

The Trend of Dengue Hemorrhagic Fever Cases in Central Jakarta 2008-2010

Dewita Kamaruddin,¹ Saleha Sungkar²

¹ Medical Science Program, Faculty of Medicine Universitas Indonesia

² Department of Parasitology, Faculty of Medicine Universitas Indonesia, Jakarta

Abstract

Dengue hemorrhagic fever (DHF) constitutes a significant public health problem in Jakarta, thus it is crucial to plan preventive measure before an outbreak occurs. The aim of the study was to find the trend of DHF cases in Central Jakarta. Subjects were diagnosed for DHF in Central Jakarta from 2008 to 2010, and were documented by Sudinkes (District Health Office) of Central Jakarta. Investigation was conducted on the trend of DHF cases using secondary data, while adjusting for several criteria such as age, gender and case fatality rate (CFR). The results showed that peak incidence of DHF infections was detected in May 2008, and in March 2009 and 2010. There was no difference observed between male and female ($p < 0.19$), whereas adult personnels were more susceptible to suffer from DHF compared to children ($p < 0.001$). CFR appeared to be under the standard ($< 1\%$). CFR of DHF in Jakarta has to be maintained as of $< 1\%$. This can be done by conducting several efforts on decreasing of DHF cases. To conclude, all societies living in the area of Central Jakarta should be aware of DHF and the awareness has to be raised particularly from March until May.

Keywords: dengue hemorrhagic fever, age, gender, case fatality rate, Central Jakarta

Tren Kasus Demam Berdarah Dengue di Jakarta Pusat, 2008-2010

Abstrak

Demam berdarah dengue (DBD) merupakan masalah kesehatan masyarakat di Jakarta sehingga penting untuk merencanakan tindakan pencegahan sebelum terjadinya wabah. DBD dikaitkan dengan perubahan iklim karena puncak kejadian biasanya pada awal dan akhir musim hujan, namun karena perubahan iklim global, iklim di Jakarta tidak dapat diprediksi. Subjek dengan diagnosis DBD di Jakarta Pusat dari tahun 2008 sampai 2010 dicatat oleh Sudinkes Jakarta Pusat. Data sekunder dianalisis untuk menyelidiki tren DBD berdasarkan usia, jenis kelamin dan case fatality rate (CFR). Hasil penelitian menunjukkan bahwa kejadian puncak diamati pada bulan Mei (tahun 2008) dan Maret (tahun 2009 dan 2010). Tidak ada perbedaan laki-laki dan perempuan ($p < 0,19$), sedangkan orang dewasa lebih rentan terhadap DBD dibandingkan dengan anak-anak ($p < 0,001$) yang berarti orang dewasa harus lebih waspada terhadap DBD dibandingkan dengan anak-anak. CFR pada ketiga tahun tersebut berada di bawah standar ($< 1\%$) yang berarti CFR di Jakarta harus dipertahankan $< 1\%$. Semua masyarakat harus waspada terhadap DBD terutama pada bulan Maret sampai Mei.

Kata kunci: demam berdarah dengue, usia, jenis kelamin, angka kematian, Jakarta Pusat

Introduction

Dengue is a mosquito-borne viral disease caused by one of the four serotypes of dengue viruses, which are transmitted to humans through the bites of infected female *Aedes* mosquitoes, with *Aedes aegypti* being the principal vector. The common presentations of dengue fever (DF) — the acute febrile state of dengue disease — include fever, muscle pain, joint pain, headache, rash and leucopenia. The worse stage of dengue fever is Dengue hemorrhagic fever (DHF), a potentially lethal complication of dengue infection. DHF is characterized by four major clinical manifestations: high fever, hemorrhagic phenomena, hepatomegaly and, in severe cases, signs of circulatory failure. Patients with circulatory failure may develop hypovolemic shock which can lead to plasma leakage. This condition is called dengue shock syndrome (DSS) and can be fatal. However, not all individuals with dengue infection will show symptoms of or suffer from dengue fever, DHF or DSS.¹⁻⁴

