Original article

An evaluation of the use of short message service during an avian influenza outbreak on a poultry farm in Young

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Abstract

In 2013 an avian influenza outbreak occurred in a large poultry farm in Young (approximately 2 hours north-west of Canberra.) The responsible strain was H7N2, which is highly pathogenic and can affect humans. Daily surveillance was required for those individuals who were possibly exposed. This was conducted through the use of daily message through the short message service (SMS). A total of 55 people were identified as having had high risk exposure and requiring monitoring during the surveillance period from 16 to 25 October 2013. A SMS message was sent daily to each contact within 2 groups. (Group 1 were contacts who agreed to take Tamiflu prophylaxis, and Group 2 were contacts who were under surveillance but declined Tamiflu prophylaxis). The average daily response rate for SMS was 66% (median 75%) over a 9 day period. Of those who nominated to receive the daily SMS 98% confirmed they'd received the SMS and it reminded them to take their Tamiflu medication. The public health unit (PHU) team found the use of SMS to be less time consuming than conducting telephone follow-up interviews. The PHU team believed that the use of the technology decreased the likelihood of additional staff being required to assist in the outbreak. Utilising SMS was a new initiative for the PHU and staff found it overall easy to use. These findings confirm there can be significant benefits to using SMS during a large surveillance activity. The application of SMS during this outbreak was estimated at 2.5 times more cost effective than telephone follow-ups and would substantially reduce staffing costs further in the event of a very large outbreak. *Commun Dis Intell* 2016;40(2):E195–E201.

Keywords: avian influenza, H7N2, surveillance, SMS

Introduction

In October 2013 an outbreak of avian influenza (AI) at a large poultry farm in Young, New South Wales was reported to the NSW Department of Primary Industries. The strain was H7N2, which was identified as highly pathogenic. Although most AI viruses do not cause disease in humans, strains H5 and H7 have adapted and spread through human populations.[1] On 15 October, Health Protection NSW requested the local public health unit (PHU) to identify close human contacts of the poultry, offer prophylactic treatment, and place these contacts under surveillance to identify any humans who may have contracted AI. Evidence suggests that some antiviral drugs, notably oseltamivir (Tamiflu), can reduce the duration of viral replication and improve prospects of survival.[2] Since 2010, there have been 376 reported cases of H5N1 in humans including 167 deaths worldwide.[3] The primary risk factor for human infection appears to be direct or indirect exposure to infected live or dead poultry or contaminated environments.

Outbreak setting

The poultry farm in Young is a well-established large poultry farm that houses over 400,000 birds across 8 free range and 6 caged sheds on site. The poultry are only for egg production. The free range sheds are about 700 metres from the cage sheds. In addition to the poultry, the farm has an onsite feed trucking business. The business employs over 103 workers and has a number of truck drivers and contractors visiting the farm. All persons who had close contact with the poultry 7 days prior to onset of illness in the birds were identified as at-risk for infection with AI.

Use of mobile phone technology

In Australia, there are 30.2 million telephones[4] for a population of 22.7 million[5] giving 133 connections per 100 citizens. Mobile phone short message service (SMS) is a communication tool with the potential to support health behaviours. It has been used in a variety of public health and medical monitoring programs such as in Western Australia were it was used to facilitate active monitoring of persons potentially exposed to Ebola virus returning from affected countries.[6] There has been some evidence that the use of SMS has made an effective contribution to advance behaviour change in

prevention programs, such as obesity prevention,[7] smoking cessation and physical activity programs.[8] SMS has also been used as an emergency warning system to provide timely information to disaster affected communities while also being used to rapidly collect information from these communities to improve aid delivery.[9] The Rural Fire Service in Australia uses SMS as an emergency warning system in fire affected areas. Unlike in health programs, a universal SMS is sent to the whole population within the vicinity of an affected area, rather than targeting specific individuals. Reasons for the success of SMS are; the cost is relatively low, its use is widespread, and it is applicable to every model of mobile phone.[9,10]

