Sunan Kalijaga Journal of Applied Mathematics ISSN 1234-5678 (print)
April 2026, Vol. 4, No. 1, 51 – 62 ISSN 9876-5432 (online)

STATISTICAL ANALYSIS OF LEPROSY CASES IN CENTRAL JAVA PROVINCE 2018 – 2019

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Abstract

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae* and remains a public health problem in several regions of Indonesia, including Central Java Province. This study aims to statistically analyze the distribution of leprosy cases in Central Java Province in 2018–2019 based on data from the Central Java Provincial Statistics Agency (BPS), sourced from the Health Office. Central Java Province. The methods used include descriptive statistical analysis, measures of central tendency and dispersion, spatial distribution analysis across regencies/cities, and interpretation of interregional case trends. The analysis results show that there are significant variations in the number of cases across regencies/cities. Brebes, Pemalang, Tegal, and Blora Regencies are categorized as areas with relatively high numbers of cases, while several cities such as Magelang City and Salatiga City have relatively low numbers of cases. In total, the number of leprosy cases in Central Java in 2018 and 2019 was recorded at 2,133 cases. This uneven distribution indicates the presence of risk factors such as social conditions, population density, and access to healthcare services that influence disease spread. This analysis suggests that health policy approaches should be targeted (targeted intervention) toward areas with high case numbers in order to reduce transmission and prevent disabilities due to delayed diagnosis.
Keywords: Case Distribution; Central Java; Descriptive Statistics; Leprosy.

1. INTRODUCTION

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae* and primarily affects the skin, peripheral nerves, and the mucosa of the upper respiratory tract (Scollard et al., 2006). This disease can cause permanent disability if not diagnosed and treated early (Britton & Lockwood, 2004). Globally, leprosy remains a public health concern. The World Health Organization (WHO) reports that thousands of new cases are still detected each year, especially in developing countries (WHO, 2020). Indonesia is among the countries with the highest burden of leprosy cases in the world (WHO, 2020). The distribution of infectious diseases is generally influenced by social and economic factors, population density, and access to healthcare services (Friis & Sellers, 2021). Therefore, statistical analysis of case distribution is important for identifying high-risk areas. Descriptive statistics is a fundamental method for understanding the characteristics of a dataset through measures of central tendency and dispersion (Walpole et al., 2012). In epidemiology, this approach is often used to describe patterns of disease distribution within a population (Gordis, 2014).

2. MATERIALS AND METHODS

2.1. Study Area

This study was conducted in the administrative region of Central Java Province, Indonesia. Central Java is located in the central part of Java Island and has an area of approximately 32,800 km², with a population of more than 34 million during the observation period (Central Bureau of Statistics, 2018). Administratively, Central Java Province consists of 35 regencies/cities, including 29 regencies and 6 cities.

Central Java has diverse geographical characteristics, ranging from northern coastal areas (Pantura), lowlands, to mountainous regions in the central and southern parts. Differences in geographical characteristics, population density, and levels of urbanization across regions may influence the distribution of infectious diseases, including leprosy.

Several regencies in the northern coastal region such as Brebes, Tegal, and Pemalang are known to have relatively high population density and significant population mobility. Meanwhile, urban areas such as Magelang City and Salatiga City have characteristics of better access to healthcare services. The selection of Central Java Province as the study area was based on the availability of official data published by the Central Bureau of Statistics and the variation in leprosy case distribution across regencies/cities, which allows for comprehensive descriptive statistical analysis. Thus, the unit of analysis in this study includes all regencies/cities in Central Java Province during 2018–2019.

2.2. Procedures

This study was conducted through several systematic stages, starting from data collection to interpretation of the analysis results. The first stage involved collecting secondary data on the number of leprosy cases by regency/city in Central Java Province for 2018–2019, obtained from official publications of the Central Java Provincial Statistics Agency. The data were then verified for consistency with published statistical tables and reorganized into numerical format using data processing software to facilitate analysis.

Next, the collected data were arranged from the smallest to the largest values to simplify the calculation of measures of central tendency and dispersion. The analysis began by calculating the mean to determine the general trend of cases per regency/city. This was followed by calculating the median to observe the midpoint of the distribution and identify possible asymmetry. The next step involved calculating measures of dispersion, including range, variance, and standard deviation, to determine the level of variation in cases across regions.

