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DEMOGRAPHIC AND PREDICTOR FACTORS OF SEVERE DENGUE IN CHILDREN AT SUMBER WARAS HOSPITAL: A RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Dengue prevalence is still high worldwide, as well as in Indonesia. Jakarta is the second province with the most dengue cases in early 2024. Funding and cost constraints hinder dengue diagnosis. This study aims to determine the demographics of dengue cases and predictive factors of severe dengue without diagnostic laboratory examination.

Patients and Methods: This was a retrospective observational study of pediatric patients at Sumber Waras Hospital Jakarta from January-June 2024. Inclusion criteria were probable dengue respondents without dengue diagnostic examination. Data in the form of home address and various predictors of severe dengue were then analyzed univariate and multivariate (chi-square, Fisher exact test, and binary logistic regression), with p value <0.05 considered significant.

Results: There were 162 cases, with 115 dengue cases with warning signs and 47 severe dengue cases; there were 2 deaths in severe dengue. Grogol Petamburan district, especially Grogol urban village, is the area with the highest proportion. Predictors of severe dengue in univariate analysis were age, lethargy, persistent vomiting, abdominal pain, mucosal bleeding, hepatomegaly, clinical fluid accumulation, hematocrit >40%, platelets count <50,000/mm^3 + hematocrit >40%, and platelets count <20,000/mm^3. On the other hand, multivariate analysis found lethargy, abdominal pain, mucosal bleeding, hepatomegaly, and hematocrit >40% were predictors of severe dengue (p-value <0.05).

Conclusion: Although with limited laboratory examination,d monitoring of dengue warning signs, periodic platelet and hematocrit examination can be a predictor of severe dengue according to WHO 2009 criteria. Larger-scale studies are needed to confirm the predictive factors of severe dengue.

Keywords: dengue., demographic., predictive factors

INTRODUCTION

The World Health Organization (WHO) notes that dengue cases are still very high. In 2023, 80 countries recorded dengue fever cases with a total of more than 6.5 million cases, and about 7300 cases ended in death. The Asian region accounts for 70 cases of dengue fever worldwide. Southeast Asia with the highest cases is Bangladesh with around 310,000 cases.[1]Indonesia experienced a high spike in dengue cases in 2024. As of April 1, 2024, there were 20,372 cases compared to 2023, with an average of 5000 cases per month.[2] DKI Jakarta is the second province with the most dengue cases from January to May 2024 (9,156 cases).[3] Data from the Ministry of Health of the Republic of Indonesia (Kemenkes) in 2022 noted that children, especially those aged 4–15 years, are the age group with the highest mortality rate due to dengue fever (45%).[4]The Aedes aegypti mosquito is the vector that spreads the dengue virus (DENV), which causes dengue fever. One of the risk factors for a high incidence of dengue fever is a residential location. One of the probable risk factors is the heavily populated West Jakarta Regency. Dengue fever cases at Sumber Waras Hospital in West Jakarta increased in 2024; as of June 19, 2024, there were 162 cases reported. Although dengue is a self-limiting illness, it can result in shock and even death if not properly monitored.[5] The two types of dengue fever are subsequently distinguished: dengue with warning signs and dengue without. When dengue presents with warning signs, it can worsen and even become fatal.[6]In daily clinical practice, there are limitations in diagnostic examinations for dengue, such as the non-structural protein 1 (NS1) antigen test, immunoglobulin M (IgM) or immunoglobulin G (IgG) anti-dengue tests, reverse transcriptase polymerase chain reaction (RT-PCR), and enzyme-linked immunosorbent assay (ELISA).[5] One of the predictive factors for the worsening of dengue fever is thrombocytopenia and hemoconcentration. Platelet and hematocrit tests are easy to perform and routinely conducted. Various studies indicate that platelet levels can be used as a predictive factor for severe dengue. In addition, early monitoring of dengue warning signs can reduce dengue mortality rates. Similar research has never been conducted at Sumber Waras Hospital. The purpose of this research is to determine the demographic

distribution of pediatric patients with dengue and to identify the predictive factors for severe dengue in children at Sumber Waras Hospital without dengue diagnostic testing.

