

APPLICATION OF CULTURAL MOTIF DESIGN IN VISUALIZING BIRD FLU CASES IN POLEWALI MANDAR (2008 – 2013)

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Abstract

Avian Influenza (AI) is one of the infectious diseases in poultry that has the potential to have economic and public health impacts, including in Polewali Mandar Regency. The distribution of AI cases shows variations between sub-district and village areas which are influenced by livestock population density, poultry distribution patterns, trade mobility, and the biosecurity system applied. Although case incidence data are available in annual reports, systematic statistical analysis is needed to identify patterns of spread and levels of variation between regions as a basis for the formulation of more effective control policies. This study aims to analyze the distribution of areas affected by Avian Influenza in Polewali Mandar Regency for the period 2008–2013 using a descriptive quantitative approach. Secondary data was obtained from the reports of related agencies and analyzed through the calculation of the size of concentration and spread, including average, maximum value, minimum value, and percentage of annual change. The results of the analysis showed that the average number of affected sub-districts during the study period was 6.83 sub-districts per year, with the highest number occurring in 2013 as many as 11 sub-districts and the lowest in 2010 as many as 3 sub-districts. Meanwhile, the average number of affected villages is 13 villages per year, with the highest number in 2011 being 20 villages and the lowest in 2010 being 4 villages. The range of the number of affected sub-districts is 8 and the range of affected villages is 16, indicating significant fluctuations in the spread from year to year. These findings confirm the importance of region- and time-based Avian Influenza control strategies, as well as the use of statistical analysis as a basis for decision-making in disease prevention and control efforts in Polewali Mandar Regency.

Keywords: Avian Influenza; Spatial Dispersal; Data Visualization

1. INTRODUCTION

Batik is known as one of Indonesia's cultural identities that has a rich aesthetic value as well as a strong philosophical meaning. Each pattern and pattern displayed is not just a visual decoration, but also a symbol that depicts the value of life, social order, and local wisdom of the community that makes it. In the context of the development of science, batik is not only positioned as a traditional art product, but can also be studied through academic approaches, including mathematical studies. "Traditional batik motifs contain the concept of geometric transformation such as translation, reflection, and rotation that are systematically arranged in a repetitive pattern." (Widodo & Purnomo, 2018)

In this discussion, the field of biology uses a mathematical calculation model to explain and describe the spread of influenza afian virus (AI) in poultry in Poliwari Regency, Mandar, West Sumatra. This model explains the rate of spread, internal and external factors, and also the pattern of the spread of influenza afian disease in poultry spread across 13 sub-districts and 53 villages in Poliwari, Mandar, West Sumatra.

"Avian Influenza virus infection causes respiratory diseases with high mortality in various poultry species such as chickens, ducks, and quail." (Asmara et al2005). The Avian influenza (AI) virus is a threat, both for Indonesia and other countries in the world. The impact caused by the AI virus is very diverse, including livestock businesses that involve large livestock populations, livestock businesses that involve many entrepreneurs and breeders directly and indirectly, the impact on food availability and safety, its potential for transmission to humans and even its development into an influenza pandemic. In Indonesia, there is currently an outbreak of avian influenza from animals to humans and has even claimed quite a lot of victims and is feared to be a pandemic. The AI virus has the ability to transmit across species and even to humans so that it has the impact of encouraging the occurrence of an influenza pandemic, which is an outbreak of respiratory diseases in humans that occurs globally and is caused by the novel genotype of influenza A which can infect humans who do not have immunity to the disease. The cumulative number of confirmed cases of AI in humans in Indonesia is 195 cases with 163 deaths per case. (Aditama, 2013).

