Taiwan Epidemiology Bulletin

July24 , 2012/ Vol.28 / No.14

Original Article

Enforcement of Mosquito Control and Dengue Fever Prevention

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Abstract

Dengue Fever has not been considered as an endemic disease in Taiwan. Residents got the disease mainly from overseas might bring the virus to Taiwan and then caused local transmission in communities. Consequently, the outbreak patterns of confirmed indigenous cases in Taiwan are usually displaying temporal aggregation and correlate with the change of the number of vectors seasonally. Because of the following four rationales, this article focuses on the implementation of routine mosquito breeding sites cleaning programs to prevent dengue fever, and emphasizes the importance of health education to people who travel to or live in the endemic or epidemic areas, how to prevent from mosquito bites. First, the risk of infection of getting dengue fever for a tourist who has a one week to more than one month tour to Southeast Asia is about 1%. The infection rate for a tourist who has taken measurements against being bitten by mosquitoes is smaller than 45%. Second, out of all imported dengue fever cases, only 20 - 60% appears with symptoms. Half of the cases can be detected by airport quarantine but half of the cases are latent and these cases can be discovered after they have symptoms and visited a doctor. Forty to eighty percent of asymptomatic or mild symptomatic cases may not be reported and may become the infection sources. Therefore, dengue fever could be spread by mosquito bites initially. Third, dengue fever is transmitted through bites by infected female mosquitoes, especially *Aedes* mosquitoes, which need blood to nourish their eggs and then a community outbreak may occur. Last, according to literatures, the relative efficacy of using insecticides is thousand times better than that of vector elimination programs but the use of insecticide may cause pollution and drug resistant problems. The authors suggested that it is better to strengthen the following interventions: 1) people who travel to Southeast Asia, South America, and Africa should take vector control measurements to prevent from vector borne diseases; 2) tourists should take some vector control measurements to stop the spreading of virus to neighborhoods at least ten days

after come back from epidemic areas, because they might be asymptomatic carriers; 3) citizens living in southern Taiwan, such as Tainan and Kaohsiung, where *Aedes* mosquitoes exist, should carry out some vector control interventions to decrease the transmission and to prevent who has been infected by a serotype of dengue fever virus, from being re-infection by another serotype and then become serious dengue hemorrhagic fever (DHF), especially during daytime and in the evening.

Key words: imported infection, asymptomatic carrier, latent infection

Introduction

Dengue Fever (DF) is one of the most important vector-borne virus transmitted diseases. There are about two fifth of the global population, which is about 25 billion people, are currently threatened by the disease. The WHO has estimated that there are 50-100 million people infected every year[1-2]. Patients may appear asymptomatic, mild to severe headache or muscle pain. The population with severe symptoms like dengue shock syndrome or dengue hemorrhagic fever (DHF) is about 2.7- 3 %. Because of the increase of population's density, the high frequency of international traveling, the demographic change caused by people migration and the climate change, vector-borne mosquitoes spread wider than before [1-3]. Vector control programs for the mosquito, *Aedes aegypti,* is the key method to prevent DF, especially when vaccine and antiviral agents against dengue fever virus (DFV) are not available. Twenty two countries in America in 1962 and all countries of Mediterranean Sea in 1972 used DDT pesticide to eradicate adult mosquitoes of *A. aegypti*. However, the use of DDT was dismissed because the environmental pollution problem, other chemical pesticides have been used widely instead. Paula *et al.* evaluated the relative efficacies of three strategies of *A. aegypti* control program and pointed out that if the relative efficacy of reduction and destruction of breeding sites of mosquitoes was 1, the relative efficacies of using adulticides and larvicides were thousands times higher; the relative efficacies were 15.8×10^3 and 28×10^3, respectively [1]. The burden of DF can be reduced to four years if high efficacy control of mosquito method is applied. Larvae control program can decrease the burden of DF up to two years. Thus, there is still limitation when adopting the program such as eliminating breeding sites. We suggested the government needs to implement different control measurements to enforce the efficacy of DF prevention.

