Do the Floods Have the Impacts on Vector-Born Diseases in Taiwan?

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Abstract

To investigate if the Typhoon Nari that occurred in September 6 2001 had any impacts on communicative diseases in Taiwan, we surveyed the data from the Epidemiological Bulletins published in Center for Disease Control (Taiwan) from January 2000 to April 2002. The medians of confirmed cases for dengue fever, Japanese encephalitis and rickettsia were 3, 0 and 14, respectively. The gradual surge of dengue fever was noted since October 2001 and persisted for 7 months. Rickettsia infection had the same tendency and persisted for even five months. Analysis of the run charts revealed that there were no endemic episodes of Japanese encephalitis after Nari. For dengue fever, there were two surges; that is, one being the period from August 2000 to November 2000, the other being the period from October 2001 to April 2002. According to the analysis of the curve, the latter surge was statistically significant. There were also two surges over the observation period for rickettsia infection. The first one was during May 2000 to January 2001, whereas the second one during November 2001 to March 2002. However, neither of the surges met the criteria of significance. In conclusion, the floods due to Nari actually brought the endemic outbreaks of dengue fever. Vector control remains an important issue for post-flood disease surveillance. *(Ann. Disaster Med 2002;1:43-50)*

Key words: Floods; Vector; Epidemiology

Introduction

Many researches revealed that dimate change during the next century may exacerbate many of the health threats in human beings, especially in resource-poor countries. These threats include disruption of water and food supplies by extreme weather events and the enhanced spread of vector-borne diseases.[1] For example, even under the most optimistic scenarios for reducing greenhouse gas emissions, average global temperatures will likely rise at least 2.5°C to 3.0°C over the next few centuries.[2] This is significant above the threshold for substantially increasing

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climate-related health threats.[3] Besides, global warming is likely reshaping the ecology of many medically important arthropod vectors. Warmer temperatures have been shown to directly increase mosquito and tick vector reproduction, biting, and pathogen transmission despite shortening mean daily survivorship.[4] Related changes in rainfall, humidity, and the El Niño/Southern Oscillation (ENSO) may alter the quality and availability of some vector breeding sites. With the advance of scientific development, remote sensing and geographic information systems have become powerful tools to study vector populations and distributions.[5]

Climate change may increase the risk of both river and coastal flooding,[6] whose immediate effects include drowning and physical trauma.[7] Longer-term effects include increases in communicable diseases such as those caused by ingestion of contaminated water or contact with contaminated water. Respiratory infections may result from overcrowding of settlements or from overgrowth of molds in flooded homes.[8]

In Taiwan, Center for Disease Control (CDC) has been engaged in monitoring of various reportable or communicative diseases. We then conducted the following retrospective study to investigate if the Typhoon Nari that occurred in September 6 2001 had any impacts on communicative diseases in Taiwan.

Methods

Epidemiological data

The epidemiological data concerning communicable diseases are assessed from the Epidemiological Bulletin from CDC, Taiwan. We included the data from all of the Epidemiological Bulletins published from January 2000 to April 2002.[9] To monitor the state of notifiable infectious diseases effectively, diversified infectious disease surveillance and reporting systems have been installed by the Centers for Disease Control, which include: the National Notifiable Disease Surveillance; the Sentinel Surveillance; the Sentinel Hospitalized Surveillance; the Pilot Clinical Syndrome Surveillance; the Laboratory Surveillance; and the Toll-free Hotline. The National Notifiable Disease Surveillance System has been installed to tackle 38 notifiable diseases currently enlisted in Taiwan, where any probable case found by physicians or medical staff island-wide is to be reported within a designated time by filling out a case report form and filed with the local health administration or directly to the bureau.

The focus of the study was based upon the most common vector-born communicative diseases such as dengue fever, Japanese encephalitis, malaria, and typhus fever (rickettsia).

Statistics

The categorical data were inputted in Microsoft Excel 2000 for descriptive statistics and further qualitative analysis. These results were depicted as the run charts. The analysis of the run charts were performed according to an established gudieline.[10]

Results

Epidemiology of vector-borne diseases

Table depicts the epidemiological data concerning vector-borne diseases released from the Epidemiological Bulletin from CDC, Taiwan from January 2000 to March 2002. Typhoon Nari swept Taiwan from September 9 to September 16 2001. The gradual surge of dengue fever was noted since October 2001 and persisted for 7 months. Rickettsia infection had the same tendency and persisted for even five months. The medians for confirmed cases of dengue fever, Japanese encephalitis and rickettsia were 3, 0 and 14, respectively.

