

## EPIDEMIOLOGICAL CHARACTERISTICS OF DENGUE HEMORRHAGEAL FEVER IN THE PERIOD 2017 - 2023 IN BINH DINH PROVINCE

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### ABSTRACT

The study was conducted to: (1) Describe the epidemiological characteristics of Dengue hemorrhagic fever (DHF) ; (2) Describe the transmission vector distribution; (3) Determine the relationship between weather factors and the outbreak of Dengue hemorrhagic fever in Binh Dinh province in the period of 2017 - 2023. The results show that the epidemic of Dengue hemorrhagic fever in the period 2017 – 2023 was complicated, the incidence rate was high, the average of incidence of Dengue hemorrhagic fever was 288.3/100,000 people/year. The test results showed the circulation of 3 virus types, DEN1, DEN2 and DEN4, of which DEN2 was dominant, and no occurrence of the DEN3. The highest incidence rate per 100,000 people was in mountainous districts (529.9), followed by the midlands (424.9), plains (257.7) and the lowest in urban areas (214.3). There was a positive linear correlation between the monthly average rainfall and the monthly average number of new cases, and the inverse correlation between the monthly average number sunshine hours and the monthly average number of new cases.

**Keywords:** *epidemiological, Dengue hemorrhagic fever, incidence*

### I. INTRODUCTION

In. According to the Department of Preventive Medicine – Ministry of Health, in the period 1980 – 2020, the number of cases

has not shown a downward trend, but the number of deaths due to Dengue hemorrhagic fever has dropped sharply from more than 1,000 cases in 1987 to less than 100 cases/year in 1999, and remained to now. The number of cases of Dengue hemorrhagic fever is still mainly in the Southern provinces (accounting for 57%) and the Central (33%), the Central Highlands region only accounts for 6% and the North only accounts for 4% of the total cases of SARS in the country [1].. Binh Dinh is one of the 5 provinces with high circularation of Dengue hemorrhagic fever in the Central region [2].

### II. METHODOLOGY

#### 2.1.Subjects of study:

- Dengue hemorrhagic fever case data in Binh Dinh province in the period 2017 – 2023.Monthly insect survey results and survey results at outbreaks in Binh Dinh province in the period of 2017 - 2023

- Results of Mac – Elisa test, virus isolation, PCR in Binh Dinh province in the period of 2017 – 2023

- Meteorological data in Binh Dinh province in the period of 2017 - 2023

#### 2.2. Research location: Binh Dinh province

#### 2.3. Research period: 12/2024 - 3/2025.

#### 2.4. Study design:

Epidemiological descriptive studies based on retrospective data.

#### 2.5. Sampling:

. All needed data is in the period 2017-2023. The criteria for sample selection are based on the Guidelines for Surveillance and Prevention and Control of Dengue Hemorrhagic Fever issued together

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### III. RESEARCH RESULTS

#### 3.1. Epidemiological characteristics of dengue hemorrhagic fever in Binh Dinh province from 2017 to 2023

In the period 2017 – 2023, in Binh Dinh province, the incidence rate of Dengue hemorrhagic fever in all years was high, the highest was in 2022 (469.3/100,000 people), the lowest was in 2021 (58.8/100,000 people). The average annual incidence in the

period 288.3 per 100,000 people. The cyclical nature of the epidemic was no longer clear. The mortality rate was low and tended to decrease.

In general, the number of cases of Dengue hemorrhagic fever in the period 2017 – 2023 in Binh Dinh province began to increase from September of the year and peaked in November and extended to January and February of next year.

#### 3.1.2. Distribution of Dengue hemorrhagic fever cases in Binh Dinh province in the period 2017 – 2023 according to human characteristics

**Table 3.1. Distribution of Dengue hemorrhagic fever cases in the period 2017-2023 in Binh Dinh province by gender, age, clinical classification**

| Year         | Number of case | Age           |               | Gender      |             | Clinical classification        |            |                |
|--------------|----------------|---------------|---------------|-------------|-------------|--------------------------------|------------|----------------|
|              |                | ≤15 years old | >15 years old | Male        | Female      | DHF and DHF with warning signs | Severe DHF | Mortality rate |
|              |                | %             | %             | %           | %           | %                              | %          | %              |
| 2017         | 3.295          | 29,7          | 70,3          | 49,3        | 50,7        | 99,1                           | 0,9        | 0,03           |
| 2018         | 3.219          | 7,6           | 92,4          | 51,7        | 48,3        | 99,3                           | 0,7        | 0,03           |
| 2019         | 6.819          | 22,9          | 77,1          | 52,4        | 47,6        | 99,8                           | 0,2        | 0,01           |
| 2020         | 7.350          | 28,4          | 71,6          | 47,3        | 52,7        | 99,3                           | 0,7        | 0,01           |
| 2021         | 934            | 0,9           | 99,1          | 49,8        | 50,2        | 100,0                          | 0,0        | 0,00           |
| 2022         | 7.481          | 31,1          | 68,9          | 46,4        | 53,6        | 98,5                           | 1,5        | 0,00           |
| 2023         | 2.908          | 8,1           | 91,9          | 50,6        | 49,4        | 98,6                           | 1,4        | 0,00           |
| <b>Total</b> | <b>32.006</b>  | <b>23,3</b>   | <b>76,7</b>   | <b>49,2</b> | <b>50,8</b> | <b>99,2</b>                    | <b>0,8</b> | <b>0,01</b>    |

