What causes H5N1 avian influenza? Lay perceptions of H5N1 aetiology in South East and East Asia

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ABSTRACT

Background Health education to reduce population poultry exposures has limited effect. Lay beliefs about H5N1 highly pathogenic avian influenza (HPAI) causes could provide insights helpful for improving public health interventions.

Methods Qualitative interviews of poultry farmers, retailers, market stall holders and consumers in Hong Kong (n = 20), Guangzhou (n = 25), Vietnam (n = 38) and Thailand (n = 40) were conducted using purposive sampling and analysed using ethnographic principles.

Results Each location produced three comparable themes: ‘viruses’: HPAI exemplified a periodic, natural, disease process therefore, deserving little concern. For some, science had ‘discovered’ something long known to farmers and lived with for generations. Others believe the virus to be new. Viral ecology was reasonably well understood among farmers, but less so by retailers and consumers; ‘husbandry practices’ included poor hygiene, overcrowding and industrial farming, modern commercial feed and veterinary drugs; ‘vulnerability factors’ included uncontrollable ‘external’ explanations involving the weather, seasonal changes, bird migrations and pollution.

Conclusions Lay explanations were generally ecologically consistent. Nonetheless, beliefs that HPAI is a normal, recurrent process, external factors and roles of industrialized poultry rearing countered health worker claims of H5N1 seriousness for smallholders. These causal beliefs incorporate contemporary models of H5N1 ecology, but in a manner that contradicts public health efforts at control.

Keywords communicable, diseases, individual behaviour, public health

Introduction

Annual outbreaks of H5N1 highly pathogenic avian influenza (H5N1 HPAI) have occurred since 2004 across Asia, the Middle East, Africa and Europe.1–3 Since 1 January 2009, 11 countries have reported outbreaks and China, Indonesia, Egypt and Vietnam had reported 14 human cases and 6 deaths at the time of writing.1–3

Migratory waterfowl, as reservoir and vector, are victims and culprits in reciprocal cross-infections between domestic and wild flocks.4,5 Commercial trade is also probably disseminating the virus.6,7

Effective infection control requires separation of vector, agent and host.8 Domestic poultry and waterfowl are the vector of human H5N1 HPAI infection and their separation from people is an important component of public health strategy. In developed urban environments, populations seldom encounter poultry beyond the supermarket freezer. Industrial ‘farms’ that provide most supermarket poultry maintain a strict biosecurity and control entry to prevent the economic loss a cull entails. However, industrial rearing contributes to viral evolution.9 Elsewhere, live poultry are ubiquitous in markets, smallholdings and in rural households, where poor biosecurity and hygiene prevail. Most cases of human H5N1 HPAI occur within such environments.1–3,10 To be effective, preventive practices require population adherence. However, beliefs about why
outbreaks happen (causal attributions) and their control (control beliefs) can modulate adherence.11 Studies of individual attributions for diseases often differ from pathophysiological causes of those diseases. When this happens, treatment adherence declines.12,13 Presumably then, in a similar fashion, if population-wide causal explanations for outbreaks differ from those underpinning public health recommendations, there is a greater likelihood of declining adherence or such recommendations being ignored.11 No reports we have seen describe causal attributions for H5N1 HPAI, though several KAP studies exist.14–19 Most of these have failed to address lay explanations of H5N1 HPAI, and hence a knowledge gap exists. As part of a study of risk perception, purchasing and rearing practices of poultry in Asia20,21 we describe causal attributions for HPAI among live poultry consumers, retailers and breeders in Vietnam, Thailand, Guangzhou and Hong Kong (HK), sites historically affected by H5N1 HPAI.

Methods: sampling

Vietnam
Of the 82 million Viet population, 73% are rural dwellers.22 Within one province (Ha Tay) Chuong My district had areas both affected and unaffected by H5N1 outbreaks within 12 months. Two communes within Chuong My, Chuc Son (urban) and Dai Yen (rural) formed the sample frame. Purposive sampling criteria were formerly epidemic/non-epidemic area; rural/urban residence; gender, age and chicken farmer/backyard raiser/retailer/consumer/non-consumer. Individual households were identified randomly from commune residence lists and approached for interview. Trained local health bureau interviewers completed one face-to-face interview/household between mid-February and mid-March 2006. Some interviews occurred in markets and/or at workplaces for logistical reasons. Respondents identified the following outbreak responses: culling, house-to-house visits by sanitation workers and veterinarians, flock vaccinations, restricted poultry movement and sale, broadcast public health announcements, meetings between commuandrs, cadres and local animal health workers, market restrictions, distribution of lime for sanitation, posters, newspaper and television coverage, and provision of replacement seed poultry.

