

Outbreak of Novel Influenza A (H1N1-2009) Linked to a Dance Club

Pei Pei Chan,¹*BSc (Hons)*, Hariharan Subramony,¹*MBBS*, Florence YL Lai,¹*MPhil*, Wee Siong Tien,¹*BSc (Life Sciences) (Hons)*, Boon Hian Tan,¹*BSc (Life Sci) (Hons)*, Suhana Solhan,¹*BSc (Phar) (Hons)*, Hwi Kwang Han,¹*BEOHS*, Bok Huay Foong,¹*BA*, Lyn James,¹*MBBS, MMed (PH), FAMS*, Peng Lim Ooi,¹*MSc, MPH, FAMS*

Abstract

Introduction: This paper describes the epidemiology and control of a community outbreak of novel influenza A (H1N1-2009) originating from a dance club in Singapore between June and July 2009. **Materials and Methods:** Cases of novel influenza A (H1N1-2009) were confirmed using in-house probe-based real-time polymerase chain reaction (PCR). Contact tracing teams from the Singapore Ministry of Health obtained epidemiological information from all cases via telephone. **Results:** A total of 48 cases were identified in this outbreak, of which 36 (75%) cases were patrons and dance club staff, and 12 (25%) cases were household members and social contacts. Mathematical modelling showed that this outbreak had a reproductive number of 1.9 to 2.1, which was similar to values calculated from outbreaks in naïve populations in other countries. **Conclusion:** This transmission risk occurred within an enclosed space with patrons engaged in intimate social activities, suggesting that dance clubs are places conducive for the spread of the virus.

Ann Acad Med Singapore 2010;39:299-302

Key words: Contact tracing, Control, Epidemiology, Mathematical modelling

Introduction

Influenza A (H1N1-2009) is a novel strain of influenza virus. The infection is thought to have first occurred in Mexico in March 2009, and then spread worldwide, resulting in the first influenza pandemic of the 21st century.¹ As of 25 September 2009, the 2009 H1N1 pandemic has resulted in more than 300,000 cases and 3917 deaths in 191 countries.²

The first reported case of novel influenza A (H1N1-2009) in Singapore was a 22-year-old female who arrived in Singapore from New York on 26 May.³ She developed influenza-like symptoms while on board the flight and was diagnosed to have novel influenza A (H1N1-2009) on the day of arrival into Singapore. The number of imported cases progressively increased, and one of the first local outbreaks of community-acquired infection was detected in a dance club in mid-June. A dance club is a drinking, dancing and entertainment venue which is distinguished by the inclusion of a dance floor and a live band or a disc jockey (DJ) booth where the DJ plays recorded dance and pop music. Dance clubs often feature lighting (e.g., flashing coloured lights, moving light beams, laser light shows, strobe lights, mirror-covered disco balls) and other effects (e.g., foam, smoke machines) to enhance the dancing experience. Entertainment

and the opportunity to meet others are the main attraction at these clubs. This paper describes the epidemiological features and control of novel influenza A (H1N1-2009) transmission linked to a dance club in Singapore.

Materials and Methods

The dance club at the epicentre of this outbreak employed 80 staff and was visited by 500 to 800 people daily, mostly young adults. The establishment covered an area of 8,000 square metres.

We defined cases of novel influenza A (H1N1-2009) as laboratory confirmed cases, diagnosed by Department of Laboratory Medicine, Tan Tock Seng Hospital, Singapore, using in-house probe-based real-time polymerase chain reaction (PCR).⁴ Epidemiological information was obtained by contact tracing teams from Ministry of Health, Singapore (MOH) via telephone, and included demographic data, clinical symptoms, contact history, travel history during the period of 7 days prior to the onset of symptoms, and movement history from the onset of symptoms to the date when medical treatment was sought.

In the statistical modelling, the basic reproduction number, defined as the expected number of secondary

¹ Communicable Diseases Division, Ministry of Health, Singapore

Address for Correspondence: Ms Chan Pei Pei, Communicable Diseases Division, Ministry of Health, College of Medicine Building, 16 College Road, Singapore 169854. Email: chan_pei_pei@moh.gov.sg

cases generated by an average infectious case over the course of his/her infectious period in an entirely susceptible population, was used as a key quantitative measure of disease transmissibility. Mathematically, R_0 , the basic reproduction number, is related to the growth rate during the initial exponential growth phase of an epidemic and the disease generation time, which is approximately the sum of the average latent period and the infectious period, with the following formula:

$$R_0 = 1 + rT_g + f(1-f)(rT_g)^2,$$

where r is exponential growth rate, T_g is the disease generation time and f is the fraction of the generation time that is latent.

