



Intrinsic Factors of Mortality Due to DHF in 2018-2021

Widya Hary Cahyati^{2✉}, Andreas Wilson Setiawan¹, Chatila Maharani³

¹Magister Kesehatan Masyarakat, Pascasarjana, Universitas Negeri Semarang, Indonesia

²Jurusan Ilmu Kesehatan Masyarakat, Fakultas Ilmu Keolahragaan, Universitas Negeri Semarang, Indonesia

³Heidelberg Institute of Global Health, University Hospital and Faculty of Medicine, Heidelberg University, Heidelberg, Germany

Article Info

Article History:

Submitted May 2022

Accepted July 2022

Published July 2022

Keywords:

Dengue Hemorrhagic
Fever, DHF background,
Mortality Due to DHF

DOI

[https://doi.org/10.15294/
kemas.v18i1.36720](https://doi.org/10.15294/kemas.v18i1.36720)

Abstract

The number of cases of mortality due to dengue fever in the ex-residence of Semarang and ex-residence of Pati from January to December 2020 was 24 people. The purpose of this study was to analyze the factors associated with mortality from dengue fever from 2018-2020 in ex-residents of Semarang and ex-residents of Pati. This type of quantitative analytic research with a case-control approach. The sample consisted of 60 respondents, 30 case groups, and 30 control groups, taken using the Consecutive sampling technique. Analysis using chi-square test. The results showed that the related factors were gender (p-value = 0.009, OR = 4.750) and a history of suffering from DHF (p-value = 0.001, OR 7.500). Lack of public awareness of the importance of 3M in preventing DHF. It is necessary to conduct counseling with promotional media that is more interesting and informative to the surrounding community so that they care about the surrounding environment, so that the community can start by cooperate in cleaning the environment.

Introduction

Dengue Hemorrhagic Fever (DHF) is an acute viral infectious disease caused by the dengue virus. It is characterized by a fever of 2-7 days accompanied by bleeding manifestations, decreased platelets (thrombocytopenia), hemoconcentration marked by plasma leakage (increased hematocrit, ascites, pleural effusion, hypoalbuminemia) (Kemenkes RI, 2017). According to WHO, cases of dengue fever in the world are increasing daily. The report from WHO stating in the last two decades, there has been a significant increase in active cases of dengue fever from 505,430 active cases in 2000 to 2,400,000 in 2010. It increased to 5.2 million in 2019 (Dengue WHO, 2021). Dengue fever is a public health problem in the tropical and subtropical world. Dengue fever cases have grown dramatically in recent years, as well as mortality due to dengue fever (Arauz et al.,

2015). Dengue virus infection poses significant health and economic burden worldwide (Budigi et al., 2018).

Active cases of dengue fever in Indonesia are classified as high, there are 95,893 active cases of dengue fever in 2020, but this has decreased compared to 2019, which amounted to 112,954 active cases of dengue fever. And for the mortality rate due to dengue fever in 2020 amounted to 661. While the mortality rate due to dengue fever in 2019 amounted to 751 (Kemenkes RI, 2020). Data on active cases of DB in Central Java from January to December 2017 before the COVID-19 pandemic was 21,601/100,000, and mortality due to DB were 1.24%. In January-December 2018, the number of active DB cases was 3,519, and mortality due to DB was 37. The number of DB cases during the COVID-19 pandemic from January to December 2020 was 5,602. The

✉ Correspondence Address:

¹Magister Kesehatan Masyarakat, Pascasarjana, Universitas Negeri Semarang, Indonesia.
Email : widyahary27@mail.unnes.ac.id

cases spread across 35 districts/cities in Central Java. Of these, 114 people died due to dengue fever (Dinas Kesehatan Provinsi Jawa Tengah, 2020). Of course, this is indeed a decline but keep in mind that the increasing number of COVID-19 cases in Indonesia at the beginning of 2020 caused other diseases were not recorded properly. The contributors to the highest DB cases among regions throughout Central Java Province include Semarang City, Semarang Regency, Salatiga City, Kendal Regency, Demak Regency, Grobogan Regency, Pati Regency, Kudus Regency, Blora Regency, and Rembang Regency. From January to December 2020, there were 1481 cases and 24 mortality caused by DB during the Covid-19 pandemic (Dinas Kesehatan Provinsi Jawa Tengah, 2020).

