

Rationality of antibiotics prescription on pneumonia patients at the Indonesia Air Force Center Hospital (RSPAU) Dr. Suhardi Hardjolutito, Yogyakarta

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ABSTRACT

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Irrational antibiotic prescriptions on pneumonia patients is common in hospitals. This study aimed to evaluate the rationality of antibiotics prescription on pneumonia patients at the Indonesia Air Force Center Hospital (RSPAU) Dr. Suhardi Hardjolutito, Yogyakarta. It was a cross-sectional study using prescriptions for inpatients and outpatients suspected of community acquired pneumonia (CAP) submitted to the Medical Record Installation. All prescribed drugs, including their dosage, duration, route of administration, and demographic information of patients were extracted. The rationality of antibiotic use was then evaluated using the Gyssens and PCNE methods by assessing the antibiotic use with standard treatments based on the Clinical Pathway of RSPAU Dr. Suhardi Hardjolutito, Yogyakarta and the Guideline for the Use of Antibiotics of the Ministry of Health, Republic of Indonesia number 28 in 2021. A total of 124 pneumonia patient prescriptions were evaluated. The rationality of antibiotic prescriptions based on the Gyssens and PCNE criteria were 65.7% and 65.26%, respectively. The irrational of antibiotics based on the Gyssens method consisted of incomplete antibiotic prescription (2.90%), antibiotics not indicated (2.23%), medications prescribed cost more than substitute medications (8.20%), and less duration of medications (19.40%). Furthermore, the irrationality of antibiotics based on the PCNE method consisted of untreated symptoms or indications (8.33%), treatment issues related to cost-effectiveness (1.39%), too short duration of medications (23.61%), and incorrect medication administration or dosage interval timing (1.39%). In conclusion, in general, the antibiotics prescription on pneumonia patients at the RSPAU Dr. Suhardi Hardjolutito was rational. However, this rationality can still be improved.

ABSTRAK

Peresepan antibiotik yang tidak rasional pada pasien pneumonia sering terjadi di rumah sakit. Penelitian ini bertujuan untuk mengevaluasi rasionalitas peresepan antibiotik pada pasien pneumonia di Rumah Sakit Pusat Angkatan Udara (RSPAU) Dr. Suhardi Hardjolutito, Yogyakarta. Jenis penelitian ini adalah potong lintang menggunakan resep untuk pasien rawat inap dan pasien rawat jalan yang diduga menderita *community acquired pneumonia* (CAP) yang ada Instalasi Rekam Medis. Semua obat yang diresepkan, termasuk dosis, durasi, rute pemberian dan informasi demografi pasien dikumpulkan. Rasionalitas penggunaan antibiotik dievaluasi menggunakan metode Gyssens dan PCNE dengan menilai penggunaan antibiotik dengan pengobatan standar berdasarkan Alur Klinis RSPAU Dr. Suhardi Hardjolutito, Yogyakarta dan Pedoman Penggunaan Antibiotik Kementerian Kesehatan Republik Indonesia nomor 28 tahun 2021. Sebanyak 124 resep pasien pneumonia telah dievaluasi. Rasionalitas peresepan antibiotik berdasarkan kriteria Gyssens dan PCNE masing-masing sebesar 65,7% dan 65,26%. Ketidakrasionalan penggunaan antibiotik berdasarkan metode Gyssens terdiri atas antibiotik yang diresepkan tidak lengkap (2,90%), antibiotik yang tidak diindikasikan (2,23%), obat yang diresepkan harganya lebih mahal dibandingkan obat penggantinya (8,20%), dan durasi obat yang kurang (19,40%). Selain itu, ketidakrasionalan penggunaan antibiotik berdasarkan metode PCNE terdiri dari gejala atau indikasi yang tidak diobati (8,33%), permasalahan pengobatan terkait efektivitas biaya (1,39%), durasi pengobatan yang terlalu singkat (23,61%), dan kesalahan pemberian obat atau waktu interval dosis (1,39%). Simpulan, secara umum peresepan antibiotik pasien pneumonia di RSPAU Dr. Suhardi Hardjolutito adalah rasional. Namun tingkat rasionalitasnya ini masih bisa ditingkatkan.

