



A Review of Response Measures Against the First Wave of Pandemic Influenza Outbreaks in Taiwan and Other Countries

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Abstract

The 2009 influenza pandemic started in April, when the United States' CDC found a novel influenza A (H1N1) case. The World Health Organization (WHO) then confirmed that the epidemic had been occurred in Mexico since late March. WHO raised the global pandemic alert to phase 4, phase 5 and phase 6 on April 28, April 30 and June 11, respectively.

Most countries have been able to respond to H1N1 outbreaks rapidly based on preparedness measures taken in recent years. The responses of Mexico, United States, Japan, United Kingdom, Australia, Hong Kong, China, and Singapore are described in this article. It also outlines Taiwan's measures against the emergence of the new virus overseas, the effects of relevant media coverage, public reactions, case management, and preparedness activities for the coming autumn and winter.

Measures to control an influenza pandemic include medical (vaccination

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and medication) and non-medical. Non-medical measures, like patient isolation, contact quarantine and social distancing, have been implemented by many countries in the first wave of the 2009 pandemic. Experiences from other countries reveal that all measures should base on scientific evidence. The intensity and practical steps taken to implement the measures also vary with pandemic phases and resources in different countries. Hence, strategies for pandemic control have to be flexible and promptly modified according to the latest information. A strong governance system and effective communication mechanism are also necessary.

In the autumn and winter seasons of 2009-2010, influenza will pose a rigorous challenge for the health-care system. The decision-making and implementation of social distancing measures will test the authorities' capabilities. The global activities of H1N1 influenza virus should be constantly monitored, and assistance needs to be provided to communities in building their self-care capabilities. Continuity plans must also be promoted in both the public and private sectors.

Keywords: influenza A (H1N1), pandemic influenza

Introduction

On April 17, 2009, the United States CDC confirmed two cases of novel influenza A (H1N1). The virus is a hybrid virus of swine, avian and human viruses [1]. Up to April 23, 7 cases had been confirmed in the United States. The World Health Organization (WHO) later confirmed that an epidemic might have occurred in Mexico since late March. By April 23, three cities in Mexico had experienced outbreaks with at least 62 deaths, and samples sent to Canada were tested positive for novel influenza A



(H1N1) [2].

In the early morning of April 28, Taipei Time, the Director-General of WHO, Dr Margaret Chan, decided to follow the suggestions of the Emergency Committee to raise the Global Pandemic alert from Phase 3 to Phase 4, showing that the virus had spread and containment strategies were no longer effective.

In the early morning of April 30, Taipei Time, WHO raised the Pandemic alert to Phase 5 because community transmission had occurred in the United States and Mexico. WHO Director-General also suggested that countries around the world activate their influenza pandemic preparedness plans and be alert toward unusual clusters of influenza-like and pneumonia cases. Strengthening disease monitoring, early treatment of cases, and infection control in medical institutions were also recommended.

In the World Health Assembly meeting in mid May, novel influenza A (H1N1) was the focus of discussion. During this meeting, the strategic direction for disease control was changed from “containment” to “mitigation” [3].

By June 11, 2009, novel influenza A (H1N1) had spread to many countries [4]. Given that the virus had been transmitted to countries around the world, including Australia and the United Kingdom that are far from the origin of the epidemic, WHO Director-General raised the Pandemic alert to Phase 6. The world now formally entered a pandemic in 2009. Up to that time, the WHO had been notified of 28,774 confirmed cases from 74 countries. Since most cases had only mild symptoms, the pandemic was defined as “mild”. WHO emphasized that it was not necessary to limit travels and close borders. Maintaining alertness is what is necessary. Countries where the disease has peaked should be prepared for the second

wave of the pandemic. WHO has accepted 5.6 million doses of antiviral drugs from Roche. Vaccine manufacturers have also started producing vaccines for novel influenza A (H1N1) [5].

On July 2 and 3, 2009, WHO sponsored the Health Departments of Mexico, Canada and United States to co-host a “high-level meeting on novel influenza A (H1N1)”. Dr Margaret Chan, Director-General of WHO, remarked that all countries should pay attention to the development of outbreaks during fall and winter in the South Hemisphere to prepare for the second wave of disease [6]. Since July 17, WHO has stopped announcing case numbers around the globe and started announcing only affected countries [7].

