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Effectiveness Analysis of Crystalloids and Crystalloid-Colloid Combinations in Hospitalized Dengue Fever Patients Without Shock at RSUD Tangerang City

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Abstract. *The high cost of colloid fluids and the large number of patients are concerns in determining which treatment standard should be chosen from several treatment alternative, where the total cost for 43 cases with a combination of crystalloid colloid fluids is IDR 209.370.993 while the total cost for 45 cases of crystalloid fluids is only UDR 146.492.268 which causes hospital losses. This study aims to determine the difference in the cost-effectiveness between crystalloid fluids and crystalloid-colloid combinations in hospitalized dengue fever patients without shock at Tangerang City Hospital. The research design used was cross-sectional with a comparative quantitative analysis method, where cost effectiveness was analyzed using the Average Cost Effectiveness Ratios (ACER) method. There were two groups of study samples: the first group, 25 patients who received crystalloid fluids, and the second group, 23 patients who received crystalloid-colloid combination fluids. This study showed a difference in the average hospitalization costs for dengue patients between crystalloid fluid therapy and crystalloid-colloid combination therapy. Hospitalization costs for dengue patients were lower in the crystalloid fluid group, with a significant difference (p=0.000). It was also found that crystalloid fluids were more cost-effective than the crystalloid-colloid combination. The implications of the study results consist of theoretical implications and practical implications. Based on the results of the analysis carried out, the crystalloid solutions are more cost-effective than crystalloid-colloid combinations. This finding can be used as a consideration in making decisions and policies that are in accordance with quality control and cost control for patients covered by the National Health Insurance (BPJS Health insurance).*

Keywords: *Average Cost-Effectiveness Ratios (ACER); Cost- Effectiveness; Crystalloid- Colloid Combinations; Crystalloid Solutions; Inpatient Dengue Fever Patients.*

1. INTRODUCTION

INA-CBGs is a packaged payment system that covers all hospital cost components based on costing data and disease coding, referring to the International Classification of Diseases (ICD) compiled by the World Health Organization (WHO) based on patient diagnoses. Under Indonesia's National Health Insurance (JKN) scheme, hospitals are reimbursed using the Indonesian Case-Based Groups (INA-CBGs) system, in which payment rates are prospectively determined according to diagnosis groups, severity levels, hospital class, and regional classification to control healthcare costs and standardize hospital payments (Agustina et al., 2019). However, the implementation of INA-CBGs has continued to generate complaints from hospitals collaborating with BPJS Kesehatan due to discrepancies between INA-CBGs tariffs and the actual costs incurred by hospitals. Several studies have reported that INA-CBGs reimbursement rates are often lower than real hospital expenditures, potentially affecting hospital financial performance and sustainability (Satibi et al., 2019) This situation is understandable since hospitals function not only as healthcare providers but also as business entities that must maintain operational and financial continuity.

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The limited budget available, it is necessary to choose the use of drugs by paying attention to the control of the quantity and cost. The application of pharmacoeconomic studies in the selection and use of drugs effectively and efficiently is needed to analyze drug costs. One of the pharmacoeconomics studies is a cost- effectiveness analysis, that is, by comparing the cost and effectiveness of alternative treatments according to the values of the Average Cost Effectiveness Ratio (ACER) and Incremental Cost Effectiveness Ratio (ICER) of treatment. Cost Effectiveness Analysis (CEA is a form of economic evaluation that compares the ratio of cost and effectiveness of several alternatives intervention or program (Probandari, 2007). In the world of health, this cost- effectiveness analysis compares the relative costs and outcomes of two or more health interventions and is a form of comprehensive economic analysis, conducted by defining the resources used (inputs) with the consequences of the services (output) between two or more alternatives (Drummond et al., 2015). Measurable outcomes are expressed in measurable terminology and not in monetary terms. The results of the CEA analysis are depicted in ratios such as the Average Cost Effectiveness Ratio (ACER). ACER describes the total cost of a program or intervention divided by the effectiveness or clinical outcome produced (Gold et al. 1996).

