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Cost of Illness Study of Patients with Dengue Hemorrhagic Fever at One of the Private Hospitals in Yogyakarta

Woro Supadmi^{1,2}, Qorni N. Izzah², Auliya A. Suwantika^{1,3}, Dyah A. Perwitasari², Rizky Abdulah^{1,3}

¹Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran, Sumedang, Indonesia, ²Faculty of Pharmacy, Universitas Ahmad Dahlan, Yogyakarta, Indonesia, ³Center of Excellence in Higher Education for Pharmaceutical Care Innovation, Universitas Padjadjaran, Sumedang, Indonesia

¹⁴
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ABSTRACT
¹⁵ Dengue hemorrhagic fever (DHF) caused by the dengue virus is one of the high-prevalence diseases in tropical countries, such as Indonesia. It has been highlighted that high-prevalence diseases are strongly correlated with high-treatment costs. In particular, Yogyakarta has been reported as one of the provinces with a high prevalence of DHF. This study aimed to estimate the cost of illness because of DHF and to analyze the correlation between the use of drugs with its cost and length of stay, with total hospital administrative cost at one of the private hospitals in Yogyakarta. A cross-sectional study was applied in this study by collecting patients' medical record and financial data, such as demographic characteristic, medication, length of stay, and direct medical cost health-care perspective. The numbers of dengue patients were applied in this study by considering 87 patients and 143 patients with DHF in 2015 and 2016, respectively. Indirect medical costs were collected from a questionnaire by 20 respondents. Pearson's statistical test was used in this study to conduct the bivariate test. The average direct medical cost from the perspective of health care in 2015 and 2016 in DHF patients with Badan Penyelenggara Jaminan Sosial (BPJS) insurance and non-BPJS insurance was US\$243.6; US\$363.41 and US\$368.13; US\$427.03. The indirect medical costs showed that the highest percentage productivity loss was US\$70.98–212.95. Correlation between the numbers of drug with drug cost was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.527 and 0.603. Correlation between lengths of stay with the cost of hospitalization was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.375 and 0.562. It can be concluded that DHF has a relatively high cost of illness both in direct and indirect costs.

KEYWORDS: cost of illness, dengue hemorrhagic fever

INTRODUCTION

World Health Organization (WHO) reported mortality rates in several countries because of dengue disease reaching 1%, in urban areas in India, Indonesia, and Myanmar reaching 3%–5%. In Indonesia, outbreaks of disease dengue >35% of the population live in urban areas. The number of cases in Indonesia in 2007 reached 150,000 cases, where Jakarta and West Java were regions with more than 25,000 cases.^[1] Dengue hemorrhagic fever (DHF) in Asia in 2001–2010 reached an average of 2.9 million each

year and at least 5906 deaths.^[2] DHF in Indonesia in 2015 reached 129,650 with a total of 1071 deaths.^[3] The highest DHF incidence rate in 2016 in Yogyakarta City was 341.97/100,000 population, whereas the lowest was in Sleman 80.17/100,000.^[4,5]

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Address for correspondence: Dr. Auliya A. Suwantika, Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran, Jl. Raya Bandung-Sumedang KM. 21 Jatinangor, Sumedang 45363, West Java, Indonesia. E-mail: auliya@unpad.ac.id

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Research to assess economic impact needed in handling the patient diseases, social, and government perspective in low-income countries can be used to make disease prevention policies.^[6] In health care, health expenditures by patients are direct costs and indirect costs.^[7] Research in America and Asia in 2005 with a study population of patients in hospitals outpatient and inpatient with a clinical diagnosis of dengue has an average cost of illness, US\$514 for hospital outpatient and US\$1394 for inpatient.^[8] Dengue becomes an economic burden of dengue illness. Publicly funded health care bears much of the economic burden of dengue illness in Sri Lanka. Weighted average cost of treating paediatric dengue in ward settings was SLR 19,422 (USD 149.4), representing 5% of per capita GDP (USD 2923 in 2012). Although funding found by households was only 16% and 28% of total costs of DHF and DF, in those below the 'poverty line', this amounted to 93.7% of monthly per capita income.^[9] The economic impact of dengue fever in Singapore from 2000 to 2009 ranged between US\$850,000,000 and US\$1.15 billion.^[10] This study aimed to identify the cost of illness, the correlation between a number of drug items, cost of drug use, and length of stay (LoS) with the cost of hospitalization.