Response measures in key countries

Mexico

The disease monitoring system of Mexico found 41,998 cases of acute respiratory diseases between March 1 and May 29. Among the 25,127 clinical samples gathered, 5,337 tested positive for novel influenza A (H1N1), and 97 of the confirmed cases had died. Epidemiological data showed that the peak was in late April.

The President of Mexico decided in the Council for General Hygiene on April 24 that schools should be temporarily closed in metropolitan areas and that disease information should be given to departing and arriving travelers at international airports. Other response measures included: publicizing measures for respiratory hygiene through the mass media, distributing masks and alcoholic hand wash to the general public, and dissuading the public from gatherings such as religious activities, public



performances and soccer games. On April 25, it was announced that cases having suspected symptoms were required to be quarantined. On April 27, classes in all schools around the countries were suspended [8]. The Minister of Finance of Mexico announced on May 7 that the economical loss caused by novel influenza A (H1N1) was estimated to be 2.3 billion, about 0.3% of the country's GDP.

On May 11, all classes were resumed. However, students having suspected symptoms were required to stay at home. Teachers and parents were screening students for fever and respiratory symptoms at school entrances. 91,357 students were found to be symptomatic on the first day. This measure was continued till May 23 [9].

United States

The United States' Centers for Disease Control and Prevention (CDC) launched the Center for Emergency Response on April 26 and stepped up efforts in screening travelers from Mexico and gathering samples from suspected cases. Travelers or flight crew having influenza-like symptoms could not board the planes. Besides, the American Embassy in Mexico was closed between April 27 and May 1, and visa service was suspended. As an emergency measure, the federal government released twelve million doses of antiviral drugs and masks for all states. The FDA also announced emergency use authorization for antiviral drugs and testing reagents for novel influenza A (H1N1), enabling approved public health or medical personnel to use pertinent drugs and tests when required. Besides, a 24-hour free hotline was created to reduce public panic. Classes in some schools were also suspended because of outbreaks. In order to provide first line medical personnel sufficient information to treat H1N1 patients, the

United States CDC also updated multiple guidelines for mask use and infection control frequently. Since the onset and severity of H1N1 outbreaks were different among states, so did responses of state governments. For example, New York State urgently distributed antiviral drugs to various health authorities and connected all hospitals and schools in the state by the Health Alert Network (HAN) around the clock to control the development of the outbreak.

In mid May, novel influenza A (H1N1) had spread rapidly in the US and confirmed cases had exceeded 3,000, and as a result, the country lifted its travel warning to Mexico on May 15. On May 26, the focus of disease control was shifted to monitoring the spreading of disease and the development of severe cases. In order to avoid wasting resources, infections were no longer confirmed case by case. The monitoring of novel influenza A (H1N1) was incorporated into regular influenza surveillance.

To prepare for the second wave in fall and winter, the United States has passed budgets for preparedness of influenza pandemic, including 7.7 billion dollars for disease prevention preparedness, one billion dollars for research and purchase of vaccines for novel influenza, and 350 million dollars to strengthen infrastructures and prepare vaccines and hospitals for high patient volumes in all states.

Japan

The Ministry of Health, Labor and Welfare of Japan strengthened screening of travelers from Canada, Mexico and United States on April 28. On-board checking was also performed on selected flights. Four travelers were found to have suspected symptoms on a flight from Canada during an on-board checking in Tokyo Narita Airport on May 8. On May 9, the first



novel influenza A (H1N1) case in Japan was confirmed. The confirmed case was admitted to the hospital and close contacts were quarantined at home for 7 days. In mid May, a senior high school in Osaka had five confirmed cases of H1N1 without travel history to epidemic areas. To reduce transmission in the community, classes were suspended on May 16, and a total of 4,200 schools and 650,000 students were affected. Classes were resumed gradually beginning May 25.

