

International Health Regulations: Lessons From the Influenza Pandemic in Singapore

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Abstract

Introduction: Singapore's defense against imported novel influenza A (H1N1-2009) comprised public health measures in compliance with the World Health Organization's (WHO) International Health Regulations (IHR), 2005. We report herein on the epidemiology and control of the first 350 cases notified between May and June 2009. **Materials and Methods:** We investigated the first 350 laboratory-confirmed cases of novel influenza A (H1N1-2009) identified from the healthcare institutions between 27 May and 25 June 2009. Epidemiological details of these cases were retrieved and analysed. Contact tracing and active case finding were also instituted for each reported case, and relevant particulars including flight information were provided to WHO and overseas counterparts. **Results:** The first 350 novel influenza A (H1N1-2009) cases comprised 221 (63%) imported cases, 124 (35%) locally acquired cases and 5 (2%) cases with unknown source. The imported cases consisted of three waves involving the United States (US), Australia and Southeast Asia. In the first wave, 11 (69%) of the 16 imported cases had visited the US within seven days prior to their onset of illness between 25 May and 4 June 2009. In the second wave, 20 (74%) of the 27 imported cases between 5 June and 12 June had travelled to Melbourne, Australia. In the third wave, 90 (51%) of the 178 imported cases between 13 June and 25 June were acquired from intra-regional travel in Southeast Asia. Specifically, 49 cases were from the Philippines and 40 (82%) of them had travelled to Manila. A total of 667 communications were effected through the IHR mechanism; a majority within 24 hours of disease notification. **Conclusion:** Singapore experienced an unprecedented need for international cooperation in surveillance and response to this novel Influenza A (H1N1-2009) pandemic. The IHR mechanism served as a useful channel to engage in regional cooperation concerning disease surveillance and data sharing, but requires improvement.

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Introduction

By virtue of the International Health Regulations (IHR) which came into force on 15 June 2007, countries are required to report specific infectious diseases and public health events to the World Health Organization (WHO). The first novel Influenza A (H1N1) patient in the US was confirmed by laboratory testing at Centers for Disease Control and Prevention (CDC) on 15 April 2009.¹ On 18 April 2009, several cases of severe respiratory illness laboratory confirmed as swine-origin influenza A (H1N1-2009) infection were communicated to Pan American Health Organization (PAHO).² The initial notification by Mexico and the US helped WHO determine that this outbreak constituted a public health emergency of international concern (PHEIC). WHO went on to raise the worldwide pandemic alert level to Phase 6 on 11 June 2009 in response to the ongoing global spread of the novel influenza A (H1N1-2009) virus.^{2,3}

Singapore identified its first imported Influenza A (H1N1-2009) case from New York, USA on 27 May 2009, and quickly began to see cases from a variety of countries. As a travel hub, Singapore Changi Airport is served by over 80 airlines with more than 4,300 weekly scheduled flights to 189 cities in 60 different countries worldwide.⁴ This connectivity makes it especially vulnerable to emerging infections. Outbreak control strategies were broadly grouped under two phases. In the Containment phase, characterised by imported cases with few and identifiable local clusters associated with imported cases, the aim of control strategies was to prevent community spread of the disease. In the Mitigation phase, characterised by community acquired infection and new cases which were no longer linked to known cases, the aim of control strategies was to reduce morbidity and mortality from the disease while minimising disruption to essential services. We report herein on the imported cases notified during Singapore's

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initial Containment phase, and the public health measures in compliance with WHO's IHR.

Materials and Methods

The Containment phase was activated when Singapore identified its first Influenza A (H1N1-2009) import, and active case finding was instituted for each reported case. We subsequently investigated into all laboratory-confirmed cases notified from the healthcare institutions during the Containment phase. Relevant particulars including flight information were obtained through the IHR mechanism from WHO and overseas counterparts. All public health measures taken during this pandemic were in accordance with the IHR. Besides temperature screening at border checkpoints, distribution of health notices and completion of a health declaration card by travellers, the designated National Focal Point of each member state is responsible for liaison with WHO and public health counterparts. Two officers in MOH were tasked to maintain communications around the clock. Identified close contacts who were not in the country during the Home Quarantine Orders (HQO) period were notified via IHR to their home/destination country. Details of the contacts' particulars, contact numbers and addresses were sent to the respective National Focal Points (NFPs) within 24 hours of disease notification.

Results

A total of 350 cases were identified during the Containment phase in Singapore. One hundred and sixty-seven (48%) of cases are males and 183 (52%) females. The cases comprised 221 (63%) imported cases, 124 (35%) locally acquired cases and 5 (2%) cases with unknown source. Individuals in the 10 to 29 age group constituted close to 60% of all imported cases; 79 (36%) from the 20 to 29 age group, 63 (29%) from the 10 to 19 age group. Our public health responses consist of 667 communications effected through the IHR platform to WPRO, WHO and the IHR NFPs. Of these, 381 (57%) comprised notifications to NFPs of close contacts who have been identified, 203 (30%) requests for NFPs and embassies to verify the identities of the cases confirmed overseas, and 83 (13%) updates on the situation with various government agencies. The imported cases occurred in three waves. The details are as follows:

First Wave (25 May to 4 June)

Eleven (69%) of the 16 imported cases during this period had visited the US within seven days prior to their onset of illness. They comprised 5 (45.4%) from New York, 1 (9.1%) from Atlanta, 1 (9.1%) from Philadelphia, 1 (9.1%) from California, 1 (9.1%) from Florida, 1 (9.1%) from Honolulu, and 1 (9.1%) from Chicago. Seven (64%) of those with a positive travel history to the US were males. By 28 April 2009, the US had reported a total of 64 confirmed Influenza A (H1N1-2009) cases; a majority of them in New York City.⁵

A week later, New York experienced substantial community transmission evident in the form of large school outbreaks. Singapore initiated communication with the US IHR NFP on 28 May 2009, 24 hours after the notification of the first confirmed Influenza A (H1N1-2009) case. The electronic exchange was to inform the US of three more confirmed Influenza A (H1N1-2009) cases notified to Singapore on 28 May 2009. Personal details of close contacts identified were forwarded to the US IHR NFP to facilitate local pandemic response measures. Communications were rapid and responses were swift. The US IHR NFP acknowledged receipt of the information within 24 hours, on 29 May 2009. However, as the pandemic progressed, the time lag in the midst of information flow increased to >72 hours on 4 June 2009. As the IHR sharing platform was no longer effective, sharing of contact tracing information was discontinued.

