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Original Article

Epidemiological and Clinical Analysis of Melioidosis in Taiwan, 2006-2010

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Abstract

In order to understand the incidence rate, demographic characteristics, clinical symptoms, and underlying diseases of melioidosis, and to analyze the correlation between the rainfall and the occurrence of melioidosis, we conducted a study by using the data of confirmed melioidosis cases reported to the National Notifiable Communicable Disease Surveillance System and the Notifiable Communicable Disease Investigation System from 2006 to2010.

The melioidosis patients identified during 2006-2010 mainly clustered in Kaohsiung-Pingtung and southern regions in Taiwan, with an incidence rate of 7.8 and 3.2 per 100,000 population, respectively. A total of 175 melioidosis cases were confirmed, the male to female ratio was 4:1, the age group with most number (48.6%) of the patients was 40-59 years, and the majority (49.1%) of them was either unemployed or retired. The most commonly seen symptom was fever (67.4%). Of the 175 cases, 138 (78.9%) have been admitted to a hospital, 41 (23.4%) were fatal cases, 141 (80.6%) had a history of underlying diseases (mainly diabetes, 70.9%, and hypertension, 39.7%), and 33 (18.9%) had a direct contact with contaminated soil or flooding water.

The melioidosis infection occurs most often during July-September. Particularly, the melioidosis cases are most likely to occur following the flooding because of extremely heavy rain brought by typhoon. During 2006-2010, the monthly cumulative rainfall and the monthly number of cases of melioidosis occurring in the same month and the following month presented weak correlation that were statistically significant in Kaohsiung areas, and the correlation coefficient was 0.417 and 0.395, respectively. In Tainan areas, the weak correlation (correlation coefficient: 0.289) that was statistically significant was also found between the monthly cumulative rainfall and the monthly number of cases of melioidosis occurring in the same month. The regression analysis indicated that the incidence of melioidosis had a statistically significant correlation ($p < 0.001$, respectively) with both the occurrence of extremely torrential rainfall and torrential rainfall in Kaohsiung area. The monthly number of melioidosis cases occurred following the extremely torrential rainfall or torrential rainfall had an average of 8 and 7 more cases than those in the months without extremely torrential rainfall and torrential rainfall, respectively. In Tainan area, the incidence of melioidosis also had a statistically significant correlation with the occurrence of both extremely torrential rainfall and extremely heavy rainfall ($p < 0.001$, respectively). The monthly number of cases of melioidosis in months with extremely torrential rainfall or extremely heavy rainfall increased with an average of 7 and 4 cases, respectively, as compared with those in months without extremely torrential rainfall or extremely heavy rainfall.

Keywords: melioidosis, incidence rate, rainfall

Introduction

Melioidosis, a zoonotic disease, is caused by infection of *Burkholderia pseudomallei* existing in soil or water, which mainly distributes in tropical areas between 20 degree North and 20 degree South latitude. The major epidemic areas for the disease are Southeast Asia and northern Australia [1] and the epidemic time is monsoon season in these areas. Since Taiwan is geographically located near the melioidosis-distributed latitude and covers areas of both tropical and subtropical climate regions, she has a similar risk of melioidosis infection as that in countries of Southeast Asia. In 1985, the first melioidosis case, an imported case from Philippines, was reported in Taiwan [2]. From 1985 to 2000, a total of 17 indigenous cases and 2 imported cases of melioidosis were identified in Taiwan areas [3]. The Centers for Disease Control in Taiwan (Taiwan CDC), therefore, added melioidosis to the list of diseases for routine surveillance in 2000. The melioidosis may occur either sporadically, such as the unknown-cause sudden death case that occurred in students of a military academy in southern Taiwan in 2004 and was confirmed by molecular biological method to be melioidosis, or in a cluster pattern, like the event of large-scale melioidosis infections among residents living along Ir-Ren river basin in 2005 [4-5]. In October 2007, melioidosis was included in the list of Category 4 communicable diseases.