After obtaining all statistical parameters, the results were interpreted from a descriptive epidemiological perspective by examining patterns of case distribution based on administrative regions. This analysis aimed to identify disparities or concentrations of cases in specific areas. The final stage of the study involved preparing the discussion and drawing conclusions based on the statistical analysis results.

2.3. Data collection

Data collection in this study was conducted through a documentation study method using secondary data published by the Central Java Provincial Statistics Agency (BPS). The data used were statistical tables titled *"Disease Cases by Regency/City and Type of Disease in Central Java Province, 2018"*, sourced from the Central Java Provincial Health Office. The specific data extracted were the number of leprosy cases in each regency and city in Central Java Province in 2018. Based on the table, the total number of leprosy cases in Central Java was recorded at 2,133 cases, distributed across 35 regencies/cities.

The data collection process was carried out by accessing official tables on the Central Java BPS website, then recording the number of leprosy cases for each administrative region

into a data processing worksheet. A verification process was then conducted to ensure consistency between the recorded data and the figures published in the official BPS tables. The data obtained were aggregate in nature, consisting of case counts per region without individual identity information, thus not requiring ethical approval. The data were then organized into a distribution table to facilitate descriptive statistical analysis, including measures of central tendency and dispersion.

Further data collection in this study was carried out through a documentation study method using secondary data published by the Central Java Provincial Statistics Agency (BPS). The data used were statistical tables titled *"Disease Cases by Regency/City and Type of Disease in Central Java Province, 2019"*, sourced from the Central Java Provincial Health Office. The specific data collected were the number of leprosy cases in each regency and city in Central Java Province in 2019. Based on the table, the total number of leprosy cases in Central Java was recorded at 2,133 cases, distributed across 35 regencies/cities.

The data collection process was conducted by accessing official tables on the Central Java BPS website, then recording the number of leprosy cases for each administrative region into a data processing worksheet. A verification process was then carried out to ensure consistency between the compiled data and the figures presented in the official BPS publication tables. The data obtained were aggregate in nature, consisting of the number of cases per region without including individual identity information, and therefore did not require ethical approval. The data were then organized into a distribution table (Table 2) to facilitate descriptive statistical analysis, including the calculation of measures of central tendency and dispersion.

2.4. Data processing

Data processing in this study was conducted after all data on the number of leprosy cases per regency/city in Central Java Province for 2018–2019 had been successfully compiled from official tables published by the Central Java Provincial Statistics Agency (BPS). The collected data were then organized into numerical format using Microsoft Excel software to facilitate statistical calculations.

The first stage of data processing involved data cleaning, which consisted of rechecking the consistency between the source tables and the compiled data. After ensuring there were no input errors, the data were sorted from the smallest to the largest values to facilitate the calculation of the median and identification of minimum and maximum values.

The next stage involved calculating measures of central tendency. The mean was calculated by summing all leprosy cases from 35 regencies/cities and dividing by the number of units of analysis (n = 35). Based on the available data, the total number of leprosy cases in Central Java was 2,133 cases, resulting in the following calculation:

$$\bar{x} = 2133 / 35 = 60.94$$

This result indicates that the average number of leprosy cases per administrative region is approximately 61 cases.

The median was determined by identifying the middle value of the sorted data. Since the number of data points is 35 (an odd number), the median lies at the 18th position after sorting. This value is used to assess the central tendency of the distribution without being affected by extreme values.

Next, measures of data dispersion were calculated. The minimum value in the dataset is 2 cases (Magelang City), while the maximum value is 422 cases (Brebes). Thus, the range is calculated as:

$$\text{Range} = 422 - 2 = 420$$

The large range indicates a substantial disparity in case distribution across regions.

The next step involved calculating variance and standard deviation to determine the level of variation relative to the mean. Variance was calculated using the formula:

$$S^2 = \sum \frac{(x_i - \bar{x})^2}{(n - 1)}$$

The standard deviation was then obtained as the square root of the variance:

$$S = \sqrt{S^2}$$

These calculations aim to measure how much the number of cases in each region deviates from the provincial average. In addition, extreme values (outliers) were identified by examining regions with case numbers far above the average, such as Brebes (422 cases), Pemalang (203 cases), and Tegal (200 cases). This identification is important for understanding the distribution pattern, which tends to be positively skewed. The processed data were then presented in distribution tables and analyzed descriptively to support epidemiological interpretation.

