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Geographical Distribution of Pleural Effusion among Hospitalized Patients in Jember Pulmonary Hospital

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ABSTRACT

Pleural effusion (PE) is a pathological condition that frequently develops in individuals with thoracic or systemic disorders, and if not recognized and treated promptly, it can have fatal consequences. This study aims to describe the epidemiology (distribution of person, time, and location) of pleural effusion among hospitalized patients. Medical records of all patients diagnosed with pleural effusion from July 2022 to June 2023 were reviewed and analyzed. The study included all hospitalized patients found to have pleural effusions, totalling 315 patients. This research used a quantitative descriptive survey, with data analyzed using spatial analysis with GIS across five districts. Patients were analyzed for socio-demographic characteristics and epidemiological distribution, including the level of diagnosis, health assurance type, frequency between months, and geographical distribution, which was analyzed spatially. The highest number of pleural effusion cases among hospitalized patients were in men (57.5%), aged between 46 and 65 years (49.2%), employed as entrepreneurs (20%), non-premium Assistance Beneficiaries for medical bill payment status (47.3%), and mostly with pleural effusion as a secondary diagnosis. The number of pleural effusion cases fluctuated, with distribution in several subdistricts from the five districts in the Jember Pulmonary Hospital. The highest cases were reported in two districts, Jember Regency and Banyuwangi Regency. Population density could be a factor that increases the risk of pleural effusion. A multidisciplinary approach is needed for optimal management.

Keywords: Hospital, Patients, Pleural effusion

1. Introduction

Pleural effusion is a condition characterized by an abnormal accumulation of fluid in the pleural cavity, surpassing its normal capacity, and can manifest as transudate or exudate fluid (D'Agostino & Edens, 2022). The excessive fluid buildup results from an imbalance between pleural fluid production and absorption, which may stem from abnormalities in the lungs, pleura, or systemic issues. Various diseases can trigger this condition, including infections such as tuberculosis, pneumonia, and abscesses, as well as non-infectious causes like lung carcinoma, pleural carcinoma, liver failure, kidney failure, and pulmonary embolism (Bakta et al., 2018).

Pleural effusion stands out as the most common among various pleural conditions observed in both developed and developing countries. Globally, it is estimated that for every one million people, 3,000 individuals are diagnosed with pleural effusion. In the United States alone, there are approximately 1.5 million cases reported annually (Krishna et al., 2023). Etiologically, the primary diseases causing pleural effusion differ between developed and developing countries. In developed nations, it is commonly linked to congestive heart failure, liver cirrhosis, malignancy, and bacterial pneumonia. Case studies from Spain reveal malignancy (27%), heart failure (20%), pneumonia (18%), tuberculosis (9%), pericardial diseases (3.5%), and cirrhosis (3%) as dominant causes. In contrast, developing countries often see pleural effusion associated with

tuberculosis infection and malignancy (J & R., 2013). Unfortunately, there is no national publication data on the prevalence of pleural effusion in Indonesia, but various hospital-based studies have provided insights.

Pleural effusion exacerbates the severity of underlying diseases and increases the risk of mortality compared to patients without the condition (Rathore et al., 2022). A study conducted at Yale-New Haven Hospital in March 2011 emphasized that 14% of patients who underwent chest radiographs or chest X-rays were identified as having pleural effusion. The severity of conditions and a cancer diagnosis were associated with higher death rates, with 35% of deaths occurring in patients with Malignant Pleural Effusion (MPE), 26% in those with multiple benign etiologies, and 7%–14% in patients with transudative causes (T. Puchalski, 2014). Pleural effusion commonly occurs in individuals with accompanying infectious or non-infectious diseases.

Pleural effusion is frequently observed in individuals aged 40 to 59 years. Research results indicate that 50.72% of cases occurred within this age group (Dewi & Fairuz, 2020). Another study found that the age group 40 to 59 years had the highest prevalence of pleural effusion, accounting for 58.3% of cases (Hutagalung et al., 2022). Gender also plays a role in pleural effusion, with one study reporting a 63.77% prevalence among men (Dewi & Fairuz, 2020), while another study states that men constitute 64.9% of cases (Ampow et al., 2023). In the preliminary study, analyzing the ten most reported diagnoses in hospitalized patients revealed that pleural effusion ranked second after pneumonia, with 315 cases documented within a year. Therefore, the researchers aimed to provide a descriptive epidemiological overview (considering the distribution of persons, time, and location) of pleural effusion among hospitalized patients at Jember Pulmonary Hospital.

