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# Optimizing surveillance for virus detection in vaccinated populations: dead bird, environmental or hybrid sampling systems

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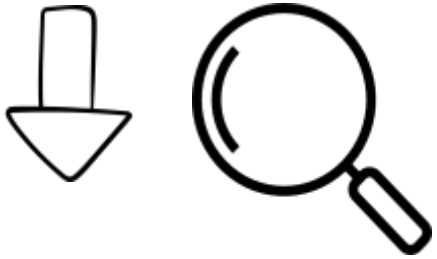
*Paris, 22 & 23 October, 2024*

# Classical strategies of surveillance of a vaccinated flock

## Passive surveillance

Observation of clinical signs & mortality

➔ Targeted sampling of birds



## Active surveillance

Random sampling of (60) birds in a flock

- ☞ **Molecular**
- ☞ **Serology (DIVA)**

# Post-vaccination surveillance: a complex balance

## EU Delegate act on HPAI vaccination surveillance / application in France

| Conditions | Enhanced passive surveillance | Active surveillance | Serological survey to evaluate the effectiveness of the campaign |
|---|---|---|---|
| **Where?** | Epidemiological Unit | Epidemiological Unit | Batch |
| **By who?** | Breeder or Technician | Official veterinarian | Official veterinarian |
| **Frequency?** | **Weekly** | **Every 30 days:**<br>**clinical visit + virological analysis** | **At the end of the batch:**<br>**serological analysis** |
| **How?** | Swabs<br>(tracheal or oropharyngeal swabs)<br>on 5 cadavers | Swabs on 60 vaccinated ducks<br>(tracheal or oropharyngeal swabs) | Blood collection from 20 animals |
| **Analysis?** | RT-PCR gene M virology<br>If the result was positive ➔<br>screening H5/H7 | RT-PCR gene M virology<br>(If the result was positive ➔<br>screening H5/H7) | ELISA NP serology |
| **Laboratory type?** | Recognised laboratory | Approved laboratory | Approved laboratory |

# Sampling diseased or dead birds?

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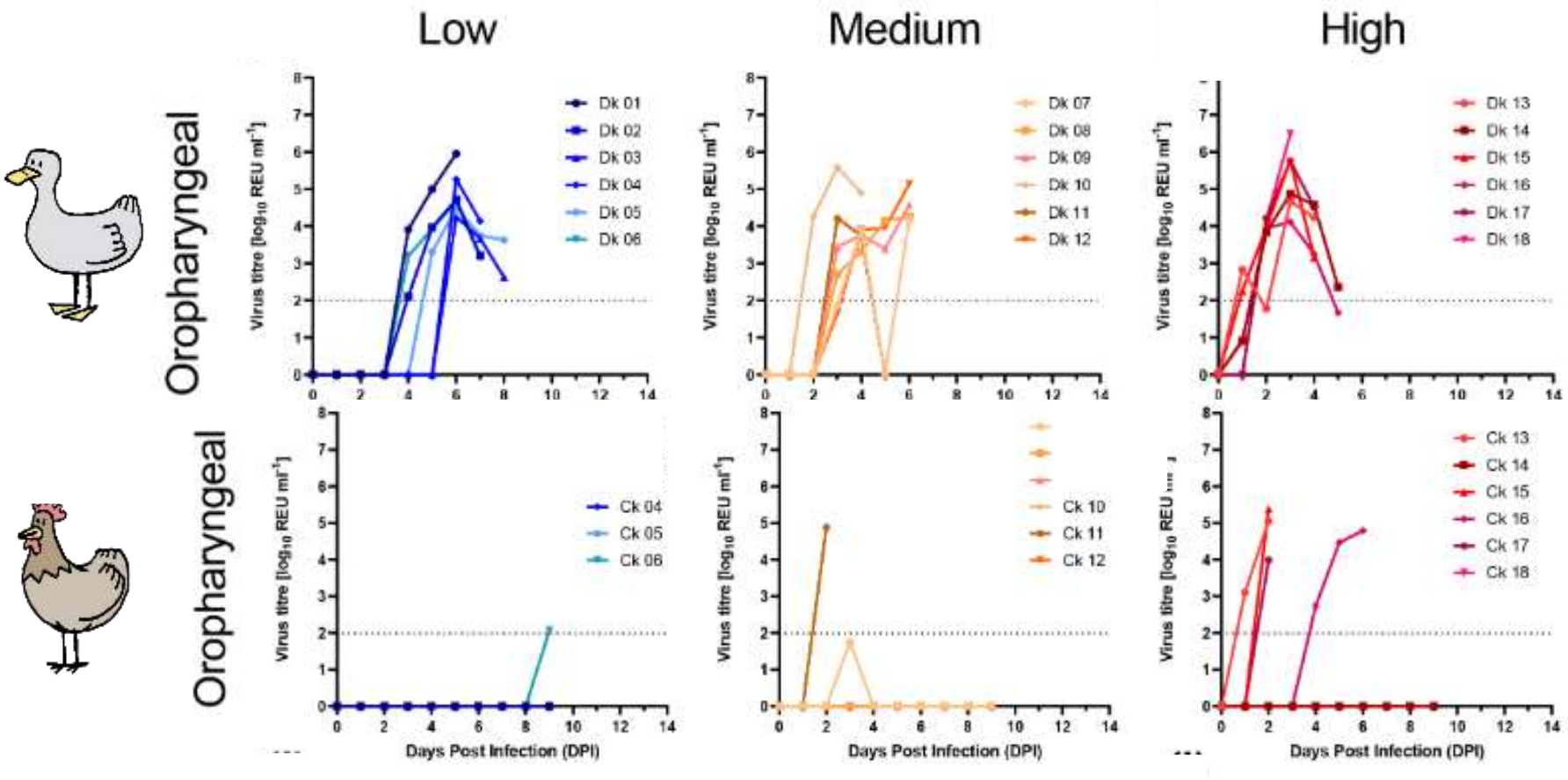
# The dynamics of excretion is host / virus dependent