The data collected through the National Notifiable Communicable Disease Surveillance System in Taiwan from 2006-2010 showed that the annual number of confirmed indigenous melioidosis cases nationwide had only minor fluctuations in 2008 (40 cases), 2009 (44 cases), and 2010 (45 cases), except a relatively lower number in 2006, 29 cases, and 2007, 17 cases [6]. The incidence rates also present only a slightly increasing trend in 2006 (0.127 per 100,000 populations), 2008 (0.174), 2009 (0.191), and 2010 (0.194), except a relatively lower level in 2007, 0.027 per 100,000 population [6-7]. Previous studies have documented that the occurrence of melioidosis was associated with typhoon, rainfall, flood, and underlying diseases [8-11]. In order to further understand the status of melioidosis in Taiwan, this study particularly focused on the analysis of epidemiology and clinical symptoms of melioidosis as well as the analysis of factors, such as rainfall, that may affect the occurrence of melioidosis.

Materials and Methods

A. Case definition

Based on Guideline for Notifiable Communicable Disease Surveillance 2009, [12] the confirmed cases of melioidosis are defined as those that meet the clinical manifestation (with varied clinical presentations ranging from no symptoms or localized skin lesions to severe pneumonia or even to general sepsis or septic shock) and have the laboratory evidence of infections (*Burkholderia pseudomallei*, the etiologic agent of human melioidosis, is isolated and confirmed from clinical specimens, such as throat swabs, respiratory excretion, pus, or blood). In addition, during 2006-2008, the case definition for notification of melioidosis was that the cases have varied clinical presentations ranging from no symptoms or localized skin lesions to severe pneumonia or even to general sepsis or septic shock and that the isolates cultured from clinical specimens collected from the cases was suspected to be *Burkholderia pseudomallei*.

B. Data sources of cases

The data for cases of melioidosis confirmed for 2006-2010 were collected from the National Notifiable Communicable Disease Surveillance System and the Notifiable Communicable Disease Investigation System operated by Taiwan CDC, including sex, age, residential address, occupation, nationality, month of onset, clinical symptoms, underlying diseases, open wounds (such as lacerations, abrasion, or burns) on skin before onset, death records, and other relevant epidemiology investigation data.

C. Data source of rainfall

The data about monthly cumulative rainfall in Kaohsiung and Tainan regions were downloaded from the website of the Division of Climate Statistics of the Central Weather Bureau [13]. Based on the rainfall classification criteria, extremely heavy rain means that the volume of a 24-hour cumulative rainfall exceeds 130 millimeters, torrential rain represents that it reaches to 200 millimeters or more, and extremely torrential rain indicates that it is 350 millimeters or more.

D. Data processing and analysis

The frequency and percentage were used to describe and analyze the occurrence of melioidosis in a variety of factors for the survival and expiring cases, respectively. The Pearson’s correlation coefficient was applied to express the relationship between the monthly cumulative rainfall and monthly cumulative cases and to analyze whether the correlation between the occurrence of melioidosis and the rainfall are statistically significant. In addition, the daily rainfall measured two days before a typhoon makes landfall and the daily rainfall measured within three days after the typhoon leaves land are added together to decide whether the monthly cumulative rainfall have reached the level of extremely heavy rain, torrential rain, or extremely torrential rain. Then, a regression analysis and statistical significance test were performed to compare the monthly number of cases of melioidosis occurred in the month following the month when extremely heavy rain, torrential rain, or extremely torrential rain was measured at usual time with that occurred in the month immediately following a typhoon during 2006-2010 in Kaohsiung and Tainan regions, respectively.

