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## Introduction

The H1N1 epidemic rapidly spread out within USA and Mexico in April, 2009. WHO gradually elevated the global epidemic level of H1N1 from level 4 to level 6 on April 28, 30 and June 11. H1N1 epidemic in Taiwan occurred in a relatively late period compared to other countries/regions. The first imported case was found on May 20. During SARS epidemic, 73 casualties were recorded (including 7 medical personnel); this event caused public panic and huge economic lost due to negative information of face mask insufficiency and other news published in media [1]. Based on past experience, government established central epidemic control center on April 28 to start up disease prevention measures and active public communication [2].

In the initial stage of H1N1 epidemic, risk communication was mainly focused on several aspects: 1. international epidemic situation; 2. national border containment and quarantine inspection for key flight boarding; 3. investigation for suspected patient and

cooperation of passengers in the same flight; and 4. disease prevention of public in daily activity. Press release, press conference, television and intermediate power (or above) broadcasting station were platforms for risk communication. "One minute film for disease prevention" was proceeded twice daily (6:00 pm to 10:00 pm). The information of risk communication included: transmission route of new virus, re-named H1N1 influenza (not swine influenza) to avoid misunderstanding (transmitted by consuming pork), propagating "handwashing is more important than wearing face masks" and releasing face masks for pharmacies and convenient stores to avoid panic when buying masks due to media reports [2].

During this investigation there was no confirmed H1N1 case recorded in Taiwan, but the government and media were alert to this epidemic. Seven press conferences and 33 press releases were published by central epidemic control center two weeks before the telephone inquiry started (from April 25 to May 8). For newspaper reports (4 top-selling newspapers and 1 evening newspaper), there were 775 reports about H1N1 epidemic, including 37 front page reports and 81 headline reports. For the report content, there were 740 neutral reports (>95%) about health education and epidemic situation, and 33 negative reports (4%) about delayed travel warning, student abroad in Mexico, face mask panic and bidding up prices. Most electronic media proceeded SNG online report during press conferences in core time interval, which indicated that all media paid close attention to H1N1 epidemic situation and government prevention measures.

Public responses and behavioral changes had been evaluated in England, Hong Kong, Beijing, Australia, Malaysia and Japan in the initial stage of H1N1 epidemic [3-10]. In England, results revealed that only 38% of public adopted preventive behaviors, 5% adopted avoidance behaviors and only 24% concerned about epidemic occurrence [3]. In Hong Kong, 67% public believed H1N1 would be transmitted by water and mosquitoes [4]. 77% Hong Kong people took avoidance behaviors (go to public places or hospital less frequently) and only 15% concerned about H1N1 infection [5]. Another investigation revealed 47% of people in Hong Kong wash hands over 10 times per day, 89% who contracted influenza-like illness wore face masks, and 22% wore masks when going to public places [6]. In Beijing, 66%/64% people covered nose and mouth (at home/in public places) by hands, 33%/63% used tissue papers and 0.4%/0% used sleeves when sneezing; 77%/46% washed hands after sneezing. Furthermore, 63% would wear face masks and 43% would receive influenza vaccine [7]. Street inquiry investigation in Australia showed that most people realized H1N1 epidemic, 44% felt the information was insufficient and 38% considered unlikely to be infected by this disease [8].

Comparing public response in the initial stage of H1N1 epidemic, the alertness of this disease in British people was obviously lower than Hong Kong people: only 5% of British people went to public places less frequently and 28% increased handwashing frequency, while 55% and 74% Hong Kong people did so, respectively. The different results between these 2 countries may be due to SARS

epidemic occurred in Hong Kong [6]. An international survey indicated that Malaysian people may have higher alertness about H1N1 influenza (go out less frequently and purchase masks) than European people [9]. The public panic extent was higher in Japan than in Hong Kong, which was probably due to local medical care system, government risk communication, and local culture [5, 10].

This investigation, which was conducted in the initial stage of H1N1 epidemic, was intended to understand the conceptions of public to H1N1 influenza, viewpoints to media, adopted preventive behaviors (increasing handwashing frequency, going to public places less frequently, wearing masks), purchasing masks and other relative influential factors in Taiwanese people, and to provide a reference for H1N1 epidemic prevention policy.

### **Materials and Methods**

This research was mainly targeted to adult Taiwanese who is over 18 years old. Telephone survey was conducted between 18:00-22:00 on May 8-9, 2009. Taiwanese residential telephone numbers were the research population sampled with random stratification by CATI (Computer Assisted Telephone Interview) system. Stratified sampling of telephone number was conducted on the level of 25 counties (subpopulations) in Taiwan. In order to cover all listed and unlisted residential telephone numbers in Taiwan, new telephone number samples were collected randomly on the basis of last two digits of previously selected numbers.

A total of 7,484 telephone samples were selected in this study; 1,349 samples were

inquired with elimination of 86 people unaware of H1N1 and non-human factors (including non-answered call, busy telephone line, suspended or malfunctioned or unavailable telephone number, facsimile machine or other transmitting facilities, answering machine, corporation, organization or governmental facility). In the 1,349 samples, 1,122 samples were inquired successfully and the success rate of telephone inquiry was 83%.