2. Methods

Medical records of all patients diagnosed with pleural effusion, identified using the ICD-10 code J90 and registered at Jember Pulmonary Hospital in Jember Regency, East Java, Indonesia, from July 2022 to June 2023, were reviewed and analyzed. The samples in this study included all hospitalized patients found to have pleural effusions, totalling 315 patients. The Institutional Review Board approved the conduct of this study. The research adopted a quantitative descriptive approach with a survey component. Data were analyzed using spatial analysis and GIS in five districts. The patients were assessed for their socio-demographic characteristics and epidemiological distribution, including the level of diagnosis, health assurance type, frequency between months, and geographical distribution, which was spatially analyzed and presented on an appropriate map.

3. Results

The findings presented in Table 1 showed that most hospitalized patients diagnosed with pleural effusion fall within the 46 - 65 age group, comprising 155 patients (49.2%), and among them, 181 patients (57.5%) are male. In terms of employment, the predominant occupation is entrepreneur, accounting for 63 patients (20%).

Table 1 Characteristics of hospitalized patients with pleural effusion (n=315)

Characteristic	N	%
Age (years old)		
6 – 25	29	9,2%
26 – 45	70	22,2%
46 – 65	155	49,2%
>65	61	19,4%
Gender		
Male	181	57,5%
Female	134	42,5%
Employment Status		
Unemployed	16	5,1%
Student	20	6,3%
Farmer	57	18,1%
Farm worker	16	5,1%
Entrepreneur	63	20,0%
Housewives	57	18,1%
Civil servant	13	4,1%
Merchant	21	6,7%
Others	52	16,5%

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Regarding medical bill payment and national health insurance coverage (refer to Table 2), the financing status of hospitalized pleural effusion patients is categorized into three groups: Self-funded, Premium Assistance Beneficiaries, and Non-Premium Assistance Beneficiaries. Notably, a substantial proportion of patients belong to the Non-Premium Assistance Beneficiary category, constituting 47.3%.

Table 2 Medical bill payment among hospitalized patients with pleural effusion (n=315)

Medical Bill Payment	**n**	**%**
Self-funded	61	19,4%
Premium Assistance Beneficiaries (JKN PBI)	105	33,3%
Non-Premium Assistance Beneficiaries (JKN NON PBI)	149	47,3%
Total	315	100%

Figure 2 illustrates the fluctuating trend in pleural effusion cases. Additionally, a significant portion of hospitalized pleural effusion cases is identified as secondary diagnoses (54.6%) (see Table 3). This pattern is further evidenced by the cases recorded between July 2022 and June 2023, with the highest instances attributed to pleural effusion as a secondary diagnosis (refer to Figure 1). Figure 1 shows that pleural effusion patients received a primary diagnosis in 115 cases, a secondary diagnosis in 172 cases, and a complication diagnosis in 28 cases. Tuberculosis emerged as the most common primary diagnosis for pleural effusion, being an infectious disease.

Table 3 Diagnosis of hospitalized patients with pleural effusion (n=315)

Diagnosis	**n**	**%**
Primary	115	36,5%
Secondary	172	54,6%
Complication	28	8,9%
Total	315	100%

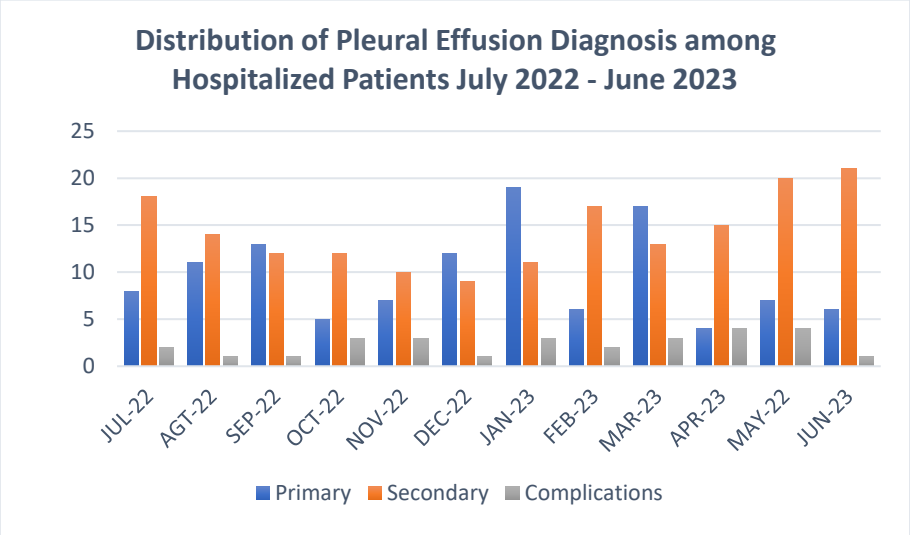

Figure 1 Distribution of Pleural Effusion Diagnosis among Hospitalized Patients between Months