Results

A. Number of cases of melioidosis occurred in Taiwan areas during 2006-2010

Table 1 shows that the confirmed melioidosis cases in Taiwan mainly clustered in Kaohsiung-Pingtung region (Kaohsiung City, Kaohsiung County, Pingtung County, and Penghu County), followed by southern Taiwan region (Yunlin County, Jiayi County & City, Tainan County & City), middle Taiwan region (Taichung County & City, Zhanghua County, and Nantou County), northern Taiwan region (Taoyuan County, Hsinchu County & City, and Miaoli County), eastern Taiwan region (Hualian County and Taitung County), and Taipei region (Keelung City, Taipei County & City, Ilan County, Kinmen County, and Lianjiang County) [6]. The county with the highest number of confirmed melioidosis cases was Kaohsiung City, followed by Tainan City, and then Pingtung County. However, some counties, such as Taipei City, Ilan County, Kinmen County, Lianjiang County, Hsinchu County & City, and Miaoli County, have never identified indigenous melioidosis cases. The average incidence rate of melioidosis in southern Taiwan region reached to 3.2 per 100,000 population during 2006-2010, much higher than other years, and, during the same period, the incidence rate in Kaohsiung-Pingtung region has largely risen to 7.8 per 100,000 population.

B. Characteristics description of the confirmed cases

The data of 175 cases of confirmed indigenous melioidosis identified during 2006-2010 were collected from the National Notifiable Communicable Disease Surveillance System and the Notifiable Communicable Disease Investigation System. The descriptions of the demographic characteristics, survival status, hospitalization history, underlying diseases, and occupation of the confirmed melioidosis cases are presented in Table 2. The male to female ratio of confirmed melioidosis cases was 4:1, nearly half of the cases occurred in 40-59 age group, 78.9% had a history of admission to a hospital for medical treatment, 80.6% had a history of underlying disease, and 49.1% were either unemployed or retired. The statistical test reveals that no significant differences in fatality rate existed between different sex, age group, and groups with or without underlying disease (each of the p-value is higher than 0.05). In addition, the symptoms commonly seen in these cases in descending order were fever in 118 (67.4%) cases, cough in 22 (12.6%), abdominal pain in 21 (12.0%), dyspnea in 19 (10.9%),

Table 1. The number of confirmed indigenous and imported melioidosis during 2006-2010 in Taiwan, by region

Year	Taipei	Northern	Middle	Southern	Kaohsiung-Pingtung	Eastern	Total
2006	1	1	1 (1)	6 (1)	20	0	29 (2)
2007	0	0	3	5	9	0	17
2008	0 (3)	0 (1)	2 (1)	5	33	0	40 (5)
2009	0	1	1	11	30	1	44
2010	0	1	1	6	36	1	45
Total	1 (3)	3 (1)	8 (2)	33 (1)	128	2	175 (7)

Note: The number in the parentheses represents count of imported melioidosis cases.

Table 2. The demographical characteristics, survival status, hospitalization history, underlying disease, and occupation of the 175 cases of melioidosis identified during 2006-2010

Items	Survival		Death		Total	
	Number	%	Number	%	Number	%
Gender						
Male	109	81.3	29	70.7	138	78.9
Female	25	18.7	12	29.3	37	21.1
Age groups						
< 19	0	0.0	1	2.4	1	0.6
20-29	0	0.0	0	0.0	0	0.0
30-39	6	4.5	2	4.8	8	4.6
40-49	30	22.3	8	19.5	38	21.7
50-59	34	25.4	13	31.7	47	26.9
60-69	25	18.7	4	9.7	29	16.6
70-79	24	17.9	8	19.5	32	18.2
≥ 80	15	11.2	5	12.2	20	11.4
Hospital admission						
Yes	111	82.8	27	65.9	138	78.9
No	15	11.2	10	24.4	25	14.2
Unknown	8	6.0	4	9.7	12	6.9
Underlying diseases						
Yes	106	79.1	35	85.4	141	80.6
No	27	20.1	3	7.3	30	17.1
Unknown	1	0.8	3	7.3	4	2.3
Occupations*						
Unemployed & retired	68	50.7	18	43.9	86	49.1
Technique-related worker	12	9.0	3	7.3	15	8.6
Farming, forestry, fishing, or livestock industry worker	13	9.7	1	2.4	14	8.0
Low-skilled worker or primary labor	20	14.9	7	17.2	27	15.4
Others	2	1.5	2	4.8	4	2.3
Unknown	19	14.2	10	24.4	29	16.6

