Early responses to H7N9 in southern Mainland China

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Keywords: H7N9; influenza; public understanding of risk
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Abstract

Background. H7N9 in China posed potentially serious health challenges for this society. The previous SARS outbreak in this country was accompanied by contradictory information, while worries about wide spread influenza have led to discrimination worldwide. Early understanding of public threat perceptions is therefore important for effective public health communication and intervention.

Methods. We interviewed a random sample of 1011 respondents by phone two weeks after the first case. Questions examined risk awareness and media use, beliefs about the emergence of the threat and those most at risk, anxiety about infection and preventive and avoidant behaviours.

Results. Results demonstrate moderate levels of anxiety but relatively high levels of trust towards government officials. Threat emergence was most frequently associated with hygiene levels and temperature change, but also with associations with floating pigs in the Huangpu river and migration to the city. Anxiety predicted both recommended and non-recommended behavioural changes.

Conclusions. Comparatively high levels of trust in Chinese government advice about H7N9 contrast positively with previous pandemic communications in China. However, anxiety helped drive both recommended and non-recommended behaviours, with potentially important economic and social implications. This included evidence of ‘othering’ of those associated with the threat (e.g. migrants). Findings therefore emphasises the need to manage public communications early during new influenza outbreaks.

Keywords: H7N9, pandemic influenza, avian flu, stigmatisation, discrimination.
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Avian influenza A H7N9 was first identified as a novel virus in China on 1\textsuperscript{st} April 2013. While several variants of highly pathogenic avian influenza have been reported worldwide, poor management of SARS in China make the H7H9 outbreak of particular concern [1]. Beliefs about disease origins and those most at risk [2-4], and cultural perceptions about the purchase and preparation of birds [3,4], influence disease reporting, self-care and appropriate avoidance behaviours. Contradictory media reports induce panic and restrict effective interventions [1] permitting anxiety to spread rapidly within families and communities. Beliefs change rapidly during an epidemic [5], making early understanding of cultural and psychological risk factors critical for subsequent health communication. We report beliefs and understandings of this novel pathogen in southern Mainland China two weeks after its emergence, and associations with preventive behaviour.

Methods

Ethical approval was from the relevant IRB board (Fudan Research Committee, School of Journalism) at Fudan University. We interviewed 1011 participants in the Shanghai region between April 12 and April 20\textsuperscript{th} 2013 (599 female, 412 male; \(M\) age 49.5 (SD 16.8)), using random digit dialing of home phones. Total H7N9 confirmed laboratory cases/ fatalities during this time ranged from 43/11 (April 12\textsuperscript{th}) to 96/18 [6]. Inclusion criteria were participants aged 18 or above who had heard of H7N9. A total of 3054 telephone numbers were dialled, of which gave 1066 interviews, and 1972 refused to participate (response rate 35%). Response rates compare positively to analogous public surveys on swine flu [7]. A further 16 gave incomplete responses, and 39 were deleted as they had not heard of H7N9 or were out of the age quota group, leaving an eligible 1011 participants.
Interviewers asked five sets of questions (Table 1), based on previous work on risk representations [7], risk communications [8], and preventive and avoidant behaviours during epidemic/pandemic threat [7, 9]. Questions covered 1) awareness of the threat 2) use of media, and credibility of communicators 3) reasons for the emergence of the threat 4) those perceived to be at risk 5) anxiety about infection and 6) behavioural responses.

Data analyses
Analyses were conducted using SPSS 18.0. We report frequencies of beliefs about H7N9 and those most at risk (Table 2) and behavioural responses to the threat (Table 3). Personal worry and worry for the family were highly related (R = .79) and combined as ‘Anxiety’. Outcome variables were divided into behaviours recommended by the Chinese Ministry of Health [10] and avoidance behaviours [7], plus purchase of medicines. Differences in trust in communications were examined through within-subjects GLM; relationships between anxiety, causal associations with H7N9 and risk group perceptions through correlations. Binary logistic regressions examined multivariate associations between media usage and anxiety, and anxiety and risk perceptions and outcome behaviours, adjusting for age and sex. All reported significance levels are .01 or below.

