FACTORS THAT HAVE CAUSED DENGUE HEMORRHAGIC FEVER (DHF) TO BECOME A PUBLIC HEALTH PROBLEM IN INDONESIA AND EFFECTIVE DHF CONTROL

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ABSTRAK

Demam berdarah dengue (DBD) endemic di kota-kota besar dan kecil di Indonesia dan cenderung menyebar di beberapa daerah pedesaan dengan mobilitas penduduk yang tinggi. Indonesia adalag negara yang memberikan kontribusi untuk jumlah kasus DBD di Asia Tenggara pada tahun 2005 dengan jumlah total 95.270 kasus dengan 1.298 kasus kematian karena DBD (CFR=1,36%). Pada tahun 2006, 57% kasus DBD di Asia Tenggara berasal dari Indonesia dan 70% kasus kematian karena DBD di Asia Tenggara adalah dari Indonesia, yaitu sebanyak 1.132 kematian dari 1.558 kematian karena DBD di Asia Tenggara. DBD merupakan masalah kesehatan masyarakat yang besar dan merupakan salah satu isu penting kesehatan di Indonesia karena insidens dan CFR nya yang selalu menunjukkan peningkatan setiap tahunnya. Epidem DBD di Indonesia disebabkan oleh perubahan demografi dan sosial, mobilitas penduduk, infrastruktur kesehatan masyarakat yang tidak memadai, dan kegiatan vektor kontrol yang tidak efektif. Cara yang efektif untuk menyelesaikan masalah DBD adalah dengan vektor kontrol yang berbasis masyarakat, seperti pengaplikasian abate dan menghilangkan sumber penularan (tempat perindukan vektor) melalui partisipasi masyarakat; serta vektor kontrol secara biologi, misalnya dengan penggunaan Mesocyclops.

Keywords: DHF, effective DHF control, Indonesia

BACKGROUND

Dengue hemorrhagic fever (DHF) is an old mosquito borne disease that is epidemic in more than 100 countries especially in tropical urban areas, placing a lot of people at risk. DHF has reemerged in the past three decades with a wider distribution of both viruses and mosquitoes vector, and increased in the number of epidemic area. There were 50–100 million cases of dengue fever and 500,000 cases of dengue hemorrhagic fever every year that need hospitalization. DHF has been a leading cause of hospitalization and death in children with case fatality rate of 0.3–0.5% in South-East Asia.

A global pandemic of dengue began in South-East Asia and the Pacific during World War II. The change in ecology that was caused by the war made the geographical distribution of Aedes aegypti wider and the densities of A. aegypti rose, placing many countries as endemic areas. The first DHF epidemic in South-East Asia occurred in manila, the Philippines, in 1953 to 1954, but in two decades this disease had become epidemic throughout South-East Asia and by the mid-1970s, DHF had became the number one disease that caused hospitalization and death in children in South-East Asia.

In Indonesia, DHF has been endemic in many cities and small towns and tends to spread in smaller villages where population movements are high. This disease was firstly reported in two provinces in 1968 and has shown an
upward trend from 1999 to 2004. In 2004, 78,690 cases were reported with 954 deaths (CFR = 1.2%). During December 2004 to 22 February 2005, outbreak occurred in 30 provinces with a total of 10,517 cases and 182 deaths (CFR = 1.73%). Indonesia was the main contributor of dengue cases in South-East Asia region in 2005 with a total of 95,270 cases and 1,298 deaths (CFR = 1.36%). In 2006, Indonesia was contributed to 57% of the dengue cases and almost 70% of the dengue deaths in South-East Asia region, 1132 deaths out of total of 1558 dengue deaths in the region. DHF has been a major public health problem in Indonesia and an important issue because the incidence and case fatality rate of DHF shows an increase every year. This review will consider some problems that have caused DHF to become a major public health problem in Indonesia. It will then put forward the effective solutions to solve this problem.

MATERIAL AND METHODOLOGY
This review was done by reviewing journal articles related to the epidemiology of DHF, DHF eradication, transmission and control of DHF, DHF vector control, DHF control intervention, and community-based dengue control.