Data analysis was conducted by SPSS 12.0 edition. Descriptive statistics was applied to present public perceptions of H1N1, media reports, governmental support and behavioral changes. Respectively, univariable logistic regression was proceeded to understand the relationships between demographic variables and behavioral changes (preventive behavior or purchasing face masks). Multivariate logistic regression was applied to analyze the relation between preventive behavior and respective independent variable (including

public correct perception and concern, opinions to media reports and support for disease prevention policies), adjusted by statistically significant demographic variables.

## Results

For all samples inquired, 56% were female; 39% were 50 years old or above; 44% with college/university (or above) academic background; and 43% were housewives/retired personnel/unemployment.

### A. Public perceptions of H1N1

In this study, 89% of people understand that H1N1 was transmitted by aerosol or direct contact; 82% knew handwashing was more important than wearing face masks; 78% understood the transmission was not through consuming pork; 48% realized that there was no H1N1 vaccine; and 41% aware of antiviral medicine available. Furthermore, 48% of people concerned about spreading out of H1N1 epidemic and 65% worried about H1N1 invasion into Taiwan (Table 1).

**Table 1. Public perceptions of H1N1, opinions to media reports, support for disease prevention policies and behavioral changes**

Item	Number	(%)
<b>Correct perceptions</b>		
Aerosol or direct contact transmission	993	(89)
Transmission was not from consuming pork	873	(78)
Handwashing was more important than wearing face masks	925	(82)
No vaccination for prevention	535	(48)
Antiviral medicine available	454	(41)
<b>Awareness level</b>		
Concern about global epidemic	541	(48)
Concern about invasion into Taiwan	725	(65)
<b>Opinions to media reports</b>		
Report information useful	872	(78)
Exaggerated report	451	(40)
<b>Support for disease prevention policies</b>		
Satisfaction for present prevention measures (very satisfied or satisfied)	814	(73)
Confidence for future disease prevention (very confident or confident)	859	(77)
<b>Behavioral changes for H1N1 prevention in last 2 weeks</b>		
Increase handwashing frequency	840	(75)
Less visiting public places	807	(72)
Wear face masks (or persuading other people to wear)	436	(39)
Purchase face masks	318	(28)

## B. Behaviors change, types of mask purchased and reasons for purchasing face masks

In order to prevent H1N1, behavioral changes for disease prevention in last two weeks included: increase handwashing frequency (75%), less visiting public places (72%), and wearing face masks or persuading other people to wear (39%) (Table 1). In the previous 2 weeks, 25% of people (n=280) had purchased face masks. Flat/surgery mask were mostly purchased by public (multiple choices, 40%) and followed by active carbon mask (26%), paper mask (18%), cotton cloth mask (8%) and N95 mask (4%). Reasons for not purchasing face mask included: not necessary (56%), previously prepared (39%) and unavailable for face masks (5%) (n=842, Table 2).

## C. Opinions for media reports and supporting level for government

Seventy-eight percent of people believed that media reports were useful, but 40% considered that were exaggerated (Table 1). Over 90% of people obtained H1N1 related information from television or advertisement, followed by newspapers (34%), internet or

electronic news (17%), broadcast (4%) and others.

Seventy-three percent of public was satisfied to present disease prevention policies and 77% was confident to future preventive measures (Table 1). Disease prevention measures that were satisfied by public included (multiple choices): enhancing border quarantine (83%), daily “one minute film for disease prevention” (80%), toll-free consulting line (72%), daily press conference (70%), increase influenza vaccine purchase quantity (65%), release sufficient masks and allot for sale through convenient stores (62%), and field investigation in Mexico by Taiwan CDC medical officer (51%). Furthermore, 71% people were willing to receive government purchased vaccines and 65% supported the government to increase purchase quantity of H1N1 vaccine.

## D. Factors influencing disease prevention behaviors and face mask purchasing of the public

In the initial epidemic stage, people who were female or over 50 years old changed preventive behaviors (increase handwashing

**Table 2. Types of mask purchased and reasons for not purchasing face masks**

	Item	Number	(%)
<b>Mask purchased</b> (face mask types)	(multiple choices)	<b>280</b>	<b>(25)</b>
	Flat/surgery mask	113	(40)
	Active carbon mask	74	(26)
	Paper mask	50	(18)
	Cotton cloth mask	23	(8)
	N95 mask	12	(4)
	Forgotten	32	(11)
<b>Not purchasing mask</b> (reasons)		<b>842</b>	<b>(75)</b>
	Not necessary	468	(56)
	Previously prepared	329	(39)
	unavailable	38	(5)
	No reason or refuse answering	7	(1)

frequency, less visiting public places, wearing masks) most (Table 3). With demographic factors adjustment, correct perceptions who considered “transmission was not conducted by consuming pork (OR, 1.53;  $P < 0.05$  )”, “handwashing was more important than wearing facemasks (OR, 2.23;  $P < 0.001$  )”, “anti-viral medicine available (OR, 1.45;  $P < 0.05$  )” increased handwashing in past 2 weeks. Perception of “handwashing is more important than wearing mask”, concerning about global epidemic, concerning about epidemic in Taiwan, considering media report pragmatic, satisfied to disease prevention policies and confident with future disease prevention were the main factors that influenced H1N1 prevention behavioral change of the public (Table 4).

