



Mapping The Distribution Of Diseases at Community Health Center In Palembang Based On Geographic Information Systems

Indri Ariyanti¹, M Arief Rahman², Yunita Fauzia Achmad³, M Prasasti Agung⁴, M Raihan⁵, and Cindy Trissia Fania⁶

^{1,2,4,5,6}Informatics Management, State Polytechnic of Sriwijaya, Palembang, Indonesia

³Computer Engineering, State Polytechnic of Sriwijaya, Palembang, Indonesia

indri@polsri.ac.id

Abstract. This study utilized Geographic Information Systems (GIS) to map and analyze the distribution of major diseases within Alang-Alang Lebar, Palembang. By integrating epidemiological data and environmental factors, the research highlights significant patterns in the prevalence of hypertension, diabetes mellitus, and Upper Respiratory Tract Infections (URTI) across various neighborhoods. The findings illustrate specific areas with heightened disease occurrence, offering a spatial understanding that aids in targeted public health interventions and resource allocation. This approach underscores the potential of GIS as a crucial tool in health surveillance and management, fostering more informed decisions that can enhance community health outcomes in Palembang.

Keywords: Geographic Information Systems, disease distribution, public health, Alang-Alang Lebar

1 Introduction

Indonesia, which has a population of 278 million by 2023, is located in the tropics. The high number of disease cases is a major problem caused by poor environment, influencing economic factors, and public health behavior that still needs to be improved. Health agencies are currently striving to implement preventive and curative measures. The effectiveness of health agency programs in disease prevention and control can be significantly improved with the support of information systems. Information systems alone have the potential to provide epidemiologic information that is sensitive to changes in the spread of disease and make it an invaluable tool in dealing with today's health challenges. [1].

Puskesmas are part of the healthcare system operated by the Indonesian government with the aim of providing economical and high-quality access to healthcare for the community. Puskesmas provide a range of facilities, including medical personnel such as doctors, pharmacists, midwives, and other health professionals. One of the main responsibilities of Puskesmas is to provide health services to the population with various needs. [2]

South Sumatra is a lowland with an average altitude of ± 79 meters above sea level which is located between 10° - 40° South latitude and between 102° - 106° East longitude with a land area of 87,421.24 km² [3]. Based on data from the central statistics agency, in 2021 the province of South Sumatra has 345 Community Health

Centers (Puskesmas) spread across several districts / cities in South Sumatra Province, and for Palembang city itself has 41 Community Health Centers, as shown in Table 1.

Table 1. Number of health centers in South Sumatra Province

No	District / City	Type Community Health		Total
		Hospitalizatio n	Non Hospitalization	
1	Ogan Komering Ulu	6	12	18
2	Ogan Komering Ilir	16	16	32
3	Muara Enim	7	15	22
4	Lahat	11	22	33
5	Musi Rawas	12	7	19
6	Musi Banyuasin	6	23	29
7	Banyuasin	15	18	33
8	OKU Selatan	7	12	19
9	OKU Timur	11	11	22
10	Ogan Ilir	8	17	25
11	Empat Lawang	4	6	10
12	PALI	1	7	8
13	Muratara	7	1	8
14	Kota Palembang	0	41	41
15	Kota Prabumulih	1	8	9
16	Kota Pagar Alam	3	4	7
17	Kota Lubuk Linggau	2	8	10

Source : Dinas Kesehatan Provinsi Sumatera Selatan, 2021 [3]

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 44 of 2016 concerning Guidelines for Community Health Management, integrated and sustainable management of Puskesmas is needed to carry out health efforts at the first level. Management that aims to achieve effective and efficient performance of health centers in managing and planning health development in the region. Data utilization, especially disease data, is a very important part for stakeholders in the decision-making process [4]. Community Health can utilize this data by conducting epidemiological surveillance, which is a security process carried out periodically and systematically against the spread of disease which will later be disseminated to parties involved in disease prevention and other health problems. Surveillance can provide information about health problems by collecting data, analyzing, interpreting and following up on improvements and changes [5].

Alang - Alang Lebar Community Health Center in Palembang City is a crucial entity in providing health services to the community. To improve the effectiveness and efficiency of health services, it is necessary to have an in-depth understanding of the distribution of diseases in the area. Therefore, this research aims to map the distribution of diseases by utilizing Geographic Information System (GIS) as a spatial analysis tool.