MATERIALS AND METHODS

The study design was *cross-sectional* with retrospective data collection from the medical record, patient bills in the finance department, and the questionnaire given to patients or families patients. Medical records patients with a primary diagnosis of dengue hemorrhagic fever without comorbidities according to the International Classification of Diseases Codes-10-A91 (ICD-10-Code-A19).

Data collection including patient characteristics, diagnosis, LoS, number of the drug from the medical record, direct medical cost of the health-care perspective from patient bills in the finance department, and indirect medical costs were obtained through a questionnaire.

The direct medical cost was obtained from 87 samples from 436 of patient data in 2015 and 143 samples from 715 of patient data in 2016. Samples were obtained with simple random sampling from medical record data in each inpatient classroom. Indirect medical costs were obtained through a questionnaire given to patients or families of patients during hospitalization at the hospital during the study period of 20 respondents (November 2017–March 2018).

Descriptive analysis included patient characteristics, drugs, cost of illness (direct medical cost) from the health-care perspective, and indirect medical cost from respondents. *Spearman's test* was used to determine the

correlation between the number of drugs with the cost of drug use and LoS with the cost of hospitalization. Ethical approval for the study was obtained from Ahmad Dahlan University's Research Ethics Committee (Protocol no. 011704039).

RESULTS

Characteristics of patients with dengue hemorrhagic fever

Characteristics of patients with DHF in 2015 and 2016 at one of the private hospitals in Yogyakarta are presented in Table 1. The highest percentage of patients based on age in 2015 and 2016 was 18–40 years about 58.49% and 0–17 years about 50.50%, respectively. On the basis of gender, most of the patients in 2015 were female about 53.0% and in 2016 male about 53.5%. The highest percentages based on occupation in 2015 and 2016 were students at 32.08% and 61.39%, respectively. Patients were not using health insurance in the years 2015 and 2016 at 55.05% and 51.4%, respectively, whereas the room facilities were class III at 35.96% and 35.9%, respectively.

Drugs based on therapeutic classes

Optimal therapy in patients with DHF can reduce the number of cases and deaths because of this disease.^[11] Selection of the right therapy is very important for the success of therapy and cost-effectiveness. Drug use in

Table 1: Characteristics of patients with DHF at one of private hospitals in Yogyakarta

Characteristics	Category	Year and percentage (%)	
		2015 (n = 87)	2016 (n = 143)
Age (year)	0–17	33.96	50.50
	18–40	58.49	44.55
	41–65	7.55	4.95
Gender	Male	46.1	53.5
	Female	53.9	46.5
Occupation	Not yet worked	22.64	18.81
	Students	32.08	61.39
	Private employees	26.42	13.86
	Labor	7.55	0.00
	Civil servants	3.77	1.98
	Entrepreneurs	1.89	0.99
	Teachers/lecturers	1.89	0.99
Paying status	Soldier/police	1.89	0.99
	Housewives	1.89	0.99
	Non-BPJS	55.05	51.4
	BPJS	44.95	48.6
Room facilities	VIP	22.47	22.54
	I	14.6	14.1
	II	26.97	27.46
	III	35.96	35.9

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Table 2: Drugs used based on therapeutic class of patients with DHF at one of private hospitals in Yogyakarta

Therapy class	Percentage of patients (%)									
	Non-BPJS (room class)					BPJS (room class)				
	VIP (n = 30)	I (n = 16)	II (n = 35)	III (n = 41)	Mean	VIP (n = 22)	I (n = 17)	II (n = 28)	III (n = 42)	Mean
Analgesics-antipyretics	100	80	93	68.6	85.5	80	70.6	88	67.5	76.5
Parenteral rehydration	96	87	89	74.3	86.6	85	70.6	68	75	74.7
Vitamin	40	20	48.1	34.3	35.5	20	17.6	40	10	22
Antihistamine	8	0	7.4	5.7	5.3	0	5.9	4	2.5	3.1
Antiemetic	52	33.3	66.7	45.7	49.4	45	76.5	48	35	51.1
Gastrointestinal	60	46.7	77.8	37.1	55.4	65	47.1	48	35	48.8
Respiratory	8	13.3	0	0	5.3	5	17.6	4	5	7.9
Diuretic	4	13.3	0	2.9	5.1	10	11.8	12	2.5	12.2
Antibiotics	4	0	0	11.4	3.9	10	0	4	10	6
Anti-vertigo	0	0	0	2.9	0.7	5	0	0	2.5	7.5
Antianxiety	0	0	3.7	0	0.9	0	0	0	5	1.3
Corticosteroids	12	33.3	14.8	14.3	18.6	45	5.9	3	15	17.2