Surveillance of contacts of avian influenza

The Communicable Diseases Network Australia National Guidelines for Public Health Units for avian influenza recommends daily follow-up of close contacts for up to 10 days after the last exposure to infected birds or environments.[11] Contact management procedures involve offering antiviral prophylaxis, and PHU surveillance officers contacting cases and exposed persons through a daily telephone follow-up. The purpose of this call is to monitor for newly developed symptoms. In the event of a large outbreak this process can be time consuming and a challenge when contacts are likely to continue with their normal daily routines, such as working on the property, and are unavailable to speak on the telephone.

To assist with this large monitoring activity a web-based SMS was used to send messages to mobile telephones of all contacts identified as having high-risk exposure to AI. The purpose of the SMS was to remind identified contacts to self-monitor for influenza-like symptoms until the AI surveillance period expired, report to PHU if any symptoms developed and prompt contacts to take prophylactic Tamiflu medication, if prescribed.

Methods

The PHU identified 80 people at risk of exposure to AI on the farm, 25 were excluded due to either not having close contact with the poultry (within 1 metre of infected poultry without appropriate personal protective equipment) or not being on the property in the days prior to the birds becoming unwell, leaving 55 people identified as high risk of exposure and requiring monitoring during the incubation period from 16 to 25 October 2013. The PHU conducted an initial interview by telephone, arranged oseltamivir prophylaxis for contacts willing to take it, and a NSW Health fact sheet on AI was provided to all contacts and local clinicians. A list of contacts was compiled and sent to the NSW Office of Chief Health Officer (OCHO) Emergency Response Team who manage NSW Health access to a web-based SMS sending service provided by Prodocom® which would send their response in a excel format to the designated email address.

The team sending SMS checked the status of each sent item with a daily delivery report. If a message fails to be delivered, it can be resent. All messages have a maximum of 160 characteristics.

An SMS message was sent daily to each contact within 2 groups. Group 1 were contacts who agreed to take Tamiflu prophylaxis, and Group 2 were contacts who were under surveillance but declined Tamiflu prophylaxis). Originally, the SMS was sent at 10 am (17–19 October 2013) and then was moved to 8 am (20–25 October 2013) with the aim of it being received by the contacts before they started work. On 18 October 3 contacts requested daily telephone contact rather than SMS so were taken off the list leaving a total of 52 contacts in the SMS groups from 19 October. The 2 groups of contacts received a message as described in Box 1.

Box 1: Short message service messages sent to contacts

Group 1: Health reminder: take your flu tablet. Sick today? Cough, fever, sore throat, runny nose, red eyes or gastro? Pls reply Yes or No ASAP. Thanks, Lisa NSW Health

Group 2: Health check: sick today? Cough, fever, sore throat, runny nose, red eyes or gastro? Pls reply Yes or No ASAP. Thanks, Lisa NSW Health

Contacts were asked to respond to the message for the PHU surveillance officers to monitor symptoms. This request to respond to the SMS was discussed with the contacts during the initial telephone interview on the 16 October 2013.

Contacts from whom the PHU had not received a response by 4 pm on any day were telephoned to make sure that they had not developed any symptoms and asked why they had not responded to the SMS. Reasons for non-response were then analysed to determine if there was any way the PHU could improve the response rates by making response easier for those contacts.

Any contacts who replied 'yes' to having symptoms were telephoned immediately by the surveillance officer to discuss the symptoms and to arrange testing if symptoms were consistent with AI.