Several studies have assessed the factors affecting the risk of mortality caused by dengue fever. They are access to health services, a history of suffering from dengue fever, and the severity of the disease (Hikmah et al., 2015). COVID-19 infection is an infectious disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (SARS-CoV-2) (Kemenkes RI, 2020). The number of COVID-19 cases is increasing daily, and it is reported that there have been at least 192 million confirmed cases of COVID-19, with a mortality toll of 4 million people worldwide (data taken from the WHO report, dated July 23, 2021) (Dengue WHO, 2021). The high case of DB and Covid-19 is a new phenomenon that allows someone infected with Covid-19 also at risk of being infected with DHF (Kemenkes RI, 2020). Both diseases are caused by a virus but of different types (Bernal et al., 2021). It's just that these two viral infections often attack simultaneously during the COVID-19 pandemic. There are similarities in clinical and laboratory characteristics between dengue infection and Covid-19 so that it obscures the diagnosis by the examining doctor and makes it difficult to make a diagnosis and provide therapy (Rana et al., 2020). The study's purpose was to analyze all the factors that could affect mortality from DHF, then determine the strength of the relationship and the main factors.

Method

The research's design is quantitative and analytical, with a case-control approach. The sample in the study was divided into two. Namely, the case samples were some DHF patients who died in Semarang Residence and Pati Residence in 2018-2021. The control samples were some DHF patients who were declared cured in Semarang Residency and Pati Residency in 2018-2021. The independent variables in the study were age, gender, and history of suffering from DHF. The dependent variable in the study was mortality due to DHF in 2018-2021. However, there is a confounding variable in the study, namely the time of mortality of DHF patients. The sample size of the case and control groups in this study was determined using the Lemeshow formula, namely 30 case groups and 30 control groups using the Consecutive Sampling technique. The sample criteria were divided into two groups. They are the inclusion-exclusion criteria for the case group and the inclusion-exclusion criteria for the control group. The inclusion criteria for the case group were the families of DHF patients in 2018-2021 who were declared dead from DHF and in the medical record and were willing to be interviewed. The exclusion criteria for the case group were the patients' families who could not be contacted. The inclusion criteria for the control group are patients with DHF in 2018-2021 who have been declared cured, while the exclusion criteria for the control group are patients with DHF in 2018-2021 who cannot be contacted. Data were analyzed using univariate and bivariate analysis techniques with a chi-square test. If the chi-square criteria are not met, the cells are simplified with one of the categories used as a comparison.

Results and Discussions

This study was conducted to know the factors associated with DHF mortality in the ex-Karisidenan Semarang and ex-Karisidenan Pati in 2018-2021. Semarang Residence consisted of six regions. Namely Semarang City, Semarang Regency, Salatiga City, Kendal Regency, Demak Regency, and Grobogan Regency.

Pati Residence consisted of five. Namely Pati, Kudus, Jepara, Rembang, and Blora Regency. Geographically, the Residency of Semarang and Pati are located on the North Coast of Java Island. They are directly adjacent to the Java Sea. According to the Central Java Central Statistics

Agency 2021, the Semarang and Pati Residence area is 11,078.71 km², while the population is 11,514,052 people. So the Population Density is 1,039.29. So the population density in Semarang and Pati residences is considered high.

Table 1. Research Result

Variables	Categories	Mortality Due to DHF				Numbers		P-value	OR 95% CI
		Patients Mortality Due to DHF		DHF Patients declared cured		n	%		
		N	%	N	%				
Age	Toddlers and Children	7	41.2	9	52.9	16	47.1	0.732	-
	Adult	10	58.8	8	47.1	18	52.9		
	Teenagers	9	50	5	38.5	14	45.2	0.717	-
	Adult	9	50	8	61.5	17	54.8		
	Adult	9	69.2	8	50	17	58.6		
	Eldery	4	30.8	8	50	12	41.4	0.451	-
Gender	Female	22	73.3	11	36.7	33	55	0.009	4.750
	Male	8	26.7	19	63.3	27	45		1.584-14.245
DHF Recording	Ever	25	83.3	12	40	37	61.7	0.001	7.500
	Never	5	16.7	18	60	23	38.3		2.244-25.062