patients with DHF is shown in Table 2. The use of drugs in each inpatient class in DHF patients with Badan Penyelenggara Jaminan Sosial (BPJS) insurance and non-BPJS insurance based on therapy classes with four high percentages were analgesic-antipyretic at 85.5% and 76.5%, parenteral rehydration at 86.6% and 74.7%, antiemetic 49.4% and 51.1%, and gastrointestinal at 55.4% and 48.8%.

Cost of patients with dengue hemorrhagic fever hospitalized in 2015–2016

Cost of patients with DHF based on a database from hospital financial department at one of the Private Hospitals in Yogyakarta. Cost of illness influenced by the number of drug used and LoS. Drug cost was the cost of drug use and its devices (health equipment, etc., related to the pharmaceutical part) used by the patient. In this study, the data obtained by the researcher were the number of drugs; it was in line with other devices or pharmaceutical equipment. LoS was a careful period of a patient in the hospital calculated as the patient entered the hospital and outgoing the hospital. Hospitalization cost includes the cost of the health equipment, room costs, laboratory checks, and another health cost (consulting fee).

Correlation test to determine the relationship of the number of drug with the cost of drugs, and length of stay with the hospitalization cost for DHF patients in the hospital. The results of the normality test using Kolmogorov–Smirnov showed that the variables were not normally distributed with a significance value of each variable <0.10 so that the correlation test used the nonparametric Spearman’s ρ test.

The average number of drugs and drug cost is shown in Table 3. The most number of drugs given to

patients was 6 drug items. The highest drug costs in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$113.82; US\$44.34 and US\$108.2; US\$106.84. Correlation between the numbers of drug with drug cost was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.527 and 0.603.

The results of LoS in patients with DHF are shown in Table 4. LoS in DHF patients with BPJS insurance and non-BPJS insurance in 2015 and 2016 were 5 and 4.4 days. The highest hospitalization costs in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$199.26; US\$249.6 and US\$251.29; US\$318.83. Correlation between LoS with the cost of hospitalization was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.375 and 0.562.

The direct medical cost in this study was all direct medical costs, which include the cost of drug and the cost of hospitalization. The direct medical cost of dengue in 2015 and 2016 is shown in Table 5. The average direct medical costs in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$243.6; US\$363.41 and US\$368.13; US\$427.03.

Indirect medical costs were obtained from patients by a questionnaire given to patients or families of patients. The results of the study were obtained by 20 respondents as shown in Table 6. This study showed that the highest percentage productivity loss was US\$70.98–212.95 or an average of 4–5 days the inpatient spend money every day of approximately US\$17.75–US\$42.59 daily. If compared with the Upah Minimum Kota (UMK) (District Minimum Wage) in Yogyakarta in 2018 was IDR. 1,709,150 (US\$121.32).^[12] The cost of illness for DHF patients are higher than income.

Table 3: Average number of drugs types and drug cost of patients with DHF at one of private hospitals in Yogyakarta

Year	Class room	Average number of drug items		Average drug cost (US\$2017)		P value; ρ Spearman
		BPJS	Non-BPJS	BPJS	Non-BPJS	
2015	16	5	5	113.82	44.34	0.000; 0.527
	I	3	5	102.74	16.01	
	II	5	6	90.16	16.01	
	III	4	4	40.21	17.73	
2016	VIP	5	5	108.2	106.84	0.000; 0.603
	I	4	5	49.97	48.67	
	II	4	4	61.81	36.59	
	III	3	4	51.41	27.91	

Table 4: Average length of stay and hospitalization costs of patients with DHF at one of private hospitals in Yogyakarta