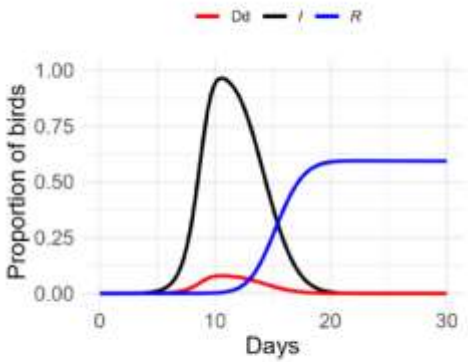


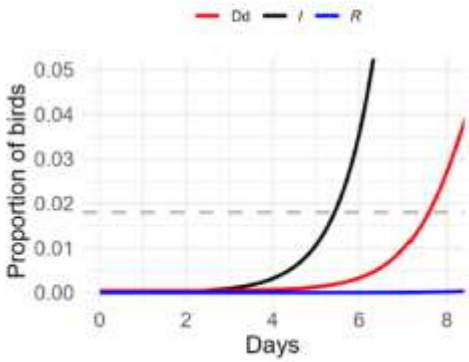

James *et al,* J. Gen Virol. 2023

Clade 2.3.4.4b H5N1 high pathogenicity avian influenza virus (HPAIV) from the 2021/22 epizootic is highly duck adapted and poorly adapted to chickens

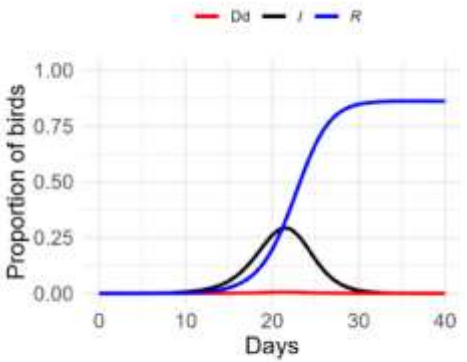
# The dynamics of excretion and mortality is host / virus dependent

