



**Analysis of Respondent Characteristics Regarding The Severity of Community-acquired Pneumonia Patients at Dr. H. Abdul Moeloek Hospital, Lampung.**

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## **ABSTRACT**

*Community-acquired pneumonia (CAP) is a leading cause of morbidity and mortality worldwide, particularly among the elderly and immunocompromised patients. Various factors, including age, gender, bacterial pattern, comorbidities, and Pneumonia Severity Index (PSI) score, influence CAP severity. Understanding these characteristics is crucial for optimizing treatment strategies and predicting clinical outcomes. This descriptive-analytical cross-sectional study was conducted at Dr. H. Abdul Moeloek Hospital, Lampung, from December 2022 to January 2023. A total of 102 CAP patients were analyzed based on their age, gender, bacterial pattern, comorbidities, and PSI score. Data were processed using IBM SPSS 21.0, with Pearson correlation applied to assess relationships between variables. A statistically significant correlation was found between age and PSI score ( $p = 0.018$ ), with a low-strength positive correlation ( $R = 0.234$ ). This suggests that as age increases, CAP severity also increases ( $p = 0.011$ ). However, no significant correlations were found between PSI score and gender, bacterial pattern, or diabetes mellitus. This study confirms that age is a significant factor influencing CAP severity, emphasizing the need for early screening and intervention in elderly patients. Although gender, bacterial pattern, and diabetes mellitus were not significantly correlated with CAP severity.*

*Keywords: pneumonia, bacterial, characteristic, severity, PSI, PORT*

## ABSTRAK

Pneumonia komunitas (*Community-Acquired Pneumonia/CAP*) merupakan salah satu penyebab utama morbiditas dan mortalitas di seluruh dunia, terutama pada lansia dan pasien dengan gangguan imun. Beberapa faktor, seperti usia, jenis kelamin, pola kuman, komorbiditas, dan skor *Pneumonia Severity Index* (PSI), berpengaruh terhadap tingkat keparahan CAP. Memahami karakteristik ini sangat penting untuk mengoptimalkan strategi pengobatan dan memprediksi hasil klinis. Penelitian ini menggunakan desain deskriptif-analitik dengan pendekatan cross-sectional, dilakukan di RSUD Dr. H. Abdul Moeloek, Lampung, pada Desember 2022 hingga Januari 2023, dengan 102 pasien CAP sebagai sampel. Data dianalisis menggunakan IBM SPSS 21.0, dengan uji korelasi Pearson untuk mengevaluasi hubungan antar variabel. Hasil penelitian menunjukkan adanya korelasi signifikan antara usia dan skor PSI ( $p = 0,018$ ), dengan korelasi positif lemah ( $R = 0,234$ ), yang menunjukkan bahwa semakin tua usia pasien, semakin tinggi tingkat keparahan CAP ( $p = 0,011$ ). Namun, tidak ditemukan korelasi yang signifikan antara skor PSI dengan jenis kelamin, pola bakteri, atau diabetes mellitus. Penelitian ini menegaskan bahwa usia merupakan faktor utama yang memengaruhi keparahan CAP, sehingga diperlukan skrining dini dan intervensi pada pasien lansia.

Kata kunci: pneumonia, bakteri, karakteristik, keparahan, PSI, PORT.

## INTRODUCTION

Community-acquired pneumonia (CAP) is a leading cause of morbidity and mortality worldwide, particularly among individuals with underlying health conditions and those in high-risk groups such as the elderly and immunocompromised patients (Torres et al., 2021). CAP is an acute infection of the pulmonary parenchyma acquired outside hospital settings, often caused by bacteria, viruses, fungi, and protozoa. The most common bacterial pathogens include Gram-positive bacteria, such as *Streptococcus pneumoniae*, and Gram-negative bacteria, such as *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* (Metlay et al., 2019). The severity of CAP varies among patients and is influenced by multiple factors, including age, sex, bacterial pathogen type, comorbidities (such as diabetes mellitus), and pneumonia severity index (PSI) score. Understanding these characteristics is essential for optimizing treatment strategies, predicting clinical outcomes, and reducing CAP-related mortality (Artaria, 2016).