Figure depicts the overall changes in numbers of confirmed cases for each disease. To compare with its median value, there were no endemic episodes of Japanese encephalitis after Nari. For dengue fever, there were two surges; that is, one being the period from August 2000 to November 2000, the other being the period from October 2001 to April 2002. According to the analysis of the curve, the latter surge was statistically significant.

The same results can be observed for the cases of rickettsia infection. There were also two surges over the observation period. The first one was during May 2000 to January 2001, whereas the second one during November 2001 to March 2002. However, neither of the surges met the criteria of significance.

Discussion

Radiative effects of anthropogenic changes in atmospheric composition are expected to cause climate changes, in particular an intensification of the global water cycle with a consequent increase in flood risk.[6,11] Flooding occurs when normally dry land is inundated with water. Flooding may result from bodies of water overflowing their banks, including artificial ones like dams; structural failure of dams and levees; rapid accumulation of runoff or surface water; typhoon-caused storm surges or earthquake-caused tsunamis; or erosion of a shoreline. A well-established flood-fighting system and planning may be the fundamental step for flood mitigation.[12] Early warning system and emergency public information, inter-agency cooperation, search and rescue, long-term health surveillance are all important issues included in it.[12] In this study, what we are concerned is the impact of the floods on public health, especially on vector-borne diseases. The epidemiological data revealed that there was an increase in vector-borne diseases such as dengue fever one month after Typhoon Nari with her devastating floods.

In general, natural disasters do no usually result in massive outbreaks of infectious disease, although in certain circumstances they do increase the potential for disease transmission.[7] In the short-term, the most frequently observed increases in disease incidence are caused by fecal contamination of water and food;[13] hence, such diseases are mainly enteric. In the long-term, an increase in vector-borne diseases occurs in some areas because of disruption of vector control efforts, particularly following heavy rains and floods.[12] Residual insecticides may be washed away from buildings and the number of mosquito breeding sites may increase. Moreover, displacement of wild or domesticated animals near human settlements brings additional risk of zoonotic infections.[13]

In the episode of Nari-related floods, the vectors such as mosquitoes did increase significantly in spite of the efforts of CDC. We believe that the condition might be more severe in lack of the efforts of CDC in vector control after the natural disasters. Other personnel from environment protection and sanitation surveillance may also become important links in preventing endemic vector-borne diseases. Because natural disasters may increase the risk of preventable diseases due to adverse changes of population density, population displacement, disruption and contamination of water supply and sanitation services, disruption of public health programs, ecological changes that breed vectors, displacement of domestic and wild animals, and provision of emergency food, water and shelter.[14] The principles of controlling communicable diseases after a disaster are to implement as soon as possible all public health measures to reduce the risk of disease transmission, to organize a reliable disease reporting system, and to investigate all reports of disease rapidly to make early clarification of the situation.[14] We still confirm the works of our CDC. However, we have to emphasize the inter-agency cooperation for the entire disease surveillance system and control will be the way for us to take efforts in.

The limitation of this study is the short follow-up period. Accordingly, the definite cause-effect relationship may be well established after at least three years' observations.[10,15] We may use the data in past 3 years for retrospective study, but the result may be not so informative. In addition, we cannot exclude completely any concomitant factors that may have impacts on public health. For example, a long-term follow-up may elucidate if any seasonal diurnal changes may play a role in the results.

