The Study of Dengue Fever Epidemic Prevention Based on Tainan City in 2015

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Abstract. Dengue fever is an infectious disease caused by dengue virus, and it is the world fastest-spread Vector-borne disease, whose incidence has increased 30 times in the past 50 years, and has overspread to new areas. Dengue fever is a kind of environmental disease, social disease, and its vector, Aedes albopictus and Aedes aegypti both had record that causing epidemics. However, there is still lack of efficient vaccine and therapy so far. Thus, the integral prevention and treatment is the main mean. (WHO, 2004) In recent years, Dengue fever has become an important public health problem not only in Taiwan but also in international. Taiwan is often troubled by Dengue fever in summer. In 2015, the first native case occurred in Tainan in May, after that, it caused the epidemic of Dengue fever become very serious which the number of confirmed cases is 22752 and the death is 112. Dengue fever turned out to become a threat to residents’ health, however, in 2015, Tainan city has started promoting various kinds of professional knowledge and scientific epidemic prevention measures during the Dengue fever epidemic period. Through the cross-departmental cooperation, information disclosure, scientific epidemic prevention strategies by the epidemic command center, we had successfully reversed the epidemic, and effectively control the spread of Dengue fever, which broke the experience that could only stop the epidemic with the cold weather. The aim of this study is to explore the successful experience of Dengue fever prevention and controlling, which can be used as reference for other cities in the future.

Introduction

Dengue virus is Flaviviridae, Flavivirus RNA virus, a total of the first to fourth different types of dengue virus serotype, by Aedes aegypti and Aedes albopictus spread. World Health Organization (WHO) [1] pointed out that global warming caused dengue fever cases and the prevalence of expanding regional, has expanded to more than 100 countries, the infected area of the population of more than 2.5 billion people worldwide each year about 20 million cases of death [2, 3]. Use Panel data model to access the relationship between climate conditions and patients of dengue fever during Jan. 2000 to Feb. 2006 in 308 cities or townships which divide into 14 counties in Taiwan area. Taiwan dengue epidemiology is closely related to the subtropical landmark (25N) and mosquito distribution as below Figure 1.

Figure 1. Subtropical landmark (25N) and mosquito distribution.
Literature Review

Dengue fever is mainly prevalent in tropical and subtropical regions. The epidemic of dengue fever in Taiwan is characterized by (1) At present, Dengue fever is not a native disease, except a few virus epidemic across the winter, most virus enter from outside borders every year, especially southeast Asian countries which have close relationships of trading and traveling, such as Indonesia, Vietnam, Thailand, Philippines, Malaysia. These countries are all Dengue fever epidemic, and thereby cause native epidemic. The epidemic usually starts from spring or summer, and ends in winter. (2) The epidemic mostly occurs in southern counties where Aedes aegypti and Aedes albopictus could survive, such as Kaohsiung city, Tainan city and Pingtung county. Central and northern region because there is only Aedes albopictus, the prevalence scale are smaller. (3) The time of epidemic has become earlier in recent years, in April or May has started to overspread and it would reach to peak in October or November. The prevalence reason and the density of disease vector mosquito are closely related to the rainy reason. In these two years (2014, 2015) the death case of Dengue fever has a substantial increase, respectively, 15,732 cases in 2014, 21 cases of death, 43,784 cases in 2015, 225 cases of death[4] In 2015, Tainan city was hit by two typhoons after suffering a severe drought. It was the most severe epidemic in Taiwan since 1943 (22,761 cases of Dengue fever, 112 cases of death); (4) In recent years, the trend has become larger epidemic which is related to the urbanization, frequent travel abroad, mosquito-borne resistance and other factors.

The Strategy of Prevention and Treatment

The study discovered six points by featuring on interview and information analyzing the prevention strategy which Tainan city used during in the year 2015. (1) The establishment of epidemic command center and the cross-office integration mechanism has created a rapid detection and development of the epidemic at any time combat strategy. (2) The effective mobilization of the administration. (3) Society mobilization. (4) Transparent information and public participation. (5) Large data science epidemic prevention. (6) Blocking Strategy of Chemical Prevention and Cure for Large Block Blocking and Block Cutting.

