R Fielding 莊日昶
GM Leung 梁卓偉
TH Lam 林大慶
WWT Lam 藍詠德

# Knowledge of risk and self-protection practices and the degree of influenza hazard from live poultry sales

**Key Messages**

1. Perceptions of risk from buying live chickens were moderate, but sickness anxieties did not predict buying or touching habits.
2. Buying was strongly predicted by the erroneous belief that cooking is the best means of protection from avian influenza. Health education groups seeking to increase preventive practices to control possible avian influenza outbreaks need to learn from this.

## Introduction

Pandemic human influenza strains emerging from co-infection of a human influenza carrier by avian influenza H5N1 virus is a small risk, but the public health impact could be catastrophic. Low probability, highly prevalent events have considerable public health importance.

Domestic waterfowl, chickens, and pigs act as aberrant hosts for both avian influenza (from migratory waterfowl and shorebirds) and human influenza viruses. Genetic reassortment of influenza viruses is likely to be more rapid in aberrant hosts.[1] Domestic animal and human avian influenza infection may therefore increase the chance of a potentially pandemic strain emerging.

Most human-animal contact is domestic or commercial. Most human avian influenza infections occur among persons working or living with domesticated birds.[2] Wet markets provide opportunities for people and live animal mixing, making them potential sources of viral amplification and infection. Severe acute respiratory syndrome coronavirus probably emerged in wet markets. Direct hand-to-face contact is the most likely path for infection. Highly dense urban populations increase opportunities for infection and transmission in any outbreak.

Minimising unnecessary mixing between people and domestic poultry by replacing live animal sales in wet markets with hygienic central slaughtering and chilling is therefore valuable.

## Aims and objectives

To determine population knowledge of risk self-protection practices and to estimate the degree of influenza hazard from live poultry sales at the height of the 2004 Asia avian influenza epidemic.

## Methods

A telephone survey of the general population was performed from 10 am to 10 pm from mid-February to mid-March 2004. Households were selected by using random digit dialling. Within households, respondents were selected by using random number tables based on varying household sizes. Inclusion criteria were Cantonese speakers, age of 16 to 95 years, and residing in Hong Kong for >12 months.

### *Instrumentation*

Of the six-section questionnaire, three sections are addressed here. Section 1 consisted of Likert scale items assessing self-rated health (excellent to very poor) and influenza-like symptoms (fever, chills, cough, headache, myalgia, breathing difficulties, coryza, sore throat, diarrhoea and low back pain ['yes', 'no', 'don't know']).[3] Section 2 consisted of 13 questions on household practices when buying live birds, and three of them assessed risk perceptions: worries about catching avian influenza from buying live chickens, likelihood of self/family members getting sick from buying live chickens (all using five- or seven-point

*Hong Kong Med J 2009;15(Suppl 9):S42-5*

**Department of Community Medicine and Behavioural Studies Unit, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, China**
R Fielding, GM Leung, TH Lam
**Department of Nursing Studies, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, China**
WWT Lam

RFCID project number: HKU-AB-002

Principal applicant and corresponding author:
Prof Richard Fielding
Department of Community Medicine and Behavioural Studies Unit, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong SAR, China
Tel: (852) 2819 9288
Fax: (852) 2855 9528
E-mail: fielding@hkusua.hku.hk

categorical ordinal response formats) and a decile anchored 0% to 100% probability assessment of getting sick from buying live chickens.[4] To help identify attitudinal and knowledge predictors of risk perceptions and behaviour change, respondents expressed agreement or disagreement using five-point Likert scales (strongly agree to strongly disagree) with 32 statements addressing attitudes, avian influenza protection practices, and perceptions of live chicken sales. Section 3 consisted of nine items concerning demographic information.