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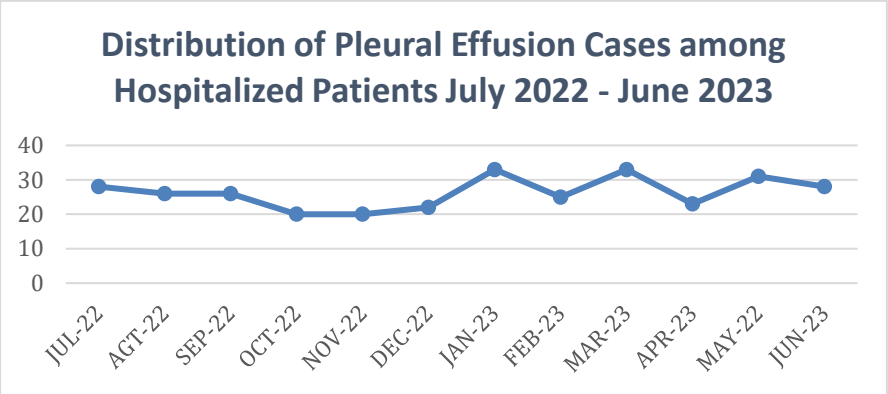

Figure 2 Distribution of Pleural Effusion Cases among Hospitalized Patients between Months

Examining the distribution of pleural effusion cases among hospitalized patients in Jember Regency, specific subdistricts stand out, namely Kaliwates, Patrang, Sumbersari, Balung, Wuluhan, Ambulu, and Silo. Balung Subdistrict reported the highest pleural effusion cases in Jember Regency, totalling 16 cases.

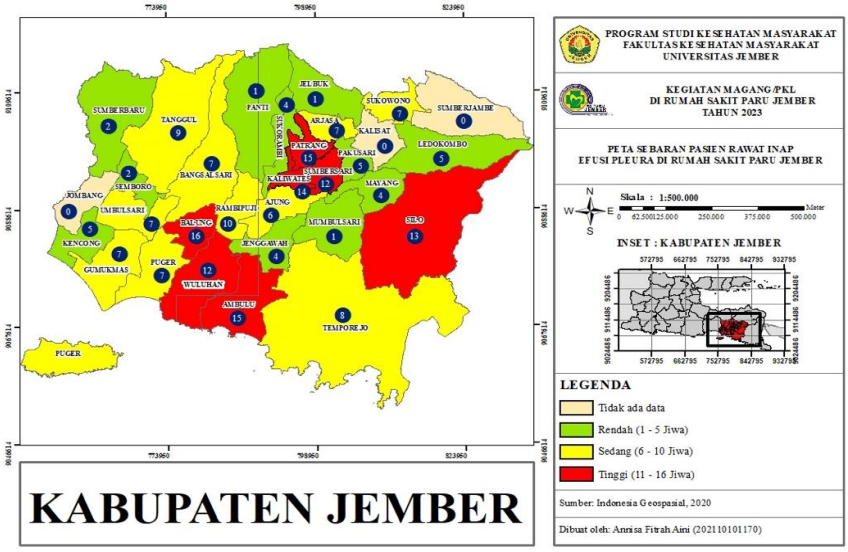

Figure 3 Distribution of Pleural Effusion Cases among Hospitalized Patients in Jember Regency

In Banyuwangi Regency, Pesanggaran Subdistrict recorded the highest number of pleural effusion cases, amounting to 11 cases.

