baringo	377	0	0	0
Lake Elementaita	731	0	0	0
Total	4601	20(0.43%)	16(80%)	4(20%)

Wild Birds Surveillance results - 2024

Site/ Lake	Total number of samples collected	Flu A Positive Samples
L.Amboseli	299	3
L.Naivasha	434	7
L.Nakuru	401	2
L.Victoria	605	0
L.Elementaita	254	0
TOTAL	**1993**	**12**

Unraveling the Genome: Understanding AIVs Genetic Diversity

Lineage Identification

Pinpointing the geographic origin and spread of viral lineages (e.g., Eurasian, African) to understand transmission pathways.

Antigenic Site Analysis

Detecting specific amino acid changes within antigenic sites, crucial for assessing potential immune evasion and vaccine effectiveness.

Insights on Genetic Diversity

Providing a comprehensive understanding of viral evolution, informing vaccine relevance, and guiding public health preparedness strategies.

Phylogenetic Findings

The genetic analysis indicated that the H9 viruses from Kenya belong to the G1 lineage and formed two distinct clusters:

First Cluster:

- Comprised 169 H9 viruses.
- More closely related to previous poultry viruses from Africa.
- Displayed 9-13 amino acid differences in HA1, including changes in antigenic sites B and C, when compared to the current WHO CVV A/Oman/2747/2019.

Second Cluster:

- Consisted of 7 H9 viruses (6 H9N2 and 1 H9N9).
- More closely related to G1 Eurasian avian viruses.
- Exhibited 45 amino acid differences in HA1, with alterations in antigenic sites A, B, and D, compared to the WHO CVV A/Bangladesh/0994/2011.
- The 7 samples were all wild birds fecal/ environmental samples from Lake Naivasha

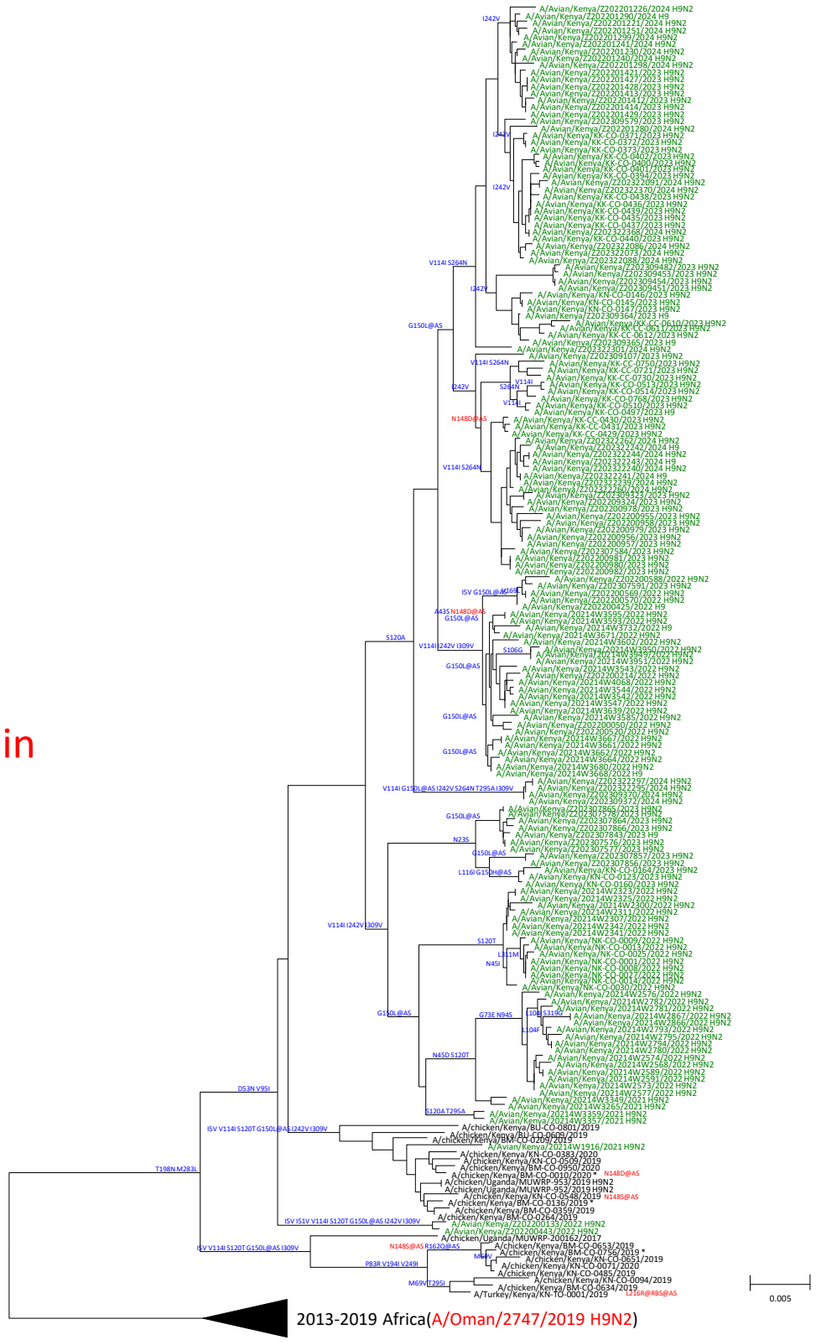
Evolution of Influenza A
(H9) HA, G1, 2019-2024 Africa