Source : Primary Data, 2022

The results showed that the research data did not meet the chi-square requirements, so cell simplification was carried out, one of the categories for comparison. After merging the cells and making the adult group as a comparison, the p-value (Asymp Sig) > = 0.05, which means that there is no relationship between age and death of dengue fever in 2018-2021 in ex-Residency of Semarang and Pati. Age was not associated with mortality from DHF based on the research conducted by researchers. There was a difference between the incidence of mortality due to DHF among young, toddlers, children, adolescents, adults, and the elderly. Respondents who died in the category of toddlers, children, and adolescents were more dominant. In theory, the younger, the higher the mortality is. So the formation of antibodies or immunity in the body increases (Anggraini & Mahmudah, 2021), because the blood vessel permeability (porosity) of toddlers and children are higher compared to adults (Abiyoga & A'in, 2021). In another study, the mortality rate for children aged 3-14 years was 14.5 times higher than for young adults aged

15-39. The mortality rate increases somewhat in adults 50 years of age and over (Guzmán, 2020).

The research aligned with this study was Saddique et al., (2020), stating there is no relationship between the age of patients with DHF and mortality as seen from the p-value obtained, which is 0.813. A similar study by Naeem et al. (2018), showed no relationship between age and death from DHF in a hospital in Puerto Rico. But an average of 58.8% of those who died from DHF were aged 15-49. According to Trang et al. (2016), showed no relationship between age and death from DHF in a hospital in Puerto Rico. But an average of 58.8% of those who died from DHF was aged 15-49. According to (Hikmah & Kasmini, 2015), there was a relationship between age and the incidence of death in DHF patients. The study also stated that the incidence of death in children patients was higher than in adults and adolescents. Other researchers support that a lower risk of DHF mortality is associated with older age with an interquartile range (27-47 years) (Chaudhury et al., 2017).

In a different study, most of the patients in Bangladeshi hospitals were males (2.2 times more than females) who took longer to recover than females ($p < 0.01$) (Pratay et al., 2022). Research by Mallhi et al. (2015) found that the factors associated with dengue mortality were >40 years of age ($p=0.004$).

Table 1 also shows that 22 (73.3%) women experienced the most deaths from DHF and 8 (26.7%). The p-value (Asymp Sig) results is ≤ 0.05 . So there is a relationship between gender and dengue fever mortality in 2018-2021 in ex-Residency of Semarang and Pati. The OR value is 4,750, which means that female patients are 4,750 times more likely to die from DHF than male patients. Gender is associated with deaths from DHF. It plays a major role in mortality from dengue fever, where more females die than males. It is affected by hormones in the female body. The glycoprotein hormones affect the development of mononuclear phagocytic cells and granulocyte cells as a response to the body's defenses. (Nguyen et al., 2021).

Research in line with this study conducted by Hikmah & Kasmini (2015), showed a relationship between the patient's gender and the incidence of mortality due to DHF with a p-value = 0.011. Respondents experiencing patient mortality tend to be female. Research similar to gender has a relationship with mortality due to dengue (Zomosa et al., 2020). Another study found a relationship between gender and DHF mortality ($p=0.000$) (Gerald et al., 2021). Another study, namely the results of statistical tests, assessed a relationship between gender and the degree of dengue infection (Wollner et al., 2021). Other studies agree that there is a difference between the control group and cases in terms of gender in the risk of dengue shock syndrome and DHF mortality (Santana et al., 2022). Research contradicting found no relationship between male and female gender with DHF mortality is by (Liew et al., 2016). Research conducted by Hikmah & Kasmini Hikmah & Kasmini (2015), found a significant relationship between comorbidities and the incidence of DHF mortality. In another study, a high risk of severe dengue (SD) was associated with the female gender and lower hematocrit levels than male (Carrasco et al., 2014). Research by Nicolete et al. (2021), found

gender has a relationship with DHF mortality. Other researchers also said that there was a relationship between DHF mortality and the female gender, which was 2.1 times higher than male (Kumar et al., 2015).