2.5. Data analysis

Data analysis in this study was conducted using a descriptive statistical approach to describe the characteristics of leprosy case distribution in Central Java Province in 2018. The analysis focused on measures of central tendency, measures of dispersion, and spatial distribution patterns across regencies/cities.

a. Mean

The mean was calculated by summing all leprosy cases from 35 regencies/cities and dividing by the number of regions. A total of 2,133 cases divided by 35 regions results in a mean value of 60.94. Thus, the average number of leprosy cases per regency/city in Central Java Province is approximately 61 cases. This value provides a general overview but does not fully represent all regions due to considerable variation.

b. Median

The median was obtained by sorting the data from smallest to largest and identifying the middle value. Since there are 35 data points (odd), the median lies at the 18th position. Based on the sorted data, the median is 29 cases. This means that half of the regions have case numbers less than or equal to 29, while the other half have case numbers greater than or equal to 29. The comparison between the mean (60.94) and median (29) indicates that the mean is higher, suggesting a non-symmetric distribution. Measures of dispersion are used to assess variation across regions.

c. Range

The range is obtained from the difference between the maximum and minimum values. The maximum value is recorded in Brebes Regency with 422 cases, while the minimum is in Magelang City with 2 cases.

$$\text{Range} = 422 - 2 = 420$$

A range of 420 indicates a very large gap between regions with the highest and lowest case numbers.

d. Variance and Standard Deviation

Variance and standard deviation are used to measure how far the data deviate from the mean. Based on calculations using data processing software, the standard deviation is relatively high compared to the mean. This indicates that the distribution of leprosy cases across regencies/cities has high variability and is uneven.

Based on the analysis of central tendency and dispersion, the data distribution shows a positively skewed pattern. This is indicated by the mean being greater than the median and the presence of several regions with case numbers far above the average (outliers).

Regions with very high case numbers include Brebes (422 cases), Pemalang (203 cases), Tegal (200 cases), and Blora (190 cases). Meanwhile, several regions have very low case numbers, such as Magelang City (2 cases), Salatiga City (4 cases), and Surakarta City (8 cases). This significant difference indicates a concentration of cases in certain areas, which can be categorized as potential risk clusters in descriptive epidemiological analysis.

The distribution of leprosy cases in Central Java Province in 2018 is not evenly distributed across regencies/cities. The average of 61 cases does not represent most regions, as the median is only 29 cases. This indicates that most regions have relatively low to moderate case numbers, while a few regions have very high case numbers that significantly influence the average.

The large range and high standard deviation indicate substantial inequality in distribution. The positively skewed distribution pattern suggests that disease control efforts should be focused on regions with high case numbers as a priority for intervention.

The total number of leprosy cases in Central Java in 2018 was 2,133 cases across 35 regencies/cities. The average number of cases per region was 60.94, with a median of 29 cases. The minimum value was 2 cases and the maximum was 422 cases, resulting in a range of 420. The data distribution shows a positively skewed pattern with considerable variation across regions.

3. RESULTS AND DISCUSSION

3.1 Results of statistical analysis

Based on data from the Central Java Provincial Statistics Agency for 2018–2019, the total number of leprosy cases recorded in Central Java Province was 2,133 cases distributed across 35 regencies/cities. The data show significant variation in case numbers across regions. The analysis of central tendency shows that the mean number of cases per regency/city is 60.94 (approximately 61 cases), while the median is 29 cases. The substantial difference between the mean and median indicates that the data distribution is not symmetric.

The maximum number of cases was recorded in Brebes Regency with 422 cases, while the minimum was in Magelang City with 2 cases. The range of 420 indicates a very large disparity between the highest and lowest case counts. The standard deviation is relatively high compared to the mean, indicating a high level of data dispersion. Therefore, leprosy cases in Central Java are not evenly distributed.

3.2 Pattern of leprosy case distribution

The analysis shows that the distribution of leprosy cases in Central Java Province tends to be positively skewed. This is reflected in the mean being higher than the median and the presence of several regions with case numbers far above the average.

Regions with high case numbers include Brebes (422 cases), Pemalang (203 cases), Tegal (200 cases), and Blora (190 cases). These figures far exceed the provincial average and can be categorized as high-burden areas.