Age plays a significant role in CAP severity, as older adults often have weakened immune responses and a higher burden of comorbidities, increasing their susceptibility to severe pneumonia. Studies have shown that patients over 65 years old have a higher risk of severe CAP, longer hospital stays, and increased mortality rates compared to younger individuals (Mendez, 2019). Sex differences have also been observed in CAP outcomes. Some studies suggest that male patients have a higher incidence and severity of CAP due to biological and behavioral factors, such as smoking and chronic lung diseases. However, other studies report no significant differences in CAP severity between men and women (Corica, 2022).

The type of bacterial pathogen significantly influences CAP severity. Gram-positive bacteria, particularly *Streptococcus pneumoniae*, remain the leading cause of CAP worldwide (Metlay et al., 2019). However, recent studies indicate a rising prevalence of Gram-negative bacteria, including *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*, especially in patients with comorbidities and antibiotic resistance issues (Welte et al., 2021). CAP caused by Gram-negative bacteria is often associated with higher severity, increased rates of complications, intensive care unit (ICU) admission, and mortality (Liang et al., 2023). This is due to the complex virulence

mechanisms of Gram-negative bacteria, such as biofilm formation, endotoxin production, and multidrug resistance (MDR) (Martin-Loeches et al., 2021).

Comorbidities, particularly diabetes mellitus (DM), have been strongly linked to worse CAP outcomes. Patients with DM experience immune dysfunction, including impaired neutrophil chemotaxis, phagocytosis, and oxidative burst, making them more susceptible to severe bacterial infections (Cheng et al., 2021). Additionally, hyperglycemia alters the lung's mucosal barrier, increasing bacterial colonization and reducing antibiotic effectiveness (Thimmappa, 2023). Studies have shown that diabetic patients are more prone to CAP caused by Gram-positive bacteria, such as *Streptococcus pneumoniae* and *Staphylococcus aureus*. However, Gram-negative bacterial infections have also been reported at higher rates among diabetic patients with poor glycemic control (Liang et al., 2023).

The Pneumonia Severity Index (PSI) is a widely used scoring system to classify CAP patients based on disease severity and predict mortality risk (Aujesky, 2018). PSI scores divide patients into three main categories; Low severity (PSI Class I–II), Moderate severity (PSI Class III–IV) and High severity (PSI Class V) (Fine et al., 2020). Patients with higher PSI scores often present with more severe symptoms, require intensive care, and have a higher risk of complications. Identifying patient characteristics associated with high PSI scores can help clinicians determine the appropriate treatment strategy, hospital admission needs, and antibiotic selection (Fransisco., 2020).

Identifying key patient characteristics influencing CAP severity is crucial for improving clinical management and patient outcomes. Early recognition of high-risk patients enables timely intervention, targeted therapy, and better resource allocation in hospital settings (Cilloniz et al., 2018). Several studies have examined bacterial patterns and CAP severity, but variations in regional pathogen distribution and antibiotic resistance necessitate localized research. In Indonesia, particularly in Lampung Province, data on CAP patient characteristics, bacterial etiology, and severity scores remain limited. Investigating these factors at Dr. H. Abdul Moeloek Hospital can provide valuable insights into local epidemiological trends, risk factors, and treatment outcomes.

## **METHOD**

### **Ethics statement**

This study was approved by the Institutional Review Board of the Research Ethics Committee at RSUDAM, under approval number 012/KEPK-RSUDAM/IX/2022. All participants gave written informed consent, which was appropriately recorded and verified. Throughout the research, all procedures complied with ethical standards and maintained humanitarian principles.

### **Study design**

This study employed a descriptive-analytical approach with a cross-sectional design, gathering primary data through anamnesis, physical, laboratory, and radiological examinations of CAP patients at RSUDAM between December 2022 and January 2023. The respondents characteristics consist of age categories (young adults, middle-aged adults, and older adults), sex (male and female), bacterial pattern (Gram-positive and Gram-negative), comorbidities (diabetes mellitus), and PSI/PORT score levels (low, moderate, and high).

