

Developing appropriate surveillance systems that provide confidence that HPAI virus is not circulating in poultry



<https://www.autostraddle.com/magic-button-make-everything-ok-106898/>

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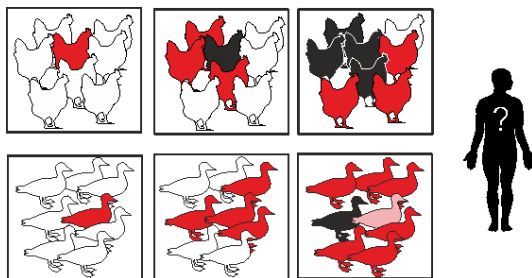
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1

Setting the scene / fully susceptible birds



- In clinically susceptible animals (**chicken**) passive surveillance will lead to identification of HPAIV affected flocks
- Early virological monitoring will downsize log phase, i.e. time of unrecognized virus spread
- In clinically less affected bird species (**adult ducks**), prolonged log phase will eventually be associated to unrecognized HPAIV spread .

2

Setting the scene / HPAI in vaccinated flocks

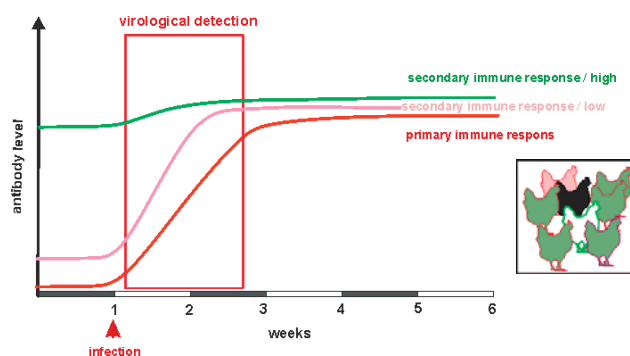


- Vaccination should induce clinical protection, reduce susceptibility to infection and reduce shedding -> transmission factor $R_0 < 1$
- Flock immunity $>85\%$ is considered efficient in controlling further spread on the epidemiological level

- Regarding clinical susceptibility, *vaccination transforms chickens into ducks*
- **Passive surveillance no longer ensures detection of HPAIV infected flocks**

3

Setting the scene / test principles



- limited window of virus detection
- Immune response takes 2 weeks; afterwards no detection of virus
- Boost of antibody (Ab) response dependent on preexisting Ab-level : CAVE false negative DIVA

4

Trust is good.

5

Where is trust required with AI vaccination?

- A matching, safe and immunogenic vaccine is being selected and used (research and licensing)
- Vaccine application ensures sufficient coverage in flocks
- Adequate population immunity is induced and maintained
- Trading partners and consumers reward the added efforts of vaccinating poultry producers (marketing)
- **HPAIV circulation is excluded from vaccinated flocks = safety of vaccinated poultry and products thereof**

- Surveillance-related item

6

Control is better!

Ascribed to V.I. Ulyanov

7

Surveillance enforces vaccination control

Surveillance strategies and diagnostic methods require careful adaptation to

- The epidemiological situation: endemic, epidemic or sporadic occurrence of HPAI
- The capacities of public veterinary services
- Socio-cultural environments
- The scope (local, regional, sectorial, integrative, etc.) and aims (emergency, waling prevention, etc.) of vaccination

Surveillance achieving zero tolerance of HPAIV circulation in vaccinated flocks can be financially demanding.

8

Surveillance approaches

Passive surveillance

- relies on farmers/veterinarians/traders etc. reporting suspicions
- more or less continuously in place, variable quality between farms
- less effective in vaccinated populations

Active surveillance,

- inspection, sampling and testing prescribed by protocol of the surveillance programme
- transparent and structured sampling frame (farms, type and number of samples, sampling frequency, tests) defines precision of surveillance
- not continuous
- pre-testing signal enhancement (e.g., bucket sampling) required, if no clear clinical or production-related signs expected

1. Monitor vaccine coverage and population immunity

- Vaccination governance (registration of holdings)
- Vaccination distribution and uptake
- Assessment of vaccine-induced protection
 - Antigenic match with circulating viruses
 - Definition of surrogate of protection (i.e., HI titer) and of threshold of protection
 - May depend on vaccine type and poultry species
 - Vaccination-challenge trials may be required to fix definitions (central institutions)

2. Prove absence of HPAIV circulation in vaccinated flocks

- Detection of new outbreaks in vaccinated flocks
 - Avoid significant spread within and between flocks (R_0 between farms below 1)
 - Passive surveillance difficult, thresholds for vaccinated populations undefined
 - Unvaccinated sentinel strategies increasingly discouraged
 - Active surveillance using RT-PCR
 - Targeted rather than random sampling recommended (bucket sampling)
 - Environmental sampling can be highly informative
 - Efficacy of serosurveys depends on type of vaccine (DIVA) and (absence of) interfering LPAIV infection
- Precision of surveillance depends on aims of vaccination and on the epidemiologic situation

Control is an illusion!

Sober interpretation of reliable facts is required

“When rolling dice in a craps game people tend to throw harder when they need high numbers and softer for low numbers.”:

More frequent boosting helps to push protective levels of immunity.

No, there are many factors that influence induction of protective immunity.

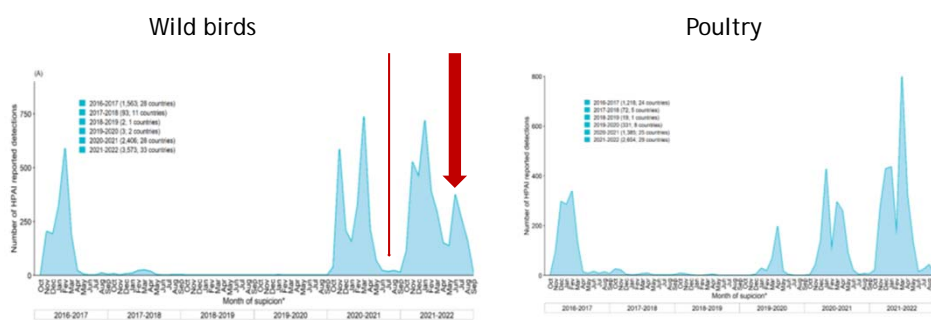
“The irrational primacy effect is involved when people give greater weight to information that occurs earlier in a series.”:

Previous examples have shown that vaccination always fosters silent virus spread.

No, but the beneficial effects of vaccination can be corrupted by various factors; careful planning and surveillance are required to stay in control.

13

H5N1 in wild birds and poultry is tightly linked



Data: European Food Safety A, Avian influenza overviews,
 e.g. EFSA J. 2021-22;19:e06497.

14

3. Assess HPAIV circulation in unvaccinated sectors

- Follow the trends of infection in such regions or in parts of the population that may be at increased risk of incursions
 - Combine passive and (low scale) active surveillance
 - Serosurveys in a region can best be done according to a two-stage sampling design: select farms first, then samples of birds
 - Seropositive results: Virological follow-up.
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- Assess incursion pressure from wild bird populations

Thinking outside the box: AI vaccination of wild birds



<https://coastalreview.org/2021/06/drones-allow-for-birds-eye-view-of-seabird-colonies/>

- Protection against disease
- Reduced virus load in the environment
- Conservation-compliant accessibility of wild birds
- Mass-applicable, baited, drone-delivered (GMO) vaccines tolerable?
- Successful examples of red fox (rabies) and wild boar (classical swine fever) bait vaccination in Europe

Full control is an illusion!

17

--but be aware what's under the vaccination blanket



Humpback whale Photo: lindsay_imagery / Getty Images

18