Thailand
Of the 68 million Thai population, 68% are rural dwellers.23,24 Suphanburi province has 868 681 people in 195 270 households across 10 districts,25 the largest population of free-grazing ducks,4 and the most HPAI outbreaks since 2003. Five districts in Suphanburi province formed the sample frame: Nongyasai (rural), Doembangnanbuat (rural), Songpinong (rural), Uthong (rural) and Muangsupsanburi (rural–urban). Within districts stratified cluster sampling selected interviewees from two large and two smaller poultry farms, two retailers and two consumers. Institute for Health research staff, Chulalongkorn University, conducted interviews from October to December 2006. Sampling from local district records randomly identified respondents by occupation (poultry farmer, butcher/market stall holder and non-poultry related) and local business registers (commercial breeders and retailers). Respondents identified outbreak responses to include culls, local public health/veterinary sanitation interventions, media announcements, village leadership activities, and, at commercial farms, corporate veterinary and technical support.

Guangzhou
Guangzhou metropolitan district (population 9.94 million26) is Guangdong, China’s provincial capital. Using two-tier stratified cluster sampling of metropolitan households (2 723 28827) according to residential and occupational criteria from records of the occupational health unit, No. 12 Peoples’ Hospital, Guangzhou Kish-grid-derived face-to-face interviews were performed by one of us (L.Q.Y.) between March and May 2007. Widespread poultry-raising in satellite districts and a large migrant population necessitated variation from HK’s protocol. Outbreak responses included media reports and vaccination of poultry flocks. General announcements of public interest (APIs) appeared in the media.

Hong Kong
Of HK’s 7 million population, 98% have fixed line home telephones. Using a pre-existing random sample (n = 1760),21 purposive sampling by gender, age, educational level and perceived risk from live poultry sales identified adults aged above 17 selected by Kish-grid to complete contract telephone interviews between mid-December 2005 and mid-February 2006. Government APIs were running during the period of data collection. No site had H5N1 HPAI outbreaks within 6 months before or during the study.

Interview development
Following ethics approval from the ethics committees of HKU (Hong Kong), HSPH (Vietnam), Chulalongkorn...
University (Thailand) and No. 12 People’s Hospital (Guangzhou), we implemented qualitative methods workshops at each site to minimize methodological variation. Limited experience in Thailand restricted optimal data collection. Therefore, within HK, Vietnam and Guangzhou semi-structured interviews were adopted and data saturation (no new data generated on three successive interviews) determined sample size. In Thailand a sample of 40 was pre-specified.

Because qualitative interviewing inexperience affects data quality, we adopted a semi-structured interview approach using a set of questions in Thailand to minimize interviewer variation. Pre-specified criteria guided questions used to initiate data collection. During a longer interview, respondents were asked about the causes of the HPAI epidemic.

Data management
Interviews were electronically recorded, transcribed and translated into English on site. English transcripts were checked against the originals by bi-lingual investigators locally to ensure semantic equivalence. Finalized English transcripts were forwarded to HK for analysis by the HK investigators.

Constrained from using constant comparison during data collection, the necessary concurrent onsite data analysis being unavailable, ethnographic principles were adopted instead for transcript analysis. Modern ethnography utilizes a variety of approaches applied to structures, organizations, groups and phenomena of interest, such as food purchasing activities.28 The present study enables both culturally specific interpretations within each country’s interviews, and culturally neutral, between-country comparisons to be used.29

Data analysis
Repeated reading of manuscript identified elements comprising individual semantic units. These were hierarchically compounded into categories comprising broader ideas and then clustered into substantive themes related to the topic of interest. This process eliminates redundancy and formulates meaningful analytic units. Explicit coding and classification outlines based on the research focus, close adherence to the research process and the evolution of codes, categories and theory to allow others to understand how analysis decisions were made facilitated analytic rigour. Two researchers independently coded data and held joint interpretive discussions of ambiguous sections of interviews. Disagreement was resolved by repeated textual reference, comparison, plausibility and discussion.