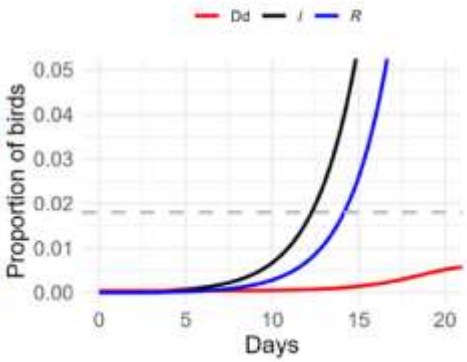
Unvaccinated Ducks



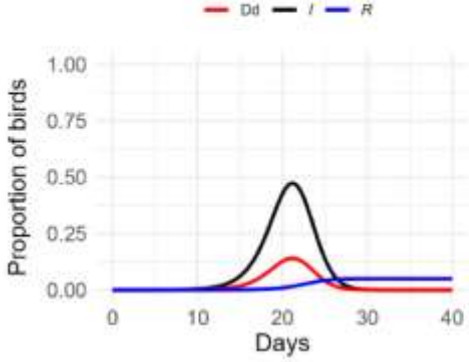



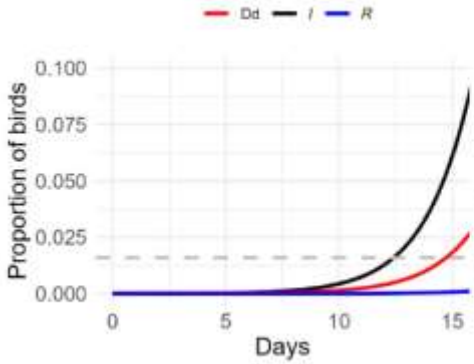

Vaccinated Ducks



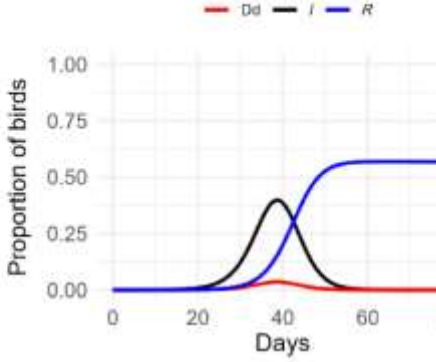



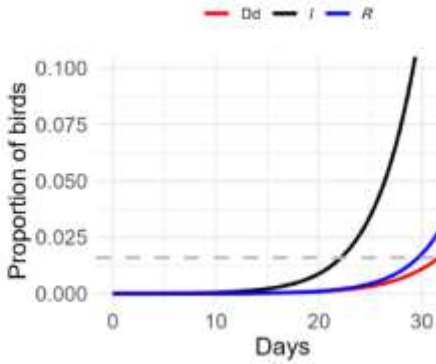

Unvaccinated layers




Vaccinated layers



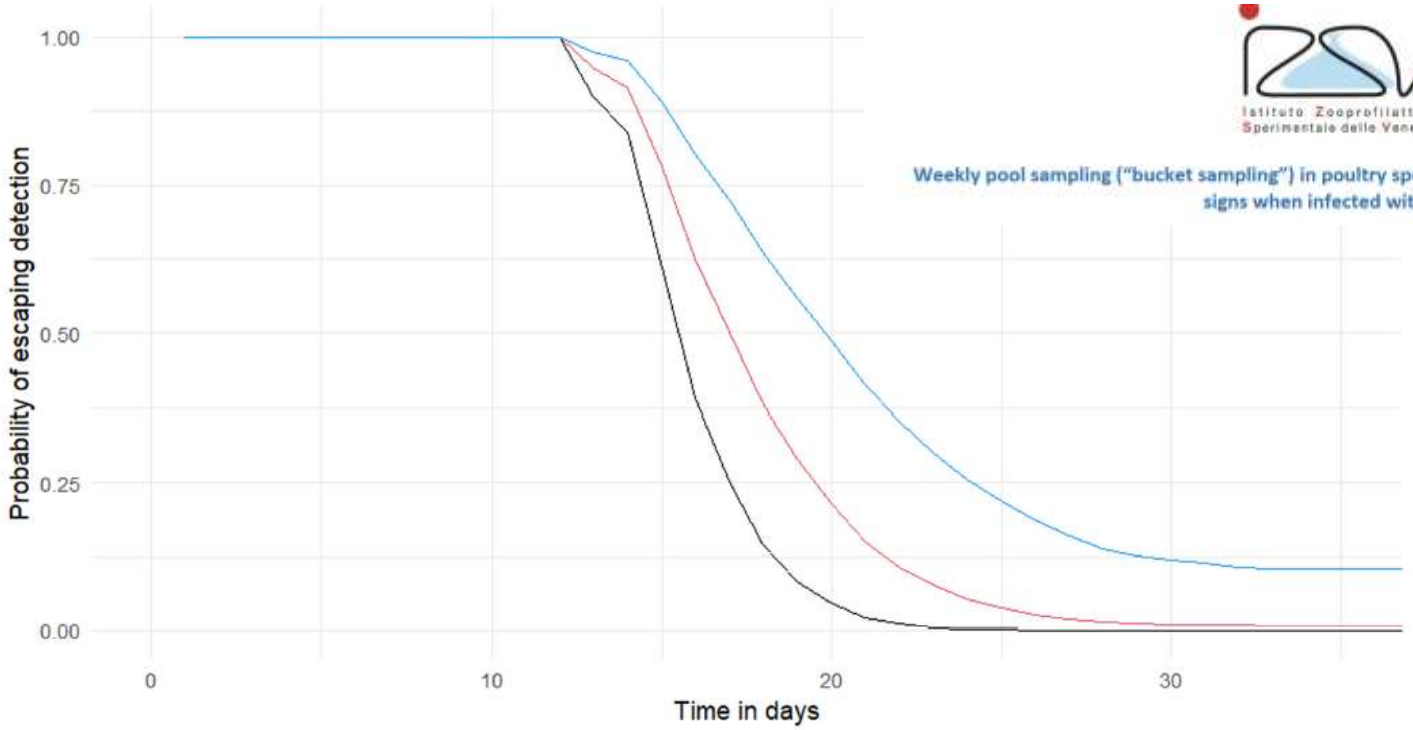




DOI: 10.2903/j.efsa.2024.8755

SCIENTIFIC OPINION

**Vaccination of poultry against highly pathogenic avian influenza – Part 2. Surveillance and mitigation measures**

# « Bucket sampling » is a sensitive and early detection strategy



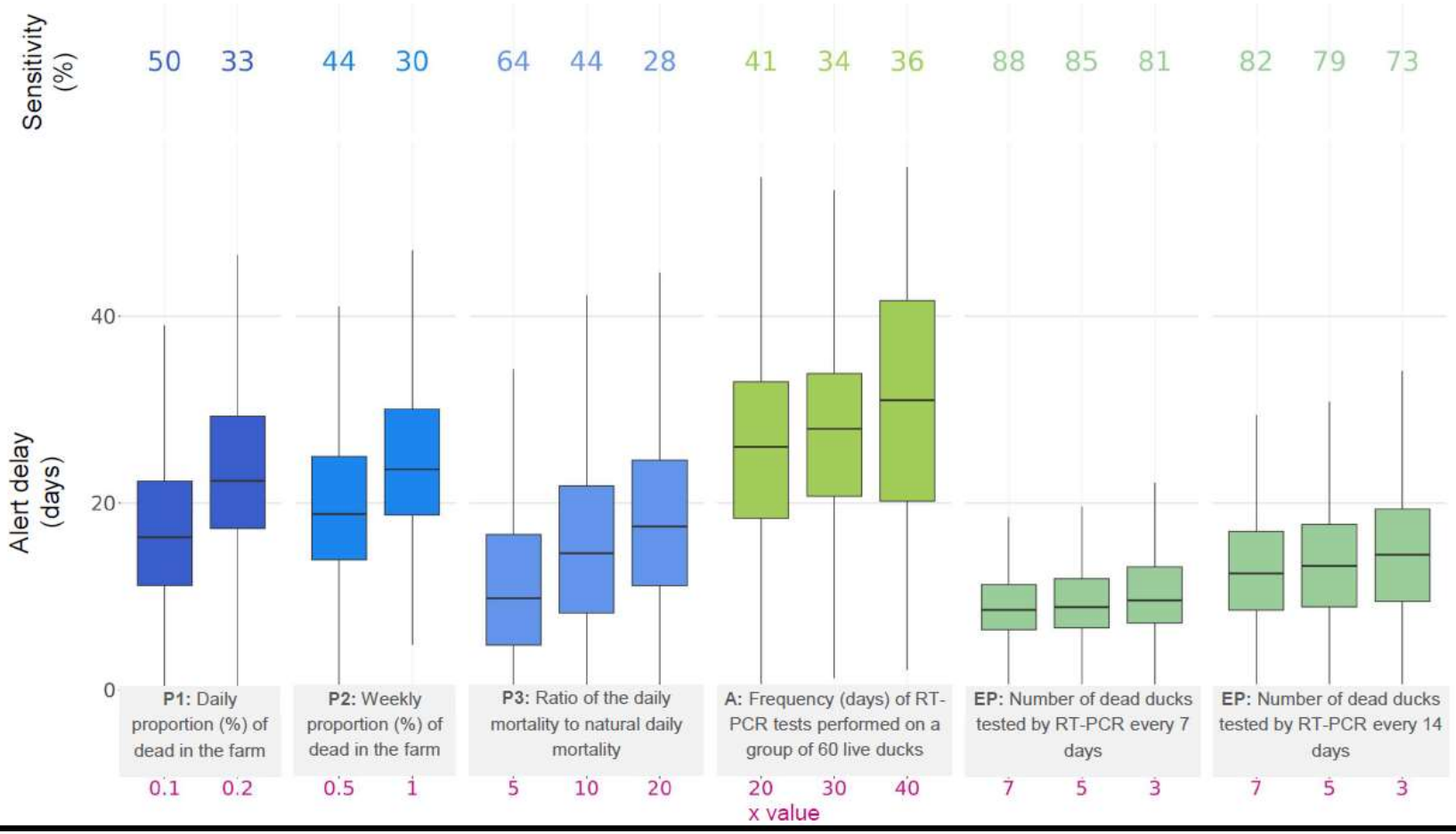

Weekly pool sampling ("bucket sampling") in poultry species that often do not manifest clinical signs when infected with HPAI

**FIGURE 4** Probability of an infected vaccinated flock (one outbreak simulation is shown) escaping detection given three surveillance strategies based on sampling five dead birds at an interval of 7 days (black line), 14 days (red line) and 30 days (blue line). In this flock the probability of escaping detection when sampling at intervals of 14 and 30 days does not decrease below the required level of detection 0.01 (≥ 99% of probability of detection). This requirement could be reached by increasing the number of birds sampled. The x-axis is the time in days from the start of outbreak in the flock.