Persons who purchased face masks were mostly women (Table 3); after adjusted by sex, the influence factors of purchasing mask included correct perception of “handwashing is more important than wearing face mask”, “concerning about global epidemic”, “concerning about epidemic in Taiwan”, and “considering media report pragmatic” (Table 4).

## Discussion

In the initial stage of H1N1 epidemic, Taiwanese people had better perceptions in disease transmission and alertness comparing with other countries or regions [3-4] which was contributive for government to spread out epidemic information [14]. Furthermore, a higher rate in handwashing frequency, less visiting public places and wearing face masks

**Table 3. Relationship of demographic factors with H1N1 preventive behaviors and mask purchasing**

Demographic factor	Sample No.	Preventive behavior						Purchasing facemask	
		Increase washing hand		Less visiting public area		Wearing facemask		No.(%)	OR(95%)
		No.(%)	OR(95%)	No.(%)	OR(95%)	No.(%)	OR(95%)		
<b>Gender</b>		<b>840(75)</b>	<b>0.46(0.19-0.73) ‡</b>	<b>807(72)</b>	<b>0.59(0.33-0.85) ‡</b>	<b>436(39)</b>	<b>0.62(0.38-0.87) ‡</b>	<b>318(28)</b>	<b>0.72(0.45-0.98)*</b>
M	496	331(67)		327(66)		162(33)		122(25)	
F §	626	509(81)		480(77)		274(44)		196(31)	
<b>Age</b>			<b>0.84(0.72-0.96) †</b>		<b>0.77(0.66-0.89) ‡</b>		<b>0.88(0.77-0.98)*</b>		<b>1.01(0.90-1.12)</b>
<30	222	152(68)		140(63)		73(33)		63(28)	
30-39	188	141(75)		124(66)		71(38)		57(30)	
40-49	257	187(73)		193(75)		98(38)		71(28)	
>=50 §	441	351(80)		344(78)		189(43)		125(28)	
<b>Academic background</b>			<b>1.00(0.83-1.17)</b>		<b>1.31(1.14-1.48) †</b>		<b>1.10(0.95-1.25)</b>		<b>0.96(0.79-1.12)</b>
Junior high and below	264	194(74)		209(79)		102(39)		66(25)	
Senior high (vocational)	358	276(77)		259(72)		155(43)		114(32)	
College and above §	485	359(74)		332(68)		171(35)		135(28)	
<b>Occupation</b>			<b>1.02(0.86-1.17)</b>		<b>0.96(0.82-1.11)</b>		<b>1.02(0.88-1.15)</b>		<b>1.03(0.89-1.18)</b>
White-collar	392	301(77)		288(73)		156(40)		115(29)	
Blue-collar	243	170(70)		159(65)		89(37)		68(28)	
Household/retired §	472	358(76)		352(75)		184(39)		132(28)	
<b>Resident area</b>			<b>0.97(0.88-1.06)</b>		<b>0.83(0.74-0.93) ‡</b>		<b>0.91(0.83-0.99)*</b>		<b>1.07(0.98-1.16)</b>
Northern	358	273(76)		237(66)		122(34)		110(31)	
Mid-North	160	105(66)		101(63)		57(36)		44(28)	
Middle Taiwan	219	164(75)		171(78)		86(39)		59(27)	
Mid-South	168	130(77)		133(79)		80(48)		46(27)	
Southern	188	145(77)		143(76)		76(40)		50(27)	
Eastern §	29	23(79)		22(76)		15(52)		5(17)	

\* $P < 0.05$ . †  $P < 0.01$ . ‡  $P < 0.001$ . § :Reference group for each independent variable.

**Table 4. Relationship of important factors with H1N1 prevention behaviors and mask purchasing after demographic adjustment**