RESULT AND DISCUSSION
Factors responsible for the emergence of the DHF
There are several factors that are responsible for the emergence of the DHF epidemic in Indonesia. The emergence of DHF is closely related to demographic and societal changes, for instance population growth and urbanization. Uncontrolled and unplanned urbanization and population growth have had a great amount of contribution to the increase of DHF incidence and the spread of dengue area. In Indonesia, and countries in South-East Asia, the population growth and the city developments have made the sanitary conditions decline. This is because the amount of vegetation has declined and at the same time man made water containers have increased, a perfect condition for A. aegypti transmission. Moreover, as a result of uncontrolled and unplanned urbanization, the low standard shelters, population density, limited water, culvert, and waste management systems have made suitable conditions for the transmission of A. aegypti. This is because these conditions have created a lot of breeding places for A. aegypti for instance water storage tanks (e.g. water tanks, water storage drums, clay jars), discarded containers collecting rainwater (e.g. jars, bottles, cans), and resting places for A. aegypti, such as hang-up clothes. The common Indonesian habit to collect and save water in a water storage tank for daily needs creates a perfect environment for the breeding of A. aegypti.

A second factor that has contributed to the emergence of DHF epidemic is increased travel. Modern transportation has given a huge opportunity for the movement of people and commodities that provides a perfect way to transmit dengue between cities within Indonesia and between cities in Indonesia and other countries. As an example is what occurred in the United States in 1994, an estimated 40 million people left the United States by plane, and more than 50% of them traveled to places where dengue was endemic. A lot of travelers became infected while visiting their destination place but became ill when they returned to the United States. As a result, dengue viruses were transported from the endemic area to other areas. This is because local mosquitoes were infected by dengue viruses when they bit the ill persons and then spread the disease to other people in that area. This has also happened in Indonesia. Because of an increase in air travel, most cities in Indonesia could be reached easily which cause dengue viruses and vector mosquitoes to be transmitted from one city to other cities thus expanding the DHF endemic areas in Indonesia.

A third factor influence the emergence
of the DHF epidemic has been a lack of public health infrastructure. Limitation in human resources leads to the lack of public health officials for research, surveillance and control programs. As a result, there is only limited research about DHF and poor surveillance and control programs. Since surveillance is poor, DHF epidemic is usually not detected until outbreak occurs and a lot of people die. Furthermore, public health policy in Indonesia has emphasized the control programs in emergency response to epidemics rather than implementing programs in order to prevent DHF epidemic. Mosquito control usually begins when dengue epidemic is recognized, but this attempt is too late to overcome the epidemic. Lastly, there have been competing priorities where government puts priority on other infectious diseases, such as tuberculosis, HIV/AIDS, or influenza that was caused by the limitation to finance all health programs.

A forth factor that contributes to the emergence of DHF in Indonesia is ineffective mosquito control. Indonesia has emphasized the control programs in emergency response. A visible emergency response has performed, such as the use of ultra low volume (ULV) insecticide space sprays for adult mosquito control. However, ULV space sprays are not an effective approach for controlling A. aegypti. This approach has been giving the community a "false sense of security" so that the community has done nothing to control mosquitoes in and around their house. As long as people see fogging activity in their area, they feel "secure" that they will not contract DHF. However, fogging or space spraying is not effective to prevent DHF because the fog does not reach all areas around and inside the houses, particularly hidden areas (e.g. under the bed, in hung clothes). Moreover, fogging is depended on wind flow. In addition, A. aegypti has spread geographically and A. aegypti density has increased because of the amount of mosquito larval habitats. At the end, neither the government nor the communities do anything effective to prevent the DHF epidemic and keep living in the epidemic cycles.

**Effective DHF control**

DHF is a major problem in Indonesia. It is the number one disease that causes hospitalization and death in children. However, the DHF incidence and case fatality rate could be reduced if effective solutions, particularly in vector control can be done.

The first solution is source reduction via community participation with rationale that dengue control could be succeeded if it was done by the communities where transmission happened. Gubler claims that community-based control is the most effective way for dengue control by putting temephos and doing larval source reduction, such as getting rid or cleaning water containers that can be breeding places for A. aegypti in and around houses.