*People who are applying academic knowledge or technique to work for architecture, metal foundry, or metal construction; for installation, operation, maintenance, and reparation of tools or equipments; for press; for manufacturing or treatment of food, textiles, wooden, and metallic products and others, for manufacturing of various handicrafts are called technique-related worker. People who are performing simple and routine tasks, such as cleaning, transporting material by hands, garbage collection, sorting or packing products by hands, driving a non-powered vehicle, housekeeping, and harvesting vegetable and fruits, are called low-skilled worker or primary laborers.

headache in 17 (9.7%), fatigue in 8 (4.6%), and vomiting in 4 (2.3%). Thirty-six (20.6%) of the cases were diagnosed with pneumonia. Of the 141 cases with underlying diseases, 100 (70.9%) were patients with diabetes, 56 (39.7%) with hypertension, 19 (13.5%) with heart disease, 7 (5.0%) receiving dialysis, 6 (4.3%) with alcoholism, and 6 (4.3%) with stroke. Forty-five (25.7%) of the cases had open wounds, such as lacerations, abrasion, or burns, on skin before onset of melioidosis and 29 of them had a history of diabetes. Only 33 (18.9%) of the cases had a history of exposure to flood water, silt, or mud because of cleaning flooded fruit farms, perch fish farms, and basement, or repairing electricity and water supply system immediately following the typhoon strikes.

C. Correlation between occurrence of melioidosis cases and rainfall

Since the cases of confirmed melioidosis were mostly concentrated in Kaohsiung-Pingtung and southern Taiwan regions, we analyzed the correlation between the occurrence of melioidosis and cumulative rainfall in Kaohsiung and Tainan areas during 2006-2010. The correlation between monthly number of melioidosis cases and monthly cumulative rainfall in the same month in Kaohsiung area is shown in Figure 1. The correlation coefficient between them is 0.417, reaching statistical significance ($p < 0.001$). The analysis also indicated that the correlation between the monthly cumulative rainfall and the monthly number of melioidosis cases occurred in the following month has statistical significance (correlation coefficient is 0.395, $p < 0.01$). Figure 2 presents the correlation between monthly number of melioidosis cases and monthly cumulative rainfall of the same month in Tainan area. The correlation coefficient between them is 0.289, reaching statistical significance ($p < 0.05$). However, the correlation between the monthly cumulative rainfall and the monthly number of melioidosis cases occurred in the following month has no statistical significance (correlation coefficient is 0.055, $p > 0.05$). In addition, we found that when the monthly cumulative rainfall reached the peaks, a relatively higher number of cases of confirmed melioidosis were identified in the same