Factor	Sample No.(%)	Prevention behavior						Purchasing mask	
		Increase washing hand		Less visiting public area		Wearing mask		OR	Adjusted OR(95%)
		OR	Adjusted OR(95%)	OR	Adjusted OR(95%)	OR	Adjusted OR(95%)		
<b>Correct perception</b>									
Aerosol or contact transmission	993(89)	1.09	1.19(0.75-1.63)	0.91	1.10(0.65-1.56)	0.87	0.96(0.57-1.375)	1.29	1.30(0.87-1.73)
No pork-related transmission	873(78)	1.43	1.53(1.20-1.85)*	1.08	1.19(0.86-1.52)	0.91	0.95(0.65-1.24)	1.10	1.10(0.79-1.42)
Washing hand more important than mask wearing	925(82)	2.39‡	2.23(1.46-3.01)‡	1.85‡	1.94(1.60-2.28)‡	1.32	1.35(1.01-1.68)	1.69†	1.65(1.28-2.03)†
No vaccine	535(48)	1.16	1.17(0.90-1.45)	1.38*	1.53(1.25-1.81)†	1.11	1.16(0.91-1.41)	1.18	1.17(0.91-1.43)
Anti-viral treatment	454(41)	1.47†	1.45(1.17-1.74)*	1.17	1.17(0.89-1.44)	1.27	1.29(1.04-1.53)*	1.0	1.28(1.02-1.54)
<b>Concerns</b>									
Global epidemic	541(48)	1.82‡	1.66(1.38-1.95)‡	1.77‡	1.74(1.46-2.02)‡	1.66‡	1.56 (1.32-1.81)‡	1.57†	1.51(1.25-1.78)†
Epidemic in Taiwan	725(65)	1.8‡	1.67(1.38-1.95)‡	1.65‡	1.62(1.34-1.90)‡	1.50†	1.43(1.17-1.70)†	1.78‡	1.70(1.41-1.99)‡
<b>Opinions to media</b>									
Exaggerated	451(40)	0.86	0.86(0.57-1.14)	0.80	0.74(0.47-1.02)*	0.94	0.94 (0.69-1.19)	0.75*	0.75(0.48-1.02)*
Pragmatic	872(78)	1.12	1.08(0.75-1.42)	1.16	1.27(0.95-1.60)	1.17	1.23 (0.93-1.53)	1.02	1.01(0.70-1.32)
<b>Support of policies</b>									
Satisfaction of present policies (Very satisfied or satisfied)	814(73)	1.50†	1.53(1.23-1.83)*	1.08	1.12 (0.82-1.43)	1.72‡	1.76(1.48-2.05)‡	0.94	0.95(0.66-1.24)
Confidence for future disease prevention (Very confident or confident)	859(77)	1.68‡	1.68(1.37-1.99)‡	1.25	1.33 (1.01-1.64)	1.99‡	2.14(1.82-2.45)‡	1.12	1.14(0.82-1.45)

\*P<0.05. † P<0.01. ‡ P<0.001.

was noted. However, the relative factors influencing H1N1 prevention behavioral change were similar to other countries [3, 5-8, 11]. The result of our study was related to active communication with the public and highly concern by media, as well as the popularization of seasonal influenza prevention project and H5N1 epidemic prevention project. Hand hygiene and good manner for coughing and sneezing were propagated through posters, handouts, electronic and outdoor media within communities, airport and harbors. Most people had essential disease prevention concept and were willing to change behavior for H1N1 prevention. Correct public perception and self protection behavior were

more important than governmental emergency responses for prevention of community infection of influenza epidemic or emerging infectious disease [6, 14]. Positive relation was found between correct perceptions of “handwashing is more important than wearing face mask” and wearing/purchasing face mask in past 2 weeks. The difference between perceptions and behaviors were probably due to the high concern from media and the impact during SARS epidemic in Taiwan.

In a previous study [12], factors influencing wearing face mask in the early stage of SARS epidemic had been discussed. Wearing face mask in the early stage of H1N1 epidemic was affected by government suggestion and the presence of severe or fatal

cases [6]. It was also mentioned that the purpose of wearing face mask is to decrease the risk of virus spreading when influenza-like symptoms appear [6, 13], but limited discussion was focused on public behavior such as purchasing face mask. During our investigation, about 25% of Taiwanese people purchased face masks in the past 2 weeks while no H1N1 case was found in Taiwan. Although only 5% of residents indicated that no face mask was available, the risk of public panic could not be neglected. Some residents had to go to several places for face masks and H1N1 consulting telephone line received more and more public complain about unavailable of masks. In addition, with information about mask insufficiency released by media, a panic situation may arise. Fortunately, successful health education such as “handwashing is more important than wearing face mask” and information of 3.5 million masks released by government being available in all convenient stores and pharmacies had relieved risk of public panic and increased public confidence in H1N1 prevention ability of health authorities [2]. Thus, disease prevention measures associated with effective public communication can establish public confidence in governmental policies and acceptance of authority recommendation and measures in disease prevention, and benefited greatly to epidemic control and diminishing possible impact [14].

Mass media has become the main channel for public communication. In our study, electronic media was the main route (94%, multiple choices) for the public to collect disease information, followed by newspapers (34%). This result may be

affected by decreased reading habit of people, and timeliness effectiveness and video magnification of television news. However, the influence of newspapers could not be ignored. In Taiwanese media environment, personnel shuffle of medical reporter in electronic media was high and, thus, usually follow the report of Daily newspapers for getting knowledge of disease prevention was difficult in a short period of time. Therefore, public health authorities should know well about daily newspapers, provide proper and prompt response for media inquiry and questions, and renew disease information for public media in the evening (before newspapers draft deadline). These measures may help public media understanding the meanings of disease prevention measures, and may also establish constructive media interaction which helps correct information publishing. Media report is one of the methods for public health authorities to understand public opinions. By proper quantification comparison and analysis of daily reports in index newspapers, authorities could understand and long-term follow-up public opinions and reactions.

SARS epidemic, anthrax attacking events in USA and other emerging infectious disease epidemics had brought the global disease prevention system a new aspect of consideration. In addition to epidemiologic investigation, clinical medical treatment and laboratory examination, public communication and reaction monitoring are also main items for risk management of infectious diseases [14]. Moreover, communication with scholars, specialists in medical areas and opinion leaders is worthy of further discussion.

