

Evaluation of the Possible Impacts of Open Policy Allowing Direct Cross-Strait Traffic on the Epidemic of Acute Infectious Disease by Examining Data from Hong Kong Experience

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Abstract

With the development of open interaction policy, the frequencies of contact between people in both sides of the Taiwan Strait will increase inevitably. In order to understand the possible threats of infectious disease in China to Taiwan because of the policy, we analyzed the trend of the number of traveler and occurrence of infectious disease associated with interaction with China after 1997. This research paper is to analyze the impact of the threats of infectious disease after the policy to allow the visits to Hong Kong from China directly. During the period 1997 to 2007, the figures of overall outbound and inbound tourists to Hong Kong had

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increased 2.1 and 2.7 times, respectively, but the figure of inbound tourists from China only has increased as many as 6.7 times (from 2.3 millions increased to 15.49 millions dramatically). Although, according to the statistics from Hong Kong Department of Health, the number of Notifiable Infectious Disease cases in Hong Kong during the same period has not increased significantly, it is an undebatable fact that the SARS epidemic in 2003 was actually introduced from China. Therefore, in order to safeguard citizens' health, some procedures such as to enhance the ability of monitoring the epidemic occurring in China, the capacity of the epidemic control, perform the international quarantine practice and domestic disease surveillance thoroughly, are still needed to be strengthened and implemented continually.

Keywords: to lift ban on cross-strait interaction, infectious disease, imported cases, quarantine

Introduction

President Ma, Ying-jeou announced in his campaign brochure, "We, commit a new tourism policy to share the Taiwan's beauty with people in the world"- based on this policy, Ma planned to widely loosen the ban on Chinese tourist (to be cited simply as MCT hereafter) visiting Taiwan and start to prepare the implementation procedures for direct cross-strait traffic. We, therefore, anticipate that the cross-strait interaction for both citizen and cargo will interact more frequently and closely, and the number of MCT visiting Taiwan is likely to grow rapidly. Consequently, the sites of ports opened for direct traffic will need to be increased. All these potential changes could ultimately bring threats to the defense line for preventing

the introduction of communicable disease into Taiwan.

The superior geographical location, in the position as a hub for East Asia, has made Hong Kong one of the most popular tourist's choices in Asia and, as a result, tourism became one of the four major economic industries of Hong Kong.[2] Unfortunately, after mid-1990, the tourism industry of Hong Kong was seriously hit by a series of events in politics, economics, and infectious disease, such as return of its sovereignty to China in 1997, at the same time, the occurrence of Asian economic storm, and the devastation of SARS (Severe Acute Respiratory Syndrome, SARS) epidemic which widely spread around the globe in 2003. The Hong Kong government, therefore, signed a memorandum with China in 2003, titled as the Closer Economic Partnership Arrangement (CEPA).[3] Under the framework of CEPA, the Individual Traveler Scheme was created, which allowed residents in China to travel individually to Hong Kong started from 28 July, 2003 and, consequently, the number of MCTs visiting to Hong Kong were growing rapidly.

Since Hong Kong is the closest area to China in geography and has the largest number of MCTs, as compared with two other Chinese-dominant areas, Macau and Singapore, we use it as an example for analyzing whether the risk of introducing acute infectious disease has been increased after the enforcement of Individual Traveler Scheme. Hopefully, we can formulate our policies and measures of quarantine and disease control in Taiwan by referring to the analysis and experience in Hong Kong, to prevent infectious disease from introduction and to safeguard the national security in disease control.



Background Information

1. Current situation of infectious disease in China

(1) The situation is worse than Taiwan.

According to the data published by World Health Organization on September 10, 2008, the number of human cases of avian influenza has accumulated to 30, including 20 deaths, in China.[4] In addition, many infectious diseases which is eradicated or well controlled in Taiwan is still an epidemic disease in China, such as malaria and rabies.

