



Epidemiology of Dengue Hemorrhagic Fever in Mainland and Archipelago in Southeast Sulawesi Province

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Abstract. *Dengue infection is a health threat, especially in tropical and subtropical countries.* In Indonesia, the morbidity and mortality rate due to dengue hemorrhagic fever (DHF) is increasing and the area of distribution is wider. This study aimed to determine the distribution of dengue morbidity and mortality rates between the mainland and island regions in Southeast Sulawesi. This research was a non-reactive study that uses secondary data on all dengue fever cases from the Southeast Sulawesi Provincial Health Service from 2015 to 2019, totaling 7,141 cases. The research results show that the highest dengue fever prevalence rate for mainland areas occurred in 2016 at 0.15%, while for island areas it occurred in 2016 and 2019 at 0.04%. Meanwhile, the highest Incidence Rate (IR) figures for both land and island areas occurred in 2016, with land areas at 154.24 and island areas at 60.71. Epidemiologically, dengue fever that occurred in the province of Southeast Sulawesi, both in coastal areas and in mainland areas, shows a fluctuating trend. The incidence of DHF, both based on prevalence rates and Incidence Rate (IR), shows that it is always higher in the mainland than in the archipelago; this can be related to climatic conditions and demographic conditions of the population of Southeast Sulawesi Province.

Keywords: DHF, Morbidity, Archipelago, Mainland.

1 Introduction

Dengue Hemorrhagic Fever (DHF) is a health problem whose number of sufferers continues to increase from year to year, and its spread is increasingly widespread. This infectious disease tends to attack children [1]. DHF is an endemic acute disease caused by the Dengue virus transmitted by the *Aedes Aegypti* mosquito in urban areas and the *Aedes Abopictus* mosquito in rural areas. Dengue is a mosquito infection found in tropical and subtropical areas worldwide [2]. The World Health Organization (WHO) reported that cases of DHF in the world continued to increase from 2.2 million in 2010 to more than 3.34 million in 2016, and there have been Extraordinary Events in various regions of the world, especially in developing tropical countries. The Americas region reported more than 2.38 million cases in 2016, Brazil with fewer than 1.5 million cases, about three times higher than in 2014, and about 1032 deaths from dengue were also reported in the region. The Western Pacific Region reported more than 375,000 suspected cases of dengue fever in 2016, of which the Philippines reported 176,411 and

Malaysia 100,028 cases, representing the same burden as the previous year for both countries. The Solomon Islands announced an outbreak with more than 7000 suspects. Burkina Faso reported a local dengue outbreak in the African region with a possible 1061 cases. In 2017, a significant reduction was reported in the number of dengue cases in America from 2,177,171 cases in 2016 to 584,263 cases in 2017 for a 73% reduction. Several countries, such as Panama, Peru, and Aruba, were the countries that recorded an increase in cases during 2017. Likewise, a 53% decrease in dengue fever cases was also recorded during 2017. Indonesia is one of the tropical countries in the Southeast Asia region, thus becoming one of the countries endemic for DHF [2].

The Ministry of Health of the Republic of Indonesia reported that dengue cases in Indonesia have fluctuated wherein 2016 as many as 204,171 and Incidence Rate (IR) of 78.85 per 100,000 and deaths of 1598 cases or CFR of 0.78%, and in 2017 the number of cases of DHF nationally decreased to 68,407 cases with an Incidence Rate (IR) of 26.12 per 100,000 population and deaths of 493 cases or a CFR of 0.72%. Meanwhile, the number of dengue cases in 2018 was reported to be 65,602 cases with an Incidence Rate of 25.11 per 100,000 with a total death toll of 467 people or a CFR of 0.71%. From the national data on the number of cases, there was a significant decrease in cases, but a significant decrease did not follow the number of cases in the death rate; therefore, DHF is still a serious disease and has the risk of causing death [3]. DHF cases have also spread to all regencies/cities in Southeast Sulawesi Province, both in the archipelago and mainland. Southeast Sulawesi Province consists of 17 regencies/cities geographically divided into two regions: the mainland and the archipelagic region. The mainland consists of eight regencies/cities, namely Kendari City as the capital of Southeast Sulawesi Province, and seven regencies, namely Konawe, South Konawe, North Konawe, Kolaka, East Kolaka, North Kolaka, and Bombana. Meanwhile, the archipelago consists of nine regencies/cities, namely Bau-Bau City, and eight regencies, namely Buton, Central Buton, South Buton, North Buton, Wakatobi, Mun, West Muna, and Konawe Islands [4].

