



Lessons Learned from Taoyuan International Airport's Response to Novel Influenza A (H1N1)

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Abstract

On April 27, 2009, the Taiwan Government announced novel influenza A (H1N1) as one of a Category I notifiable diseases. During the period between April 27, 2009 and June 19, 2009 when novel influenza A (H1N1) was announced as a Category IV notifiable disease, the Taoyuan International Airport has enhanced their quarantine procedures. Taoyuan International Airport Health and Security Working Group was also transferred to Taoyuan International Airport H1N1 Influenza Epidemic Command Center in order to manage the emergent situations, and integrate quarantine affairs with all related agencies in the airport. During this period, the command center has set standard working procedures and protocols about the quarantine. These procedures included the on-board quarantine, designated anchor site quarantine, fever screening, isolation of suspicious cases, follow-up of passenger contacts, health education for inbound and outbound passengers, and enhancing disease prevention measures of the airport; these measures were improvement of personal protection of the airport staff, monitoring of fever and possible outbreaks

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in each department, provision of disease control material, and preparation of pathway for patients. All these measures make the Taoyuan International Airport to meet the requirements of the International Health Regulations (IHR) and provide it with the ability of dealing with large-scale epidemics. Also, there are several practical problems that occurred in the process of fighting the disease, such as not having enough personnel to deal with various incident problems, not meeting the needs of the public media, many difficulties in following passenger contacts, and the departure control of being followed cases. The solutions for all these issues need to be prepared and suitable measures need to be taken for the future epidemics.

Keywords: novel influenza A (H1N1), quarantine, Taoyuan International Airport

Introduction

On April 25, 2009, according to the information released by the World Health Organization (WHO), CDC of the United States, Taipei Economic and Cultural Office in Mexico and the medical officer dispatched to Mexico from Taiwan, the epidemic of novel influenza A (H1N1) has broken out in Mexico and the Southwestern part of the United States. On the next day, Taiwan Centers for Disease Control (TCDC) activated the Influenza Pandemic Strategic Plan, announced warnings for traveling to Mexico and the US, and started to implement several preventive measures. Subsequently, on April 27, based on the definition of novel influenza A (H1N1) published by the WHO and panel discussions of infectious disease experts, novel influenza A (H1N1) was officially announced as a Category I notifiable disease. According to the strategic plan, actions for the international quarantine have to be taken and



strengthened (including on-board inspections for flights from the US and Canada), due to the fact that the seriousness of novel influenza A (H1N1) was still yet unknown [1].

After a pandemic in 1918, the H1N1 influenza virus was still the main cause of pandemics in the 20th century, influencing 5%~15% of the global population each year. Although most cases are mild, 3~5 million have experienced severe symptoms and 250~500 thousand have died, with a fatality rate of $< 0.05\%$. The current pandemic is caused by type A H1N1 influenza virus, which is a new strain of the virus. It has caused a pandemic in the world and is still circulating in countries, especially, in the southern hemisphere (where is currently the winter influenza season). The first case of novel influenza A (H1N1) was found in the US, and has caused a pandemic in Mexico [2-4]. Thus, WHO elevated the level of the disease alert and announced the H1N1 influenza pandemic alert has entered into phase six [5] on June 12, 2009. Fortunately, the disease is considered mild, allowing the CDC to adjust the prevention and control strategies, announce a monitoring system for the Severely Complicated H1N1 Influenza cases, and degrade it as a Category IV notifiable disease on June 19 [6,7].

Since severe acute respiratory syndrome (SARS), the so-called “plague of the century”, has broken out in 2003, health officials faced another pandemic, the novel influenza A (H1N1) epidemic, in six years shortly. Many officials are concerned as to whether the epidemic this time would be riskier than SARS or not? How long would the pandemic last? Whether the Taoyuan International Airport’s previous experience of fighting the SARS epidemic is still workable? As for those personnel who

have not undergone the SARS pandemic, this time would be a valuable experience. We hope that the reviews of the working process will become a reference in fighting future international pandemics.