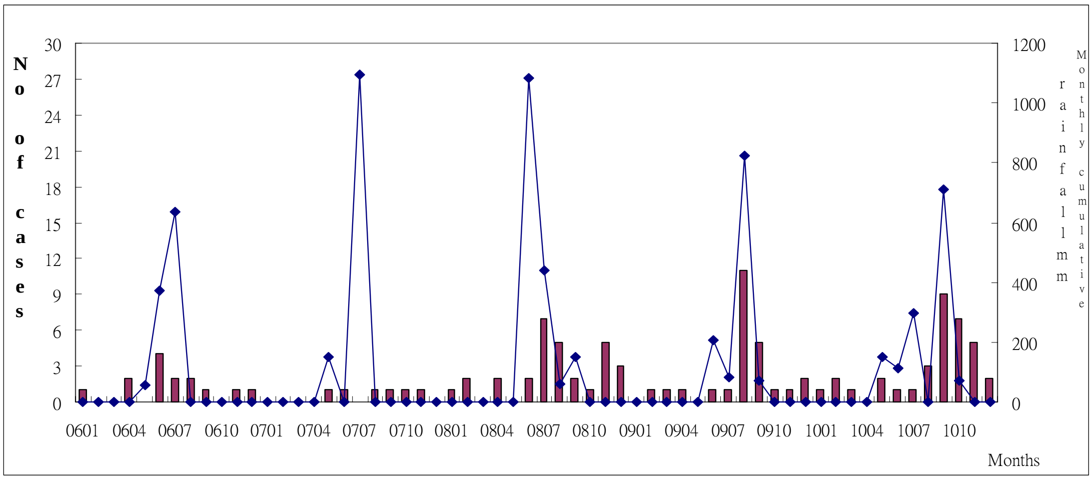

Figure 1. Correlation between monthly number of melioidosis cases and monthly cumulative rainfall in Kaohsiung area during 2006-2010

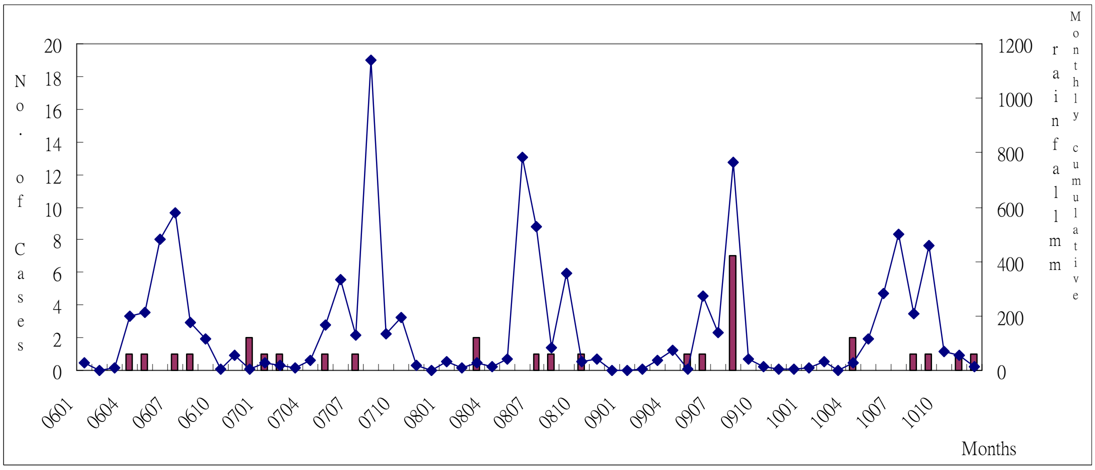

Figure 2. Correlation between monthly number of melioidosis cases and monthly cumulative rainfall in Tainan area during 2006-2010