(2) The major source of imported cases of notifiable infectious disease to Taiwan.

Based on the statistics posted on the website of Taiwan CDC, China is the country of the second, and third largest source of imported cases of Notifiable Infectious Disease to Taiwan from 2005 to 2007.

2. Scenario of opening for MCT to visit Hong Kong: 1997-2007

(1) History of opening for MCT to Hong Kong

Hong Kong has always been prosperous in tourism industry until the last decade when it encountered three major hits; the return of its sovereignty to China in 1997, Asian economic storm occurred in the same year, and the devastation of SARS epidemic in 2003.[6,7] Especially, the SARS epidemic occurred in March 2003, Hong Kong had suffered a crushing setback in tourism industry, because the World Health Organization announced that Hong Kong was SARS affected area and advised traveler to avoid traveling to Hong Kong and Guang Dong areas unless necessary. However, China government issued the Individual Traveler Scheme in July 2003 that the number

of MCT visiting Hong Kong started to increase significantly year by year. Please see table 1 below for details of these data.

(2)Number of inbound and outbound travelers

The Hong Kong Annual Report posted on the website of Hong Kong government [8] shows both the number of overall inbound and outbound travelers and the number of inbound non-Hong Kong resident travelers was significantly increased in every year except 1997 and 2003 when the number of the inbound and outbound travelers was stagnant or even decreased because of the political, economic, and epidemic reasons. For example, the number of Hong Kong's inbound and outbound travelers significantly increased from 10.55 million in 1997 to 21.78 million in 2007, a 2-fold increase, and the number of inbound non-Hong Kong resident travelers also increased significantly from 1.04 million in 1997 to 2.817 million in 2007, a 2.7-fold increase [9], and, especially, the number of MCT visiting Hong Kong had largely increased from 2.3 million in 1997 to 15.49 million in 2007, a 6.7-fold increase.[10] Table 1 shows the details of these data.



Table 1. Number of Hong Kong's inbound and outbound travelers and number of inbound foreign travelers from 1997 to 2007

Year	Number of inbound and outbound travelers (Unit: ten thousands)*				Number of inbound foreign travelers (Unit: ten thousands)**		
	Total	By air	By sea	By land	Total	MCT	MCT/Total(%)
1997	10,550	2,180	1,890	6,490	1,040	230	22.12%
1998	11,550	2,050	1,800	7,700	960	260	27.08%
1999	12,900	2,130	1,740	9,030	1,070	310	28.97%
2000	14,400	2,300	1,920	10,170	1,306	379	29.02%
2001	14,970	2,300	2,000	10,660	1,373	445	32.41%
2002	16,200	2,360	2,100	11,760	1,657	683	41.22%
2003	15,300	1,880	1,860	11,550	1,554	847	54.50%
2004	18,150	2,420	2,140	13,590	2,181	1,225	56.17%
2005	19,130	2,600	2,150	14,380	2,336	1,254	53.68%
2006	20,210	2,810	2,330	15,080	2,525	1,359	53.82%
2007	21,780	3,010	2,650	16,120	2,817	1,549	54.99%
Total	175,160	26,040	22,580	126,520	18,814	8,541	45.38%

Source: Hong Kong Annual Report 1997-2007 posted on the website of Hong Kong government.
<http://www.yearbook.gov.hk/2007/tc/index.html>.

*: Number of inbound and outbound travelers includes all travelers of native Hong Kong residents and foreign visitors.

** : Number of inbound non-Hong Kong resident travelers means number of foreigners traveling to Hong Kong.

(3) Statistics on infectious disease in Hong Kong

Statistics of Notifiable Infectious Disease 1997-2007 on the website of Hong Kong Department of Health shows, over the period of more than ten years, the number of Notifiable Infectious Disease has increased from 14,209 in 1997 to 25,339 in 2007. However, I would like to make a note that some diseases such as chickenpox, SARS, Japanese encephalitis, Streptococcus suis infection, and community-associated methicillin-resistant Staphylococcus aureus infection were not reported as Notifiable Infectious Disease until 1999, 2003, 2004, 2005, and 2007, respectively.