Results

A total of 48 cases were epidemiologically linked in time and place to the outbreak. These cases developed symptoms from 16 to 30 June 2009 and were based on the known incubation period of influenza A (H1N1-2009) from 1 to 7 days,⁵ and the period of exposure was determined to be from 15 to 23 June 2009. The male-to-female ratio was 1.7, with 30 (62%) males and 18 (37%) females (Table 1). Median age was 22 years (inter-quartile range, 19 to 26 years), and a majority (79%) of the cases were ethnic Chinese. In order of decreasing frequency, the main symptoms were as follows: fever (40%), cough (21%), sore throat (14%), runny nose (14%) and headache (4%).

The outbreak chain of transmission at the dance club is provided in Figure 1. The first generation arising from

the index case comprised 23 cases, followed by a second generation of 20 cases, and 2 cases each in the third and fourth generations. The index case was a 20-year-old student who developed flu-like symptoms on 16 June 2009 after returning from a Malaysian beach resort 2 days earlier. She visited the dance club a day after the onset of symptoms (on 17 June) with 20 friends, 3 of whom were diagnosed with novel influenza A (H1N1-2009) within 2 days after their exposure. There were another 16 patrons and 3 employees who tested positive for the infection over the next 8 days. These 3 employees (all with onset of illness on 20 June 2009) had worked on 18 to 20 June 2009 at the dance club, and were likely sources of infection for another 11 patrons and 2 employees. There were another 12 (25%) cases who were social contacts of the earlier cases and did not visit the dance club prior to their onset of illness. These social contacts were work colleagues, family members and friends.

The onset chart of the outbreak at the dance club is provided in Figure 2. The mean and median incubation periods were 3.6 days and 3.0 days, respectively (range, 1 to 8 days). The exponential growth phase shows an estimated exponential growth rate of 0.4599 cases per day over a span of 8 days. Using the disease generation time of 1.91 days, as estimated based on the outbreak of novel influenza A (H1N1-2009) in the village of La Gloria, Mexico,⁶ R_0 was estimated to be between 1.9 and 2.1.

Discussion

The epidemiological features of this outbreak were consistent with a common source infection, traced to a single index case who developed novel influenza A (H1N1-2009) on 16 June, 2 days after returning from a Malaysian tourist resort. The median age of the cases was 22 years. Based on our epidemiological investigation, all cases of novel influenza A (H1N1-2009) included in this study showed some linkage to the dance club, with an onset date from 17 June 2009 onwards.

Response to the outbreak was aimed at preventing the spread of the disease from the epicentre to the larger community. Cases were isolated and treated. Contact tracing was carried out and close contacts of cases were placed under a strict 7-day home quarantine order, with advice directing them to seek medical attention should they developed flu-like symptoms during the quarantine period. There was risk communication to the public specifically informing them of this outbreak and advising general preventive measures such as frequent hand washing, sneezing and coughing into tissues, wearing surgical masks and seeking medical attention if unwell. Lastly, the operators of this club were alerted of this outbreak who responded with voluntary closure and disinfection of the premises from 20 June to 1 July 2009. When the club re-opened its premises, it instituted temperature screening on entry for patrons and

Table 1. Demographics of the Cases Linked to the Dance Club Outbreak based on Gender, Age Group and Ethnic Group

Variable	No. of cases	Proportion (%)
Gender		
Male	30	62.5
Female	18	37.5
Age group (y)		
<15	1	2.1
15-17	2	4.2
18-20	17	35.4
21-23	10	20.8
24-26	10	20.8
27-29	2	4.2
>30	6	12.5
Ethnic group		
Chinese	38	79.2
Malay	2	4.2
Indian	2	4.2
Others	6	12.5