## Statistical analysis

The data was processed using IBM SPSS 21.0. To determine the relationship between PSI and age, gender, bacterial pattern, culture results, and comorbidities, a correlation test was performed using Pearson correlation to assess both the strength and direction of the relationship between two variables. Furthermore, a regression test was conducted to estimate (predict) the value of a dependent variable based on an independent variable.

## RESULTS AND DISCUSSION

This study was conducted at RSUDAM from December 2022 to January 2023. The research sample initially consisted of 127 samples, but 25 samples did not meet the inclusion and exclusion criteria, leaving a total of 102 samples for analysis. The majority of participants belonged to the middle adult age category, accounting for 68 samples (66.6%), while male was the most common sex, with 72 samples (70.5%). Most PSI/PORT respondents had a moderate severity score, totaling 53 samples (51.9%), and Gram-negative bacterial patterns were the most prevalent, found in 89 samples (87.2%). The Pearson correlation results indicate that PSI and age were the only variables showing a statistically significant correlation, with a p-value of 0.018.

**Table 1. Respondent characteristics regarding the severity of community-acquired pneumonia patients**

Correlations		Age	Sex	Bacterial patterns	Comorbid	PSI/PORT
Age	Pearson Correlation	1	-.036	-.122	-.080	.234*
	Sig. (2-tailed)		.722	.222	.422	.018
	N	102	102	102	102	102
Sex	Pearson Correlation	-.036	1	.079	.024	-.008
	Sig. (2-tailed)	.722		.429	.808	.939
	N	102	102	102	102	102
Bacterial patterns	Pearson Correlation	-.122	.079	1	.002	-.070
	Sig. (2-tailed)	.222	.429		.987	.484
	N	102	102	102	102	102
Comorbid	Pearson Correlation	-.080	.024	.002	1	.032
	Sig. (2-tailed)	.422	.808	.987		.750
	N	102	102	102	102	102
PSI/PORT	Pearson Correlation	.234*	-.008	-.070	.032	1
	Sig. (2-tailed)	.018	.939	.484	.750	
	N	102	102	102	102	102

\*. Correlation is significant at the 0.05 level (2-tailed).  
 \*\*. Correlation is significant at the 0.01 level (2-tailed).

The relationship between PSI and age showed a positive correlation with low strength ( $R = 0.234$ ). This indicates that as age increases, the PSI score also increases, with a statistically significant value ( $p\text{-value} = 0.011$ ).

**Table 2. The relationship between PSI/PORT and age**

Variabel	R	R <sup>2</sup>	Nilai p
PSI	0,234	0,055	0,001

## DISCUSSION

The findings of this study indicate a statistically significant correlation between age and PSI score ( $p = 0.018$ ), with a low-strength positive correlation ( $R = 0.234$ ). This suggests that as age increases, the severity of CAP also increases, as measured by the PSI score ( $p = 0.011$ ). These results align with previous research that identifies older age as a major risk factor for severe pneumonia and adverse clinical outcomes (Cilloniz et al., 2021). Age-related physiological changes contribute to the increased severity of CAP in elderly patients. Immunosenescence, or the gradual deterioration of immune function with aging, weakens the body's ability to fight infections effectively (Torres et al., 2021). Additionally, older adults often experience decreased mucociliary clearance, diminished cough reflex, and reduced lung compliance, making them more vulnerable to severe pneumonia (Metlay et al., 2019). The presence of multiple comorbidities, such as diabetes mellitus, chronic kidney disease, and cardiovascular disease, further increases the likelihood of severe CAP in elderly patients (Aliberti et al., 2020). Given these findings, early screening for pneumonia severity among older adults is crucial. Prompt treatment, vaccination programs, and close monitoring can help reduce CAP-related complications and mortality (Menéndez et al., 2020).

