



Modeling of Survival Analysis of Recovery Rate of Dengue Hemorrhagic Fever Patients at Dr. M. Djamil Padang Hospital

Masrizal Masrizal¹ , Yudi Pradipta¹ , Sari Laila Wahyuni¹ , Randy Novirsa^{2*} , Muhammad Alfarezi¹ 

¹Department of Epidemiology, Faculty of Public Health, Andalas University, Padang, Indonesia; ²Department of Occupational and Environmental Health, Faculty of Public Health, Andalas University, Padang, Indonesia

Abstract

Edited by: Slavica Hristomanova-Mitkovska
Citation: Masrizal M, Pradipta Y, Wahyuni SL, Novirsa R, Alfarezi M. Modeling of Survival Analysis of Recovery Rate of Dengue Hemorrhagic Fever Patients at Dr. M. Djamil Padang Hospital. Open Access Maced J Med Sci. 2023 Feb 10; 11(E):166-169.
https://doi.org/10.3889/oamjms.2023.11399

Keywords: Dengue, hospital, modelling, recovery, survival analysis
***Correspondence:** Randy Novirsa, Department of Occupational and Environmental Health, Faculty of Public Health, Andalas University, Padang, Indonesia.
E-mail: randynovirsa@ph.unand.ac.id

Received: 14-Dec-2022

Revised: 12-Jan-2023

Accepted: 31-Jan-2023

Copyright: © 2023 Masrizal Masrizal, Yudi Pradipta, Sari Laila Wahyuni, Randy Novirsa, Muhammad Alfarezi
Funding: This research did not receive any financial support

Competing Interests: The authors have declared that no competing interests exist

Open Access: This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0)

BACKGROUND: Dengue hemorrhagic fever (DHF) is one of the endemic diseases with the highest cases in Indonesia. According to the World Health Organization data in 2020, the incidence of DHF has increased more than 8 times over the last two decades, from 505,430 cases in 2000, to more than 2.4 million in 2010 and 5.2 million in 2019.

AIM: This study aims to analyze the recovery rate of DHF patients at Dr. M. Djamil Padang Hospital during the COVID-19 period and the factors that influence it.

METHODS: This study is a quantitative study with a retrospective cohort study design. Data were taken from the medical records of DHF patients during the COVID-19 period (March 2020–February 2022). The sampling technique used was simple random sampling. The analysis used the Kaplan-Meier, Cox Regression method, and the Cox Proportional Hazard analysis.

RESULTS: The average time it takes a patient to recover from DHF at Dr. M. Djamil Padang is 10 days. Patients who experienced the event were 32.7%, with an incidence rate of 0.061%. DHF patients at RSUP Dr. M. Djamil Padang, most of them were >14-years-old, male, duration of fever before hospitalization >4 days, platelet level 100,000, hematocrit level >20%, and patients using insurance.

CONCLUSION: DHF patients aged >14 years, duration of fever before hospitalization 4 days, hematocrit level 20% had a longer recovery rate. It is recommended to the hospital to be better prepared to handle DHF patients according to risk factors and to collaborate for health education.

Introduction

According to the World Health Organization, dengue hemorrhagic fever (DHF) is a disease caused by the bite of an *Aedes* mosquito infected with one of the four types of dengue virus with clinical manifestations of fever, muscle aches, and joint pain accompanied by leukopenia, rash, lymphadenopathy, thrombocyt, and hemorrhagic diathesis [1].

In DHF, plasma seepage occurs, which is characterized by hemoconcentration (increased hematocrit) or accumulation of fluid in the body cavity [2]. DHF is an endemic disease in tropical and subtropical areas that appears throughout the year, especially during the rainy season when conditions are optimal for mosquitoes to breed. Usually, a large number of people will be infected in a short time (an epidemic) [3].

Dengue fever is caused by the dengue virus, which belongs to the arthropod-borne Flavivirus genus and family Flaviviridae [4]. DHF itself is transmitted through the bites of *Aedes aegypti* and *Aedes albopictus* mosquitoes, but *A. aegypti* plays a more important role in the process of DHF transmission. This disease will occur throughout the

year and can attack all ages, from infants to the elderly. The dengue virus is transmitted from person to person by the *Aedes* (*Ae.*) mosquito of the *Stegomyia* subgenus [3].

