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# Parameters Data Distribution Analysis for Dengue Fever Outbreak in Jember Using Monte Carlo

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**ABSTRACT**

Dengue Hemorrhagic Fever (DHF) is one of the most challenging infectious disease world's issues in public health scope includes in some districts or cities in Indonesia. Based on the data of dengue infection cases from 2009 until 2012 in Jember, DHF spread almost comprehensive with the incidence rate of dengue tend to increase. Therefore we need a way to predict the spread of dengue disease in Jember which would help in making the strategies and plans to forecast any outbreak in future well in advance. Some Factors that influence the spread of dengue disease including, population, population density, rainfall, the number of days of rain, larva-free numbers, house index. The number of missing data on the parameter data make the data are not normally distributed. In this paper, we propose an implementation of monte carlo method to predict any influence factor of the spread of dengue disease using different randomization and compared its to get normal distribution.

Keywords: *Rainfall, Rainy Day, Larva-Free Number, House Index, Montecarlo, Jember DHF*.

## 1. INTRODUCTION

Dengue Haemorrhagic Fever (DHF) is one of the most infectious disease issues in public health scope which rapid spreading and potentially death [1]. Jember with 31 districts, located in East Java. It have a tropical climate with a temperature range between 23$^{o}$C - 31$^{o}$C. With high rainfall, which ranges from 1,969 mm to 3,394 mm [2]. The spread of dengue disease affected by weather changes that lead to changes in rainfall, temperature, humidity, wind direction. So the impact on terrestrial ecosystems, oceans and on health. Especially against the proliferation of disease vectors such as the Aedes mosquito, malaria and others.

In addition, behavioral factors and community participation is still lacking in mosquito eradication activities. Factor of population growth and population mobility enhancement factor is in line with the improvement of transportation facilities means that the higher the incidence rate of dengue fever [3]. In the calculation method of the survey larva mosquito-free numbers and House Index (HI) to describe the extent of the spread of mosquitoes in a region [4]. On handling Jember District Health Office conducted a survey of DHF just flick without seeing climate change is also a factor of the spread of dengue disease. So that the treatment can not achieve maximum results [5].

According to Achmad Basuki (2004), the Monte Carlo method is a method of solution searched at random and repeated to produce the expected solution or approach. This method looks very simple because it only requires a solution that is otherwise way, then scrambles value to obtain the expected value of the model solutions exist [6]. There are some things that need to be improved from the random searching concept, among others: (1) Not all values in the solution should be changed in each iteration. Of a solution is close to the target, it does not need a big change. (2) It should be considered that the emergence of random numbers depends on the used random number distribution.

This method assumes the variable incidence pattern calculation in two models, namely the distribution of normal distribution and uniform distribution. This assumption can weaken a case that has a distribution pattern outside of both of these assumptions. The trick with little statistical manipulation to meet these two distribution assumptions. Further statistical manipulation of data is still not normal distribution becomes normal distribution. This process is done by four different ways scrambling to produce a distribution that can be used for further processing in predicting disease of Dengue Fever in Jember.

## 2. PURPOSED SYSTEM

The proposed system is shown in fig 1. There are two processes, include information extraction and prediction.

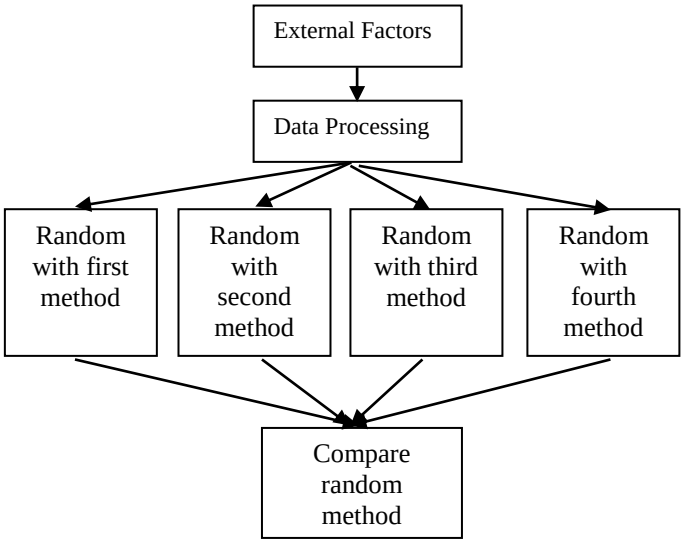


*Fig. 1 Proposed System*

The data processing steps describe the factor parameter data of DHF spread sorted in each district in months and years. From the sorted data, it is looked for the mean, variance, standard deviation, and skewness values for each data. Then into the random Montecarlo simulation step. In this study, it used four different randomization ways with monte carlo method.
After that, it is obtained the results and the data simulation distribution of DHF spread factors and compared the data distribution results from the 4 randomization ways.