Results
Sample structure
We performed and analysed 123 interviews: 38 Vietnamese respondents who were either poultry buyers (11), domestic or commercial poultry keepers (22) or poultry sellers (5); 20 HK Chinese poultry consumers, 13 females and 7 males, aged from 18 to 73 years; 40 Thai commercial or domestic poultry breeders, retailers, consumers and non-consumers; and 25 Mainland Chinese Guangzhou residents of various backgrounds (supplementary file).

Common causal attributions emerged at all four sites. For parsimony, we emphasize similarities and differences in attributions and present quotes (the letters V, T, G or H preceding the subject number indicate country of residence) from different countries to exemplify these (Tables 2–4). Sites varied largely by degree of emphasis rather than causal attribution. Three main themes embodying lay attributions for the causes of H5N1 HPAI emerged. These focused on (i) viruses, (ii) husbandry-related factors and (iii) vulnerability factors. A fourth theme, Other explanations, emerged mostly, but not exclusively from Guangzhou’s, mainly urban sample.

Viruses
Rural dwellers described coherent communicable disease ecologies recognizing and emphasized the links between both infectious agent and vulnerability factors. Urban dwellers also identified these interactions, but less frequently and in a less comprehensive manner. Viruses comprised two main components: ‘Old diseases’ and ‘New diseases’.

Old diseases: Many rural respondents (Table 1a–c) believed that H5N1 HPAI was nothing new, another periodic disease affecting animals as occurred from time to time and so of little concern. ‘Traditional’ zoonotic epidemics were ‘ordinary’ problems and were often undifferentiated from each other. Historically, these have always occurred and so there was little concern that H5N1 HPAI was anything to be concerned about. Several urban respondents in Guangzhou and HK (Table 1d–g), many of whom had migrated from rural areas where they were born and raised also considered H5N1 HPAI synonymous with ‘chicken plague’ reflecting stories of their childhood when they witnessed die-offs of farm animals. Several respondents felt that the re-interpretation or ‘discovery’ by science of these old diseases did nothing to alter the fact that this was part of farming life (Table 1h,i). A number of rural respondents dismissed H5N1 HPAI all together as rumour or propaganda. This was particularly the case in rural Vietnam and Thailand (Table 1j–l). These latter opinions were not expressed by urban respondents.
‘New disease’: Few respondents identified H5N1 HPAI as novel, some alluding to mutations (Table 1m,n). However, while these views corresponded to contemporary scientific opinion, they were not widespread.

**Husbandry practices**

Poor husbandry was widely inculpated. Explanations involved overcrowding, antibiotic resistance and cross-infection. In particular, ‘Keeper and commercial behaviour, Overcrowding, Cross-infection, Poultry breeds and Commercial feed and additives’ were thought by many to be core components of H5N1 HPAI emergence. While these views were widespread among rural respondents they were also common in urban respondents too.

‘Keeper and commercial behaviour’ encapsulated poor husbandry, sanitation and lax scrutiny of imported poultry strains (Table 2a–c). In particular, the failure of small/medium sized farms to effect suitable hygiene and sanitation practices were most frequently mentioned. The problem of imported poultry, alluding to lax standards or insufficient monitoring in international poultry trading also emerged.

Commercial practices of husbandry for profit were also implicated (Table 2d,e). In particular, the idea of maximizing profit by intensely raising fast-growing birds fed on poor-quality feedstuffs enhanced with growth promoting antibiotics and sometimes fluid-retaining hormones was often raised by both rural and more often urban dwellers.
Keep the information in the image as is. This text represents the data found within the image. No additional context or interpretation is needed.