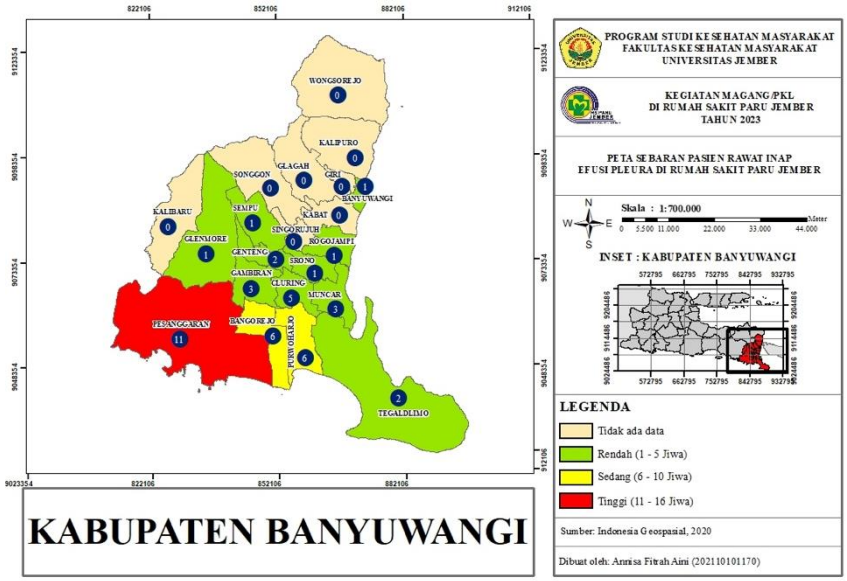

Figure 4 Distribution of Pleural Effusion Cases among Hospitalized Patients in Banyuwangi Regency

In Bondowoso Regency, pleural effusion cases were relatively low, concentrated in Klabang, Cerme, and Bondowoso Subdistricts.

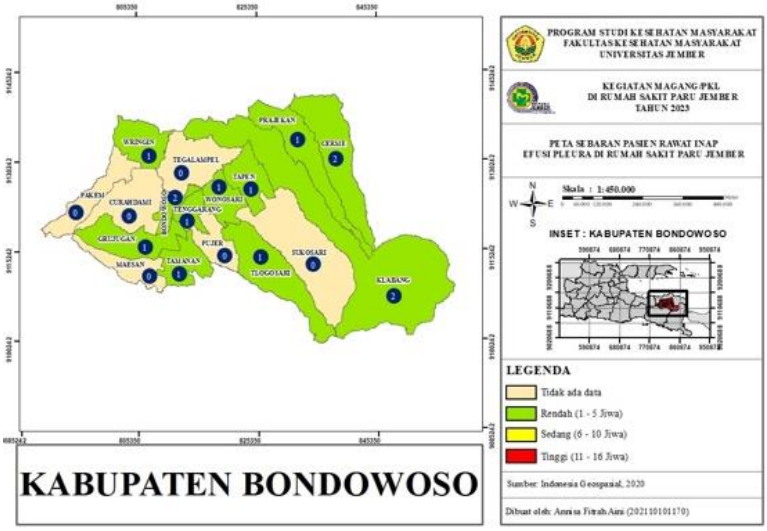

Figure 5 Distribution of Pleural Effusion Cases among Hospitalized Patients in Bondowoso Regency

Situbondo Regency also exhibited a low incidence of pleural effusion cases, with occurrences limited to Panji, Kendit, and Panarukan Subdistricts.

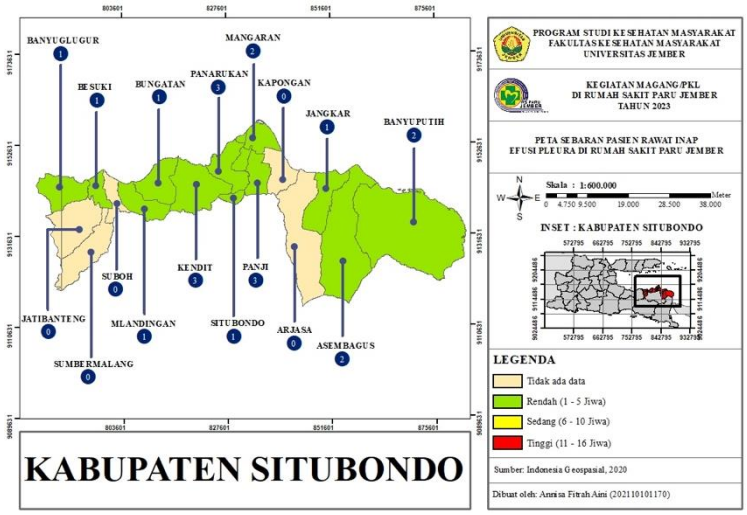

Figure 6 Distribution of Pleural Effusion Cases among Hospitalized Patients in Situbondo Regency

Similarly, in Lumajang Regency, the prevalence of pleural effusion cases was low, confined to Pasirian, Kedungjajang, and Randuagung Subdistricts.

