



Predictors of Length of Stay in Dengue Fever: A Multicenter Study

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ABSTRACT

Dengue fever (DF) is mostly common in certain geographical areas, such as Indonesia, where it continues to be public health problem due to its nature as a viral infection spread through mosquitos. The focus of this study is to assess the factors affecting length of hospital stay (LOS) among DF patients in Buleleng Regency. Between July and December 2024, a cross-sectional investigation was carried out at many hospitals, retrieving the medical records of 940 DF patients. The Spearman test was used in statistical analysis to examine the association between LOS and clinical indicators. The majority of patients (60.96%) were youngsters, 95.5% were admitted to the paediatric ward, and their recovery rate (99.89%) and mortality rate (0.11%) were also high. LOS was significantly associated with leukocyte levels, fever duration, and severity of the disease ($p < 0.05$). However, age, gender, hematocrit, and platelet levels did not show significant association with LOS ($p > 0.05$). This reveals that leukocyte count, duration of fever, and severity of DF contribute in determining hospital stay duration while discharge criteria as such degree of anemia and thrombocytopenia do not appear to be reliable predictors. It is suggested that there is a gap in literature that needs to be looked into regarding the genetic clinical determinants of LOS patients with DF needs further evaluation.

INTRODUCTION

Dengue fever is a dengue virus (DENV) infection transmitted through *Aedes*, *Aedes aegypti* and *A. albopictus* mosquito vectors with a probability of infection of about 40% in tropical and subtropical regions (Ferreira-de-Lima & Lima-Camara, 2018; Wu et al., 2022; Zerfu et al., 2023). Epidemiologically, the number of dengue fever cases continues to increase over time (Du et al., 2021; Tian et al., 2022). According to the World Health Organization (WHO), there were 5.2 million cases of dengue fever in 2019, with 658,301 cases in Southeast Asia. In 2019, there were 138,127 cases of dengue fever in Indonesia, with Bali Province ranked third with the highest Incident Rate (IR) of 137 per 100,000 population. Meanwhile, Buleleng Regency experienced an increase in dengue fever morbidity from 19.6 per 100,000 population in 2018 to 46.9 per 100,000 in 2018 (Mallhi et al., 2016; Mutsuddy et al., 2019).

The high incidence of dengue fever requires comprehensive monitoring to diagnose the disease (Wong et al., 2020; Zerfu et al., 2023; Zhang et al., 2024). WHO provides recommendations to diagnose dengue fever by examining virus isolation and serotype identification, viral nucleic acid detection, and antigen or antibody detection; however, most of these tests are not available in every region. According to Muller (2017), the diagnosis of

dengue virus infection can be made by clinical and laboratory tests (Muller et al., 2017). Although it is a self-limiting disease, dengue fever can cause death due to severe infection.

The severity of dengue fever is caused by leakage of systemic blood vessels, especially in the peritoneal space (Chanthick et al., 2018; Priya et al., 2017; Rosenberger et al., 2016). In the critical stage, dengue fever can manifest as dengue shock syndrome (DSS) which causes organ damage and requires intensive care (Amin et al., 2018; Nguyen et al., 2023). To prevent severity, dengue fever patients will be monitored by hospitalization in health institutions (Bajwala et al., 2019; Jayawickreme et al., 2021; Sood et al., 2023).

In 2017, it is known that the Length of Stay (LOS) in Buleleng Regency ranked second in Bali Province with a length of stay of about 2.11 days. Research on adult dengue fever patients in Jakarta with an average length of hospitalization ≥ 4 days showed no significant effect between platelets, hematocrit, and leukocytes on length of hospitalization. However, another study mentioned that dengue fever patients with hospitalization >4 days showed an association between platelet hematocrit, and leukocyte levels and length of hospitalization. Research in Batu, Malang showed different results compared to previous studies that platelets, hematocrit, and leukocytes affect the length of hospitalization of dengue fever patients with $LOS \leq 4$ days. The study has several shortcomings including the limited number of samples and locations that have the potential to cause research bias. The purpose of this study was to determine the prediction of LOS of dengue fever patients in Buleleng Regency Hospital. The findings are expected to provide clinical benefits by helping healthcare providers identify patients at risk of prolonged hospitalization early, allowing for more efficient resource allocation and tailored patient management. Ultimately, this research can contribute to optimizing hospital bed occupancy, reducing healthcare costs, and improving the quality of care for dengue patients.