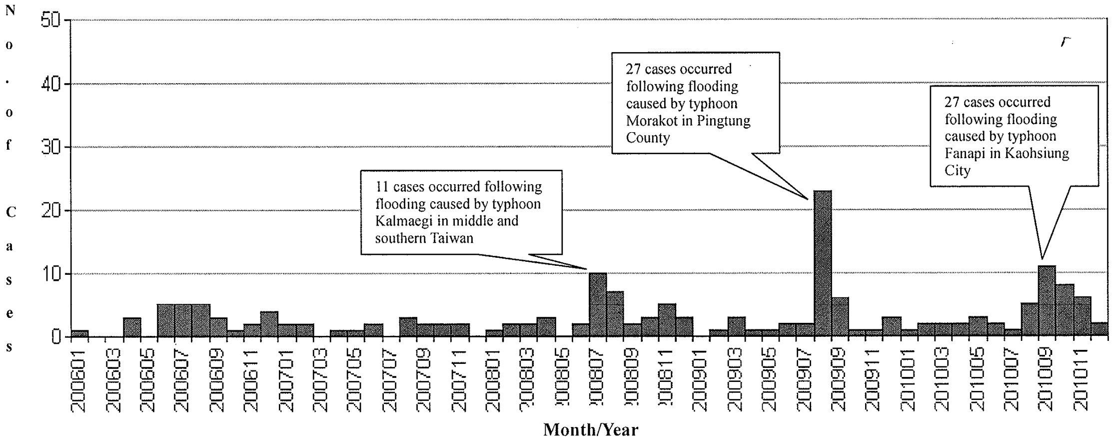

Figure 3. Trends in the distribution of confirmed indigenous cases of melioidosis in Taiwan during 2006-2010

or the following months in Kaohsiung area in 2006, 2008, 2009, and 2010, as shown in Figure 1. Similar tendency was also found in Tainan area where when the monthly cumulative rainfall reached the peak, the number of cases of confirmed melioidosis was relatively higher in the same or following months in Tainan area in 2009.

In Figures 1 and 2, the time when the cumulative rainfalls reach peaks between July and September is usually the period that the typhoon strikes frequently occur and is just the summer and autumn season when the people are most likely to become infected with melioidosis. Figure 3 shows that 11 cases of melioidosis were identified following the strikes of moderately intense typhoon, Kalmaegi, that leads to flooding in middle and southern Taiwan in July 2008. In August 2009, typhoon Morakot brought extremely torrential rain and caused disastrous floods to Tainan and Kaohsiung areas, and 27 cases of melioidosis were identified after the strikes. In September 2010, typhoon Fanapi brought extremely heavy rain to Tainan areas and also caused floods in the Lotus Pond area of Kaohsiung City. As a result of the strikes, 27 cases of melioidosis were confirmed. We, therefore, performed a regression analysis to verify the hypothesis that the extremely heavy rain, torrential rain, and extremely torrential rain brought by typhoon are associated with the monthly incidence of melioidosis. The analysis supported that the correlation between the incidence of melioidosis and extremely torrential rain has a statistical significance ($p < 0.001$) in Kaohsiung area during 2006-2010. The linear regression model obtained is: $Y=1.439+7.561*X$. In Tainan area, the correlation between the incidence of melioidosis and extremely torrential rain has a statistical significance ($p < 0.001$), too. The linear regression model created is:$Y=0.390+6.610*X$. In these two models, Y represents monthly number of cases of melioidosis (to be interpreted in the same way hereafter), and X means whether the volume of rainfall reaches the level of extremely torrential rain and is defined as 1 if extremely torrential rain has occurred and 0 if extremely torrential rain has not been observed. When torrential rains occur, a statistical significance ($p < 0.001$) also exists in the analysis of correlation between the incidence of melioidosis and torrential rain in Kaohsiung area. The linear regression model is: $Y=1.273+6.527*X$, where X=1 means that an extremely torrential rain or torrential rain has occurred and X=0 has not occurred. Regarding the extremely heavy rain, the correlation between the extremely heavy rain and clustering of melioidosis reaches a statistical significance ($p < 0.001$) in Taiwan area. The linear regression equation formulated is: $Y=0.379+3.621*X$, where X=1 means that an extremely torrential rain, torrential rain, or extremely heavy rain has occurred and X=0 has not occurred.