In recent years, dengue cases in Southeast Sulawesi have increased, both in the mainland and archipelago. The number of dengue cases in 2017 was 619 cases (177 mainland area and 519 archipelago area), in 2018 there were 832 cases (199 mainland area and 633 archipelagic area) and in 2019, there were 1.357 cases (1038 land area and 325 archipelagic area) [5]. This data shows that DHF is generally still a major problem for people's health in Southeast Sulawesi province, both on the mainland and in the archipelago [6]. DHF is an area-based disease with fairly short pathogenesis but can be fatal if not properly managed, especially in pediatric patients. Good countermeasures in the prevention and treatment of a disease, including dengue fever, must be well prepared and begin with a good planning stage as well. Epidemiological studies have a fairly important contribution in the prevention and curative efforts of disease, and in epidemiological studies, the basic data for programs to control a disease, especially infectious diseases such as dengue fever, is the prevalence, incidence, and case fatality rate (CFR) which is known as the epidemiological measures of the disease. The existence of differences in epidemiological figures from one region to another certainly shows that the direction of the prevention program between these regions is also different. Thus, to improve the dengue prevention program in Southeast Sulawesi

Province, it is necessary to conduct an epidemiological study of the dengue disease itself on a regional basis.

2 Methods

This research is a non-reactive or unconstructive type of research. The data used in this study were the secondary data about Dengue Hemorrhagic Fever (DHF) obtained from the Health Department of Southeast Sulawesi Province, Indonesia. The population and sample in this study were all data on DHF cases in Southeast Sulawesi, both in the archipelago and in the mainland from 2015 to 2019, as many as 7141 cases consisting of 1310 cases for the archipelago and 5831 cases for the mainland. Furthermore, the data were analyzed through univariate analysis with the help of the SPSS program to describe the distribution of dengue cases in the archipelago and mainland in Southeast Sulawesi, Indonesia, based on prevalence rates, Incidence Rate, and Case Fatality Rate (CFR).

3 Results

The collected data were then analyzed through univariate analysis to see the trend of dengue cases in the mainland and archipelagic areas in Southeast Sulawesi, Indonesia, based on the prevalence and incidence rate (IR).

3.1 Epidemiology of DHF Based on Prevalence Rates in Mainland and Archipelagic Regions in Southeast Sulawesi

Figure 1 below is the results of the analysis of the distribution of dengue cases in mainland and archipelagic areas in Southeast Sulawesi, Indonesia, from 2015 to 2019, based on prevalence rates.

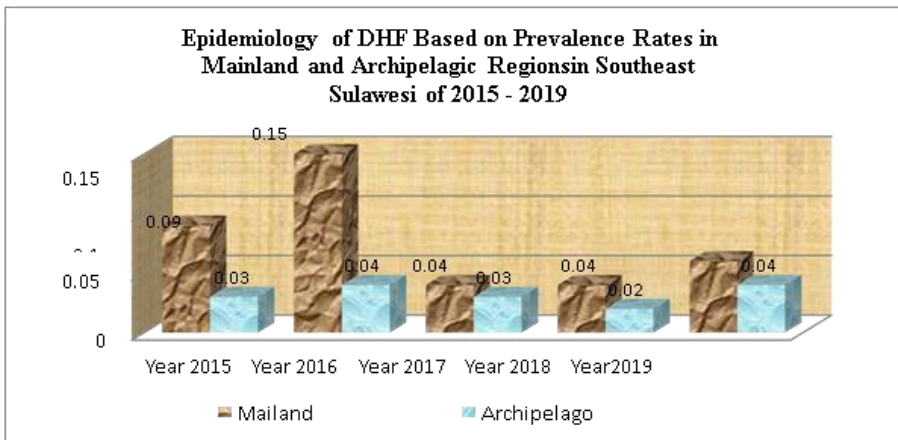


Figure 1. Epidemiological graph of dengue fever based on prevalence rates in mainland and archipelago in Southeast Sulawesi, Indonesia.

Based on Figure 1, the prevalence rate of DHF incidence distribution between mainland and archipelago in the Southeast Sulawesi Province of Indonesia from 2015 to 2019 tended to have the same distribution pattern, which was fluctuating. It also appears that the peak distribution of the prevalence rate of DHF in Southeast Sulawesi Province during 2015 to 2019 in mainland areas occurred in 2016 with a prevalence rate of 0.15%, while in the archipelago, it occurred in 2016 and 2019 by 0.04%. Furthermore, the distribution of the prevalence rate of DHF in mainland areas decreased drastically in 2017 and 2018 to 0.04, but the prevalence curve for DHF in mainland areas increased again in 2019 by 0.06%. Likewise, the distribution of DHF prevalence rates in the archipelago after peaking in 2016 decreased in 2017 and 2018 and peaked again in 2019. It can be concluded that the distribution of DHF prevalence rates throughout observation from 2015 to 2019 shows that the prevalence rate of DHF in mainland areas was always higher than the distribution of DHF prevalence rates in archipelagic areas.