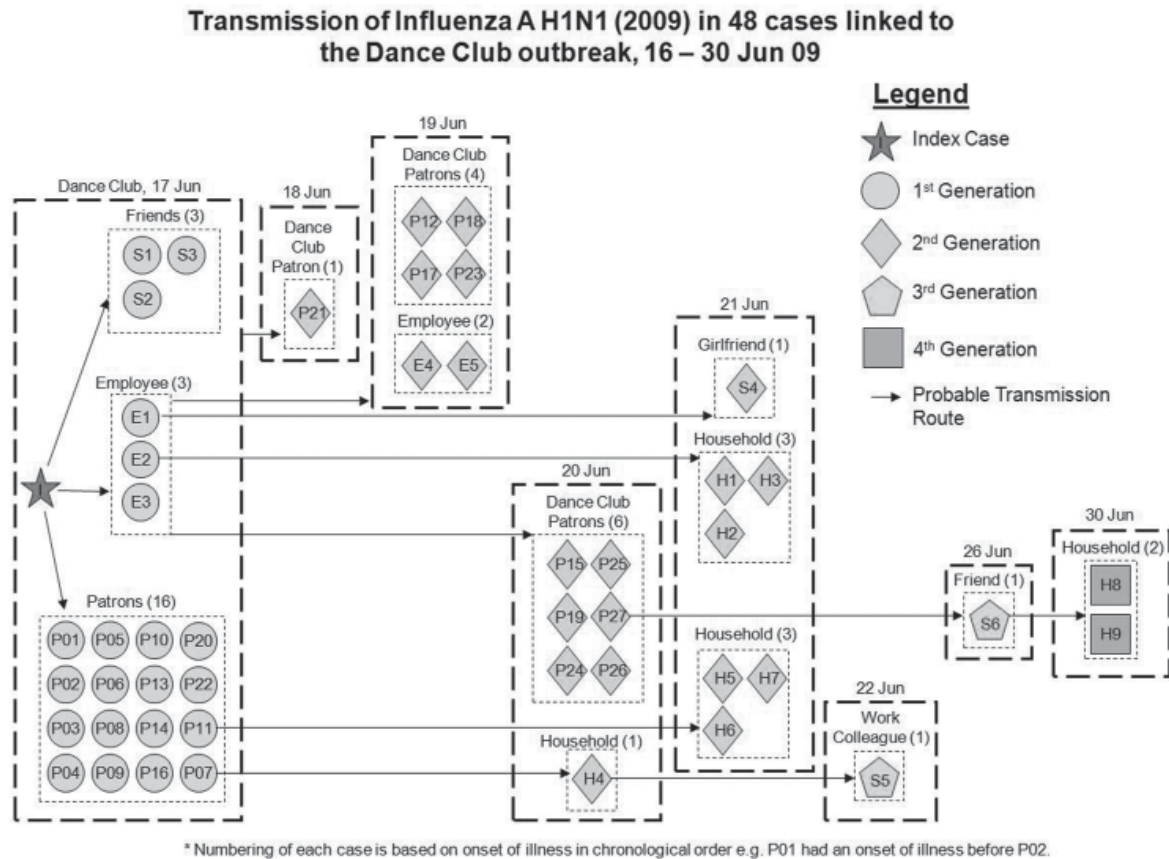


Fig. 1. Pictogram on the transmission of the 48 cases linked to the dance club outbreak.

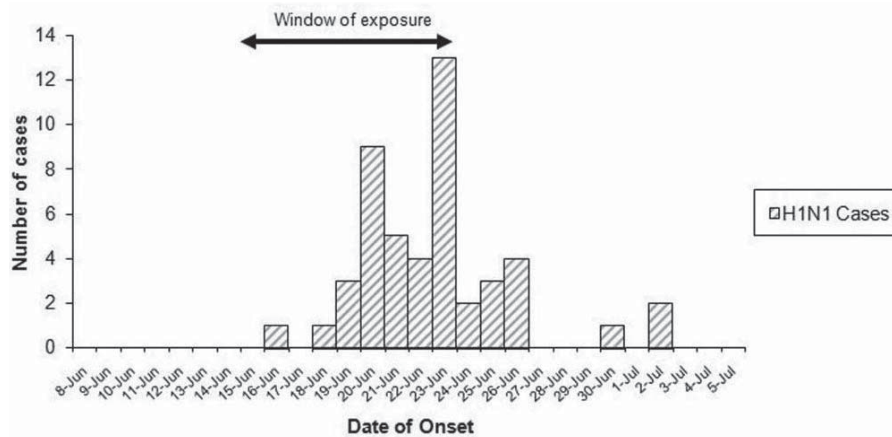


Fig. 2. Onset chart of 48 influenza A (H1N1-2009) cases linked to the dance club outbreak.

staff. Hand sanitisers were also made readily available within the premises.

The spread of disease in the dance club outbreak was influenced by factors such as the environmental conditions of the premises, the duration of infectivity of an infected person, and the contact rate between infectious and non-infectious persons. The dance club is an enclosed environment with poor ventilation and is crowded during its peak hours. Patrons engage in intimate social activities such as sharing of drinks and food, ear-whispering and kissing. All these

factors contributed to the spread of disease. In addition, this strain of virus can bind well onto common surfaces such as door knobs and glass and is viable on these surfaces for up to 2 days.⁷

However, there were limitations in the investigation of the outbreak. Firstly, cases were interviewed as part of contract tracing to determine their movement history as well as identify close contacts. A case control study could not be conducted as the daily volume of patrons to the dance club was high and there was difficulty in identifying contacts.