Since large scale community outbreaks had occurred, the focus of disease control was shifted from “containment of disease outside of borders“ to “strengthening domestic medical systems”. On-board checking was stopped on May 21. Suspected cases were also not detained in the airports. Besides, to ensure severe cases could be treated in hospitals, mild cases have been asked to stay at home since late May. Suspected cases could also be treated in regular hospitals at a separate consultation time from other patients. The main foci of measures were to treat severe cases, to decrease mortality and develop as well as manufacture vaccines [10].

United Kingdom

The first confirmed case of novel influenza A (H1N1) was found on April 23. Since then, quarantine measures have been implemented at the borders. Flights from Mexico were asked to report symptomatic cases. Arriving travelers were asked to monitor their own health for 7 days. Efforts to monitor travelers for respiratory symptoms were strengthened. In addition to isolating suspected cases, close contacts of confirmed cases have been given antiviral drugs since May 25.

Since infected cases were increasing at a rate of a few hundred per day, the UK gave up the strategy to contain the disease at affected areas on

June 23 and shifted the main focus to treating cases on July 3. Resources were distributed to susceptible population. Tracing and isolation of close contacts were also stopped. In order to rapidly distributing antiviral drugs to patients, a phone diagnosis system was set up on July 17. Once the necessity of medication was confirmed after phone inquiry, family members or friends of the patients could get medication from designated places for early treatment to relieve symptoms and decrease the chances of severe complications [11]. To prepare for the second wave in fall and winter, the reserve level of antiviral drugs has been raised to cover 80% of the whole population. Vaccines for novel influenza A (H1N1) have been purchased to cover 100% of the population [12].

Australia

Australia classifies the epidemic into five phases: delay, containment, sustain, control and recovery. To respond to the international outbreaks, the “delay” phase was announced on April 29, and the main focus was on border control. On May 9, the first imported case was confirmed, and on May 22 the first human-to-human transmission was confirmed. The “containment” phase was announced on May 23. Social distancing was enforced. By June, the state of Victoria had experienced sustained community transmission and reported the largest number of confirmed cases in Australia. Cases were also reported in other areas.

In mid June, in response to WHO’s information of virus and the epidemic, Australia add a “protect” stage between the phases of “containment” and “sustain”, and on July 17, the country entered the “protect” phase. The focus of disease control was shifted to protecting susceptible population form getting infection [13], and to treat severe



cases and cluster events. Border control was stopped, and home quarantine of students was no longer required. After mid July, disease in Victoria had subsided, and it was not the state having the largest number of cases any more. However, cases in other areas were still increasing.

As to medical intervention, Australia has raised its level of reserve of antiviral drugs to cover 40% of the population. Twenty-one million doses of vaccines will also be purchased for the whole population in October this year.

Hong Kong

Hong Kong confirmed the first case of novel influenza A (H1N1) at the evening of May 1 and raised the alert level for transmissible disease from “severe” to “emergency”. The case was a Mexican who arrived in Hong Kong from Mexico via China by air. Hong Kong government closed the hotel where the patient was staying immediately and isolated 300 its workers and lodgers. There were given Tamiflu. Symptomatic cases were admitted to the hospital.

As to treatment strategy, isolated areas were set up in emergency rooms and outpatient departments of public hospitals on April 29. On June 11, designated influenza clinics were set up to share the loads of emergency rooms in public hospitals. Outbreaks happened in schools in June, and all classes in elementary schools and kindergartens were suspended for 14 days starting on June 12 (till June 25), followed by the summer vacation. Middle schools could decide whether to start summer vacation earlier or not.

Since the disease had entered the community in mid June, the focus of disease prevention was shifted from “control” to “mitigation”. On June 25, mild cases were no longer required to be admitted to the hospital.

Hospital isolation of patients was also not required any more. On July 21, the original 2-week class suspension was shortened to 1 week, and the decision on whether to prolong it would depend on future development of the epidemic.

China

China requires active reporting from symptomatic cases arriving from affected areas. After Hong Kong had its first confirmed case on May 1, Mexican Airlines' flights to Shanghai, China, were declined on May 2 to stop the disease from spreading during the country's peak travel season beginning May 1. On May 3, close contacts of patients were quarantined. Policies instituted during the SARS epidemic, such as "daily case report" and "zero case report," were applied. "Zero case report" means reporting has to be done even no relevant case was found.