Table. Epidemiology of the three main vector-borne diseases in Taiwan (Jan 2000 to Apr 2002)

	Dengue fever		Japanese encephalitis		Rickettsia	
	Reported	Confirmed	Reported	Confirmed	Reported	Confirmed
Jan-00	28	2	23	0	48	14
Feb	31	2	23	0	53	12
Mar	45	3	34	0	69	3
Apr	46	0	18	0	62	8
May	82	1	48	0	120	25
Jun	71	3	52	1	157	44
Jul	76	6	59	10	113	21
Aug	140	36	44	2	204	30
Sep	140	47	28	0	122	30
Oct	80	22	23	0	103	30
Nov	83	14	15	0	113	28
Dec	32	3	19	0	110	24
Jan-01	22	1	7	0	75	16
Feb	24	1	9	0	76	5
Mar	54	2	34	0	65	3
Apr	44	0	24	0	75	3
May	51	1	28	1	97	4
Jun	56	1	56	15	124	1
Jul	78	7	44	7	134	6
Aug	112	8	43	3	159	11
Sep	64	3	16	0	94	0
Oct	118	61	19	1	107	14
Nov	231	105	19	0	139	21
Dec	130	40	16	0	81	16
Jan-02	72	31	9	0	88	15
Feb	45	22	10	0	78	17
Mar	33	14	8	0	79	14
Apr	28	13	7	0	65	7

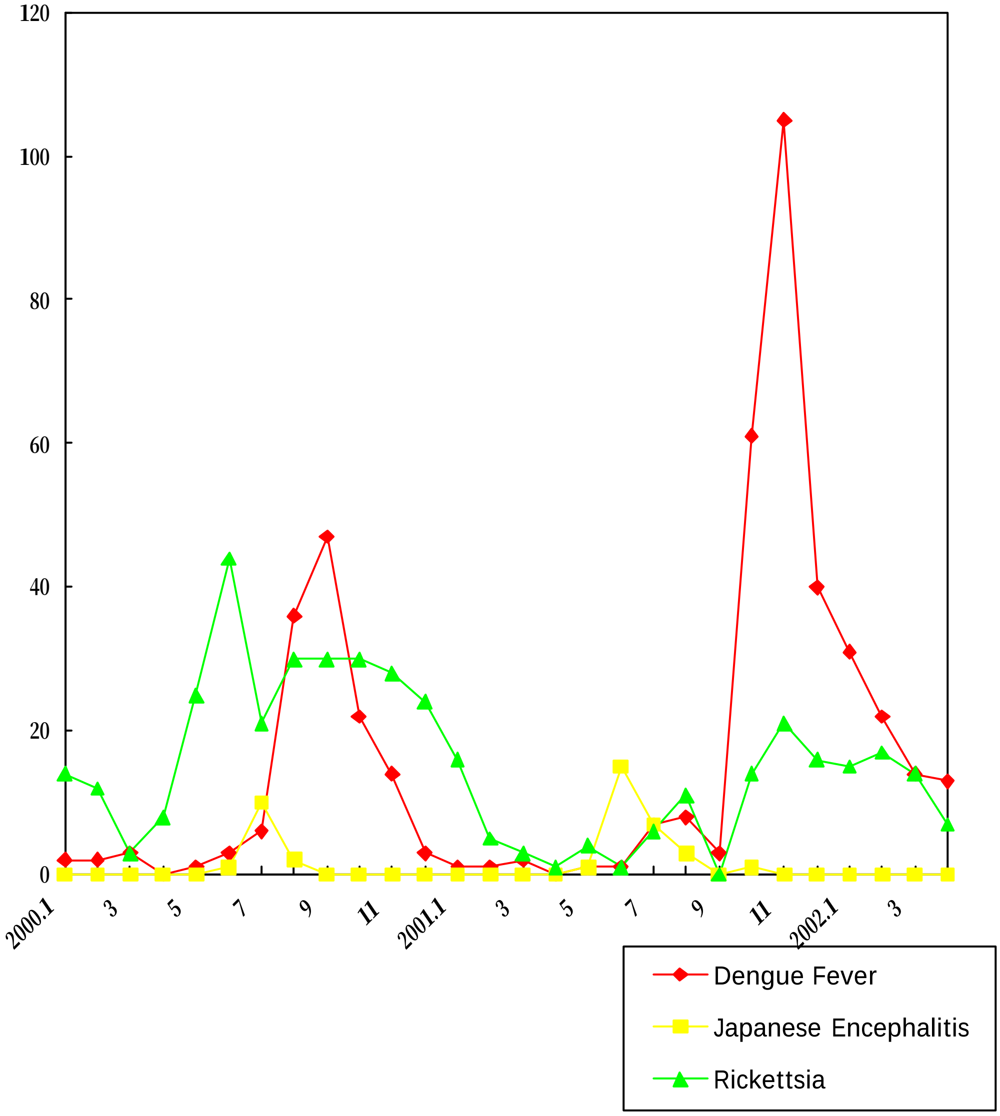

Figure. The run charts of three main vector-borne diseases (dengue fever, Japanese encephalitis and rickettsia) during January 2000 to April 2002.