Dengue represents a major international public health concern which poses a significant health, economic and social burden, particularly on the populations of endemic areas.⁵ Dengue has been observed to infect 50 million people every year with about half a million of DHF cases requiring hospitalization. Americas, South-East Asia, Western Pacific, Eastern Mediterranean, and the tropical regions of Africa are dengue-endemic areas. Indonesia, as one of the South East Asia regions (SEAR), is considered to be the country with the highest total number of dengue cases. In 2005, 53% of dengue infections in SEAR diagnosed in Indonesia. Furthermore, in 2006, the total of dengue infections in Indonesia accounted for 57% of all the dengue cases in SEAR and as many as 70% of those diagnosed with dengue died. The number of deaths was reported in SEAR occurred in Indonesia. A significant increase in the number of dengue cases had also been recorded in several Indonesian provinces in the year of 2006.⁶

Jakarta is a province known for having the peak incidence of dengue cases in Indonesia. Approximately 25% of all dengue cases diagnosed in Indonesia occurred in Jakarta and the total of dengue infections has not been controlled yet. It has been progressively increasing each year. The outbreak in Indonesia that took place from December 2004 to February 2005 in DKI Jakarta province was found to be the most critical outbreak of all history of dengue infection.⁷

As DHF constitutes a significant public health

problem in Jakarta and is able to leave substantial negative impacts on a country in the aspects of health, economy and sociology, it becomes important to study the cyclical pattern and the seasons when dengue cases increase, so that preventive measures can be planned before an outbreak occurs.

DHF is strongly related to climate changes because the highest incidence usually appeared in the beginning and towards the end of the rainy season. However, the climate, particularly in Jakarta, is not predictable, most probably due to the changes of global climate.⁸ Therefore, this research will study the trend of the occurrence of DHF cases in Jakarta, which is known to have the peak incidence of dengue infection cases in Indonesia. Nevertheless, due to the shortage of time and limited resources, this research study will focus only on one region in Jakarta, namely Central Jakarta. The information gathered from this research will be used to raise discussion and solutions among health care providers on appropriate approaches and strategies to encourage early warning system to prevent a dengue outbreak.

Methods

The research design used in this study is a descriptive research. We utilize a cross-sectional design to study the number of DHF cases, CFR and peak incidence of DHF occurred in 2008-2010. The data that we used are secondary data gained from Suku Dinas Kesehatan (Sudinkes) Jakarta Pusat.

The target population in this study is subjects who became ill due to DHF in certain regions of Central Jakarta. The population of people that becomes the samples of our research were subjects diagnosed for DHF in Central Jakarta in 2008-2010. The sample used in this study were the patients recorded by Sudinkes Jakarta Pusat in the year of 2008- 2010. Calculation of sample size was not performed and it was not necessary as all cases of DHF will be used as our research subjects in this study.

Recording data of DHF cases was carried out by Sudinkes Jakarta Pusat based on the number of people diagnosed for having DHF showing its characteristic clinical manifestations, age, gender and CFR. The recording of cases was carried out every month for every subdistrict of Central Jakarta from January 2008 until December 2010, then the total of all cases occurred in a year were calculated. The results of data analysis will be presented in the form of written text and graphics such as tables, diagrams, and graphs to illustrate results that have been statistically analyzed.

In this study, it is not necessary to have an ethical clearance because the secondary data of DHF cases that the researchers obtained did not show identity of the participants who suffered from DHF. Moreover, researchers have obtained the permission from Sudinkes Jakarta Pusat to use the secondary data for this research.

Results

Demographic profile of Central Jakarta

Central Jakarta is one of the five cities which form Jakarta, Indonesia. Central Jakarta has an average of 19,000 residents per square km, making it the most densely populated municipality in Jakarta.⁸ Central Jakarta is bounded by North Jakarta to the north, East Jakarta to the east, South Jakarta to the south, and West Jakarta to the west.

