

# Epidemiological Situation on Pandemic Influenza H1N1 2009 in the World and in Japan

JMAJ 54(5): 277–283, 2011

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## Abstract

The epidemic of novel influenza in Japan began with the detection of the first patient in May 2009, spread to various parts of the country in mid-June, looked like the winter of an ordinary season in October and November, and finally turned to a decrease in early December. Cases with severe pneumonia and acute encephalopathy were reported, as well as deaths. However, the situations in Japan in terms of disease expansion after the first case, the trends of hospitalized patients, and the occurrence of deaths were considerably different from those in other countries. This article briefly describes the epidemiologic situation in Japan focusing on the difference from that in other countries.

**Key words** Novel influenza (A/H1N1), Pandemic H1N1 2009, Epidemiology

## Introduction

While three influenza epidemics of extraordinary magnitude occurred in the 20th century, humankind was not hit by a novel influenza for 40 years after the emergence of the Hong Kong Influenza in 1968. Several years ago, many countries in the world started preparing for an anticipated global epidemic (pandemic) of a novel influenza.

The basic role of pandemic control are to delay the emergence of a novel virus to the extent possible, to retard the expansion of disease once it comes into existence, and to minimize health damage and social turmoil once expansion occurs. The nature and clinical features of the novel virus should be investigated as quickly as possible, and actions should be taken with continuous assessment of effectiveness in real situations and the addition of further measures. These are challenges common to all countries.

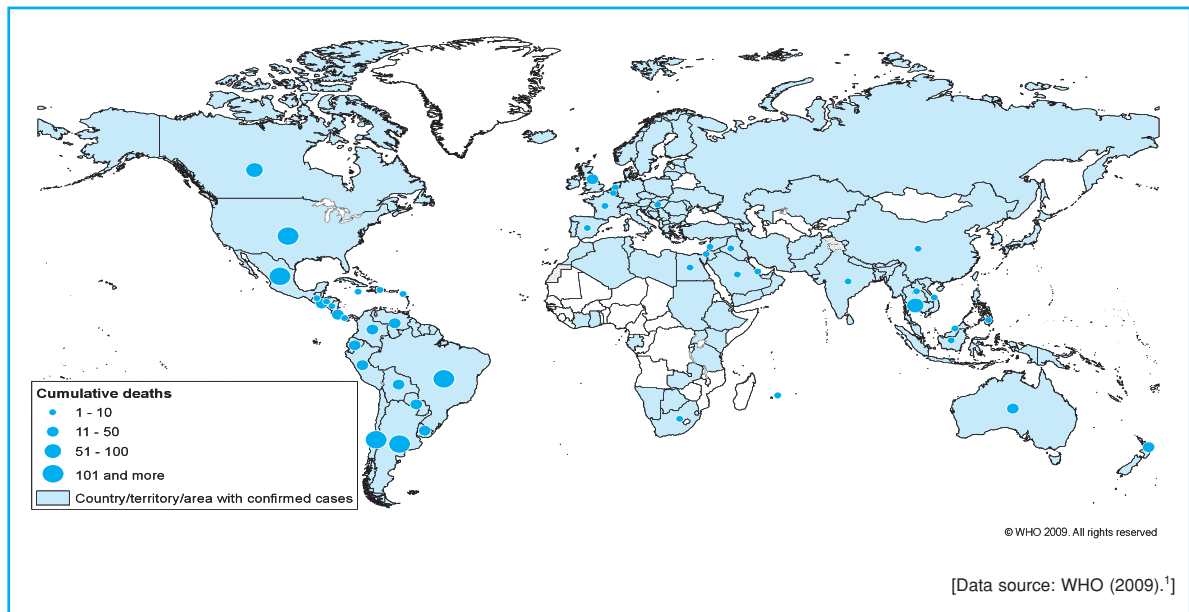
Measures must be taken not only in the field of medicine and healthcare but also in public health responses, dissemination of knowledge,

and actions in society, all in a combination. These measures do not only serve for the control of novel influenza but also can be applied in response to outbreaks of other new or existing infections, effectively contributing to the enhancement of infection control capabilities in general.

