Prevalence and risk factors of avian influenza and Newcastle disease in Mali

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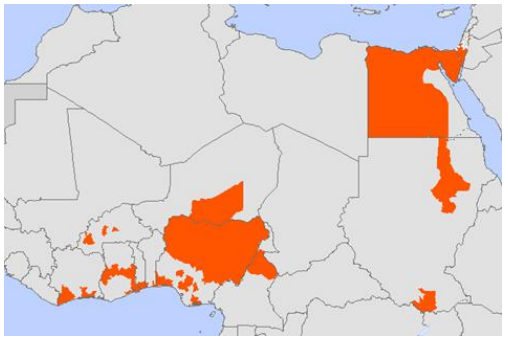
Introduction



- 2006: H5N1 HPAI arrives in Africa
- Mali considered at risk:
  - HPAI outbreaks in neighboring countries
  - Inner delta of the Niger River (IDN): presence of millions of migratory birds, potentially carrying virus

- Surveillance complicated by:
  - Presence of Newcastle disease (ND) but limited knowledge about the prevalence (proportional morbidity 32.9%; Sylla et al, 2003)
  - No information on avian influenza

Objective: Better understand prevalence and risk factors for AI and ND in Mali

Method

- Pilot (2007) and cross-sectional (2008) study
  - Study zone: 3 zones at risk for H5N1 HPAI:
    - Mopti: IDN palearctic and afrotropical migratory birds
    - Sikasso: cross-border trade with countries with HPAI outbreaks
    - Bamako: numerous commercial farms with limited biosecurity

  - Objective: sample 1500 birds
    - 250 for pilot study (February 2007)
    - 1250 for cross-sectional study (2008)
      - 2 seasons: February (dry cold) and May (dry hot)
      - 2 productions types: commercial farming and traditional backyard farming
      - 2 species: chicken and duck

Method

- Longitudinal study (2009-2011)
  - Representative: random sampling of investigated villages
  - Study zone enlarged to the southern half of Mali
  - Only backyard poultry
  - Longitudinal: survey in the same villages and whenever possible in the same birds (individual ring identification)
  - Sample size determined from 2007-2008 results (expected prevalence, inter-village variance)
    - 32 poultry/village in 32 villages => 1024 poultry
    - 6 sampling periods => 6144 poultry in total

Sample collection & analysis

- **Tracheal and cloacal swabs**
  - Put in cryotubes containing transport medium, transported in liquid nitrogen containers
  - Tested by:
    - rRT-PCR for gene F (NDV detection)
    - rRT-PCR for gene M (AIV detection)
      - Positive tested by H5 and H7 rRT-PCR

- **Sera**
  - Blood sample => centrifugation => transport in cool boxes and storage at -20 C
  - Tested by:
    - ELISA IdVET FluA (detection of antibodies against AIV in chickens)
    - ELISA LSI AVINDV and NDVAb (detection of antibodies against NDV in respectively chickens and other species)

Statistical analyses

- **Risk factor identification**
  - Testing association between individual prevalence and risk factors including species, age, sex, region, season
    - First univariate analysis
    - Then multivariate: random effect logistic regression

Results AI

2007-2008 study

Prevalence

- Low
  - Backyard: 3.1% sero; 1.1% PCR
  - Commercial: 0% sero, 0% PCR
- No HPAI

Risk factors

- Species: no
- Sex: no
- Age: no
- Region: OR Mopti/Sikasso = 2.0
- Season: OR Fév07/Fév08 = 4.0

2009-2011 study

Prevalence

- Low
  - Backyard: 1.6% sero; <1% PCR
  - Commercial: not tested
- No HPAI

Risk factors

- Species: no
- Sex: OR Female /Male = 1.7
- Age: no
- Region: no
- Season : OR Nov09/Feb10 = 2.5
  OR Nov09/May10 = 1.9

Results ND

Vaccination

- 6.8% in backyard poultry
- 100% in commercial poultry
- Seroconversion 98.4% in backyard poultry, and 99.6% in commercial poultry

Prevalence (unvaccinated)

- High in backyard (58.4%)

Risk factors

- Species : OR chicken/duck = 2.0
- Sex: OR female/male = 1.7
- Age: OR adult/young= 3.1
- Region: OR Sikasso /Mopti = 3.0
- Season: OR Feb08/ Feb07 = 5.1

Vaccination

- 52.8% in backyard poultry
- Commercial not tested
- Seroconversion 89.3% in backyard poultry

Prevalence (unvaccinated)