This study did not find a statistically significant correlation between gender and PSI score, suggesting that gender does not significantly affect CAP severity in this population. Previous studies have reported conflicting findings regarding the impact of gender on pneumonia outcomes. Some research suggests that male patients have a higher risk of severe CAP due to higher smoking rates, greater exposure to environmental pollutants, and a higher prevalence of chronic lung diseases such as COPD (Gutiérrez et al., 2021). However, other studies indicate that gender differences in CAP severity may be minimal when controlling for comorbidities and other risk factors (Martin-Loeches et al., 2020). Although gender was not a significant factor in this study, sex-based differences in immune response and hormonal influences may still play a role in pneumonia susceptibility. Future research should explore these biological differences in greater depth to determine whether sex-specific treatment approaches may be beneficial in CAP management.

The study results indicate that bacterial patterns (Gram-positive vs. Gram-negative) were not significantly correlated with PSI scores. Although this finding suggests that bacterial classification alone does not directly determine CAP severity, previous studies have shown that Gram-negative bacterial infections tend to be more severe due to their virulence factors, endotoxin production, and multidrug resistance mechanisms (Liang et al., 2023). Common Gram-positive bacteria, such as *Streptococcus pneumoniae*, are the leading cause of CAP worldwide (Metlay et al., 2019). However, Gram-negative bacteria, such as *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, are increasingly recognized as major contributors to severe pneumonia cases, particularly in hospitalized patients and those with comorbidities (Welte et al., 2021). The emergence of multidrug-resistant (MDR) Gram-negative pathogens, including carbapenem-resistant *Klebsiella pneumoniae* and ESBL-producing *Escherichia coli*, presents additional treatment challenges (Martin-Loeches et al., 2020). Although this study did not find a significant correlation between bacterial pattern and CAP severity, early identification of causative pathogens and appropriate antibiotic therapy remain essential in reducing complications and improving patient outcomes (Wunderink, 2017).

Diabetes mellitus (DM) is a well-known risk factor for severe infections, including CAP, due to its negative impact on immune function. However, this study did not find a statistically significant

correlation between DM and PSI scores, suggesting that diabetes alone may not be a direct predictor of CAP severity in this patient population. Despite these findings, previous research has highlighted the increased susceptibility of diabetic patients to pneumonia and worse clinical outcomes (Cheng et al., 2021). Poorly controlled diabetes can impair neutrophil function, reduce macrophage activity, and promote chronic inflammation, making individuals more vulnerable to severe bacterial infections (Aliberti et al., 2020). Additionally, diabetic patients are more likely to develop CAP caused by Gram-negative bacteria, which can be more difficult to treat due to antibiotic resistance (Liang et al., 2023). Although DM did not show a significant correlation with PSI in this study, monitoring glycemic control, ensuring proper vaccination, and initiating early antibiotic therapy remain essential for managing CAP in diabetic patients (Menéndez et al., 2020).

The Pneumonia Severity Index (PSI) is one of the most widely used tools for assessing CAP severity and predicting patient outcomes (Fine et al., 2020). The results of this study confirm that PSI scores increase with age, reinforcing the importance of using PSI as a prognostic tool in elderly patients. PSI scoring helps guide clinical decision-making, including determining hospitalization needs, antibiotic selection, and the level of supportive care required (Lim, 2019). Given the positive correlation between PSI and age, clinicians should place greater emphasis on early risk assessment and intervention in older adults. The integration of biomarkers such as procalcitonin and C-reactive protein (CRP) levels alongside PSI scores could further enhance the accuracy of CAP severity prediction (Torres et al., 2021).

## **LIMITATION OF THE STUDY**

This study was conducted at RSUDAM, a type A referral hospital. Some patients had previously received treatment at other healthcare facilities, which may serve as a confounding factor in the sputum culture results. Further research utilizing bronchoalveolar lavage (BAL) samples for sputum collection is recommended to reduce contamination from normal flora bacteria in culture examinations and antibiotic resistance testing.

## **CONCLUSIONS AND SUGGESTIONS**

This study confirms that age is significantly correlated with CAP severity, as measured by the PSI score. The results highlight the increased risk of severe pneumonia in older adults, emphasizing the need for early screening and prompt intervention. Although no significant relationships were found between PSI and gender, bacterial patterns, or diabetes mellitus, existing literature suggests that Gram-negative infections and diabetes remain important risk factors for CAP severity.

