

Analysis of the effect of fever screening at Taoyuan International Airport

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Abstract

In 2003, Asia was under the terrifying shadows of SARS. Many public places, in particular, international airports, were under close surveillance for SARS. In order to effectively seal off the import of possible SARS cases, Taiwan Centers for Disease Control (CDC) set up fever screening stations at airports to monitor incoming passengers, hoping to prevent importation of infectious diseases.

Analysis of the effect of fever screening at Taoyuan International Airport showed: between January 2005 and May 2007, fever screening detected 90 cases of dengue fever, 34 cases of shigellosis, 2 cases of malaria, and one case of each of the following, chikungunya fever, Japanese encephalitis, typhoid, and paratyphoid. Dengue fever and shigellosis were the most commonly found diseases. Compared to all dengue fever cases nationwide, the percentage of imported cases of dengue fever rose from 11.8% in 1996, when only surveys were used to identify cases, to 51.85% by May 2007. Furthermore, those cases identified at Taoyuan International Airport consist 66.7% of all import cases. Compared all shigellosis cases nationwide, the percentage of imported cases of shigellosis

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also rose from 22.5% in 1996 to 55% in 2007. Currently, shigellosis consists of 57.89% of all imported cases identified at Taoyuan International Airport. Most positive cases were found during summer vacation, most frequently in travelers arriving from Southeast Asian countries. Cases of dengue fever mainly came from Indonesia, Vietnam, and Thailand, while cases of shigellosis came from China, Indonesia, and Vietnam.

By the end of May 2007, April was the month with the largest numbers of imported dengue fever and shigellosis cases, and most of the cases came from Indonesia. Because the peak season for imported dengue fever and shigellosis occur during summer vacation, to effectively control outbreaks and prevent importation of infectious diseases from other countries, the Second Branch of CDC will focus efforts on disseminating health information and prevention messages to travel agencies, foreign workers, foreign spouses, and travelers returning from endemic Southeast Asian countries.

Keywords: fever screening, dengue fever, shigellosis, travelers

Background

Increased international economic exchange activities and travel had resulted in rapid movement of people and opportunities for infectious diseases to be imported. In view of increased incidence of diseases such as SARS, new and emerging influenza and other infectious diseases, quarantine, the first line defense in preventing diseases from entering into a country, had become even more important. In 2003, fever screening was implemented at Taoyuan International Airport, which has been successful in disease prevention. This article discusses the background, progress, and goal of fever screening, and analyzes the effectiveness of fever screening in detecting infectious diseases.

Initiation, process, and goal for establishing fever screening at Taoyuan International Airport

Initiating fever screening

During the SARS epidemic of 2003, the virus was spread to different countries via international flights [1-3]. At that time, the World Health Organization (WHO) announced a breakthrough finding, stating that SARS will not spread without fever [4].

Therefore, on March 27, 2003, WHO recommended fever screening at airports for passengers leaving the country, to avoid dissemination of the virus. New Zealand, Australia, Hong Kong, Singapore, and Canada expanded screening to include passengers exiting and entering the country [5, 6].

To effectively prevent importation of SARS into Taiwan, “SARS prevention survey” was implemented on March 30, 2003. The survey was distributed to all passengers entering Taiwan through international airports. On April 10 of the same year, the policy of fever screening by checking ear temperature was announced. At 12 noon on April 23, fever screening through checking ear temperature began.

Setting up fever screening

Fever is the first symptom of SARS. Therefore, checking for fever is an important method in containing SARS [7]. During the SARS epidemic in 2003, the period of time between deciding on fever screening at airports to the actual implementation of the policy was very short. The policy was decided in the morning of April 10, and all personnel and equipment were to be ready by 3 pm [8]. At that time, Taoyuan International Airport set up 12 lines for fever screening in three different areas. Because there were no infrared temperature sensor