Results
Respondents most associated H7N9 with poor hygiene or climatic changes (Table 2). At least half our respondents rated those in greater contact with poultry, with weakened immunity, elderly or children as at enhanced risk; 38% suggested migrants were at greater risk. Television was the most frequent source of information about H7N9 (mentioned by 879 (87%) of respondents). Overall 5% of respondents relied solely on social media (microblogs,
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Social media or cell phone newsletters, 28% combined media sources. When communicating about the threat Chinese officials or experts were believed more than Western experts ($F (2, 1430) = 142.5, P=.001$).

Respondents demonstrated low to moderate anxiety about H7N9 ($M = 1.7/4$). 385 (38%) were moderately worried (worried ‘a little’ or ‘quite a lot’), 582 (58%) were ‘not worried’ about infection. 404 (40%) respondents reported ‘a little’/ ‘some’ difficulties in their daily life as a result of the virus, 562 (56%) none. 400 (40%) respondents had been thinking ‘a little more’ about their death since the outbreak, 10% a ‘great deal’ more. Participants with greater anxiety associated floating pigs, migrants and poultry trade hygiene with the outbreak (R = .08 P = .01 (migrants) to R = .20 P=.001(‘floating pigs’)); and thought children (R = .15, P = .001) and the elderly (R = .08 P.01) were at greater risk. The media source for information about H7N9 (only traditional, only social) was unrelated to anxiety (respective ORs .90, 1.21; Ps=.20, .26).

Table 3 provides recommended and non-recommended behavioural responses to H7N9. The most widely adopted recommended response was home ventilation, with half reporting changing cooking behaviours, half avoiding sick people, nearly half changing washing habits. The most frequent non-recommended changes were the avoidance of buying poultry or eggs, and the avoidance of crowds. A minority of respondents reported mask wearing, cancelling or changing public transport travel plans, avoiding being physically close to migrants, or purchasing Chinese or Western medicine. Participants carrying out two or more recommended behaviours, or participating in avoidant behaviour, were higher on anxiety, perceived probability of infection and mortality awareness (for recommended behaviour respective ORs 1.73, 1.77, 2.22, P = .001; for avoidant behaviour ORs 1.77, 1.71, 1.69;
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P=.001). Purchasing Chinese medicine was associated with anxiety and death awareness (ORs 1.58, 1.64, P=.001). An association of H7N9 with floating pigs, hygiene standards in the poultry industry, hygiene in Chinese society, and migration predicted recommended behaviour change (ORs 1.50, 1.30, 1.35, 1.30, all P<.01). Associations with floating pigs and general hygiene standards predicted avoidant behaviour (ORs 1.29, 1.24; P = .01). Neither local temperature or climate change were associated with recommended or avoidant behaviours (ORs 1.10, 1.06 Ps = .36, .48).

Discussion

Large populations and high population density make it critical to understand public responses to novel influenza viruses in China. Mixed messages from official sources can produce confusion, permitting anxiety to spread rapidly within families and communities, and reducing important behavioural change [1]. In this study, relatively high levels of trust in Chinese government advice about H7N9 contrast positively with previous pandemic communications in this country. National and regional media, along with Chinese CDC, disseminated preventive knowledge and local governments updated their pandemic status on a daily basis. This reflected a new determination to provide rapid, reliable information on such threats in this country [11]. Respondents learnt primarily about the threat via traditional media: there was little evidence of the social amplification of anxiety via social media [12]. This may be a consequence of fears of detention, following arrests for spreading online rumours about the outbreak.

Respondents associated temperature changes, the poultry trade and unexplained local events (e.g. floating pigs) with H7N9. Associations with floating pigs in the Huangpu river may reflect anxieties prevalent during the 2009 H5N1 outbreak. Risk associations with the poultry
industry echoed official communications from the Chinese government, as well as broader public concerns about farming methods during earlier influenza A outbreaks [3]. Associations with seasonal and climatic variations in influenza, also suggested in the research literature [13], imply high awareness of temporal factors. Anxiety levels, while relatively low, were higher than those reported early on during H5N1 in the PRC, where 72% claimed they were ‘not worried’ about infection [14]). Consistent with studies of pandemic threat elsewhere [7, 8] anxiety helped drive both recommended and non-recommended behaviours. Almost a quarter of respondents reported cancelling travel plans, emphasising the significant economic impacts of pandemic threat [1]. There was also some evidence of stigmatisation and the ‘othering’ of those associated with the threat (e.g. migrants), particularly amongst the most anxious. Such findings have also been reported elsewhere during pandemic threat [8,9].