Diverted can be seen through the availability of space, allocation of resources, and budget funds (refocusing). Based on The Presidential Instruction of the Republic of Indonesia Number 4 (2020) on COVID-19 Control, the government can carry out programs to accelerate the handling of the pandemic, revise the budget, and plan the procurement of goods and services for the purposes of handling the pandemic [5] [6] [7]. Through budget reallocation and refocusing of activities, the government can carry out programs to accelerate the handling of the pandemic, revise the budget, and program the procurement of goods and services for the purposes of handling the pandemic [7].

Both DHF and COVID-19 are characterized by high fever. The similarities in symptoms between dengue fever and COVID-19 often lead to confusing diagnoses, with both infections presenting with high fever and flu-like symptoms. Likewise, routine blood tests for initial screening often show the same pattern, with the thrombocytopenia characteristic of dengue fever often appearing in COVID-19 infection as well.

The incidence of disease based on the epidemiological triad is caused by: an imbalance between the patient (host), environment (environment), and agents disease-causing agent (agent). In relation to DHF, the disease agent is that dengue virus is transmitted to humans through the bite of the *A. aegypti* mosquito. Host factors of disease were age, sex, duration of fever before treatment, platelet count, and hematocrit levels. The environmental factors that cause this disease are education, work, space hospitalization, and insurance.

Table 1: Survival status of DHF patients at RSUP Dr. M. Djamil Padang

Survival status	Frequency	%
Event	17	32.7
Censored	35	67.3
Death	2	3.85
Recovery	30	57.7
Lost to follow-up	3	5.78
Total	52	100

DHF: Dengue hemorrhagic fever.

Table 2: Relationship between risk factors and the rate of recovery DHF patients in RSUP Dr. M. Djamil Padang

Variable	p-log rank	p-value	HR	(95%CI)
Age	0.024	0.039	2.732	1.051–7.102
Gender	0.269	0.299	1.695	0.626–4.589
Duration before treatment	0.001	0.006	0.121	0.027–0.539
Trombosit	0.871	0.877	0.905	0.257–3.192
Hematokrit	0.011	0.040	0.212	0.048–0.934
Insurance	0.725	0.739	1.286	0.293–5.649

DHF: Dengue hemorrhagic fever.

Table 3: Multivariate analysis of the DHF recovery rate and risk factors.

Variable	p-value	HR	95%CI
Fever duration before treatment	0.040	0.195	0.041–0.929
Age*	0.211	1.861	0.703–4.928
Hematocrite*	0.289	0.314	0.037–2.671

*Confounder.

Methods

This research is a quantitative study with an analytical approach and a retrospective cohort study design. Survival analysis is used to see factors – factors that affect the rate of recovery of DHF patients in Dr. M. Djamil Padang with healing as an event. The population of this study is all DHF patients and hospitalized in RSUP Dr. M. Djamil Padang. The number of samples was 52. Sampling was carried out using simple random sampling technique based on medical record data from March 2020 to February 2022. Data were collected using secondary data (medical records) and analyzed through univariate, bivariate and multivariate analysis.

Results

The average time it takes a patient to recover from DHF at Dr. M. Djamil Padang is for 10 days with

an interquartile distance of 8–11 day. Meanwhile, the minimum and maximum recovery times were obtained for 1 and 14 days, respectively the result of the survival status was showed in Table 1.

In this study, there were 17 (32.7%) events were recorded during the observation period. While those who experienced censored (died, improved, and disappeared from observation) were 35 people (67.3%) with details as many as 2 people (3.85%) died, 30 people (57.7%) improved or had not recovered until the end of the observation, and 3 people (5.78%) who returned at their own request or disappeared from observation. Hence, the DHF patient at the Dr. M. Djamil During the COVID-19 period, more people were censored than those who experienced events.

Most of the DHF patients at RSUP Dr. M. Djamil Padang during the COVID-19 period, he was >14 years old, male, had a fever for >4 days before being treated, had a platelet level of $\leq 100,000 \text{ mm}^3$, had a hematocrit level of >20%, and used insurance. The relationship between risk factors and the rate of recovery was shown in Table 2.

There is a significant relationship between age and the recovery rate of DHF patients ($p = 0.039$; $HR = 2.7$). DHF patients aged >14 years have a risk of a longer recovery rate. There is no significant relationship between gender and the recovery rate of DHF patients ($p = 0.299$; $HR = 1.7$). Types of DHF patients male and female sex have a healing rate that is not too different.

There is a significant relationship between the length of fever before being treated with the recovery rate of DHF patients ($p = 0.006$; $HR = 0.1$). DHF patients who had a long fever before being treated for 4 days had a higher risk of recovery long.