METHOD

This type of research was conducted with a quantitative analytic method with a cross sectional approach that was approved by the Research Ethics Committee of Buleleng General Hospital numbered 035/EC/KEPK-RSB/VIII/2024. This study was conducted from July to December 2024 in Buleleng District Hospital, Kertha Usada Hospital, Bali Med Buleleng Hospital, TkIV Singaraja Hospital, Tangguwisia Hospital by collecting medical record data of patients diagnosed with dengue fever with ICD X code A90 and or A91. The research sample must meet the following criteria: patients aged 1 month - 60 years with a diagnosis of dengue fever at discharge through an inpatient resume as evidenced by a complete blood test, patients do not have comorbidities, such as diabetes mellitus, secondary infections, immunocompromised states, congenital diseases, and pregnancy, medical record data is clearly legible and complete including patient identity (name, medical record number, age, gender, room, diagnosis), vital sign measurements, and length of stay, fever duration before hospitalization 3-7 days (Critical phase). The results of medical record data were then analyzed using the SPSS program. The analysis used in this study was the Mann whitney test.

RESULT AND DISCUSSION

Respondent Characteristics

This study involved 940 dengue fever patients diagnosed in January-June 2024, dominated by pediatric patients (60.96%), with treatment in regular rooms (95.5%). The mortality rate of dengue fever infection in this study was 0.11%. General characteristics of dengue fever respondents can be seen in Table 1.

Table 1. Characteristics of respondents

	N	%
Age		
Child	573	60.96
Adult	367	39.04
Hospital Room		
Regular room	898	95.5
ICU	42	4.5
Outcome		
Recovery	939	99.89
Death	1	0.11

Source: Primary data from patient medical records (2024)

Child respondents

There were 573 children respondents in this study, predominantly male (53.8%) with fever on the fourth day of admission (40.5%). The majority of patients had dengue fever without warning signs (74.7%) with an average length of treatment of four days (34.2%). The characteristics of pediatric respondents can be seen in Table 2.

Table 2. Characteristics of child respondents

	N	%
Sex		
Male	308	53.8
Female	265	46.3
Fever day		
3	148	25.8
4	232	40.5
5	148	25.8
6	34	5.9
7	10	1.7
8	-	0
9	1	0.3
Grade		
Dengue without warning sign	428	74.7
Dengue with warning sign	106	18.5
Severe Dengue	39	6.8
LOS		
< 3	6	1
3	103	18
4	196	34.2
5	171	30
6	70	12.2
7	15	2.6
> 7	12	2

Source: Primary data from patient medical records (2024)

Adult respondents

There were 367 adult respondents in this study, dominated by male gender (52.3%) with the most age in the range of 21-30 years (44.7%). The majority of patients came on the fourth day of fever (37%) with dengue fever without warning signs (86%) and the length of treatment was four days (34.1%). The characteristics of pediatric respondents can be seen in Table 3.

Table 3. Characteristics of adult respondents

	N	%
Sex		
Male	192	52.3
Female	175	47.7
Age		
≤20	69	18.8
21-30	164	44.7
31-40	71	19.3
41-50	42	11.4
51-60	21	5.8
Fever day		
3	116	31.6
4	136	37
5	86	23.4
6	16	4.4
7	10	2.7
8	3	1.3
Grade		
Dengue with warning sign	316	86
Dengue without warning sign	39	10.6
Severe Dengue	12	3.4
LOS		
< 3	4	1.1
3	66	18
4	125	34.1
5	113	30.8
6	34	9.3
7	22	6
> 7	2	0.5
Passed away	1	0.2

Source: Primary data from patient medical records (2024)

Based on the results of data analysis using the Spearman test, there was a significant relationship between the length of stay group with the results of leukocytes, days of fever, and severity ($p < 0.05$). While the age group, gender, hematocrit, and platelets had no significant relationship ($p > 0.05$). The results of the Spearman test analysis can be seen in Table 4.

Table 4. Spearman correlation results LOS

Parameter	<i>Spearman Rho Correlation</i>	Sign	N
Age	-.003	.921	939
Sex	0.050	0.125	
Fever day	-0.270	0.000	
Leukocytes	-0.126	0.000	
Platelets	-0.016	0.624	
Hematocrit	0.052	0.110	
Grade	0.113	0.000	

Source: Results of statistical analysis from primary data (2024)

Dengue fever has become a significant public health problem globally, with Indonesia being one of the most affected countries due to its tropical climate that favors mosquito breeding. Evidently in our study, the number of patients diagnosed with dengue fever was 940 patients with most without warning signs.