Table 2. Number of cases of notifiable infectious disease in Hong Kong, 1997-2007

Diseases	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cholera	14	71	18	12	38	4	7	5	5	1	3
Plague	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Poliomyelitis	0	0	0	1	0	0	0	0	0	0	0
Amoebic Dysentery	12	3	3	3	6	5	16	23	2	4	4
Bacillary Dysentery	363	512	289	310	390	284	116	140	129	140	67
Chickenpox ¹	-	-	10,890	8,556	16,472	16,727	6,780	11,784	11,933	14,415	17,940
Community-associated methicillin-resistant <i>Staphylococcus aureus</i> infection ⁵	-	-	-	-	-	-	-	-	-	-	173
Dengue fever	10	15	5	11	17	44	49	31	31	31	58
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Food Outbreaks	364	577	538	618	671	670	422	821	972	1095	621
Poisoning Persons affected	1,900	3,011	2,818	2,452	2,707	2,640	2,230	3,131	3,595	4,147	1,992
Japanese Encephalitis ³	-	-	-	-	-	-	-	5	2	0	2
Legionellosis	2	1	1	2	3	4	3	3	11	16	11
Leprosy	11	13	14	11	10	6	7	6	4	6	2
Malaria	101	54	55	35	47	54	28	37	32	40	33
Measles	316	56	32	61	179	61	33	51	65	106	88
Meningococcal infections	5	2	3	14	10	6	3	4	4	6	2
Mumps	51	25	63	77	67	89	121	221	145	184	180
Paratyphoid Fever	18	16	13	13	21	21	60	39	33	39	28
Rabies	0	0	1	0	1	0	0	0	0	0	0
Relapsing Fever	0	0	0	0	0	0	0	0	0	0	0
Rubella	4,958	33	52	2,338	51	36	19	23	53	34	38
Scarlet Fever	77	27	126	123	147	119	63	125	177	230	224
SARS ²	-	-	-	-	-	-	1,755	0	0	0	0
<i>Streptococcus suis</i> Infection ⁴	-	-	-	-	-	-	-	-	13	8	6
Tetanus	8	3	7	7	4	2	3	3	0	2	1
Tuberculosis	7,072	7,673	7,512	7,578	7,262	6,602	6,024	6,226	6,160	5,766	5,545
Typhoid Fever	71	69	72	105	67	67	49	53	36	46	46
Typhus Fever	8	8	26	4	7	13	14	18	38	24	18
A	595	474	426	505	464	267	107	121	64	76	68
B	100	145	152	137	134	121	98	134	105	123	74
Viral Hepatitis	0	0	0	0	0	4	0	1	1	2	2
E	4	16	8	11	26	28	19	38	34	34	65
Unclassified	37	29	31	30	23	10	8	6	0	0	0
Pertussis	12	3	5	11	15	23	5	10	32	21	31
Total ⁶	14,209	9,825	20,342	20,573	26,162	25,267	15,809	19,928	20,081	22,449	25,331

Note: 1: To be added to the list of Notifiable Infectious Disease on 1 February, 1999.

2: To be added to the list of Notifiable Infectious Disease on 27 March, 2003.

3: To be added to the list of Notifiable Infectious Disease on 16 July, 2004.

4: To be added to the list of Notifiable Infectious Disease on 2 August, 2005.

5: To be added to the list of Notifiable Infectious Disease on 5 January, 2007.

6: Total means the sum of all cases occurred in the same year, but do not include the cases caused by food poisoning.