There was no significant relationship between platelets and the recovery rate of DHF patients ($p = 0.877$; $HR = 1$). DHF patients who have platelets $100,000 \text{ mm}^3$ and platelets $>100,000 \text{ mm}^3$ have a cure rate that is not too different. There is a significant relationship between hematocrit and the recovery rate of DHF patients ($p = 0.040$; $HR = 0.2$). DHF patients who have a hematocrit 20% have a longer risk of recovery. There is no significant relationship between insurance and rate recovery of DHF patients ($p = 0.739$; $HR = 1.2$). DHF patients who use and do not use insurance have recovery rates that are not too different.

Final model of multivariate analysis related to the recovery rate of DHF patients in Dr. M. Djamil Padang at the time of COVID-19 was shown in Table 3. By taking into account the confounder variables, namely, age and hematocrit as a factor that can influence other factors in the rate of the recovery of DHF patients, the most influential variable is obtained the rate of cure is

the duration of fever before treatment ($p = 0.04$; HR 0.195; 95% CI 0.041–0.929).

Discussion

Age is related to the rate of recovery of DHF patients. This study is in line with Putu's (2012) research which states that age has a significant effect on the recovery rate of DHF patients ($p = 0.017$). From result in Ni Putu's study, older patients tend to have a longer recovery rate than younger patients [9].

Gender is not related to the recovery rate of DHF patients. The results of this study are in line with the research of Alifa Silfi (2016) which concluded that the time of improvement in the clinical condition of DHF patients with male and female gender was not significantly different [10]. Another study conducted by Like (2020) stated that gender did not have a significant relationship with the recovery rate of DHF patients ($p = 0.763$) [11]. The duration of fever before being treated is related to the recovery rate of DHF patients. The results of this study are in line with the results of Putri's research (2018), which states that DHF patients who had a long fever before being treated for >4 days had a faster recovery rate than patients who had a fever before being treated for 4 days ($p = 0.046$) [12]. The course of dengue fever is non-specific, patients often come to the hospital in serious condition, and many people end up not being cured. In another study, the shock phase occurred on the 3rd–5th day. The critical phase of dengue fever is when the body temperature drops, thrombocytopenia occurs with plasma concentrations that reflect plasma leakage. Immediate and appropriate fluid replacement with isotonic plasma solutions is a measure that can prevent shock [13].

Trombocyte level has no relationship with the healing rate of DHF patients. The results of this study are in line with the results of research conducted by Irfan (2017), which states that platelets have no significant effect on the recovery rate of DHF patients ($p = 0.218$) [14]. Research conducted by Mohammad (2020) also states that platelets does not have a significant relationship with the recovery rate of DHF patients ($p = 0.0715$). Dengue virus that enters the blood vessels can cause platelet cell death be faster. This condition makes platelets quickly clot due to damage to the lining of blood vessels, and results in decreased platelet production in the bone marrow. The majority of DHF patients have quite low platelet levels.

Hematocrit has a relationship with the recovery rate of DHF patients. The results of this study are in line with the results of a study conducted by Irfan (2017), who found a significant relationship between hematocrit and the recovery rate of DHF patients ($p = 0.004$) [14]. The same was also found from Mufidah's research

(2016) that hematocrit significantly related to the recovery rate of DHF patients. According to Mufidah (2016), for every increase of one unit of hematocrit level, there is a possibility of a decrease in the patient's clinical condition improvement by 0.937 times. The data taken are the initial assessment data where the hematocrit level is indeed high.

Insurance is not related to the recovery rate of DHF patients. The results of this study are in line with the results of research conducted by Like (2020), which stated that insurance was not significantly related to the recovery rate of DHF patients ($p = 0.406$). Based on the attached Kaplan–Meier curve, it can be concluded that there is no significant difference in the recovery rate between patients who use insurance or without insurance [11]. In health services, patients who do not use insurance will get the same. In multivariate analysis, the most dominant variable affects the rate of DHF patient recovery was the duration of fever before being treated. Suganda Research (2015) found that the duration of fever before being treated >4 days had a risk occurrence of dengue shock syndrome which can cause death [15].

Long fever in DHF consists of three phases, namely, the febrile phase, the critical phase, and healing phase. In the febrile phase, sudden fever occurs on 1st–3rd days. The patient experiences heat with a high temperature. The critical phase occurs on 4–5th days accompanied by a fever that drops suddenly and is often mistaken for the patient's fever recovered, but precisely at that time the patient experienced a critical phase. Meanwhile on the healing phase lasts longer than 7 days. In general, DHF sufferers successfully passed the critical phase will recover without complications in more or less time from 24 to 48 h after shock [16].

