April 19, 2013

Tracking H7N9 Awareness in China Using RIWI's RDIT for Early Warning of Emerging Threat Areas

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ABSTRACT

New cases of H7N9 avian influenza were reported in China during April 2013. In order to anticipate anti-viral treatment and in order to determine whether an epidemic might emerge, 29,136 random non-panel Web users in China were intercepted over 20 hours on April 14-15 by a RIWI™ method to gauge their awareness of apparent bird flu in their local area; 7,016, or 24.1% of the Web users, replied. The Web users were asked whether they knew of someone in their local area who had contracted bird flu. The results were segregated according to province and city. The main question (in Mandarin) was "Do you know someone who has contracted the new avian flu (bird flu) in your local area?" Answers to this question could alert health workers to areas of emergent need. The data showed a qualitative non-linear relation between case prevalence and contagion awareness on April 18, 2013: Shanghai city: 32 cases, and 40% awareness; Zhejiang province: 27 cases, and 26% awareness; Jiangsu province: 12 cases, and 26% awareness. Henan province: 3 cases, and 22% awareness; Anhui province: 3 cases, and 19% awareness. Because there was a qualitative relation between contagion awareness and the reports of cases, and because of evidence that the viral cases were spreading, this method could potentially be used as a way of tracking emerging threat areas for new cases. This rapid RIWI method of collecting many thousands of non-incented opinions in any country in a matter of hours may help detect outbreaks of virus infection.

Key words: Beijing; Shanghai; SARS; contagion awareness; pre-epidemic

Introduction

At the time of writing, early reports had been emerging from China, in April 2013, of increasing numbers of cases of H7N9 avian influenza. The first three cases of H7N9 in China were announced by the central government on March 31, 2013, followed by a detailed report on April 11, 2013 (1).

The World Health Organization (2) reported a rate of 11 deaths per 51 patients with H7N9 (21.6%) on April 14. Subsequently reported were a rate of 21.7% (13 deaths out of 60 patients) on April 15; a rate of 22.2% (14 deaths out of 63 patients) on April 16; and a rate of 20.7% (17 deaths out of 82 patients) on April 17; and a rate of 19.54% (17 deaths out of 87 cases) on April 18. The average 5-day death rate was 21.2%.

By way of comparison, the H5N1 bird flu strain infected 566 human confirmed cases that resulted in the deaths of at least 332 people since 2003, a death rate of 58.7% in this group (mostly in Asia and Africa) (3). The SARS epidemic (Severe Acute Respiratory Syndrome) had a case fatality rate of 9.6%.

As noted by Uyeki and Cox (4), the first three patients with H7N9 virus infection (1) received late treatment with Oseltamir™ starting on day 7 or 8 of illness while critically ill. They recommended oral Oseltamir™ or inhaled Zanamivir™ to be given as soon as possible to patients suspected or confirmed to have H7N9 infection, because secondary bacterial infection can cause severe and fatal complications. In fact, a 7-year-old child in Beijing received early anti-viral treatment and was reported to be responding to the medication and improving (5).

Because anti-viral treatment may be effective when given early, rapid identification is essential. In addition, early reports indicated one or two family clusters where some of the individuals had not been exposed to poultry (6). Such family clusters suggested possible human-to-human transmission of the virus. Therefore, it is essential to monitor the various regions of the country for

any preliminary indications of an emerging epidemic. Such information would provide advance notice to healthcare workers to re-allocate personnel and communications.

This report provides an early view of the level of contagion awareness of apparent infection with H7N9 bird flu in the Chinese population. It represents 7, 016 responses of people in China to specific questions over a 20-hour period. An abstract of this work has been presented elsewhere (7).

Method

This report is based on a Web search polling method (8) that reaches Web users in any world region. The users, none of whom are incented or are members of an opt-in panel commonly used in market research, are asked questions, and the replies are immediately and automatically tallied and encrypted. For this particular project on the H7N9 bird flu virus, the questions that were asked in Mandarin were: “What is your age? What is your gender?” “Do you know someone who contracted the new Bird flu (avian flu) in your local area?” Only Web users in China were contacted. The data were segmented according to province and city. The question was phrased to provide insights to public health workers to move scarce resources to affected areas. This is different than other common Web approaches that have been tried to track epidemic spread, notably ‘infodemiology’ or ‘fludemiology’ (9) that seeks to assess what Web users are searching for (e.g. ‘epidemic’) using search engines such as Google™ -- a process that is limited in situations where there are unusual signs and symptoms, as is the case with H7N9; or social media Web analytics (10), a process that is limited to tracking linguistics or words (e.g. ‘flu’ or ‘fever’) posted in online communities such as Twitter™ by the small subset of Web users that use such communities.