Establish the Epidemic Command Center Which Commanded by the Mayor and Construct Cross-Office Integration Mechanism So That We Could View the Efficacy of Vaccination and Develop the Epidemic Strategy

Set the flow to "Multiple entries, single exit". The mayor is the chairman in the meeting of command center, integrating and mobilizing resources of various ministries and inviting experts and scholars such as virology, epidemiology, insects, microbiology, social sciences to participate in decision-making and action. The command center issues united orders and holds press conference daily to make the latest news and announcement. As the flow is gradually on track, the holistic epidemic prevention function has begun to appear.
The Effective Mobilization of the Administration

The mayor would regularly preside the comprehensive cross-office epidemic prevention meeting to formulate the work-division of emergency prevention and treatment and mobilize all workers of the local government to volunteer the epidemic zone.

Society Mobilization

The base administrative service unit in Taiwan is village. In 2015, when the epidemic in Tainan become more serious, the government tried very hard to remove the breeding sources and control household chemical. Unexpectedly, residents even stopped the government from their missions. Thus, Tainan city immediately implemented the proper epidemic prevention as an advocacy and amended the organizational structure urgently. Through organizing volunteers to join the health education by chief of village, it had strengthened the prevention system. Also, with the daily report from chief of each village, the command center could analyze and monitor the epidemic situation. By the sharing and comparing of the epidemic situation, whole village had become active.

Transparent Information and Public Participation

The vise-mayor holds press conference regularly to explain the latest epidemic situation to mass media and propagate correct epidemic prevention knowledge and concepts. Besides, set up a "Dengue Fever Epidemic Net" on the homepage of the government’s website and act in connect with the 24-hour epidemic prevention line that residents are able to master all instant messages rapidly. All is to expect all residents could understand the recent situation and every act of government.

Large Data Science Epidemic Prevention

With combining large data provided by the open data platform and Geographic Information System and Global Positioning System, the government could locate the case coordinates and movement trends, which helps to evaluate the result of epidemic prevention and situation. Adding advices from experts, the government is able to adjust the strategy of epidemic prevention according to local conditions timely. After National Cheng Kung University analyzing and counting numbers and information on the open data platform, they designed an automatic capture program to read the information, display the number of cases of dengue fever or the trend with graphs and animation and use the most advanced large-scale data analysis system in the weekly epidemic analysis. The first real-time application of GIS/GPS system in dengue control: Evolution of the dengue cases was monitored week by week as below Figure 3.

Figure 3. Dengue cases.
Control Policy and Strategy based on Scientific information as below Figure 4.

![Figure 4. Control Policy and Strategy.](image)

**Blocking Strategy of Chemical Prevention and Cure for Large Block Blocking and Block Cutting**

From August 2015 to November 2015 in the city high-risk areas, sub-warning areas, warm zones and hot zones, such as the implementation of three-stage firewall block cutting of outdoor chemical control, from the periphery and gradually encircled, and then divided into small And the spraying area was 66.87 km² (km²) in 12 districts. The environmental breeding source and mosquito-borne mosquitoes were reduced to prevent rapid spread of the epidemic. The epidemic situation began to turn over at the 38th week of the year, and the control and notification were obtained. Cases declined significantly.

Showing results as below. Figure 5-8.

![Figure 5. 2015/08/01-2015/08/15.](image)  ![Figure 6. 2015/09/01-2015/09/15.](image)

![Figure 7. 2015/09/16-2015/09/30.](image)  ![Figure 8. 2015/10/01-2015/10/15.](image)
Conclusion

After the interviews and analysis of actual data, the control of dengue fever in Tainan City in 2015 is determined by the government's decision-making, leadership, and science-based execution. Involving experts and scholars such as virology, epidemiology, insects, microbiology, social sciences and information to participate in decision-making and action to effectively prevent the spread of dengue fever, and enhance the effectiveness of epidemic prevention is a non-negligible success factor.

In addition, the outbreak of the epidemic also made good use of the positive administrative team, which promoted Dengue fever community participation and scientific epidemic prevention strategically. This policy controlled the situation of disease and prevented epidemic from spreading successfully. The result of this study can be used as a reference for the future government to promote the prevention and treatment of dengue fever by analyzing the innovative methods to promote dengue epidemic prevention and promoting the mobilization of social resources and government forces to influence the effectiveness of urban policies.

Studies have shown that although the dengue fever outbreak in Tainan City in 2015 has shaken the city's public health system, it has also led to a full-blown review of the dengue epidemic. When in face of fierce challenge of dengue fever, the authorities have learned lessons about how to control and master the opportunity and reformed experiences from regulations, organizations, policy, practical operations and other aspects. What’s more, Tainan city even set up the first "dengue fever prevention center" which organized by local government. This pragmatic core value is a worthwhile successful prevention and treatment experience to consult and refer.

Reference