Conclusion

DHF patients at RSUP Dr. M. Djamil Padang During the COVID-19 period, there were more people who experienced censored than those who experienced events. Most of the DHF patients were >14-years-old, male, had a fever >4 days before being admitted, had platelet levels $\leq 100,000 \text{ mm}^3$, had a hematocrit level >20%, and used insurance. Age, length of fever before being treated, and hematocrit affect the recovery rate of DHF patients at Dr. RSUP. M. Djamil Padang during the COVID-19 period. The most dominant factor affecting the rate of recovery of DHF patients in Dr. RSUP. M. Djamil Padang during the COVID-19 period is the length of fever before the treatment.

It is hoped that the hospital will improve the management of DHF patient services so that the patient's clinical improvement process will be faster

and improve health education through the hospital health promotion program (PKM-RS) to patients, patient families, and hospital visitors related to the risk of developing DHF.

References

- World Health Organization. Dengue Guidelines for Diagnosis, Treatment, Prevention, and Control France. Geneva: World Health Organization; 2020.
- Oroh MY, Pinontoan OR, Tuda JB. Environmental, human and health services factors associated with the incidence of dengue hemorrhagic fever. *J Public Health Community Med.* 2020;1(3):35-46.
- World Health Organization. Dengue and Severe Dengue. Geneva: World Health Organization; 2021. Available from: <https://www.who.int/news-room/dengue-and-severe-dengue> [Last accessed on 2022 Dec 02].
- Ministry of Health RI. Indonesia Health Profile 2020. Ministry of Health of the Republic of Indonesia; 2021. p. 139. Available from: <https://www.pusdatin.kemkes.go.id/resources/download/pusdatin/profil-kesehatanindonesia/Profil-Kesehatan-Indonesia-Tahun-2020> [Last accessed on 2022 Dec 02].
- Ministry of Health RI. Indonesian Health Profile 2016. Jakarta: Ministry of Health of the Republic of Indonesia; 2017.
- Padang City Health Office. Padang City Health Profile 2020; 2021. Available from: <https://www.dinkes.padang.go.id/profile-kesehatantahun-2020> [Last accessed on 2022 Dec 02].
- Lestyowati J, Kautsarina A. Implementation of Budget Reallocation and Refocusing Activities During the COVID-19 Pandemic: A Case Study of BDK Yogyakarta. *National Symposium on Finances.* 2020;2:424-439.
- Kembuan GJ. Dengue serology in Indonesian COVID-19 patients: Coinfection or serological overlap? *IDCases.* 2020;22:e00927. <https://doi.org/10.1016/j.idcr.2020.e00927> PMID:32802747
- Putu N, Ernawatiningsih L. Survival Analysis with cox regression model case study: Dengue hemorrhagic fever patient at Haji hospital Surabaya. *Math J.* 2012;2(2):1693-4.
- US Mufidah, Purhadi. Survival analysis of dengue hemorrhagic fever (DHF) patients at RSU Haji Surabaya using the weibull regression model. *J Sci Arts ITS.* 2016;5(2):301-6.
- Widyawati LE, Bektı RD. Proportional hazard and weibull Regression. *Jurnal Statistika Industri dan Komputasi.* 2020;5(2):26-36.
- Hasibuan P. Analysis of Survival with Cox Regression on Healing Rates of Patients with Dengue Hemorrhagic Fever (DHF) at Dr. Hospital Pringadi Medan. Indonesia: University of Northern Sumatra; 2018.
- Hadi L. Factors Affecting the Degree of Severity of Dengue Hemorrhagic Fever in Children at Dr. M. Djamil Padang Year 2016-2018. Indonesia: Andalas University; 2019.
- Affi I, Maruddani DA, Hoyyi A. Analysis of survival of dengue hemorrhagic fever patients with cox regression Type III sensory proportional failure case study at the Temanggung Regional general hospital (RSUD). *Jurnal Gaussian.* 2017;6:365-74.
- Yatra IM, Putra IW, Pinatih GN. Riwayat Demam Dengue dan Keterlambatan Diagnosis sebagai Faktor Risiko Dengue Shock Syndrome di RSUD Wangaya Denpasar. *Public Health and Preventive Medicine Archive.* 2015 Dec 1;3(2):150-4.
- Pujiarti R. Faktor-Faktor yang Berhubungan dengan Kejadian Dengue Shock Syndrome (DSS) Pada Anak di Rumah Sakit Umum Daerah Tugurejo Kota Semarang. Indonesia: Universitas Negeri Semarang; 2016. p. 35-43.