In Table 1, the history of suffering from DHF in the ever category was 25 (83.3%), with the most deaths from DHF. The category of never experiencing death from DHF was 5 (16.7%) respondents. The p-value (Asymp Sig) of ≤ 0.05 shows a relationship between a record of suffering from dengue fever and dengue fever deaths in 2018-2021 in the ex-Residency of Semarang and Pati. The OR value of 7,500 means that patients who ever had DHF have a 7,500 times greater risk of death by DHF than patients who have never had a history of DHF.

DHF history has a relationship with mortality due to DHF. Based on studies of people who have been exposed to dengue fever before, in primary dengue infection, when the patient recovers, the individual will have lifelong immunity to the serotype of the virus that has attacked him. But against other dengue virus serotypes, they are not immune (Eltom et al., 2021). The cross-reactivity existence occurring due to previous dengue infection can increase the infectivity of the dengue virus. It can cause the spread of the disease to be more severe and severe. Various reinfections are associated with dengue/DSS outbreaks, where cases are severe. Generally occur in children (Prasetya et al., 2017). Other studies also assume that secondary infection shows DEN-3 is the dominant viral serotype causing severe cases. For example, someone suffers from dengue. Then they get reinfection with a different type of virus within six months to 5 years. Among those who got a second infection, an immunological reaction can occur, thus can lead to DHF symptoms (Gallichotte et al., 2018). Of the 60 respondents, 40 experienced previous DHF events related to death.

A similar study with the results of the Chi-Square statistical test showed that there was no relationship between a history of DHF and the incidence of death due to DHF with a p-value of 0.668 ($p > 0.05$) (Hikmah & Kasmini., 2015). The relationship between a history of ever suffering from dengue

hemorrhagic fever and the incidence of dengue shock syndrome was significant (p-value = 0.0009). The OR calculation resulted OR = 7.980 with a 95% Confidence Interval (CI) = 2.837 – 23.909 (Gerald et al., 2021). In a similar study, a variable that was significantly related to the incidence of DHF was a history of suffering from DHF (p-value= <0.001; OR= 9.1; 95% CI: 2,486-32,579) (Díaz-Quijano & Waldman, 2012). Another study stated that there was a relationship between a history of DHF infection in cases of DB death with a p-value of 0.003 (Yatra dkk, 2015). Research by Carabali et al. (2015) found factors associated with dengue

mortality are the history of having suffered from DHF before (p<0.05) and a history of having other comorbidities (p<0.001).

Another study in line is by Prasetya et al. (2017), who said a statistical test of a history of suffering from DHF p-value 0.033 in the incidence of DHF in the city of Bandung. One of the factors affecting DHF mortality is a patient with a DHF record (p-value of 0.05) (Anggraini & Mahmudah, 2021). Another study with a p-value of 0.015 found that DHF record is related to DHF incidence, with an OR of 2,213 at the Celikah Health Center (Hikmah & Kasmini, 2015). Priyamvada et al. (2016)

Table 2. DHF Mortality by Time of Death in Januari 1, 2018 - December 31, 2021

Time of Death	DHF Mortality	Anxiety in Visits to Health Services				Numbers		Or 95% CI
		No		Yes		n	%	
		n	%	n	%			
Januari 1, 2018 - December 31, 2019	DHF patients who are declared cured	7	70%	3	30%	10	100%	44.333 3.929- 500.269
	DHF patients who death	1	5%	19	95%	20	100%	
Januari 1, 2018 - December 31, 2019	DHF patients who are declared cured	8	88.9	1	11.1	9	100	76.000 6.002- 962.319
	DHF patients who death	2	2	19	30.5	21	100	

Source : Primary Data, 2022

Table 2 shows the relationship between the DHF mortality incidence and anxiety in visiting health services based on the time of death from January 1, 2018 - December 31, 2019. The value of OR(1) = 44,333 means that respondents feel anxiety in visiting health services, and at the time of death on January 1, 2018 – December 31, 2019, had a 44,333 times risk of dying from DHF compared to respondents who did not feel anxious when visiting health services. After controlling for the relationship between time of death, it turns out that experiencing anxiety during visits to health services increases the risk of death due to DHF due to rough OR < OR(1) (3.3 > 44.3), so there is confusion that increases the relationship between anxiety about visiting health services and actual death due to DHF.

