Avian Influenza Research Activities in Cambodia

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H5N1 Outbreaks in Animals & Humans
Cambodia, 2004 – 2007

Poultry:
25 outbreaks including 15 in 2004, 3 in 2005, 6 in 2006 and 1 in 2007

Human:
7 H5N1 patients including 4 in spring 2005, 2 in spring 2006, and 1 in spring 2007

*IPC Unpublished data; slide courtesy of P Buchy, IPC
Research undertaken on AI in Cambodia since 2004

• **H5N1 Outbreak investigations** in human and poultry populations
  – Contribution to avian flu field investigations
  – Monitoring of H5N1 transmission
  – Human seroprevalence studies & case-control studies
  – Retrospective poultry mortality studies

• **KAP surveys** of backyard poultry owners, market sellers and middlemen transporting poultry

• **Hospital-based surveillance** of respiratory infections

• **Environmental Surveys**
AI Investigations Flow

- In depth-case ascertainment
- Poultry retrospective mortality surveys
- KAP Surveys

Immediate field investigations
- Follow-up investigations
- Seroprevalence survey

AI human case reporting
- Environmental survey
- Contact investigation
- Case control study
AI Investigations Flow

In-depth case ascertainment → AI human case reporting
AI Investigations Flow

- In-depth case ascertainment
- AI human case reporting
- Immediate field investigations
- Contact investigation
AI Investigations Flow

- In-depth case ascertainment
- Poultry retrospective mortality survey
- Immediate field investigations
- AI human case reporting
- Contact investigation
Poultry mortality survey

Methodology

- Door-to-door survey
- Questionnaire on poultry ownership, mortality experienced, flock movements
- Animal specimens (PCR)
  - Collection of death / sick animals
  - Sera, tracheal / cloacal swabbing
- Poultry ownership >80%
- High mortality (>60%) within 6 weeks prior to the H5N1 patient’s death

High probability of H5N1 infection in chickens

- Sudden death (1 day)
- All ages (adults and youngsters)
- 100% Case Fatality Rate
- Mortality Rate > 60%
AI Investigation Flow

- In-depth case ascertainment
- AI human case reporting
- Immediate field investigations
- Environmental survey
- Contact investigation
- Poultry retrospective mortality survey
Environmental Survey

Objectives
• H5N1 virus in environment? How long? Other vectors (insects…)?

Methods
• Sampling in case’s household and surroundings: garden (dirt, plant, dung, mud …), pond (water, fish, shells…)

• Detection H5N1 in environment is not a routine testing and the best approach still unknown
AI Investigations Flow

1. AI human case reporting
2. Immediate field investigations
   - Environmental survey
   - Contact investigation
   - Seroprevalence survey
3. Follow-up investigations
   - In depth-case ascertainment
   - Poultry retrospective mortality survey
4. Case control study
Follow-up investigations

Two-steps study design

Step 1: Seroprevalence Survey
- Essential tool for monitoring H5N1 transmission
- Assess sub-clinical and asymptomatic cases

Step 2: Case-Control Study
- Based on the findings of the seroprevalence survey
  - Cases = Seropositive individuals
  - Controls = Seronegative individuals
- In-depth documentation of AI risk factors
Seroprevalence Surveys

**Design:** 3 surveys in 4 villages where Avian influenza human cases have been reported

- **Mar 05:** H5N1 Village of H5N1 case #2†
  - Kampot province*
  - 93 households, 351 serums
  - No serologic markers of H5N1 infection

- **May 06:** Villages of H5N1 cases #5 and #6‡
  - Kampong Speu & Prey Veng provinces
  - 162 households; 670 serums
  - Serologic markers in 7 individuals (seroprevalence of 1.04%)

- **Jun 07:** Kampong Cham province
  - Village of H5N1 patient #7 (149 households, 708 serums)

* Results in Vong S et al, 2006, EID
† Vong et al, manuscript in progress
Case-Control Study*

Cases
- Subjects that were tested positive for H5N1 neutralizing antibodies during previous serosurvey (Kg Speu – Prey Veng, May 2006)

Controls
- Subject being tested negative during the serosurvey
- 3-4 controls per case
- Matching on age, gender and village of residence

In-depth questionnaire:
Investigation of potential behavioural risks factors during outbreak period
- Environmental exposures
- Animal exposures & food handling / preparation practices
- Contact with confirmed H5N1 human case

( *) Vong S et al, in press
AI Investigations Flow

- In depth-case ascertainment
- AI human case reporting
- Immediate field investigations
- Environmental survey
- Contact investigation
- Poultry retrospective mortality survey
- Follow-up investigations
- Seroprevalence survey
- KAP Survey
- Case control study
KAP Surveys: Backyard poultry owners

- **Methodology**
  - Two-stages cluster sampling

- **Study areas**
  - PV & Kg Cham Provinces†
    - Jan 2006; 23 villages
    - 460 respondents
  - Pusat, Takeo, S Rieng, B Meanchey)‡
    - Nov – Dec 2006; 77 villages; 2,400 respondents
  - PV & Kg Cham Provinces
    - Nov – Dec 2007; 40 villages; 1,200 respondents

- **Objectives**
  - Evaluate the frequency and extent of exposure to poultry in backyard poultry raising settings
  - Evaluate understanding (knowledge and attitudes) of AI

(†) Results in Ly S et al, 2007, EID
(‡) Van Kerkhove et al, manuscript in progress
Cross-sectional survey of markets and middlemen

• Snowball Sampling Methods to identify eligible subjects

• Objectives
  – ID preparation for sale practices
  – Disposal of carcasses and other waste; cleaning practices
  – Origin of purchase; middlemen use

• Study Locations
  – B. Meanchey, Pursat, S Rieng, Takeo Provinces
    • Nov – Dec 2006
  – Phnom Penh, surrounding areas around PP (Kandal Province)
    • Jan – Apr 2007
  – Kampong Cham, Prey Veng, Phnom Penh
    • Nov- Dec 2007
What have we learned?

• H5N1 appears to be endemic in domestic poultry in Cambodia
• Approximately 90% population in Cambodia is involved in poultry raising primarily as backyard poultry raising
  – (FAO Sector 4 poultry production system)
• There are significant differences in poultry handling behaviors by gender and age of rural Cambodians
  – Risky behaviors occur despite awareness of AI
  – Use of PPE in domestic and occupational settings is minimal
  – The use of biosecurity in backyard settings is almost non-existent
• Poultry-to-human transmission has been limited thus far, but large-scale seroprevalence studies have not been carried out
What have we learned? (con’t)

• Strong evidence of direct contact of villagers with poultry and poultry products

• Importance of environmental exposures in the H5N1 transmission

• H5N1 virus in its current form is not easily transmissible to human

• Genotyping of the Cambodian isolates did not show any reassortment with human influenza virus nor mutation that can facilitate human to human transmission
Gaps in Current Knowledge

• Why do risky practices still occur despite high awareness of AI?
• How to we change awareness of AI to understanding of AI?
• How can we increase reporting of any & all poultry mortality to village chief or VAHW who are trained to distinguish normal & suspect mortality?
• What are the poultry handling practices that have a higher transmission potential?
• What role does water and other environmental factors in the village play in transmission between poultry and from poultry to human populations?
• What are background poultry mortality rates and how can we reduce poultry mortality in backyard raising settings?
  – How can we improve biosecurity?