

**Risk Factors for Highly
Pathogenic Avian Influenza Virus
H5N1 Outbreaks in Chicken
Farms in Hong Kong SAR during
2002**

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Time line

- **H5N1 isolated from retail poultry markets (early Jan 2002)**
 - Scattered distribution, low mortality
- **High stocking density at local chicken farms for Chinese New Year**
- **1/2/02: Unusual numbers of dead chickens in live poultry wholesale market. Tracing back to one local chicken farm**
- **Mortality on chicken farms started on 2 Feb 2002**
 - Concentrated in few areas, high mortality
- **Monitoring dead chickens on farms (AFCD)**

Time line (cont')

- **Affected farms & nearby chicken farms under quarantine**
 - Kam Tin area
- **Slaughter out chickens under quarantine**
 - 2 Feb- 20 Mar 2002
 - 30 chicken farms
- **Case farms**
 - Kam Tin (17), Pai Sha (4), Hung Shui Kiu (1)
- **Time period: 1 Feb- 20 Mar 2002**
- **Vaccination: 11 Apr 2002**
 - 21 chicken farms in Pak Sha area

Slaughter operation at chicken farms



Case-control study

- **Objectives:**

- Identify risk factors that may be directly influential in causing outbreaks
- Screen non-causal “indicator variables” which may be:
 - Associated with various transmission mechanisms
 - Proxies for important variables which could not be directly measured
 - Confounding variables

Case-control study (cont')

- **Study population**
 - Case/control chicken farms
 - Sample size
 - Time period
- **Data collection**
 - Questionnaire
 - Interview
- **Data entry**
- **Statistical analysis (SPSS)**

Study population

- **Case**

- Definition of case

- H5N1 virus positive (virus isolation, PCR)

- 22 affected farms, 16 enrolled

- **Control**

- Randomly selected

- 2:1 ratios at first stage (30:16)

- 3:1 ratios at second stage (46:16)

Data collection

- **Questionnaire**
 - **Question design**
 - Possible risk factors
 - Open, closed
 - **Pre-test**
- **Interviews**
 - **Interviewer training**
 - **discussions**















Questionnaire

- **Farm profiles**

- Physical description, other animals, pond, stream, water source

- **Stock**

- Numbers, day-old chicks, vaccination history, flock health history, medication, feed, marketing

- **Sheds**

- Numbers, ventilation, cleaning, manure scraper, wild birds

- **Farm management**

- Owner, farm workers, visitors, biosecurity, transportation, waste disposal

Data entry

- Database design
 - 77 variables
 - Simple answers (dichotomous variables)
 - Multiple answers (polychotomous variables)
 - Microsoft Access
- Data verification
- Data validation

Data analysis

- **Univariate (descriptive) analysis**
 - **Chi-square tests & Fisher's exact tests**
 - Categorical variables
 - Odds ratios
 - **T- tests**
 - Continuous variables
- **Multivariate analysis**
 - **Logistic regression (best-fit equation)**
 - **Model building**

Univariate analysis

- Numbers of chicken on farm ($p < 0.001$)
- Stock density ($p = 0.007$)
- Most deaths in birds older than 30 days ($p = 0.017$)
- Given medication during Jan-Feb 2002 ($p = 0.02$)
- Sell chickens directly to retail markets ($p = 0.002$)
- Installed automatic manure scraper ($p = 0.018$)
- Farm owner live off farm ($p < 0.001$)
- Visitors from retail markets ($p = 0.01$)
- Visitors been inside the sheds ($p = 0.04$)

Multivariate analysis

- **Assess associations between independent variables and the outcome of interest**
- **Model building**
 - Backward stepwise approach
 - Forward stepwise approach
 - Adapted “best subsets” approach

Multivariate analysis

- **Models:**

- Owner live off farm (OR=45.8)
- Sold chickens directly to retails (OR=28.4)
- Relative in poultry industry (OR=19.4)
- Highest mortality rate in chickens older than 30 days (OR=24.3)

- **Fitness**

- Hosmer-Lemeshow goodness-of-fit test
- Ratio of the deviance to the degree of freedom