available, it was very inconvenient to check ear temperature on the more than 100,000 passengers from 142 to 177 flights that land at the airport daily. To increase efficiency of fever screening and avoid passenger delays, the Centers for Disease Control borrowed five infrared temperature monitors from Taiwan Power Company. After that, screening was expanded to include two lines for exiting the country, two lines for entering into the country at Terminal One, and one line for exiting and one line for entering into the country at Terminal Two. Using advanced technological equipment to sense temperature, travelers' temperatures could be accurately obtained while travelers walk through the quarantine area at a normal pace [9]. On May 21 of the same year, Singapore donated two infrared temperature monitors to aid Taiwan's quarantine work at international airports. After which, CDC procured additional infrared temperature monitors, to avoid congestion of passengers in airports. In January 2004, CDC negotiated with airport authorities to construct fixed fever screening stations at the airports, and establish health education stations and set up accessories for the temperature monitors. By then, the SARS epidemic had already ended, and fever screening for passengers exiting the country was abolished.

For persons with abnormal temperature, quarantine officers will confirm the temperature using ear thermometer, then, depending on the symptoms and travel history, fill out "Communicable Disease Survey Form". When necessary, medical officers will provide initial assessment. After quarantine officers have collected needed information and laboratory specimens, officers will assist in referring the patient to hospitals for further examination and treatment. Then enter all information into the computer, so the health departments may continue to follow up [10].

Currently, there are four fever screening stations in the two terminals of

Taoyuan International Airport, providing fever screening of all passengers entering into the country. In case of large epidemics, these fever screening stations will be able to provide timely and effective quarantine.

Goals of fever screening

The original goal for establishing fever screening was to identify passengers with fever during SARS, in order to minimize dissemination of SARS internationally [9]. Evaluation in other countries showed that fever screening was not effective in identifying SARS cases. Australia, Canada, and Singapore did not find any cases of SARS through screening, except two cases of SARS identified in Hong Kong. [1, 5, 6]. Therefore, after the SARS epidemic, many countries abolished fever screening. In Taiwan, fever screening was kept in place to detect Japanese encephalitis, dengue fever, and malaria after the SARS epidemic. Later on, it was shown that screening was effect in detecting shigellosis and dengue fever (Table 1). The reason for our success was that, having continued modification, Taiwan was able to find diseases with typical presentation, which can be effectively detected through fever screening. In addition, collection of physical specimens and collaboration of the laboratory were keys for the success of our fever screening program. Fever screening was especially effective in rapidly identifying imported cases of dengue fever [11]. It is shown here that proactive border control using fever screening may decrease infectious diseases.

Materials and Method

1. Target population and study period

To evaluate the effectiveness of fever screening for the identification of infectious diseases, Second Branch retrospectively collected information on confirmed cases of dengue fever and shigellosis from paper-based documents,

infectious disease reporting system, and database warehouse. Information from January 2005 to May 2007 was collected.

2. Results

For passengers with abnormal temperature, who had returned from endemic areas, blood sample or stool swab would be collected, depending on symptoms. For 2005, 2006, and 2007, Taoyuan International Airport collected specimens from 3676, 3587, and 2424 passengers, respectively (Figure 1). A total of 90 cases of dengue fever, 34 cases of shigellosis, 2 cases of malaria, and one case of each of the following, chikungunya fever, Japanese encephalitis, typhoid, and paratyphoid were detected. Compared to all dengue fever cases nationwide, the percentage of imported cases of dengue fever rose from 11.8% in 1996 [10], when only surveys were used to identify cases, to 51.85% by May 2007. Furthermore, those cases identified at Taoyuan International Airport consist 66.7% of all import cases. Compared to all shigellosis cases nationwide, the percentage of imported cases of shigellosis also rose from 22.5% in 1996 [10] to 55%. Currently, shigellosis consists of 57.89% of all diseases identified at Taoyuan International Airport. This shows that fever screening is effective as a first line of defense in preventing importation of diseases (Tables 2, and 3).

Most positive cases were found during summer vacation, most frequently in travelers arriving from Southeast Asian countries. Cases of dengue fever mainly came from Indonesia, Vietnam, and Thailand, while cases of shigellosis came from China, Indonesia, and Vietnam.