Data to evaluate the use of SMS monitoring for this outbreak were collected using 3 approaches:

1. A review of all surveillance records was conducted: SMS response data were extracted from the New South Wales Notifiable Conditions Information Management System for the surveillance period 17 to 25 October 2013. Data from the 16 October 2013 were excluded as telephone calls were conducted in the first instance to collect all relevant personal data.
2. Data were collected from contacts who were telephoned if they did not respond to the SMS (same day or > 2 days) as part of AI contact management processes by the PHU team. During their telephone follow-up 3 questions were asked:
    1. Did you receive a text message this morning? (YES/NO)
    2. Did it prompt you to take your flu tablets? (YES/NO)
    3. To help improve our services would you mind telling me why you didn't respond to the SMS?
3. Telephone interviews were conducted in November 2013 with contacts who had responded to the SMS on 8 or more days and were asked:
    1. Did you find receiving a SMS useful? (YES/NO)
    2. Did it prompt you to take your flu tablets? (YES/NO)
    3. Did it make you look out for signs (and symptoms) of flu? (YES/NO)
    4. Are there better ways to contact you? (YES/NO)
    5. If yes, what?
    6. Was responding to the SMS difficult?

Data were entered into Excel v2010 for analysis and basic descriptive statistical analysis was used. Open ended responses were coded and collapsed into themes using a simple content analysis.

Results

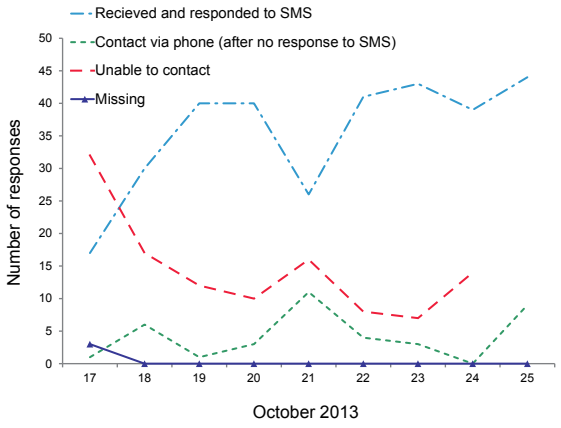
The average daily response rate for SMS was 66% (median 75%) over a 9 day period (Figure 1). The lowest response rate was on 18 October (2nd day using SMS, 32%). The second lowest response rate was 21 October 2013 (48%) mid-way through the surveillance period. On Monday 21 October 2013, 11 contacts were followed up by telephone, which was a 30% increase in telephone calls compared with an average day during the surveillance period. Excluding 21 October the use of the SMS increased over the 9 day period. The response rate of 66% reduced the PHU workload considerably. It was estimated that the use of SMS as a part of the contact management process was over 4 times more cost effective than telephone follow-ups (Box 2). These calculations were based upon a surveillance officer spending 1.5 hours a day administering the SMS process and conducting telephone follow-ups as needed. Conducting the process by telephone was estimated as taking 2 people 4 hours per day over a 9 day period. Overhead costs were excluded from the analysis.

Box 2: Cost analysis of short message service

SMS contact management: Middle grade HSM (1 surveillance officer) x 1.5 hours x 9 days = $590.62 + $152 for sending SMS messages = $742.62

Telephone contact management: Middle grade HSM per hour x 2 persons /4 hours = $3500 x 9 days = $31,500

Figure 1: Short message service responses from contacts over the 9 day surveillance period 17 to 25 October 2013



Non-respondents to short message service

Of the 52 contacts (from 18 October 2013) 7 were consistently un-contactable. Seventeen contacts were followed up by telephone (as no SMS response was received for more than 2 days). Of those who

opted to receive SMS, 98% confirmed they had received the SMS and it reminded them to take their Tamiflu medication.

The reasons for non-response are listed in the Table. Contacts not realising that a reply was required (n = 5) and finding it challenging to respond when working on site (n = 4) were the most common reasons for non-responses.