Comments: From 2017 to 2023, the whole province of Binh Dinh recorded 32,006 cases of Dengue hemorrhagic fever, men and women accounted for the similiar proportion. People over 15 years old were the most common group with 76.7%. According to the clinical classification, most cases of dengue are Dengue hemorrhagic fever and Dengue hemorrhagic fever with warning signs, the rate of severe Dengue hemorrhagic fever was very low, accounting for only 0.8%, and the overall mortality rate was 0.01%.

**Table 3.2. Dengue hemorrhagic fever test results in Binh Dinh province from 2017 to 2023**

| Year | M.Elisa test | Virus separation |       |       |               |     |    |    |          |
|------|--------------|------------------|-------|-------|---------------|-----|----|----|----------|
|      |              | n                | n (+) | % (+) | Type of virus |     |    |    |          |
|      |              |                  |       |       | D1            | D2  | D3 | D4 | ≥2 Types |
| 2017 | 51.26        | 117              | 67    | 57.26 | 25            | 24  | 0  | 16 | 2        |
| 2018 | 51.47        | 126              | 51    | 40.48 | 9             | 30  | 0  | 10 | 2        |
| 2019 | 65.77        | 325              | 176   | 54.15 | 33            | 106 | 0  | 23 | 14       |

| Year         | M.Elisa test | Virus separation |            |              |               |            |          |           |           |
|--------------|--------------|------------------|------------|--------------|---------------|------------|----------|-----------|-----------|
|              | % (+)        | n                | n (+)      | % (+)        | Type of virus |            |          |           |           |
| 2020         | 63.91        | 326              | 194        | 59.51        | 55            | 99         | 0        | 29        | 11        |
| 2021         | 30.88        | 6                | 2          | 33.33        | 2             | 0          | 0        | 0         | 0         |
| 2022         | 65.12        | 28               | 18         | 64.29        | 16            | 1          | 0        | 1         | 0         |
| 2023         | 65.08        | 54               | 16         | 29.63        | 1             | 15         | 0        | 0         | 0         |
| <b>Total</b> | <b>60.74</b> | <b>982</b>       | <b>524</b> | <b>53.36</b> | <b>141</b>    | <b>275</b> | <b>0</b> | <b>79</b> | <b>29</b> |

Comments: The overall positive test rate of M.Elisa Dengue hemorrhagic fever in the period 2017-2023 was 60.74% and the percentage of positive test of strains separation of Dengue virus was 53.36%. During the whole period, the dominant circulating virus type was DEN2, followed by DEN1, no DEN3 type was recorded, except in 2017 and 2022 the DEN 1 virus type emerged to dominate.

**Table 3.3. Incidence of Dengue hemorrhagic fever by ecological region in Binh Dinh from 2017 - 2023**

| Eco Zone     | Population        | New cases     | Incidence rate/year |
|--------------|-------------------|---------------|---------------------|
| Town         | 2.044.394         | 4.382         | 214,3               |
| Plain        | 6.877.010         | 17.725        | 257,7               |
| Midlands     | 1.581.705         | 6.721         | 424,9               |
| Mountain     | 599.687           | 3.178         | 529,9               |
| <b>Total</b> | <b>11.102.796</b> | <b>32.006</b> | <b>288,3</b>        |

Comment: The annual incidence of Dengue hemorrhagic fever in Binh Dinh from 2017 - 2023 was the highest in mountainous areas (529.9/100.000), followed by the midlands (424.9/100,000 inhabitants), deltas (257.7/100.000) and the lowest was the city (214.3/100.000).

### 3.2. Some characteristics of the index of insects that transmit dengue hemorrhagic fever in Binh Dinh province from 2019 to 2023

The BI (Breteau Index – Number of water containers with larvae in 100 surveyed houses) started to rise in September and remained at a relatively high level until March of next year. When the BI index increases, the DI (Mosquito density index) also increases, especially in March, the DI index increased later than the BI index

### 3.3. Correlation between weather factors and the number of cases of Dengue virus in the period 2017 – 2023 in Binh Dinh province

There was a positive linear correlation between the average monthly rainfall and the average monthly number of

new cases of Dengue hemorrhagic fever; And there was an inverse correlation between the average monthly sunshine hours and the average monthly number of new cases of Dengue hemorrhagic fever. No correlation between average monthly temperature or average monthly humidity and the average monthly incidence.