As to the focus of disease prevention, China had shifted it from "border control" and "confirmation and treatment on a case-by-case basis" to "monitoring selected populations", "tracing virus mutations", and "treatment of severe cases". On July 9, the strategy of disease prevention was shifted to "reduction of secondary cases, prevention of community transmission, strengthening treatment of severe cases, and prompt response to changes in epidemics". Beijing on July 22 shifted the focus of disease prevention toward key sites including hospitals, schools and communities.

Treatment strategies also changed according to development of the epidemic and knowledge of the virus. Since July 7, mild cases were treated and isolated at their homes and visited by community doctors or public health department officials. Since July 15, mild cases are not required to



take Tamiflu.

Singapore

The disease monitoring system of Singapore coded the epidemic of novel influenza A (H1N1) into five colors: green, yellow, orange, red, and black, and responded accordingly.

In late April, to respond to epidemics in Mexico and the United States, temperature monitoring was implemented at airports. One hospital was designated to be the first line hospital to treat novel influenza A (H1N1) related cases. Medical personnel in the emergency rooms and ICUs were required to wear protective gears. In early May, travelers from Mexico were required to be quarantined for 7 days.

In mid June, the main focus of disease prevention was shifted from preventing transmission to alleviating impact. On July 10, temperature screening of arriving travelers was stopped, since community transmission has occurred. However, temperature monitoring of attendees was still conducted for some large scale activities. Besides, since July 16 suspected novel influenza A (H1N1) cases were transported by designated cars to hospitals.

Response measures in Taiwan

Response system promptly set up for international outbreaks

The Centers for Disease Control (CDC), the Department of Health issued a warning for travelers to the United States and Mexico on April 25. On April 26, the travel warning to the United States and Mexico was strengthened. On April 27, novel influenza A (H1N1) was announced to be a Category 1 communicable disease according to Item 3 of the Communicable

Disease Act. The Executive Yuan held an emergency interdepartmental meeting on April 27. On April 28, 26 departments and councils were organized into a Central Epidemic Command Center (CECC). Local governments were also required to set up local command centers within 24 hours. Between April 27 and April 29, CECC announced guidelines for case surveillance, patient isolation, contact quarantine, and preventive medication to be followed by local governments.

Border control was the focus of disease control during the early weeks of the epidemic, since no domestic cases had been found

The severity of the epidemic could not be confirmed initially, since mortality was high in Mexico but relatively low in the United States. Although there was no case in Taiwan, after the outbreak of SARS the general population has become very sensitive to outbreaks of transmissible diseases. Hence, many response measures in Taiwan were based on previous preparation for H5N1 avian influenza. The Ministry of Foreign Affairs announced through CECC on April 29 that the travel warning to Mexico had been raised to “red”, meaning travel not recommended.

Initially, prevention was mainly done through border control. Selected onboard quarantine inspection was implemented on April 29. Close contact of cases, including travelers sitting within three rows in front of and behind the cases, were asked to report to and be followed-up by the local health authorities. Preventive medication was also given to them. According to changes in the global epidemic and shifts in the strategic direction of disease control, onboard quarantine inspection was canceled on May 19 and was replaced by reporting of abnormalities by international flights. Airlines would suggest passengers with fever or cough to delay



boarding or ask passengers to obtain a health certificate before boarding. During the flight, symptomatic passengers should be offered masks and seated far from other passengers. Before landing, flight control authorities should be notified so that they could arrange for onboard quarantine inspection.

Media effects and concerted effort to alleviate public panic

Since information about the epidemic was announced, the mass media had reported on case management, border quarantine procedures, and mask supply extensively in popular time slots or on main pages, leading to a massive increase in telephone inquiries to the Taiwan CDC. Other than scheduled daily meetings with journalists, the command center had implemented other measures to strengthen public confidence to the government and to alleviate social panic. The Premier was arranged to inspect airports, hospitals and drug stockpiles. Journalists were invited to visit the command center. Since May 3, local governments have been asked to strengthen health education through neighborhood mechanisms. From May 4 to 10, the National Communications Commission requisitioned 14 television channels to broadcast a one-minute segment of disease prevention information twice daily.