3.2 Epidemiology of DHF Based on Incidence Rate (IR) in Coastal and Mainland Areas

Figure 2 is the results of the analysis of the distribution of dengue cases in the mainland and archipelagic areas in Southeast Sulawesi, Indonesia, from 2015 to 2019 based on Incidence Rate (IR).

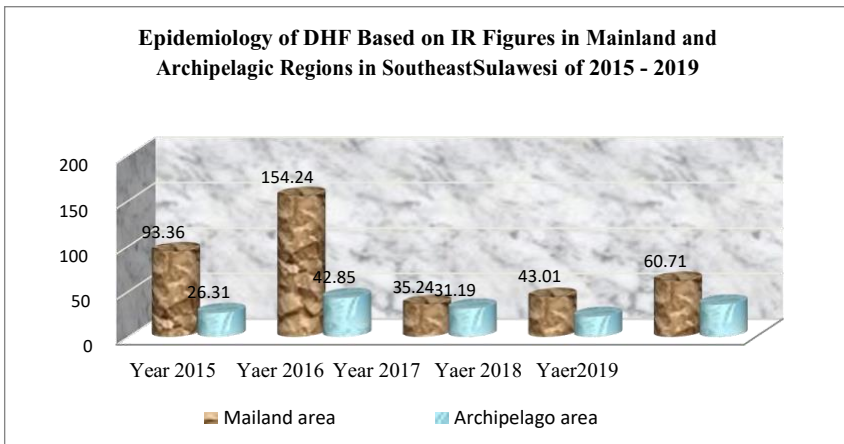


Figure 2. The graph of the epidemiology of dengue fever is based on the Incidence Rate (IR) in mainland and archipelagic areas in Southeast Sulawesi, Indonesia, from 2015 to 2019.

Based on Figure 2, the distribution of the Incidence Rate (IR) of the incidence of DHF between the mainland and the archipelago in the Southeast Sulawesi Province of Indonesia from 2015 to 2019 also tended to have the same distribution pattern, which

was fluctuating. It also appears that the peak distribution of the incidence rate (IR) of dengue fever in Southeast Sulawesi Province during 2015 to 2019 both in the mainland and in the archipelago occurred in 2016, with the Incidence Rate (IR) figure of 154.24 for the mainland, and 42.25 for the archipelago. Furthermore, the DHF Incidence Rate (IR) figure distribution in the mainland and the archipelago experienced a drastic decline in 2017 and increased equally in 2018 and 2019. It can also be concluded that the distribution of Incidence Rate (The IR incidence of DHF throughout observation from 2015 to 2019 shows that the DHF Incidence Rate (IR) in mainland areas was always higher than the distribution of the DHF Incidence Rate (IR) figures in archipelagic areas.

4 Discussion

4.1 Epidemiology of DHF Based on Prevalence Rates in Coastal and Mainland Areas

The prevalence rate is one of the epidemiological measures to see the magnitude of the disease problem in a particular region and community or society. Prevalence in epidemiological studies of a disease shows the proportion of the population that has certain characteristics over a certain period. This character is then associated with other characters or the phenomenon of a health problem such as a certain disease [4]. Based on Figure 1, it can be concluded that the distribution of the prevalence rate of DHF incidence throughout observation from 2015 to 2019 shows that the prevalence rate of DHF in mainland areas was always higher than the distribution of DHF prevalence rates in archipelagic areas. The high distribution of DHF prevalence rates in mainland areas compared to the distribution of DHF prevalence rates in archipelagic areas can be attributed to various factors, including host factors, environmental factors, and agent factors. Host factors are as human behavior as intermediate hosts of DHF disease, and vector density factors as definitive host factors for DHF disease.

The demographic conditions of the people on the mainland in Southeast Sulawesi, especially the population density level, are slightly different from the demographic characteristics related to the population density level in the island community. The mainland area in Southeast Sulawesi, which consists of eight districts/cities, one of which is Kendari City, is the capital city of Southeast Sulawesi province with the highest population density of all districts/cities in the province of Southeast Sulawesi, with a density of 1305.56 inhabitants/km². While in the archipelago, one of the regencies/cities with the highest population density is Bau-Bau City, with a density of 777.38 people/km²; this is the most populous district/city in the province of Southeast Sulawesi. Based on data by the Statistics of Southeast Sulawesi, it appears that all regencies/cities in mainland areas had a higher population density than regencies/cities in archipelagic areas. The average population density level in Southeast Sulawesi in 2019 for the mainland area was 206.54 people/km² and for the archipelago, it was 173.24 people/km². This population density was higher than regencies/cities in Southeast Sulawesi Province [7]. This supports the researcher's assumption that one of the factors that caused the distribution of the prevalence rate of DHF in mainland areas

in Southeast Sulawesi was higher than the distribution of the number of dengue fever. The prevalence of DHF that occurred in the archipelago in Southeast Sulawesi.