## IV. DISCUSSION

### 4.1. Epidemiological characteristics of Dengue hemorrhagic fever in Binh Dinh province in the period of 2017 -2023

The incidence of dengue in the period 2017 - 2023 in Binh Dinh province was relatively high. In which, the highest incidence rate was in 2022 (469.3/100,000 people) and the lowest was in 2021

(58.8/100,000 people). The average incidence rate per year of the province in this period was 288.3/100,000 people, that is very high compared to the rate of 119.7/100,000 people in the period 2007 – 2016 in the thesis of Bui Ngoc Lan [3].

In regard to gender, men and women accounted for 49.2% and 50.8%, respectively. The age group over 15 years old accounted for 76.7% and the under 15-year-old only accounted for 23.3%. This result is similar to the results of the thesis of Bui Ngoc Lan in Binh Dinh province in the period 2007 – 2016 [3]. Tran Nhu Duong and his colleagues in Hanoi 2006 - 2011 also showed that cases were evenly distributed in both sexes [4].

The incidence of Dengue hemorrhagic fever per year in Binh Dinh from 2017 – 2023 varies greatly between ecological regions. The highest was in mountainous areas (529.9/100.000), followed by the midlands (424.9/100,000 inhabitants), deltas (257.7/100.000) and the lowest was the city (214.3/100.000). Deltas, towns and cities had a much lower incidence of Dengue hemorrhagic fever than mountainous and midland areas. The incidence of Dengue hemorrhagic fever by ecological region in Binh Dinh province also changes with each period. Previously, the disease was common in urban areas, in the period 2007 – 2016, the highest incidence was in mountainous areas (231.2/100 000), followed by cities (189.0/100 000), plains (102.4/100 000) and the lowest in midland areas (74.8/100 000) [3].

The overall positive test rate of M.Elisa Dengue hemorrhagic fever in the period 2017-2023 was 60.74% and the positive isolation rate of Dengue virus was 53.36%. The year with the lowest positive test rate was 2021 (M.Elisa: 30.88% and virus isolation: 33.33%) and this is also the

year with the lowest number of test samples. The the rate of M.Elisa testing and virus isolation in the period 2017-2023 is somewhat higher than that of the period 2007-2016 and much higher than the research of Nguyen Thi Thu Thuy et al in Hanoi in 2009 [2], [3], [6].

In the period of 2017 – 2023, in Binh Dinh province, the circulation of 3 types of Dengue virus were identified, namely DEN1, DEN2 and DEN4, of which the DEN2 virus type was dominant, followed by DEN1, but in 2022, the DEN1 type was dominant. The results of research on the circulation of the dengue virus in Binh Dinh province in the period of 2017 – 2013 are also consistent with the research at different stages [2], [3]. That is, the DEN 2 and DEN 1 viruses always alternately dominate. The DEN3 type appears infrequently and has periods of absence as in the study of Nguyen Thi Tra My et al. in 2020 in Dak Lak [7], the study of Duong Thi Hien et al. from 2015 to 2022, in Bac Giang province [8], the report of the Department of Preventive Medicine on the distribution of endemic virus types in different regions [1].

#### **4.2. Characteristics of the index of insects transmitting dengue hemorrhagic fever in Binh Dinh province from 2017 to 2023**

The average BI and DI indices in this period were higher than those in Binh Dinh in the period 2007 – 2016 (in the monthly survey, the BI and DI indices were always below the risk threshold, the  $DI < 0.5$ ;  $BI < 30$ ). This might be the factor that makes the incidence of social diseases in this period increase compared to the previous period (the average incidence rate/year of 288.3/100,000 population of the province in the period 2017-2023 is very high compared to the rate of 119.7/100,000 population in the period 2007-2016 in the study) [3]

### 4.3. Correlation between weather factors and the number of cases of dengue from 2017 to 2023

There was a positive linear correlation between the average monthly rainfall and the monthly average number of new cases of Dengue hemorrhagic fever, inverse correlation between the total number of sunshine hours per month and the average number of new cases of Dengue hemorrhagic fever per month, and there was no correlation between temperature and humidity and the average number of DHF cases in the month. This result is similar to the study of Bui Ngoc Lan in Binh Dinh province in the period 2007 – 2016, that is, there was a positive correlation between the average rainfall in the month and the average number of cases of Dengue hemorrhagic fever in the month [3]. The incidence of Dengue hemorrhagic fever was positively correlated with the average temperature of the previous month. For precipitation, the average rainfall of the previous month was correlated with a higher incidence of Dengue hemorrhagic fever with the average rainfall in the month [5].

### V. CONCLUSION

The Dengue hemorrhagic fever epidemic in Binh Dinh province in the period of 2017 - 2023 was relatively complicated, the average incidence rate per year was 288.3/100,000 people; the rate of severe cases and mortality were very low. The highest incidence rate was in the mountainous area (529.9/100,000) and the lowest was in the urban area (214.3/100,000). There are 3 circulating virus types: DEN1, DEN2 and DEN4, of which DEN2 was dominant.

The BI index started to increase from September and remained relatively high until March of the following year,

There was a positive linear correlation between average monthly rainfall and average monthly new cases of Dengue hemorrhagic fever and an inverse correlation between the total average monthly hours of sunshine and average monthly new cases of Dengue hemorrhagic fever.

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