Table 2 Theme 2: Husbandry practices

Keeper and commercial behaviour

a. I think that there were some sources of infection such as unsafe breeding facilities, outside impacts, illegal selling, people's awareness, insects, and birds are also a source of infection. However, among these, the most important source is people's awareness. It is the breeders who make their poultry possible to infect. They should care and take prevention methods when the environment is unsafe. (V15)

b. Maybe they raise too many poultry now, I think because they export from other countries. But they do not know that the poultry is already infected by the virus before exporting, they think the poultry is infected after that. So if there was no export, the bird flu could not occur. (V37)

c. I think it may be because the chicken disease has changed, and the present way of raising chickens is different from that of the old time, right? It is not a natural way of raising poultry. So some of the chickens produced have changed their gene. (H17)

d. To make money, people focus on economic benefits. That space those coops... and chickens live closely together, no space for their activity. (H7)

e. I think those people want to earn quick money too much... And I also think there are some illegal merchants... I think they really want to earn quick money, and the opportunists are really crucial. (H1)

Overcrowding

f. I think crowding is one reason. Keeping a lot together, it's stuffy. Like people in a car, if you stuff a lot of people in, (you) cannot breathe. No ventilation. When (there's) a lot of chicken dung, it stinks. How stuffy it is! It causes disease. When chickens died, other birds may eat it, turning it into a communicable disease. But anyway, another country (has) got it also. People, who never get it will not know how it happens. (T11)

g. I think it is too stuffy... the quality of the air is bad... and the sanitary conditions of the whole farm are not so good... Thus the virus is born. (H10)

Cross-infection

h. There was no problem in the second epidemic, but this area was designated yellow. The third time this area became red zone, some of the village farmers raised baby ducks in the field... only people in this area who raise poultry... didn't have much experience. What happened? A lot of rain then the duck pen got wet, the owner of the ducks brought them to the dirty area, so the baby ducks got diarrhoea, unfortunately. Is that so? After that the baby ducks died near the rice field. The owner didn't see some chickens (were there). Some ducks died in the water, then the owner brought the ducks again, after that they got infected. So, this spread to the others? Yes, and other duck farmers raised ducks in the rice field, and the ducks ate the dead shells there, so they too got diarrhoea and died. If more than 10% of the ducks were (affected) I informed the local health centre and Livestock official. They didn't check, they said it's the bird flu. How does it spread? I think that the birds are the carriers; they transmit this disease to others. Sometimes, it spreads from the dirty cars that transport the ducks... They are paid to transport the ducks from one place to another, from fields to fields, from province to province. The chicken farmers buying from the vans selling chickens in baskets are also to blame, because they can be the carriers. (T29)

Poultry breeds

i. Because of the mass production breeding, it is very hard to choose portly ducks in comparison with in the past. Nowadays, ducks are mainly raised by combination method between free roaming and mass production breeding. This model of raising is called semi-mass production. (V38)

Commercial feed and additives

j. I don't know in terms of science. As people often say that it was the mash that caused bird flu, I think even a normal pig which ate bad mash may get smelly. There wasn't any smelly meat in the past. (V5)

k. Did you feed them with other kinds of food? Still rice and paddy... I'm not sure of industrial mash and don't know if it contains stimulants or agents that help in gaining weight. Poultry shouldn't eat much mash. Is mash not good? Why is it not good for poultry besides the reason that it makes meat less succulent? It's not good because it makes poultry gain weight in short time and drink much water. The chickens which drink too much water often get... diseases such as diarrhoea because they have to drink much water as mash is dry. Drinking too much makes them get diarrhoea. If they eat rice or paddy, they won't drink that much. (V17)

l. In the old days, chickens were fed with rice, but now they are fed with... (food containing) oxytocin which may cause... I have no idea. Anyway, I don't worry about this problem... it should have something done with the environment, I mean the environment and that... er... the feed which may have been mixed with something harmful... I have no idea about this. I wonder why the chickens can grow so fast, right? the demand is so great now, if using the traditional way to feed the chickens, how can you satisfy the demand! I think so. (G3)

m. I think it is from food which animals eat, including various medicines. There are oral drugs, injection, drop drugs and vaccine. They eat too many then some diseases resist (the) drug. Treatments (therefore) aren't effective (so) they become epidemic disease. It is called bird flu. Don't you think that (it is) related (to) birds? I don't think so (haha). I think it must be from food, water and drugs. Compare with humans (who) eat everything everyday, it is not good. People who raise chickens (are the) same too, they use many kinds of drug to get the chickens grow very quickly. When he sells them he gets a good price. People who raise pigs give some drug to them then their meat is red colour. (T25)

n. The poultry were fed with natural feedstuff before, but the feedstuff now has added catalyst... they don't use the correct ways to feed, but use some chemical ways... So the chicken changes, not grow normally, not healthy... (H3)

