CHAPTER II

LITERATURE REVIEWS

Knowledge of Dengue Haemorrhagic Fever (DHF)

"Dengue Haemorrhagic Fever" or "DHF" (Ministry of Public Health, Department of Disease Control, 2003); is a mosquito borne disease caused by "dengue virus". It is characterized by high fever, haemorrhagic phenomena, often with enlargement of the liver and the patient may rapidly go into a critical state of shock and die. Its major vector called "*Aedes aegypti* mosquito".

2.1 Characteristic

Typical case of DHF are characterized by four major clinical manifestations: high fever, haemorrhagic phenomena, and often, hepatomegaly and circulatory failure. Moderate to marked thrombocytopenia with concurrent haemoconcentration is a distinctive clinical laboratory finding of DHF. The major pathophysiological change that determines the severity of disease in DHF—and differentiates it from DF—is the leakage of plasma, as manifested by an elevated haematocrit (i.e. haemoconcentration), a serous effusion or hypoproteinaemia.

Children with DHF commonly present with a sudden rise in temperature accompanied by facial flush and other non-specific constitutional symptoms resembling DF, such as anorexia, vomiting, headache, and muscle or bone and joint pain. Some patients complain of sore throat, and injected pharynx is frequently

evident on examination, but rhinitis and cough are infrequent. Mild tenderness at the right costal margin, and generalized abdominal pain are common. The temperature is usually high (>39°C) and remains so fare 2-7 days. Occasionally, temperature may be as high as 40-41°C; febrile convulsions may occur, particularly in infants.

The most common haemorrhagic phenomenon is a positive tourniquet test, easy bruising and bleeding at veepuncture sites. Present in most cases are discrete fine petechiae scattered on the extremities, axillae, face and soft palate, which are usually seen during the early febrile phase. Epistaxis and gingival bleeding occur infrequently; mild gastrointestinal haemorrhage may be observed during the febrile period.

The liver is usually palpable early in the febrile phase and varies in size from just palpable to 2-4cm below the costal margin. Although liver size is not correlated with disease severity, an enlarge liver is observed more frequently in shock than in non-chock cases. The liver is tender, but jaundice is not usually observed. Splenomegaly is rarely observed in infants; however, the spleen may be prominent on X-ray examination.

The critical stage of the disease course is reached at the end of the febrile phase. After 2-7 days of fever, a rapid fall in temperature is often accompanied by signs of circulatory disturbance of varying severity. The patient may sweat, be restless, have cool extremities and show some changes in pulse rate and blood pressure. In less severe cases, these changes are minimal and transient, reflecting a mild degree of plasma leakage. Many patients recover spontaneously, or after a short period of fluid and electrolyte therapy. In more severe cases, when plasma loss is

critical, shock ensues and can progress rapidly to profound shock and death if not properly treated.

The severity of the disease can be modified by early diagnosis and replacement of plasma loss. Thrombocytopenia and haemoconcentration are usually detectable before the subsidence of fever and the onset of chock.

Case definition for DHF: The following must all be present;

- Fever, or history of acute fever, lasting 2-7 days, occasionally biphasic.
- Haemorrhagic tendencies, evidenced by at least one of the following:
    - a positive tourniquet test
    - petechiae, ecchymoses or purpura
    - bleeding from the mucosa, gastrointestinal tract, injection sites or other locations
    - haematemesis or melaena.
- Thrombocytopenia (100 000 cells per mm^3 or less)
- Evidence of plasma leakage due to increased vascular permeability, manifested by at least one of the following:
    - a rise in the haematocrit equal to or greater than 20% above average for age, sex and populations;
    - a drop in the haematocrit fllowing volume-replacement treatment equal to or greater than 20% of baseline;
    - signs of plasma leakage such as pleural effusion, ascites and hypoproteinaemia.

Case definition for dengue shock syndrome: All of the above four criteria for DHF must be present, plus evidence of circulatory failure manifested by:

- Rapid and weak pulse, and
- Narrow pulse pressure (<20 mmHg (2.7kPa)) or manifested by :
- Hypotension for age, and
- Cold, clammy skin and restlessness.