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There were several limitations in our study: 1. This was a cross-sectional study suited for relative description, which could not confirm causes and effects; 2. The result of this research may overestimated the public correct perceptions of this disease while the 86 people who had not heard about H1N1 were excluded; 3. All residents who accepted telephone inquiry were anonymous and actual activity for the interviewee could not be verified; 4. As for type of mask purchased, people may be confused by surgery mask and flat mask; 5. The result of this study would be more reliable while comparing with other countries or regions where SARS or other similar epidemics had occurred.

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## Quarantine Response to Novel Influenza A (H1N1) at Kaohsiung International Airport

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### Abstract

The outbreak of novel influenza A (H1N1) began on April 25, 2009; the globe had been in a tense atmosphere due to fear of another influenza pandemic. During that time, in order to acquire more time and space for getting prepared for disease control, the high-level containment strategy of border quarantine was adopted in Taiwan.

To effectively control the importation of cases of novel influenza A (H1N1), Taiwan Centers for Disease Control (Taiwan CDC)

has put a lot of efforts and resources in all international ports of Taiwan. The quarantine measures implemented differ in detail due to varying software and hardware capacities of the ports. This article describes the quarantine response of Fifth Branch of Taiwan CDC at Kaohsiung International Airport during the pandemic, including the strengthening of quarantine procedures, the implementation of personnel protective measures, health education and advocacy, external communication and internal operation adjustments. We also analyze the results of medical evacuation of the passengers. Based on those experiences, we have learned several lessons, including how to reinforce the consistency of internal information to make our colleagues easy to follow; how to establish good relationships with all units in the airports for the administration of the response plan; and an independent space should be set up for those who will be medically evacuated to ensure the privacy of the passengers and reduce fear of other persons. Furthermore, in order to prepare for the next outbreaks, we should plan the deploy and preservation of the quarantine manpower at the earliest time possible.

**Keywords** : quarantine, novel influenza A (H1N1), response, international port, airport

### Introduction

On April 25, 2009, the outbreaks of "swine flu" in Mexico and the southwest of the United States put the whole world in combat readiness [1-3]. Next day, Taiwan activated the "Influenza Pandemic Strategic

Plan" and in accordance with the case definition and epidemic levels from the World Health Organization (WHO), designated novel influenza A (H1N1) as category 1 notifiable disease, set up a central command center for the epidemic, performed on board quarantine in focus flights, integrated our surveillance and laboratory systems, and executed the vaccine procurement program [4].

The WHO declared that the severity of novel influenza A (H1N1) was "moderate" on June 11, 2009 [5]; Taiwan removed novel influenza A (H1N1) from category 1 notifiable disease and infection with severe complications were managed and reported as other influenza infection with complications, a category 4 notifiable disease on June 19, 2009. At the same time, Taiwan enhanced the community viral surveillance. Border quarantine is the first defense line to block the entry of infectious diseases. The Fifth Branch of Taiwan CDC presides over international ports and airport and is responsible for adjusting related action based on central government policies and local characteristics. To provide a reference for the future quarantine activities, this article describes the practice of border quarantine at Kaohsiung International Airport at the start of the outbreaks, evaluates the measures implemented and discusses the outcomes of medical evacuation and treatment of the passengers.

### **Response actions**

There are 14 airlines flying 15 routes at Kaohsiung International Airport; the main routes are between Taiwan and Southeast Asia or East Asia. There are 26~30 arrival flights,

with 3500~4500 passengers per day; the number of departure flights and passengers are similar to those for the arrivals. As to the passengers to or from Europe or the United States, they mostly transit at Taoyuan International Airport.

At the start of the outbreaks, Taiwan CDC issued two press releases on April 26, 2009, to raise the level of travel warning for Mexico and the United States and to activate the "Influenza Pandemic Strategic Plan" based on the epidemic situations in Mexico and the United States. In the afternoon of April 27, 2009, the Department of Health announced novel influenza A (H1N1) as a category 1 notifiable disease. On April 28, 2009, the Executive Yuan announced the launch of a central command center for the novel influenza A (H1N1) epidemic. After that, there were many policies announced in response to the epidemic, one after another.

In addition to the policies, the international ports under our jurisdiction also implemented many response measures in this epidemic, such as the strengthening of quarantine procedures, enhancement of personnel protective measures, promotion of health education and advocacy to the passengers, request for cooperation from related organizations and adjustment of internal operation. The details are as follows:

#### **A. Strengthening of quarantine procedures**

In addition to the routine temperature screening of arriving passengers, passengers are also asked to provide relevant travel history and symptoms in the "Questionnaire for Infectious Disease Control", and the "Quarantine Information of Imported Infectious Diseases or Suspected Patients with

Infectious Diseases”. Our colleagues use the latest epidemic information as a basis for the screening of the novel influenza A (H1N1). If a person meets the criteria for medical inspection, he or she will be sent to designated hospital for medical treatment. To facilitate communication with foreign passengers, we have designed multi-language sheets based on information provided by the headquarters of Taiwan CDC, and we ask related organizations (e.g., Council of Labor Affairs, Tourism Bureau) to assist in the communication with the foreigners.