Reviews of the Quarantine Practice

Since the government has announced to activate Influenza Pandemic Strategic Plan on April 26, 2009, TCDC was responsible for international ports quarantine, not only maintaining the regular quarantine procedures, but also providing surgical masks and gloves for personnel working at National Immigration Agency, Customs Office, and Aviation Police Office in Taoyuan International Airport. In addition, surgical masks were conditionally provided for duty-free shops and ground service companies, who were unable to get it from the market, in Taoyuan International Airport. And in response to the change of epidemic situations, various health education posters for novel influenza A (H1N1) were provided and posted on remarkable site around the building of airport (Table 1).

In addition, TCDC transformed the Taoyuan International Airport Health and Security Working Group to the Taoyuan International Airport H1N1 Influenza Command Center rapidly in response to epidemic situation. The QICS departments (Quarantine, Immigration, Customs, and Security) within the airport, through the command center, actively managed all possible incidental epidemic situations (Table 1).

Moreover, supported by inspector and medical officers from TCDC headquarter, the Second Branch of the TCDC has restructured its personnel's work assignment to deal with sudden increases of inspection workloads, such as examination of suspicious passengers, transferring



Table 1. Important matters regarding global pandemic H1N1 influenza quarantine in Taoyuan International Airport

4/26: 1.WHO raised its pandemic alert level to Phase 4. 2.Strategic plans were activated. 3.Education Posters were made.	4/27: 1.Staff taking days off were prohibited 2.QICS staff were equipped with masks	4/28: 1.First Taoyuan airport health and security meeting in 2009 was held 2.Meeting for on-board quarantine was held.	4/29: On-board inspection of flight from the US and Canada	5/19: The Fifth Command Center Meeting held. All airplanes with ill passenger should report for on-board inspection.
4/30: 1.WHO raised its pandemic alert level to Phase 5 2. First Taoyuan International Airport H1N1 Influenza Command Center Meeting was held.	5/20: 1.1st imported case was confirmed and released for public media. 2.2nd imported case was confirmed.	5/1: Second Command Center Meeting	5/21: 3rd imported case was confirmed.	5/27: The Sixth Command Center Meeting
5/2: 1. Distribution of Health DM on board 2. Central control center standardized report and specimen sampling guideline for the passenger contacts of cases	5/31: 13th confirmed case was found.			
April	May	June		
	5/3: Transferred cases should be reported and taken specimen by received hospital.		6/4: Quarantine on a diplomat group lead by President was conducted.	
	5/4: Designated-anchor-site on-board inspection of flights from Mexico & US		6/5-6/13: 8 confirmed cases found	
	5/5: Director General took an on-site check			
	5/10: All flights loading tour group from the US & Canada had to report for on-board inspection.			
	5/11: The Third Command Center Meeting was held			
	5/14: The Fourth Command Center Meeting was held			
				6/19: The seventh airport command center meeting. Announcement of H1N1 as a Category IV notifiable disease.

cases to the hospital, and investigating and collecting information of contacts board the flight.

On-board quarantine is a special measure taken in this incident. Due to the fact that outbreak occurred in the US, Canada, and Mexico, the central command center announced on April 29 that all incoming flights from the US and Canada needed to be inspected on-board upon arrival (since there was no direct flights from Mexico, most passengers was coming from the US or Canada) [8]. Later on, because the disease had spread to 40 different countries with more than 8,800 cases and community transmission has started to occur among Asian countries [9], the central command center concludes that cases may entered the country through other flights, except from US and Canada. Therefore, all flights with passengers appearing suspected symptoms were required to be

inspected and should report to TCDC starting from May 20.

During this period of time, an important incident occurred in early May when a report of a 73 members' tour group returned from a cruise ship trip in the US and Mexico was received. Based on the decision made by the emergency meeting held at the airport command center, the flight was required to land at the particularly designated spot and was thoroughly inspected and screened. The experience can be used as a model of designated anchor site quarantine in the future.

From April 29 to June 16 (52 days), a total of 280 flights have received on-board quarantine, 783 passengers have reported illness, 852 passengers have been physically examined and interviewed by quarantine physician, 125 patients have been sent to hospital for medical assistance, 28 flights have been required to provide passengers' personal information, and 17 problematic cases related to departure restriction have been handled. During this time, 61 confirmed cases of novel influenza A (H1N1) were found in the country [6], and 12 of these cases were detected at the border quarantine, accounting for 19.67% of the total cases (Table 2). The first three cases that appeared in the country were all detected by the border quarantine; showing how well prepared the border inspections were in facing the pandemic [10].