The metropolitan areas in southern Taiwan, such as Tainan, Kaohsiung, and Pingtung, are the hotspots of DF because of warm weather and the existence of *A. aegypti*. Mostly, *A. aegypti* are active during daytime and in the evening. People are also active at the same time. Thus, people are easily bitten by mosquitoes. During the outbreak seasons of DF, it is proposed that a person should avoiding being bitten by mosquitoes, especially in the high risk areas of the disease. The appeal should bring a significant effect of stopping female

mosquito to suck blood and blocking the life cycle of mosquitoes at the period of laying eggs down. DF in Taiwan is not considered as an endemic disease based on the study of the epidemic trend of the disease in 2011 [4]. This article emphasized on health education about DF prevention, to provide suggestions to the government in formulating the policy against DF in the future.

Reflections of the epidemiology and the efficacies of the control strategies of Dengue Fever in Taiwan

1. The epidemic trends of DF outbreaks in Taiwan

1.1. DF is not considered as an endemic infectious disease in Taiwan. The type of weather and the low temperature, ranging from 10 to 18 ℃, in Taiwan's winter prevent DFV from replicating in mosquitoes and then the transmission is stopped. Every year, the first DF confirmed case is identified as an imported case, which results in transmission through communities. The peak of the imported cases appears months earlier than that of the indigenous infection.

1.2. Southern Taiwan is the high risk area. Cities of Tainan, Kaohsiung, and Pingtung are located in the tropical zone and suitable for survival of *A. aegypti* mosquitoes, so the area is the potential hotspot of DF (Figure 1). On the contrast, northern Taiwan is located in the sub-tropical zone and only *Aedes albopictus* exists, so mainly imported cases and only sporadic indigenous DF cases have been reported.

1.3. The change of the number of DF confirmed cases presents a seasonal pattern, which is similar to the active pattern of *A. aegypti* mosquitoes. The reported cases are few from January to May and few imported DF cases are recorded. *A. aegypti* mosquitoes become

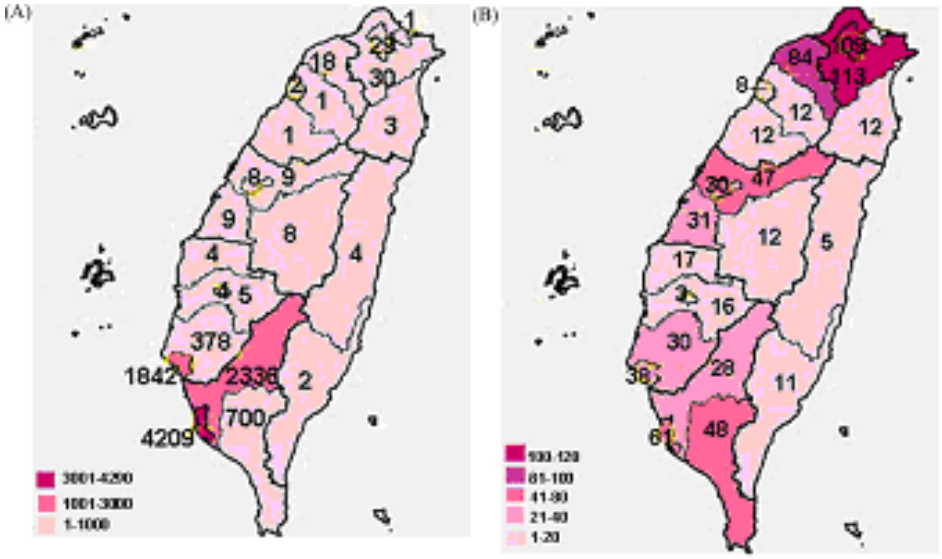
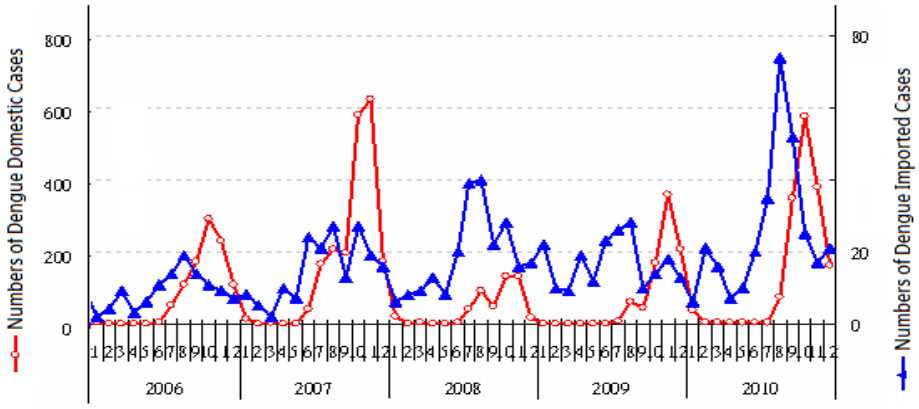