Year	Class	Average length of stay (days)		Average hospitalization cost (US\$2017)		P value; ρ Spearman correlation
		BPJS	Non-BPJS	BPJS	Non-BPJS	
2015	VIP	5	4.5	199.26	249.6	0.000; 0.375
	I	4	4.4	144.33	221.59	
	II	3.6	4.5	144.33	148.27	
	III	3.8	3.9	118.83	99.05	
2016	VIP	4.4	4.4	251.29	318.83	0.000; 0.562
	I	4	4	206.04	179.72	
	II	3.5	3.7	152.19	151.9	
	III	3.6	3.9	134.03	175.46	

Table 5: The average direct medical costs of patients with DHF at one of private hospitals in Yogyakarta

Year	Class	Average direct medical costs (US\$2017)	
		BPJS	Non-BPJS
2015	VIP	243.60	363.41
	I	160.34	324.33
	II	160.34	238.43
	III	136.56	139.26
2016	VIP	368.13	427.03
	I	254.71	229.69
	II	188.78	213.71
	III	161.94	227.63

DISCUSSION

Characteristics of patients with DHF are based on age, respectively, 18–40 years 58.49% and 0–17 years 50.50%. Study in eight countries in the Americas and Asia 1,695 patients which are 48% pediatric and 52% adult.^[8] Indonesian Ministry of Health recorded the number of dengue patients from January to February 2016 as many as 8487 people with of 108 people dead and the highest age group was 5–15 years reaching 43.44% and 15–44 years reaching 33.25%.^[13] In a study in Dhaka, Bangladesh, the highest DF and DHF infected age groups were in-between 21 and 30 years.^[14] Study in eight countries in the Americas and Asia 1,695 patients

which are 48% pediatric and 52% adult.^[8] Transmission is not only at home but at school or work, so that to eradicate mosquitoes movement also needs to be promoted at school and work. The pattern of dengue fever changes from children under 15 years to all age groups, even more at productive ages.^[15] Data based on age are very important to conduct prevention programs such as vaccine use, education to parents of patients, and an increase in the immune system at that age.

On the basis of gender, most of the patients in 2015 were female about 53.0% and male about 53.5% in 2016. Kasper *et al.* (2009) in Maulida^[16] showed that women experience DHF more than male. Study in eight countries in America and Asia in 2005 as many as 54% of DHF patients were females.^[8]

The highest percentages based on occupation in 2015 and 2016 were students at 32.08% and 61.39%, respectively. In a study in Vietnam, the highest percentage of occupation was students at 39.9%.^[17] *Aedes aegypti* mosquitoes transmit dengue virus in the morning at 09.00 until 10:00, at which time the children are doing activities at school and adults are doing activities in the work environment that can affect the transmission of DHF.^[18] The majority of them are school children; therefore, it is necessary to increase the knowledge of DHF students in schools and control of vectors in schools.

Table 6: Average indirect medical costs of patients with DHF at one of private hospitals in Yogyakarta

Variable	US\$ 2017	Number of patients	Percentage (%)
Productivity loss	70.98–212.95	19	95
	283.93–425.89	0	0
	496.88–709.82	0	0
	709.82	1	5

In total, 55.05% and 51.4% of patients in the years of 2015 and 2016, respectively, were not using health insurance. Patient with DF is one of the beneficiaries for health insurance as prescribed by the Ministry of Health of Vietnam. Depending on the type of health insurance, patients with insurance will be paid different percentages. Although a quarter of survey patients were not entitled to health insurance, the remaining three-quarters are paid most of the cost of 80% (62.5%), and only a small percentage (about 5.9%) was 100% covered by insurance for costs.^[17] In Indonesia, DHF is covered by BPJS insurance, but in this study, more than 50% of patients had not yet used the insurance. Therefore, it was necessary to conduct a survey to find out the reasons for patients and the socialization of BPJS insurance benefits. Health insurance can reduce the economic burden on patients because of dengue fever.

The room class facilities utilized by patients in 2015 and 2016 with the highest percentage were class III at 35.96% and 35.9%, respectively. This is likely due to consideration of the costs to be incurred by the patient. The class can affect the cost of illness because the facilities provided to patients in the hospital depend on the room.