## 3. DATA COLLECTION

This section presents the details of the trials included, the study area, the data collection and methods

### 3.1 Study Area

Study area This study conducted in Jember district consisting of 31 districts. With an average increase of 100 thousand of population every 10 years. Temperatures in Jember district in the range of 23 ° -31 ° C and rainfall is quite high, ranging from 1,969 mm to 3,394 mm (Agency for Local Government, 2010). It can be said that Jember has weather that supports the development of dengue vectors. In addition the district often muddy the district with the status of the extraordinary incident Dengue Hemorrhagic Fever. So Jember very well be used for research.

### 3.2 Data

In this research, including data collection rainfall every month of the year 2009 through the measuring station for each region is obtained from BAPPEDA Jember. Data on the number of rainy days per month from 2009 through the measuring station for each region is obtained from the Department of Irrigation Jember. Mosquito-free numbers data and house index through Jember District Health Office.

## 4. METHOD

Monte Carlo simulation is one of method to solve the problem where the variables are uncertain. This simulation uses the existing sampling data (historical data) and has been known distribution data. According to the Journal of epidemiology in 2013, a lot of factors that influence the dengue hemorrhagic fever. in this study, the authors simply take factors that are already available data. Existing Data is still in the form of raw data and its distribution is unknown. Thus the authors use monte carlo simulation in this study.
This study discusses the manipulation of statistics on the data with random method montecarlo. The raw data is not yet known distribution becomes normal distribution as assumptions for the calculation of the next montecarlo. Because of the many factors parameter data from the 2009 dengue authors simply take the data parameter of dengue fever factor is the number of population in January 2009. Furthermore, to compare distribution patterns by comparing the pattern of distribution of data from 4 different ways randomization, namely:

1. Randomization parameter data with a lower limit on the minimum value of the data and the upper limit on the maximum value of the data.
2. Randomization parameter data between the average value and average value around the data.
3. Randomization parameter data between the standard deviation and the value of alpha (95%).
4. Randomization parameter data between the average value, standard deviation and skewness.

## 5. EXPERIMENTS AND RESULT

1. Randomization parameter data with a lower limit on the minimum value of the data and the upper limit on the maximum value of the data.

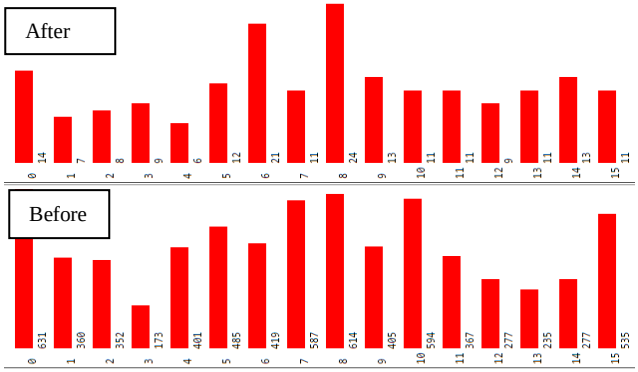


*Fig. 2. histogram data before and after in random with first method*

Seen on the first experiment with 100 iterations, the distribution of random data is still largely followed the pattern of the original data and the distribution is still unknown. This randomized effective way if the original data had normal distribution because of this random way do randomization with minimal lowest number on the data and the highest rates in the data. But the data are not all berditribusi normal parameters., the distribution of random data is still largely followed the pattern of the original data and distrbution still unknown.