The number of dengue fever cases in Tangerang City was 331 as of July 2022. Dengue fever is a major global public health problem with a rapidly increasing incidence in tropical and subtropical regions, and it represents one of the most common causes of hospitalization due to its potential to progress to severe dengue with plasma leakage (Bhatt et al., 2013). Appropriate fluid management is a cornerstone of dengue treatment to prevent shock and mortality; clinical evidence suggests that crystalloid solutions should be used as first-line therapy, while colloid solutions may be considered in patients with severe plasma leakage or circulatory compromise (Saurabh & Yadav, 2020). Accordingly, Tangerang City Hospital applies a clinical practice guideline for dengue fever that includes intravenous crystalloid fluids such as Ringer's lactate, with the use of colloid or plasma expanders in grade III–IV dengue if clinically indicated. From hospital medical records, data were obtained from 226 hospitalized adult dengue fever patients (aged ≥18 years), of whom 43 patients without comorbidities, without shock, and who received a combination of crystalloid and colloid fluids were included in this study. Where the total cost for 43 cases with a combination of crystalloid and colloid fluids was Rp. 209,370,993, while the total cost for 45 cases of crystalloid fluids was only Rp. 146,492,268.

This situation occurs because some attending physicians (DPJPs) still use a combination of crystalloid and colloid fluids in the management of dengue fever, influenced

by evidence supporting colloid therapy, which suggests that colloids can restore hemodynamic stability more rapidly than crystalloids and better maintain colloid osmotic pressure. In addition, colloid solutions have the advantage of expanding plasma volume more quickly, persisting longer in the intravascular space, and requiring smaller volumes compared to crystalloid fluids, which may increase the risk of pulmonary edema when administered excessively (Wills et al., 2005). The continued preference for colloid-based therapy may consequently increase the cost of dengue fever treatment. This has contributed to higher hospital claims for dengue cases, where reimbursement values frequently exceed the tariffs set under the Indonesian Case-Based Groups (INA-CBGs) payment system, reflecting ongoing challenges in aligning prospective payment rates with actual hospital costs (Witter et al., 2025).

The high cost of colloidal fluids and the large number of patients are a concern in determining which treatment standard should be chosen from several treatment alternatives. Consequently, the author emphasizes the significance of conducting a research study to evaluate the cost-effectiveness of employing crystalloid-colloidal fluid therapy in comparison to the combination of crystalloid-colloidal therapy in dengue patients at the Tangerang City Hospital. Consequently, it is anticipated that the findings of this study will be instrumental in identifying cost-effective therapeutic interventions that can be integrated into the DPJP framework. This integration is expected to enhance compliance with the implementation of PPK, thereby augmenting the perceived value of effectiveness and cost efficiency. Consequently, this approach is anticipated to yield financial profitability for hospitals.

2. RESEARCH METHODS

The research was conducted at the Tangerang City Regional General Hospital, located at Jl. Pulau Putri Raya Blok A1 No. 1, RT 005/RW 003, Kelapa Indah Village, Tangerang District, Banten, 15117. The research period spanned one month, commencing in January and concluding in February 2025. This study employed a cross-sectional design with quantitative and comparative analyses, which is commonly used to evaluate clinical and economic outcomes at a single point in time (Levin, 2006). The research population comprised all dengue patients admitted to the Tangerang City Hospital who did not have BPJS Kesehatan guarantee shock. The research sample consisted of dengue patients who met the inclusion and exclusion criteria during 2023 and who did not have BPJS Kesehatan guarantee shock criteria. The inclusion criteria were patients with dengue fever without shock (degree I, II, and III detainee), admitted through the emergency room with MAP > 65, patients with an age of > 17 years, and receiving crystalloid-colloidal fluid therapy and crystalloid-colloid combination. The exclusion

criteria were dengue fever patients accompanied by other diseases. The classification of dengue severity and intravenous fluid strategies applied in this study were consistent with evidence from clinical studies evaluating fluid resuscitation approaches in dengue management (Kalayanarooj, 2011).

This study did not intervene with the subjects, as the data used were secondary data from cost documents and medical records of the subjects at Tangerang City Hospital. Data collection was conducted retrospectively using a total sampling technique, a method commonly applied in hospital-based observational studies to minimize selection bias and capture complete population data (Song & Chung, 2010). The subjects were patients with dengue fever without shock, grade I, II, and III, from January 2023 to December 2023. Data on costs, taken from cost documents during the patient's treatment, which consisted of doctors, nurses, supporting examinations, Consumables (BHP), rooms, medicines, facilities and emergency room. Clinical data of the study subjects were taken from medical records during treatment, i.e. duration of treatment, decrease in hematocrit ≤ 72 hours after administration of fluids and increase in platelets≤ 72 hours after administration of fluids. The use of retrospective secondary data from medical records and administrative cost documents is widely accepted in health services and economic research for evaluating clinical outcomes and resource utilization (Vassar & Matthew, 2013). Medical records from DBD patients without BPJS Kesehatan guarantee during 2023 were collected from medical records, with total sampling techniques, namely:

a. A number of dengue patients without shock with BPJS Kesehatan guarantees during 2023 who meet the criteria for secondary data taken from Patient's Medical Records.
b. From the patient's medical records, data on effectiveness were obtained, namely the length of the patient's treatment, the decrease in hematocrit ≤ 72 hours after administration of fluids and the increase in platelets ≤ 72 hours after administration of fluids. This data is then tabulated.
c. The total cost during the patient's treatment is obtained from the spreadsheet.

In addition to the secondary data, primary data was also taken in the form of interviews with DPJP doctors, namely internal medicine specialists at the Tangerang Hospital, to find out the reasons why DPJP does not use crystalloids but the combination of colloidal crystalloids even though the price of colloidal is much more expensive than the price of crystalloid. The data that had been documented in the paper was then analyzed. This data is included in the SPSS Versi 20 program. Numerical variable data (cost and duration of treatment) were statistically analyzed using an independent t-test when the distribution was normal, but if the distribution

was abnormal, the Mann- Whitney test was used. An independent *t*-test was applied when data were normally distributed, whereas the Mann–Whitney U test was used for non-normally distributed data, in accordance with standard statistical methods for comparing two independent groups (Ghasemi & Zahediasl, 2012).

Data on hematocrit decrease and platelet increase ≤ 72 hours after administration of fluids that were category variables were analyzed using the Chi Square test or the Fisher test (if the Chi Square test requirements were not met). The pharmacoeconomic analysis method uses Cost Effectiveness Analysis using a hospital perspective. The results of the calculation of the Average Effectiveness Ratio (ACER) and Incremental Cost Effectiveness (ICER) evaluation were used as the basis for the selection of more cost- effective fluids for the treatment of Dengue Hemorrhagic Fever (DHF). The clinical outcomes used in the calculation of ACER used the length of stay of the patient (length of stay) ≤ 4 days, a decrease in hematocrit ≤ 72 hours after administration of fluids, and an increase in platelets ≤ 72 hours after administration of fluids.

3. RESULTS AND DISCUSSION

Results

Descriptive Analysis

Table 1. Characteristics Data of Dengue Fever Patients.

Variable		Crystalloids (RL)	Crystalloid-Colloid Combinations (RL+Gelofusine)
Age (years)		Mean: 31.83 SD: 12.93	Mean: 38.79 SD: 16.6
Sex	Male	25 (55.6%)	27 (62.8%)
	Female	20 (44,4%)	16 (37.2%)

Table 2. Normality Test of Age Characteristics Patient

Treatment	Kolmogorov–Smirnov		
	Statistic	df	Sig.
Crystalloid	0.195	45	0,000
Crystalloid–Colloid Combination	0.124	43	0,094

The average age of the sample was 31.83 (±12.93) years in patients who were given crystalloid therapy, while in patients who were given crystallloid-colloid combination fluid therapy was 38.79 (±16.6) years. The distribution of patient characteristics based on the

category of sex type, shows that in the crystalloid fluid group, the largest percentage for the sex type of patients with dengue fever is male with 25 patients (55.6%). In the liquid group, the largest percentage of crystalloids and colloids was also male with 27 patients (62.8%).

Analysis of the Difference in Dengue Fever Treatment Costs with Crystalloid Fluids and a Combination of Crystalloid and Colloid

Cost Data Difference Test

Table 3. Average Cost of Crystalloid Liquids and Colloidal Crystalloid Combinations.

	Mean	p-value
Crystalloid Fluid	3,255,033.44	0.001
Crystalloid–Colloid Combination	4,869,092.86	0.200

Table 4. Normality Test of Dengue Fever Patient Cost Data.

Treatment	Shapiro–Wilk		
	Statistic	df	Sig.
Crystalloid	0.793	45	0.000
Crystalloid–Colloid Combination	0.970	43	0.306

The average cost of crystalloid fluids was Rp. 3,255,033.44 where the crystalloid fluid cost data was not normally distributed ($p<0.05$), while the average cost of the crystalloid-colloid combination was Rp. 4,869,092.86 which was normally distributed ($p>0.05$), so a test of the difference in the means of 2 unpaired groups was carried out using the Mann-Whitney test.