### *Data analysis*

Categorical data were analysed with Chi squared tests and continuous data with *t* tests. Average annual live chicken purchase rates were calculated by using a conservatively estimated number of live chicken purchases per response category. To households reporting one live chicken purchase per year, one live chicken purchase was attributed; to households reporting 'a few times a year', four were attributed; to households reporting 'monthly', 12 were attributed; to households reporting 'a few times per month', 24 were attributed; to households reporting 'weekly', 52 were attributed; and to those reporting 'a few times a week', 100 were attributed. Perceived risk moderates behaviour. To identify predictors of greater risk perception and behaviour, purchase (yes/no) [model 1] and touching during purchase (yes/no) [model 2] of live chickens, and perceived likelihood of getting sick from buying live chickens (dependent variable 50th percentile dichotomised 0% to 100% probability assessment responses to the question, "How likely is it that you will get sick from buying live chickens?") [model 3] were regressed in forward-stepped multivariate logistic equations on five attitudinal factors, adjusted for demographics. Attitudinal factors were derived by reducing the 32 attitudinal statements with varimax-rotated principal components factor analysis by using scree-plot and Eigen vector-driven factor extraction. Dichotomisation and logistic regression were required for binary dependent variables in models 1 and 2, and to overcome multimodal distribution difficulties on the response scale used in model 3. All proportions were rounded to the nearest whole number. Analyses were performed using SPSS 11.0. (SPSS, Cary [NC], US).

## Results

Seven interviewers called 6603 telephone numbers in 4 weeks. Of these, 2596 were invalid (fax or answering machines), and persons reached by 1765 numbers were ineligible (non-Cantonese speakers, residing in Hong Kong for <12 months). Of 2240 eligible respondents, 1256 declined to participate or complete the survey (556 were 'too busy', 688 refused for other reasons), leaving 986 eligible respondents who completed the survey, giving a response rate of 44% (986/2240).

The sample comprised 589 women and 397 men closely matching the most recent population census data. Men had a wider age distribution than did women (P=0.006), were more likely to be single (P<0.001), born in Hong Kong (P<0.001), and better educated (P=0.015).

### *Purchase of live chickens*

Of female respondents, 20% (116/589; 95% confidence interval [CI], 17-23%) reported that their household never bought live chickens, compared to 24% (96/396; 95% CI, 20-28%) of male respondents. In households (78%) that reported buying live chickens, 76% (95% CI, 72-78%) of female and 31% (95% CI, 26-36%) of male respondents did so personally; other family members or domestic helpers did the rest of the purchasing. Of male respondents, 18% (95% CI, 14-22%) reported that all family members bought live chickens, 14% (95% CI, 10-18%) claimed to be the sole purchasers, whereas 69% (95% CI, 64-74%) reported that other household members did the purchase. The corresponding rates among females were 11% (95% CI, 8-14%), 65% (95% CI, 61-69%), and 24% (95% CI, 20-28%).

Because 65% of women but only 14% of men personally bought live chickens, we adjusted for sex differences in purchasing rates by applying the female rate to the remaining proportion of purchases in male-respondent households (86%), and all but 14% in female respondent households, the remainder being attributed at the male rate.

### *Contact with live chickens during purchase*

Of the 78% of respondents who reported their household bought live chickens, 13% (95% CI, 10-16%) of female and 19% (95% CI, 14-23%) of male purchasers touched the chickens when buying. Overall, 14% (95% CI, 9-13%) of purchases involved physical contact with a live chicken. Extrapolating these exposures (14% of 78%=11%) by the average number of chickens purchased annually (18.7), multiplied by the number of Hong Kong households (2 051 890), gives 4 220 738 person-chicken exposures annually. Of those reporting that they touched live chickens when buying, only about 30% said they 'always' or 'usually' washed hands afterwards. Anxiety scores did not differ between those who bought live chickens and those who did not.

### *Risk perception*

Among all respondents, four separate items tapped perception of risk from buying live chickens. The first assessed perceived objective risk. Overall, 36% (95% CI, 33-39%) of respondents agreed with the statement 'buying live chickens is risky to health'. The next two items considered perceived consequences of risk (odds of getting sick). Statement-based probability estimates for 'getting sick from buying live chickens' indicated that 34% (95% CI, 31-37%) of respondents considered that they would 'never' or were 'very unlikely' to get sick from buying live chickens, whereas 27% (95% CI, 24-30%) thought it was 'unlikely', 24% (95% CI, 21-27%) 'chances are even' and 15% (95% CI, 13-17%) 'likely' or 'very likely'. The

third item (0-100% probability estimates of sickness risk) produced lower risk estimates than the second item, with 53% (95% CI, 50-56%) perceiving the likelihood of getting sick at below 26%, 38% (95% CI, 35-41%) in the range 26-50%, and 9% (95% CI, 7-11%), exceeding a 51% likelihood. Item 4 assessed the risk expressed by others. Overall, 46% (95% CI, 43-49%) of respondents reported that their friends had expressed worries about catching avian influenza. Risk perceptions did not differ by age, sex, education, income, or occupation.