In contrast, several cities such as Magelang (2 cases), Salatiga (4 cases), and Surakarta (8 cases) have relatively low case numbers. This disparity indicates unequal distribution across regions.

Geographically, regions with high case numbers tend to be located in the northern coastal area (Pantura), which has relatively high population density and mobility. These factors may contribute to increased transmission risk of infectious diseases. Based on data

from the Central Java Provincial Statistics Agency (2018), leprosy case numbers in Central Java in 2018 show significant variation across regencies/cities.

Table 1. Number of Leprosy Cases in Central Java Province, 2018

No	Name of Regency / City	Number of Leprosy Cases in Central Java Province, 2018
1.	Cilacap	47
2.	Banyumas	24
3.	Purbalingga	24
4.	Banjarnegara	29
5.	Kebumen	23
6.	Purworejo	19
7.	Wonosobo	20
8.	Magelang	12
9.	Boyolali	23
10.	Klaten	28
11.	Sukoharjo	35
12.	Wonogiri	15
13.	Karanganyar	14
14.	Sragen	52
15.	Grobogan	41
16.	Blora	190
17.	Rembang	110
18.	Pati	99
19.	Kudus	42
20.	Jepara	116
21.	Demak	66
22.	Semarang	9
23.	Temanggung	6
24.	Kendal	18
25.	Batang	51
26.	Pekalongan	56
27.	Pemalang	203
28.	Tegal	200
29.	Brebes	422
30.	Kota Magelang	2
31.	Kota Surakarta	8
32.	Kota Salatiga	4
33.	Kota Semarang	23
34.	Kota Pekalongan	73
35.	Kota Tegal	29

Source: Central Java Provincial Statistics Agency (BPS), 2018

Based on Table 1, the distribution of leprosy cases across each regency/city in Central Java Province in 2018 can be observed. To provide a clearer visual comparison of patterns between regions, the data are then presented in graphical form in Figure 1.

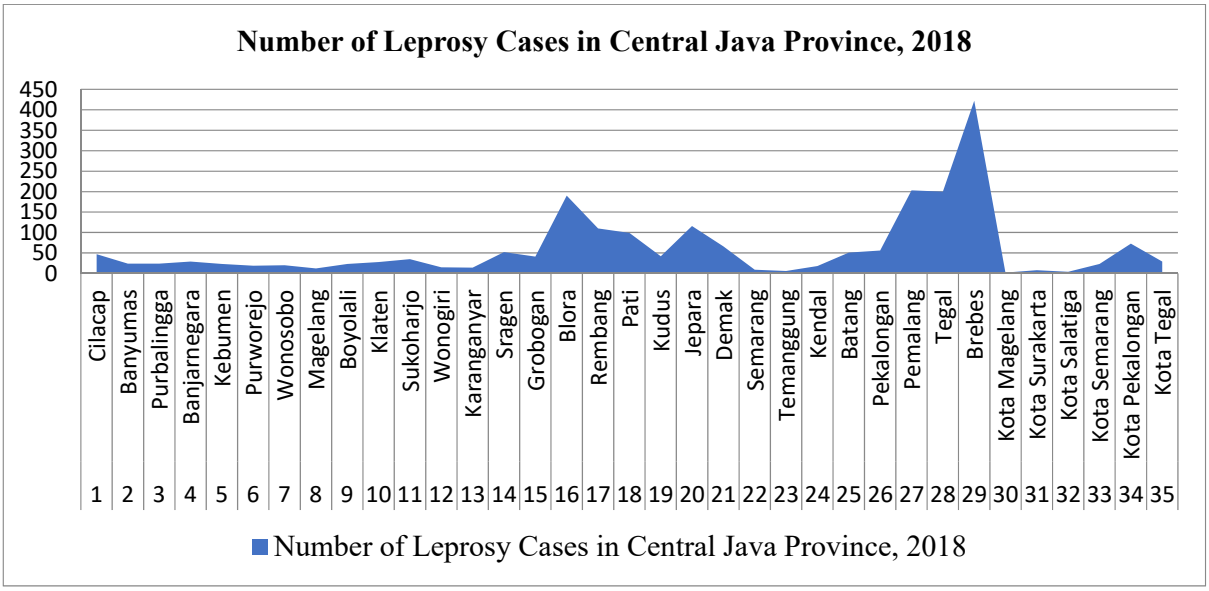

Figure 1. Number of Leprosy Cases in Central Java Province, 2018

Based on data from the Central Java Provincial Statistics Agency (BPS) in 2019, the number of leprosy cases in Central Java Province in 2019 shows the same data pattern across regencies/cities as reported in the BPS data.