Responders to short message service

Identified contacts (n = 22, 79%) who frequently responded (≥ 8 days) to SMS over the 9 day period were interviewed over the phone (Figure 2). Over 80% of respondents found the SMS useful. Three respondents felt the fact sheet provided enough information but felt they should respond. Fourteen (64%) said it reminded them to take their Tamiflu tablets. The main reason why the remaining 8 respondents felt that the SMS did not remind them to take their medication was because the time the SMS was received didn't coincide with the time to take their tablets. Nonetheless, over 80% agreed that once they had received their SMS it did prompt them to look out for symptoms described in the SMS. A total of 7 contacts were tested after reporting through SMS that they had symptoms. All results were negative to H7N2. Two positive results were recorded for rhinovirus and respiratory syncytial virus. Two respondents praised the work of the PHU team as they felt 'looked after' during a difficult time.

In response to the question "Were there any associated challenges to participating in the SMS process?" 12 (55%) respondents confirmed they found the SMS process easy (Figure 3). However, the remaining 10 raised challenges to responding and these included; being unable to respond during work time (22%, n = 6) and having to remember to respond in the evening. This finding was consistent with the non-responders. Thirteen per cent (n = 3) said they were not clear if they had to keep responding over the 9 day period.

Figure 2: Responses to follow-up questions to contacts on the use of short message services during the outbreak on the poultry farm in Young

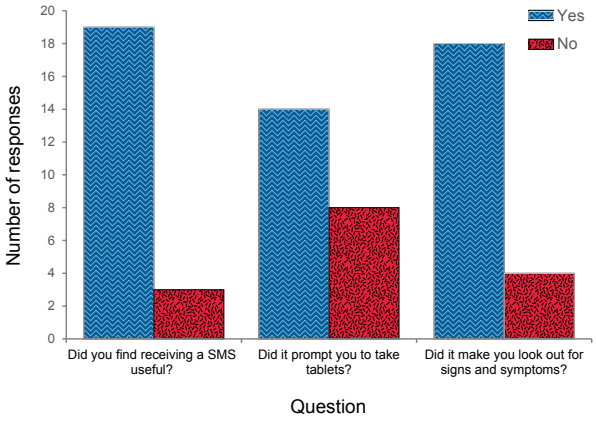
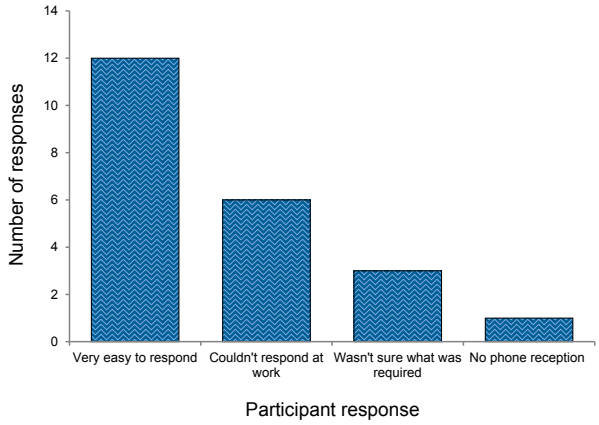


Figure 3: Interview responses identifying the challenges to responding to short message services



Process management

The process of sending out the SMS was reported by the OCHO team to be straightforward and the PHU team found it to be less time consuming than conducting telephone follow up interviews. The process used during this outbreak is described

Table: Contacts reason for not responding to short message service

	Frequency n=16	Proportion of total respondents %
Didn't realise /forgot to respond	5	30
Can't reply when at work	4	24
No service	2	23
No phone credit	3	23
Locked out of house	1	0.5
No receipt of text message	1	0.5

in Figure 4. The PHU team believed that the use of the technology decreased the need for additional staff being required to assist in the outbreak. However, management of the SMS involved liaising across 3 departments (OCHO, PHU and the Communicable Disease Branch) and still required manual administration from the OCHO to set the system up and the PHU team to manage the responses to SMSs, which impacted on workloads. The additional steps in the process for the PHU surveillance officer is described in Figure 5 and involved the SMS responses being sent to a surveillance officer's email address. This presented a problem when surveillance officers changed shifts and subsequently the OCHO had to redirect the emails. Further, the process used required manually matching the mobile phone numbers from the emails to the mobile numbers in a database to find the contact's details.