‘Overcrowding’ within the coops was considered to be important and this often was linked to poor ventilation and poor sanitation as risk factors for H5N1 HPAI outbreaks (Table 2f,g).

‘Cross-infection’ was widely commented on by younger, more educated farmers. Some cited specific examples of traditional rural and more contemporary farm practices that reflected contamination of shared free-range sites and...
poultry transport systems that contribute to cross-infection (Table 2h).

‘Poultry breeds’: Traditional varieties of poultry were generally viewed as harder than contemporary commercial ‘broiler’ breeds. Poultry weakness was exacerbated by both poor housing and feeding practices broilers were subject to (Table 2).

‘Commercial feed and additives’: Using industrial mash as a feed was considered by respondents involved in husbandry and retail to weaken chickens, but was popular because of...
its convenience and low cost. Most small-scale farmers however rejected this feed as many believed it increased vulnerability to disease, preferring instead to use rice, paddy (unhusked rice) or other grain (Table 2j–n).

**Vulnerability and environmental factors**

Factors increasing vulnerability to H5N1 HPAI included ‘Weather, Pollution and Wild birds’. This category featured external causal agents of transmission and spread not under the control of man.

‘Weather’ was widely cited as a causal factor—most respondents mentioning weather cited the change of seasons as the most likely time for H5N1 HPAI outbreaks to occur (Table 3a–e).

‘Pollution’ in contrast to ‘Weather’, was cited as a component that included industrial pollutants and agricultural practices, including pesticide use (Table 3f–i).

‘Wild birds’ often were implicated by respondents, but more often they too were victims. Several respondents mentioned how wild birds died off suddenly, whilst others cited migratory behaviour as being responsible (Table 3j–l).

**Other explanations reflected: ‘poor food and personal hygiene, confusion and population and technical growth’**

This last theme included elements of poor personal practices, including eating improperly prepared food, especially undercooked meats, lack of personal hygiene, confusion about why the outbreaks occurred and other explanations that seemed to be casting around for understanding what was happening.

‘Poor food and personal hygiene’ was mentioned by urban dwellers focusing on the most proximal causes (Table 4a).

‘Confusion’: Some had no real explanation for the epidemic and remained puzzled (Table 4b–c).

‘Population and technical growth’ encompassed the most distal explanations, such as demand for poultry and antibiotic resistance (Table 4d,e).

**Discussion**

**Main findings**

Remarkably similar attributions were made by respondents with differing educational, occupational, cultural and other background characteristics. Respondents frequently raised questions about the novelty of H5N1 HPAI in the light of past poultry epidemics. The ‘rediscovery by science’ of these ‘old’ diseases was particularly frequently cited by rural farmers. These beliefs that re-emergent diseases were cyclic and natural reflect a degree of acceptance of these events as little to be concerned about. This is likely to work against education efforts designed to encourage the use of protective equipment and improved hygiene. The commercialization of poultry farming, weakened flocks, poor hygiene and insanitary commercial practices, misuse of veterinarian drugs and growth promoters, driven by profits and demand was also commonly inculpated. Some elements of contemporary viral evolution and cross-infection were found, but few respondents gave coherent technical accounts. Those giving contemporary explanations had either specialist backgrounds, such as health workers from Guangzhou and Vietnam, or were younger, well-educated large-scale poultry breeders, in Thailand. Urban dwellers tended to express more anxious thoughts about H5N1 HPAI. The apparent randomness of infection left some respondents puzzled.