The clinical presentation of dengue fever usually starts with a sudden high fever lasting between two to seven days. In this study, 372 (38.8%) patients would visit the health care centre on the fourth day of fever. Patients may experience non-specific symptoms such as severe headache, retro-orbital pain, muscle and joint pain, nausea, vomiting, and rash. Advanced dengue fever may manifest with severe abdominal pain, persistent vomiting, hematemesis (vomiting blood), epistaxis (nosebleeds), gingival bleeding (dengue gums), and thick black stools (melena). These symptoms often signal the onset of plasma leakage and potential progression to dengue shock syndrome (DSS), which can be fatal without prompt medical intervention. In this study, 51 patients (5.4%) experienced severe dengue with a case fatality rate of 0.11%.

Dengue fever management centers on supportive care aimed at maintaining fluid balance and preventing complications arising from shock as there is currently no specific antiviral treatment for dengue virus infection. The length of hospital stay (LOS) in patients with dengue fever has a significant impact on leukocyte dynamics, fever duration, and overall disease severity. Studies have shown that the average length of hospital stay for patients with dengue fever is 3-4 days, but this duration can vary greatly based on the clinical presentation and complications that arise during hospitalization.

In this study, the length of stay correlated with leucocyte counts, days of fever, and severity ($p < 0.05$). This is in line with previous studies that in severe cases of leucopenia correlated with the severity and duration of fever so that these parameters can be used as indicators of disease progression. The duration of fever in dengue fever patients is closely related to the dynamics of leucocyte counts. Studies have shown that patients with a lower percentage of lymphocytes on admission tend to have a longer hospital stay, which suggests that a strong immune response, reflected by a higher lymphocyte count, may accelerate recovery and shorten hospitalization. In contrast, prolonged febrile phases are common in severely affected individuals, and these prolonged periods can be attributed back to the ongoing battle between the host immune system and the invading viruses. An important observation made in some case series is that patients who require a longer duration of hospitalization tend to have a longer duration of fever. About two-thirds of all hospitalized patients do not show improvement until at least five days post-baseline, which underscores how closely these variables are linked.

In addition, the severity of dengue fever may also be associated with leukocyte fluctuations during hospitalization. In several studies, it has been highlighted that leukocytosis is relatively rare, usually only occurring in cases complicated by secondary infection. This suggests that while leucopenia may indicate a more severe initial presentation, leukocytosis may signal potential complications that require longer hospitalization. These dynamics of hematological changes are particularly important as the duration of hospitalization can range from two to seven days, and understanding these patterns can help healthcare providers anticipate complications and manage treatment effectively.

Previous studies have shown that hematological parameters such as platelet count and hematocrit levels also play an important role in assessing disease severity. Thrombocytopenia is a hallmark of dengue fever and has been shown to correlate with disease severity; patients with severe dengue fever often exhibit marked thrombocytopenia along with elevated hematocrit levels due to plasma leakage. These factors further complicate the clinical picture and highlight the need for comprehensive monitoring during hospitalization. This study showed interesting results that hematocrit and platelet levels were not associated with length of stay. In general, including in Indonesia, the LOS of DHF patients is determined by platelet levels, which means that patients can be discharged if platelets rise. These results are in line with research on adult dengue fever patients in Jakarta with an average length of stay ≥ 4 days showing no significant effect between platelets, hematocrit, and leukocytes on length of stay. Research in India conducted on dengue fever patients in 2011-2014 showed thrombocytopenia was not associated with length of stay, only associated with complications such as rash, transaminitis, and decreased albumin. This study has several limitations including the research method used is cross-sectional which takes data from patient medical records. In addition, this study only examined patient laboratory variables without considering other factors such as nutrition, weight, occupation, access to health facilities that may have an impact on the length of stay of patients. We also did not analyze patient care in the intensive care unit (ICU).

CONCLUSION

Based on the results of the study it can be concluded that dengue fever cases in Buleleng Regency in January-June 2024 were 940 cases dominated by children (60.96%), with regular room treatment (95.5%) and complete recovery (99.89%) with a case fatality rate of 0.11%. There was a significant association between the length of stay group and the results of leukocytes, hot days, and severity ($p < 0.05$). While the age, gender, hematocrit, and platelet groups did not have a significant relationship ($p > 0.05$). Further tests need to be conducted related to the role of platelets, hematocrit, and leucocytes on the severity of the disease genetically and other factors that influence the length of stay of dengue fever patients. In addition, analysis of factors that influence the treatment of dengue fever patients in the ICU can be an idea for future research.

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