Tabel 5. The difference in the average cost of Crystalloid Fluids and Crystalloid Colloid Combinations.

	Mean	SD	p	Mean Difference	CI 95%
Crystalloid	3,255,033.44	1,029,901.186	0.000	1,613,709.127	1,194,909.237 – 2,032,509.017
Crystalloid–Colloid Combination	4,869,092.86	941,846.703			

Based on the Mann Whitney test, the difference in costs for treating DHF patients with crystalloid fluids and a combination of crystalloid and colloid was very significant ($p = 0.000$). It was found that the average difference in the total cost of crystalloid fluids and a combination of crystalloid and colloid was Rp 1,613,709.127 with a 95% confidence interval of Rp 2,032,509.017 - Rp 1,194,909.237.

Clinical Outcome Difference Tests

Table 6. Clinical differences in Treatment Dengue Patients.

Effectiveness		Crystalloid		Crystalloid–Colloid Combination		P
		N	%	n	%	
Length of Hospital Stay	≤ 4 days	33	73.3	33	76.7	0.713
	>4 days	12	26.7	10	23.3	
Decrease in Hematocrit Level	≤ 72 hours	31	68.9	33	76.7	0.411
	> 72 hours	14	31.1	10	23.3	
Increase in Platelet Count	≤ 72 hours	19	42.2	25	34.9	0.482
	> 72 hours	29	57.8	28	65.1	

The table above shows that the length of stay ≤ 4 days in the Crystalloid group was less (73.3%) than the length of stay in the crystalloid colloid group (76.7%). The decrease in Hematocrit Value ≤ 72 hours after fluid administration was greater in the crystalloid colloid combination group, namely 76.7% compared to the crystalloid group, namely 68.9%. The increase in platelet value ≤ 72 hours after fluid administration was greater in the crystalloid group, namely 42.2% compared to the crystalloid colloid combination group, namely 34.9%.

Table 7. Average length of treatment days.

	Mean	P
Crystalloid	3.98	0.000
Crystalloid–Colloid Combination	3.81	0.000

The distribution of data for the length of treatment days of Crystalloids and combinations of Crystalloids was abnormal, so the average difference for the length of treatment days used a non- parametric test, namely the Mann Whitney test.

Table 8. Difference in the average length of treatment of Crystalloids and Combination Crystalloids Colloid.

		Mean	SD	p	Mean Difference
Length of Stay (LOS)	Crystalloid	3.98	1.270	0.849	0.164
	Crystalloid–Colloid Combination	3.81	0.794		

The table above shows that based on the Mann Whitney test, there was no difference in the average length of days of treatment between crystalloids (3.98±1.270) and combination of colloidal crystalloids (3.81±0.794) difference signifikan (>0,05)

Table 9. Difference between therapeutics and decreased hematocrit values.

		Decrease in Hematocrit		p	OR	CI 95%
		≤ 72 hours	> 72 hours			
Type of Fluid	Crystalloid	31	14	0.408	0.671	0.260 – 1.732
	Crystalloid–Colloid Combination	33	10			

The table above shows that there is no significant difference between the type of fluid and the decrease in hematocrit value due to p-value > 0.05. The table above uses the Chi-Square test because the Chi-Square condition is met (there are no cells with an Expected Count < 5).

Table 10. Differences between Fluid Therapy with an increase in platelet values.

		Increase in Platelet Count		p	OR	CI 95%
		≤ 72 hours	> 72 hours			
Type of Fluid	Crystalloid	19	26	0.480	1.364	0.576-3.230
	Crystalloid–Colloid Combination	15	28			

From table above shows that there was no significant difference between the type of fluid and the increase in platelet values because the P-value > 0.05. The table above uses the Chi-Square test because the Chi- Square requirement is met (there are no cells with an ExpectedCount < 5).

Tabel 11. Regression Analysis of Length of Hospital Stay (LOS).

Variable	B (Unstd.)	Beta (Std.)	p-Value
Constant	1.379	-	0.000
Type of Fluid	-0.063	-0.096	0.514
Age (years)	0.003	0.108	0.332
Sex	-0.103	-0.095	0.285

$R^2 = 0.025$; $p > 0.001$

Tabel 12. Regression Analysis of Hematocrit Decrease.