This study is following research by Tamaphalo et al. to see the relationship between the environment and the incidence of dengue fever and dengue hemorrhagic fever (DHF), which also found that there was a relationship between the level of residential density and the incidence of dengue fever and dengue hemorrhagic fever. In the research, he found a significant relationship between residential density and the incidence of dengue fever and dengue hemorrhagic fever with a P-value of 0.00001. This shows that residential density was closely related to the incidence of DHF in urban areas [8]. Research by Bouzid M et al. (2014) also found a correlation between population density and the incidence of DHF in the plains of Europe. In addition to population density, the incidence of dengue fever in European countries was also associated with environmental factors, namely climate change [9]. The results of this study are different from the research by Schumid et al. (2017), which found that dengue outbreaks were higher in rural or suburban areas with a low population density level of below 3000 people/km², while in urban areas with a population density level was between 3,000 people/km² to 7,000 people/km², there was no dengue outbreak; this happened due to the lack of water supply in taps, thus people used more water storage systems which triggers the high prevalence of dengue fever in suburban or rural areas [10]. Community water reservoirs are a breeding ground for dengue vectors in ideal rural or suburban areas. Meanwhile, this study only focuses on population density between the mainland and the archipelago in Southeast Sulawesi [10].

4.2 Epidemiology of DHF Based on Incidence Rate (IR) of DHF in Coastal and Land Areas

The incidence rate is a description of new sufferers of a disease found at a certain time in a community group. This study examines the description of new patients with dengue fever in people living in the islands of Southeast Sulawesi Province. Based on Figure 2, the distribution of the Incidence Rate (IR) for the incidence of DHF between mainland and archipelago in Southeast Sulawesi Province during 2015 to 2019 also tended to have the same distribution pattern which was fluctuating. Figure 2 also shows that the peak distribution of the incidence rate (IR) of dengue fever in Southeast Sulawesi Province during 2015 to 2019 both in the mainland and in the archipelago occurred in 2016, with an Incidence Rate (IR) of 154.24 for the mainland and 42.25 for the archipelago. Furthermore, the DHF Incidence Rate (IR) figure distribution in the mainland and the archipelago experienced a drastic decrease in 2017 and increased equally in 2018 and 2019. Based on Figure 2, it can also be concluded that the distribution of Incidence Rate of DHF throughout the observation year period from 2015 to 2019 shows that the DHF Incidence Rate (IR) in mainland areas was always higher than the distribution of DHF Incidence Rate (IR) in the archipelago.

Many factors influence the occurrence of new disease cases in a community group, including environmental factors, behavioral factors, and health service factors. Factors of population growth, population density, urbanization, access to transportation can all affect the level of disease spread, especially diseases with intermediary vectors such as DHF. On the mainland in the province of Southeast Sulawesi, most of the land has

become plantation and mining land. Meanwhile, vacant land, originally a water catchment area on the mainland in urban areas, has become residential land for city residents. This can trigger the emergence of puddles, a breeding ground for the *Aedes Aegyptus* mosquito as the main dengue fever vector in urban areas. This phenomenon triggers the outbreak of dengue fever.

The difference in the incidence rate of dengue fever in several years of observation between the mainland and the archipelago in Southeast Sulawesi can be attributed to several things, one of which is the transportation access factor. Access to land transportation, which as a whole can be reached by land, makes it easier for everyone to mobilize from one regency/city to one regency/city in the mainland area of Southeast Sulawesi. This allows the spread of disease in the mainland of Southeast Sulawesi Province. This is different from transportation access in regencies/cities geographically located in archipelagic areas where the means of transportation must be through sea and air transportation or a combination of land and sea transportation, thereby slowing the pattern of disease spread. All regencies/cities in the Southeast Sulawesi archipelago can only be accessed by sea transportation, including the Konawe Islands and Buton regency, because these two areas do not yet have an airport. This condition certainly affects population mobility, which affects the spread of diseases such as dengue fever, of course. The results of this study are different from the research by Vicente et al. (2017), which found that there was no difference between regions in Victoria, Brazil, concerning the DHF epidemic based on family income, house index, and population density. They found that family income was related to the incidence of dengue epidemics in several study areas, while the house index and population density were not related to the incidence of dengue epidemics in several areas in the State of Victoria, Brazil [11].

5 Conclusion

5.1 Conclusion

Epidemiologically, dengue fever that occurred in the province of Southeast Sulawesi, both in coastal areas and in mainland areas, shows a fluctuating trend. The incidence of DHF, both based on prevalence rates and Incidence Rate (IR), shows that it is always higher in the mainland than in the archipelago; this can be related to climatic conditions and demographic conditions of the population of Southeast Sulawesi Province. More active promotional efforts are needed from related parties to prevent the occurrence of DDB disease, especially in land areas.

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