(World Health Organization [WHO], 1997a)

In conclusion, DHF is a potentially deadly complication that is characterized by high fever, haemorrhagic phenomena: often with enlargement of the liver, and in severe cases, circulatory failure. The illness commonly began with a sudden rise in temperature accompanied by facial flush and other non-specific constitutional symptoms of dengue fever. The fever usually continued for two or seven days and can be high as 40°-41° C, possibly with febrile convulsions and haemorragic phenomena. In moderate DHF cases, all signs and symptoms abate after the fever subsides. In severe cases, the patient's condition may suddenly deteriorate after a few days of fever; the temperature droops, followed by signs of circulatory failure, and the patient may rapidly go into a critical state of shock and died within 12-24 hours, or quickly recover following appropriate volume replacement therapy.

There is no specific treatment of dengue fever. However, careful clinical management by experienced physicians and nurses frequently save the lives of DHF patients. With appropriate intensive supportive therapy, mortality may be reduced to less than 1%. Maintenance of circulating fluid volume is the central feature of DHF case management. (WHO, 2002)

2.2. Transmission

Dengue viruses are transmitted to human through the bites of infective female *Aedes aegypti;* which is the most important vector, also sometimes *Ades albopictus* mosquitoes. Mosquitoes generally acquire the virus while feeding on the blood of an infected person. After virus incubation for 8-10 days, an infected mosquito is capable, during probing and blood feeding, of transmitting the virus, to susceptible individuals for the rest of its life. Infected female mosquitoes may also transmit the virus to their offspring by transovarial (via the egg) transmission, but the role of this in sustaining transmission of virus to humans has not yet be delineated.

Human are the main amplifying host of the virus, although studies have shown that in some parts of the world monkeys may become infected and perhaps serve as a source of virus for uninfected mosquitoes. The virus circulates in the blood of infected humans for tow to seven days, at approximately the same time as they have fever; Aedes mosquitoes may acquire the virus when they feed on an individual during this period. (WHO, 2002)

2.2.1 "*Aedes aegypti*" Mosquitoes; DHF vector:

Aedes aegypti mosquitoes occur around the world and there are over 950 species. They can cause a serious biting nuisance to people and animals, both in the tropics and in cooler climates. In tropical countries *Aedes aegypti* is an important vector of dengue, dengue haemorrhagic fever, yellow fever and other viral diseases.

Aedes aegypti is easily recognized by the contrasting black and white rings on its legs and the lyre-shaped pattern of silver marking on the upper surface of the thorax. Aedes mosquitoes bite mainly in the morning or evening; the prevalent time is during 9.00-11.00 and 13.00-14.00, especially in rainy season. This is because of the

appropriate temperature and humidity that could lead to its growth and expansion. According to the study in Thailand, there were more than 200-300 aedes mosquitoes preferred habitats in 100 houses in one year. (WHO, 1997b)

2.2.2 *Aedes* aegypti Mosquitoes: Favorable habitats:

Aedes aegypti mainly breeds in the domestic environment: its preferred habitats are water storage tanks and jars inside and outside houses, and roof gutters, leaf axils, bamboo stumps and temporary containers such as jars, drums, used care tyres, tin cans, bottles and plant pots. (WHO, 1997b)

Also, at school the most favorable habitats for this animal is cement tank in the toilettes, bottles and plant pots in the classrooms. According to many studies, it was found that *Aedes* aegypti can also breeds in dirty drains as good as in clean water habitats.

2.2.3 *Aedes* aegypti Mosquitoes; Life cycle:

Mosquitoes have four stages in their life cycle:

- Eggs; laid on or above water surface
- Larva or respiratory tube; takes air from water surface
- Pupa; takes air from water surface
- Adult; emerges from pupa at water surface

Once hatched, the larvae do not grow continuously but in four different stages (instars). The first instar measures about 1.5 mm in length, the fourth about 8-10 mm. Although they have no legs, they have a well developed head and body covered with hairs, and swim with sweeping movements of the body. They feed on yeasts, bacteria and small aquatic organisms. Most mosquito larvae have a siphon located at the tip of the abdomen through which air is taken in and come to the water

surface to breathe; they dive to the bottom for short periods in order to feed or escape danger.