### *Factor analysis*

The 32 attitude statements produced a five-factor best-fit solution, which accounted for 38.5% of the score variance. These five factors were labelled according to their item content. Factor 1, 'animal husbandry risk' (10% of variance), included items attributing avian influenza to market practices, live animal sales, and poor home and market hygiene. Factor 2, 'traditional market practices' (9% of variance), items supported traditional markets, their low health risks, live chicken sales, and trivialised health 'scares'. Factor 3, 'protective practice' (8% of variance), items reflected unwillingness to continue live chicken purchases despite risks, unwillingness to take risks for enjoyment, risks from zoonotic infections, and responsibility for own health. Factor 4, 'avian influenza anxieties' (6% of variance), items reflected avian influenza worries, effect of media reports, and sense of vulnerability. Factor 5, 'feel protected' (6% of variance), items reflected reassurance from media reports, trust in government, and confidence in existing avian influenza control measures.

Models 1 to 3 were adjusted for sex, age, marital status, education, occupation, income, place of birth, years of residence in Hong Kong, and recent travel in mainland China. All models also included factors 1 to 5 plus attitudinal items not included in the factor scores.

Model 1 produced six independent predictors of buying live chickens: (1) travel: respondents reporting recent travel in mainland China were less likely to buy (adjusted odds ratio [AOR]=0.35; 95% CI, 0.1-0.9); (2) employment status: unemployed people were less likely to buy (AOR=0.18; 95% CI, 0.05-0.6); (3) traditional market practices (factor 2 score): persons supporting traditional markets were more likely to buy (AOR=1.2; 95% CI, 1.06-1.1); (4) protective practice (factor 3 score): persons reporting high protective practices were more likely to buy (AOR=1.2; 95% CI, 1.06-1.5); (5) willingness to change buying habits if other persons do the same (AOR=0.3; 95% CI, 0.1-0.8); and (6) belief that cooking food thoroughly is the best protection against bird flu (AOR=8.7; 95% CI, 1.6-46.7).

Model 2 estimated independent predictors of touching chickens when buying, using only respondents who reported buying live chickens themselves (n=451). Two variables independently predicted higher risk of touching: place of birth—persons born outside of Hong Kong—(AOR [China]=2.8; 95% CI, 1.4-5.4; AOR [elsewhere]=4.2; 95% CI, 1.4-12.5), and employment status—unemployment—(AOR=3.9; 95% CI, 1.2-12.1).

Model 3 identified adjusted independent predictors of risk perceptions for getting sick from buying live chickens. Older age lowered perceived risk (AOR [54 years of age]=0.3; 95% CI, 0.2-0.6; AOR [35-54 years of age]=0.5; 95% CI, 0.3-0.8 [reference, 18-34 years]), whereas worries about catching bird flu (AOR=2.9; 95% CI, 1.9-4.5), animal husbandry risk (Factor 1) [AOR=1.1; 95% CI, 1.04-1.14], protective practices (Factor 3) [AOR=1.1; 95% CI, 1.04-1.2], and avian influenza anxiety (Factor 4) [AOR=1.1; 95% CI, 1.0-1.2], all increased risk perception.

## Discussion

Women are usually responsible for food shopping; shopping practices differ by gender, and reporting differences by gender have been found elsewhere.[5] The observed purchase (and therefore exposure) rate of 18.7 live chickens/household/year (38 370 343 purchases annually) matches government figures of about 38 325 000 live chickens purchased in 2004 in Hong Kong. This provides important independent validation of our data accuracy.

How much risk this exposure represents is difficult to accurately quantify. A highly conservative estimation assumes that genetic reassortment of human and avian influenza viruses can occur only on day 1 of a 5-day infectious period in a person with human influenza.[6] During the two 10-week human influenza seasons that occur annually in Hong Kong, sentinel data for influenza-like symptoms 1998 to 2004 indicate that peak population infection rates (pi) average 10% (±50% lower and upper bound estimates, ie 5-15%), giving $0.2 \times (4\,220\,738/52) \times 20 \times \text{pi} = 32\,467$ (16 233-48 700) episodes when persons on day 1 of a human influenza infection face exposure to live chickens. Wet markets amplify viral loads. Before the enactment in 2003 of wet market 'rest days', H5N1 isolates occurred in about 10% of chickens for sale in Hong Kong.[7] As all live chickens available in Hong Kong are vaccinated against avian influenza and the vaccine is presumed 90% effective, then only 1% (10% of 10% carrier rate) are potentially avian influenza infected, giving 325 (162-487) day 1 potential co-infection exposures when reassortment could occur, a rate of 0.0077% (0.0038-0.0115%). Influenza produces no symptoms for 24-48 hours after infection so shopping rates would be unaffected—assuming that 50% of persons shop on day 1 of infection reduces the figure by half to 162 (81-243) co-infection exposures annually. Among the 11% who touch the chickens, risk for avian influenza infection is likely to be greater. These estimates, though highly uncertain, quantify the potential risk involved.