Secondly, though possible factors of transmission have been discussed, the exact mode of transmission of H1N1 could not be ascertained. A series of activities that were multi-factorial could have triggered the outbreak and led to the widespread transmission. The dance club was voluntarily closed for cleaning and disinfection, following which no further cases were reported to MOH.

R_0 for H1N1(2009) infection in a population setting was generally estimated to be 1.1 to 1.8.^{6,8} In specific contexts, like schools, R_0 were expected to be higher. Japan reported a R_0 of 2.3 based on the school outbreaks as contact rates amongst school children were higher.⁹ The present study reported an R_0 between 1.9 to 2.1 for the outbreak linked to a dance club in Singapore as gatherings in an enclosed environment like a dance club can concentrate infectious diseases and amplify their transmission. The estimation of reproduction number in different settings may be useful for the rapid assessment of the transmission potential of novel diseases in the future.

Dance clubs are part of the nightlife of many cities and have been implicated in outbreaks of various contact-transmissible diseases amongst young adults. Examples include reports of a cluster of drug-resistant tuberculosis in patrons visiting a dance club in London¹⁰ and a cluster of meningococcal disease reported in a dance club in western Sydney, Australia.¹¹ One of the earliest outbreaks of H1N1 in Thailand was linked to a dance club in Pattaya.¹² From our findings, the transmission which occurred from the index case to 22 patrons in one evening at the dance club showed that such activity facilitated an efficient spread. This carries important lessons for public health.

REFERENCES

1. World Health Organization. World now at the start of 2009 pandemic. Statement to the Press by World Health Organization Director General, Dr Margaret Chan. Available at: http://www.who.int/mediacenter/news/statements/2009/h1n1_pandemic_phase_6_20090611/en/index.html. Accessed 1 July 2009.
2. World Health Organization. Pandemic (H1N1) 2009—update 67. Available at: http://www.who.int/csr/don/2009_09_25/en/index.html. Accessed 28 September 2009.
3. Liang M, Lye DC, Chen MI, Chow A, Krishnan P, Seow E, et al. New influenza A (H1N1) 2009 in Singapore: the first ten adult imported cases. *Singapore Med J* 2009;50:581-3.
4. Ling LM, Chow AL, Lye DC, Tan AS, Krishnan P, Cui L, et al. Effects of early oseltamivir therapy on viral shedding in pandemic (H1N1) 2009. *Clin Infect Dis* (In press).
5. Centers for Disease Control and Prevention. Interim Guidance for Clinicians on Identifying and Caring for Patients with Swine-Origin Influenza A (H1N1) Virus Infection. Available at: <http://www.cdc.gov/h1n1flu/identifyingpatients.html>. Accessed 8 October 2009.
6. Fraser C, Donnelly CA, Cauchemez S, Hanage WP, Van Kerkhove MD, Hollingsworth TD, et al. WHO Rapid Pandemic Assessment Collaboration. Pandemic potential of a strain of influenza A (H1N1): early findings. *Science* 2009;324:1557-61.
7. Thomas Y, Vogel G, Wunderli W, Suter P, Witschi M, Koch D, et al. Survival of influenza virus on banknotes. *Appl Environ Microb* 2008;74:3002-7.
8. World Health Organization. Transmission dynamics and impact of pandemic influenza A (H1N1) 2009 virus. *Weekly Epidemiol Rec* 2009;46:481-4.
9. Nishiura H, Castillo-Chavez C, Safan M, Chowell G. Transmission potential of the new influenza A (H1N1) virus and its age-specificity in Japan. *Euro Surveill* 2009;14:1-4.
10. Highbeam Research. Article: London clubbers at "high risk" from drug resistant TB. Available at: <http://www.highbeam.com/doc/1P2-5325010.html>. Accessed 5 October 2009.
11. Jelfs J, Jalaludin B, Munro R, Patel M, Kerr M, Daley D, et al. A cluster of meningococcal disease in western Sydney, Australia initially associated with a nightclub. *Epidemiol Infect* 1998;120:263-70.
12. BangkokPost.com. Pattaya ups flu alert level. Available at: <http://www.bangkokpost.com/news/local/18291/pattaya-ups-flu-alert-level>. Accessed 8 October 2009.