In order to provide the first-line colleagues with action guidelines, the “Related Matters of Personnel Quarantine for the Novel Influenza A (H1N1)” was developed based on the policies from the central command center and the situation at Kaohsiung International Airport. These guidelines spell out the executives’ instructions, the existing quarantine measures and so on. At 4am on April 28, 2009, WHO upgraded the global pandemic alert level to Phase 4. On April 29, Taiwan CDC announced on board quarantine for selected flights. At Kaohsiung International Airport, although there were no flights from the United States, Canada and Mexico, we soon developed relevant criteria and algorithms for on board quarantine in focus flights. When policy “on board quarantine for selected flights” changed to “on board quarantine for flights with abnormal notice” on May 19, we also revised the “On Board Quarantine Process under Abnormal Notice at Kaohsiung International Airport” as the basis for the operation. From that time to June 19, 2009, on board quarantine was performed to a total of 2

flights, and 2 passengers were reported to the symptom surveillance system. One of the passengers was medically evacuated to the Kaohsiung Municipal Hsiao-Kang Hospital and was diagnosed as suspected pneumonia.

From April 26 to June 19, 2009, 187,505 passengers entered Taiwan at Kaohsiung International Airport. Among them, 183 passengers showed symptoms (0.98‰). Blood or stool samples were taken from 65 passengers, and 3 of them were disease positive (1 dengue fever, 1 Chikungunya Fever and 1 vibrio enteritis). Eighty-seven passengers were medically evacuated, and rapid influenza tests indicated that 83 of them were flu A negative, 4 of them were positive, but novel influenza A (H1N1) infection was excluded after RT-PCR typing.

#### **B. Personnel protective measures**

The PPE (personal protective equipments) for our first line colleagues were based on the standard of “Protection Recommendations to Port staffs in response to the Epidemic of H5N1 Influenza” from the “Influenza Pandemic Response Plan” [6]. In response to the escalating pandemic, the experience of our frontline colleagues and the opinion of our medical officer were used to re-formulate the PPE guidelines, which were subsequently reported to the “Conference in Response to the Epidemic of Novel Influenza A (H1N1)” for approval. The revised guidelines were then presented in the “Health and Safety Group Meeting of Kaohsiung International Airport” for to raise awareness of different units. The PPE guidelines for our colleagues include wearing N95 masks and gloves in sampling of passengers with symptom on focus flights (from the United

States, Canada and Mexico), throughout on board quarantine, and during medical evacuation of passengers suspected of H1N1 infection; and wearing surgical masks for ordinary duties without close contact with the passengers.

### **C. Health education and advocacy**

When the epidemic occurs, we soon placed health education posters on the exits and entries of the airports. And health education leaflets for the passengers were placed at the exits and entries as well as the counters of airlines in the airport; the brief presentations about the epidemic were played in the immigration advisory broadcast television. We asked the airports and banks in the airports to show the epidemic information in their scrolling text marquees, and also asked all airlines to broadcast our advisories and distribute health education leaflets. In addition to those passive education advisories, for providing the first-hand epidemic information, our colleagues actively delivered the health education leaflets and provided oral health educational consultation to the passengers of selected departure flights.

Also, as the epidemic evolved, our colleagues printed and circulated novel influenza A (H1N1) information on a daily basis and modified the posters and leaflets promptly in response to the upgrade of travel warning, the occurrence of the first confirmed case in Hong Kong, the renaming of the novel influenza A (H1N1) in English and so on.

### **D. External communication**

During the outbreak, we profoundly recognized the importance of co-operation between all units in the airports, and of establishing a horizontal communication

platform. For example, to reduce the contact with other passengers by a passenger who was about to be medically evacuated, we requested that he or she could undergo passport inspection at the counters reserved for Immigration Department officials, that airline staffs would help get the passenger's luggage, that the custom officers would come and inspect the luggage, and that the passenger could get on the ambulance by way of the Aviation Police official gate to the police parking lot. These tasks could only be achieved with all units in the airports modifying their regular work processes and assisting in the ways required. So "Health and Safety Group Meetings of Kaohsiung International Airport" was held 3 times during that period. In those meetings, we offered updates on the international epidemic, Taiwan's responses, and our present quarantine response actions. We also used the meeting as a horizontal communication platform to communicate and convey the requests that needed the co-operation of various units. To promote communication among all units and to ensure that all units is given timely information for epidemic management, we assigned specific colleagues to forward daily the latest updates on the international epidemic and the press releases from the command center to the committee members of the Health and Safety Group via email. Taking into account the demand for disease control supplies in response to the outbreaks, a colleague of our branch responsible for managing the supplies, help dispatch or allocate the supplies, and actively answering the requests from all units in the airports.

In addition to external affair communication, communication with the media is another important topic. The media played critical role during the epidemic. The reports from the media can catch public attention rapidly and remind everyone the importance of respiratory tract hygiene and cough courtesy. Media coverage of related issues or events can also raise public knowledge and reduce fear for the unknown. On April 29, 2009, with agreement of the airport and the Aviation Police Office, we arranged 7 local media to visit the fever screen stations to see quarantine practice on inbound passengers. On May 2, 2009, during his inspection visit to the Kaohsiung international airport, Premier Liu, accompanied by media personnel, also visited the fever screen stations and airport quarantine. Through relevant reports, the public can learn more about the rigorous borderline defense. Meanwhile, Premier Liu's approval of our quarantine work could also relieve public.