To guarantee sustainability, the larval source reduction program must be emphasized using community-based approaches. Continuous A. aegypti control can be achieved only by the people who live in the houses where mosquito breeding places might exist and by the people who have contribution to make the mosquito breeding places by the way they live. Additionally, larval source reduction by putting temephos sand granules into water containers is one of the effective ways to control dengue vector.

In Thailand, larval source reduction program through community participation is a leading vector control. The use of temephos sand granules depends on the type of water containers. In Singapore, larval source reduction has been implemented since 1968 and in addition to this program, the vector control program has two elements, public education and law enforcement. The implementation of this program in Singapore had reduced A. aegypti population from 16% to 2%. To
keep this lower vector population density, public involvement was needed because without it vector can repopulate the area. Singapore implemented complete house inspections and fines to eradicate *A. aegypti* habitats in and around people's houses.

Indonesia has implemented larval source program for years. However, the implementation of the program has not been continuous, only during rainy season. In addition, there is a lack of community participation as well as law enforcement. In order to implement a sustainable community-based dengue control in Indonesia, it is essential to maintain the behavioral changes related to dengue control, such as the use of temephos, the protection of artificial containers, and the coverage of water storage. It needs many years to accomplish the sustainability because if the behavioural changes do not sustain, it is more likely to find more *Aedes aegypti* foci. Moreover, this is an ongoing process that needs community ownership and active involvement.

To achieve behavioral changes related to dengue control and in the end a sustainable community participation dengue control program, it is important to give public education about dengue control to the community. The communities need to receive an ongoing education program not only about dengue but also about capacity building, such as problem identification, action plan, and evaluation. Therefore, they would be able to mobilize other people to actively involved in the program.

Giving comprehensive education to people in community as well as law enforcement in addition to larval source reduction via community participation can potentially reduce the DHF incidence and case fatality rate.

The next solution is the using of biological control, for instance Mesocyclops, a tiny crustacean that prey on mosquito larvae. Mesocyclops are effective for vector control because of its wide range of diet, including algae, protozoa, rotifers, and most aquatic animals. The Mesocyclop's ability to kill mosquito larvae is immense. Many studies have been conducted that validate the use of Mesocyclops as the most effective solution for control of *A. aegypti* larvae. Research in Australia, Honduras, USA, Philippines, and Vietnam has proven that Mesocyclops can eliminate *A. aegypti*.

The most phenomenal achievement in using Mesocyclops to eliminate *A. aegypti* has happened in Vietnam when in August, *A. aegypti* disappeared from Phanboi, Vietnam. Mesocyclops were used for biological control of *A. aegypti* by putting them into water containers, such as large cement tanks, ceramic jars, and other domestic containers. Since the use of Mesocyclops has been successful to eliminate *A. aegypti* in Phanboi, the same project was implemented in other rural communes in Vietnam. A community-based program in Vietnam showed that Mesocyclops reduced *A. aegypti* by approximately 90% in year 1 and *A. aegypti* had been eliminated by the third year. Also, by the first year, the incidence of dengue in those areas had reduced by 76.7%. The key to successful use of Mesocyclops is community organization. Everyone was involved with this program; communal management committees, health officials, housewives, schoolteachers, and even pupils.

Indonesia can adopt this method in order to reduce DHF. Most *A. aegypti* breeding places in Indonesia are similar to the water containers in Vietnam that have proven perfect for Mesocyclops. Other advantages of using Mesocyclops are, it does not demand enormous time, effort, or technical expertise from the community and the cost is low. There is a possibility of negative side effects of introducing new species. However, Mesocyclops are harmless. The main problem is only the loss of Mesocycloos from water containers when are cleaned. If Indonesia wants to adopt this method, we need to make sure that everyone in communities and public health officials will get
involved and maintain this program continuously. Moreover, the availability of Mesocyclops is also need to be considered along with the need to do more review about the side effect of using Mesocyclops.

CONCLUSION
The emergence of DHF epidemic in Indonesia has been caused by demographic and societal changes, people mobility, decay of public health infrastructure, and ineffective vector control. The effective way to solve this problem is a community-based vector control, such applying temephos, and source reduction via community participation; and biological control, such as the use of Mesocyclops. However, the government has to ensure that everyone in the community is willing to participate and at the same time give comprehensive education about DHF and the importance of vector control programs to the community as well as law enforcement.

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