The HPAI outbreak itself first entered West Sulawesi Province in 2005. The districts that were infected at that time were Polewali Mandar and Majene districts. This virus is very easy to mutate and spread, so it is a serious threat to other areas, both in the Polewali Mandar Regency area or other districts in West Sulawesi Province and even other provinces that are directly bordered, for example, Pinrang Regency, South Sulawesi Province. Various strategies have been carried out by the provincial government of West Sulawesi and Polewali Mandar district in tackling the HPAI outbreak. The limited budget is one of the problems in the regions, this is what requires the government to be able to take effective and efficient policies. Based on the description above, the research "Map of the Spread of AI Virus in Poultry in Polewali Mandar Regency in 2008 – 2013" was carried out in order to obtain complete data or information about the spread of AI virus in the period 2008 – 2013 so that it can be used by various parties to develop strategies in controlling AI virus outbreaks both in Polewali Mandar Regency and other areas. The purpose of this study is to determine the level and pattern of spread of the AI Virus in Poultry in Polewali Mandar Regency. (Thaha et al., 2018).

Avian Influenza (AI) has become endemic in Indonesia since it was first declared infected on February 3, 2004 through the Decree of the Minister of Agriculture (Kepmentan) No. 96/Kpts/PD.620/2/2004. Various countermeasures have been carried out by the government, including through the establishment of the Avian Influenza Control Strategy and the issuance of the Decree of the Director General of Livestock No. 17/Kpts/PD.640/F/02.04 dated February 4, 2004 concerning Guidelines for the Prevention, Control, and Eradication of Infectious Animal Diseases of Influenza in Poultry. In addition, Kepdirjennak No. 46/Kpts/PD.640/F/04.04 and Kepdirjennak No. 46/PD.640/F/08.05 were also issued as a form of strengthening policies in controlling the disease.

Since February 2004 until now, as many as 33 provinces out of a total of 34 provinces in Indonesia have been reported to be infected with the Highly Pathogenic Avian Influenza (HPAI) virus. Based on the report on the development of AI disease cases in poultry in Indonesia, the positive Rapid Test results reported by the PDSR (Participatory Disease Surveillance and Response) Team through the SMS Gateway system nationwide until January 31, 2014 show that since the outbreak of AI in poultry in Indonesia until 2007, the frequency of cases has reached 10,386 cases (Directorate General of Animal Husbandry, 2014).

The purpose of this study is to build batik motifs based on graphic visualization and mathematical equations of the spread of influenza afian. This research seeks to explore the relationship between science and art that is rarely combined, especially between mathematics and batik art, by showing that mathematical patterns can be transformed into beautiful visual works that have scientific meaning, are innovative and contain aesthetic elements.

2. MATERIALS AND METHODS

2.1. research area

The research was conducted using data on the spread of Avian Influenza in poultry in Polewali Mandar Regency for the period 2008–2013. The study area includes sub-districts and villages affected by the case. A map of the distribution of the study area is presented in Figure 1 to show the geographical context of the spread of the disease.

The data used is secondary data sourced from the Central Statistics Agency of West Sumatra Province in the journal Thaha, Rauf, & Bagenda 2018 which has conducted research on the spread of influenza flu cases in the West Sumatra Polywari Mandar. And this data is also strengthened by data from the Central Statistics Agency of West Sumatra Province.

2.2. Procedure

This research is carried out through several regular steps to obtain definite and accurate data. First, the researcher searches for and collects data that is in accordance with the topic of the problem/research. After that, the data is checked and processed so that it is ready for analysis. The analysis was carried out using quantitative methods to describe the data clearly. Finally, the results are explained based on the basic principles of mathematical data processing.

2.3. Data Collection

At the data collection stage, this study uses secondary data obtained from the official report of the Central Statistics Agency of West Sumatra Province in 2013. The data collected includes the number of cases of the spread of the influenza flu virus in the Mandar polywari. The data on the number of spreads is used to calculate the number of spreads that occur in several areas in Poliwari Mandar district. Secondary data was chosen because it was sourced from official government institutions so that it had gone through an examination process and could be trusted. In addition, the use of BPS data helps to keep the research results objective and allows comparison with other studies in the future. The data on the spread of the influenza afian virus in Poliwari Mandar Regency is as follows:

Table 1. The number of HPAI Distribution in Polewali Mandar Regency for the period 2008 to 2013

No	Year	Number of spreads	
		Districts	Village
1	2008	7	16
2	2009	4	6
3	2010	3	4
4	2011	8	20
5	2012	8	15
6	2013	11	17