Table 2. Number of novel influenza A (H1N1) confirmed cases by detection route

	Cases	Percentage
Total	61	
Report from community physicians	49	80.33
Border quarantine	12	19.67
Routine fever screening	11	18.03
On-board quarantine	1	1.64



Discussion

When we look back on the quarantine measures taken by Taoyuan International Airport during novel influenza A (H1N1) combat period, some experiences in working with various authorities at the airport can be referred as a cooperation model in fighting the possible pandemic in the future. Some of the practical experiences are described as follows:

1. Administrative Response

(1) Quick establishment of the Taoyuan International Airport H1N1 Influenza Epidemic Command Center

The Taoyuan International Airport Health and Security Working Group was established in July, 2006, according to the International Health Regulations. The goal is to enable international ports to have ability to deal with international public health issues. This Group has been running for three years, so when the novel influenza A (H1N1) epidemic broke out, the Taoyuan International Airport was able to quickly establish the epidemic control command center. The advantage is that this center chaired by TCDC and the Aviation Authority of Taoyuan International Airport can easily combine health professionals and the airport management system and fully cooperate with each other to effectively implement quarantine and pandemic control. This command center has held 7 times of meeting during the epidemic period. All authorities attending the meeting were given updated epidemic information and shared control works, allowing each related unit to realize the responsibility and the importance in participating the quarantine. Moreover, these meetings have developed cooperation pattern between various units

on some issues, including the transfer of suspicious passengers, working procedures for collection of passengers' personal information for follow-up, 24-hours contact point in each unit, ambulance service, designated quarantine for risky airplane, and various Standard Operational Procedure (SOP) related to quarantine measures. [11] In other words, this Center has substantially improved the operation of quarantine practices. In order to make all units working in the airport for international quarantine keep being familiar with the related standard operating procedures, we suggest that this Center should convene the meeting on a regular basis.

(2) To mobilize manpower to support border quarantine

Although the number of ill passengers screened out by quarantine at Taoyuan International Airport before and after the epidemic (an average of 308.18 person / week, 307.88 person / week, respectively) was almost the same, the workloads for handling problems from passenger quarantine have increased significantly. For example, before the epidemic, the number of passengers needed to be examined by physicians was, on average, 16.24 people per week, but it was 106.5 people per week after the epidemic occurred, a 6.56-fold increase. In addition, the number of ill passengers needed to be transferred for medical treatment increased from an average of 0.29 people per week (only 5 people during January to April) to an average of 15.63 people per week (125 people during the 8-week period), a 53-fold increase. (Table 3) The implementation of on-board quarantine for flights from the US and Canada also needed a large amount of manpower. Therefore, it is estimated that an extra 18-19



personnel (not including quarantine physician) was needed, for an increase, on average, of 4.5 persons per day for 24-hours operation, dealing with the suddenly increased quarantine works during epidemic. However, only 8 quarantine officers and 1 quarantine physician have been added to participate the quarantine works during this epidemic. Therefore, what kind of the external support manpower should be deployed and how these manpower should be deployed to maximize the substantial effectiveness of the support would be an important issue needed to be carefully considered and solved.

Table 3. Comparison of number of ill passengers before and after novel influenza A (H1N1) epidemic

	Jan. 1-April 25, before the epidemic	April 26-June 19, during the epidemic	Comparison
Confirmed cases of H1N1 influenza	0	12	
Number of ill passengers examined by physicians	276	852	6.56-fold increase
Average number of ill passengers examined by physicians per week	16.24	106.5	
Number of ill passengers transferred for medical treatment	5	125	53-fold increase
Average number of ill passengers transferred for medical treatment per week	0.29	15.63	
Average number of passengers needed for recheck per week	308.18	307.88	no significant change

Furthermore, in order to maximize manpower efficiency of the Second Branch of TCDC, the work assignments for each staff were re-assigned, which other working groups, such as personnel working for passenger transfer, decontamination, and administrative support, were created in addition to the original assignments for

body temperature monitor, investigation and specimen sampling, and mobile manpower. In addition, each supporting hospital was required to assign a specific contact personnel to handle the large amount of transferred patients possibly appeared during epidemic. Also, various guidelines related to quarantine practices were reviewed and revised based on the experience in this epidemic. We suggest that the example in adjusting work assignments, as mentioned above, can be a model of manpower allocation for dealing with quarantine practices for pandemic.