Figure 1. In total, 10,351 confirmed cases of DF from 1998 to 2007 were recorded. The geographic distribution of confirmed cases is heterogeneous. The left graph (A) shows that 92.9% of confirmed cases are indigenous DF cases and 98.5% of the cases mainly aggregated in southern Taiwan. Out of 62.9% of the cases are aggregated in cities of Tainan and Kaohsiung. The right graph (B) presents that 7.1% of confirmed cases are imported. These mainly aggregated in northern Taiwan.

more active from June to July. That means Adult index, Breteau index and house index gradually increase; meanwhile the confirmed indigenous cases of DF increase coincidently. The months, from October to November, are suitable for *A. aegypti* mosquitoes to be active. The number of indigenous DF cases reaches to the high peak (Figure 2 A and B). From December to the first few months of the following year, the temperatures could be lower than 10 to 18℃. The cooler climate will inhibit the life cycle of *A. aegypti*, and inhibits the DF transmission. According to the three detection indices, *A. aegypti* activities obviously decrease (Figure 2). Therefore, the indigenous DF cases have declined and reached to the lowest number at the first few days of the next year. In addition, after the number of the water-filled containers per 100 houses are evaluated, no obvious seasonal change can be observed (Figure2).

(A)



(B)

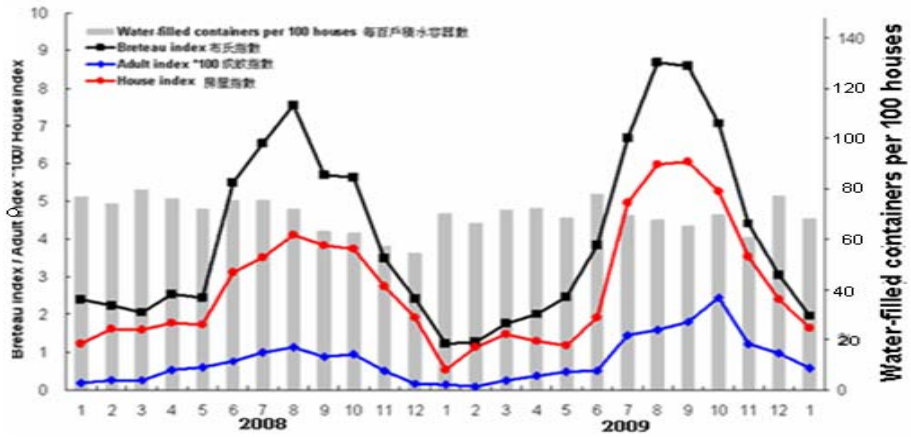


Figure 2. The growth and decline of the confirmed indigenous cases of DF and the activity pattern of *A. aegypti* present similar seasonal pattern. The upper figure (A) indicates that the confirmed cases presented a seasonal pattern from 2006 to 2010. The number of patients increased gradually between June and July and then reached to a peak between October and December. The numbers decreased again in December gradually and then dropped to the lowest point. These imported cases and the indigenous cases, which are recorded at the day of presenting clinical signs, were temporally correlated. The highest incidence of imported cases appeared months earlier than that of the indigenous cases. The bottom figure (B) presents that the type of activities of *A. aegypti* in southern Taiwan. A seasonal pattern between 2008 and 2009 was observed. The adult index ×100, the Breteau index and the house index increased slightly in June, and reached to a peak between July and October. These decreased gradually again in December. The lower temperature in winter resulted in the decrease of the mosquitoes' activities but the number of the water- filled containers per house did not change obviously.