Impact on public health unit resources

It was estimated that the use of SMS for contact management was 2.5 times more cost effective than telephone follow-ups. These calculations were based upon a surveillance officer spending 1.5 hours a day administering the SMS process and conducting telephone follow ups as and when needed. Conducting the same number of telephone interviews was estimated as taking 2 people 4 hours per day over a 9 day period. Overhead costs were excluded from the analysis.

Figure 4: Process of using short message service as a surveillance tool during the avian influenza outbreak on a chicken farm in Young, October 2013

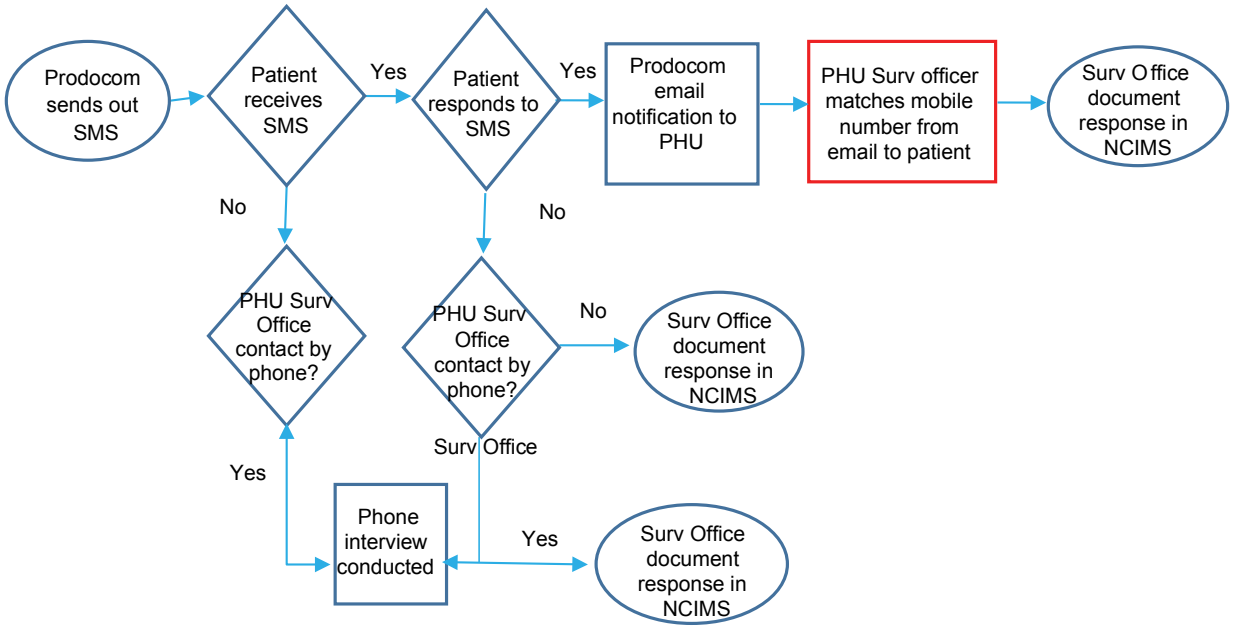
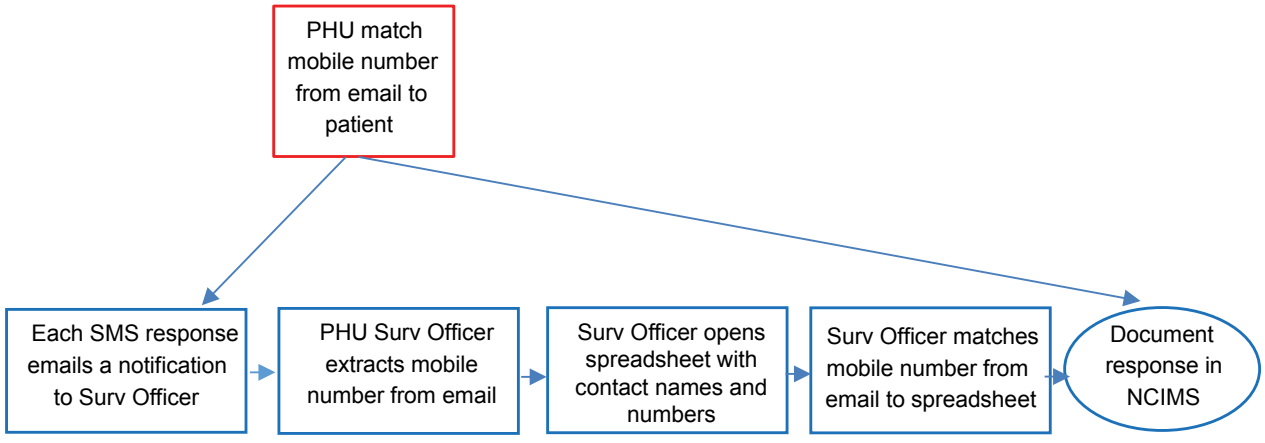