PATIENTS AND METHODS

This study is an analytical observational research using a retrospective observational study design at Sumber Waras Hospital from January to June 2024. All research data comes from medical records with the approval of the Health Research Ethics Committee of Sumber Waras Hospital, with the Ethical Clearance Letter number 26/RSSW/Kom.EP/VII/2024. Inclusion criteria were pediatric inpatients with probable dengue without dengue diagnostic examination, having complete data including age, gender, weight, height, dengue warning signs, platelets, and hematocrit. Exclusion criteria were incomplete data and probable dengue patients diagnosed with other diseases (typhoid fever, sepsis). The demographic data includes gender, age, obesity, warning signs of dengue, platelet count <20,000/mm^3, hematocrit >40%, and platelet count <50,000/mm^3 accompanied by hematocrit >40%. The criteria for obesity using BMI based on age according to the WHO z-score curve.[7] The warning signs of dengue include lethargy, persistent vomiting, abdominal pain, mucosal bleeding, hepatomegaly, and clinical fluid accumulation.[6] Participant flowchart shown in figure 1. Univariate analysis using chi-square and Fisher's exact test. Then conduct a multivariate analysis using binary logistic regression. Statistical analysis using SPSS version 29: a p-value < 0.05 is considered significant.

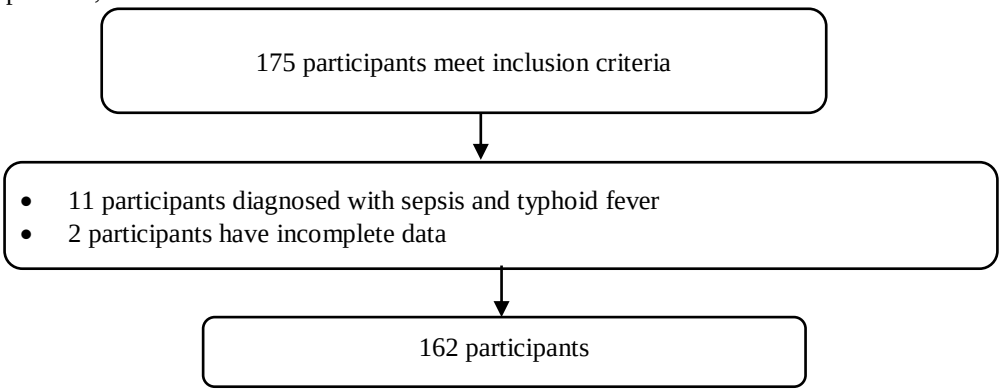

Figure 1. Flowchart of study participants.

RESULT

A total of 162 pediatric inpatients at Sumber Waras Hospital from January to June 2024 with probable dengue fever according to WHO criteria 2009 were included in this study. All respondents participated in the study until the end. Dengue fever with warning signs was experienced by 115 children, while severe dengue was experienced by 47 children. There were only 2 cases of death in individuals over 5 years old who were obese, and all occurred in the severe dengue group. One case of death involving a male and another case involving a female. The cases of death originate from the Tomang and Tanjung Duren Utara sub-districts. The patient demographics are predominantly from the West Jakarta regency, accounting for 148 cases (91.4%). Other regencies include Central Jakarta (3.7%), North Jakarta (1.9%), Cianjur (1.2%), Tangerang (0.6%), West Semarang (0.6%), and Grobogan (0.6%). The district with the highest number of dengue cases in West Jakarta is Grogol-Petamburan, with 67 cases (45.3%). The Grogol urban village has the highest cases, reporting 16 dengue fever cases with warning signs and 4 severe dengue cases. (Tabel 1).

Table 1. Demographics of dengue cases

Districts in West Jakarta	Dengue cases n (%)
Grogol-Petamburan	67 (45.2)
Tomang	40 (27)
Cengkareng	14 (9.4)
Kebon Jeruk	13 (8.7)
Kembangan	6 (4)
Palmerah	4 (2.7)
Taman Sari	3 (2)
Kalideres	1 (0.6)

Urban villages in Grogol-Petamburan District	Dengue cases (n)	
	Dengue with warning signs	Severe dengue
Grogol	16	4
Tomang	12	4
Jelambar	6	4
Wijaya Kusuma	6	4
Jelambar Baru	6	1
Tanjung Duren Utara	2	1
Tanjung Duren Selatan	0	1

This study's characteristics are dominated by boys (87 children), who are ≥ 5 years old and have normal nutritional status. (107 children). In the univariate analysis, the following variables were found to be predictive of severe dengue: age; lethargy; persistent vomiting; abdominal pain; mucosal bleeding; hepatomegaly; clinical fluid accumulation; platelet count <20,000/mm^3; hematocrit >40%; and platelet count <50,000/mm^3 combined with hematocrit >40%. (Table 2).

