Three Waves of the 2009 H1N1 Influenza Pandemic in Thailand

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Thailand was among the first countries in Southeast Asia hit hardest by the 2009 H1N1 influenza pandemic soon after the reports of swine-origin influenza A H1N1 outbreaks in the American continent in mid-April 2009.[1] An official announcement by the World Health Organization (WHO) on 25 April 2009 indicated that the event was a Public Health Emergency of International Concern, with a significant potential of pandemic threat. On 11 June 2009, WHO raised the six-level classification of influenza pandemic alert from phase 5 to phase 6; the global pandemic was official.[2] Countries around the world, including Thailand, had been affected at different magnitudes by the novel H1N1 influenza virus. With comprehensive systems for influenza surveillance, three waves of the influenza pandemic were clearly documented in Thailand between May 2009 and November 2010 (Fig 1). This report describes the scope and epidemiological characteristics of the three waves of the 2009 H1N1 influenza pandemic in Thailand during 2009 - 2010.

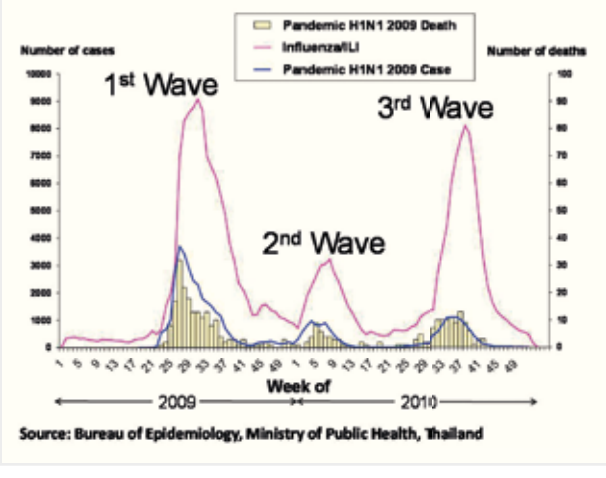

Fig 1. Three waves of the 2009 influenza pandemic in Thailand, 2009-2010.

Chronology of the 2009 H1N1 influenza pandemic in Thailand

From May 2009 to December 2010, approximately 226,000 influenza/influenza-like illnesses (ILI) and 47,000 cases of laboratory-confirmed pandemic H1N1 2009 were reported to the surveillance center at the Bureau of Epidemiology (BOE), Ministry of Public Health, Thailand. The three waves of the 2009 H1N1 influenza pandemic were observed over 18 months after the first novel virus was introduced to Thailand in May 2009; each wave of the pandemic had a duration of about 6 months. The pattern of the pandemic waves is also illustrated through information obtained from different influenza surveillance systems, the sentinel influenza surveillance and the hospital-based ILI surveillance. The three pandemic waves are summarized as follows:

First wave of the influenza pandemic in Thailand (May-October 2009)

Imported cases of the 2009 H1N1 influenza in May 2009

The first imported case of pandemic H1N1 2009 case was detected in early May 2009. Returning to Thailand from Mexico, a 17-year-old Thai female student developed symptoms of influenza illness on 3 May 2009. A 17-year-old Thai man, also a student, had traveled and had close contact with her before getting sick three days later (Fig 2).

Of the first 12 laboratory-confirmed pandemic H1N1 cases, 11 were Thai travelers returning from overseas. The median age was 20 years (range: 17-52). Most cases were detected in late May and early June 2009. The first known local infection was identified at the end of May 2009. A 19-year-old male was infected domestically by his parents, who returned home with influenza illness following an international trip. Of 11 infected travelers, 4 developed respiratory symptoms after arrival in Thailand.