Although there was no outbreak in Taiwan, the media had reported on mask shortages in the market. Many people also complained about not being able to obtain masks or reported illegal behaviors through Taiwan CDC's telephone hotline. The command center consequently followed a three-step strategy of "Investigation, release, and requisition," which involved investigating companies that hoard masks or raise prices, releasing 200 million masks on May 7 and 9 to be sold at supermarkets

and 150 million to be sold at drug stores. Requisition was never applied.

The command center also published health education materials on the website of the Taiwan CDC to be viewed or downloaded by local governments, the general public or medical personnel.

Individual and clustering of cases occurred domestically; case-by case investigation and disease control measures implemented.

Initially most cases were imported. The first case was detected on May 20, and as a result, the epidemic level was raised to level 2. Up to the evening of May 22 when a kindergartner was confirmed to have been infected, a total of 6 cases had been detected, and they were all imported. Since novel influenza A (H1N1) is a category 1 communicable disease, isolation of cases is required by law. Hence, each confirmed case was sent to a designated site for isolation and treatment according to the mechanism of the “Communicable Disease Prevention Medical Network”. The command center also followed up on close contacts of patients, including passengers seated within three rows in front of or behind a patient on a plane and the flight crew. They were asked to monitor their own health, follow health management measures like taking regular measurements of body temperature, and wait for disease prevention personnel to investigate, gather samples and administer preventive medications.

As to the school of the sixth confirmed case, which was a kindergarten affiliated with an elementary school, the command center asked the school to be closed for seven days at the night when the case was confirmed. Students were asked to monitor their health at home. Preventive medication was given to all students in the kindergarten.

The seventh confirmed case detected on May 25, and it was the



country's first domestic case infected by imported cases. As a result, the epidemic level was raised to level 3 (yellow). Since there was no community transmission, preventive measures stayed the same. Up to the end of the 7-day isolation (May 31) period of this first domestic case, no other domestic case was reported. The command center lowered the epidemic level back to level 2 (yellow).

In early June, a cluster infection happened to a group of students who went to Thailand for graduation travel. Since graduation travel groups have higher infection rates than other travel groups, the command center announced that, according to Item 42 of the Communicable Disease Act, leaders of the groups should be responsible for caring and reporting students having flu-like symptoms. Otherwise, a fine between NT\$10,000 and NT\$150,000 will be issued according to Item 69 of the act. The Tourism Bureau under the Ministry of Transportation and Communications also warned travel agencies to be alert and report abnormalities. The command center also worked with the disease control authorities of Thailand in conducting epidemiological investigation. This cluster event was continuously followed up until 7 days after the last case being isolated and treated.

In mid June, when coincided with the graduation season and the end of semester, the focus of disease control was shifted to "mitigation" in line with the direction of international disease prevention. Since June 9, the Ministry of Education resumed running programs such as summer travel study and study abroad. However, advice of the WHO should be complied with. Symptomatic cases should delay international travels and comply with national regulations in seeking treatment. Since international travels

of students increased significantly during that period, the 11th meeting of the command center passed the “Points for attention during studying abroad in level 4 H1N1 affected countries” drafted by the Ministry of Education for reference by students and travel agencies on June 9.

July was the peak season for large scale international summer camps and meetings. Since multiple H1N1 cluster events happened in late July, the command center asked the sponsors to be alert of disease prevention measures - including active surveillance, early identification and isolation - and to promote cough courtesy and hand wash. Sponsors were also asked to contact and collaborate with local health authorities to prepare for events of outbreaks.

Disease category and treatment guidelines adjusted according to evolving characteristics of the pandemic

The command center removed novel influenza A (H1N1) from category 1 communicable disease on June 19. Cases infected by the H1N1 virus with severe complications were managed and reported according to rules set up for category 4 designated communicable diseases, which includes influenza with severe complications.

Since June 19, domestic cases have not been required to be treated in isolation facilities; cases are instead judged by doctors to see whether hospital admission is necessary. Epidemiological investigation is no longer conducted for new cases unless cluster events have happened. Contacts of patients are given health education and their health status monitored. The health promotion campaign to promote hand washing, cough manners, respiratory hygiene, and mask wearing when sick is ongoing.