Table 2. Characteristics and Univariate Analysis

Predictor factors	Dengue cases		Total n	*P value*	OR (95% CI)
	Dengue with warning signs n (%)	Severe dengue n (%)			
Gender					
Male	59 (67.8)	28 (32.2)	87		
Female	56 (74.6)	19 (25.4)	75	0.33	0.71 (0.35-1.42)
Age					
< 5 years old	17 (100)	0 (0)	17		
≥ 5 years old	98 (67.6)	47 (32.4)	145	0.003	1.48 (1.32-1.65)
Obesity					
No	76 (71)	31 (29)	107		
Yes	39 (70.9)	16 (29.1)	55	0.98	1.006(0.49-2.05)
Lethargy					
No	47	3	50		
Yes	68	44	112	<0.001	0.09 (0.02-0.33)
Persistent vomiting					
No	59	9	68		
Yes	56	38	94	<0.001	0.22 (0.1-0.5)
Abdominal pain					
No	48	4	52		
Yes	67	43	110	<0.001	0.13 (0.04-0.38)
Mucosal bleeding					
No	97	24	121		
Yes	18	23	41	<0.001	0.19 (0.09-0.41)
Hepatomegaly					
No	108	22	130		
Yes	7	25	32	<0.001	0.05 (0.02-0.14)
Clinical fluid accumulation					
No	113	32	245		
Yes	2	15	17	<0.001	0.03 (0.008-0.17)
Platelet count <20.000/mm^3					
No	114	35	149		
Yes	1	12	13	<0.001	0.02 (0.003-0.20)
HT >40%					
No	61	10	71		

Yes	54	37	91	<0.001	0.23 (0.10-0.52)
Platelet count<50.000/mm^3 + HT >40%					
No	107	30	137		
Yes	8	17	25	<0.001	0.13 (0.05-0.33)

Note: * HT: hematocrit, Odds ratio with a 95% confidence interval, P ≤0.2 is considered significant.

Univariate analysis with a p-value < 0.2 was then included in multivariate analysis using binary logistic regression (Table 3). In the multivariate analysis, it was found that only lethargy, abdominal pain, mucosal bleeding, hepatomegaly, and hematocrit > 40% had a significant relationship with severe dengue (p-value < 0.05).

Table 3. Multivariate Analysis

Predictor factors	OR	AOR	*P value*
Age (≥ 5 years old)	1.48 (1.32-1.65)	Tidak terdefinisi	0.99
Lethargy	0.09 (0.02-0.33)	0.03 (0.003-0.35)	0.005
Persistent vomiting	0.22 (0.1-0.5)	0.37 (0.09-1.53)	0.17
Abdominal pain	0.13 (0.04-0.38)	0.04 (0.006-0.42)	0.006
Mucosal bleeding	0.19 (0.09-0.41)	0.05 (0.009-0.38)	0.003
Hepatomegaly	0.05 (0.02-0.14)	0.08 (0.01-0.66)	0.01
Clinical fluid accumulation	0.03 (0.008-0.17)	0.007 (0.000-1.61)	0.07
Platelet count <20.000/mm^3	0.02 (0.003-0.20)	0.02 (0.000-1.35)	0.07
HT >40%	0.23 (0.10-0.52)	0.06 (0.007-0.52)	0.01
Platelet count <50.000/mm^3 + HT >40%	0.13 (0.05-0.33)	0.21 (0.04-1.003)	0.05

Note: *HT: hematocrit, OR: odds ratio with a 95% confidence interval, AOR: adjusted odds ratio, P <0.05 is considered significant.