The RDIT™ data approach, a patented approach owned by The RIWI Corporation (Real Time Interactive World-Wide Intelligence), ran in all parts of China from Sunday, April 14, 2013, at 22:49 to Monday, April 15, 2013 at

19:50, a total duration of 20 hours, during which time 29,136 Web users were contacted, with 7,016 Web users, or 24.1%, replying.

The findings are based on patented, privacy-compliant and peer-reviewed data algorithms (11). The method reaches Web users with equal random probability in any targeted region of the Web-enabled world (12). This means the potential respondents are not members of any opt-in or incented panel, a common approach used by global market research companies. Through the patented procedure of someone making a manual type-in error in the browser bar (URL bar, or navigation bar) on any browser on any Web-enabled device, such as a tablet, a mobile phone or a desktop computer, the user stumbles upon thousands of random, rotating 'nonsense' and non-trademark domain names on any top-level or country-specific domain. In the present case, the user comes upon URLs accessed by Chinese citizens, China having the top-level country domain name of .cn, where RIWI Nano-Surveys™ are hosted. The Web user is asked, in Mandarin, short, rapid questions; the replies are immediately and automatically tallied on many RIWI servers. The servers link IP-based respondents to privacy-compliant identifiers. RIWI software ensures that the users can only answer once, that 'bots' cannot spam the question pages, and that all the users are real, human respondents. Additional details can be found elsewhere (8).

Results

During the 20 hours of data tracking, 83% of the 7,016 respondents were under the age of 35, while 17% were age 35 or older. The following cities showed a statistically significant number of Web users who reported that they knew of an individual who had contracted the bird flu in their local area. That is, the level of self-reported contagion awareness in the cities was 31% in Beijing, 38% in Hangzhou, 33% in Nanjing, 40% in Shanghai, and 28% in Zhengzhou (Chi Square; $P = 0.05$). Central cities such as Chengdu (contagion awareness of 8.6%) had less than expected reports of individuals known to have apparent bird flu.

The level of statistical significance was based on a Chi Square test comparing reported levels versus levels expected on the basis of the population density using 2010 Chinese Census data.

The level of contagion awareness of the avian flu was crudely related to the prevalence of the cases. In particular, the data, showing a qualitative non-linear relation between case prevalence and contagion awareness, were as follows on April 18, 2013:

Shanghai city: 32 cases, and 40% awareness;
Zhejiang province: 27 cases, and 26% awareness;
Jiangsu province: 12 cases, and 26% awareness;
Henan province: 3 cases, and 22% awareness;
Anhui province: 3 cases, and 19% awareness.

This list omits Beijing because it only had one case, but had 31% awareness. Therefore, if the single case of Beijing is added (a 7-year-old child who is currently being treated and improving), there is no correlation between case prevalence and contagion awareness. Obviously, more data are needed to test the possible relation.

Discussion

While this early view indicates that Web users in major cities in China were aware of apparent bird flu cases in their local area, medical confirmation of the cases is obviously needed. However, the knowledge of apparent bird flu in the local areas of the major cities provides a clue as to where additional public health services may be needed in the near future.

In addition to the H7N9 virus spreading from birds to humans, it is unknown, at the time of writing, whether there is human to human spread (6).

Given the method described here, factors that need to be considered in the possible relation between self-reported contagion awareness and the prevalence of apparent cases include:

1. Relative access and usage of the Web in all regions of China.
2. The incubation period of the virus.
3. The prevalence of masks in the region.
4. The presence of major news media in the region.
5. The educational level of citizens in the area.
6. The number of friends and relatives with whom Web users interact.

While it is acknowledged that the present Nano-Survey™ data were collected from Web users who may have only been informed indirectly or by hearsay that someone in their local area had apparent bird flu, the present data provide a basis for a possible epidemic warning, as based on the rapid spread of media reports.

Before the H7N9 virus could infect humans, it should be noted that the virus may have undergone extensive mutations in poultry for many months preceding the transfer to humans (13). Such viral mutations would be expected to continue, thereby increasing or decreasing the extent of infectivity between birds and humans, while also putting at risk human-to-human transfer.

The present high-speed method of obtaining thousands of views and opinions from Web users randomly during a short period, with a very high response rate as compared to other online data capture methods, may assist in the future development of rapid epidemiological predictive models and methods.

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Acknowledgements

We thank Philip Seeman, M.D., Ph.D., David M. Fisman, M.D., and Michael D. Christian, M.D., M.Sc., for helpful comments and assistance during the early assembly of our results.

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