(3) Support of information systems

Internet reporting system such as the symptoms reporting system, self-health management systems, central infectious disease notification system, developed after SARS epidemic, have played a very important role in the control of novel influenza A (H1N1) outbreak, They significantly enhance the efficiency of airport Quarantine officers in dealing with the suspected infectious cases, such as accelerating the distribution of passenger's information, and avoiding the situation that local public health officer enquired the quarantine officer about the information of cases over and over again, so that the quarantine authority can quickly pass the information of detected suspect cases to the central and local public health agencies, to conduct the tracking and medical assistance for cases as soon as possible.

(4) Dissemination of the most updated education materials

During the epidemic, the TCDC updated epidemic situations for international tourism by using the digital screen displayed at the



departure hall and the Immigration and Quarantine Station, and by placing the health education pamphlets and posters at easily accessible site at the terminal, such as traffic control for passengers quarantine, so that visitors can get relevant information, reminding them of epidemic prevention measures.

2. Quarantine measures taken

(1) Enhancing fever screening

Fever was the only vital sign that can be detected without the passengers' notification by using the infrared body temperature detector that can be administered for fever screening of large crowds. Therefore, after SARS epidemic, the TCDC has been continually implementing fever screening at the Taoyuan International Airport for incoming passengers at the quarantine station. The suspects identified by infrared thermal detector were rechecked by ear thermometers for body temperature. Although not all diseases will produce fever symptoms, as compared to the past, fever screen has made quarantine became one of the active notification system and has substantially increased number of cases detected at entry point through quarantine procedures and enhanced the effectiveness of blocking imported infectious diseases. For example, 67% of imported cases of dengue fever in 2006-2008 were detected through fever screen at international airport [12].

Although a total of 12 confirmed novel influenza A (H1N1) cases, including 11 from the infrared fever screening, have been detected through the border inspection and quarantine, infrared fever screening accounted for only one-sixth of total imported cases, 61

cases. This means that if symptom is not a typical symptom of the disease or if the patients were not in fever condition at the entry point, infrared fever screening is very difficult to find the cases. The novel influenza A (H1N1) is different from the SARS that is contagious only after the onset of fever symptom. Therefore, diseases that are contagious during the incubation period and the diseases that the fever symptom is not apparent will be unable to be detected by fever screen of the border quarantine.

(2) On-board inspections for all flights from the US and Canada

It was really a big challenge to adopt on-board quarantine for all flights from certain areas. According to the practical implementation, we found that all these flights began arriving at 4:30 to 5:00 am. This means that a plane is scheduled to land in an average of every 10 minute within the period of only 90 minutes to 120 minutes [13]. Because flights arrived too intensively, to inspect all flights immediately after arriving was almost impossible under the limited human resources and in order to maintain the routine functions of quarantine. Especially, when arrival time of a flight was changed or passengers with suspected symptoms onboard need to be dealt with, the manpower for on-board quarantine was apparently not enough. Because Narita Airport in Japan did not have well established fever monitoring system, it had to also adopt on-board quarantine procedures [14]. During the period of implementing the intensified quarantine measure, the average weekly number of ill passengers detected through fever screen at Taoyuan International Airport, was around 156 cases. No increase in number of cases was found, as



compared with 221 cases detected before the period. Of the 12 confirmed cases identified by the Taoyuan International Airport quarantine station, 11 cases, accounted for 91.67% (Table 4), were detected by the infrared body temperature screening tools. This result suggested that the routine fever screen was more effective than the on-board quarantine for all flights from certain areas in the detection of ill passengers.

Table 4. Number of cases detected through the border quarantine

	Number of cases	Percentage (%)
Total	12	100
Fever screening	11	91.67
Not fever screening	1	8.33

(3) Transfer of suspected cases for medical treatment

Passengers having flu-like symptoms and arriving from the World Health Organization published novel influenza A (H1N1) epidemic areas were transferred to hospital for medical treatment, so that they can be efficiently isolated during the period of taking throat specimens and waiting for test results. The TCDC made the transfer plan for suspected passengers, including the traffic control, and transferred patients by fully cooperating with the airline companies, Immigration Department, Customs Bureau, Aviation units, and Police Station. During the period, a total of 125 patients were transferred for medical treatment. All these patients have been transferred through the well-designed traffic control and under the well-isolated conditions. Therefore, the infection control within the

terminal can be strengthened and non-cooperative attitude of tourists can be effectively reduced.