Central Jakarta is divided into 8 Kecamatan (subdistrict): Gambir, Tanah Abang, Menteng, Senen, Cempaka Putih, Johar Baru, Kemayoran, and Sawah Besar. However, water supply and sanitation were found inadequate. Many homes

are temporary structures without running water and more than a third of households have no access to tap water.⁹ These subdistricts are urban areas yet occupied by slums. The residents living in places with highly dense population usually use containers to keep clean water. Moreover, those containers could become breeding places for *Aedes* to grow.

The Trend of DHF Cases in Central Jakarta in 2008-2010

Number of DHF cases was observed from 2008 until 2010 (Figure 1). The trend of DHF cases in the year 2008 showed the peak incidence to appear in May with as many as 556 cases out of a total of 3452 cases in that year and the lowest in September with 91 cases. Moreover, there was an interesting trend occurred in 2009 and 2010. Both years showed the peak incidence to occur in the same month which was March with 576 cases out of total 3222 cases in 2009 and 289 cases out of total 2075 cases in 2010. Therefore, 2008 was the year among those three years to have the peak incidence of DHF cases.

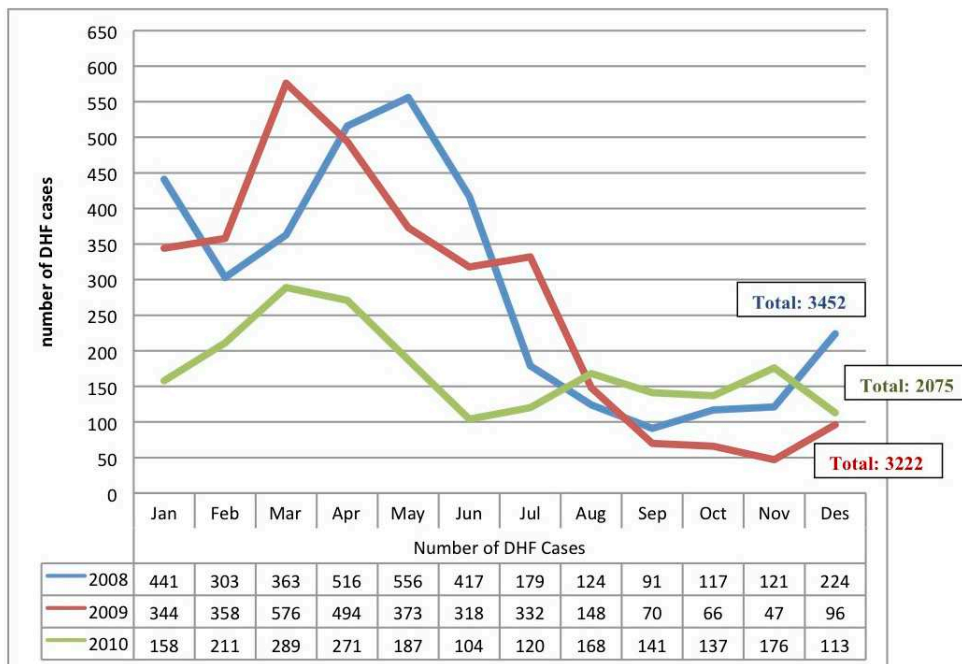


Figure 1. Number of DHF Cases per Month in 2008, 2009 and 2010 in Central Jakarta

Comparison of DHF Cases in Male and Female in Central Jakarta in 2008-2010

Figure 2 shows the percentage of male and female infected with DHF in Central Jakarta from 2008 until 2010. Results suggested that DHF infects more male compared to female. This finding

was consistent for 3 consecutive years (2008, 2009 and 2010) with male patients constituted above 50% (51.5% in 2008, 51.4% in 2009 and 53.7% in 2010) of overall DHF cases. However, there was no significant difference between male and female groups ($p = 0.19$).