## Emergence of Novel Influenza (A/H1N1)

The recent world epidemic of novel influenza (A/H1N1) began on April 12, 2009, when increases in deaths from pneumonia and patients with influenza-like illness in Veracruz, a town in south Mexico were reported to the World Health Organization (WHO) according to the International Health Regulations (IHR). From April 15 to 17, the virus isolated from 2 patients with mild influenza-like illness in southern California, USA was identified as a novel influenza virus that humankind had never experienced before. Soon, the virus also detected from the Mexican patients and that from the American patients who had no epidemiological link each other,

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**Fig. 1** Distribution of confirmed cases and deaths from novel influenza (A/H1N1) reported to the WHO (August 13, 2009)

were found to be identical. It became clear that infection with the virus was spreading in different parts of the world.

The WHO on April 25 declared that the disease was a Public Health Emergency of International Concern (PHEIC), and on April 27 escalated the pandemic phase from 3 to 4 (the virus has started to spread from human to human). Later, the pandemic phase was raised to 6, as the spread of infection was considered to be global rather than geographically limited. (Eventually on August 10, 2009, the WHO called off a PHEIC and announced that the disease had moved from pandemic phase 6 to a Post-Pandemic phase.)

The novel influenza virus that arguably originated in Mexico was first named swine-lineage influenza (A/H1N1 swl), as it was derived from the North American endemic swine influenza virus A/H1N1 (considered to have descended from the Spanish influenza virus) probably through reassortment with the genes of North American avian influenza virus, human influenza virus, and Eurasian swine influenza virus. The reassortment was considered to have occurred in the bodies of North American pigs.

Because the virus was a member of the H1N1 family, modified from A/H1N1 (USSR type),

some doubted that the virus was “novel.” However, it was acknowledged as a novel influenza virus, since its gene structure was considerably different from that of conventional A/H1N1 (USSR type). The nomenclature of this virus changed several times over a short period. In the current terminology of the WHO, the virus is called influenza A (H1N1) pdm 09 (abbreviated as AH1pdm; “pdm” stands for pandemic) and the disease is called pandemic (H1N1) 2009. In Japan, it is most commonly known as “novel influenza,” and we use this term for convenience in this article. The term “novel influenza (A/H1N1)” is preferred as a rule for use in the special feature articles of the Journal of the Japan Medical Association.

### Spread of Novel Influenza (A/H1N1)

The novel influenza (A/H1N1) that allegedly originated in Mexico quickly spread all over the world. **Figure 1** illustrates the situation of novel influenza (A/H1N1) on August 13, 2009 according to the data from the WHO.<sup>1</sup> Patients were found in almost all parts of the world except for some limited areas, and deaths occurred in many regions.