Results and Discussion

1. Traveler mainly through land route and mostly coming from mainland China

Hong Kong is located near the southeast coast of China and connects with Guang Dong province, so travelers entering or exiting Hong Kong are mainly Hong Kong residents and MCT. From 1997 to 2007, the number of travelers entering/exiting Hong Kong through land route has increased from 6.49 million to 16.12 million, around 2.5-fold increase. The percentage of travelers through land route also increased from 61.5% in 1997 to 74.0% in 2007. (Table 1) Therefore, land route has become the major channel for travelers to enter/ exit Hong Kong.

In addition, the statistics show that MCTs account for a large part of the increase of the Hong Kong's inbound non-Hong Kong resident travelers. For example, the percentage of MCT was only 22.12% (2.3 million) in 1997, then increased to more than 50% in 2003, and finally reached up to 54.99% (15.49 million) in 2007. Obviously, most of the increased travelers of the Hong Kong's inbound non-Hong Kong resident traveler were MCT and the channel to enter Hong Kong was mainly through land route.

2. Significant increase in Inbound non-Hong Kong resident travelers, no significant increase in Notifiable Infectious Disease cases

The number of cases of the Hong Kong's Notifiable Infectious Disease increased from 14,209 cases in 1997 to 25,331 in 2007. However, the chickenpox was added to the list of the Notifiable Infectious Disease in 1999 (Table 2), and, as a result, an average of 12,833 chickenpox cases were reported per year during 1999 to 2007. When the number of

chickenpox cases was excluded from the total number of cases of Notifiable Infectious Disease, we found that, in fact, the number of the later one has not increased significantly (Figure 1) and the incidence rate of Notifiable Infectious Disease (number of reported cases divided by total population of Hong Kong) appeared no changes (Figure 2) during 1999 to 2007. Clearly, although MCT entering to Hong Kong has increased significantly, the total number of cases of Hong Kong's Notifiable Infectious Disease did not significantly increase during around the ten-year period.

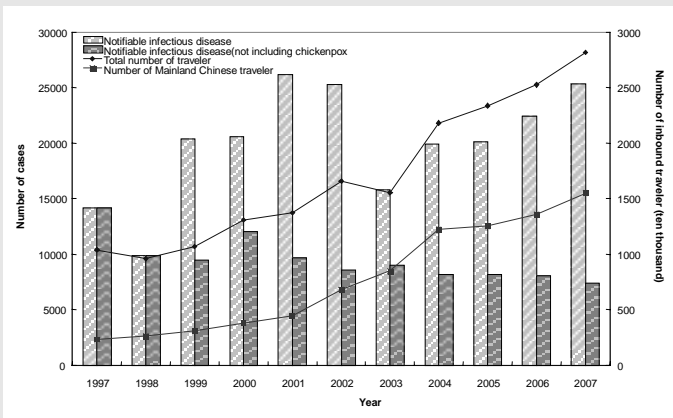


Figure 1. Trend of notifiable infectious disease and inbound non-Hong Kong resident travelers of Hong Kong, 1997-2007

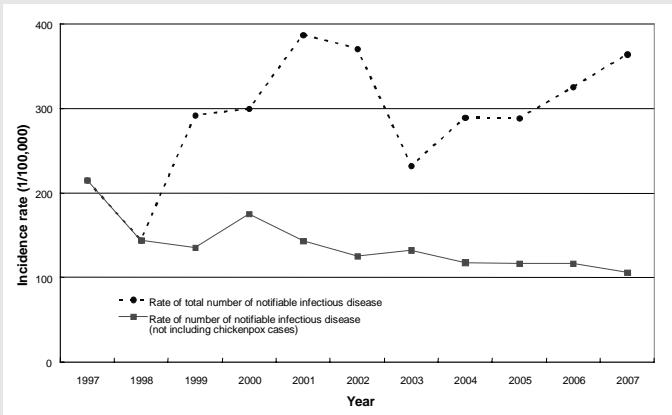


Figure 2. Incidence rate of notifiable infectious disease in Hong Kong, 1997-2007