2. The transmission model of DFV in Taiwan

2.1. Cases from overseas. Gijs *et al.* pointed out that the infection rate of being proved as a DF cases after a Southeast Asia tour of a period from one week to more than one month was about 1% [8]. At the condition that a traveler had accepted DF health education before tour to overseas, only 45% of travelers would use DEET anti-mosquitoes repellents during tour. About 17% never use any mosquito repellent. The latent period of DF is about 3 to 7 days. Approximately 20 - 60% of infected cases presented symptoms, but 40 - 80% of cases only presented mild symptoms or did not have any symptom. Among the imported cases with symptoms, about 50% of cases with fever could be detected at airport quarantine. Other 50% of cases were missed from the quarantine. They went back to their home communities while they were still in the latent period. Then, after the onset of the symptoms, they were screened out. Only 40 - 80% with mild symptoms or asymptomatic cases still had the chance to affect other people within 10 to 14 days after they back to their home towns. If the confirmed and suspected cases of DF have done some anti-mosquito interventions well, their close contacting friends and relatives could be away from mosquito bites. Then, the risk of getting infection would be reduced. Taiwanese tourists, who travel to Southeast Asia, increase yearly; the number was about 471,938 to 2,729,618 between 2006 and 2010. The number of tourists is positively correlated with the number of indigenous cases (Pearson's correlation coefficient, R=0.4) (Table 1). Therefore, the increases of indigenous DF cases are positively correlated with the increases of tourists and dengue imported cases.

Table1. The statistical data of Taiwanese tourists back form Southeast Asia and the Dengue Fever cases

Year / Arrival tourists each year from Southeast Asia	2006	2007	2008	2009	2010
Thailand	374,904	360,591	124,373	419,924	628,072
Myanmar	6,857	0	0	0	0
Vietnam	59,933	224,596	109,590	332,603	661,624
Indonesia	135,400	171,641	60,836	203,731	407,208
Indian	10,298	13,405	5,815	12,920	3,921
Singapore	153,236	151,855	66,365	205,783	438,457
Cambodia	9,137	16,618	7,406	28,833	56,137
Philippine	86,148	86,178	41,002	15,302	247,410
Malaysia	98,207	139,407	56,551	167,261	286,789
Total tourists	934,120	1,164,291	471,938	1,486,357	2,729,618
Imported cases	109	179	226	204	304
Infection risk*	$12/10^5$	$15/10^5$	$48/10^5$	$14/10^5$	$11/10^5$
Indigenous cases	1074	2179	714	1052	1592

∗ Imported cases/ total tourist number

2.2. The vector, mosquito, habitat and its life cycle (Table 2): The mosquitoes, *A. aegypti,* are the main vector to transmit DF. The virus transmission ability of the mosquitoes, *A. albopictus,* is relatively low. *A. aegypti* mosquitoes are alert, and sensitive to a touch. They often need to suck blood many times to have enough. *A. aegypti* mosquito belongs to *Diptera*. Only female mosquitoes need the protein from blood to nourish their eggs. Mosquitoes' piercing-sucking mouthparts consist of six stylets. There are two different glands for sending blood and saliva. When female mosquitoes suck the blood containing the dengue virus, the virus will arrive to the salivary glands after 7 - 12days. The affected female mosquitoes can then infect other new hosts. Female mosquitoes need blood to hatch their eggs. They can lay eggs three to four times all through their whole life but it depends on how long they survive; their life could be less than 30 days or up to 2 weeks. They can lay one hundred eggs once. The eggs can survive on little amount of water and withstand the drought for nine months. Taiwan is highly urbanized. In cities, mosquitoes usually suck human's blood. Hence, inform people how to prevent mosquito bites, will both interrupt the virus transmission and terminate mosquito breeding is the utmost key factor of controlling DF.