Second Wave (5 to 12 June)

The first wave of infection which originated largely from USA continued for a while before the emergence of a second wave closer to home. On 30 May 2009, an Influenza A (H1N1-2009) case was identified in an 18-year-old Singaporean male who returned from Melbourne, Australia. Subsequently, 20 (74%) of the 27 imported cases notified between 5 June and 12 June had travelled to Australia. All 20 (100%) cases with a positive travel history to Australia visited Melbourne in particular. Half (50%) of them were males. Singapore initiated communication with the Australia IHR NFP on 27 May 2009. They requested Singapore's assistance in tracking the instances where Australians were hospitalised or quarantined on arrival from Australia due to influenza symptoms. Their government reported a one third jump in Australia's Influenza A(H1N1) cases to 500; intensifying a major health emergency.⁵ The state of Victoria was disproportionately affected with most of the infections concentrated in the north and west of the state capital, Melbourne; 12 schools were closed in Victoria as of 1 June 2009.⁶

Third Wave (13 to 25 June)

The second wave from Australia continued simultaneously with the third budding Southeast Asia wave. Singapore reported cases with a travel history to the Philippines as far back as 30 May 2009 but a rising trend of Influenza A (H1N1-2009) cases imported from the neighboring Southeast Asian countries only started on 14 June. Ninety (51%) of the 178 imported cases between 13 and 25 June were acquired from intra-regional travel in Southeast Asia. The Philippines contributed 49 (55%) of those who travelled to neighbouring countries. Of those who travelled to the Philippines, 40 (82%) went to Manila. The others comprised 18 (20%) from Indonesia, 12 (13%) from Malaysia, 10 (11%) from Thailand and 1 (1%) from Cambodia. We were informed of the first laboratory confirmed case from the Philippines

on 21 May 2009.⁷ Singapore initiated communication with the Philippines NFP on 13 June 2009 to clarify the disease situation but received no response.

Discussion

In the globalised world, diseases can spread far and wide via international travel and trade. The first human infections with the new Influenza A (H1N1-2009) variant virus, a novel triple reassortant swine influenza virus, were identified in two patients in the US on 17 April 2009.⁸ A health crisis in one country can impact livelihoods and economies in many parts of the world.⁹ Singapore's economic hub status and connectivity made it particularly vulnerable to the pandemic which could be imported by foreigners from their host country, and by locals returning from an affected country. The alternative of affordable and short-haul flights has facilitated the spread of the pandemic, making our border more porous than ever.

Although the communication links between Singapore and the various IHR NFPs could be regarded as optimum for timely data sharing, the bilateral flow of information did not meet up to our expectations. One reason could be the lack of common procedures for WHO member states to report the detection of the imported infection within their borders. The IHR NFPs were not equally responsive, neither were information provided synchronised, perhaps because disease reporting via the IHR has not been given enough public health importance.

In most times, our communications with the IHR NFPs stopped after the first one. A lack of response by the IHR NFP involved resulted in a lack of knowledge on the epidemiology of the local infections and transmission dynamics. This downside carried repercussions on containment in Singapore, which could account why most infected cases could be categorised into three huge waves. We also observed the lack of an integrated approach in the IHR process at the state level which made it especially hard for disease control as the infections spread. An evident example is Australia, where the infections spread from Victoria to other states like Queensland and New South Wales. In this regard, there is a need to establish a coordinated response framework for IHR reporting between the *different states* in a country.

Because of a lack of information from the IHR NFPs, Singapore often had to explore alternative sources of information. Although all member states are represented by their IHR NFP for communication with WHO, not all were equally diligent with responding to additional requests, as well as providing timely information. This time-lapse could be a major pitfall in future pandemics.

Since the inception of the new IHR, there was until now no implementation of the IHR in response to a public health emergency. The H1N1-2009 pandemic has since provided the learning opportunity and demonstrated that

strong international health agreements and good planning are vital in detection and evaluation of the emergence of the infection.^{9,10} Singapore experienced an unprecedented level of international cooperation for surveillance and response to this novel Influenza A (H1N1-2009) pandemic. Besides demonstrating local effectiveness, the impact of the IHR on coordinated response was extended well beyond our shores. We managed to assist Sri Lanka in identifying her first Influenza A (H1N1) case using IHR platform. Sri Lanka's first case was identified as a close contact on board the same flight as one of our confirmed cases. Details of the close contact were fed to the relevant IHR NFP within 24 hours of disease notification so as to enable successful detection and isolation of suspected cases.

The IHR mechanism served as a useful channel to engage in regional cooperation concerning disease surveillance and data sharing. Bilateral communications could be better enhanced if member states exercised more diligent response. Although main provisions in the IHR are aimed at facilitating global communication and cooperation, more guidance on the common procedures are needed. Response time should be reduced, and the eventual response provided by the IHR NFP should be informative of the situation unfolding in the country. The most pressing issue would be to raise the awareness and importance of the IHR as a detection system in every part of the world, and the global commitment to work together on this.⁹

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