DISCUSSION

The increase in the number of dengue fever cases among pediatric inpatients at Sumber Waras Hospital corresponds with the rise in dengue fever cases in the DKI Jakarta Province at the beginning of 2024.[3] This upward trend is also observed in a study conducted in West Java from January to March. This is likely due to an increase in precipitation caused by heavy rainfall, leading to a rise in the number of dengue fever vectors.[8]

The demographic description shows that 91.4% of respondents reside in West Jakarta Regency, with 45.2% of them living in the Grogol-Petamburan District, specifically in the Grogol urban village. The economic growth rate of West Jakarta in 2023 is 5.30%, placing it in the second highest position in the Jakarta Province. West Jakarta also has the second lowest percentage of poor residents in the Jakarta Province, at 4.09%, following South Jakarta Regency, which ranks first at 3.10%.[9] Dengue cases generally occur in areas with low economic conditions. [10] However, research in West Java found that high-risk dengue areas are located in regions with good socio-economic conditions. The settlement has many private swimming pools and an ineffective fogging program due to limited access. In addition, the number of doctors in the area is quite high, which has also led to an increase in confirmed dengue cases.[8]Dengue cases are generally higher in densely populated areas.[11] The population density in West Jakarta in 2023 is 20,132 people/km^2, with Tambora urban village having the highest density at 49,972 people/km^2.[9] In this study, the most dengue cases occurred in Grogol urban village, which has a population density of only 23,900 people/km^2. This research was conducted in only one hospital, so the respondents' residences were predominantly located in the area surrounding the hospital. Further research needs to be conducted in various hospitals in different regions to confirm these findings.The male gender dominates this research, and there is no relationship between gender and severe dengue. In contrast, a study conducted in India suggests that men are more likely than women to experience severe dengue because of more outdoor activity and more exposed body regions.[12] The respondents in previous survey were not the same age as those in this study. This study is consistent with research conducted at Soetomo General Hospital in Surabaya with a comparable age cohort, showing no variation in immune responses according to gender in dengue infections.[13]Severe dengue is significantly correlated with age. Severe dengue is more likely to affect children five years of age and up.

Additionally, a number of studies show that those who are five years of age and older have a higher chance of contracting severe dengue.[14-17] This happens as a result of secondary infections brought on by infections from various dengue virus serotypes, which also produce an increase in immunity in the body.[18]In this study, there were 2 cases of death in the severe dengue group, and the respondents were obese. However, statistically, there is no relationship between obesity and severe dengue. This finding contradicts various studies because obesity is associated with unexpected clinical progression and a worse prognosis.[19] Research by Maneerattanasak even states that overweight patients are at a higher risk of experiencing severe dengue.[20] Obese patients have a stronger immune response, which increases the risk of severe dengue.[21] Additionally, the increase in white adipose tissue production leads to an increase in the production of inflammatory mediators such as TNF-α, IL-1β, IL-6, and IL-8. These inflammatory mediators increase capillary permeability, resulting in massive plasma leakage that heightens the risk of severe dengue.[22] Further research with a larger sample size is still needed.Various studies on warning signs of dengue indicate that not all warning signs are associated with severe dengue.[23-5] This is also evident in this study, where only lethargy, abdominal pain, mucosal bleeding, and hepatomegaly had statistically significant values in the multivariate analysis. However, a 2021 meta-analysis on the predictive factors of severe dengue states that all warning signs of dengue are still reliable.[26] Further research on a larger scale is still needed.Based on the multivariate analysis of platelet levels and hematocrit, only hematocrit levels >40% have a significant relationship with severe dengue (p value <0.01). Cecilia's research also found a similar result where only thrombocytopenia was significant in the univariate analysis.[27] However, Maneerattanasak's study, which had a larger sample size (647 samples), indicated a significant relationship for both thrombocytopenia <50,000/mm^3 and hematocrit >42% with severe dengue.[20] Plasma leakage due to increased vascular permeability leads to an increase in hemoconcentration, making this parameter reliable as a predictor factor for severe dengue during the initial examination.[20]This study has a one-year time frame and is restricted to one hospital. Given the large population density seen throughout the Jakarta Province, data collected from several hospitals over an extended period of time is anticipated to more accurately depict the demographics and predictive factors of severe dengue.

CONCLUSION

The Grogol Petamburan district, specifically the Grogol village, is an area with the highest number of dengue cases. Children aged 5 and above who are obese are at a higher risk of experiencing severe dengue. Monitoring warning signs of dengue plays a role as a predictive factor for dengue without the need for additional diagnostic examinations.

Conflict of Interests

This research is an independent study conducted by the researcher without any sponsorship. There are no conflicts of interest in this research. This research has received ethical permission from the hospital.

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