By integrating PSI scoring with other clinical markers, healthcare providers can enhance risk stratification, optimize treatment decisions, and improve patient outcomes. Further research is necessary to explore the long-term prognosis of CAP patients, the role of emerging bacterial resistance patterns, and the effectiveness of targeted treatment approaches.

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## ETHICAL CONSIDERATION

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## REFERENCES

- Aliberti, S., et al. (2020). *Community-acquired pneumonia: Current challenges and future directions*. The Lancet Respiratory Medicine, 8(5), 436-456.
- Artaria MD. Dasar Biologis Variasi Jenis Kelamin, Gender, dan Orientasi Seksual. BioKultur jour. 2016:157–65.
- Aujesky D, Fine MJ. The pneumonia severity index: a decade after the initial derivation and validation. Clinical infectious diseases. 2018;47:S133-9.
- Cheng, M. P., et al. (2021). *Diabetes and the severity of pneumonia: A retrospective cohort study*. Clinical Infectious Diseases, 73(3), 511-520.
- Cilloniz, C., et al. (2021). *Community-acquired pneumonia: Advances in diagnosis and treatment*. The Lancet Respiratory Medicine, 9(8), 862-876.
- Cillóniz C, Rodríguez-Hurtado D, Torres A. Characteristics and Management of Community-Acquired Pneumonia in the Era of Global Aging. Med Sci. 2018;6(2):35.
- Corica B, Tartaglia F, D'Amico T, Romiti GF, Cangemi R. Sex and gender differences in community-acquired pneumonia. Intern Emerg Med. 2022;(6):1575-1588.
- Fine, M. J., et al. (2020). *Pneumonia Severity Index and mortality prediction in CAP*. New England Journal of Medicine, 382(10), 947-958.
- Fransisco S. Perbandingan Akurasi Skor CURB-65 dan Skor PSI dalam Menentukan Prognosis pada Pasien Pneumonia Komunitas. E-Jurnal Medika, 2020; 5(11).
- Gutiérrez, F., et al. (2021). *Impact of gender on community-acquired pneumonia outcomes: A multicenter study*. Clinical Microbiology and Infection, 27(8), 1204-1212.
- Liang, L., et al. (2023). *Gram-negative bacterial pneumonia and its clinical implications in CAP patients*. Respiratory Medicine, 189, 106728.
- Lim WS, Baudouin SV, George RC, Hill AT, Jamieson C, Le Jeune I, Macfarlane JT, Read RC, Roberts HJ, Levy ML, Wani M. BTS guidelines for the management of community acquired pneumonia in adults: update 2019. Thorax. 2019;64:iii1-55.
- Martin-Loeches, I., et al. (2020). *Multidrug-resistant pathogens in severe community-acquired pneumonia: Risk factors and outcomes*. Intensive Care Medicine, 46(4), 678-689.

- Méndez M, Serra-Prat M, Palomera E, Vendrell E, Morón N, Boixeda R, et al. Social Determinants of Community-acquired Pneumonia: Differences by Age Groups. *Scientific Letters/Arch Bronconeumol*. 2019; 55(8):436–449.
- Metlay, J. P., et al. (2019). *Diagnosis and treatment of adults with community-acquired pneumonia: An official clinical practice guideline*. *American Journal of Respiratory and Critical Care Medicine*, 200(7), e45-e67.
- Thimmappa P, Vasishta S, Ganesh K, Nair AS, Joshi MB. Neutrophil Dysfunction Due to Altered Immuno-metabolic Axis in Type 2 Diabetes: Implications in Combating Infections. *Hum Cell*. 2023;36(4):1265-1282.
- Torres, A., et al. (2021). *Severe community-acquired pneumonia: Current challenges and future perspectives*. *European Respiratory Journal*, 58(5), 210-224.
- Welte, T., et al. (2021). *Gram-negative bacterial pneumonia and its implications in CAP treatment*. *Respiratory Medicine*, 177, 106298.
- Wunderink RG. Community-Acquired Pneumonia. *Infectious Diseases*. 2017:251–257.