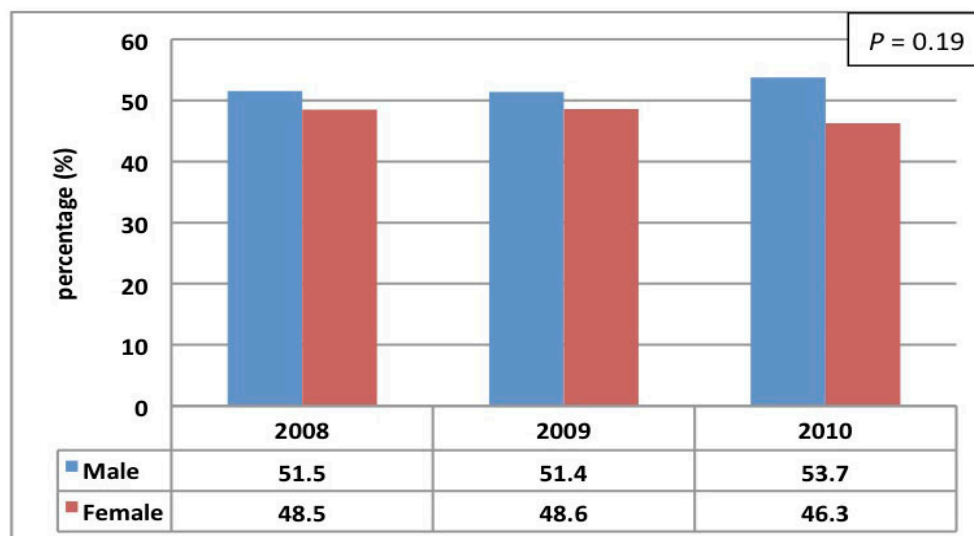


Figure 2. Percentage of DHF cases in male and female in Central Jakarta

The DHF Cases According to Age Group in Central Jakarta in 2008-2010

As shown in Table 1, result revealed that age group <1 year had the lowest incidence of DHF cases in 2008, 2009 and 2010. The number of DHF cases elevated in accordance to older age and reached the peak in age group 15 – 44 year. In 2008, as many as 1860 cases out of overall 3409 cases occurred in age group 15 – 44 year. The number accounted for 54.6% of overall DHF cases. In 2009 and 2010, age group 15 – 44 year remained the most susceptible age group towards DHF compared to the entire age category making up to a respective 56.5% and 49.3% of the total DHF cases. However, the increasing susceptibility in accordance with age

did not apply to the age group more than 45 year (Table 2). The percentages of DHF cases were much lower in age group ≥ 45 year than those in age group 15-44 year. Next, we combined smaller groups in order to make two categories: children (<15 years) and adult (≥ 15 years).

Table 2 shows the comparison of DHF cases between the pediatric group (<15 years) and adult group (≥ 15 years). Results revealed that there were bigger percentages of adult groups suffering from DHF compared to the pediatric group indicating that adult group has the tendency to be infected by dengue virus. The finding was consistent for the 3 successive years and it showed a significant result in the statistic test ($p < 0.001$).

Table 1. Number of DHF Cases Based on Age Group

Age Group (year)	2008	2009	2010
< 1	57 (1.7%)	54 (1.7%)	36 (1.7%)
1 - 4	335 (9.8%)	295 (9.2%)	198 (9.5%)
5 - 14	912 (26.8%)	820 (24%)	636 (30.7%)
15 - 44	1860 (54.6%)	1817 (56.4%)	1022 (49.3%)
≥ 45	245 (7.2%)	233 (7.2%)	183 (8.8%)
Total	3409 (100%)	3219 (100%)	2075 (100%)

Table 2. Comparison between the Number of DHF in Children and Adults

Age group (year)	2008	2009	2010	p value
<15	1304 (38.2%)	1169 (36.3%)	870 (41.9%)	< 0.001
≥ 15	2105 (61.8%)	2050 (63.7%)	1205 (58.1%)	
Total	3409(100%)	3219 (100%)	2075 (100%)	

CFR of Overall DHF Cases in Central Jakarta in 2008-2010

CFR refers to the proportion of people who died of DHF divided by the total sum of those suffering from DHF in the respective year. Since dengue infection can be fatal, CFR of overall DHF cases was also studied. As indicated by Table 3, it was shown that the highest CFR among those years was in 2009 with 5 deaths in 3222 patients with DHF (0.2%). The CFR of DHF cases from 2008 until 2010 were found to below the standard.