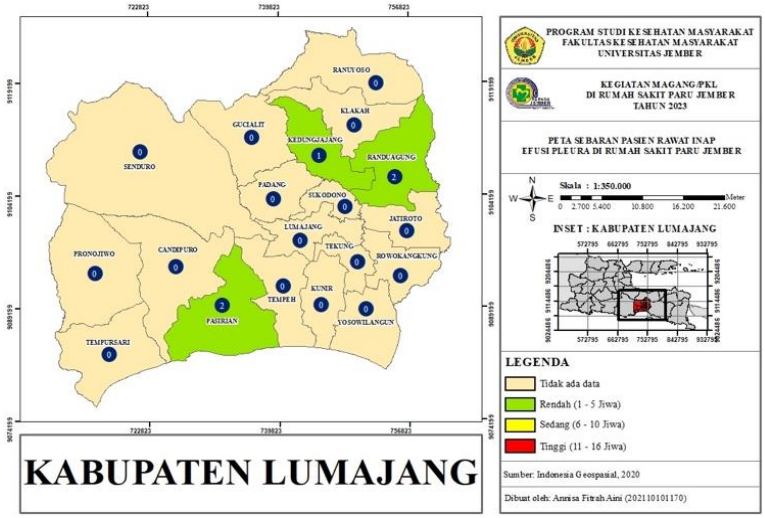

Figure 7 Distribution of Pleural Effusion Cases among Hospitalized Patients in Lumajang Regency

Outside the service area of Jember Pulmonary Hospital, encompassing Jember, Banyuwangi, Bondowoso, Situbondo, and Lumajang Districts, patients from other areas were identified. These patients hailed from Probolinggo Regency (10 cases across six subdistricts), Sumenep Regency (two cases in two subdistricts), Kediri Regency (two cases in two subdistricts), Malang Regency (two cases in two subdistricts), Pati Regency (one case in Batangan Subdistrict), Ogan Komering Ulu Regency (one case in East Baturaja Subdistrict), Bekasi City (one case in Tambun Selatan Subdistrict), Kendal Regency (one case in Gebangan Subdistrict), Wonosobo Regency (one case in Kaliwiro Subdistrict), Sarmi Regency (one case in Sarmi Subdistrict), and Central Lampung Regency (one case in Sendang Agung Subdistrict).

4. Discussion

Based on the study results, the data revealed that the highest number of pleural effusion cases occurs in the age group of 46 - 65 years. This is attributed to the susceptibility of this age group to tuberculosis, which is a fundamental cause of pleural effusion. The productive age group is often affected by pleural effusion due to frequent interactions with others in a busy work environment. Individuals over 45 years old with pleural effusion are typically associated with malignancy. This finding aligns with prior research conducted at Arifin Achmad Hospital Pekanbaru, which reported a high percentage of 39.2% in the age group of 45 – 64 years (Yovi et al., 2017). Another study showed that the age group of 46 – 65 years had pleural effusion primarily due to pulmonary tuberculosis, with a percentage of 42.3% (Ampow et al., 2023).

Gender plays a significant role in a person's quality of life, with men being the most affected by pleural effusion. This is consistent with research conducted in Jambi City, indicating a higher percentage in men compared to women (63.77%) (Adeoye et al., 2017; Dewi & Fairuz, 2020; Khilar & S., 2023). Additional studies support the notion that men have a higher incidence of pleural effusion, especially due to pulmonary tuberculosis, with a percentage of 64.9% (Ampow et al., 2023). This correlation is explained by research suggesting that men, who often consume alcohol and smoke, are more susceptible to pleural effusion. Additionally, their outdoor activities or work expose them to infectious diseases such as tuberculosis and pneumonia (Yovi et al., 2017).

Entrepreneurs were notably overrepresented among pleural effusion patients. Work, as a primary human routine, can influence the likelihood of illness. Entrepreneurial activities, such as trading, pose a risk of exposure to infectious diseases (such as tuberculosis and pneumonia) due to frequent contact with many people. This finding is in line with previous research at Labuang Baji Makassar Regional Hospital, reporting that 42% of patients worked as entrepreneurs (Widys Sari et al., 2022). Similarly, a study at the Bandung Community Pulmonary Health Center found that 70 respondents engaged in entrepreneurial work were susceptible to contracting infectious diseases (Rahmatillah et al., 2018).