Variable	B (Unstd.)	Beta (Std.)	p-Value
Constant	1.628	-	0.000
Type of Fluid	0.106	0.119	0.280
Age (years)	0.002	0.067	0.542
Sex	-0.190	-0,210	0.053

$R^2 = 0.054$; $p > 0.001$

Tabel 13. Regression Analysis of Increased Platelet Values.

Variable	B (Unstd.)	Beta (Std.)	p-Value
Constant	0.709	-	0.000
Type of Fluid	0.087	0.089	0.426
Age (years)	-0.003	-0.088	0.430
Sex	-0.088	-0.089	0.413

$R^2 = 0.025$; $p > 0.001$

Linear regression analysis was conducted to assess the impact of fluid type (crystalloidal vs. crystalloid – colloidal combination), age, and sex on three primary clinical outcomes in dengue patients: hospital length of stay (LOS), increase in red blood cells (rhombocytes), and decrease in hematocrit within 72 hours. The analysis revealed that all p-values exceeded 0.001, indicating that none of the independent variables exhibited a statistically significant influence on the dependent variables. Specifically, the type of fluid, age, and type of swelling did not demonstrate a significant effect on LOS, hematocrit reduction, or platelet increase.

Tabel 14. Cost Effectiveness Data.

	Crystalloid	**Crystalloid–Colloid Combination**
1. Cost Consequences Analysis (CCA)		
Total Treatment Cost (IDR)	3,255,033.44	4,869,092.86
% Length of Stay ≤ 4 days	33/45 = 73.3%	33/43 = 76.7%
% Decrease in Hematocrit ≤ 72 hours	31/45 = 68.9%	33/43 = 76.7%
% Increase in Platelet Count ≤ 72 hours	19/45 = 42.0%	15/43 = 34.9%
2. Average Cost-Effectivesness Ratio (ACER)		
Total Treatment Cost (IDR)	3,255,033.44	4,869,092.86
Length of Stay ≤ 4 days	3,255,033.44 / 0.733 = 4,440,700.46	4,869,092.86 / 0.767 = 6,348,230.59
Decrease in Hematocrit ≤ 72 hours	3,255,033.44 / 0.689 = 4,724,286.56	4,869,092.86 / 0.767 = 6,348,230.59
Increase in Platelet Count ≤ 72 hours	3,255,033.44 / 0.420 = 7,750,079.62	4,869,092.86 / 0.349 = 13,951,555.50
3. Incremental Cost–Effectiveness Ratio (ICER)		
Incremental Cost–Effectiveness Ratio (ICER) analysis was not performed, because the mean cost of crystalloid therapy was lower than that of the crystalloid–colloid combination across all effectiveness outcomes (length of stay ≤ 4 days, decrease in hematocrit ≤ 72 hours, and increase in platelet count ≤ 72 hours). Therefore, ICER calculation was not applicable.		

From the cost consequences analysis, the average total cost of treatment with crystalloid treatment was Rp3,255,033.44 and with the combination of crystalloid and colloid treatment was Rp4,869,092.86. From the Average Cost Effectiveness Ratios (ACER), it was obtained that the total cost of treatment (% LOS ≤ 4 days was Rp4,724,286.56 in the group with Crystalloid treatment, and Rp6,348,230.59 in the group with Crystalloid Colloid Combination treatment. The total cost of treatment (% Decrease in Hematocrit ≤ 72 hours) in the treatment with Crystalloid was Rp4,724,286.56 while in the group with Crystalloid Colloid Combination treatment was Rp6,348,230.59. The cost of treatment (% increase in platelets ≤ 72 hours) in the crystalloid treatment was Rp7,750,079.62, while in the treatment with crystalloid colloid combination fluid was Rp13,951,555.5.

Incremental Cost Effectiveness Ratios (ICER) were not performed because the average cost of crystalloid fluids was lower with almost the same effectiveness. Crystalloid fluids were lower in cost compared to the cost of crystalloid-colloid combinations in terms of effectiveness in length of stay ≤ 4 days, decrease in hematocrit ≤ 72 hours and increase in platelets ≤ 72 hours, so ICER was not performed.

Discussion

The results of the study showed that the average age of the samples given crystalloid colloid combination therapy was 38 years and the average age of the samples of dengue fever patients given crystalloid therapy was 35.4 years. This is in accordance with the data of the Ministry of Health Pusdatin, 2020, which is the proportion of DHF cases based on the age group of 14-44 years by 33.97%, and Dinesh Kumar's research (2023) that the average age of sufferers is in the form of 39,13 ± 20.64 years.