The treatment of DHF is symptomatic and supportive, namely the administration of oral or intravenous fluids to prevent dehydration and antipyretic administration.^[19] The results showed that analgesic-antipyretic and parenteral were the highest percentage. Analgesic-antipyretic is used to treat pain and fever in patients. According to Drwal-Klein and Phelps in Karyanti *et al.*^[20] by lowering body temperature and improving children's activity and alertness, mood and appetite also improved. Rehydration therapy is a supportive therapy given to patients with DHF for plasma fluids because in general patients with DHF will lose plasma fluid. Plasma fluid loss is a result of increased vascular permeability and bleeding so fluid resuscitation is necessary for patients with DHF.^[21] High-percentage gastrointestinal drugs are used to treat nausea, vomiting, diarrhea constipation, and abdominal pain. Patient with DHF has the risk of experiencing *stress-ulcers*.^[22]

The longest stay in this study was 5 days, while previous studies were duration of illness is 11.9 days for outpatients and 11.0 days for inpatients. Dengue causes students to lose 5.6 school days, whereas those who working lose 9.9 workdays per average episode of dengue fever. The average hospital cost was US\$514 for outpatient and US\$1394 for hospitalization cases.^[8] Similar research by Allosomba^[23] states that the LoS is likely to add drugs used by patients with DHF, so the longer the patient's hospitalization period, the greater the costs incurred for medical cost at the hospital.

The average direct medical costs in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$243.6; US\$363.41 and US\$368.13; US\$427.03. Dengue has become an economic burden for the Sri Lankan government. The average cost of illness of dengue fever in pediatric patients is Sri Lanka Rupee (SLR) 19.422 (US\$149.4) at 5% of per capita. The funds spent on the cost of illness dengue are 16% and 28% of family opinion, but in families below the poverty line, the funds reach 93.7% of per capita income per month.^[9] Overall mean costs were US\$514 and US\$1394 for an ambulatory and hospitalized case, respectively. With an annual average of 574,000 cases reported,^[8] research in Cambodia in 2006–2008 showed that the average cost per dengue cases varied from US\$36 to more than US\$75.^[24]

The average annual cost per dengue case was Peso Philipina (PHP) 32,324 (US\$734). The 21–25 age subgroups had the highest average annual direct cost which amounted to PHP 243,181 (US\$5526), followed by the 45–54 age subgroups which amounted to PHP 201,481 (US\$4579).^[25] The median costs of illness for inpatient and outpatient groups were US\$110.10 and US\$36.10, respectively.^[26] Across age groups, the average cost per episode was US\$48.10. The highest costs US\$56.61 were incurred in the adult age group (>15 years), and the lowest costs US\$30.10 were incurred in the pediatric age group (<15 years).^[27]

The indirect medical costs showed that the highest percentage productivity loss was US\$70.98–212.95, whereas the UMK (District Minimum Wage) in Yogyakarta in 2018 was US\$121.32. This showed that

the cost of dengue fever become an economic burden on patients. In a study in Vietnam, indirect costs (productivity lost) for pediatric patients (≤ 15 years), adults (> 15 years), and all ages were US\$47, US\$52.9, and US\$51, respectively.^[17] The median indirect cost for the inpatient and outpatient hospitalization types were US\$88.10 and US\$44.10; however, inpatient hospitalization had a much wider cost range (US\$4.40–1189.40 versus US\$ 8.80–118.90).^[26]

CONCLUSION

The highest drug cost in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$113.82; US\$44.34 and US\$108.2; US\$106.84. Correlation between several drugs with drug cost was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.527 and 0.603. The highest hospitalization costs in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$199.26; US\$249.6, and US\$251.29; US\$318.83. Correlation between LoS with the cost of hospitalization was significant ($P < 0.05$) with correlation coefficient (value ρ) of 0.375 and 0.562.

The average direct medical costs from the perspective of health care in 2015 and 2016 in DHF patients with BPJS insurance and non-BPJS insurance were US\$243.6; US\$363.41 and US\$368.13; US\$427.03. The indirect medical costs showed that the highest percentage productivity loss was US\$70.98–212.95

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Conflicts of interest

There are no conflicts of interest.

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