TRANSMISSION ELIMINATION OF LIMFATIC FILARIASIS USING SPATIAL AUTOCORRELATION

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**Abstract**. At present, spatial analysis have been used on epidemiology. Spatial analysis was used to determine the environmental risk that influence to transmission of Filariasis. The aim of the study was to identify, at industrial area, the environment determinant that are associated with Filariasis cases in Pekalongan City.

The geocoding method was applied on the prevalence of cases to determine the pattern of spatial. Spatial autocorrelation was used to determine the effect of the environment on filariasis transmission. The kernel method was used to determine the density of filariasis cases.

Based on the spatial analysis, the statistical values ​​associated with the correlation between the risk of filariasis transmission and environmental factors were obtained. The correlation value of the influence of the environment on the transmission of Filariasis was statistically significant, this coefficient is 0.312. The value of R indicates that the spatial pattern of filariasis cases forms a cluster pattern. The Moran's index calculation obtained a positive spatial autocorrelation value of 0.44 with z-score is 16.05 and P-value is 0.00.

Spatial autocorrelation was useful to determining the level of risk transmission of filariasis in Pekalongan City which may help to adopt effective control stategies in filariasis eradication programs in Pekalongan City.

Keywords: Transmission of Lymphatic Filariasis, Spatial Autocorrelation, Moran's Index, Kernel Density

1. Introduction

Spatial analysis has been widely used in various fields, one of which is in the field of epidemiology. The use of spatial analysis in the field of epidemiology is primarily to determine the relationship between environmental conditions and disease incidence. One method of analysing the relationship between environmental conditions and disease incidence is a spatial autocorrelation. The spatial pattern of objects, phenomena and events is determined by certain environmental variables. An understanding of the degree of spatial structure is often described based on the first law of geography, namely: "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970, in Liang, 2008).

Filariasis is caused by filarial worms which are transmitted through the bite of an infected mosquito into the human body. The abundance of mosquitoes infected with filaria can be explained based on the mosquito habitat that supports them as a place to lay eggs and breed. A supportive environment as a place to lay eggs and breed as a factor in the presence of disease endemics in an area. Pekalongan is noticed as endemic for filariasis based on the microfilaria rate (mf rate) which reaches more than 1%.

Several studies have been conducted regarding the elimination strategy of filariasis transmission. The research approach was carried out using descriptive surveys to determine transmission risk factors such as the presence of shrubs and irrigation systems, residential environment (Wulandhari, 2015, Amelia, 2014), Filariasis diagnostic test to support transmission mapping and monitoring (Rebollo, 2014), mapping risk and visualization are used for filariasis endemic identification and filariasis monitoring of filariasis transmission using geo-climatic variables. (Palaniyandi, 2014; Mwase, 2014; Sabesan, 2013; Upadyalula). The development / poverty index (especially in urban areas) should be considered as a risk factor for LF transmission (Manhenje, 2013). Pekalongan City as a filariasis endemic area is still very potential as an area of ​​transmission and spread of filariasis (Windiastuti, 2013). Remote sensing and geographic information systems are also increasingly being carried out, especially for mapping the prevalence of disease and modelling the distribution of hosts (Zhang, 2013, Simoonga et. Al., 2009, Sugimori, 2004). At the stage of adult mosquitoes need water, which in this case still associated with wetlands as an ecology of mosquitoes and diseases caused by vectors (Hamid, 2012). Apart from the factors that influence filariasis cases, the spatial relationship between filariasis cases and attributes is also needed in the framework of strategies to break filariasis transmission. This research was conducted to determine the degree of dependency of filariasis cases on risk factors for filariasis transmission.

1. Method

The data used in this study is 2016 lymphatic filariasis case registered data from the Pekalongan City Health Office and Pekalongan Regency, Central Java Province. Geocoding method is done by using GPS to plot the location of lymphatic filariasis cases. Exploratory spatial data analysis (ESDA) is used for spatial analysis of filariasis case data.

1. Result
	1. Spatial distribution of filariasis cases

The results of statistical analysis using the nearest neighbourhood ratio method obtained an R value of 0.31, which means that the spatial distribution of filariasis cases in the study area forms a cluster pattern. The Z score shows a cluster pattern with a very significant statistical value. The Z score for the spatial pattern of lymphatic filariasis cases shows a very significant statistical value, namely -23.