Table 2. Life cycle, growth, distribution and transmission model of *A. aegypti*

Life cycle	Eggs (2 days)→larvae (5 – 6 days) →pupae (1 day) →Adult (14- 30 days, the duration depends on the environmental temperature and humidity). →female mosquitoes lay eggs after sucking blood (4 days).
Breeding sites	The *A. aegypti,* lays eggs on the surface of water. Containers like china, bottles, can, used tires; plate, jar and bowls can provide a growth environment. Mosquitoes still can survive in the tree caves and mud even without container.
Eating habit	Mosquitoes usually drink the liquid of plants. Female mosquitoes need protein, which they collect from blood in order to maturate the eggs. They prefer to suck blood during daytime and avoid the period of high temperature in summer. The peak period for mosquitoes to bite is 4 – 5 pm and the second peak period is 9 - 10 am.
Main habitats	Indoors: clothes, curtains, furniture or other dark places. Mosquitoes can be found indoors and any human living environment.
Distribution	Southern Taiwan: Chiayi county, Tainan county, Kaohsiung, Pingtung
Propagation	Female mosquitoes prefer laying eggs on the surface of dark and rough articles, or on the ledge of water or the surface of water. Female mosquitoes can lay eggs three to four times a whole life, and about 100 eggs every time. Their eggs can withstand drought for nine months and can grow if it is raining.
Disease transmission	1. Classical Dengue Fever: the latent period is about 5 – 6 days. The early stage: from the first onset day of symptoms to the second day, patients may have fever, fatigue, headache, chills, back pain, sweating, and stiff joints. The middle stage: 3 – 4 days, the symptoms include fever, swollen face and hand, and skin rushes. The recovery stage: 5 – 7 days, DHF mainly occurs in children. The mortality of DHF is relative high. The symptoms of DHF include subcutaneous hemorrhage, purpura, eyes, nose, gums and organs bleeding.

3. The importance and reflections of multidimensional dengue control

3.1. The idea of cleaning breeding sites is the core of prevention

Female *A. aegypti* mosquitoes can lay eggs on paddling pools, whose depth could be as thin as a coin [7]. Their eggs can survive up to 9 months in drought weather [7]. The temperature is usually high and rainy in summer in Taiwan. Standing water sometimes seen in areas. Thus, the natural ecological change in the number of *A. aegypti* coincides with the environment and seasonality in southern Taiwan. Although to empty water from containers such as pots, bottles, used tires, plates, bottles and cans, can minimize the mosquitoes breeding sites, female mosquitoes still can lay eggs in the thin layer of water like tree holes and mud. The eggs of mosquitoes even can survive without water for many months till it is raining.

3.2. Spraying insecticide around the confirmed case's house and environment.

Nowadays, the main method to control the number of adult mosquitoes around the environment of the confirmed cases is to spray pesticides.

3.3. Case management. To prevent the transmission caused by a confirmed case, the job should be done by making sure that although the patient still has some activities, he or she has had well-done his or her self-management at home.

3.4. Screening procedure at airports: Asymptomatic or patients at the stage of latent infection still can carry the DFV into Taiwan and then indigenous cases may occur at the community level.

In conclusion, to improve the knowledge of people living in a high risk area of getting DF infection and to strengthen the mosquito control are the most important parts in DF prevention. Strengthen the content of mosquito prevention guidance, which contains the information of "infectious" cases and the mosquito preventive measures at the level of house and community, may prevent the transmission caused by these index cases. The meaning of "infectious" should include the confirmed and asymptomatic cases, and cases with latent infection. By increasing self-alertness, active mosquito prevention and mosquito elimination measures, the rate of unconscious transmission can be minimized.

Equipments for Mosquito Protective Measures

1. Anti-mosquito devices and repellents

1.1. The function of anti-mosquito devices and repellents.

Female mosquitoes are attracted by the smell of human skin and exhaled CO_2. The purpose of mosquito's bite is to get proteins in order to help the development of mosquito's eggs. Some mosquitoes may still fly around the skin, which has been covered by anti-mosquito spray. The purpose of a repellent is to reduce the attraction of mosquitoes to the skin, but not to kill mosquitoes.