SCIENTIFIC OPINION

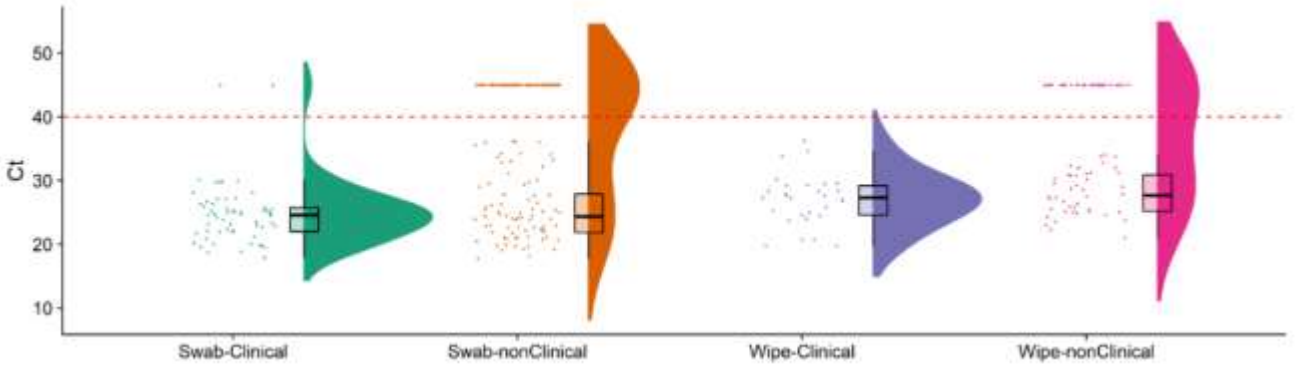
**Vaccination of poultry against highly pathogenic avian influenza – Part 2. Surveillance and mitigation measures**