References:

1. Patz JA, Engelberg D, Last J. The effects of changing weather on public health. Annu Rev Public Health. 2000;21:271-307
2. Intergovernmental Panel on Climate Change. Climate Change 2001: The Scientific Basis. Sec. 9.3.3.1. Available at: http://www.ipcc.ch/pub/tar/wg1/354.htm#fig916 .
3. Hadley Centre. The Greenhouse Effect and Climate Change. Berkshire, England: Hadley Center; 1999
4. Yoganathan D, Rom WN. Medical aspects of global warming. Am J Ind Med. 2001;40:199-210
5. National Research Council. Under the Weather: Climate, Ecosystems, and Infectious Disease. Washington, DC: National Academy Press; 2000
6. Milly PC, Wetherald RT, Dunne KA, Delworth TL. Increasing risk of great floods in a changing climate. Nature 2002;415:514-7
7. Malilay J. Floods. In: Noji E, ed. The Public Health Consequences of Disasters. New York, NY: Oxford University Press. 1997;287-301
8. Patz JA, Khaliq M. Global climate change and health: challenges for future practitioners. JAMA 2002;287:2283-4
9. Center for Disease Control, Taiwan, ROC. The Epidemiological Bulletins 2001;17:1-643
10. Cubasch, U. In: Houghton J T, et al. ed. Climate Change 2001: The Scientific Basis. Ch. 9 Cambridge Univ. Press, Cambridge, 2001
11. Wheeler DJ. Understanding variation: the key to managing chaos. Tennessee: SPS Press (Statistical Process Control). 1993
12. FEMA. Guide for all-hazard emergency operations planning. Ch. 6 Hazard: unique planning considerations. Attachment B: flood/dam failure. 1996
13. Malilay J. Estimating health risks from natural hazards using with assessment and Epidemiology. Risk Analysis 1997;17:353-8
14. Pan American Health Organization (PAHO). Ch. 7 Epidemiological surveillance and disease control. In: PAHO ed. Natural disasters: protecting the public's health. Scientific publication No. 575, 2000;43-9
15. Taiwan Joint Commission on Hospital Accreditation. http://www.tjcha.org.tw/quality/quality_body02.asp

台灣水患對病媒傳染性疾病造成的衝擊

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摘要

為了研究台灣於 2001 **年** 9 **月** 6 **日發生的納莉颱風是否會造成任何的傳染病流行，我們研究了疾病管制局** 2000 **年** 1 **月至** 2002 **年** 4 **月在疫情報導中所公佈的資料。其中被証實的個案中，登革熱的中位數為每月** 3 **個病例、日本腦炎為每月** 0 **個病例及羌蟲病為每月** 14 **個病例。登革熱自** 2001 **年** 10 **月開始逐漸激增，並且持續了** 7 **個月。羌蟲病感染也有相同的趨勢，而且持續了至少** 5 **個月。經由推移圖的分析顯示，在納莉颱風之後，沒有地方性的日本腦炎病例。就登革熱病例而言，有二次激增情形發生，一次是在** 2000 **年** 8 **月至** 2000 **年** 11 **月期間，另一次則是在** 2001 **年** 10 **月至** 2002 **年** 4 **月期間；第二次激增有統計學上的意義。羌蟲病病例在觀察期間也有二次的激增情形發生，首先是在** 2000 **年** 5 **月至** 2001 **年** 1 **月期間，另一次是在** 2001 **年** 11 **月至** 2002 **年** 3 **月期間；然而沒有一次的暴增是符合重要的標準。因此，結論是納莉颱風造成的水患確實會引起地方性登革熱流行。病媒控制對於水患後的疾病管制仍然是極重要的課題。** *(Ann. Disaster Med 2002;1:43-50)*

關鍵詞：水患；病媒；流行病學

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