Discussions

The countries that reported the most number of cases of melioidosis in the world are Thailand and Australia, especially in northeastern Thailand and northern Australia, where are considered as endemic areas of the melioidosis. With regard to the incidence rate of melioidosis, it was 4.4 per 100,000 population in north-eastern Thailand during 1987-1991 and has increased from 11.53 per 100,000 population in 1987 to 21.3 in 2006, with an average of 12.7 per 100,000 population [14]. The average incidence rates of melioidosis in the second largest province, Queensland, in Australia during 2000-2009 were changing from 1.4 per 100,000 population in Cairns to 3.3 in Townsville and about 40 in aboriginal residing areas (including Torres Strait, Northern Peninsula Area, Mt Isa, and Cape York) [15]. In addition, the incidence rates of melioidosis in northern Australia during 2009-2010 were 50.2 per 100,000 population in Top End areas and 102.4 in aboriginal residing areas [16]. In Taiwan, the average incidence rates in the two areas, southern Taiwan and Kaohsiung- Pingtung regions, where melioidosis are most likely to occur, were 3.2 and 7.8 per 100,000 population, respectively, during 2006-2010, which are still far lower than those in northeastern Thailand and northern Australia. As to the case fatality rate of melioidosis, it was 50% in northeastern Thailand [17] and 19% in Australia during 1989-1999 [18], 26% during 2000-2004, and 14% during 2005-2009 [16]. The case fatality rate in Taiwan was 23.6%, falling in between the values in Thailand and Australia. Therefore, the melioidosis has still not become a serious endemic disease in Taiwan even in the Kaohsiung-Pingtung and southern Taiwan regions where has relatively high incidence rate. However, the melioidosis is still worthy of notice to the disease control authorities in Taiwan because of the slightly higher case fatality rate. More than half of the melioidosis patients identified in foreign countries present with pneumonia [19-20], for example, the study conducted by Currie, et al. found that 51% (278/540) of the cases have symptom of pneumonia [19]. However, only 20.6% (36/175) of the confirmed melioidosis cases in Taiwan present pneumonia. Other important clinical manifestations, including urinary and genital tract infections, and skin or soft tissue infections, were also reported in cases identified in Australia and Thailand, but were much less frequently mentioned in cases of Taiwan [20]. Previous studies indicated that melioidosis patients have a higher percentage of having underlying diseases, such as diabetes, kidney disease, chronic lung disease, and thalassemia [20-21]. These chronic diseases were also considered as risk factors for melioidosis infections. Of the 141 melioidosis patients with underlying diseases, 70.9% had diabetes, 39.7% had hypertension, 13.5% had heart disease, and a low percentage had other underlying diseases.

Previous studies reported that the number of cases of melioidosis in male is usually larger than that in female, with a male to female ratio of 7:3 [11, 19]. That is to say that the risk of acquiring melioidosis in male is 2.4 times higher than that in female (95% confidence interval 1.9-3.0) [20]. In Taiwan, the male to female ratio in patients with melioidosis was 4:1. This indicates that the proportion of melioidosis cases in male is much higher than that in female, as compared with other countries. Bhengsri et al. reported that the highest incidence rate for melioidosis was recorded in people aged 50-59 years old in eastern and northeastern Thailand. Cheng et al. found that the risk of contracting melioidosis for people 45 years of age and over was 4.0 times higher than those under 45 years old (95% confidence interval 3.2-5.1) [20].

The melioidosis is mainly transmitted through direct contact of open wound in the skin with soil or water contaminated with pathogens [17]. In this study, 8.0% of the melioidosis cases were performing work in relation to farming, forestry, fishing, or livestock activities. Therefore, they were very likely to acquire the disease because of exposure to contaminated mud or dirty water. There were 18.9% of confirmed melioidosis cases who have had a contact with mud, dirty water, or flood water and pooling water caused by typhoon in the basement. The extremely heavy rain or flooding occurring in monsoon season or brought by typhoon may even cause infection of melioidosis in many people [11, 15, 22]. For example, all the flooding caused by Kalmaegi typhoon in middle and southern Taiwan in July 2008, Morakot typhoon in Pingtumg County in August 2009, and Fanapi typhoon in Kaohsiung City in September 2010 have lead to the occurrence of infection of melioidosis (with 11, 27, and 16 cases, respectively). A survey collecting soil specimens from the fields along the Er-Ren River and the freeway was conducted to better understand the distribution of *Burkholderia pseudomallei* in the natural environment all over Taiwan. The results show that the existence of *Burkholderia pseudomallei* was limited only in some villages or townships where were active in agricultural production in Er-Ren River basin and middle and southern Taiwan [23]. These findings support that the people residing in these regions may have the risk of contracting melioidosis for the sake of contact with soil or water contaminated with *Burkholderia pseudomallei*. The melioidosis may also spread through routes other than direct contact. Particularly, Currie and Jacups indicated in their study that, under very heavy rain conditions, the infection of melioidosis may occur mainly through inhalation, but not through contact with contaminated aerosol or soil [22]. In this study, since the patients who were unemployed/retired (49.1%) and in unknown occupation (16.6%) account for a very high proportion of the confirmed melioidosis cases, we were unable to conduct further analysis on whether the infection of melioidosis were associated with occupational exposure.