Local outbreaks of the pandemic H1N1 2009 in Thailand

Rapid transmissions of the pandemic virus in communities were silent until the notifications of the first two influenza outbreaks during the second week of June 2009. The first notification was a cluster of the 2009 H1N1

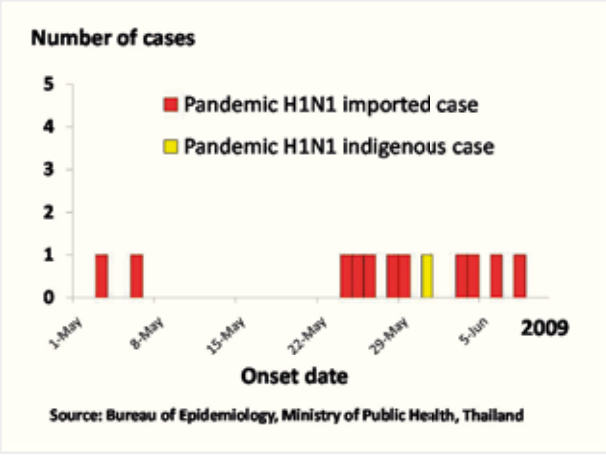

Fig 2. The first twelve laboratory-confirmed cases of pandemic H1N1 in Thailand.

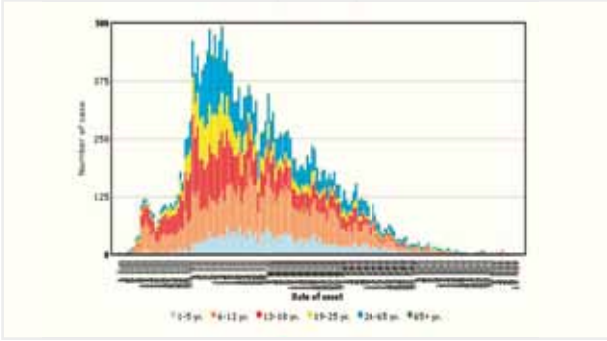

Fig 3. Number of laboratory-confirmed influenza A H1N1 2009 cases by age-group, May-October 2009 (1st wave).

influenza cases in Taiwanese university graduates, which was notified by an officer of the Taiwan Centers for Disease Control on 8 June 2009. An outbreak investigation was promptly conducted and subsequently confirmed local transmissions of the novel influenza in a tourist province.[3]

A second notification was received on the following day, 9 June 2009, when a confirmed pandemic H1N1 case was found in an 11-year-old student in a private school, when a notification was sent by an attending physician in a private hospital.[4] The boy had not traveled abroad prior to the onset of illness on 6 June 2009. The outbreak investigation identified high attack rates of ILI of up to 41.2% in the school. Between June and August 2009, over 100 schools in Bangkok and nearby provinces reported one or more confirmed cases of pandemic H1N1 and outbreaks among school children and teachers.

The number of reported influenza cases was most prevalent in primary school students aged 6-12 years, followed by secondary school students aged 13-18 years (Fig 3). Both age groups accounted for 70-80% of the total cases during the early pandemic. The next age groups infected with the novel virus were adult-aged parents and preschool-aged (1-6 years) children. Both groups contracted the disease from sick school-aged family members.

In Thailand, the first known death caused by the pandemic H1N1 influenza virus was reported from a private hospital on 20 June 2009. The trend of death cases in Thailand were concurrent with the trends of pandemic H1N1 and influenza/ILI cases throughout the pandemic (Fig 1). The case fatality ratio of pandemic H1N1 influenza was 0.19% in 2009 and declined to 0.13% in 2010 (Table 1). Please note the number of clinical specimens collected for viral confirmation that tested positive for pandemic H1N1 in 2010 was about half (53.2%) of the number in 2009. This was a result of lower rates of positive H1N1 tests and changing the recommendation of sample collection to only a few cases in an outbreak in order to reduce costs.

The epidemics of pandemic H1N1 influenza also penetrated communities and other institutional settings, e.g., military camps, hospitals, prisons, companies, factories, childcare centers.[5-8] Mitigations of the influenza pandemic in Thailand followed WHO recommendations. Non-pharmaceutical interventions included daily screening of ILI cases before class, self-isolation of cases at home, delay of mass gathering, promoting hand washing and mask use, and risk communication strategies that involved the media (e.g. health education focusing on respiratory hygiene).