#### **E. Internal operation adjustment**

We established the "Organizational Structure in Response to the Novel Influenza A (H1N1)" in the early stage of the epidemic, and assigned persons for various activities and for external communication. In the daily "Meeting in Response to Novel Influenza A (H1N1)" at 16:00 that were convened by the chief of the Fifth Branch, the colleagues reported progresses on previous unsolved issues and on the focus of today's work. The person on duty of the airport is responsible for communicating relevant information and coordinating the entrusted issues. Also, in response to the massive increase in workload and the demand of message delivery and

response, the allocation of manpower was adjusted, and we sent officers of the harbor to support the airport quarantine personnel and to cover holiday duties. Besides the manpower issue, in the early stage prior to the arrival of a large number of health education leaflets, we coordinated the members and resources to produce printed materials and to purchase the health education leaflets for distribution to the passengers.

#### **F. The results of medical evacuation of the passengers**

Since there is no physician deployed at the Kaohsiung International Airport, assessment of questionnaires, sampling for tests, and evacuation of patients are executed by quarantine officers. During the containment stage of the novel influenza A (H1N1), we adjusted the criteria for medically evacuating a passenger for treatment as follows:

1. A passenger comes from the epidemic areas of dengue fever or malaria, and meets the conditions of sampling while it is difficult to sample at the airport, e.g., difficulty of blood withdrawing from young persons or those with self-reported chronic diseases.
2. A passenger with epidemiological history that was compatible with the definition of the person under investigation (PUI) for H5N1 flu, and under emergency condition.
3. At the start of the outbreaks of novel influenza A (H1N1), the medical evacuation criteria were the same as the definition of the PUI; however, because the interpretations of clinical signs tend to be more subjective and to avoid misses

due to pre-clinical stage, we adjusted the criteria for medical evacuation such that those meeting the conditions of novel influenza A (H1N1) in the “symptom surveillance system” (i.e., passengers meeting the conditions of fever and epidemiological history) are evacuated.

From April 26 to June 19, 2009, 87 passengers were evacuated based on these criteria. Among them, 4 passengers were evacuated due to difficulty of sampling; 0 was from H5N1 epidemic areas; 83 were evacuated for survey of novel influenza A (H1N1). In those 83 passengers, 80 (96.4%) were detected by the fever screen stations; 3 (3.6%) actively

informed the quarantine officers; 77 (92.8%) were natives; 6 (7.2%) were foreigners; ratio of males to females was 1.13 (44:39); the average age was 33.4 years (range: 1 year old to 88 years old); 22.9% of the passengers were under 10 years of age; 22.9% were between 21 to 30 years old. Table 1 shows the detailed age distribution of the passengers. The majority had travel history to Mainland China or Hong Kong during the past 10 days, accounting for 51.9% (43 passengers), followed by Vietnam (12.0%, 10 passengers) and Japan (8.5%, 7 passengers); the travel history of the passengers is shown in the Table 2. The majority of the passengers lived in southern Taiwan; Kaohsiung county

**Table 1. The age distribution of the medically evacuated passengers**

Age (yr)	Number of passengers	Percentage (%)	Accumulated percentage (%)
0~10	19	22.9	22.9
11~20	1	1.2	24.1
21~30	19	22.9	47.0
31~40	15	18.1	65.1
41~50	7	8.4	73.5
51~60	13	15.7	89.2
> 60	9	10.8	100.0
Sum	83	100.0	

**Table 2. Travel sites distribution of the medically evacuated passengers**

10 days prior to arrival	Number of passengers	Percentage (%)	Accumulated percentage (%)
China	36	43.4	43.4
Vietnam	10	12.0	55.4
Hong Kong, China	7	8.5	63.9
Japan	7	8.5	72.4
Thailand	4	4.8	77.2
Philippines	4	4.8	82.0
Malaysia	3	3.6	85.6
Korea	2	2.4	88.0
Singapore	2	2.4	90.4
France	2	2.4	92.8
Indonesia	1	1.2	94.0
America	1	1.2	95.2
Canada	1	1.2	96.4
England	1	1.2	97.6
Spain, Portugal	1	1.2	98.8
Australia	1	1.2	100.0
Sum	83	100.0	

and city accounted for 54.2% (45 people); and Tainan county and city, 21.7% (18 people). Only 4 of the passengers were reported as cases of novel influenza A (H1N1) by the evacuation hospital, and the results were all negative. As to the reasons of no detection of a confirmed case with novel influenza A (H1N1) from those fever screen stations, we infer that passengers might have avoided trips to those states with outbreaks; further, most of the evacuated passengers were natives, and they tended to stay out of the areas crowded by the locals in epidemic areas.