Epidemiology

1. Imported cases of dengue fever

Between January 2005 and May 2007, there were a total of 240 imported cases of dengue fever, of which, 90 were identified through fever screening at Taoyuan International Airport. The ratio of Taiwanese to non-Taiwanese was 1.3:1. Foreign laborer consisted of 66.7% of all non-Taiwanese cases, and 2.6% were foreign spouses. The ratio of male to female imported cases was 2.7:1. The age ranged from 1-81 years (mean = 37 years, median = 34 years); the age group with the most number of cases was 20-39 years, consisting of 56.7% of all cases (Figure 2). Counties with most cases were Taoyuan County and Taipei County.

The peak number of dengue fever cases was July to September (Figure 3), which is also the peak season for summer vacation travels. Countries where infection took place were mainly Southeast Asian countries. Indonesia contributed the most number of cases (28 cases, 31.1%), followed by Vietnam (19 cases, 21.1%), and Thailand (16 cases, 17.8%) (Figure 4). By the end of May 2007, there were 7 cases imported in April. Of which, 5 were imported from Indonesia. This is higher than the past.

2. Imported cases of shigellosis

Between January 2005 and May 2007, there were 97 cases of shigellosis reported in Taiwan, of which, 34 were detected through fever screening at Taoyuan International Airport. Most of the infected persons were Taiwanese citizens (85%). Of the non-Taiwanese citizens, 40% were foreign spouses, and 20% were foreign workers. Male to female ratio was 0.9:1.0. Age of the cases ranged from 1 to 73 years (mean = 32.8 years, median = 30 years). The

age group with the most number of cases was 20-39 years, consisting of 61.8% of all cases (Figure 2). Most of the cases lived in Taipei City and Taipei County.

Peak number of positive shigellosis cases was found during summer holidays. There were 10 cases (29.4%) from China, 7 (20.6%) from Indonesia, and 6 (17.6%) cases from Cambodia (figure 4). Since March of this year, there has been increased number of imported shigellosis cases; the majority came from Indonesia.

Laboratory diagnosis

Of the 90 cases of dengue fever cases identified at Taoyuan International Airport, dengue type 2 virus was most common (29 cases), followed by types 1, 3, then 4. Dengue type 1 and 3 were mainly imported from Indonesia, while dengue type 2 was from Vietnam, and dengue type 4 was from Thailand. For imported shigellosis cases, the most commonly isolated bacteria were *Shigella* serogroup D (20 cases) and serogroup B (12 cases). For *Shigella* serogroup D, 40% were imported from China.

Discussion and Recommendation

For febrile traveler returning from tropical countries, it is utmost important to quickly have a diagnosis and initiate the risk of disease [12]. Cases of dengue fever found at Taoyuan International Airport mainly came from nearby Southeast Asian countries, including Indonesia, Vietnam, and Thailand. These are also the main dengue fever endemic countries [12-16]. Increasing number of Taiwanese traveling to Southeast Asian countries, importation of foreign laborers, and growing number of foreign spouses have lead to increased interaction with these countries. This may be the main reason for the importation of dengue fever from

Southeast Asia [16]. Compared to previous years, dengue fever epidemic in Southeast Asian countries was much worse in 2007. By the end of May 2007, most of the serum-positive dengue fever cases were from Indonesia (8 cases, 57.1%). Therefore, travelers must be aware of the risk of disease when traveling to Indonesia.

While dengue virus is transmitted through mosquitoes, shigellosis is a highly contagious gastrointestinal illness. Increased traveling to Southeast Asia and rising number of foreign laborer and stowaways have resulted in increasing shigellosis cases [17]. The most common illness acquired by travelers returning from Southeast Asia is bacterial diarrhea. Shigellosis is especially prevalence in East Asian and South Asian countries such as China, India, and Nepal [14]. During 2002-2004, Indonesia was the country that contributed the highest number of imported cases of shigellosis [18]. However, since 2005, cases imported from China rose. Now 29.4% of the cases found in Taoyuan International Airport came from China, and 20.5% from Indonesia.

Currently, the focus of quarantine is on identifying cases of dengue fever and shigellosis. The peak number of laboratory positive cases occurs during peak seasons of travel [13]. Therefore, in addition to strengthening the quarantine officers' ability to identify these cases, educating travelers is also important. For imported dengue fever cases, the proportion of foreign laborers and foreign spouses is rising. On the other hand, imported cases of shigellosis occur mainly in Taiwanese citizens. Therefore, during peak season for travel, educating travel agencies, foreign workers, foreign spouses, and travelers returning from endemic countries on prevention measures is needed, to circumvent dissemination of the disease in communities.