Table 2. Number of Leprosy Cases in Central Java Province, 2019

No	Name of Regency / City	Number of Leprosy Cases in Central Java Province, 2019
1.	Cilacap	47
2.	Banyumas	24
3.	Purbalingga	24
4.	Banjarnegara	29
5.	Kebumen	23
6.	Purworejo	19
7.	Wonosobo	20
8.	Magelang	12
9.	Boyolali	23
10.	Klaten	28
11.	Sukoharjo	35
12.	Wonogiri	15
13.	Karanganyar	14
14.	Sragen	52
15.	Grobogan	41
16.	Blora	190
17.	Rembang	110
18.	Pati	99
19.	Kudus	42
20.	Jepara	116
21.	Demak	66
22.	Semarang	9
23.	Temanggung	6

No	Name of Regency / City	Number of Leprosy Cases in Central Java Province, 2019
24.	Kendal	18
25.	Batang	51
26.	Pekalongan	56
27.	Pemalang	203
28.	Tegal	200
29.	Brebes	422
30.	Kota Magelang	2
31.	Kota Surakarta	8
32.	Kota Salatiga	4
33.	Kota Semarang	23
34.	Kota Pekalongan	73
35.	Kota Tegal	29

Source: Central Java Provincial Statistics Agency (BPS), 2019

Based on Table 2, the distribution of leprosy cases across each regency/city in Central Java Province in 2019 can be observed. To provide a clearer visual comparison of patterns between regions, the data are then presented in graphical form in Figure 2.

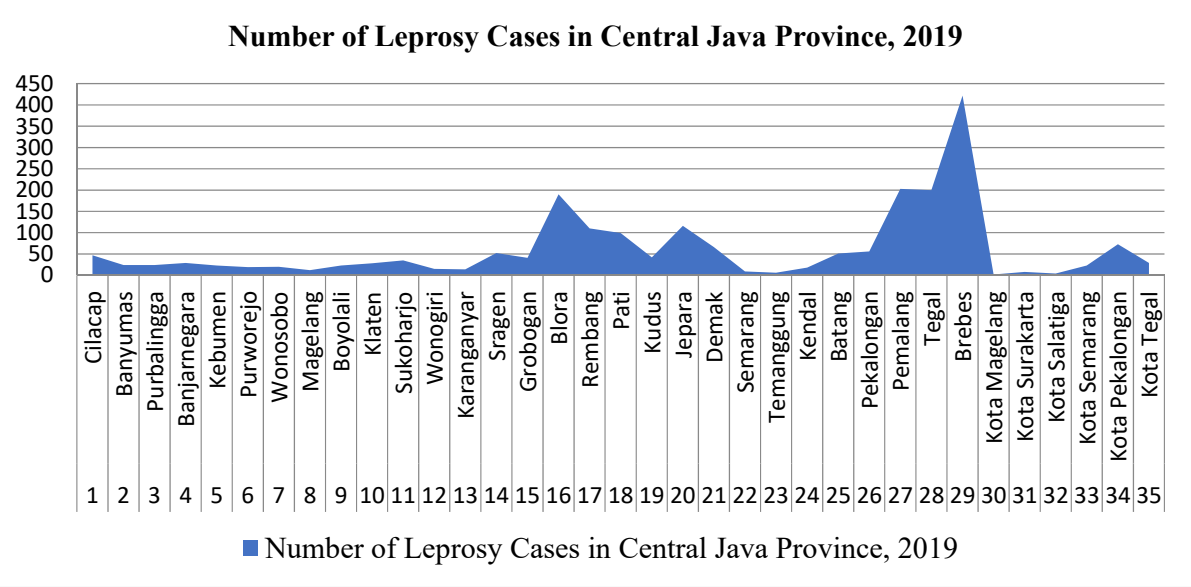

Figure 2. Number of Leprosy Cases in Central Java Province, 2019

Based on the data in Figures 1 and 2, the number of leprosy cases in Central Java Province for 2018–2019 is shown. The figures indicate that there are no striking differences across regencies/cities within the one-year period. Brebes Regency has the highest morbidity rate (422 cases), far exceeding other regions. Meanwhile, Magelang City (2 cases) and Salatiga City (4 cases) show relatively low morbidity rates compared to other areas.