# « Bucket sampling » is a sensitive and early detection strategy

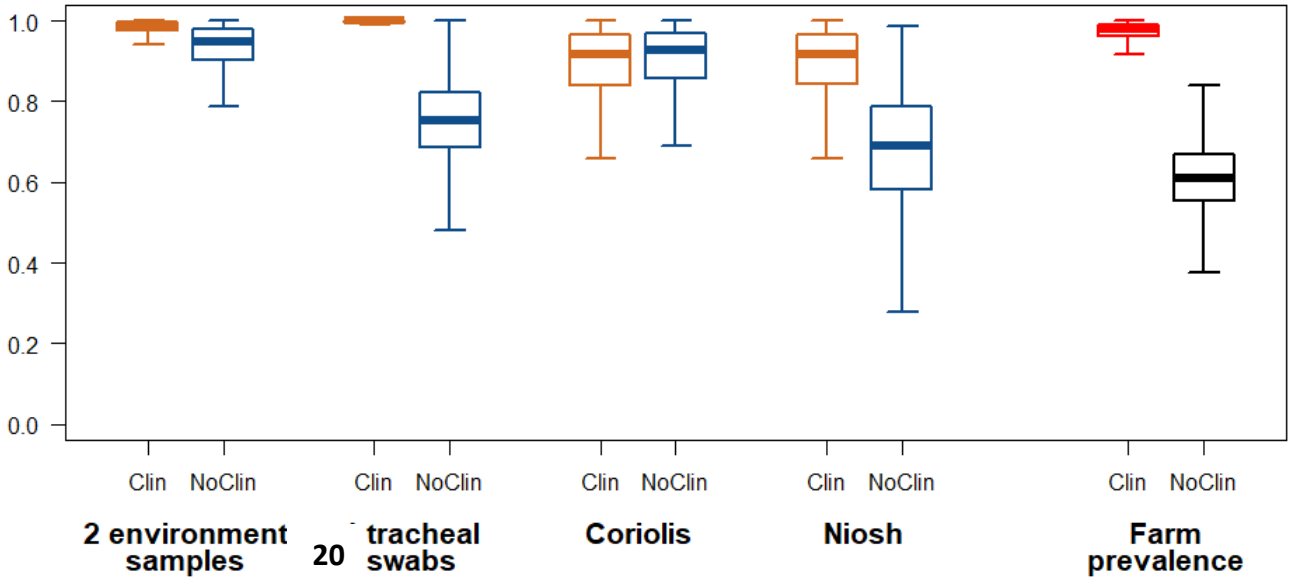



Planchand *et al*, *in revision*

# 2.3.4.4.b HPAIVs are efficiently detected in dust and aerosols



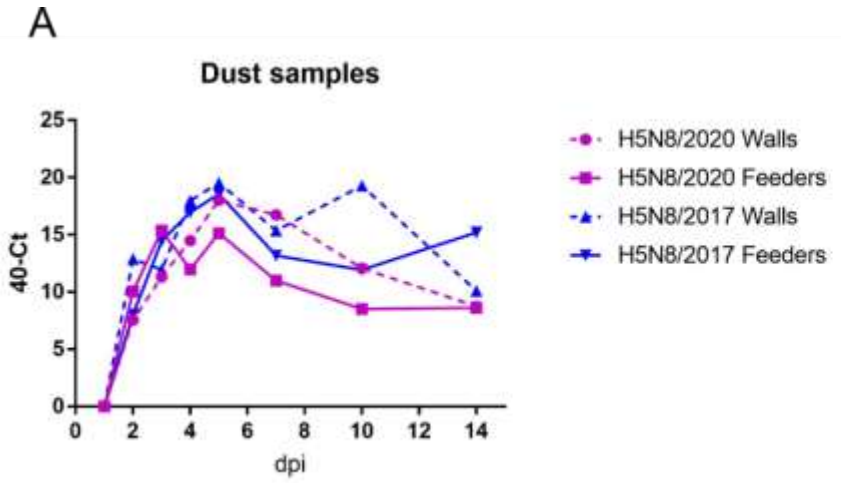


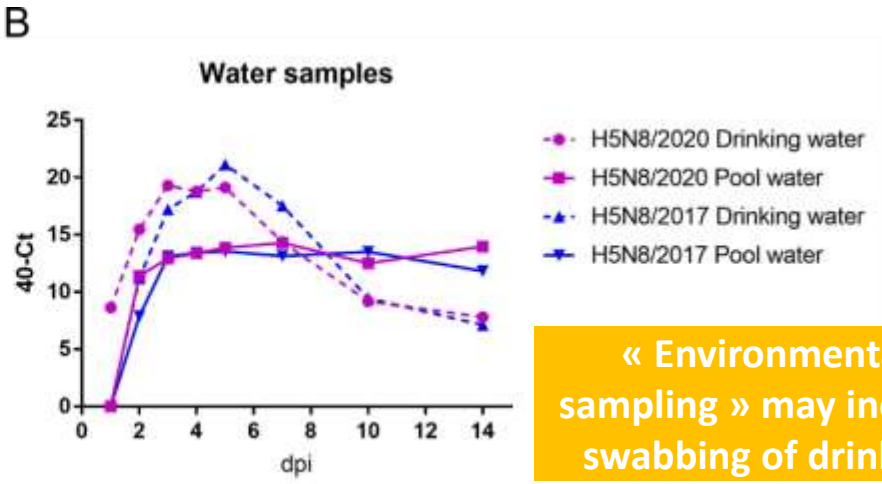



**Highly Pathogenic Avian Influenza A(H5N8) Clade 2.3.4.4b Virus in Dust Samples from Poultry Farms, France, 2021**

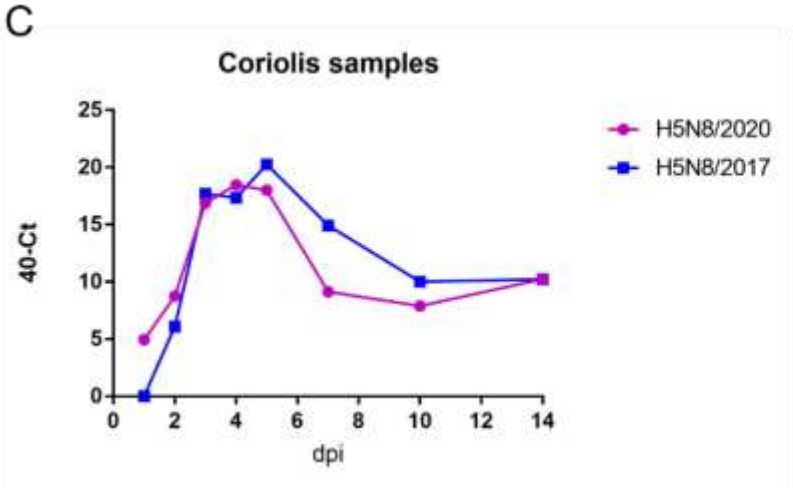
Fabien Filaire, Laetitia Lebre, Charlotte Foret-Lucas, Timothée Vergne, Patrick Daniel, Aurélie Lefèvre, Antoine de Barros, Adam Jbenyeni, Pierrick Bokon, Mathilde Paul, Guillaume Croville, Jean-Luc Guérin

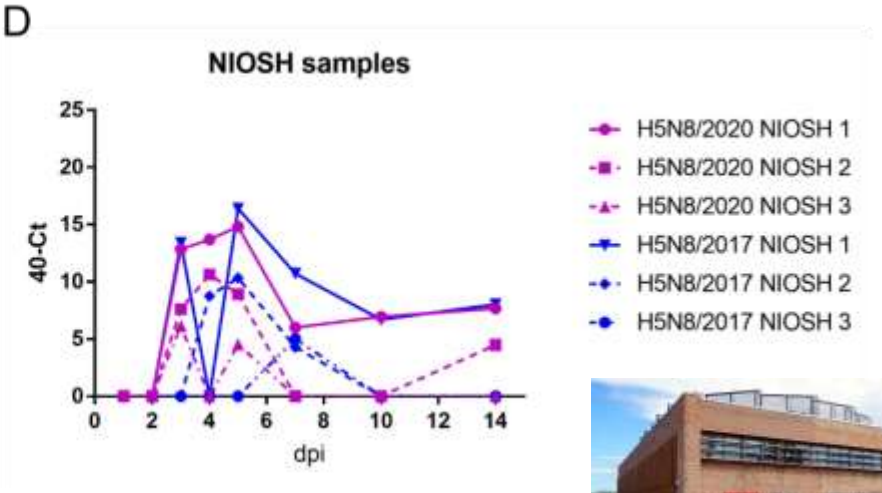
# Ducks: environmental excretion starts very early in the course of infection