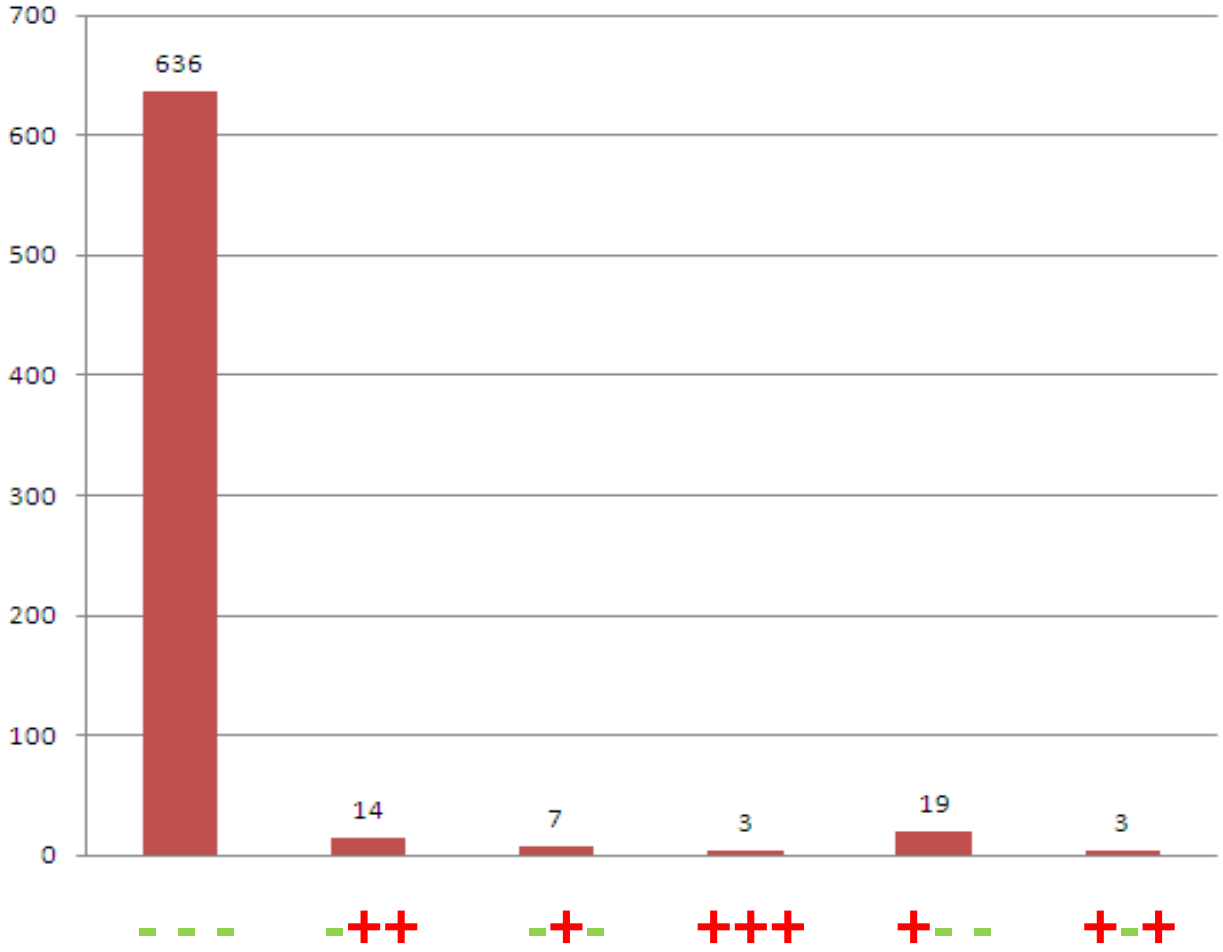
- High in backyard (68.2%)

Risk factors

- Species: OR chicken/duck = 2.0 (Gfowl 4.1)
- Sex: OR female /male = 1.7
- Age: OR adult/young = 3.0
- Region: OR Sikasso/Kayes = 3.3
- Season : OR Nov09/Feb10 = 2.5

Results longitudinal study AI

- 4890 birds sampled: 4187 sampled once and 703 sampled more than once
- 6 categories among the 703 birds sampled several times



Results longitudinal study AI

- Among the 703 birds sampled several times:
  - When seronegative at the 1st sampling:
    - 96.8% remain seronegative - - -
    - 3,2% become seropositive -++ -+-