1.2. Conditions when mosquito repellent is needed to control the disease transmission:

(1) When there is a confirmed DF case or a suspected case with fever, the transmission may occur from a viremic patient. (2) When a confirmed case or a suspected case with fever in a family member or a neighbor is found. (3) When a person visits or lives in either a high density of mosquitoes or an area with high risk of getting infection. To use mosquito repellents can reduce the chance of being bitten by a mosquito.

1.3.The effective ingredients in mosquito repellents

According to U.S. CDC [5], the effective ingredient of a mosquito repellent should fit to the following criteria: 1) which has been proved effective in scientific experiments; 2) which is non-hazardous to human and environment and which has been certificated by US Environmental Protection Agency (EPA). Four effective ingredients of mosquito repellents can support longer protective ability are:

(1) DEET; N,N-diethyl-m-toluamide: The effective chemical has been used in many different mosquito repellents and formula. According to Fradin and Day's report [6], a product contains 23.8% DEET can protect from biting by mosquitoes up to 5 hours. If a product contains 20% DEET, the protective ability is 4 hours. If a product contains 6.65% DEET, the protection is 2 hours. If a product contains 4.75% DEET, the protection is 1 to 1.5 hours. Hence, if a person is going to stay outdoors for many hours, he or she would be best to choose an anti-mosquito repellent containing higher concentration of an effective ingredient. A product containing low concentration of an effective ingredient has a limited effective period. Thus, if a person is planning to stay outdoors longer time, then a booster spray should be applied.

(2) Picaridin（KBR 3023 or Bayrepel）

(3) Oil of lemon eucalyptus. Its active compound is *p*-menthane 3,8-diol (PMD). It is a natural anti-mosquito repellent. It has been approved by U.S. EPA. Compared with other plant-based mosquito repellents, it can supply longer protection. A recent report in USA discovered that its efficacy was very similar to a product containing low concentration of DEET. It can protect a person from being bitten by mosquitoes up to 2 hours.

(4) Permethrin. It is a long lasting anti-mosquito compound. The product would be better used on textures such as clothes or a mosquito net. It is not suitable to apply on skin directly.

1. 4. Apply mosquito repellent on children. The best method of applying mosquito repellent on children is to put some liquid on adult's hands first and then rub it on children. Any mosquito repellent should not contact to the eyes, mouth and palm. Long sleeve and trousers should be dressed. A mosquito net can be used for infants. Empty container with water is a good method to reduce the growth of mosquitoes.

2. Other anti-mosquito devices

Other natural anti-mosquito devices for personal use such as anti-mosquito patches, mosquito repellents, can reduce the activity of mosquitoes and the potential transmission of DFV. Except to clean the environment around a house, to reduce the numbers of water-filled

containers, clean and cover the water-filled containers can reduce the breeding chance of mosquitoes. Moreover, put some mosquito traps such as CO_2 releasing mosquito captures with timer setting can reduce the chance of pets and livestock being bitten by mosquitoes.

3. SWOT analysis of executing mosquito prevention interventions:

3.1. Strengths: With involvement of public health administrative system to guide and implement anti-mosquito intervention will gain advantages from different dimensions.

3.2. Weaknesses: The public health administrative system has long being less involved in the guidance and development of anti-mosquito instructions. Reinforcement of health education in mosquito control is recommended.

3.3. Opportunities: To implement a self-defensive anti-mosquito intervention is energy conservation and less toxic. It is easily acceptable by people and the efficacy of prevention can be expanded. Moreover, the implementation can benefit the development of industry for disease prevention and control.

3.4. Threats: it is still necessary to re-plan methods, which relate to master and evaluate the progress of anti-mosquito procedure used by people. The efficacies of some new anti-mosquito devices need to be evaluated. We suggest that these data related to the efficacy should be published and evaluated first before the devices can be applied.