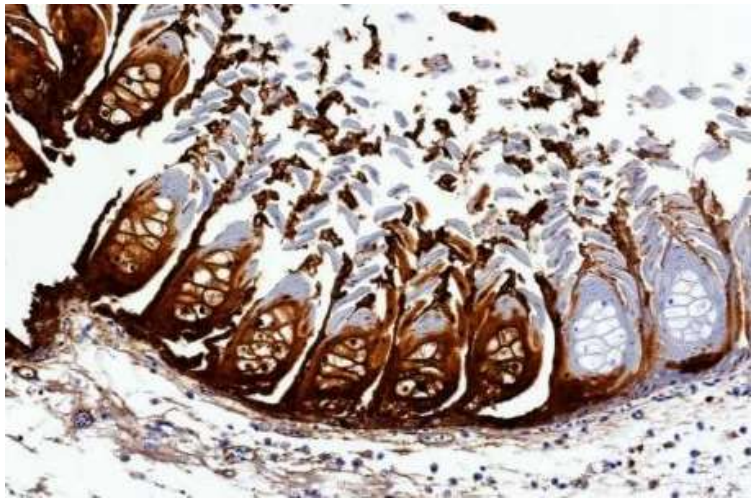

« Environmental sampling » may include swabbing of drinkers



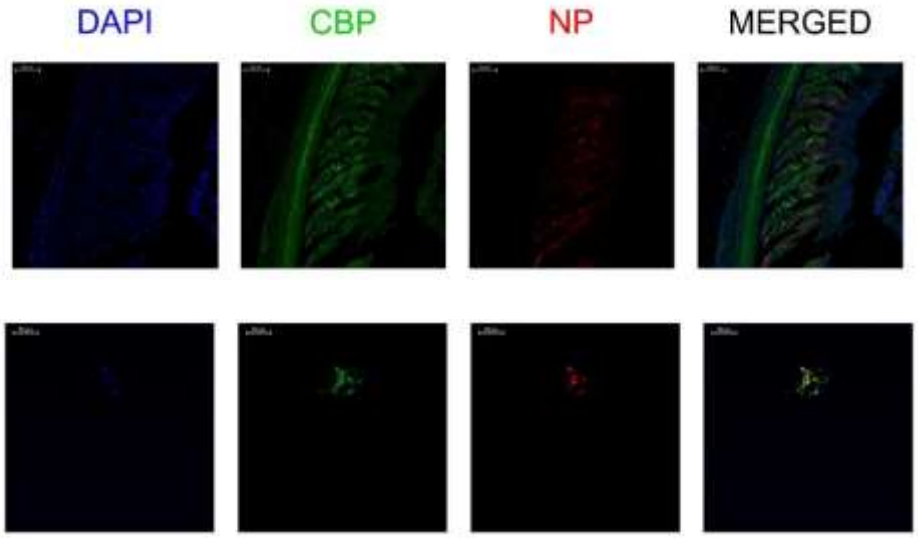

Filaire *et al. Veterinary Research* (2024) 55:100
https://doi.org/10.1186/s13567-024-01357-z

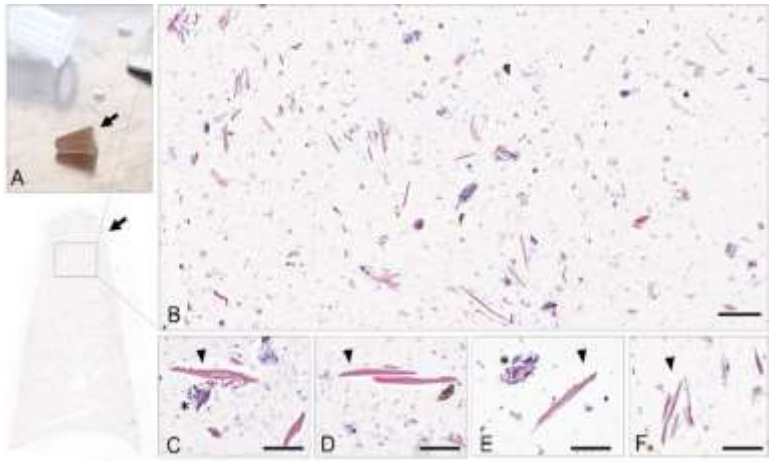
# Ducks may excrete HPAIVs in the environment *via* feather fragments