In warm climates, the larval period lasts about 4-7 days, or longer if there is a shortage of food. The fully grown larva then changes into a comma-shaped pupa, which does not feed and spends most of its time at the water surface. If disturbed it dives swiftly to the bottom. When mature, the pupal skin splits at one end and a fully developed adult mosquito emerges. In the tropics the pupal period lasts 1-3 days. The entire period from egg to adult takes about 7-13 days under good condition.

"*Aedes* aegypti" eggs are laid singly, between 140-144 eggs at a time, on damp surfaces just above or near the water line in temporary pools and other habitats where the water level rises and falls lays. The eggs usually hatch within 2-3 days. Some species (e.g Aedes) lay their eggs just above the water line or on a wet mud; these eggs hatch only when flooded with water. If left dry they can remain viable for many weeks. (WHO, 1997b)

In Thailand, the two majors Aedes mosquitoes, important vectors of DHF, are found as follows:

1. *Aedes* aegypti; the main vector, and
2. *Aedes* albopictus; the minor vector

Aedes aegypti preferably breeds in the domestic environment: outdoors more than outdoors. Referred to the surveys of its habitats, 64.52% of water storage habitats was found indoors while 35.53% was found outdoors. The water storages found were jars, pot under cupboards, feet washing basin, plant pots, vases, and water storage for feeding animals.

Aedes albopictus, like aedes aegypti, breeds in temporary containers but prefers natural ones in forests, such as tree holes, leaf axils, ground pools and coconut shells, and breeds more often outdoors in gardens and less frequently indoors in artificial containers. (WHO, 1997b)

2.3 Prevention and control

DHF epidemic was composed of 3 major factors:

1. Agent: Dengue serotype viruses 1, 2, 3, and 4
2. Host: People; The most risky was among people who are 0-14 years old
3. Environment or vector: *Aedes* aegypti and *aedes* albonictus

In case that a community had 3 favorable factors, it emerged DHF epidemic easily. Hence, to find the control measure for DHF, it was strongly needed to control or reduce all mentioned factors or may be one of three factors. Anyway, for DHF, it could be monitored each factors, one by one, as follows:

Agent; there had been no specific treatment to control and stop dengue viruses, as a result the specific measurement to control this factor was very difficult to implement.

People; DHF was only found in human being, then human being was like a reservoir of infection. To eradicate or reduce disease reservoir, it required to generate immunization. One of the ways to generate immunization was to create a DHF vaccination. Anyway, a vaccine is not yet available as it required a vaccine that can prevent diseases that caused by 4 serotypes DHF virus, so called "Tetravalent vaccine". Because any of four different viruses may causes severe diseases, and

because protection against only one (monovalent), two (bivalent) or three (trivalent vaccines) viruses could actually increase the risk of more serious disease. Nonetheless, progress is being made in the development of vaccines that may protect against all four dengue viruses (tetravalent). Such products may become available for public health use within 4 or 5 years.

Vector; The most efficient control measure of DHF is to combat the vector mosquitoes. The implementations of vector control and surveillance activities are as follows:

1. *Larval habitats control:*

Cover containers to prevent access by egg laying female mosquitoes, by using double cover with materials like mosquitoes net, nylon net and plastic sheet

Drained useless water storage containers Burn, bury, disposal or drain favorable larval habitats for preventing of mosquitoes breeding.

2. *Siphons control*:

Physical control; Disposal, bury, burn and eliminate water storage containers.

Chemical control; i.e., Abates product. According to the study of Salupsri & Pothimol, 2003, it was strongly needed to add more Abates every two months in to the siphon found water storage containers. This method generated an efficient consequence. Normally, to add more abate every three months diminished *Aedes* agypti siphons in water storage containers if there were not more added water in those containers.

Bio-environmental control: Vector siphons are favorable eaten by larvivorous fishes (mostly guppy).

3. *Adult control:* By using chemical products as follows:

Ultra Low Volume (ULV) Spraying: Sprayed a chemical product by using an air pressed spraying motor throughout a tiny spraying. The chemical product were spread in the air and directly contacted to mosquitoes.

Thermal fogging: Sprayed a chemical product by using a hot air spraying motor, like a fog spread in the air and directly contacted to mosquitoes.