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| **Table 1.** Results of spatial statistical analysis using the nearest neighbourhood ratio method. |

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| --- | --- | --- | --- | --- |
| **R*statistic*** | **Z-score** | **P-value** | **Robs** | **Rexp** |
| 0.31 | -23.54 | 0.00 | 233.92 | 749.14 |

Source: Spatial data analysis (2019)

Picture 1. Map of spatial distribution of filariasis cases



* 1. Autokorelasi spasial

The similarity in the characteristics of the locations is done by calculating the different attributes of spatially adjacent points. The index that is often used to measure spatial autocorrelation in point distributions is the Moran's Index.

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| **Table 2.** Spatial statistic using Moran’s I |
| **Moran’s I** | **Z-score** | **P-value** |
| 0.44 | 16.05 | 0.00 |

Source: Statistical spatial data analysis (2019)

The model validation test was carried out by taking 40 sample point locations. 40 samples were considered because the risk classes used were 4 classes and 10 samples were taken for each class. Furthermore, the location of the sample points will be tested for validation to determine the accuracy of the model. The validation test was carried out by comparing the FL transmission risk classes in the model with the transmission risk classes calculated based on the distance to the FL case. Based on the calculation, the accuracy model is 89.77%

1. Discussioun

At the first step, a mapping stage needs to be done to determine the environmental conditions that influence and the spread of the disease. To determine environmental factors, Remote sensing technology is used. Some of the advantages of remote sensing are covering a large area, fast, relatively cheaper, and it can reach remote areas.

Identifying FL transmission requires an understanding of the distribution of disease incidence and environmental factors as causes. By knowing the environmental factors that influence the incidence of a disease, it can then be used to assist in the implementation of eradication and surveillance programs against infectious diseases caused by environmental factors.

Mapping is an alternative method in assisting the lymphatic filariasis elimination program and it shows areas with a high enough prevalence so that intervention is necessary. The risk factors for FL transmission have various factors and are influenced by several things, including land cover conditions, vegetation density, building density, and surface water conditions. The vegetation condition that affects is the presence of shrubs and forests. Shrubs are a great place to settle for mosquitoes. Meanwhile, the forest will provide a suitable environment for mosquito breeding. The building density condition is a representation of the population density condition. Occupation density is a risk factor for FL transmission. The denser the population, the possibility of FL transmission will also be very high. Soil moisture conditions also make it easier for waterlogging to occur where is a breeding ground for mosquito larvae.

1. Conclusion

The spatial structure of the filariasis case is influenced by its attribute as a result of the spatial dependence between variables. Spatial dependence is a case response to environmental conditions (spatial autocorrelation). A high moran index value indicates a high level of spatial aucorrelation and a z-score value indicates the strength of this relationship. Based on the spatial statistical analysis, the Moran's index value was 0.44. Filariasis spread even more over a wider area. Based on the description above, in general the research area is included in the category of positive spatial autocorrelation, this indicates that the cluster pattern of filariasis cases is influenced by environmental factors.

References

1. Liang, 2008, Advance in Land Remote Sensing System, Modelling, Inversion and Application,Springer.
2. Amelia, 2014, Analisis Faktor Risiko Kejadian Penyakit Filariasis . *Unnes Journal of Public Health Vol.3 No.1*.
3. Palanyandi, 2014, A geo-spatial modeling for mapping of filariasis transmission risk in India, using remote sensing and GIS, International Journal of Mosquito Research Volume I Issue 1 (2014)
4. Mwase et. al, 2014, Mapping the Geographical Distribution of Lymphatic Filariasis in Zambia, February 2014 | Volume 8 | Issue 2 | e2714, PLOS Neglected Tropical Diseases | [www.plosntds.org](http://www.plosntds.org)
5. Sabesan, 2013, Subramanian, Srivastava, dan Jambulingam. , 2013, Lymphatic Filariasis Transmission Risk Map of India, Based on a Geo-Environmental Risk Model, Vector-Borne And Zoonotic Diseases Volume 13, Number 9, 2013 Mary Ann Liebert, Inc.
6. Manhenje, 2013, Socio-environental variables and transmission risk of lymphatic filariasis in central and northern Mozabique. *Geospatial Health 7(2)*, pg 391-398.
7. Windiastuti, 2013, Hubungan Kondisi Lingkungan Rumah, Sosial Ekonomi dan Perilaku Masyarakat dengan Kejadian Filariasis di kecamatan Pekalongan Selatan kota Pekalongan. *Jurnal Kesehatan Lingkungan Indonesia* , Vol.12 No.1.
8. Hamid, 2012, Spatial Distribution and Abundance of culicine mosquitoes in realtion to the risk of filariasis transmission in El Sharqiya Governote, Egypt. *Acad J.Biologi Sci* , (1) : 39-48.