Table 2. Most common diseases in the Alang - Alang wide health center area of Palembang City

No	Disease Name	Total
1	Hipertensi	4.182
2	DM	2.623
3	ISPA	1.633
4	Dermatitis	1.526
5	MYOPIA	1.237
6	DYSPEPSIA	1.143
7	ARTRITIS	994
8	MYALGIA	798
9	VERTIGO	795
10	ASMA	771

Source: Profile of Alang - Alang Lebar Health Center, 2022 [6]

A geographic information system (GIS) is a computer-based information system specifically designed to work with data that has spatial information. Its functions include retrieval, checking, integration, manipulation, analysis, and display of spatially referenced data. GIS technology combines common data base operations, such as queries and statistical analysis, with visualization and analysis capabilities associated with mapping. This uniqueness distinguishes GIS from other information systems, making it useful for a variety of needs including explaining events, planning strategies, and predicting possible developments [5]. Public health problems are not only medical in nature, but also related to environmental and geographical factors. By utilizing GIS technology, this research is expected to provide a more holistic understanding of these factors, so that prevention and control efforts can be carried out in a more targeted and precise manner.

2 Literature Review

2.1 Public Health

Public health is a branch of science that focuses on efforts to improve the overall health of populations. [7]. This includes various aspects, from disease prevention, health promotion, intervention, to public health monitoring and evaluation. [8]. The ultimate goal is to create an environment that promotes health and prevents disease and other health problems. Methods used in public health include disease surveillance, epi-demiological analysis, behavioral interventions, health policy, and public education. [9].

2.2 Health Information System

Health Information System (HIS) is the infrastructure used to collect, store, manage, analyze, and disseminate information related to health [10]. The purpose of ICT is to support evidence-based decision making, improve the efficiency and effectiveness of health services, and facilitate monitoring and evaluation of health programs [11]. The main components of ICT include patient data, clinical data, administrative data, and geographic information systems.

2.3 Geographic Information System (GIS)

Geographic Information System (GIS) is a technology used to collect, store, manage, analyze, and present data that has a spatial or geographic component [12]. GIS allows users to understand and analyze spatial patterns and relationships between geographic phenomena and various other variables, including public health. In the context of public health, GIS is used for disease distribution mapping, identification of environmental risk factors, health service planning, and decision-making in disease management [13].

3 Research Methodology



Fig. 1. Research Method

Data collection methods are an important step in the research process to obtain the necessary information. In this study, data on disease distribution and environmental factors will be collected using an integrated approach. The following are the data collection methods that will be used:

3.1 Epidemiological Studies

Data on disease distribution will be collected through epidemiologic studies involving disease surveillance [14]. Epidemiological data including number of cases, severity, and geographical distribution of the disease will be obtained from the medical records of Alang - Alang Lebar Health Center and related health agencies [15].

Disease distribution refers to the pattern and spread of diseases across different geographic locations, populations, or demographic groups. It encompasses the number of cases, the severity of the illness, and the regions affected by specific diseases.

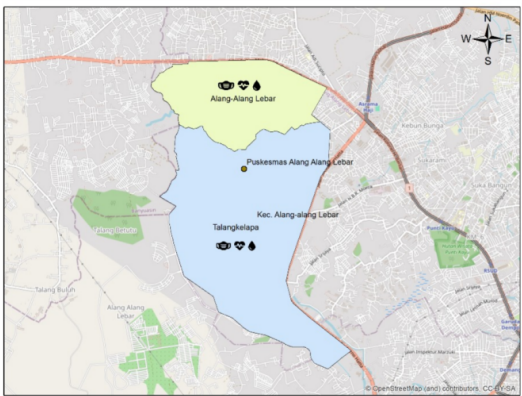


Fig. 2. Disease Distribution

Figure 1 illustrates the geographical distribution of diseases, highlighting the areas affected, the number of cases, and the severity levels within the region.

Table 1. Disease Data Distribution

Urban Village	2022			2023		
	Hipertensi	DM	URTI	Hipertensi i	DM	URTI
Albar	2.786	759	1.264	3.003	212	1.897
Talang kelapa	11.136	3.034	325	12.017	847	455

Source: Alang-alang Lebar Community Health, 2024

Table 1 shows the distribution of diseases in two urban villages, Albar and Talang Kelapa, for 2022 and 2023. The data includes the number of cases for hypertension, diabetes mellitus (DM), and upper respiratory tract infections (URTI). In both years, Talang Kelapa has significantly higher cases of hypertension and DM compared to Albar, with noticeable changes in URTI cases across both villages.

3.2 Field Survey

To collect information on environmental factors affecting disease spread, a field survey will be conducted. The survey will involve direct observation of physical environmental conditions such as air quality, humidity, and the presence of disease vectors.

This data will provide insights into how environmental factors contribute to the prevalence of diseases in specific areas, allowing for better disease prevention and control strategies. In addition to environmental monitoring, figures such as air quality indices and disease vector counts will be compiled to understand the relationship between environmental conditions and the incidence of diseases.

3.3 Interview and Questionnaire

Interviews and questionnaires will be conducted with local communities to obtain information on socioeconomic and behavioral factors that could potentially affect health. This will help in further understanding of the social determinants of health in the area.