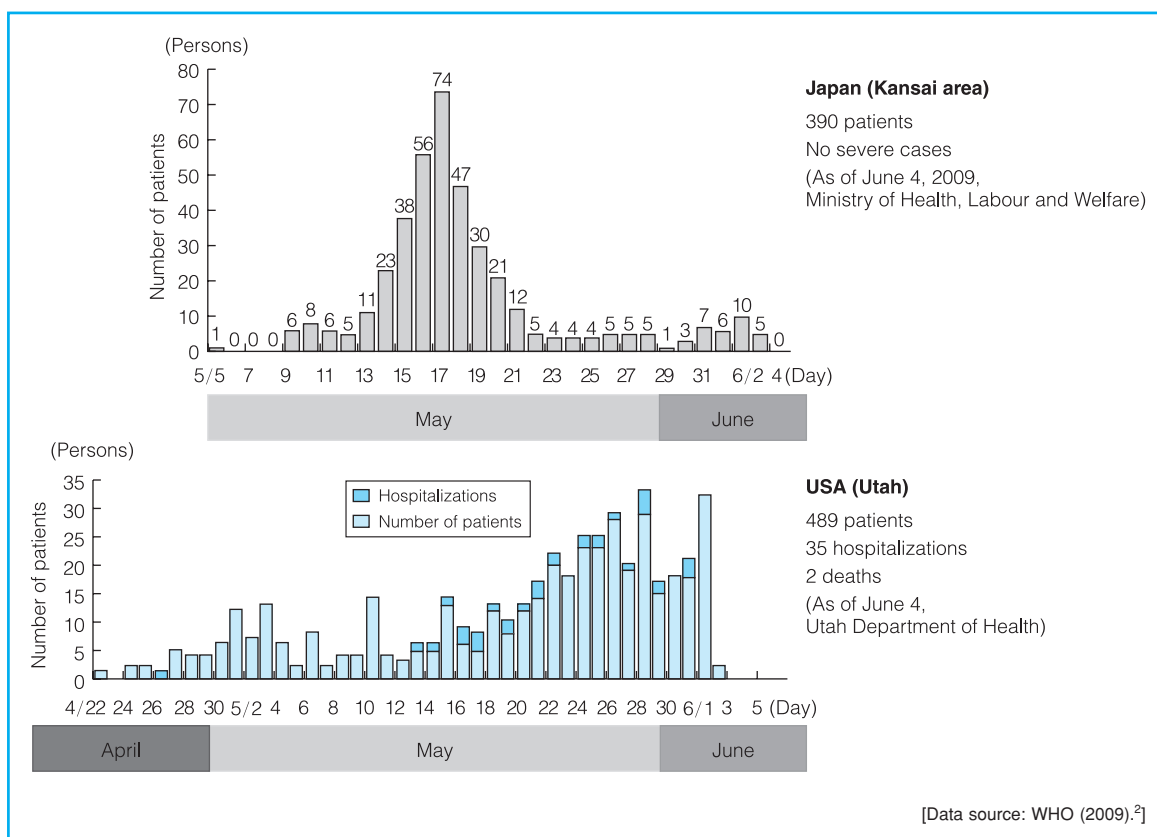
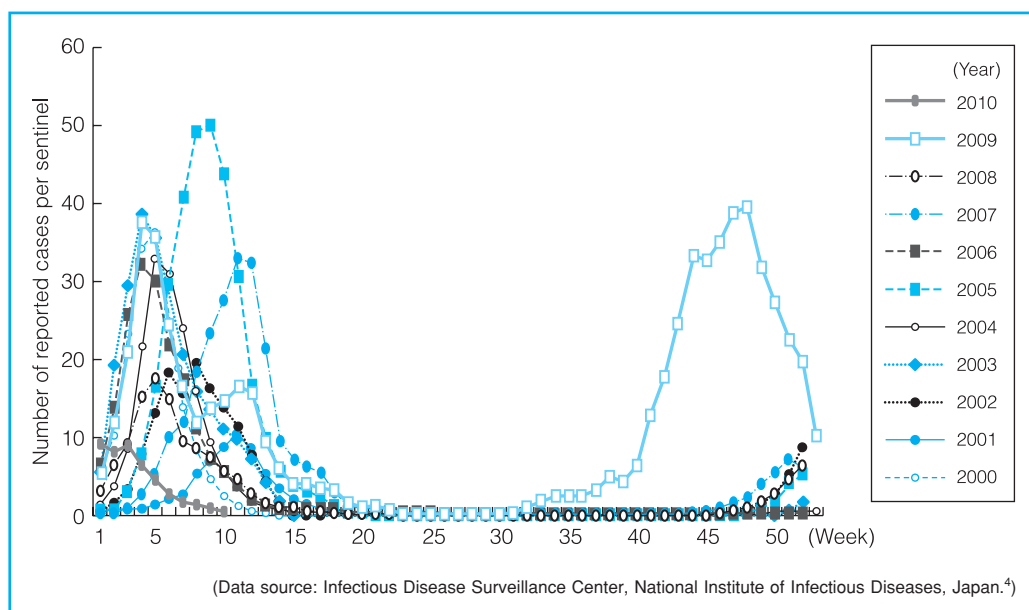