The high number of cases in several regions indicates the presence of social risk factors, population density, and limited access to healthcare services that influence disease distribution. The high number of cases in Brebes Regency requires a targeted health policy approach in high-case areas to reduce transmission and prevent disability due to delayed diagnosis.

3.3. Epidemiological interpretation

From a descriptive epidemiology perspective, analyzing disease distribution by place is an important step in identifying patterns of disease spread within a region. The uneven distribution of leprosy cases in Central Java indicates differences in social and environmental determinants across regions. Population density, sanitation conditions, education levels, and access to healthcare services can influence case detection and reporting rates.

Regions with more active health surveillance systems tend to report more cases due to better early detection, whereas regions with lower reporting rates are not necessarily free of cases but may reflect limited access to healthcare services. Additionally, leprosy has a long incubation period, meaning that the distribution pattern observed during the study period reflects not only current conditions but also long-term risk factors.

3.4 Distribution Inequality and Its Implications

A range value of 420 indicates a very high disparity between regions with the highest and lowest case numbers. This inequality suggests that a uniform health policy approach across all regions may be less effective. Regions with high case numbers require more intensive interventions, such as active community screening, education on early symptoms of leprosy, strengthening primary healthcare services, and reducing social stigma toward individuals with leprosy.

Meanwhile, regions with low case numbers still require preventive efforts to avoid the emergence of new cases. The positively skewed distribution indicates that most regions have relatively low to moderate case numbers, while a few regions bear a very high disease burden. Statistical measures such as mean, median, and standard deviation help in understanding data concentration and variation. With this information, area-based interventions can be focused on high-burden regions for more effective policy implementation, while still monitoring low- to moderate-case regions to prevent sudden increases. This approach not only improves resource efficiency but also maximizes the effectiveness of disease prevention and control programs, making health policies more responsive and targeted.

3.5 Comparison of Mean and Median in Policy Context

The mean value of 61 cases provides a general overview, but the median value of 29 cases indicates that most regions actually have case numbers below the average. This confirms that the mean is influenced by several extreme high values. In the context of health policy, the median is often more representative in describing the general condition of regions. Therefore, statistical analysis should not stop at numerical calculations but must also be interpreted contextually. The results of the analysis show that leprosy cases in Central Java Province during 2018–2019 have an uneven distribution with high variation across regions. The average of 61 cases does not represent the majority of regions due to the presence of several regencies with very high case numbers. The positively skewed distribution indicates a concentration of cases in specific areas, particularly in the northern coastal region. These findings highlight the importance of descriptive epidemiological approaches in understanding disease distribution patterns as a basis for planning more effective and targeted public health interventions.

4. PHILOSOPHICAL BATIK MOTIFS

Figure 3 presents the philosophical meaning derived from the graph of leprosy disease represented in the batik motif.

a. Dots (Discrete Data) in the batik motif symbolize individual data units, such as the number of cases in each region. These dots illustrate that statistical information is constructed from small data points which, when combined, form meaningful insights.
b. Repeating Patterns (Data Distribution) in the batik reflect the repetition of motifs, representing the distribution of data within a population. These patterns show how data are spread across different regions, often unevenly, and form specific tendencies that can be analyzed.
c. Peaks and Valleys in the Batik Waves represent the maximum and minimum values within the data. The peaks indicate regions with the highest number of cases, while the valleys show regions with lower case numbers.
d. Floral Elements in the Motif symbolize balance and focal points within the batik pattern. These elements illustrate efforts to achieve an ideal or balanced condition, in which each region maintains controlled and evenly distributed case numbers.
e. Small Diamond-Shaped Ornaments represent structured and measurable data points. Their symmetrical shape reflects precision, order, and accuracy in statistical processing, where each value has its own role and position in forming the overall distribution pattern.
f. Pattern Balance in the Batik represents efforts to achieve stability (data stability) and control variability, similar to trend analysis and prediction in statistical studies.