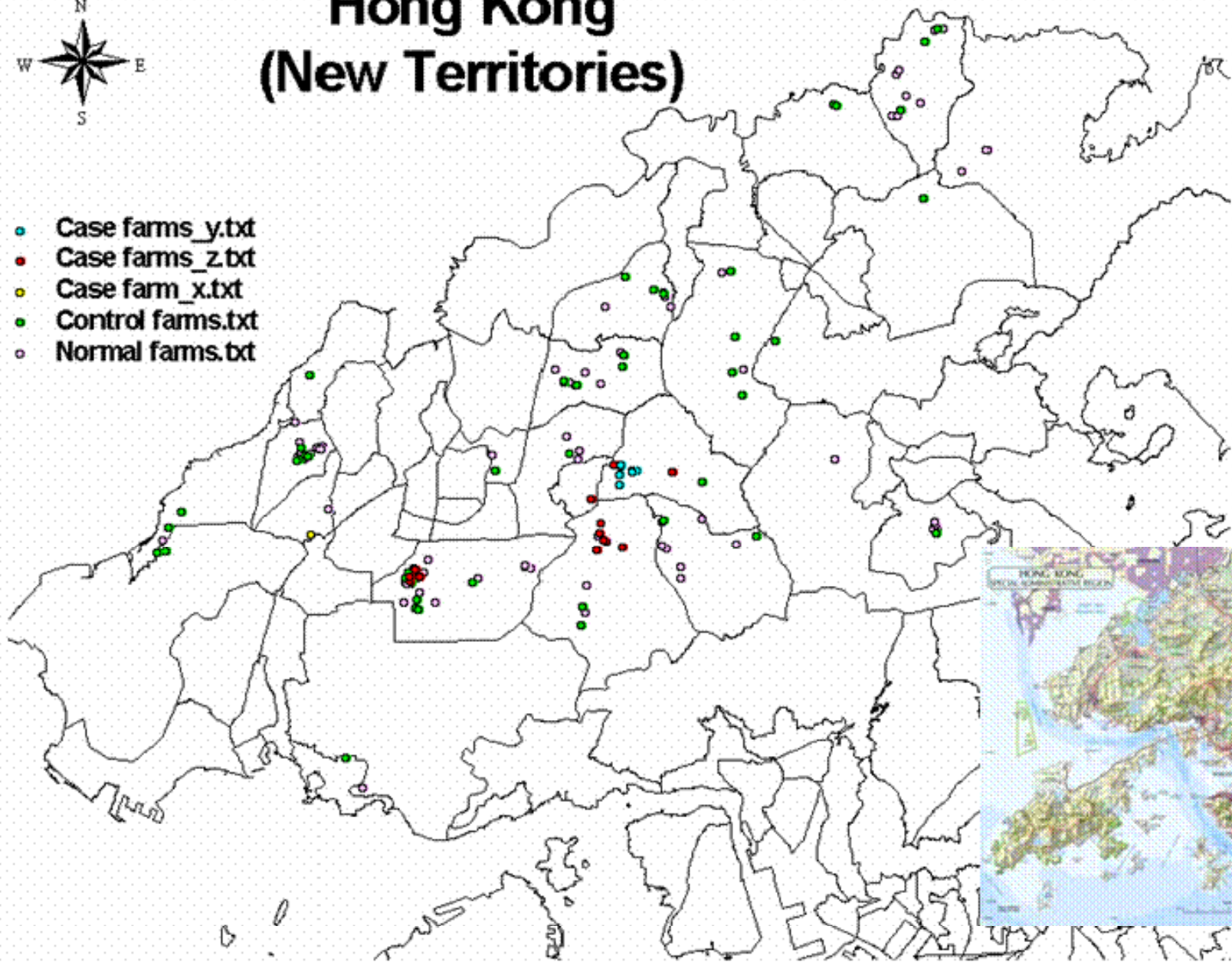
Other studies

- **Virus genotyping**
 - Viruses from retail poultry markets
 - B, X, X2, X3, Z
 - Viruses from chicken farms
 - X, Y, Z,
- **Infection network study**
 - Index farms
 - Secondary farms
- **Spatial analysis**
 - Geographical distribution

Hong Kong (New Territories)



- Case farms_y.txt
- Case farms_z.txt
- Case farm_x.txt
- Control farms.txt
- Normal farms.txt



10 0 10 20 Kilometers

Results summary

- Multiple introduction of viruses
- Locally operating contagious risk factors from common source (cages, truck, personnel, etc)
- Identification the link with retail markets
- Farm biosecurity

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