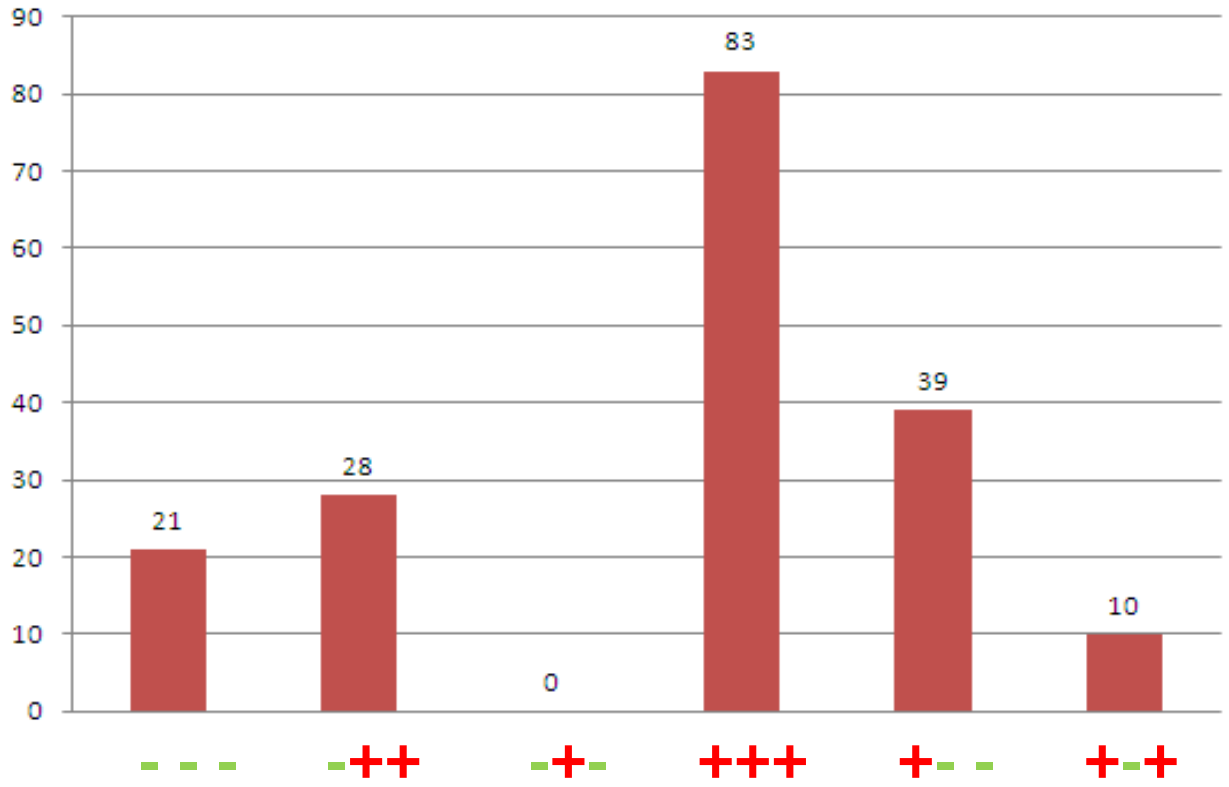
    => Gross estimation of AI incidence: 3.2% (2.0% when correcting for imperfect ELISA test)

  - When seropositive at the 1st sampling :
    - 12.0% remain seronegative +++
    - 76.0% become seronegative and remain seronegative +- -
    - 12.0% become seronegative and then seropositive +-+

    => Persistence of antibodies against AI seems limited

Results longitudinal study ND

- Among the 703 birds sampled several times:
  - 516 were vaccinated at some point during the study => data cannot be used to estimate incidence
  - 187 were never vaccinated:



Results longitudinal study ND

- Among the 187 birds sampled several times and having never been vaccinated against ND:
  - When seronegative at the 1st sampling:
    - 42.9% remain seronegative - - -
    - 57.1% become seropositive - + +

    => Gross estimation of ND incidence: 57.1%
  - When seropositive at the 1st sampling :
    - 62.9% remain seropositive + + +
    - 29.5% become seronegative and remain seronegative + - -
    - 7.6% become seronegative then seropositive again + - +

    => Two possible and non exclusive explanations:
      - Antibodies against NDV seem to persist longer than antibodies against AIV
      - Birds remain seropositive because they regularly encounter NDV

Conclusion

- About the study
  - Very similar results with studies that differ in terms of sampling strategy, geographical coverage, length
  - Results from 2009-2011 study more representative
  - Lack of power for longitudinal study of individual poultry
- « Take home » AI results
  - No circulation of HPAI
  - Circulation of LPAI but low prevalence (<2%) and incidence (≈3%)
  - No difference of circulation among regions except IDN where important presence of migratory birds
- « Take home » ND results
  - Wide circulation of NDV in traditional poultry (seroprevalence 68% and incidence ≈57%)
  - Vaccination against ND not sufficiently used in backyard poultry (53% of birds) but with satisfactory seroconversion



Thank you for your attention