The shift in the age of dengue fever sufferers from children to young adults is associated with increased outdoor activities, which increases the risk of being bitten by the Aedes aegypti mosquito. Data from the Indonesian Ministry of Health's Epidemiology Data and Surveillance Center in 2010 and research conducted by WK Cheah in Malaysia showed that 34% of dengue fever patients were aged 20-29 years and over 15 years.

The majority of patients were male, both with crystalloid fluid therapy (36 patients) (54.5%) and those receiving crystalloid-colloid combination fluid therapy (27 patients) (62.8%). This is in line with Mulya's (2021) research which found that based on gender, in Indonesia, dengue fever attacks more men (53.11%) than women (46.89%), and is also in accordance with Sri Masyeni's (2023) research which found that dengue fever sufferers are more dominantly male (54.5%) than female (45.5%). Dinesh Kumar's (2023) research also found that dengue fever sufferers are more male (52.89%) than female (47.11%).

Cost-effectiveness data can be summarized as follows:

a) Statistical data:

There was no significant difference in length of hospital stay between treatment with crystalloid fluids and with a combination of crystalloid and colloid fluids. - The decrease in hematocrit values ≤ 72 hours after fluid administration was greater in the crystalloid-colloid combination group, at 76.7% compared to the crystalloid group, at 68.9%, but there was no significant difference (p-value = 0.408).

- The increase in platelet values ≤ 72 hours after fluid administration was greater in the crystalloid group, at 42.2% compared to the crystalloid-colloid combination group, at 34.9%, but there was no significant difference (p-value = 0.480).

b) There was a difference in average costs between the two types of fluids, with the total cost of crystalloid fluids being Rp 3,255,033.44, while the cost of the crystalloid-colloid combination was Rp 4,869,092.86, a significant increase of Rp 1,739,059.42. Statistically, this difference was significant ($p<0.05$).

c) Average length of stay with crystalloid fluids (3.98±1.270) and the crystalloid-colloid combination (3.81±0.794). Statistical tests showed no significant difference ($p>0.05$) in length of stay between the two treatments.

d) The average cost of treatment with crystalloid fluids was IDR 3,130,033.44, and the average cost of treatment with the crystalloid-colloid combination was IDR 4,869,092.86.

e) Average Cost-Effectiveness Ratios (ACER) = total cost/clinical effectiveness. The average cost- effectiveness analysis calculation is as follows:

- The ACER for length of stay (LOS) ≤ 4 days with crystalloid fluid therapy is IDR 4,396,113.76, and with the crystalloid-colloid combination is IDR 6,348,230.59.
- The ACER for decreased hematocrit values with crystalloid fluids is IDR 4,396,113.76. 4,396,114.38 and a crystalloid-colloid combination fluid is Rp. 6,348,230.59
- The ACER for platelet count increases is Rp. 5,296,164.87 for crystalloid fluids and Rp. 9,118,151.42 for crystalloid- colloid combination fluids.
- It can be concluded that crystalloid- colloid fluid therapy is more cost-effective than crystalloid-colloid combination fluids.

This is in accordance with WHO recommendations and various international and national studies, including research by Lum et al (2002) in Malaysia, which concluded that crystalloids are effective and safer in most cases of dengue fever, the use of colloids adds costs without clear benefits, except in cases of shock. Research by Cheah WK et al. (2016) assessed the outcomes of adult DHF patients treated with fluid therapy in Malaysian hospitals and found no significant difference between crystalloid therapy compared to a combination of crystalloids and colloids in terms of length of hospital stay, changes in hematocrit and platelets, the cost of crystalloid fluid therapy was much lower and concluded that crystalloids were more cost-effective. Research by Surtani et al in 2018 at Bakti Asih Hospital Tangerang entitled "Cost Effectiveness Analysis of Crystalloid and Crystaloid-Colloid Combination on Dengue Fever without Shock" published in the Journal of Pharmaceutical Management and Services. analyzed 171 DHF patients without shock obtained the results of the crystalloid group (n = 106), the average treatment cost was IDR 4,005,223, the crystalloid-colloid combination group (n = 65): an average of IDR 5,525,407, clinical effectiveness (seeing hematocrit values) was not significantly different ($p > 0.05$), only the costs were significantly higher in the combination group.