Table 2 also produces OR (2) = 76,000, which means that respondents who experience

anxiety visit health services and experience time of death for the period January 1, 2019-December 31, 2020 or during a pandemic have 76,000 times more risk of experiencing death from dengue than respondents who do not experience anxiety visiting health services. After controlling for the relationship between time of death, it turns out that experiencing anxiety when visiting health services has an increased risk of death from DHF due to crude OR < Or (2) (3.3 > 70), so there is confusion that increases the relationship between anxiety about visiting health services and actual death due to dengue.

Prolonged anxiety will cause stress. It interferes with daily activities and causes instability in the situation and condition, one of which is that people are afraid to check with health services. Anxiety is a feeling almost the same as fear, but anxiety tends to be less specific

(Hikmah & Kasmini, 2015). A similar study conducted by Livana et al. (2020) found that all respondents were worried about visiting local health services so that people were alert and avoided the transmission of Covid-19. Another researcher explained that five respondents experienced anxiety resulting from concerns that made respondents afraid to check with health services during the COVID-19 pandemic (Puspita Mustakim, 2021).

Conclusions

Based on the results, the study concludes that the factors associated with DHF mortality are gender (p-value = 0.009, OR = 4.750) and a history of suffering from DHF (p-value = 0.001, OR 7.500). While the age factor was not associated with mortality due to DHF (p-value > 0.05). From the confounding variables, there was an increase in anxiety about visiting health services during the COVID-19 pandemic.

References

- Abiyoga, A., & A'in, A., 2021. Pendidikan Kesehatan Mengenai Perawatan Anak Dengan Demam Berdarah Dengue (DBD) Pada Usia 6-11 Tahun. *Jurnal Pengabdian Masyarakat*, 1(1), pp.60–65.
- Angraini, F., & Mahmudah, N., 2021. Bayesian Spatial Survival Lognormal 3 Parameter Models for Event Processes Dengue Fever in Tuban. *International Journal of Applied Mathematics*. 51(4).
- Arauz, M.J., Ridde, V., Hernández, L.M., Charris, Y., Carabali, M., & Villar, L.Á., 2015. Developing A Social Autopsy Tool For Dengue Mortality: A Pilot Study. *PLoS One*, 10(2), pp.1–17.
- Bernal, J.L., Andrews, N., Gower, C., & Gallagher, E., 2021. Effectiveness of Covid-19 Vaccines against the B.1.617.2 (Delta) Variant. *The New England Journal of Medicine*, 385, pp.585–589.