In this study, interviews and questionnaires will be conducted with approximately 20 respondents from the local communities in the Alang-Alang Lebar region. These respondents will be selected based on a diverse range of demographic factors, including age, gender, occupation, and education level, to ensure a comprehensive representation of the population. The aim is to gather detailed information on socioeconomic and behavioral factors, such as access to healthcare, lifestyle habits, and hygiene practices, which may influence health outcomes. This approach will provide a deeper understanding of the social determinants of health in the area and their potential impact on disease distribution.

4 Result and Discussion

In this section, the research questions guiding the study will be addressed based on the data and analysis conducted. The key questions explored in this research are as follows:

1. What is the geographical distribution of diseases in the Alang-Alang Lebar Health Center area? This question seeks to identify how diseases are spread across different urban villages and regions within the study area, highlighting any clusters or patterns of high disease prevalence.
2. What environmental factors contribute to the distribution of diseases in the region? This explores the role of physical environmental conditions such as air quality, humidity, and the presence of disease vectors in influencing disease spread.
3. How do socioeconomic and behavioral factors impact health outcomes in the local community? This question investigates how factors like access to healthcare, hygiene practices, and community behavior affect the incidence and severity of diseases in the area.

These questions are answered by analyzing the data collected from epidemiological studies, field surveys, and community questionnaires, which are further visualized through GIS mapping techniques.

The data collected for this study was successfully integrated and processed using ArcMap version 10.8.2. This mapping process involved the visualization of data including the number of cases, geographical distribution of diseases, and environmental factors that potentially affect the distribution of diseases in the Alang-Alang Lebar Health Center area, Palembang City. The resulting map provides a clear and detailed picture of disease distribution patterns, enabling a better understanding of the health dynamics in the area visualized as follows.

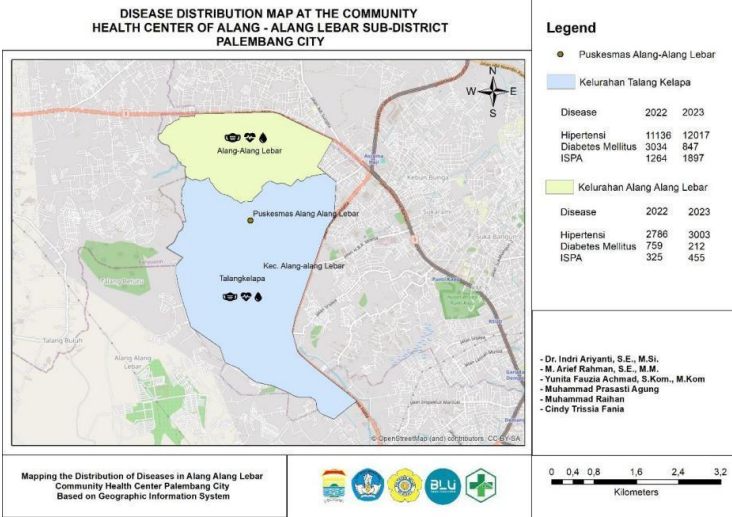


Fig. 3. Visualization of Disease Distribution Map in Alang-Alang Lebar

Figure 3 depicts a map of disease distribution in Alang-Alang Lebar sub-district, Palembang city, visualized using a Geographic Information System. The map divides the sub-district into several wards, each marked with a different color to indicate the existing public health centers. Special symbols are used to mark the location and number of cases of major diseases such as hypertension, diabetes mellitus, and ISPA for the years 2022 and 2023. This data is clearly displayed on the map, which also includes a legend to help users interpret the information presented. The map is effective in visualizing the geographical distribution of diseases, which is crucial for health intervention planning and resource allocation.

5 Conclusion

The conclusions drawn from this research are as follows:

This research has successfully identified and visualized the distribution of diseases in Alang-Alang Lebar Sub-district, Palembang City, using Geographic Information System (GIS) technology. The results show specific patterns in the distribution of diseases such as hypertension, diabetes mellitus, and ARI, which vary between neighborhoods. This data reveals areas that require more attention in terms of health interventions and resource allocation. This analysis helps to illustrate how geographical and environmental factors interact in influencing disease distribution, providing a strong basis for more informed decision-making in public health management.

Future research should focus on expanding the scope of disease monitoring by incorporating additional diseases and exploring longer time periods to track changes in disease patterns over time. It is also recommended to include more detailed environmental data, such as temperature fluctuations and seasonal weather conditions, to further understand their role in disease distribution. Furthermore, integrating real-time data collection and community-based health surveillance systems would

enhance the accuracy of disease mapping and allow for quicker responses to emerging health concerns. Collaboration with local health authorities to implement targeted interventions based on the findings could further improve public health outcomes in the Alang-Alang Lebar area.

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