Although one third of respondents perceived some risks from live chicken sales, risk magnitude seldom exceeded 60%, and peaks at 25% and 50% are partially artifactual.

Almost 50% indicated that their friends had expressed anxieties about avian influenza. Attributing greater concerns to others than to themselves reflects optimistic attribution bias, a protective response enabling expression of concern while preserving 'face'. Sickness anxieties reflected the fact that the markets and live chicken sales were perceived as health threats. Older persons, possibly due to past experience of buying live chickens, or past 'chicken plagues', viewed the present avian influenza outbreak as low risk. Hazard familiarity and experience can reduce associated risk perceptions. Respondents who reported higher anxiety and greater risk were no less likely to buy live chickens.

Raising population anxiety levels by warnings about disease produces only transient, inconsistent changes, and therefore appears to be ineffective as a means of reducing long-term high-risk behaviour. This is because (1) persons perceiving control over dubious 'hazards' seem to underestimate the associated risk, which reduces the likelihood of behaviour change; (2) persons who perceive little or no control over a threat adopt fatalistic responses continue with established behaviour, and direct coping efforts towards controlling emotions rather than risks; and (3) hazard exposure causes familiarity, thus reducing perceptions of risk. For these reasons, persons may dismiss the warnings as exaggerated or unrealistic. Once confidence in food safety is lost, recovery time may be protracted.

## Conclusions

Perceptions of risk from buying live chickens were moderate, but sickness anxieties did not predict buying or touching habits. Buying was, importantly, strongly predicted by the belief that cooking is the best way to protect from avian influenza. This perception is an important message for health education groups seeking to increase preventive practices to control possible avian influenza outbreaks.

When planning for education programmes that aim to increase preventive practices to control possible avian influenza outbreaks, health education groups should remember that buying habits are strongly based on the erroneous belief that cooking is the best way to protect purchasers from avian influenza. Cooking protects from infection by eating, but not from infection through contact prior to eating.

## Acknowledgements

This project forms part of a series of studies commissioned by the Food and Health Bureau of the Hong Kong SAR Government and was funded by the Research Fund for the Control of Infectious Diseases. The results of this study have been reported in the following publication:
Fielding R, Lam WW, Ho EY, Lam TH, Hedley AJ, Leung GM. Avian influenza risk perception, Hong Kong. Emerg Infect Dis 2005;11:677-82.

## References

1. Suarez DL, Senne DA, Banks J, et al. Recombination resulting in virulence shift in avian influenza outbreak, Chile. Emerg Infect Dis 2004;10:693-9.
2. Avian flu: avian influenza—Thailand update. World Health Organization. Southeast Asian section. November 2004. WHO website: http://w3.whosea.org/en/Section10/Section1027_6761.htm. Accessed July 2005.
3. Leung GM, Quah S, Ho LM, et al. A tale of two cities: community psychobehavioral surveillance and related impact on outbreak control in Hong Kong and Singapore during the severe acute respiratory syndrome epidemic. Infect Control Hosp Epidemiol 2004;25:1033-41.
4. Li C, Fielding R, Marcoolyn G, Wong CM, Hedley AJ. Smoking behaviour among Asian women. Tob Control 1994;3:21-9.
5. Ionescu MD. Sex differences in memory estimates for pictures and words. Psychol Rep 2000;87:315-22.
6. Cauchemez S, Carrat F, Viboud C, Valleron AJ, Boëlle PY. A Bayesian MCMC approach to study transmission of influenza: application to household longitudinal data. Stat Med 2004;23:3469-87.
7. Peiris M. Humans, animals and flu. Influenza: implications for control. Symposium, School of Public Health, The University of Hong Kong; 2004.