The present study had some limitations. The telephone interview meant could we not contact those without home phones and limited the length of the survey. Data was from self-reports that cannot be independently verified. Need for immediate data collection reduced sample size, while random dialling potentially limited response rate.

At the time of writing there has been little evidence of human-to-human transmission of H7N9. Nevertheless our findings have important implications for clinicians and those working in health communication. Local expertise was particularly valued by our respondents, suggesting the efficacy of a new governmental strategy to provide rapid, transparent information. Other national authorities elsewhere may learn from this example when faced with emergent influenza threats. At the same time, even at this early stage, respondents reported buying preventive medicines, particularly local products. Public officials need to be aware that increased public anxiety may rapidly produce medical
shortages. ‘Common sense’, lay beliefs about those at risk, and appropriate behaviours to adopt to avoid infection, influence adherence and self-care behaviours but are rarely considered by practitioners. Perceptions of enhanced risk from some groups, such as those from outside a city, may cause socially disruptive behaviours, particularly if threat levels increase. This emphasises the continuing need for clear risk communications to abate potential discrimination and public disorders during widespread influenza threat.
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Table 1: Survey items and response categories

**Awareness:** Have you previously heard of H7N9 (yes/no)

Did you use the following to media to learn about H7N9? (each yes/no):

- TV, Radio, Newspapers, Micro-blogs, Social networks, Cell phone news

**Credibility:** To what extent do you believe the following information sources about H7N9?

(Do not believe/ moderately believe/ strongly believe):

- The Chinese government; Chinese domestic experts; Western experts

**Associations:** To what extent do you associate each of the following with H7N9? (related, unrelated, uncertain):

- Floating pigs in the Huangpu; New migrants to Shanghai; Poor Chinese hygiene in general; The unhygienic poultry trade; Recent temperature fluctuations; Global climate change

**Groups at risk:** What is the risk of the following groups being at risk from H7N9? (more at risk than me, similar risk than me, less risk than me, unsure):

- Those with regular contact with poultry; Migrants; Children; Young people; Old people; Those with weak immunity

**Anxiety:** Do you worry you (your family) will be infected with H7N9? (do not worry, worry a little, worry quite a lot, worry a great deal)? Since the H7N9 outbreak, have you been thinking more about life and death? (No, a little more, a great deal)? Did H7N9 bring any difficulty to your daily life? (none, just a little, some, a lot)

**Behavioural responses:** Following H7N9 did you (yes/ no):

- Buy Chinese medicine to prevent the virus; Buy western medicine to prevent the virus; Increase house ventilation; Avoid buying poultry or eggs; Change cooking methods; Avoid crowded places; Avoid recent migrants to Shanghai; Decrease public transport use; Postpone or cancel travelling; Change washing habits
Table 2: Beliefs about H7N9 and relative risk perceptions following H7N9 outbreak