2. Randomization parameter data between the average value and average value around the data.

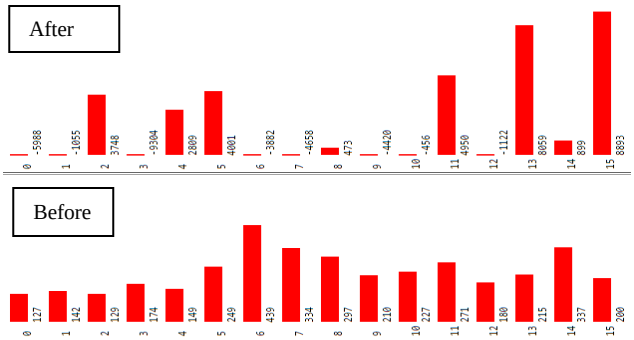


*Fig. 3. histogram data before and after in random with two method*

From the second experiment with 100 iterations, using randomization to limit the average value and average value around the data. The intent of the average value around the data is the average value of the surrounding data. suppose the average value of the data 129 so the average value of approximately ranging from 0 - 129. Whatever we wanted to use an average value of about data origin between 0-129. Distribution of random data is still largely followed the pattern of the original data and the distribution is still unknown may also depend on the limits of the average value of the surrounding data.

3. Randomization parameter data between the standard deviation and the value of alpha (95%).

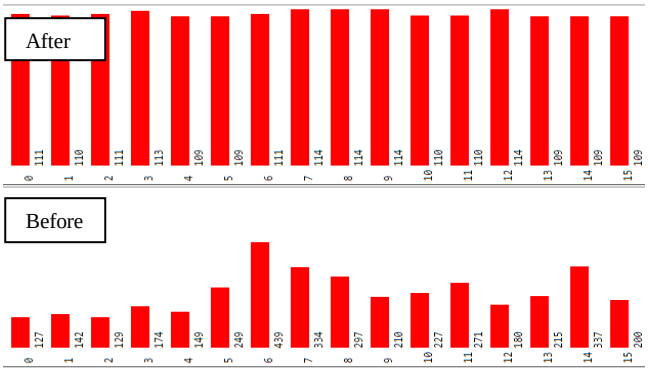


*Fig. 4. histogram data before and after in random with third method*

From the third experiment with 100 iterations, the standard deviation of the checks between the data and the alpha value. The standard deviation is used to determine how the distribution of data in the sample, and how close the individual data points to the mean or average value of the sample. Because this data is discrete, continuous and less than 1o years then taking alpha value obtained from a table t students with a level of 95% and a distribution function (df) 0,025 2,042 values obtained.

The distribution pattern of data after randomization forming a uniform pattern in accordance with the assumption that the incidence of the variable pattern forming monte carlo normal distribution pattern and uniform.

4. Randomization parameter data between the average value, standard deviation and skewness.

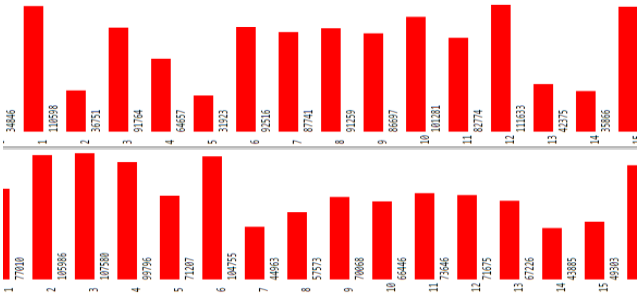

*Fig. 5. histogram data before and after in random with fourth method*

From the fourth experiment with 100 iterations, try to combine randomization between the average value, standard deviation and skewness. Skewness value is used to determine the slope of the data. If the value is positive skewness in the data means the data slope to the left and vice versa. After knowing the slope of the data and the data known to be positive so that the data is skewed to the left. After that the numbers in the data are

more inclined to the left at random with 2 times the odds of the other expected data generated are normal but the data is still not normal, but close to normal as the image histogram.

## 6. CONCLUSION

From the results of four different ways of scrambling data generated pattern of each of distribution of data each randomization. Experiment 1 pattern before and after the random distribution of the data is still not known to have an effective way if the original data had normal distribution. Experiment 2 pattern before and after the random distribution of the data is not yet known there is a possibility of randomization depends on the average value of the data entered. For the third experiment shaped uniform distribution pattern. For the experiment four distribution patterns are still unknown but are approaching normal distribution because monte carlo method is a method so the best approach is randomization in experiments 3 and 4.

## 7. FUTURE WORKS

This research continues into the future development of dengue website prediction system using monte carlo method. Montecarlo simulation model and this will be combined with the parameters of the factors that cause dengue fever. This website not only predict but can perform simulations anticipate an outbreak of dengue fever so that people can understand how muddy anticipation of dengue fever. The usefulness of this study itself to help health districts of Jember in suppressing the incidence of dengue fever.

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