ICER is used to determine the additional costs for each 1 unit change in cost-effectiveness. Based on the cost- effectiveness grid, the results in column I (lower costs, higher effectiveness) are not subject to ICER calculations. In this study, ICER calculations were not necessary to determine the additional costs required for each length of stay, decrease in hematocrit values ≤ 72 hours, and increase in platelet values ≤ 72 hours after administration of crystalloid fluids and a combination of crystalloid and colloid in dengue patients because all three are not located in column I.

Tabel 15. Cost effectiveness grid (Rascati,2009).

Cost–Effectiveness	**Lower Cost**	**Same Cost**	**Higher Cost**
Lower Effectiveness	A – ACER calculation	B	C – Dominated
Same Effectiveness	D	C – Arbitrary	F
Higher Effectiveness	G	H	ICER calculation

4. CONCLUSION

a. There was a difference in the average cost of crystalloid fluids and crystalloid-colloid combination fluids in dengue fever patients at Tangerang City Hospital. The average cost of crystalloid fluid therapy was IDR 3,130,033.44, and the average cost of crystalloid-colloid combination fluids was IDR 4,869,092.86. The calculation of the average cost showed that the average cost for crystalloid fluids was lower than that for crystalloid-colloid combination fluids, with the average cost difference being IDR 1,613,709.127. This difference was significant (p=0.000).

b. There was no difference in clinical outcomes (length of hospitalization, decrease in hematocrit, increase in platelets) in dengue fever patients treated with crystalloid fluids compared to crystalloid- colloid combination fluids.
   - There was no significant difference (p=0.525) in the length of hospitalization between crystalloid fluid treatment and crystalloid-colloid combination fluids. There was no significant difference (p=0.525) in hematocrit decrease ≤ 72 hours between crystalloid fluid treatment and crystalloid-colloid combination fluid treatment.
   - There was no significant difference (p=0.566) in platelet increase ≤ 72 hours between crystalloid fluid treatment and crystalloid-colloid combination fluid treatment.

c. There was a difference in cost-effectiveness in the form of the Average Cost-Effectiveness Ratio (ACER) between the use of crystalloid fluids and crystalloid-colloid combination fluids in hospitalized DHF patients without shock at Tangerang City Hospital. The ACER calculation shows that the crystalloid value is smaller than the crystalloid-colloid combination value based on clinical effectiveness (length of hospitalization, hematocrit decrease, and platelet increase). A lower ACER value indicates that the use of crystalloid fluids is more cost-effective.

d. No ICER calculation is required to determine the additional costs required for length of stay, decrease in hematocrit values ≤ 72 hours, and increase in platelet values ≤ 72 hours after administration of crystalloid fluids and a combination of crystalloids and colloid crystals in dengue fever patients because crystalloids are more effective for length of stay and lower costs than combination fluids. The effectiveness of crystalloid fluids in reducing hematocrit values and increasing platelet values is almost the same as combination fluids, while the cost is lower. Based on the cost- effectiveness plane or Quadrant CEA Plane data display, if

crystalloid fluids are in Quadrant IV, they have higher effectiveness at a lower cost. DPJP initially chose to use a combination of crystalloids and colloids, regardless of drug price, in treating dengue fever patients because, in theory, colloid fluids increase intravascular volume more quickly with a smaller volume. This resulted in the hospital incurring losses because hospital bills for dengue fever were higher than the INA- CBG rates used by BPJS to pay hospital claims.

Suggestion

a. Treating dengue fever patients with crystalloid fluids is more cost-effective than using a combination of crystalloid and colloid. This can be used as a consideration in making decisions and policies that align with quality control and cost control for patients covered by BPJS Kesehatan (Indonesian Health Insurance).
b. The development of science and research has led to an increasing number of new drugs and medical devices, necessitating cost containment. With this development, strategies must be developed to provide good healthcare (quality control) with more efficient financing (cost control).
c. Similar research is needed, involving a larger sample size from various hospitals of various classes (multi- center) to better reflect the target population. 4. Management needs to improve or change the system so that all DPJPs treating DHF patients use colloid fluids, thus benefiting the hospital.
d. Hospital management, through research and development, needs to also conduct cost-effectiveness research on other diseases at Tangerang City Hospital, especially those with a high patient population and unprofitable outcomes. This will allow for future system changes to increase profits, increase the revenue of the Regional Public Service Agency (BLUD), and enable hospital development without burdening the local government budget.