3. Significant increase in number of cases of chickenpox, legionellosis, and hepatitis E after CEPA issued

In order to evaluate the impact of allowing MCTs visiting Hong Kong individually, the so-called Individual Traveler Scheme (to be cited simply as independent travel hereafter), on the occurrence of some certain infectious disease, we performed a further analysis by using the data published by Hong Kong Department of Health, as those presented on Table 2. Since the CEPA was issued in 2003 by Hong Kong and China government, we first divided those data into two parts, data of 2004-2007 and 1997-2002, and only the cases of diseases that have been included in the list of Notifiable Infectious Disease before 2003 was analyzed, and then calculated the relative risk and 95 percent confidence interval of the incidence of each of the disease during the two periods. The results of these calculations are presented in Figure 3.

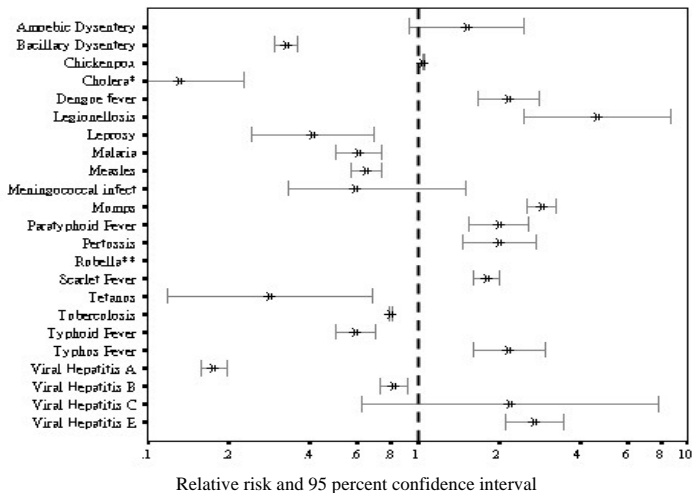
The analysis shows that the incidence rates after CEPA is significantly

higher than those before CEPA in 9 of 29 infectious diseases. They are chickenpox, dengue fever, legionellosis, mumps, paratyphoid fever, scarlet fever, typhus fever, Hepatitis E, and Pertussis.

Although the increase of MCT accounts for the largest part of the increased inbound non-Hong Kong resident travelers, non-Hong Kong resident travelers from places other than Mainland China are also in an increased trend. (Table 1) Therefore, simply from the fact that the incidence rate of the nine Notifiable Infectious Diseases has significantly increased after CEPA, we are still unable to confirm the cause-effect association between the increased rate and CEPA. Taking the incidence of dengue fever as an example, although the incidence rate of dengue fever in Hong Kong has significantly increased after CEPA, all dengue fever cases identified (total 281 cases) were imported cases from 1997 to 2007, total of eleven years, except additional 20 and 1 indigenous cases in 2002 and 2003, respectively. Besides, the report published by some international organization shows the dengue fever epidemic and risk in countries of Southeast Asia is higher than in China. The number of cases of imported dengue fever identified in Taiwan during the last decade also appeared in an increased trend. We, therefore, infer that the increase of imported dengue fever cases should have no association with the Independent Travel of MCT. However, the fact that the number of cases of the remaining 20 Notifiable Infectious Disease does not increase significantly in Hong Kong after CEPA can not assure that the open policy allowing MCT visiting Taiwan will have no impact on the occurrence of infectious diseases. The scale of the impact of imported cases on the occurrence of some certain diseases such as measles and poliomyelitis in one country or area sometimes depends

on the immunization policy or control measures of the country or area.

The immunization coverage rate for OPV, DTP, and MMR vaccine in Taiwan reaches more than 95 percent so the herd immunity is higher in some diseases such as poliomyelitis, diphtheria, tetanus, pertussis, measles, mumps, and rubella. We, therefore, anticipate that it is not easy for the imported cases of the aforementioned disease to cause outbreak in Taiwan. For example, although measles is a highly infectious disease and several cases have been imported from outbreak happened in Japan in recent year, there has been only some scattered cases associated with the imported cases occurred in Taiwan. This supports that high immunization coverage can effectively prevent the imported cases from causing outbreak in the country.