This article collated much historical information. Because of the frequent

exchange of official documents sent during SARS, sifting through the large amount of documents was needed to understand how the fever screening station was established. Collating the documents was made more difficult because of recent re-organization of the agency. As for data analysis, because some of the variable for the surveillance system were recent additions, there were limitations to this analysis. More objective analysis of the complete data may be performed in the future, to fully understand the effectiveness of the fever screening stations.

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Table 1. Imported infectious diseases identified at Taoyuan International Airport, January 2002 to May 2007.

Year	2002	2003	2004	2005	2006	January-May, 2007	Total
SARS	-	4	0	0	0	0	4
Dengue fever	1	15	42	38	38	14	148
Malaria	0	0	3	1	1	0	5
Shigellosis	4	27	41	10	13	11	106
Others	-	-	-	Japanese encephalitis: 1	Chikungunya fever: 1 Typhoid, paratyphoid: 1		3
Total	5	46	86	50	54	25	266
Control measures	Health declaration	Prior to December 2004: All passengers filled out Communicable Disease Survey Form and screened for fever					
		After December 2004: Passenger self-reported illness then screened for fever					

Table 2. Cases of dengue fever identified through fever screening at Taoyuan International Airport, January 2005 to May 2007.

Year	2005	2006	January-May 2007
Confirmed cases, Nation-wide	306	1,074	43
Confirmed imported cases, Nation-wide	104	109	27
Confirmed imported cases through Taoyuan International Airport	80	81	21
Confirmed imported cases identified at Taoyuan International Airport	38 (36.54%)	38 (34.86%)	14 (51.85%)

Table 3. Cases of shigellosis identified through fever screening at Taoyuan International Airport, January 2005 to May 2007.

Year	2005	2006	January-May 2007
Confirmed cases, Nation-wide	174	139	34
Confirmed imported cases, Nation-wide	39	38	20
Confirmed imported cases through Taoyuan International Airport	35	34	19
Confirmed imported cases identified at Taoyuan International Airport	10 (25.64%)	13 (34.21%)	11 (55.00%)

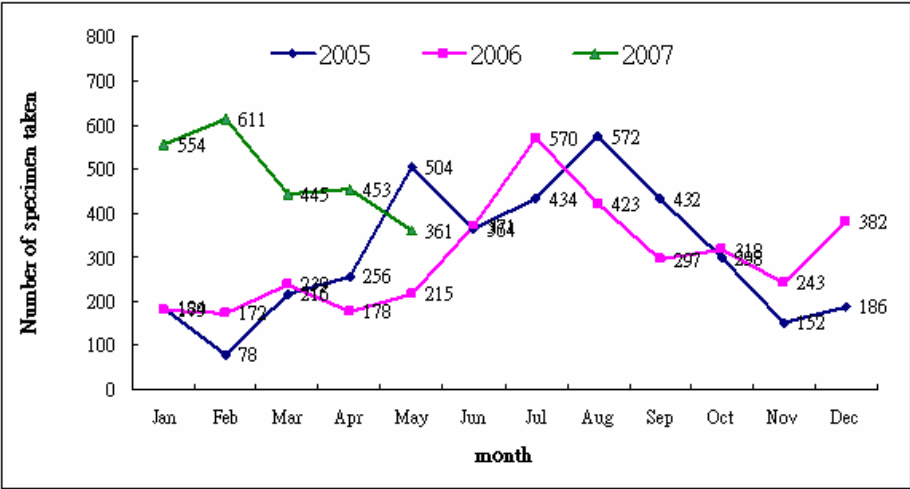


Figure 1. Number of specimens taken at Taoyuan International Airport, by month, January 2005 - May 2007.