Most hospitalized patients with pleural effusion receive a diagnosis as a secondary condition. Pleural effusion often emerges as a secondary consequence of various primary diseases, including pneumonia, pulmonary infections, nephrotic syndrome, connective tissue diseases, neoplastic tumors, comprehensive heart failure, and malignancy. This finding is consistent with prior research conducted at dr. Hasan Sadikin Hospital in Bandung, which detailed clinical diagnoses of pleural effusion attributed to tuberculosis (20 cases), lung cancer (57 cases), malignancy outside the lung (128 cases), unspecified malignancy (10 cases), pneumonia (13 cases), and systemic disease outside the lung (45 cases) (Sidiq et al., 2020). Another study conducted at Sanglah General Hospital noted that pleural effusion was not primarily caused by malignancy but rather resulted from secondary malignancy in 52 patients (Ariyansyah et al., 2020; Khilar & S., 2023).

The most prevalent funding status among hospitalized patients with pleural effusion is Non-Premium Assistance Beneficiaries, who are required to pay their health insurance regularly. The National Health Insurance is a specialized service program by the Social Security Agency on Health, ensuring that participants receive healthcare and protection to meet the basic health needs of every individual, regardless of whether they contribute payments, or the contributions are covered by the government. Participants in the National Health Insurance program are divided into two categories: Non-Premium Assistance Beneficiaries (who pay the health insurance regularly) and Premium Assistance Beneficiaries (whose contributions are covered by the government) (Leni Karunia Septiani et al., 2022).

Non-Premium Assistance Beneficiaries are further categorized into three groups: Wage Receiving Workers, Non-Wage Receiving Workers, and Non-Wage Workers (Kemenkes RI, 2019). In this study, hospitalized pleural effusion inpatients were predominantly composed of entrepreneur workers (such as traders), civil servants, private sector employees, midwives, police officers, and retirees. A previous study conducted at Haji Surabaya General Hospital reported a similar result, indicating that hospitalized patients with Non-Premium Assistance Beneficiaries status accounted for the highest rate at 58% (Worotikan et al., 2019).

The total data for hospitalized patients with pleural effusion within a year was 315. However, the number of pleural effusion cases among hospitalized patients fluctuated between 2022 and 2023. This fluctuation is not seasonally based, as cases occur throughout the year. The occurrence of this condition is influenced by several factors, including exposure to pollution, engaging in activities outside the home, and lifestyle choices such as smoking and alcohol consumption. Previous research explains that individuals engaged in activities outside the home are often exposed to pollution, dust, and viruses, leading to the potential for infectious diseases from both the environment and other individuals. Additionally, individuals frequently involved in activities outside the home are more susceptible to infectious diseases, causing a decrease in their immune system due to frequent contact with many people (Fitrianti et al., 2022). Another study conducted at Pusri Palembang Hospital further elaborates that individual with unhealthy lifestyles, such as frequent smoking and alcohol consumption, can influence other factors (Oscar Ari Wiryansyah, 2019).

Data on the distribution of pleural effusion patients across several subdistricts within the five districts served by Jember Pulmonary Hospital shows two districts with high cases of pleural effusion: Jember Regency and Banyuwangi Regency. This phenomenon is attributed to one public health problem, namely, dense population. Population density in an area can expedite the transmission and spread of infectious diseases, such as tuberculosis and pneumonia, among individuals (Bellytra et al., 2021). Another contributing factor is population mobility, defined as the movement of people from one area to another within a specific period (Badan Pusat Statistik (BPS) RI, 2019). Residents may move seeking improved community facilities like schools, housing, and entertainment venues. This movement can influence the spread of infectious diseases through physical contact, airborne droplets, and contact with bodily fluids. Infectious diseases that frequently lead to pleural effusion include tuberculosis and pneumonia (Kementerian Kesehatan, 2018). Previous research also highlighted that the primary diagnosis for pleural effusion was tuberculosis, an infectious disease (KL et al., 2023).

5. Conclusion

The highest incidence of pleural effusion among hospitalized patients occurred in men (57.5%), within the age range of 46–65 years old (49.2%), and among those working as entrepreneurs (20%). Non-premium Assistance Beneficiaries accounted for 47.3% of medical bill payment status, with pleural effusion predominantly diagnosed as a secondary condition. The number of pleural effusion cases exhibited fluctuations. The distribution of pleural effusion patients across several subdistricts within the five districts served by Jember Pulmonary Hospital showed the highest instances in two districts, namely Jember Regency and Banyuwangi Regency.

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