Table 3. CFR of DHF in Central Jakarta in 2008-2010

Year	Patients	Death	CFR
2008	3452	2	0.1
2009	3222	5	0.2
2010	2075	2	0.1

Discussion

DHF control through vector control program has been done in Indonesia for years but it fails to stop dengue transmission. As dengue known to have seasonal pattern with the peak number of cases are at the beginning and towards the end of the rainy season, the program is only implemented mainly during both of this time. The problem nowadays is that the rainfall peaks are different because the change in global climate. If these problems continue, it will be very difficult to take control over dengue outbreak because lack of data concerning when to prepare for outbreaks.

For that reason, this research is carried out to study the trend of DHF throughout a year. Specifically, this study is to learn the peak incidence of DHF to find in which month it occurs in a year. Also, the incidence of DHF will be investigated in relation with age, gender, CFR and climate change. However, its association with climate change will be discussed superficially.

The Peak Incidence of DHF Cases in Central Jakarta in 2008-2010

Generally, the number of DHF cases in Central Jakarta decreased from 3452 cases in 2008 into 3222 cases in 2009 and 2075 cases in 2010. The number of DHF cases in 2008 was the highest among those 3 years. Pratana et al described that dengue epidemic occurred at regular intervals a 5 year cycle

in Indonesia when it was first recognized in Java.¹⁰ Also, it has been predicted that there would be an explosive outbreak in 2008 after a massive outbreak in 2004 in Indonesia. So, our finding is consistent with the prediction described before.

Although there was a marked decrease of DHF incidence, the number of cases was still considered high. On that account, prevention over DHF remains a paramount measure to overcome the problem.

The peak incidence of DHF cases occurred in May with 556 cases (15.7% of the total cases) and the lowest in September with 91 cases (2.6% of the total cases) in 2008. It has been observed that in several countries, rainy season plays an important role in the rising transmission of DHF. The associations between temperature and rainfall are essential determinants of dengue infection transmission. Evidence shows cooler temperatures affect the survival of adult mosquitoes, therefore affects the rate of transmission. Moreover, rainfall and temperature may influence the patterns of mosquito feeding and its reproduction, and hence the population density of vector mosquitoes.¹¹ With regard to this, we attempted to link the incidence of DHF with rainfall or seasonal pattern in a year.

Throughout 2008, the highest rainfall appeared to be in September, which was 32.43 mm/day and the lowest was at 4.32 mm/day in May. This is an interesting finding as the outbreak of DHF did not occur in line with the highest rainfall in that year. Theoretically, *Aedes* mosquitoes rapidly grow and breed many off springs of mosquitoes particularly during the rainy season. In the period of the rainy season, tree holes, bamboo stumps, rain barrels for collecting rainwater, clogged up roof gutters, and all artificial containers which can accumulate water become potential breeding habitats outdoor.¹² However, despite the fact that rainwater during the highest concentration of rainfall has high possibility to wash away the adult mosquitoes, the eggs that adult mosquitoes lay might still attach to the container and survive. This can explain why the highest incidence of DHF cases usually happened to be in the months near that period of highest rainfall.

Contradicting with our finding, if we look back to the pattern of DHF spread in 2008, the number of cases steadily increased in such an order: it steadily increased from January until April of the year – reached the peak in May – decreased progressively until September – slightly increased again in October. Our result showed that the peak incidence of DHF occurred in May which was the lowest rainfall in 2008 and the incidence remained relatively low around the highest rainfall, surprisingly.

In 2009, the outbreak occurred in March (576 cases) with lower total DHF cases (3222 cases) compared to that of year 2008 (3452 cases). A similar pattern was observed in 2010 as its peak incidence (289 cases) occurred in the same month, March, with a substantial lower incidence of DHF cases (2075 cases) compared to 2009 (3222 cases). Following the peak incidence, the number of DHF cases in 2009 and 2010 was reduced stably and rose again in July. Unfortunately, there has not data concerning the rainfall in Central Jakarta for 2009 and 2010 by *Badan Pusat Statistik Indonesia*. Therefore, this finding was inconclusive regarding the role of rainy season and temperatures as we were not able to compare the incidence of DHF cases in those three years.