- Budigi, Y., Ong, E.Z., Robinson, L.N., Ong, L.C., Rowley, K.J., Winnett, A., Tan, H.C., Hobbie, S., Shriver, Z., Babcock, G.J., Alonso, S., & Ooi, E.E., 2018. Neutralization of Antibody-Enhanced Dengue Infection By VIS513, A Pan Serotype Reactive Monoclonal Antibody Targeting Domain III of The Dengue E Protein. *PLoS Negl Trop Dis*, 12(2), pp.1–20.
- Carabali, M., Hernandez, L.M., & Arauz, M., 2015. Why are People with Dengue Dying? A Scoping Review of Determinants for Dengue Mortality. *BMC Infect Dis*, 13(2), pp.161–166.
- Carrasco, L.R., Leo, Y.S., Cook, A.R., Lee, V.J., Thein, T.L., & Go, C., 2014. Predictive Tools for Severe Dengue Conforming to World Health Organization 2009 Criteria. *PLoS Negl Trop Dis*, 8(7), pp.1–9.
- Chaudhury, S., Gromowski, G.D., Ripoll, D.R., Khavrutskii, I.V., Desai, V., & Wallqvist, A., 2017. Dengue Virus Antibody Database: Systematically Linking Serotype-specificity With Epitope Mapping in Dengue Virus. *PLoS Negl Trop Dis*, 11(2), pp.1–17.
- Dengue and Severe., 2021. *World Health Organization*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>
- Díaz-Quijano, F.A., & Waldman, E.A., 2012. Factors Associated with Dengue Mortality in Latin America and the Caribbean, 1995-2009: An Ecological Study. *The American Journal of Tropical Medicine and Hygiene*, 86(2), pp.328–334.
- Dinas Kesehatan Provinsi Jawa Tengah., 2020. *Profil Kesehatan Provinsi Jawa Tengah 2020*. Jawa Tengah: Dinas Kesehatan Jawa Tengah.
- Eltom, K., Enan, K., El-Hussein, A.R.M., & Elkhidir, I.M., 2021. Dengue Virus Infection in Sub-Saharan Africa Between 2010 and 2020: A Systematic Review and Meta-Analysis. *Front Cell Infect Microbiol.*, 11.
- Gallichotte, E.N., Baric, T.J., Yount, B.L., Widman, D.G., Durbin, A., Whitehead, S., Baric, R.S., & de-Silva, A.M., 2018. Human Dengue Virus Serotype 2 Neutralizing Antibodies Target Two Distinct Quaternary Epitopes. *PLoS Pathog*, 14(2), pp.1–17.
- Gerald, C.D.P., Suryadi, N.N.T., & Max, F.J., 2021. Faktor Resiko Terjadinya Sindrom Syok pada Demam Berdarah Dengue. *Jurnal Biomedik*, 13(2), pp.161–166.
- Guzmán, M.G., Kouri, G., Bravo, J., Valdes, L., Susana, V., & Halstead, S.B., 2020. Effect of Age on Outcome of Secondary Dengue 2 Infections. *International Journal of Infectious Diseases*, 6(2), pp.118–124.
- Hikmah, M., & Kasmini, O.W., 2015. Faktor Yang Berhubungan Dengan Kejadian Kematian Akibat Demam Berdarah Dengue. *Unnes Journal of Public Health*, 4(4), pp.180–189.
- Kemetrician Kesehatan RI., 2017. *Pedoman Pencegahan dan Pengendalian Demam Berdarah Dengue di Indonesia*.
- Kemenkes RI., 2020. *Pedoman Pencegahan dan Pengendalian Coronavirus Disease (COVID-19) Revisi Ke-5*. Jakarta.
- Kumar, A., Hilair, M.G., Jason, V., Ugwuagu, C.,