<table>
<thead>
<tr>
<th>Item</th>
<th>Related (N, %)</th>
<th>Uncertain</th>
<th>Not related</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beliefs about causation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floating pigs</td>
<td>349 (34.5)</td>
<td>272 (26.9)</td>
<td>385 (38.0)</td>
</tr>
<tr>
<td>New migrants</td>
<td>232 (23.1)</td>
<td>246 (24.5)</td>
<td>525 (52.3)</td>
</tr>
<tr>
<td>Poor Chinese hygiene</td>
<td>622 (61.7)</td>
<td>272 (27.0)</td>
<td>114 (11.3)</td>
</tr>
<tr>
<td>Unhygienic poultry trade</td>
<td>784 (77.6)</td>
<td>90 (8.9)</td>
<td>136 (13.5)</td>
</tr>
<tr>
<td>Recent temperature fluctuations</td>
<td>548 (54.4)</td>
<td>95 (9.4)</td>
<td>364 (36.1)</td>
</tr>
<tr>
<td>Global climate change</td>
<td>450 (44.6)</td>
<td>202 (20.0)</td>
<td>356 (35.3)</td>
</tr>
<tr>
<td><strong>Trust in communications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese government</td>
<td>360 (36.5)</td>
<td>529 (53.6)</td>
<td>98 (9.9)</td>
</tr>
<tr>
<td>Chinese experts</td>
<td>191 (20.0)</td>
<td>525 (54.9)</td>
<td>241 (25.2)</td>
</tr>
<tr>
<td>Western experts</td>
<td>87 (11.8)</td>
<td>339 (45.9)</td>
<td>312 (42.3)</td>
</tr>
<tr>
<td><strong>Beliefs about relative risk</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular contact with poultry</td>
<td>863 (85.4)</td>
<td>60 (5.9)</td>
<td>88 (8.7)</td>
</tr>
<tr>
<td>Migrants</td>
<td>381 (37.7)</td>
<td>420 (40.6)</td>
<td>210 (20.8)</td>
</tr>
<tr>
<td>Children</td>
<td>522 (51.6)</td>
<td>383 (37.9)</td>
<td>106 (10.5)</td>
</tr>
<tr>
<td>Young people</td>
<td>59 (5.8)</td>
<td>821 (81.2)</td>
<td>131 (13.0)</td>
</tr>
<tr>
<td>Aged</td>
<td>736 (72.8)</td>
<td>198 (19.5)</td>
<td>77 (7.6)</td>
</tr>
<tr>
<td>Those with weak immunity</td>
<td>815 (80.6)</td>
<td>106 (10.5)</td>
<td>90 (8.9)</td>
</tr>
</tbody>
</table>
Table 3: Behavioural responses to H7N9

<table>
<thead>
<tr>
<th>Items</th>
<th>No. (%) positive responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended behaviours</strong></td>
<td></td>
</tr>
<tr>
<td>Changes in cooking behaviour (poultry/eggs)</td>
<td>515 (51.5)</td>
</tr>
<tr>
<td>Change hand washing habits</td>
<td>431 (42.8)</td>
</tr>
<tr>
<td>Ventilation at home</td>
<td>675 (66.9)</td>
</tr>
<tr>
<td>Avoiding those who are sick</td>
<td>515 (51.8)</td>
</tr>
<tr>
<td><strong>Non-recommended behaviours</strong></td>
<td></td>
</tr>
<tr>
<td>Avoided buying poultry/eggs</td>
<td>711 (70.5)</td>
</tr>
<tr>
<td>Avoiding public transport</td>
<td>128 (12.8)</td>
</tr>
<tr>
<td>Avoiding crowds</td>
<td>581 (57.8)</td>
</tr>
<tr>
<td>Avoiding recent migrants entering Shanghai</td>
<td>169 (17.1)</td>
</tr>
<tr>
<td>Wearing a mask</td>
<td>301 (29.7)</td>
</tr>
<tr>
<td>Cancelling travel plans</td>
<td>234 (23.3)</td>
</tr>
<tr>
<td><strong>Additional purchases</strong></td>
<td></td>
</tr>
<tr>
<td>Purchasing Chinese medicine</td>
<td>98 (9.7)</td>
</tr>
<tr>
<td>Purchasing Western medicine</td>
<td>30 (3.0)</td>
</tr>
</tbody>
</table>

* Behaviours recommended by the Chinese Ministry of Health [10].
Acknowledgements

Sun had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Acquisition of data: Sun.

Analysis and interpretation of data: Sun, Goodwin,

Drafting of the manuscript: Goodwin, Sun

Statistical analysis: Goodwin, Sun.

Critical revision of the manuscript for important intellectual content: Goodwin, Sun.

Final approval of manuscript: Goodwin, Sun.

Obtained funding: Sun

Administrative, technical, or material support: Sun.

Study supervision: Sun

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