Collectively, based on the description above, we have to be aware of the possibility of an explosive outbreak especially in March and May thus be prepared at least one month before the occurrence of the outbreak. Preparations for DHF outbreak includes early warning system through community education and encouragement of integrated vector control.

Since *Aedes* larvae are container-breeders which thrive in both clean and organically rich water in both natural and artificial containers, they are able to grow and become vectors (carrier mosquitoes) of DHF. Therefore, further study is still needed to elucidate the correlation between vector identification and the number of DHF cases throughout a year.

DHF, as one of the major public health problem in Indonesia especially Jakarta, is predicted to be able to continue growing. In order to reverse this situation, preventive efforts have to be directed at the control of mosquito control and also health promotion as a health strategy. Additionally, participations of researchers, health professionals and communities will be of a great importance. Having that mentioned, preventive efforts should be routinely implemented and to be aimed at least one month before an outbreak.

Comparison of DHF Cases Based on Gender in Central Jakarta in 2008-2010

Specific demographic factor such as sex may be related to the exposure to dengue. A few studies from Asia, such as those from Singapore, that have examined male and female dengue incidence, have tended to find greater male incidence. Differences in dengue incidence have been attributed to gender-

related differences in exposures such as time away from home.^{13,14} The finding was consistent with one study by Anker et al. suggesting that male are more susceptible to DHF because men as breadwinners work outside home during daytime-hours.¹⁵

Our study suggested a similar finding as male were more susceptible to DHF infection. This pattern was consistent over a period of 3 years (2008, 2009 and 2010). However, after a statistical analysis was performed, there was no significant difference between male and female group. One of the explanations is that Jakarta renders same proportions of male and female working outside the house as it is a big city. Therefore, both male and female should have the same chances to exposures to dengue-carrying mosquitoes during daytime hours either at the workplace or while travelling to and from work. In addition, Yew et al. suggested that male-female differences in the use of health services and/or male-female differences in disease severity might account for this discrepancy.¹⁶ For example, working adults in Singapore (who are more likely to be male) may be more likely to seek treatment and be reported to the Ministry of Health when ill because they require medical certification for absences.

Comparison of DHF Cases Based on Age Group in Central Jakarta in 2008-2010

Besides sex, age is also associated with the likelihood of exposure to *Ae. aegypti*, the vector for dengue. It has been long known that DHF may affect persons of all ages in dengue endemic areas. However, most cases occur in children less than 15 years of age. The main reason behind it is because children represent the largest segment of susceptible individuals with the population at risk.¹⁷ As age roles change over the human lifespan, it is of importance to examine DHF cases based on age group. Therefore, we analyzed the reported number of incident DHF cases and group them according to the age.

On the contrary, our results showed that adult group (≥ 15 years old) was more susceptible to DHF compared to children group (< 15 years old). The finding was consistent for 2008, 2009 and 2010 with the proportions of adult group as much as 61.8%, 63.9% and 58% in the respective years. Moreover, the results were statistically significant. For those ≤ 15 years of age, sex differences in the reported number of cases were less striking. Taken together, not only children, adults should also be more aware of DHF infection since epidemiology of dengue is rapidly changing.

Since the data assessed in this study are based on national surveillance systems by Sudinkes Jakarta Pusat, they are subject to the limitations inherent in surveillance data such as underreporting, misreporting and reporting biases. This is shown by inconsistencies of the total number of DHF cases reported. The data recorded based on age group appeared to have less number of total DHF cases compared to that of peak incidence, gender and CFR studies. Nevertheless, the differences in the total number of cases were relatively low. There were as many as 49 cases missing in the age group in 2008 and only 3 cases in 2010.

As gender and age also play a profound role in the susceptibility of exposures to DHF. Perhaps, Male and adult age group (≥ 15 years old) should be highly aware of DHF due to a rapidly change of epidemiology. However, that does not mean that female and children do not have to be aware of the disease.