Following the report of school outbreaks in many provinces of the central region, it took only a few weeks for the influenza pandemic to spread throughout the country. A large number of novel influenza cases were identified in many tourist provinces in the south and north; a smaller number of cases were identified in the north-eastern region (Fig 4). A nationwide epidemic may have occurred due to increased contact between cases and healthy population at several mass gathering events, e.g., music concerts, school camps, religious ceremonies, and the special school holidays in early July 2009.

Following the peak incidence and mortality of pandemic H1N1 influenza in July-August 2009, the declining trend of the epidemics was evident by the reduction of cases and deaths (Fig 1). Concurrently with the surveillance of cases, the BOE sentinel surveillance for influenza reported the percentages of pandemic H1N1 in patients with ILI at outpatient departments had decreased from 68.8% to 6.8% between July and October 2009. Of all subtypes, the pandemic H1N1 influenza virus shared a greatest fraction (97.3%) during July-September 2009 and dropped to 61.3% in October 2009.

Second wave of the influenza pandemic in Thailand (November 2009-April 2010)

After a one-month school break in October 2009, the second semester began in November with low levels of influenza transmission activities. In December 2009, school outbreaks were sporadically reported with more frequency from the remote areas where the first pandemic wave had not yet arrived. In the cities, the attack rates in the school outbreaks were significantly low in comparison to the first wave. The peak of the second wave was in February 2010, before it gradually decreased to a baseline throughout April 2010 (Fig 1). Between the Thai winter months of December and February, an increase in influenza incidence was observed (more than in the previous year) for the second highest peak of seasonal influenza

TABLE 1. Number of influenza-like illness, pandemic H1N1 cases and deaths in Thailand, May 2009 - December 2010.

	2009	2010
Influenza-like illness and other influenza subtypes cases	102,400	113,831
Pandemic H1N1 cases	30,956	16,455
Pandemic H1N1 deaths	197	150
Case fatality ratio	0.19%	0.13%

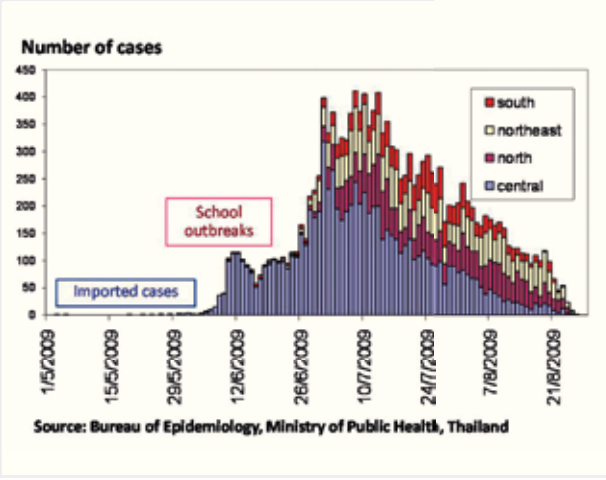

Fig 4. Number of laboratory-confirmed influenza A H1N1 2009 cases by region, May-August 2009 (1st wave).

after the rainy season, May-September. The percentages of adult cases aged over 25 years increased significantly (Fig 5). This suggests more infection rates among adults than the first wave.

Approximately two million doses of the monovalent pandemic H1N1 vaccine were administered to the recommended subpopulations, including healthcare workers, patients with chronic diseases, mentally disabled people, pregnant women, and obese individuals, between January and June 2010.

The spread of influenza virus was reported among local travelers from Bangkok and major tourist provinces to the more rural provinces after the New Year holiday, suggesting an increase in transmission rates during the winter holiday. Limited scale outbreaks were reported from work places, including offices, hospitals, and universities. Fewer school outbreaks were reported in the second wave in comparison to the first wave.