Fig. 2 Country-specific differences in infection status

The first case in Japan was a patient with novel influenza (A/H1N1) detected at Narita Airport Quarantine Station on May 9, 2009. Another confirmed case were found in Kobe City in Hyogo Prefecture on May 16 and then in Osaka Prefecture on May 17 in western part of Japan called Kansai area, revealing the occurrence of a mass outbreak centered on high schools in Hyogo and Osaka Prefectures. Measures were taken including the temporary closure of schools strictly in the region and asking close contacts to stay in their homes, and this was effective in preventing the spread to the general public in Hyogo and Osaka Prefectures. As a result, there were no severe or fatal cases because it was not spread out in the community widely. In this respect, the situation in Japan was different from that in other countries, where the initial increase in the number of patients was observed usually accompanied by the appearance of severe cases. **Figure 2** compares the occurrence of patients in Kansai

region of Japan and Utah, USA, based on the data from the WHO. Although the magnitude of the epidemic was generally similar, the number of hospitalized patients increased and deaths were reported in Utah as the number of patients increased.<sup>2</sup>

However, the occurrence of patients in Japan increased again starting from mid-June. The occurrence of influenza-like illness in August resembled that in December of an ordinary influenza season, and the period from October to November looked like the winter of an ordinary season. The number of patients finally started to decrease in December. We considered that the virus responsible for the initial outbreak in Hyogo and Osaka areas and the virus responsible for later outbreaks across Japan belonged to different cluster of micro-clade of H1N1 pdm 09, and the first virus in Narita and Kansai area became extinct before another new virus subsequently entered the country from overseas.<sup>3</sup>



**Fig. 3 Occurrence of influenza reported cases per sentinels by age group and week (from 1st week of 2000 to 10th week of 2010)**

The estimated cumulative number of patients in Japan as of the 4th week of 2010 was about 20 million. Although this number exceeded the 10-year historical high of 18 million in the number of patients with influenza (seasonal influenza), recorded in the 2004/05 season, the height of the peak was lower than that of seasonal influenza (Fig. 3).<sup>4</sup>

### Epidemiological Situation of Novel Influenza (A/H1N1)

Typical symptoms of novel influenza (A/H1N1) are generally similar to those of seasonal influenza. Like seasonal influenza, it tends to cause severe conditions when complicated with pneumonia. While pneumonia associated with seasonal influenza most frequently occurs as secondary bacterial pneumonia in elderly patients and is rarely fatal, novel influenza (A/H1N1) tends to cause pneumonia in younger patients than seasonal influenza.

The age distribution of patients in Japan was high at ages from 5 to 14 and low at middle and high ages. In other countries, the morbidity rate was the highest among high teens and young adults. Hospitalization is considered to reflect the

progression to severe conditions. In Japan, hospitalization was the most frequent among lower grade elementary school students at ages from 5 to 9, while in other countries, it was the most frequent among children aged 5 years or less (Fig. 4).<sup>2</sup> Death in other countries was the most frequent at ages from 50 to 60 with the median ranging from 35 to 51. Although disease onset and death at middle and high ages were rare in Japan, the fatality rate among patients at these ages was much higher than that among children. Deaths increased at ages above 40, and the fatality rate among aged patients was high (Fig. 5).

The most frequent cause of death, so long as it was confirmed, was viral pneumonia, although cases complicated with bacterial infection were also reported in other countries. Both in Japan and overseas, severe cases frequently had underlying diseases such as asthma and other chronic respiratory disorders and cardiovascular disorders. Reports from other countries pointed out a high risk among pregnant women in the third trimester, although few pregnant patients were hospitalized in Japan and none required the use of a respirator or took a fatal course. In addition, obesity was identified as a risk factor in other countries.