Based on data on Table 1, the spread of the Avian Influenza (AI) virus in Polewali Mandar in 2008–2013, there was a fluctuation in the number of affected areas both at the sub-district and village levels. In 2008, 7 sub-districts and 16 villages were affected. In 2009 there was a decrease to 4 sub-districts (down about 42.9%) and 6 villages (down about 62.5%) compared to the previous year. The decline occurred again in 2010 with 3 sub-districts (down 25% from 2009) and 4 villages (down 33.3%). However, in 2011 there was a significant jump to 8 sub-districts (up 166.7% from 2010) and 20 villages (up 400%). In 2012 the number of sub-districts remained at 8 (0%), but the number of villages decreased to 15 (down 25%). The peak of the spread occurred in 2013 with 11 sub-districts (up 37.5% from 2012) and 17 villages (up 13.3%).

Overall, compared to the initial year (2008), in 2013 the number of affected sub-districts increased by around 57.1%, while the villages increased by around 6.25%. This data shows that although there was a decline in the period 2009–2010, the spread of the AI virus increased significantly again after 2011, which indicates the need to strengthen disease control and prevention in the Polewali Mandar area.

2.4. Data Processing

Initial data related to influenza flu cases in Polewali Mandar Regency were first compiled and presented in the form of a table using computer-based word processing software. The data preparation is carried out based on the division of sub-district areas to facilitate grouping and analysis. The results of numerical calculations are written in the form of decimal numbers to increase accuracy and make it easier to read data statistically.

The next stage is to calculate the incidence rate by dividing the number of influenza cases in each sub-district by the total population in the region in the observation period. The values obtained were used to compare the incidence rate of disease between sub-districts as well as to illustrate the pattern of the spatial distribution of influenza in Polewali Mandar Regency.

Furthermore, the data is analyzed descriptively to obtain an overview through the calculation of the mean value, the highest value, the lowest value, and the difference between the maximum and minimum value (range). This analysis aims to show the variation in the rate of influenza spread in the study area in a more systematic and structured manner.

2.5. Data Analysis

Data processing is carried out through a descriptive statistical approach and comparative analysis between regions. A descriptive approach is used to present an overview of the number of influenza flu cases in each sub-district in the form of a distribution table and percentage proportion. Meanwhile, comparative analysis was used to assess the difference in incidence rates between sub-districts so that the areas with the highest case burden could be identified. The analysis procedure includes several stages, namely: (1) calculating the proportion of the number of cases in each sub-district to the total influenza cases in Polewali Mandar Regency, (2) comparing the incidence figures between sub-districts to assess variations in the level of risk of transmission, and (3) examining the pattern of case distribution in the observation year to detect certain trends or data deviations in the distribution of influenza cases. In general, the analysis is carried out using quantitative descriptive statistics. The mean value is obtained by summing all cases and then dividing it by the number of sub-districts observed, thus providing an overview of the overall incidence rate of influenza in the study area.

Data analysis was carried out using quantitative descriptive statistics. The average is calculated using the formula:

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

\bar{x} = mean average value

x_i = the value of the i data

n = total data

Σ = sum symbol from 1st to n data

In addition, the range is calculated with the formula:

$$\text{Range} = X_{\max} - X_{\min}$$

This analysis aims to determine the level of variation in the distribution of cases of the spread of the influenza afian virus in West Sumatra.

3. RESULTS AND DISCUSSION

Avian influenza (AI) is an infectious disease caused by the influenza virus type A and can infect various species of poultry and humans, making it a serious global health problem. This disease is zoonotic and has the potential for widespread spread through interactions between humans and domestic and wild poultry. (Elytha 2011).

According to Thaha, Rauf, & Bagenda (2018). The Agriculture and Livestock Office of Polewali Mandar Regency, recorded that since 2008-2013 cases of poultry deaths caused by the AI virus have spread in 13 sub-districts and 53 villages throughout Polewali Mandar Regency. as seen in Figure 1. This shows that 81.25% of sub-districts and 31.74% of villages/sub-districts in Polewali Mandar Regency have been infected with the AI virus. The number of poultry deaths caused by the AI virus in the period from 2008 to 2013 was 49,182 heads. The affected poultry consisted of free-range chickens, broiler chickens, ornamental chickens (Filipino), measuring birds, rooster/complaints, and ducks that have a scale 3 pattern of yard poultry and commercial poultry (the average number of poultry raised is 10-10,000 heads).