**What is already known?**

Not surprisingly, public knowledge of H5N1 HPAI and health education impacts on poultry practices remain modest.14–19 Simply providing information takes no account of a population’s causal attributions, perceived risks14,17,21,30, perceptual bias17 or structural determinants of behaviour and is unlikely to result in significant and sustained change. For this reason, a deeper understanding of the perceptions of risk, biases, attributions of cause, and both facilitators and barriers to change is needed for planning effective health behaviour change.

**What this study adds**

The responses described here suggest that many rural dwellers view H5N1 HPAI as yet another periodic but natural zoonosis, many of which have occurred in the past when life still went on largely unaffected. Poultry died, people ate the poultry, most were unaffected. There was a view that rural dwellers felt the urban dwellers had suddenly ‘discovered’ these diseases and felt threatened. Because of this, there was the wide-scale culling and response common to outbreaks. However, within many rural villages, residents will not be motivated to change their husbandry and other relevant practices to protect themselves where they do not see any threat. Health education efforts that fail to take heed of prevailing views are likely to remain ineffectual.

There was an underlying moral tone to husbandry and vulnerability explanations, reflecting Beck’s Modernity and Douglas’s pollution models of risk theorizing.31 Respondents reflected a sense of current commercial behaviour as lax and misguided, and thereby culpable.

Despite the widespread publicity regarding H5N1 HPAI, especially in affected rural areas, levels of concern were
Imputed and detailed understanding of aetiology remained, for the most part, fragmentary. Numerous respondents denied threats from these ‘natural’ zoonoses and this often removed any justification for precautionary practices such as using personal protective equipment even when such had been recommended. It is likely that these perceptions remain common in rural areas of South East Asia. If so, they pose a significant barrier to the adoption of hygienic practices, most likely among smaller scale farmers and smallholders who do not have large investments in breeding as a business. This problem is unlikely to be ameliorated by the extension of health education efforts that simply repeat established messages about H5N1 HPAI. Similarly, legislative or regulatory efforts by animal health agencies may be poorly enforced and, as some respondents alluded to, may be subject to being undermined by corrupt practices such as paying veterinary workers to look the other way whilst prize fighting cocks were hidden from ongoing culls. As a result, high levels of exposure are likely to continue within poor and poorly educated settings across South East and East Asia, which will remain therefore, a probable site of further H5N1 HPAI related deaths in the foreseeable future.

Implications for public health practice

It is too simplistic to assume that just giving information changes behaviour. Instead, greater recognition of the complexities involved in changing behaviour is needed, from the political, such as naïve urban groups perceiving greater risk than rural dwellers and dictating rural policy accordingly, 

experiential and historical, such as past experience with sick poultry incurring no consequences; psychological, such as risk perception and optimistic bias structural, such as the pragmatics of rural food production. These issues are poorly researched and understood in the context of communicable disease control. They nonetheless are likely to hold important lessons for improving separation of vectors and hosts in poor rural communities.

The lay explanations people hold for why H5N1 HPAI has occurred are unlikely to change by information giving alone unless active epidemics increase threat, which is to be avoided. Social psychological research has established that non-congruent information (contradicts or challenges beliefs) and congruent information (agrees with beliefs) are both received and recalled differently, with the former being seen as erroneous and subsequently poorly recalled. Frequency of exposure can enhance acceptability of messages. More frequently encountered messages, particularly those presented by known and liked individuals (hence media and sports personalities’ product endorsements), or those perceived to be competent can enhance message acceptability. The more cognitive processing a message receives, the more likely it will be effective if prior conditions are in place. Anxiety generation can be helpful in changing behaviour but if no anxiety is aroused, the message will be dismissed as irrelevant. This seems to be happening among a large segment of rural respondents. Despite efforts to optimize health messages, they remain of limited effectiveness. However, recent evidence suggests that perceived risk enhancement is associated with changed risk taking behaviour towards live poultry. This approach is consistent with earlier work, and suggests that addressing, then redirecting perceptions of H5N1 HPAI away from it being just another manifestation of an old problem, emphasizing the potential harm may be an important strategy to help reduce risky behaviours around live poultry.

Limitations

Qualitative data should be considered descriptive until confirmed. Some slight distortion of meaning may have occurred during translation into English. Sampling and methods differed in Thailand and may have introduced bias, but the responses from each site nonetheless remained remarkably comparable.

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References