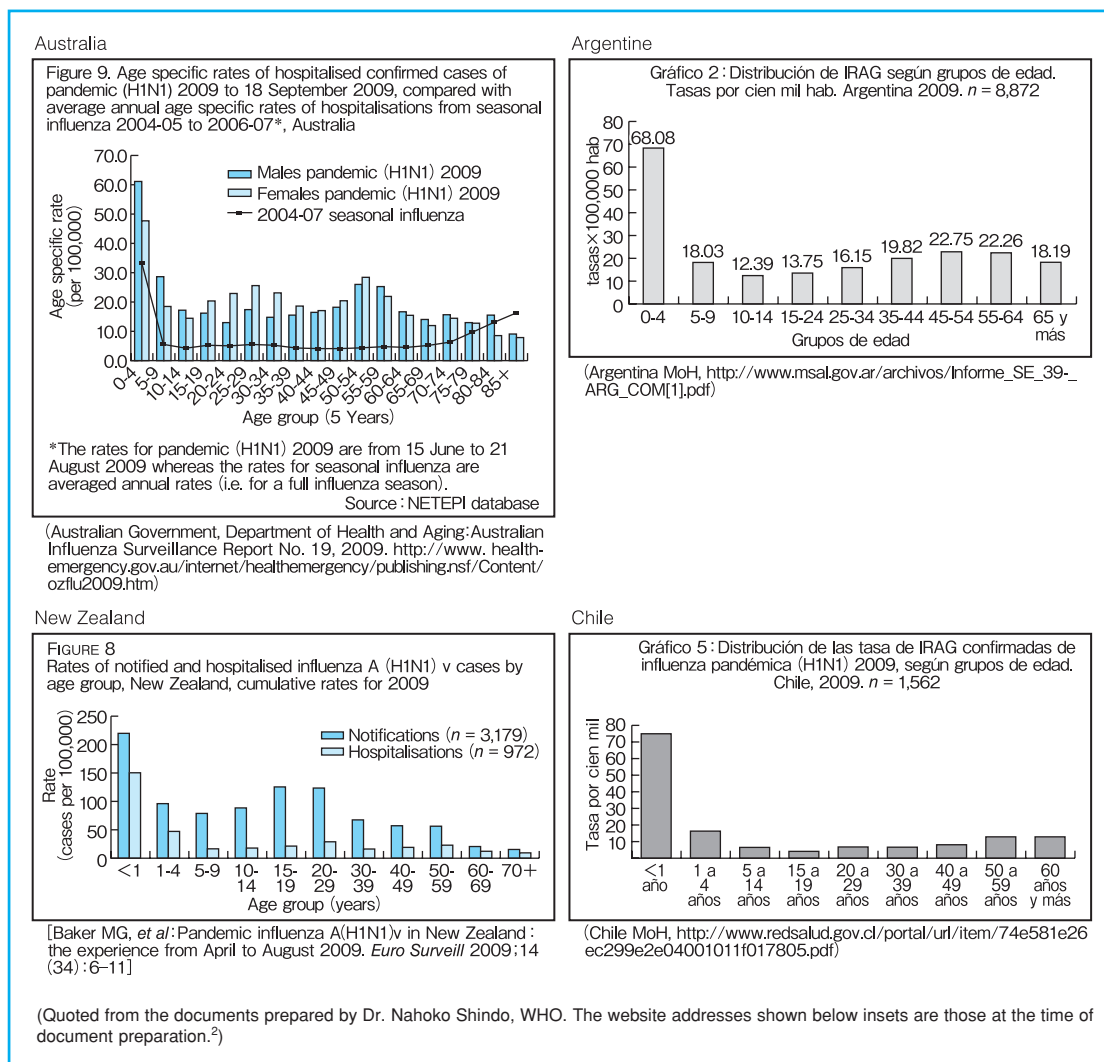


Fig. 4 Hospitalization rate in various countries (by age group)

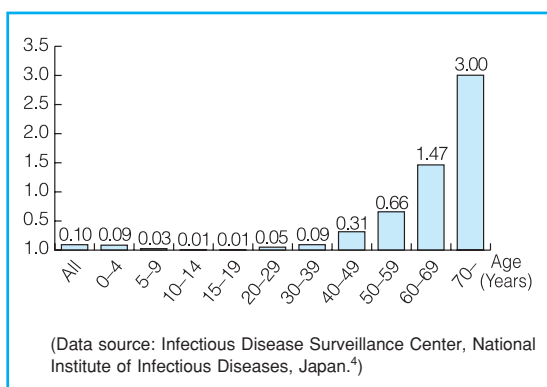


Fig. 5 Age-specific fatality rate of influenza per 10,000 estimated patients under medical care (from July 28, 2009 to March 30, 2010)

Of the estimated 21 million patients that occurred cumulatively in Japan (until the 13th week of 2010), 17,646 were hospitalized and 198 died as reported to the Ministry of Health, Labour and Welfare (until March 31, 2010). Although there might be many unreported cases, these numbers were remarkably low as compared with other countries.