4. Suggestions for health education.

4.1 To improve the knowledge of mosquito prevention for people

4.1.1. The risk of DF transmission and health education about mosquito control: it should be noted that the transmission risk of DF, which is the number of all infected cases including the asymptomatic cases, is 1.75 to 4 times higher than the rate of transmission risk of symptomatic cases (Table 3).

(1) The confirmed cases: To comply with the surveillance system, all confirmed cases including who were detected at airports, community survey, and clinics should be provided with knowledge of mosquito prevention. The purpose is to stop reinfection and prevent transmission of the disease to neighbors or family members.

Table 3. Meta-analysis of the risks of getting infection after traveling to Dengue Fever epidemic areas

Dengue Fever Epidemic Areas	Incidence rate relating to traveling	Symptomatic Patients: Asymptomatic patients	All infection risk*	Traveling period (Traveling year)	References
Southeast Asia, South America, and Africa	18.5 per 1000 person-months	1:1.8(64%)	51.8 per 1000 persons	1-13 weeks (2006-2007)	[8]
	11.0 per 1000 person-months	1:3(75%)	44.0 per 1000 persons	4 weeks (1991-1992)	[9]
	36.9 per 1000 person-months	1:0.75(43%)	64.6 per 1000 persons	3-16 months (1999)	[10]

* the study pointed out the risk is high enough to cause a transmission

(2) Mild or latent infected patients. Because these patients are hard to be screened out actively, about 1 to 2 million citizens who travel to Southeast Asia should be the main population to be instructed. Estimated from the data of 2006 -2010, the infection risk of people with clinical signs was 11-48/100,000 population, and the transmission risk was 19-192/100,000 population. Because the latent period after getting infected by DFV is between 3 and 14 days, and the viremia period after onset of symptoms is between 5 and 6 days. The authors suggest that tourists, who have traveled from high risk areas of DF, should execute anti-mosquito intervention within about 14 days after coming back [11]. The purpose is to prevent cases with severe symptoms to transmit the disease to neighbors or family members.

(3) Residents in southern Taiwan, especially during the epidemic season. The years from 2002 to 2009 were considered as epidemic years because the number of indigenous cases was higher than 900. During the period, the infection risk for residents with symptoms in Tainan City was 8.9 -130/100,000; in Tainan County it was 1.6-44.8/100,000, in Kaohsiung City it was 49.8-187/100,000, in Kaohsiung County it was 14.8-160/100,000 [4]. The transmission rate is 1.75-4 times higher, i.e., the transmission risk of DF in Tainan City was 15.6-520/100,000, in Kaohsiung City was 87.2 -748/100,000. We encourage the residents should be alert and strengthen mosquito control intervention during the epidemic seasons.

4.1.2 Anti-mosquito health education. 1) To educate people and let people understand the life cycle of *A. aegypti* and the mechanism of how the female mosquitoes suck blood. 2) To provide anti-mosquito equipments, e.g. electronic anti-mosquito watches and natural anti-mosquito patches, and mosquito eliminating procedures in the house, e.g., the information about setting mosquito capturing or extinguishing equipments. It is to help other dimensions in mosquito control campaign and not just to remove mosquito breeding sites. In addition, wear long sleeves and trousers and use anti-mosquito devices, e.g. mosquito repellents, anti-mosquito patches or electronic bug zappers, to prevent infection or re-infection. 3) To put strength on mosquito extinguishment at the house level. For example, to set up high effect mosquito captures, to set up mosquito nets or to remove mosquito breeding sites. 4) To appeal mosquito dispelling, extinguishing campaigns. For example, to achieve the purpose of multi-dimensional DF prevention by mobilize all members in a community to eliminate mosquitoes.

4.2. Advocacy strategies.

4.2.1. Preparation of education materials: Use facts sheet, poster, and internet to advocate the importance of mosquito prevention.