Reassortant vaccine candidate

Viruses received by CDC

Amino acid differences relative to:
A/Oman/2747/2019 H9N2

Mutation found in genetic changes inventory in red
@AS – mutation at putative antigenic site
@RBS – mutation at receptor binding site



Evolution of Influenza A
(H9) HA, G1

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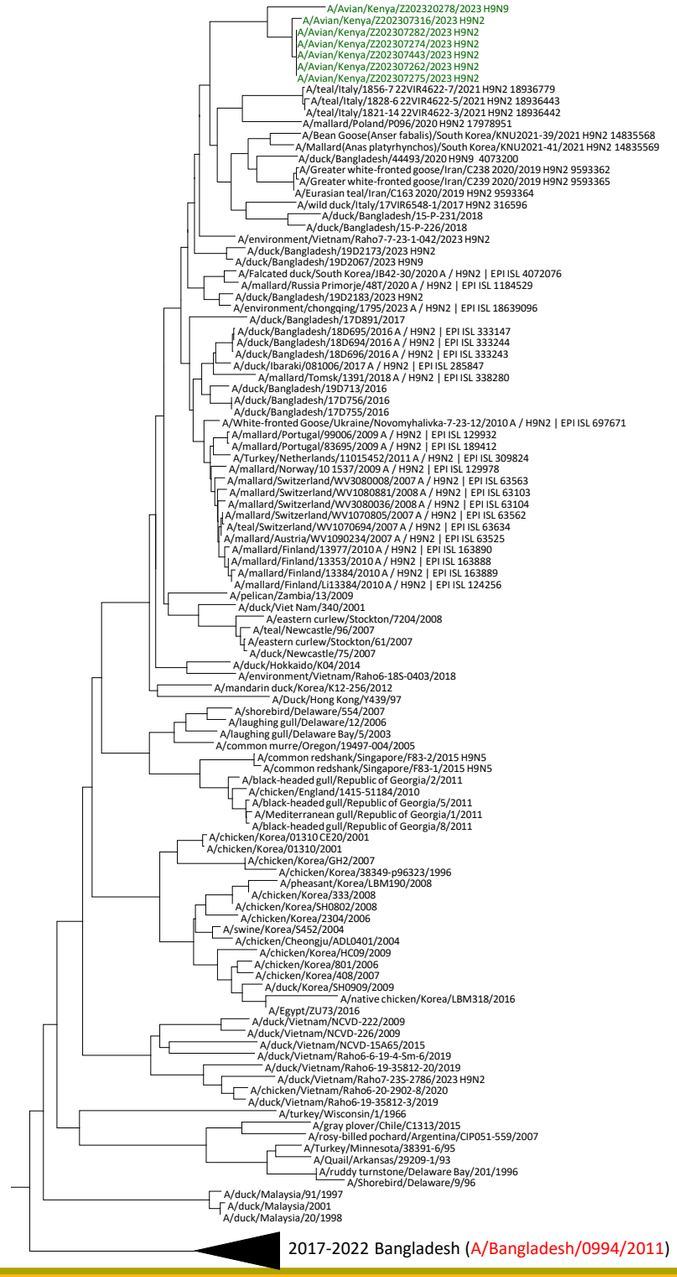
Viruses received by CDC