- Krishnamurthy, K., 2015. The Clinical Characteristics and Outcome of Hospitalized with Dengue in Barbados, an English Caribbean County. *The Journal Of Infection In Developing Countries*, 9(4), pp.394–401.
- Lai, S.C., Huang, Y.Y., Wey, J.J., Tsai, M.H., Chen, Y.L., Shu, P.Y., Chang, S.F., Hung, Y.J., Hou, J.N., & Lin, C.C., 2022. Development of Novel Dengue NS1 Multiplex Lateral Flow Immunoassay to Differentiate Serotypes in Serum of Acute Phase Patients and Infected Mosquitoes. *Front Immunol*, 13(8).
- Liew, S.M., Khoo, E.M., Ho, B.K., Lee, Y.K., Omar, M., & Ayadurai, V., 2016. Dengue in Malaysia: Factors Associated with Dengue Mortality from a National Registry. *PLoS ONE*, 11(6).
- Livana, P.H., Khoerina, A., Sofyan, E., Ningsih, D.K., Kandar, & Suerni, T., 2020. Gambaran Kecemasan Masyarakat Dalam Berkunjung Ke Pelayanan Kesehatan Pada Masa Pandemi Covid-19. *Jurnal Ilmiah Kesehatan Jiwa*, 9(2), pp.90–96.
- Mallhi, T.H., Khan, A.H., Adnan, A.S., Sarriff, A., Khan, Y.H., & Jummaat, F., 2015. Clinico-Laboratory Spectrum of Dengue Viral Infection and Risk Factors Associated with Dengue Hemorrhagic Fever: A Retrospective Study. *BMC Infect Dis*, 15, pp.1–12.
- Naeem, S., Pari, A., Gulzar, N., Yousaf, S., & Akhtar, M.S., 2018. Mortality Rate of Patients with Dengue Hemorrhagic Fever. *PJMHS.*, 12(1), pp.337–339.
- Nguyen, H.D., Chaudhury, S., Waickman, A.T., Friberg, H., & Curier, J.R., 2021. Stochastic Model of the Adaptive Immune Response Predicts Disease Severity and Captures Enhanced Cross-Reactivity in Natural Dengue Infection. *Front Immunol*, 91(5).
- Nicolette, V.C., Rodrigues, P.T., Johansen, I.C., Corde, R.M., Tonini, J., Cardoso, M.A., de Jesus, J.G., Claro, I. M., Faria, N.R., Sabino, E.C. Castro, M.C., & Ferreira, M., 2021. Interacting Epidemics in Amazonian Brazil: Prior Dengue Infection Associated with Increased COVID-19 Risk in a Population-Based Cohort Study. *Jurnal of Medical*, 6(10), pp.1–35.
- Prasetya, D.I. & Suryo, H., Sofu, M.A.U., Lukmono, D.T., & M., 2017. Faktor Karakteristik Klinis Host dan Sosedemografik yang Berpengaruh Terhadap Kejadian Dengue Shock Syndrome. *Jurnal Epidemiologi Kesehatan Komunitas*, 2(2), pp.99–108.
- Pratay, K.M.R., Sarkar, R., Shaifullah, A.Z., & Harir, R., 2022. A Retrospective Study on the Socio-demographic Factors and Clinical Parameters of Dengue Disease and Their Effects on the Clinical Course and Recovery of the Patients in a Tertiary Care Hospital of Bangladesh. *PLoS Negl Trop Dis*, 16(4).
- Priyamvada, L., Cho, A., Onlamoon, N., Zheng, N.Y., Huang, M., Kovalenkov, Y., Chokephaibulkit, K., Angkasekwinai, N., Pattanapanyasat, K., Ahmed, R., & Wilson, P.C., 2016. B Cell Responses during Secondary Dengue Virus Infection Are Dominated by Highly Cross-Reactive, Memory-Derived Plasmablasts. *J Virol*, 90(12), pp.5574–5585.
- Puspita, N.R., & M., 2021. Presepsi Pasien dalam Implementasi Pelayanan Kesehatan Pada Masa Pandemi Covid-19 di Wilayah Kota Bekasi Tahun 2020. *Jurnal Kedokteran Dan Kesehatan.*, 17(1), pp.99–109.
- Rana, W., Mukhtar, S., & Mukhtar, S., 2020. Mental Health Of Medical Workers in Pakistan during the Pandemic Covid-19 Outbreak. *Asian Journal of Psychiatry*, 5(1), pp.36–40.
- Saddique, A., Suleman, R.M., Masroor A.M., Ikram, A., Usman, M., Salman, M., & Faryal, R., 2020. Emergence of Co-Infection of COVID-19 and Dengue: A Serious Public Health Threat. *Journal of Infection*, 81(6), pp.16–18.
- Santana, L.M.R., Baquero, O.S., Maeda, A.Y., Nogueira, J.S., & Chiaravalloti, N., 2022. Spatio-Temporal Dynamics of Dengue-related Deaths and Associated Factors. *Rev Inst Med Trop Sao Paulo*, 2(4), pp.637–645.
- Trang, N.T.H., Long, N.P., Hue, T.T.M., Trung, T.D., Dinh, D.N., & Luan, N., 2016. Association between Nutritional Status and Dengue Infection: A Systematic Review and Meta-Analysis. *BMC Infect Dis*, 16(1), pp.1–11.
- Wollner, C.J., Richner, M., Hassert, M.A., Pinto, A.K., Brien, J.D., & Richner, J. M., 2021. A Dengue Virus Serotype 1 mRNA-LNP Vaccine Elicits Protective Immune Responses. *J Virol.*, 95(12).
- Zomosa-Signoret, V.C., Morales-González, K.R., Estrada-Rodríguez, A.E., Rivas-Estilla, A.M., Devèze-García, M.C., Galaviz-Aguilar, E., & V. R., 2020. Alanine Substitution Inactivates Cross-Reacting Epitopes in Dengue Virus Recombinant Envelope Proteins. *Viruses*, 12(2).