Third wave of the influenza pandemic in Thailand (May-October 2010)

A low level of influenza transmission was observed between May and June 2010 in the rainy season. The third pandemic wave began to rise in July 2010; it peaked in September 2010 (Fig 1). In this wave, the average age of cases was higher than the first two waves and more adults were infected. ILI cases were commonly detected in both the urban and rural areas of Thailand. It is important to note that the WHO announced a post-pandemic phase on 10 August 2010 while Thailands trend was on the rise. The announcement was based on the declining trend of the global 2009 H1N1 pandemic. During the third wave, increased proportions of influenza A H3N2 and influenza B in different sentinel hospitals had been observed. However, the pandemic H1N1 subtype was the most prominent amongst all subtypes.

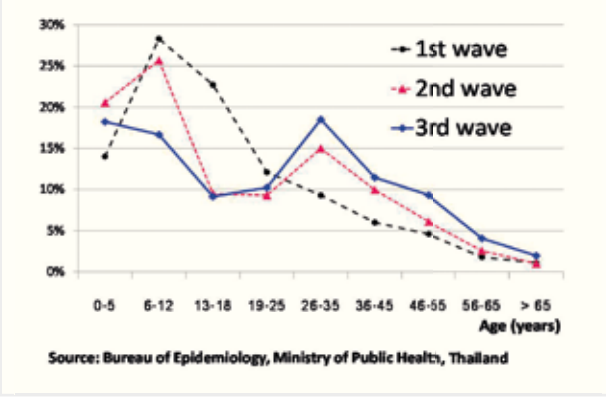

Fig 5. Shifts in Ages of Patients with Pandemic Influenza A (H1N1) 2009 Infections in 3 pandemic waves.

TABLE 2. Comparison of some characteristics of the 1st, 2nd and 3rd wave of the 2009 H1N1 influenza pandemic in Thailand

Characteristics	1st wave	2nd wave	3rd wave
Attack rate	High 20%	Low 10%	Moderate 15%
Age-group	School age	Adults	Older
Area of concentration	Urban	Rural	Urban/Rural
Length of time	May-Oct 2009	Nov 2009 - Apr 2010	May-Oct 2010
Control measures	Intensive	Moderate	Less
Influenza vaccine	Not available	Monovalent H1N1 vaccine	Trivalent vaccine

The influenza epidemics were frequently reported from rural districts outside cities and municipalities, especially the remote provinces in the northeastern region. The institutional outbreaks were also observed in some urban areas, e.g., prisons, temples, and military training camps.[9] Most schools previously attacked by the pandemic H1N1 virus had a low incidence of influenza infection in the second year of the virus circulation.

It was estimated that the first pandemic wave had infected up to 20% of the entire population. Lower rates of 10% and 15% were estimated in the population for the second and third waves, respectively. It is critical to note that the number of reported ILI cases and influenza deaths in the third wave was greater than the second wave, but less than the first wave (Fig 1). The third wave occurred in the same months as the usual seasonal influenza peak.

In July 2010, approximately two million doses of the trivalent influenza vaccine were distributed to the selected subpopulation groups. However, the other control measures, including non-pharmaceutical interventions, were less practiced in communities during the third pandemic wave.

Summary of the 2009 H1N1 Influenza Pandemic in Thailand

Nearly one half of the Thai population may have been infected by the pandemic H1N1 influenza over the 18-month period, between May 2009 and October 2010. The most affected subpopulation group, and mostly not immune to the pandemic H1N1, was children in primary schools, followed by students in secondary schools. Within a couple months of the rainy season, the concentration of school outbreaks was likely a major cause of widespread infection throughout the country. Intensive responses to the pandemic, including non-pharmaceutical interventions and other mitigation measures, were apparently effective in reducing pandemic influenza transmission, especially during the first wave. The reverse trend reflected a decrease in transmission rates after the comprehensive interventions. However, the lack of sustainable interventions in the population as well as the inability to prevent further transmission of the pandemic virus resulted in the pandemics second and third wave.

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