The study shows that the monthly cumulative rainfall and the monthly number of cases of melioidosis occurring in the same month has statistically significant correlation in Kaohsiung and Tainan areas during 2006-2010 although the correlation coefficients (0.417 and 0.289, respectively) are not high. However, the correlation between the monthly cumulative rainfall and the monthly number of cases of melioidosis occurring in the following month were statistically significant only in Kaohsiung area (with a correlation coefficient 0.395). Furthermore, the number of cases of melioidosis increased obviously following the strikes of typhoon during 2006-2010, as shown in Figure 3. The regression analysis also supported that both the occurrence of extremely torrential rainfall and torrential rainfall had a statistically significant correlation ($p < 0.001$, respectively) with the incidence of melioidosis in Kaohsiung area. The monthly number of melioidosis cases occurred following the extremely torrential rainfall and torrential rainfall had an average of 8 and 7 more cases than those in the months without extremely torrential rainfall and torrential rainfall, respectively. In Tainan area, the incidence of melioidosis also had a statistically significant correlation with the occurrence of both extremely torrential rainfall and extremely heavy rainfall ($p < 0.001$, respectively). The monthly number of cases of melioidosis in months with extremely torrential rainfall or extremely heavy rainfall increased with an average of 7 and 4 cases, respectively, as compared with those in months without extremely torrential rainfall or extremely heavy rainfall. Although the cumulative rainfall is closely related to wind speed, but people usually do not perform outdoor activities during the typhoon striking period, we do not explore whether a correlation between the wind speed of a typhoon and case clustering of melioidosis exists.

In any case, this study was performed mainly in description of the incidence rate, demographic characteristics, symptoms, and underlying diseases of melioidosis, and in analysis of the correlation between the cumulative rainfall and the occurrence of melioidosis. However, we do not analyze whether the items on demographic characteristics and underlying diseases are the risk factors of acquiring melioidosis, which are worthy of further exploration.

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Outbreak Investigation Express

A Preliminary Report of the Preparedness and Response to Avian Influenza A(H7N9) Infections, Taiwan, 2013

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Abstract

Outbreak of human infections with avian influenza A(H7N9) was reported by China in March 2013. This is the first time that humans infected by avian influenza A(H7N9) virus and cause fatalities. Human infections by this virus continue to be reported in China. Because of frequent cross-strait exchanges, human H7N9 infections in China are menacing. The Infectious Diseases Advisory Committee meeting convened by Department of Health on April 3 and recommended to enact the "Pandemic Influenza Preparedness Plan", use 4 major strategies and 5 defense lines in response. Listed the H7N9 influenza as Category V Notifiable Infectious Disease; organized the Central Epidemic Command Center for H7N9 influenza; and collaborating and managing the resources to ensure effective response with relevant departments. The preliminary responses are outbreak surveillance, border quarantine, medical system assembly, risk communication and response, antiviral medicine stockpile, and vaccine preparation. To response timely, continue updating the newest outbreak information in domestic and international societies.

Keywords：H7N9 influenza, pandemic influenza

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