4.2.2. Create mosquito prevention networks: Information such as effective methods to prevent mosquito bites either indoors or outdoors during daytime and evening; provide effective ingredients of mosquitoes repellents; devices for mosquito control, e.g., mosquito wristwatch, patches/devices/sprays to prevent mosquito bites; information on low environmental toxicity of mosquito repellent/ insecticide (household use powerful devices to control mosquitoes, and mosquito nets) and the efficacy of devices to eliminate and control mosquitoes.

4.2.3. News release: Inform people living in high risk areas of DF to take interventions against mosquito bites automatically, and to appeal community people automatically taking measures to prevent mosquito bites either indoors or outdoors and to drive mosquitoes away or to kill mosquitoes.

4.2.4. Community guidance. Arrange health education related with DF in people's daily activities in epidemic seasons such as to use advertisements on the buses or neighborhood congresses.

4.2.5. Campus guidance: Encourage schools to design the teaching materials and plans about DF education and to include these in school curriculums.

Conclusion

The article suggests to clean mosquito breeding sites daily and to provide enough information of how to prevent DF to citizens are important, especially the information about how to reduce the transmission of the disease to neighborhoods before go to and after coming back from epidemic areas and if new indigenous cases have been reported. For personal mosquito prevention procedures, such as: 1) to enforce the mosquito prevention intervention if travel to Southeast Asia, South America, and Africa; 2) to prevent from bitten by mosquitoes within 14 days after traveling back from an epidemic area to reduce the neighborhood transmission. Because only 20-60% of patients with clinical signs will be screened at airports or at the time when they see doctors, there are other viremic carriers and 40-80% of asymptomatic carriers exist; 3) to enforce the mosquito prevention measurements in the evening or daytime in southern Taiwan during DF season since *A. aegypti* are active plus there might have infected carriers in the community. As for mosquito prevention in the household and community, families with DF infected patient and some old communities in southern Taiwan should install screen windows to their houses, and continue to remove mosquito breeding sites with neighbors and even a whole community.

Acknowledgements

The article was inspired by the authors taking part in the campaign of the Originality of Dengue Fever Prevention. Thanks to the campaign committee and the convener, Director-General Feng-Yee Chang, who encouraged me to revise the article. In addition, thanks

to Dr. Jyh-Hsiung Huang, and two reviewers who gave a lot of useful information.

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Outbreak Investigation Express

Investigation of An Infant With Meningococcal Meningitis in Pingtung County, 2012

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The Fifth Branch of Taiwan Centers for Disease Control received a notification on March 5th from a regional hospital in Pingtung County of a four-month-old girl with suspected meningococcal meningitis. The Center for Research and Diagnostics confirmed the isolation of serogroup B *Neisseria meningitidis* on March 8th. This is the first confirmed case of meningococcal meningitis in 2012, and also the youngest case of this disease in a decade. The patient developed high fever on February 29 and was brought to a regional hospital in Pingtung. She was subsequently hospitalized on the same day and received antibiotic treatment. Her vital sign was stable on the next day, and resumed the food intake and activity. In order to manage the contacts, the early symptoms of her family members and their close contacts should be closely monitored, especially fever. If contacts present fever and other symptoms, they should be classified as suspected cases for immediate specimen collection and treatment. Otherwise, test is not required for asymptomatic contacts. As susceptibility of meningococcal meningitis is quite low, not every contact will develop illness. It is necessary to assess whether to provide prophylactic medication based on their clinical symptoms, therapeutic medication, or directly and intensively contact with patients' nasopharyngeal secretions.

Keywords: meningococcal meningitis, prophylactic medication, contacts

The Taiwan Epidemiology Bulletin series of publications is published by Centers for Disease Control, Department of Health, Taiwan (R.O.C.) since Dec 15, 1984.
Publisher : Feng-Yee Chang
Editor-in-Chief : Yi-Chun Wu **Telephone No :** (02) 2395-9825
Executive Editor : Li-Gin Wu, Hsiu-Lan Liu **Website :** http://teb.cdc.gov.tw/
Address : No.6, Linshen S. Road, Taipei, Taiwan 100 (R.O.C.)
Suggested Citation :
[Author].[Article title].Taiwan Epidemiol Bull 2012;28:[inclusive page numbers].