Tangible Impact: Milestones in Avian Influenza Control

- Sustained Surveillance Presence

  Successfully established and maintained active AIVs surveillance in 8 selected Live Bird Markets (LBMs) across 6 counties, ensuring continuous monitoring in high-risk areas.

- Near Real-time Results

  Achieved efficient, near real-time testing and prompt sharing of AIVs results, significantly reducing diagnostic turnaround times and facilitating rapid response.

- Enhanced Capacity Building

  Strengthened diagnostic and epidemiological capacity at NVRL (CVL + RVILs) through training of staff from counties and labs on AIVs surveillance procedures, testing, equipment use, and media preparation. Also ensured procurement and maintenance of critical molecular lab equipment.

- Adaptive Strategy & Feedback

  Implemented annual stakeholders review and feedback meetings, fostering continuous improvement and adaptation of the surveillance strategy based on emerging data and operational insights.

Tangible Impact: Milestones in Avian Influenza Control

- Strengthened International Networks
  Cultivated robust international collaborations and networks through successful sample sharing with partner labs in Atlanta (e.g., CDC) for advanced viral characterization, contributing to global understanding of AIVs.

- Biosecurity Guidelines Development
  Identified critical biosecurity gaps within LBMs and are actively developing comprehensive Biosecurity Guidelines for Live Bird Markets across Kenya to improve disease prevention and control practices.

- Advanced Scientific Contribution
  Contributed to the scientific community with 1 peer-reviewed publication already completed and several more in progress, disseminating valuable research findings to the wider public health domain.

viruses

MDPI

Article

Characterization of Avian Influenza Viruses Detected in Kenyan Live Bird Markets and Wild Bird Habitats Reveal Genetically Diverse Subtypes and High Proportion of A(H9N2), 2018–2020

Peninah Munyua [1,*], Eric Osoro [2], Joyce Jones [3], George Njogu [4], Genyan Yang [3], Elizabeth Hunsperger [1], Christine M. Szablewski [3], Ruth Njoroge [2], Doris Marwanga [2], Harry Oyas [4], Ben Andagalu [5], Romona Ndanyi [4], Nancy Otieno [6], Vincent Obanda [7], Carolyne Nasimiyu [2], Obadiah Njagi [4], Juliana DaSilva [3], Yunho Jang [3], John Barnes [3], Gideon O. Emukule [5], Clayton O. Onyango [1] and C. Todd Davis [3]

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4 Directorate of Veterinary Services, Ministry of Agriculture and Livestock Development, P.O. Box 29114, Kangemi, Nairobi 00625, Kenya
5 Influenza Division, US Centers for Disease Control and Prevention, Village Market,

A Healthier Future: The Far-Reaching Impact of AI Surveillance

The sustained efforts in Avian Influenza surveillance in Kenya yield profound benefits, extending beyond national borders to bolster regional and global public health security.

Informed Control Measures

Early and precise detection of circulating AIV subtypes provides critical intelligence to guide the timely implementation of effective disease control and prevention measures, mitigating outbreak risks.

Strategic Genetic Data

The comprehensive genetic data collected is invaluable. It directly informs vaccine candidate selection, ensuring that vaccines developed are relevant and effective against circulating strains. This data also enhances regional preparedness strategies for potential outbreaks.

Enhanced Global Surveillance Networks

Kenya's contributions significantly strengthen global influenza surveillance networks by providing real-time data and insights from a critical geographic region, fostering a more resilient worldwide response to emerging threats.

Acknowledgement

WASHINGTON STATE UNIVERSITY

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

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BUSIA COUNTY
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KYAA NDAA

USHAURI KWA UAMINIFU

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