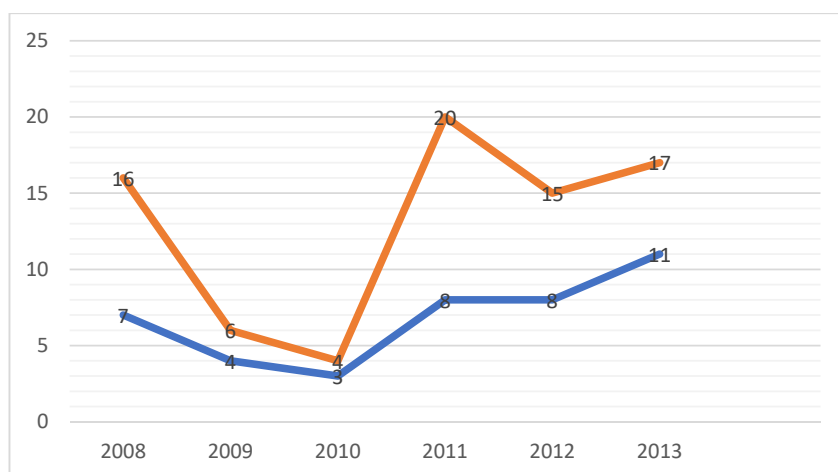


Figure 1. Static Data on the Spread of HPAI in Polewali Mandar Regency for the Period 2008 to 2013

Figure 1 shows data on the spread of the influenza flu virus that occurred in sub-districts and even villages in Polewali Mandar Regency, South Sumatra. In the period from 2008 to 2013. At the beginning of the spread, there were many confirmed cases spread as many as 7 cases in urban areas and 16 cases in rural areas. In 2008-2009 there was a decrease in cases of the spread of the influenza flu virus, but in 2011 the spread was recorded in 13 sub-districts, including in the sub-districts of Alu, Anreapi, Balanipa, Campalagian, Limboro, Luyo, Binuang, Mapilli, Matakali, Polewali, Tapango, Tinambung, and Wonomulyo. According to the distribution data in figure 1, there is 1 area that experiences 2 cases per year, namely in the districts of Wonomulyo, Polewali, and Binuang while AI cases per year are below 2 cases in 9 sub-districts, namely Allu, Limboro, Tinambung, Balanipa, Campalagian, Mapilli, Matakali, Anreapi, and Tapango. In addition, 4 sub-districts with an average of zero AI cases per year are Tutar, Luyo, Bulo, and Matangnga sub-districts. This is closely related to the high density of livestock. The higher the density of poultry in the area, the greater the risk of AI incidents.

According to Gould and Higgs (2009), the factors that determine the emergence of an epidemic of a disease include human mobility, commercial transportation, human density and animal population density. Binuang District, although the density of livestock is lower than Wonomulyo and Polewali sub-districts, but the high cases are due to the large number of scale

3 commercial poultry farmers spread across this sub-district and are near community settlements so that livestock traffic (vehicles transporting feed, transporting livestock, and others) is dense in this area which is also one of the risk factors for the spread of the AI virus.

There are other factors that affect the spread of the influenza virus, especially in the Polywari Mandar area, which consists of internal and external factors, both directly and indirectly. Internal factors include: the location of poultry farms on the side of the road and close to residential areas, the density and poorly maintained condition of the livestock kennels, and also the low understanding of the community to play an active role in tackling the spread of the AI virus. External factors that affect the spread both directly and indirectly include: livestock traffic and vehicles transporting sapronak. Livestock and sapronak trade networks with long distances that move from one farm to another are at risk of spreading pathogens (Gilbert et al., 2017), erratic climate change. Global warming and climate change have a direct impact on hospes (animals) in the form of stress that causes the animals to be more susceptible to infectious diseases (Bahri and Syafriati, 2011). Climate change is also bringing changes to the distribution, composition, and migratory behavior of wild bird flocks that are natural reservoirs of AI viruses to other regions (Gilbert, et al., 2008).