Regarding the medical expenses, the total cost of medical evacuation of passengers in response to novel influenza A (H1N1) was NT\$ 147,685 (yuan), 1,779 yuan per passenger in average. There was no obvious difference in comparison with the average medical expenses of 1,820 yuan over the years from those evacuated due to difficulty of sampling. Given that no physician was deployed on-site, and that the contract evacuation hospital is 20 minutes away by car from the airport, in consideration of time and cost, it is appropriate to evacuate the passengers with suspected infectious disease to the hospital. During that time, the resistance or difficulties we encountered were as follows:

1. The workload of the contract hospital increased: during the epidemic of the novel influenza A (H1N1), there was a significant rise in the number of evacuated passengers; the number was 0 to 7 people a day. The number of inbound flights increased after 2pm at the Kaohsiung International Airport daily. It was inevitably that there might be several

passengers with symptoms/signs that met the evacuation criteria within a short period of time, and the hospital must dispatched ambulances to transport them in a short period. Sometimes, the physician might be required to take care of many passengers in the same time, and it might affect the timeliness and quality of medical care. In addition, longer waiting caused more complaints. And it also increased the workload of the hospital staffs in terms of communication and management tasks.

2. Passengers' criticisms and resistance: most passengers want to be home desperately. At Kaohsiung International Airport, although most of the inbound passengers live in southern Taiwan, the journey to the evacuation hospital, and the sampling and examination procedures disturbed their schedules. What's more, once they were reported as PUI cases of H1N1, they will be isolated until being excluded from having the disease or being cured of the disease. Therefore, mandatory evacuations easily caused passengers' criticisms.
3. Shortage of quarantine manpower : before the medical evacuation, there are steps to complete – survey by questionnaire, coordination with related units for co-operation over the customs matters (for example, to request the airlines to receive the baggage, and the customs officers to conduct inspection where the luggage is), contact with the hospital to dispatch an ambulance, send at least one quarantine officer to guide the passenger through the customs



following the evacuation line, and wait for the ambulance; the time lag is about 20 to 30 minutes. Those operations were carried out by different personnel in a collaborative manner to shorten the waiting time for the passengers. In addition, we also performed onboard quarantine for the focus flights, and it took 2 members every time. Therefore, if there were several passengers needed to be evacuated and onboard quarantine needed to be performed, the manpower dispatch would be difficult.

## Discussion

At the start of the outbreak, the most important thing is to provide sufficient information that provides guidance for the frontline staffs. The internet is well developed and by which, we can obtain the latest news in time. However, 10 people could watch 9 different sources of messages. Therefore, it is very important to establish the transmission way of message flow, and to unify the route for gaining the information. We informed the quarantine officers with e-mails, and also set up the "Shift Note for Novel Influenza A (H1N1)"; and we put the current instructions and announcements in this shift note. To enable the colleagues to handle the current announcements in work, we asked all staffs on duty to read, sign on, and circulate the shift note.

Besides, it is worthy to note that being one of the units in the airport, the relationship with other units in the airport will decided the quality of response actions. So it is essential to establish a list of contact persons and ways of contact with other units. To enable all units in

the airport to handle the newest condition of the epidemic, we fulfilled the list in the beginning of the epidemic and provided daily epidemic news as well as real-time first-hand messages.

From the experience of passengers' evacuation, we suggest that an independent space should be set up for those who will be medically evacuated. The average waiting period for the ambulance is about 20 to 30 minutes, and it would be up to 40 minutes during the rush hours. Although we chose the temporary waiting area for the passengers according to the principles of infection control, but the waiting area was still open to others. In spite of a sick passenger might be 2 meters away from others in the airport, staffs of some other units might remain concerned about contact with the ill passenger during the whole process of evacuation. In a long-term plan, we might set up an independent space to provide a more comfortable environment for the waiting sick passengers and to ensure their privacy. This would also relieve the unnecessary panic of others.

As to the next epidemic, we suggest that planning for the dispatch and preservation of quarantine manpower should start early. At the beginning of the outbreak, high-level containment strategy was adopted and related quarantine measures demanded a large amount of manpower and time being devoted to continuing adjustment. The number of evacuated passengers was surged above the usual level in this period so the manpower need for quarantine was elevated. This time, the protection, dispatching, and supporting of personnel were executed fairly well. Though we did not detect any confirmed case, the

response model is adequate for next epidemic. If there is another epidemic of some other infection disease, the first thing to do is to ensure that there is sufficient quarantine manpower to defend the border and to prevent serious infectious diseases from entering our country. Therefore, we should start planning as soon as possible the dispatch and preservation of the quarantine manpower.

Because the epidemic evolved rapidly and the whole world knew little about the epidemiology, virulence, and mortality rate of the novel influenza A (H1N1) in the beginning, every country reacted based on their own conditions. Taiwan implemented a high-level containment strategy in the borders, and Taiwan CDC adjusted the manpower in response to the condition in the Kaohsiung International Airport while evacuating a volume of passengers that was tenfold of the usual number. However, based on the virus characteristics of novel influenza A (H1N1) and the situation of the inbound passengers (most of them were natives with short-term traveling), no novel influenza A (H1N1) positive passenger was detected. The response measures implemented for the epidemic could serve as references for action during the next epidemic or when the main strategy is shift to “disaster-reduction-oriented management”.

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