The number of patients with influenza encephalopathy associated with novel influenza (A/H1N1) in Japan, as reported based on the Infectious Diseases Act, was more than 300. Although cases with central nervous system complications were reported also in other countries, the prominence of acute encephalopathy was distinctive of Japan.

## Temporary Closure of Schools and Other Measures

Shortly after the emergence of novel influenza (A/H1N1), temporary closure of schools, kindergartens, and nursery schools without patients was practiced rigorously in Japan according to the Pandemic Influenza Preparedness Action Plan, because the nature of the virus was unknown and the clinical picture was not clear. As mentioned above, this was effective in minimizing the scale and geographical extent of initial outbreaks.

As the nature of the disease has become better understood, such drastic measures are now considered unnecessary. However, adoption of less stringent measures needs a consensus that we would allow the development of disease in a limited number of patients. The measures taken at schools, kindergartens, and nursery schools have two fronts: one is to ensure the recovery of individual patients, and the other is to protect the health of the population (to prevent the spread of infection to the extent possible). The role of school closure as a means for social defense, as achieved in the present case, is also important. On the other hand, nonattendance of uninfected healthy students causes a delay in education and school event schedule, and also forces parents to change their daily activities. We need to strike a balance between intended effects and negative consequences, but this is not an easy task.

In other countries, measures taken in Japan such as school closure are often considered impractical for several reasons. School closure due to seasonal influenza is not customary in many countries. The way classes are given in many Western countries is different from that in Japan (teaching is organized based on subjects rather than classrooms; students go to a class where a particular subject is taught, in contrast to the Japanese system where the teacher comes to the classroom). The absence of parents from work as a result of their children staying home may jeopardize their employment. In some developing countries, the discontinuation of school lunch due to school closure may result in malnutrition. On the other hand, the experience of Japan demonstrates that school closure is an option worth considering when the disease burden is extremely high.

As is the case with seasonal influenza, school

closure for 2 or 3 days may not be effective in preventing the spread of infection; it should be continued for at least 4 days, or more desirably a week including a weekend. This recommendation was supported by the observation of fever among patients at schools that were closed during the early days of an epidemic.

## Conclusion

This article outlines the epidemiological situation of novel influenza (A/H1N1) in Japan and in the world. Both in and outside Japan, an overwhelming majority of the patients with novel influenza recovered. However, some patients developed severe pneumonia, renal failure, multiple organ failure, and shock. Cases with acute encephalopathy were reported in Japan as frequently as or more frequently in seasonal influenza.

On the other hand, the occurrences of hospitalization and fatal cases, as well as hospitalization of pregnant patients, were considerably less in Japan than those in other countries, and this fact attracted much attention at international conferences and academic meetings. We have no clear answer to explain the different situation between Japan and other countries, but supposed that this was a result of the efforts made by clinicians, public health workers, and other professionals, as well as the enhanced awareness of novel influenza among the general public.

After completion of this report, the WHO on August 10, 2010 redefined the situation from pandemic phase 6 to a post-pandemic phase. The word "pandemic" is gradually disappearing from the designation of the disease. However, the virus that caused the pandemic will stay in the world for a period of time, and its antigenicity may change at any time in the future. The possibility of future outbreaks still remains an open question. While "post-pandemic" is often regarded as being synonymous to "ending" in Japanese translation, it is feared that such interpretation may lead to hasty loosening of controls. In addition, it is likely that there are many susceptible individuals remaining in the adult population of Japan. We need to be on the alert, because this situation may increase the number of severe cases and deaths in a future outbreak, if occurring among adults.

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