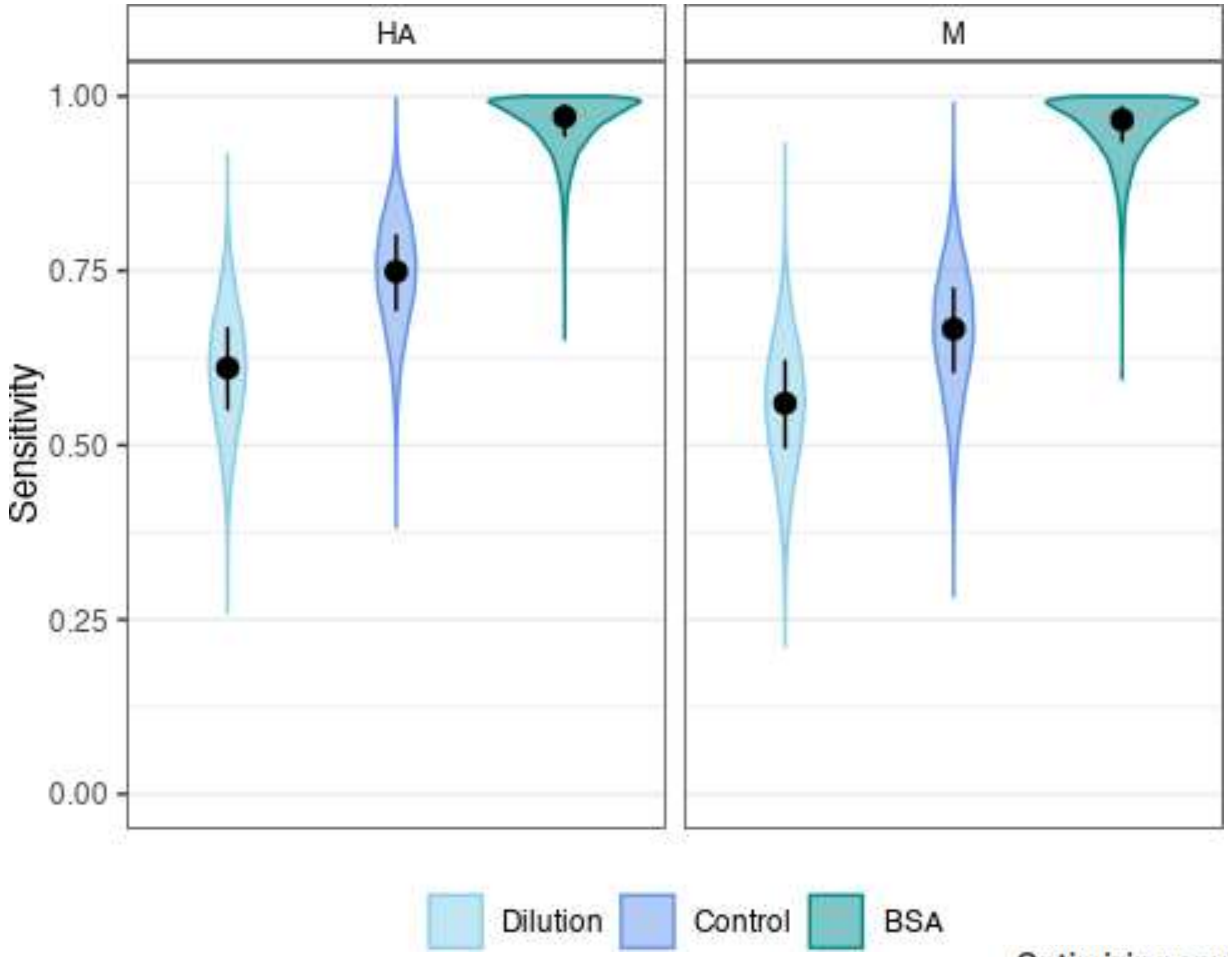
Feather

Dust




# There’s room for research & innovation to control PCR inhibition on environmental samples !




AMERICAN SOCIETY FOR MICROBIOLOGY | Microbiology Spectrum

**Optimizing environmental viral surveillance: bovine serum albumin increases RT-qPCR sensitivity for high pathogenicity avian influenza H5Nx virus detection from dust samples**

Pierre Bessière,[1] Brandon Hayes,[1] Fabien Filaire,[1,2] Laetitia Lèbre,[1] Timothée Vergne,[1] Matthieu Pinson,[2] Guillaume Croville, Jean-Luc Guérin[1]

# Take-home messages

- Profiles of clinical signs, excretion and mortality are host species (and virus strains) dependent
- Targeted molecular testing on dead/diseased birds should be considered in surveillance official plans
- Detection of 2.3.4.4b virus in dust and drinking water is possible very early in the course of infection: environmental sampling could *complement* swabs in surveillance plans
- There's need of further validation and improvement of sensitivity and reliability of environmental samples: sampling SOP, extraction and PCR
- A combination of targeted birds sampling + environmental (+ random if needed) is likely the most efficient option

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