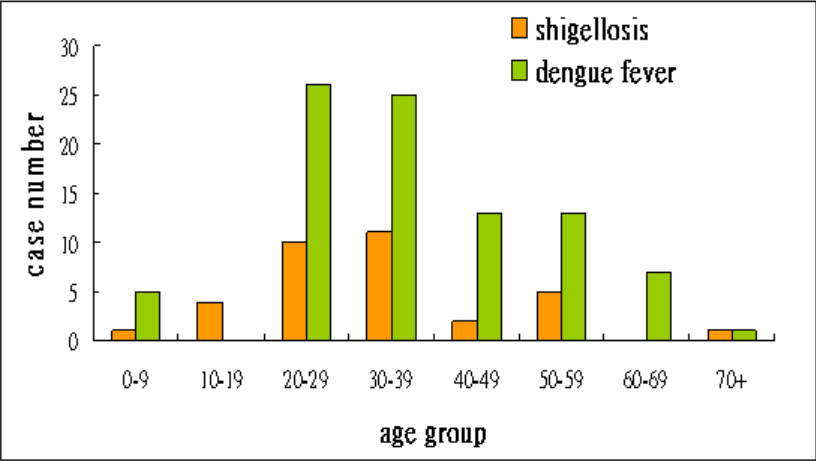


Figure 2. Age stratification of specimens taken at Taoyuan International Airport, January 2005 - May 2007.

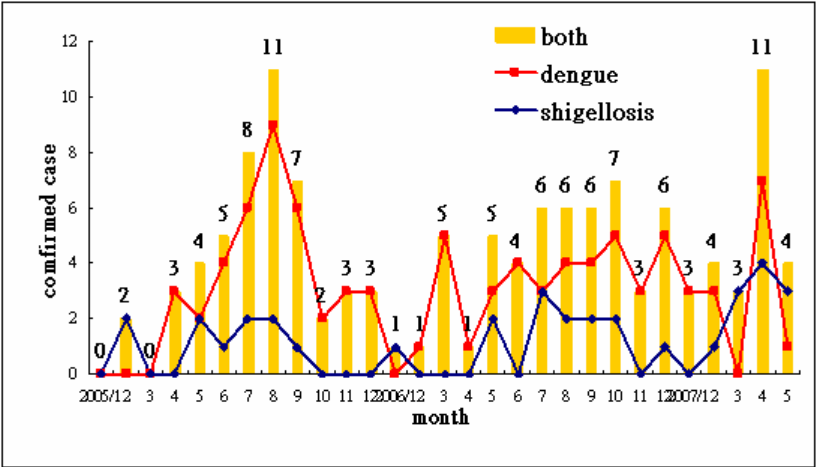


Figure 3. Confirmed imported dengue fever and shigellosis cases identified at Taoyuan International Airport, January 2005 -May 2007.

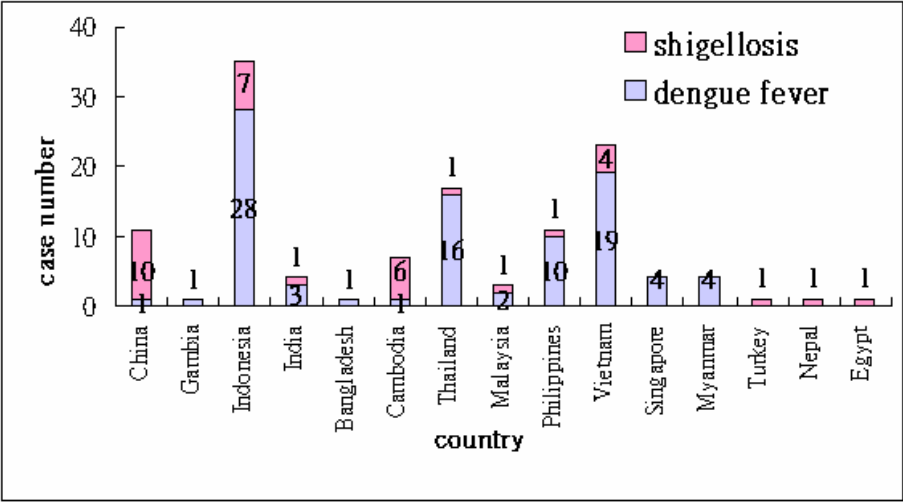


Figure 4. Number of dengue fever and shigellosis cases identified at Taoyuan International Airport, by country of origin, January 2005 – May 2007.