Figure 5: Breakdown of activities for surveillance officer to administer the short message service process



Discussion

Utilising SMS was a new follow-up initiative for the PHU and staff found it overall easy to use. The findings confirm there are significant gains in using SMS during a large surveillance activity, with only minor technical errors (only 1 contact not receiving the SMS). The application of SMS during this outbreak was estimated at 2.5 times more cost effective than telephone follow-ups and would substantially reduce staffing costs further in the event of a very large outbreak. In addition, it was noted by a number of contacts that the SMS increased their confidence in the response to the situation during a difficult time. In larger outbreaks, SMS could be the only way to resource the required follow-up.

Just over 60% of contacts responded to the SMS daily. The findings from the interviews with contacts reported that there were 2 main reasons for the remaining 40% not responding. Firstly, not all contacts were clear about what was required from them, particularly towards the end of the 9 day period when there were no signs of illness. This was reflected in the sudden drop in SMS response rates half way through the surveillance period. And secondly, the timing of the SMS did not fit in with contact's work schedule. While the time was brought forward from 10 am to 8 am, we found that the 8 am SMS may still be within a workday bandwidth and therefore may need to be earlier or during the evening to increase the likelihood of a response. The timing of the SMS needs to be flexible to be able to change with work schedules and convenience of those who are required to respond.

Other contributing factors to non-responses include mobile phone numbers given to public health by those under surveillance where phones were shared by other family members and not always carried by the targeted person. Reduced mobile reception coverage also impacted some responses and alternative contact arrangements could have been arranged at the commencement of surveillance to circumvent the above situations.

The process of sending out a SMS was described as straightforward. Mapping the process highlighted a number of steps involved in tracking contacts responses, which required manual input and was therefore vulnerable to errors because of the amount of paperwork required, particularly with a large number of contacts. It is recommended that these steps be streamlined through exploring if short messages can be sent and received through 1 central database.

This evaluation has a number of limitations. The first is that we were not able to conduct a comprehensive comparison between early detection of illness between telephone follow-ups and the use of SMS. Further studies would be valuable to determine which would be a quicker way to identify sick patients and to determine if people were less or more likely to disclose illness via SMS. Secondly, this study involved adult participants. If contact management was conducted with children and young persons, who may be on pre-paid telephone plans or access parents' telephones, the response rates may be different. This limitation hasn't been highlighted in other studies but requires further consideration.

Using the SMS for daily follow up was a new strategy the PHU had not used before and with digital technology becoming more popular could see SMS surveillance used routinely by PHUs in the future.

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