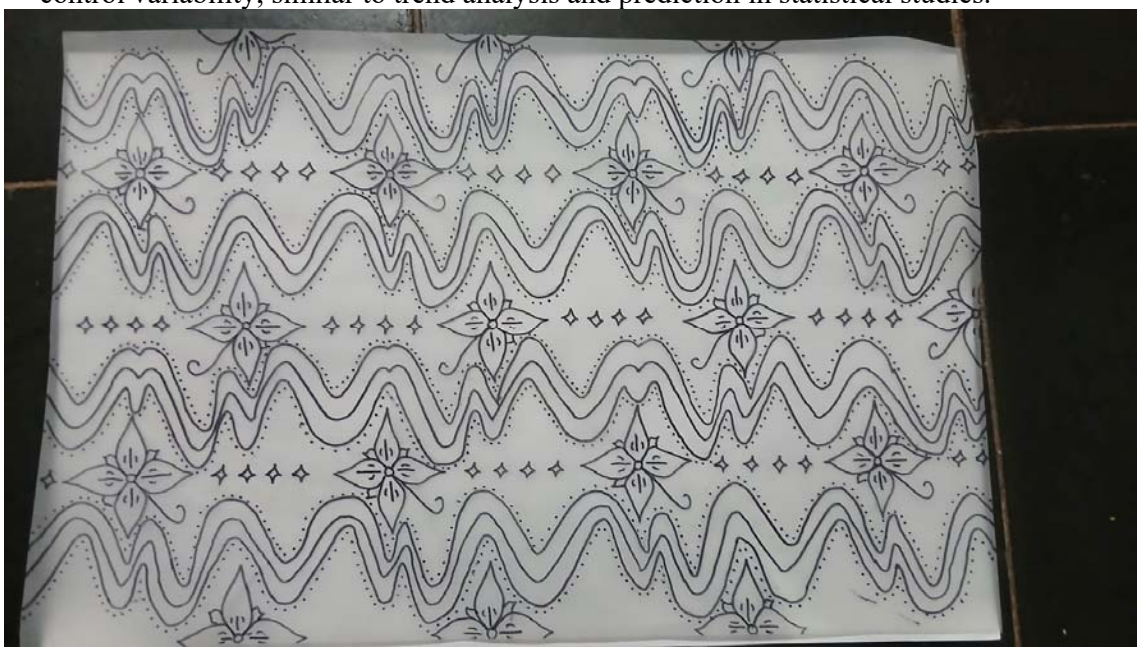

Figure 3. Batik Motif on Tracing Paper

Figure 4. Batik Motif in Leprosy Disease

5. CONCLUSION

Based on the statistical analysis of leprosy case data in Central Java Province for 2018–2019, it can be concluded that the distribution of leprosy cases across regencies/cities shows significant variation and is uneven. In 2018 and 2019, a total of 2,133 leprosy cases were recorded across 35 regencies/cities. The mean number of cases per region was 60.94, while the median was 29 cases. The considerable difference between the mean and median indicates that the data distribution is asymmetric and positively skewed.

The maximum number of cases was found in Brebes Regency with 422 cases, whereas the minimum was in Magelang City with 2 cases, resulting in a range of 420. The large range and high standard deviation indicate a sharp inequality in case distribution between regions. Most regencies/cities have relatively low to moderate case numbers, but several areas exhibit very high case counts, which significantly influence the provincial mean.

This distribution pattern indicates a concentration of cases in certain areas, particularly in the northern coastal region (Pantura), likely influenced by factors such as population density, community mobility, socio-economic conditions, and access to healthcare services. Therefore, public health policy approaches for leprosy control in Central Java should be targeted, focusing on high-burden regions, while not neglecting preventive measures in low-case areas. Overall, the descriptive statistical analysis conducted in this study provides a quantitative overview of leprosy case distribution in Central Java. These results can serve as a basis for planning more effective, efficient, and area-based disease control programs.

6. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Batik Ghakhuka for the artistic collaboration and support in the development of mathematical batik designs. Special appreciation is also extended to the Batik Matematika community for providing creative insights and inspiration that enriched the integration of mathematical concepts into traditional batik motifs. Their contributions have played an essential role in enhancing the cultural and scientific value of this work.

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