4. *Man-mosquito contact control:*

Use mosquito net while sleeping

Use mosquito net glazed with mosquito repellent

Use mosquito repellent

Vector control and surveillance, elimination or reduction of vector habitats, was the most efficient way to prevent DHF. Because it was costless especially buying a chemical products. Also, it was very effective as it controlled mosquito naissance which was the static target that easy to be controlled. Moreover, it was not require the chemical uses which were very harmful to bio-environment. Anyway, to accomplish this measure, it was strongly needed to have community participation, including collaboration of private and public sectors.

2.4 Dengue Haemorrhagic Fever Prevention and Control Project:

The Ministry of Public Health (2001); has conducted activities and projects for preventing and controlling DHF. They were aimed to monitor and survey sick and fatality rates, for not being harmful to Thai people, i.e., "DHF Prevention And Control

Project For the 72 Anniversary of His Majesty the King, in 1999 , and "DHF Prevention and Control Bi-Parties Project: In Collaboration Between Responsible And Local Administrative Organizations (Ministry of Public Health, Department of Diseases Control, 2003) etc.

In 2003; the Ministry of Public Health, in cooperation with the Ministry of Education, was first conducted a "Youth Empowerment Against Dengue Haemorrhagic Fever Project". This project aimed to encourage youth especially students to realize and aware of surveillance, control and elimination of *Aedes aegypti* mosquito habitats, both at their houses and schools. It was done by integrating knowledge of prevention and control of DHF into the studying-learning curriculum. Also, it was initiated the continuous survey and control mosquito habitats activities in every Friday. These activities were implemented all over Thailand at the same time. The project was composed of activities as follows:

1. Conducted surveillance and control of *Aedes aegypti* mosquito reservoirs both households and schools in every Friday, including recorded the activity results.
2. Planned and implemented "DHF Prevention and Control Week Campaign". This was a collaboration among schools, communities and relevant organizations
3. Conducted extra-activities, i.e., slogan and composition related to DHF prevention and control competitions.
4. Supported and Facilitate activities recording sheets, and facilitated "Youth Empowerment Against DHF Project" to all schools in its responsible areas, by the Ministry of Public Health.

In Krabi province, the activities of "Youth Empowerment Against DHF Project", were as follows:

1. Krabi Provincial Chief of Medical Office organized a meeting for informing and initiating projects activities to responsible health officials at district and community hospital levels.
2. Klongthom Health Office organized a meeting for informing objectives, guidelines and activities of the project to teachers and health officials who were responsible for preventing and controlling DHF.
3. Health officials who were responsible for preventing and controlling DHF, at district level, organized a meeting for informing objectives, guidelines and activities of the project to students of primary schools: grade 3^{rd} -6^{th} of all responsible areas schools.
4. All students at primary schools grade 3^{rd} -6^{th}, once every week, surveyed and destroyed *Aedes* aegypti mosquito favorable habitats both at their houses and schools by using "Performance of Surveillance And Control of Mosquito Habitats at Schools And Homes Records Sheet"
5. Students reported and feedback their results of projects performances.