3.1. Pattern of Spread of Avian Influenza (AI) Virus in Poultry in Polewali Mandar Regency

The pattern of the spread of the Avian Influenza (AI) virus in poultry in Polewali Mandar Regency in this study was analyzed based on the time of occurrence of cases, which was based on data obtained from the relevant agencies. Based on these data, the trend of increasing poultry deaths due to the AI virus during the period from 2008 to 2013 in Polewali Mandar Regency generally occurred in January, February, March, July, September, November, and December.

The pattern of the spread of the AI virus in poultry in Polewali Mandar Regency is influenced by several factors, including climatic or weather conditions, waterfowl (duck) rearing patterns, and the customs or habits of the local community. Based on data from the Central Statistics Agency (BPS, 2014), the highest average rainfall in Polewali Mandar Regency occurs from December to June. This condition triggered a high number of AI cases, especially in December, January, February, and March. In Indonesia, reports of AI cases generally increase during the rainy season because high humidity levels are a supporting factor for the development and spread of AI viruses in the environment. Research on the circulation of AI virus subtype H5 in poultry in West Java, Banten, and East Java in 2008–2009 conducted by Dharmayanti and Hewajuli (2005) showed that AI virus subtype H5 was found in most poultry, including waterfowl, collected during the rainy season. In contrast, most poultry samples taken during the dry season were not identified as containing the AI virus subtype H5. This is thought to be caused by higher temperatures in the dry season which can cause the AI virus in the environment to become dormant. The AI virus is known to be inactivated at 56°C for 3 hours or at 60°C for 30 minutes, as well as at pH conditions of less than 5 or more than 8. In addition to climate factors, waterfowl rearing patterns also affect the increase in AI cases. Based on the results of interviews with Mapilli Sub-district Head (2014) and PDSR (Participatory Disease Surveillance and Response) officers of Polewali Mandar Regency (2014), it is known that after the rice harvest season around July, October, and March, many ducks come from inside and outside the Polewali Mandar Regency area, such as from Pinrang Regency and Sidrap Regency. The ducks are then grazed in a nomadic manner in the harvested rice fields. The migration of poultry from one place to another has an important role in the transmission and spread of AI diseases. Ducks that are grazed freely and move locations during the harvest season are one of the factors that contribute to the spread of the HPAI H5N1 virus (Gilbert et al., 2017). Waterfowl are known to be a natural reservoir of the AI virus, as this virus can multiply in large numbers in the digestive tract of waterfowl without causing clinical

symptoms in the animal (Olsen et al., 2006). The high population of waterfowl and free grazing systems increase the potential of waterfowl as a reservoir of the AI H5N1 virus in Indonesia (Hewajuli and Dharmayanti, 2012). This is of particular concern because Pinrang Regency and Sidrap Regency are areas with a fairly high rate of AI cases, so waterfowl from these areas have the potential to carry the AI virus. Another factor that also affects the pattern of the spread of the AI virus is the customs or habits of the local community. On religious holidays and other social events, the consumption of poultry products such as chicken meat and eggs tends to increase. During the period from 2008 to 2013, the celebration of religious holidays such as Eid al-Fitr, Eid al-Adha, the Birthday of the Prophet Muhammad SAW, as well as various social activities such as wedding receptions and graduation ceremonies or santriwati usually take place in January, February, March, July, August, September, November, and December. The increase in the consumption of poultry products is in line with the increasing circulation of live poultry, chicken meat, and eggs in traditional markets in Polewali Mandar Regency. This condition has the potential to increase the risk of spreading the AI virus. According to Wibawan (2012), afkir chicken shelters and live bird markets can be the source of new outbreaks. This is due to conditions in shelters or markets that often cause stress on poultry, such as high density, inadequate ventilation, limited feed and drinking water, and a mix of various types of poultry from various regions. These stressful conditions can be a predisposing factor that triggers the emergence of diseases that were previously subclinical