* : The lower limit of 95 percent confidence interval (0.076 ~ 0.227)for cholera is less than 0.1.
 ** :Because both the lower and upper limit of 95 percent confidence interval (0.024-0.034) for rubella are less than 0.1, they are not presented in this Figure.

Figure 3. Relative risk of incidence of notifiable infectious disease during the periods of 2004-2007 and 1997-2002 in Hong Kong

4. Hong Kong was seriously hit by SARS from mainland China

Although the fact that several-fold increase of inbound MCT has not led to a relative increase in number of Notifiable Infectious Disease cases during 1997 and 2007, we do not actually support the hypothesis that MCT are a group of higher risk in terms of source of infectious disease. It has been well confirmed that the SARS outbreak in Hong Kong in 2003 was introduced from Mainland China. The SARS outbreak originated from mainland China has given Hong Kong or even the whole world a certain level of impact on economic and society.

5. Less impacts on the epidemic of acute infectious disease from allowing MCT visiting Taiwan than visiting Hong Kong

Although Hong Kong has set up infrared camera to perform fever screen for entering travelers at international airports and seaports, from the quarantine point of view, the epidemic of infectious disease in China could still be a threat to Hong Kong, because the purposes of this quarantine procedure mainly focus on the detection of human cases of avian influenza A (H5N1) [12-13] and MCT entering Hong Kong are mainly through the land route. In comparison with Hong Kong, Taiwan is supposed to be able to implement quarantine procedure more thoroughly since it is an island country and all passengers will have to enter through international airports or seaports, where infrared cameras for fever screen have been set up right after the SARS outbreak in 2003 and have successfully detected imported cases for several diseases such as dengue fever, bacillary dysentery, and chikungunya fever disease [14-17].

According to the previous report, immigrants to be a traveler



returning to his motherland for visiting their relatives or friends have higher risk of infection than general travelers.[18-19] The reasons may be that the general travelers usually have better socioeconomic status and will consult the epidemic situation in their destination location before leaving, but, in contrast, immigrants returning to their original country are usually less concerned about the risk of infection existing in the hometowns and the environmental sanitation in their original location which are usually poorer than their new living location. Based on this scenario, MCT visiting Taiwan should have higher socioeconomic status than those visiting Hong Kong. Since they will have to enter Taiwan, the island country, only by airplane or by ship, no land routes are available as to Hong Kong, and traveling cost is higher than to go to Hong Kong too. Therefore, MCT visiting Taiwan should have been coming from cities with lower risk in term of carrying an infectious disease.

Before open policy was issued, all persons traveling between Mainland China and Taiwan were required to transfer through Hong Kong, Korea, or other places. Although the transfer process has made travelers spend more time on the traffic, it was more advantageous for us to respond to possible imported cases in consideration of disease's incubation period. However, when the transfer requirements is lifted, several airports in both sides has to be opened for direct flights or sailing and the space access barrier will be disappeared, the shortened traffic time will be disadvantageous for us to prevent the disease from introduction. As a result, the threats resulting from opening for direct flight to Taiwan will be more similar to those to Hong Kong in terms of

disease control.

On the other hand, for some reasons such as Hong Kong's experience, Taiwan's geographical location, and Taiwan's more strict quarantine procedure will help us to anticipate the threats of infectious disease from Mainland China to Taiwan. Therefore, we believe the threat of disease outbreak in Taiwan will be less than Hong Kong when the open policy is implemented.