CFR of DHF Cases in Central Jakarta in 2008-2010

When not receiving proper management, DHF can be fatal. In our study, we collected the number of deaths due to DHF and counted its CFR for 2008, 2009 and 2010. Apparently, the mortality rates in those 3 years were below standard ($< 1\%$) which were phenomenal. The CFR of DHF can be decreased by the reduction of DHF cases. The increased awareness of communities towards DHF might explain the tremendous decrease of total number of DHF cases from 2009 to 2010. Hence, community participation in vector control is crucial to control DHF outbreak, thus CFR. In addition, the CFR of DHF can be considerably decreased with early diagnosis and appropriate replacement fluid therapy is given early in the course of the disease.¹²

Key clinical findings in DHF are high fever, internal bleeding (haemorrhagic phenomena), hepatomegaly, circulatory failure, thrombocytopenia with haemo-concentration.

The diagnosis of dengue infection involves similar diagnostic issues to other acute viral infections, such as influenza. Clinical diagnosis is of some benefit, but is not definitive. Laboratory findings should ideally be obtained to confirm the diagnosis. When laboratory testing is impractical, evidence, such as recent, laboratory-confirmed, dengue cases in the local area are very instructive when presented with a patient exhibiting characteristic signs and symptoms. In the laboratory, dengue fever is diagnosed by identifying either the:

- **Dengue virus** (virus culture or PCR)
- **Antibodies** to the virus (serology testing)
- **RT-PCR** (reverse-transcriptase polymerase chain reaction) – a rapid test that detects viral DNA in serum up to 10 days following symptom onset. Its use is limited by concerns over standardization issues, but if managed properly it is a highly sensitive detection method.

Serologic testing is the most practical and widely utilized test today. All serology laboratory tests require that a sample of blood is collected from the subject. Tests currently available include:

- **HI** (haemagglutination inhibition) – the gold standard diagnostic for dengue because of its high sensitivity for detecting dengue antibodies and its ease of use.
- **MAC-ELISA** (IgM antibody-capture enzyme-linked immunosorbent assay) – widely utilised, but is limited by an inability to differentiate between dengue virus serotypes.
- **PRNT** (plaque reduction neutralization test) relatively expensive, but the most sensitive and specific serological test for dengue virus. Has the advantage of being able to differentiate serotypes in primary infections.
- **CF** (complement fixation) – reasonably difficult to perform, this test is not routinely used for dengue diagnosis.¹¹

There are no specific treatments for dengue fever. However, basic treatment should be started as soon as possible when the diagnosis of DHF is confirmed.¹² High fever should be treated by sponging and appropriate use of paracetamol. Aspirin and other salicylates should not be given because they may lead to bleeding and cause gastric irritation and acidosis.

Oral rehydration must be attempted in the early stages of fever. Sugar and salt solution for diarrheal diseases can be given in repeated small quantities. Fruit juice is preferable to plain water.

If there is any evidence of bleeding, the patient should be referred promptly to a hospital. If the body temperature drops, the extremities become cold, and the patient becomes restless, prompt referral to a hospital or suitable health centre is necessary for intravenous fluid administration. If referral is not possible, oral rehydration should be continued

until the child urinates and the skin becomes warm. Timely fluid and electrolyte therapy can prevent mortality and facilitate complete recovery.¹⁸

Effectively, early diagnosis and prompt treatment of DHF cases will be valuable in controlling DHF. In addition, preventive measures including integrated vector management and outbreak response communication are strongly encouraged. On top of that, CFR in Indonesia especially in Jakarta should be maintained < 1% by the reduction of DHF cases. Therefore, it is hoped that promotion and implementation of improved dengue vector control programs result in better health of the communities at risk.

Conclusion

In Central Jakarta, there have been fluctuations in the occurrence of DHF cases throughout 2008 until 2010. However, the peak incidence was observed in May in 2008 and in March in both 2009 and 2010. The occurrence of DHF cases based on gender revealed that male patients had the same opportunity to be infected by DHF compared to female patients. The occurrence of DHF based on age group revealed that adults are more susceptible to DHF (61.2%) compared to children (38.8%). CFR of DHF was below the standard (<1%).

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