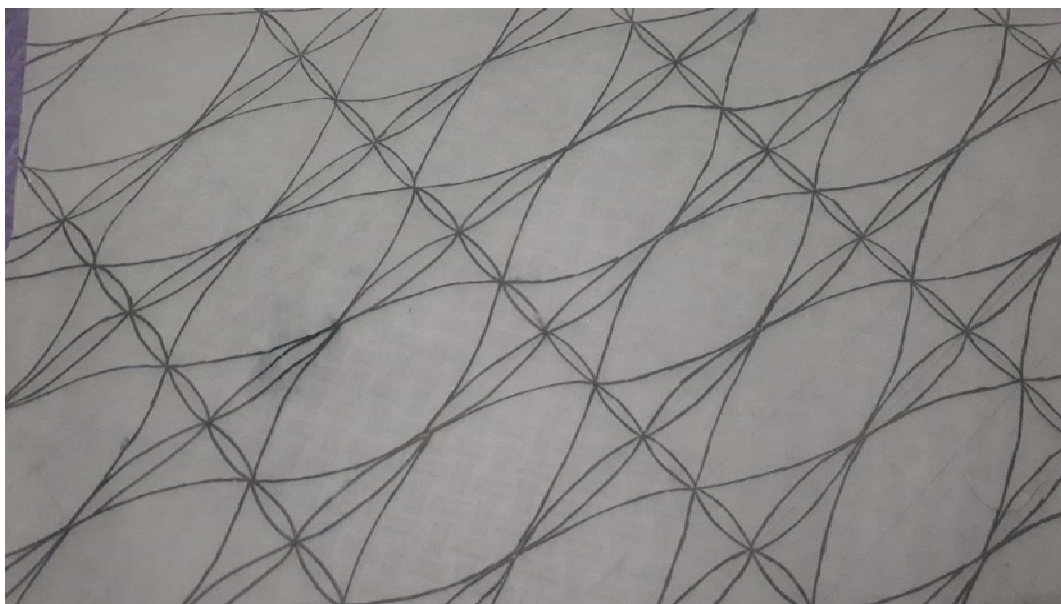


Figure 2. Image of batik motif for Static data on the Spread of HPAI in Polewali Mandar Regency for the period 2008 to 2013

3.2. The Meaning of Mathematical Philosophy

Mathematically, the batik motif can be interpreted as a representation of a dynamic system composed of structured elements. Consistent box patterns demonstrate the concepts of regularity and division of space in spatial models, while scattered dots depict discrete data analyzed in the form of frequency distributions. An asymmetrically flowing curved line reflects a variable change over time, resembling a growth and decline curve in time series analysis. Motif repetition signifies the principles of geometric transformations such as translation and reflection, which in a mathematical context describe the repetitive patterns of a phenomenon that remain in a single system.

In terms of public health, this motif symbolizes the process of spreading the AI virus that moves through interaction between regions. The small dots depict the initial case that has the potential to develop, while the curved lines indicate the path of spread affected by environmental factors, mobility, and control responses. The changing density of patterns reflects unstable epidemic conditions—there is a controlled phase and there is an increasing phase of cases. In a symbolic sense, this motif implies that the spread of disease is not a stand-alone event, but rather part of a social and ecological dynamic that requires continuous surveillance and planned prevention strategies.

4. CONCLUSION

Based on the results of research on the spread of the Avian Influenza (AI) virus in poultry in Polewali Mandar Regency in 2008–2013, it can be concluded that the pattern of the spread of AI cases shows a tendency to increase in certain months, namely January, February, March, July, September, November, and December. The pattern is influenced by several main factors, including climatic conditions with high rainfall and humidity in the rainy season, waterfowl rearing patterns, especially the duck grazing system in a moving manner after the harvest season, as well as community social activities that increase the demand and circulation of poultry in traditional markets during religious holidays and social events. These factors play a role in accelerating the spread of the AI virus because it increases contact between birds from various regions and increases the potential for disease transmission. Therefore, stricter surveillance, biosecurity, and poultry traffic control efforts are needed to minimize the risk of spreading the Avian Influenza virus in the Polewali Mandar Regency area.

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