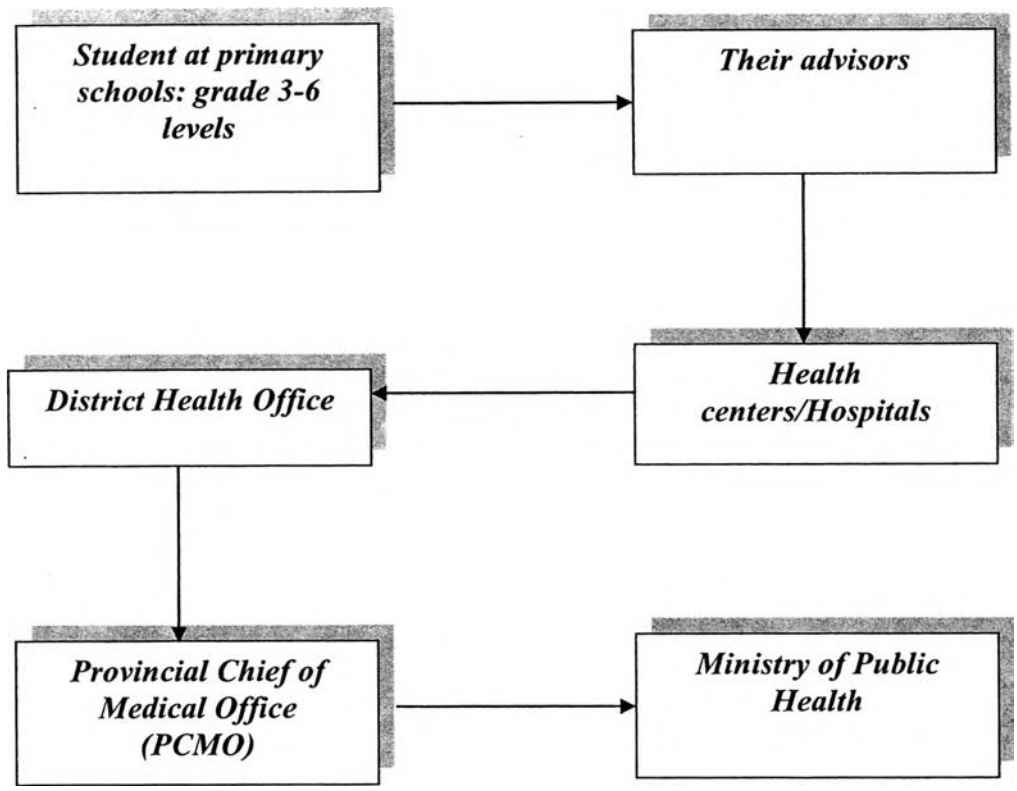

Figure 2: Flow of monthly checklist report (Ministry of Public Health, 2003)

Even though the mentioned above project had been implemented in all schools; public and private schools, in Krabi Province from October 2003 (B.E. 2546) to October 2005; there was neither a supervision nor an evaluation processes from Krabi PCOM or Klongthom Health Office. That was the reason why the researcher interested in project evaluation especially of all schools in the areas of Klongthom Nuea Sub-district, Klongthom District.

For evaluating "Youth Empowerment Against DHF Project" focused on students at primary schools level, which has been conducted for 2 years, the researcher will conduct an on-going project, called formative evaluation. The study was aimed to evaluate knowledge, attitude, performance, satisfaction, problems and barriers, and output of the project during on-going period.

According to Suchart Prasitiratsit, 1989 defined "evaluation project" was to measure project by comparing output and set objectives. As a result, it was utilized, in the future, as a guideline for decision making and project improvement.

Juncami (1982) said that the main idea of health project evaluation was composed of the following steps:

1. Identifying what to be evaluate.
2. Specifying evaluating topics
3. Specifying evaluating indexes and defined their meaning.
4. Creating evaluating instruments
5. Specifying sample and its quantity
6. Specifying data collecting guidelines
7. Providing suggestions and discussions for project improvement

Chareonphol (1992), Chooto (1992) and Pravalapreug (1983) divided an evaluation as follows:

1. Evaluation during planning and appraisal or Ex-ante evaluation. To evaluate during the early stage of a project, it was composed of pre-feasibility study and feasibility study; i.e., technical study, funding, needs assessment, environment and social impact, administrative systems both of project and community, cost benefit study towards community and financial analysis and possibility of its resources. The evaluators for this period were staff from funding support sectors, i.e., from government and international organizations, including form policy section or project advisor section.

2. On-going project evaluation or formative evaluation. During the on-going period, for insisting of efficient performance under the time frame, and to solve any

difficulties, project evaluation was recommended. This was for assessing progress, monitoring and supervising project activities to be in accordance with its objectives. The evaluation during this period of time was called differently, for example, formative evaluation, implementation or monitoring evaluation and process evaluation. Required documents for the evaluation were progress, construction, engineering, technical, financial and annual reports. The evaluators mostly were staffs who worked in the same project from evaluating section, because these people were familiar with performance and working system.

3. Post-project evaluation or summative evaluation. It was the measurement of project accomplishment, or it was helpful to identify the project barriers when being compare with financial investment. It also was to collect performance while starting project and overall outputs and providing suggestions for the near future project. This is why the components of evaluation were composed of project's objectives, resources, opportunity and other alternatives, barriers, output and outcome analysis, impacts and others details of project limitations. Required documents were all mentioned documents in planning and on-going evaluations, including outcome or impact evaluation and social impacts after the project termination.