(4) Cases and contacts tracing

During the period, the tourist name lists of 28 flights were collected by the TCDC from Taoyuan International Airport and, through the assistance of Immigration Department, they were sent to local health bureaus as soon as possible for follow-up. Because, the processing of such information was very complicated and involved the tourists' privacy, we suggested that it is better and more appropriate to collect these information through a single-window system, the TCDC, than to be requested by user ends, local health bureaus.

For necessity of prevention, treatment, and follow-up, cases and their contacts were restricted to depart for other countries within a certain period. However, the criteria for departure restriction were not clear enough, which often caused those restricted passengers being stopped at the airport and being unable to go abroad under the circumstance of without noticing the restriction. And because several hundreds of people were restricted, it was not easy for quarantine officers to conduct on-site verification, causing a heavy work load. We, therefore, suggested that the restricted name list should be updated as often as possible and the passengers should be removed from the list immediately after the restriction period has ended in order to avoid compromising the rights of people.

3. Emergency Logistics Response

(1) Personal protection equipment



During the initial epidemic period, the Second Branch of TCDC has started to prepare and request supply from TCDC headquarter through the logistics management system for personal protection equipments. Therefore, staffs who may frequently contact passengers because of the work in each of the authorities at the airport, such as National Immigration Agency, Aviation Police Office, duty-free shops, are able to get masks to wear during their on-duty hours and understand the importance of working together to control the spread of the disease. In addition, through the logistics management system, the consumptions and stockpiles of masks and other protection resources can be closely monitored.

(2) Developing guidelines for communication with public media during epidemic

During novel influenza A (H1N1) epidemic period, incorrect news reports on issue of the border quarantine operations have occurred as it was in the SARS period. Moreover, media photos made in short distance of the passengers have caused a lot of panic, anger, and other emotional responses and, these have brought the quarantine personnel much difficulties and pressures in dealing with passengers. We, therefore, suggested that the criteria and areas for allowing the press reporters to interview or take picture of passengers could be established in accordance with the characters of infectious disease and the scale of disease epidemic [15], or the Director of the Second Branch of TCDC can be empowered to speak out to the news media under the situations without violating the principles of TCDC press spokesman system. Hopefully, this

will allow us to achieve the purposes of “three wins” of the disease control authorities, public news media, and passengers.

- (3) To assign a specific contact officers in the central epidemic command center for international airport

The border quarantine at international airport is the first line of defense against infectious diseases. Since the epidemic situation may be ever-changing, the disease control activities and quarantine procedures, demands and distributions of disease control materials and dissemination of health education materials should be updated in time in parallel to the development of the epidemic. Staff in the first line must fully grasp the right message in the shortest time to completely connect the fighting activities of the international airport with that of TCDC headquarter. Therefore, we suggested that the central command center in the very early stage of the epidemic should assign a contact officer to master the defense activities conducted by the first-line border quarantine and to convey feedback information to headquarter to improve their combat effectiveness.

Conclusions

From the lesson learned during the SARS epidemic, the Taiwan government has actively improved the capacity in international quarantine in the past six years. These include the establishment of computerized quarantine information system, continuous implementation of fever screening, and the improvement of work force. Therefore, this time, in facing the novel influenza A (H1N1) epidemic, the situation was not as



panicky as that during the SARS epidemic. In this epidemic, the International Airport epidemic command center was established to integrate various authorities within the international airport to construct standard working guideline together in areas such as sending cases to hospitals, collecting the name list of on-board passengers, and assigning a single contact window. These not only leave a record of valuable experience in fighting epidemics but also greatly increased Taoyuan International Airport's ability in managing major health incidents under the principles of the International Health Regulations. However, support systems for the manpower supply and other operational issues for epidemic control should be established in order to thoroughly resolve the long-standing manpower problem in quarantine administration and leave precious experience for colleague to handle the future epidemic.

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