BIBLIOGRAPHY

Agustina, R., Dartanto, T., Sitompul, R., Susiloretni, K. A., Suparmi, A., Achadi, E. L., Taher, A., Wirawan, F., Sungkar, S., Sudarmono, P., Shankar, A. H., Thabrany, H., Agustina, R., Dartanto, T., Sitompul, R., Susiloretni, K. A., Suparmi, A., Achadi, E. L., Taher, A., … Khusun, H. (2019). Universal health coverage in Indonesia: Concept, progress, and challenges. *The Lancet, 393*(10166), 75–102. https://doi.org/10.1016/S0140-6736(18)31647-7

Bhatt, S., Gething, P. W., Brady, O. J., Messina, J. P., Farlow, A. W., Moyes, C. L., Drake, J. M., Brownstein, J. S., Hoen, A. G., Sankoh, O., Myers, M. F., George, D. B., Jaenisch, T., Wint, G. R. W., Simmons, C. P., Scott, T. W., Farrar, J. J., & Hay, S. I. (2013). The global distribution and burden of dengue. *Nature, 496*(7446), 504–507. https://doi.org/10.1038/nature12060

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes*. Oxford University Press.

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism, 10*(2), 486–489. https://doi.org/10.5812/ijem.3505

Gold, M. R., Siegel, J. E., Russell, L. B., & Weinstein, M. C. (1996). *Cost-effectiveness in health and medicine*. Oxford University Press.

Kalayanarooj, S. (2011). Clinical manifestations and management of dengue/DHF/DSS. *Tropical Medicine and Health, 39*(4SUPPLEMENT), S83–S87. https://doi.org/10.2149/tmh.2011-S10

Levin, K. A. (2006). Study design III: Cross-sectional studies. *Evidence-Based Dentistry, 7*(1), 24–25. https://doi.org/10.1038/sj.ebd.6400375

Peraturan Menteri Kesehatan Nomor 69 Tahun 2013 tentang Standar Tarif Pelayanan Kesehatan pada Fasilitas Kesehatan Tingkat Pertama dan Fasilitas Kesehatan Tingkat Lanjutan dalam Penyelenggaraan Program Jaminan Kesehatan.

Probandi, A. (2007). *Cost effectiveness analysis dalam penentuan kebijakan kesehatan: Sekedar konsep atau aplikatif?* Universitas Sebelas Maret.

Satibi, S., Andayani, T. M., Endarti, D., Suwantara, I. P. T., Wintariani, N. P., & Agustini, N. P. D. (2019). Comparison of real cost versus the Indonesian case base groups (INZ-CBGs) tariff rates among patients of high-incidence cancers under the national health insurance scheme. *Asian Pacific Journal of Cancer Prevention, 20*(1), 117–122. https://doi.org/10.31557/APJCP.2019.20.1.117

Saurabh, S., & Yadav, R. K. (2020). Recalibration of insecticide-measuring containers could prevent underdosing of insecticide during indoor residual spraying for visceral leishmaniasis (kala-azar) elimination in India. *Transactions of The Royal Society of Tropical Medicine and Hygiene, 114*(7), 549–552. https://doi.org/10.1093/trstmh/traa026

Song, J. W., & Chung, K. C. (2010). Observational studies: Cohort and case-control studies. *Plastic and Reconstructive Surgery, 126*(6), 2234–2242. https://doi.org/10.1097/PRS.0b013e3181f44abc

Vassar, M., & Matthew, H. (2013). The retrospective chart review: Important methodological

considerations. *Journal of Educational Evaluation for Health Professions, 10*, 12. https://doi.org/10.3352/jeehp.2013.10.12

Wills, B. A., Dung, N. M., Loan, H. T., Tam, D. T. H., Thuy, T. T. N., Minh, L. T. T., Diet, T. V., Hao, N. T., Chau, N. V., Stepniewska, K., White, N. J., & Farrar, J. J. (2005). Comparison of three fluid solutions for resuscitation in dengue shock syndrome. *New England Journal of Medicine, 353*(9), 877–889. https://doi.org/10.1056/NEJMoa044057

Witter, S., Bertone, M. P., Baral, S., Gautam, G., Pratap, S. K. C., Pholpark, A., Saputri, N. S., Darmawan, A. B., Toyamah, N., Fillaili, R., de Oliveira Cruz, V., & Sparkes, S. (2025). Political economy analysis of health financing reforms in times of crisis: Findings from three case studies in south-east Asia. *International Journal for Equity in Health, 24*(1), 34. https://doi.org/10.1186/s12939-025-02395-5