Early preparedness for possible outbreaks in fall and winter



Since a lot of cases could appear in the second wave of the pandemic, allocation of materials and medical resources could be challenging. Hence, “procuring and reserving materials” and “monitoring and treating severe cases” have become the focus of disease control and prevention. Detailed strategies are as follows:

1. Procuring and reserving materials: The reserve of antiviral drugs has been raised from covering 10% to covering 13% of the whole population. The purchase of vaccines has been expedited, and a usage plan is developed in advance. The reserve of preventive equipment is also being restocked for materials used up to cope with the initial outbreak and public demand.
2. Disease monitoring: In addition to using the database of the National Health Insurance system, community viral infection monitoring, pneumonia and influenza mortality monitoring, emergency department real time monitoring and Real-time Outbreak and Disease Surveillance system (RODS) are also used to monitor the epidemics. Disease development in the south hemisphere is also being closely monitored.
3. Clinical treatment: The scope of coverage of the National Health Insurance is discussed, including coverage for antiviral drugs, treatment of severe complications from influenza infection, applicability and use of semi-ICUs, and suspension of elective surgeries. Besides, reserves for ventilators, off-label use of antiviral drugs, criteria for patient admission and transfer are also being planned to prepare for the possible massive volumes of cases during the outbreaks in fall and winter. Besides, we are focused on monitoring resistance to antiviral drugs.
4. Risk communication: The best weapon to prevent influenza infection is

good hygiene habits of the whole population. Hence, the most fundamental preparation for possible outbreaks in fall and winter would be to strengthen influenza prevention-related knowledge, attitudes and behavior of the general public.

Conclusion

The process through which the newly-emerged H1N1 virus spread and caused a global pandemic in 2009 was rapid, which posed a challenge to public health systems of all countries. However, lessons learnt from the SARS epidemic in 2003 led to the revision of the International Health Regulations (IHR) in 2005. The threat posed by the H5N1 influenza virus in the past five years has also prompted all countries to engage in preparedness activities. Hence, WHO and most countries have been able to respond rapidly. The stockpiles of antiviral drugs and personal protective equipment that have been built up by the Taiwan government in recent years were effectively used in the first wave of the pandemic.

Overall, intervention measures for a pandemic include medical interventions (vaccines and drugs) and non-medical interventions (isolation, quarantine, and social distancing). Vaccines for novel influenza are under production. The efficacy of drugs is still under observation because they have not been used on a large scale. Isolation, quarantine and social distancing have been used by all countries to control infections. Many disease prevention strategies developed for SARS and avian influenza were determined to be not cost-effective for novel influenza A (H1N1). For example, initial measures like quarantine implemented at the Viking Hotel in Hong Kong and class suspension carried out in the US were all



modified later. The current system of classifying global pandemic phases set by WHO considers only the transmissibility and geographical spread of a virus without taking into account its severity, and this has been challenged by some countries. Hence, an important lesson learned from the first wave of the pandemic is that disease control measures need to be based on scientific evidence [14].

Besides, the intensity and administration of preventive measures have been adjusted according to the development of the pandemic and the resources of different nations. For example, in the global disease surveillance guidelines of the WHO, countries having no cases should focus on early identification of laboratory confirmed cases. Countries having experienced outbreaks should focus on long term surveillance of the epidemiology, virology and clinical symptoms of the disease, and on assessing the effects of the outbreak on their medical systems [15]. Hence, disease prevention policies have to be flexible. In order to effectively administer prevention policies and change them according to new situations, countries need to have powerful command systems and effective intra-departmental and inter-departmental communication systems.

Fall and winter are flu seasons of the north hemisphere. Flu patients are expected to increase significantly, and significant numbers of them are likely to be novel influenza A (H1N1), which would pose a challenge the medical systems. Although social distancing measures including cancellation of social gatherings and closure of public facilities could slow down the transmission of virus in the community, such measures have to be well planned to minimize their impacts on the economy. Hence, in addition to following closely the global activities of novel influenza A (H1N1) virus

and conducting a thorough risk assessment to set appropriate policies, resources in the community should not be overlooked. The authorities should provide resources to help build up self-care ability in the community. Both the public and private sectors are also required to set up hygiene and business continuity plans to be used during the pandemic.

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