Conclusions and Suggestions

1. To enhance the ability to monitor and control the disease occurred in China

From the above-mentioned analysis, the number of cases of Notifiable Infectious Disease in Hong Kong did not increase significantly after a large amount of MCT has visited her. This means that the Independent Travel did not incur significant impacts on Hong Kong based on the data of currently known infectious disease. However, some unknown infectious disease (e.g., SARS or other unknown disease may result in serious epidemic even in a few number of imported cases) may cause serious impacts on the epidemic of Hong Kong or even the whole world. We assumed that the reasons why the SARS has spread widely in a very short time was China had very limited knowledge about SARS in the early stage of epidemic and, therefore, was unable to take effective prevention and control measures. Consequently, to enhance the ability to monitor and control the disease occurred in China, to improve the information exchange channel between both sides of the Strait, or even to validate the track of traveling



activities and residence location of MCT in Taiwan will be important for us to prevent and control the imported infectious disease.

2.To continually enforce international quarantine screen and domestic disease surveillance to preclude imported cases from spreading

Although China has commonly been considered as a serious epidemic area, the surveillance data obtained from Hong Kong and Taiwan shows the countries that the most number of imported cases in Taiwan during 2005 and 2007 have been originated were from the Southeast Asia countries of Indonesia, and then Vietnam. In fact, China was actually ranked as the second, and third imported source in 2005, 2006, and 2007, respectively. Therefore, Taiwan should take the advantage of being an island country to continually enforce international quarantine screen for all incoming passengers, and domestic disease surveillance to preclude imported cases from spread and to assure the safety of the citizens against epidemic infection.

3.To evaluate the impacts of the open policy on quarantine and infectious disease control periodically at different stages of the policy implementation in favor of modifying the quarantine and disease control policy and measures

Although Independent Travel did not significantly increase the total number of Notifiable Infectious Disease cases in Hong Kong, a significant increase was found in the number of cases of nine of the Notifiable Infectious Disease. In spite of the fact that the increase of the number of cases has no significant association with the Independent Travel, we still recommend that Taiwan, except enforcing currently established quarantine and disease control measures, should regularly

conduct evaluation and review of the impacts of the open policy on quarantine and infectious disease control at different stage of the policy implementation for a better understanding of the disease that have the most serious impact, and take steps to reconstruct effective quarantine and disease control measures.

Limitations

The data of number of inbound and outbound travelers, inbound non-Hong Kong resident travelers, and Notifiable Infectious Disease cases of Hong Kong presented in this report were obtained from the website of Hong Kong government, no original data was available for further analysis. Moreover, in the evaluation of risk of infectious disease, we could only describe the occurrence trend by using the data of the total number of Notifiable Infectious Disease cases. We also are unable to perform further analysis about the number of the total cases implicated in the imported cases from MCT or even to explore the association of the disease occurrence with the Individual Traveler Scheme for each of the Notifiable Infectious Disease.

Because of the data limitation, we can only compare the occurrence trend of the total number of Notifiable Infectious Disease cases with that of the total number of inbound and outbound travelers in around ten-year period. However, we are unable to compare the difference of the disease occurrence between MCT visiting Hong Kong and Taiwan and that between Hong Kong and Taiwan residents returning from visiting China, nor can we compare the difference of risk of infection between same number of MCT visiting Hong Kong and Taiwan and that between same



number of Hong Kong and Taiwan residents returning from visiting China.

Postscript

In October 2008, three months after the open policy of weekend direct chartered flight between the two sides of Strait has been implemented, we performed an evaluation of the risk of importing infectious disease cases from MCT, and found that there was no statistically significant difference ($P=0.357>0.05$) in illness rate between the travelers of weekend direct chartered flights and those of overall incoming flights and the incidence of cases of Notifiable Infectious Disease detected at international airport screening among travelers of weekend direct chartered flights is lower than that of overall incoming travelers ($1.125 \times 10^{-5} < 1.557 \times 10^{-4}$). In addition, one case for each of bacillary dysentery and chickenpox of Notifiable Infectious Disease were reported for each of the population of MCT and overall incoming travelers, respectively, during the three months period.

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