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INTRODUCTION

Pneumonia is an inflammatory condition of the lung that primarily affects the lung parenchyma distal to the terminal bronchioles including the respiratory bronchioles and alveoli resulting in lung tissue consolidation and interruption of local gas exchange.¹ People with pneumonia suspect are characterized by fever accompanied by shaking chills, a productive cough, shortness of breath, cloudy-colored sputum, and plural hemoptosis.² In 1999, the World Health Organization (WHO) listed pneumonia as one of the causes of death related to acute respiratory infections. According to the SEAMIC Health Statistics data in 2001, pneumonia was the sixth leading cause of death in Indonesia.³

Pneumonia is usually caused by viruses or bacteria and less commonly by microorganisms. *Streptococcus pneumoniae*, and *Mycoplasma pneumoniae* are the most common cause of pneumonia.⁴ Pneumonia can be very serious and even cause death due to its complications including respiratory failure, sepsis, and lung abscess. Microbial identification of microorganisms causing pneumonia is an important issue for the appropriate therapy of pneumonia.⁵ Blood test is commonly used to determine the cause of pneumonia. However, it usually takes a few days to identify bacteria which to be targeted for definitive antimicrobial therapy. Therefore, initial empiric antimicrobial therapy in patients with pneumonia is recommended until the blood test results can be obtained to guide the definitive antimicrobial therapy.⁶

Irrational use of antibiotics in patients with suspected community-acquired pneumonia (CAP) is widely reported worldwide. A study conducted in Dr. Sardjito General Hospital, Yogyakarta reported that 28.3% of children with pneumonia received irrational antibiotic treatment.⁷ Another study conducted in a private hospital in Surakarta, Center Java reported that inappropriate antibiotic choice in pediatric patients with pneumonia is 72.2%.⁸ The irrational

use of antibiotics in patients suspected of CAP is not only reported in Indonesia, but also in other countries. A study conducted in a Chinese pediatric hospital reported that 59.6% of patients received inappropriate antibiotics empirical therapy.⁹ High percentages of irrational use of antibiotics were also reported in Mongolia (56.6%), Turkey (56.6%), and India (56.0%).^{10,11}

Several factors cause the irrational use of antibiotics including patients or general public factors and health care providers.^{12,13} The patients or general public factors includes 1) lack of public knowledge and awareness, 2) access to antibiotics without prescription, and 3) leftover antibiotics. The health care providers include 1) knowledge, attitude, and perception regarding antibiotic use and resistance, 2) lack of adequate education, 3) pharmaceutical promotion, 4) lack of rapid and sufficient diagnostic tests and local antibiotic susceptibility data, and 5) patient–doctor interaction.¹²⁻¹⁴ Furthermore, the irrational use of antibiotics affects public health worldwide. It leads to decreased treatment outcomes, drug resistance, increased treatment costs, and death.^{5,7,15} Due to the negative impacts of the irrational use of antibiotics, regular evaluation of the use of antibiotics in public health care is needed. This study aimed to investigate the rationality of antibiotics prescription on pneumonia patients at the Indonesia Air Force Center Hospital (RSPAU) Dr. Suhardi Hardjolukito, Yogyakarta. The results of this study will be beneficial to the management in improving the quality use of antibiotics in the hospital.

MATERIALS AND METHODS

Study design and samples

This study was a cross-sectional study with retrospective data collection methods. This study was conducted at the Medical Record Installation of the RSPAU Dr. Suhardi Hardjolukito, Yogyakarta. The sample of study was all patients diagnosed with pneumonia both inpatients and outpatients at the

RSPAU Dr. Suhardi Hardjolukito from January 2021 to December 2022, who met the inclusion and exclusion criteria. The inclusion criteria were pneumonia patients prescribing antibiotics, whereas the exclusion criteria were pneumonia patients with comorbidities, incomplete medical record data, and problems necessitating antibiotic combination therapy. Sampling was conducted using the total sampling method. The protocol of this study has been approved by the Medical and Health Research Ethics Committee, Faculty of Medicine, Public Health dan Nursing, Universitas Gadjah Mada, Yogyakarta

Data collection

Prescriptions for patients with suspected CAP written on the prescription by the prescriber submitted to the Medical

Record Installation was collected. All prescribed drugs, including their dosage, duration, route of administration and demographic information of patients were extracted from the prescriptions. The rationality of antibiotic use was then evaluated using the Gyssens and PCNE methods by assessing the use of antibiotic therapy received by patients with standard treatments based on the Clinical Pathway of RSPAU Dr. Suhardi Hardjolukito, Yogyakarta and the Guideline for the Use of Antibiotics of the Ministry of Health, Republic of Indonesia number 28 in 2021.

Based on the Gyssens method, the antibiotics use was considered rational if it met the criteria for each evaluation stage with a Gyssens flow chart so that it was included in category 0. Whereas, the antibiotics use was considered irrational if it met categories I to VI (TABLE 1).

TABLE 1. The rationality of antibiotic use based on Gyssens method

	Gyssens category	Rational (category 0)	Irrational (category I–VI)
The completeness of data	Complete data	√	–
	Incomplete data	–	√ (VI)
Indication	Appropriate indication	√	–
	Inappropriate indication	–	√ (V)
Effectiveness	Effective antibiotics (according to the culture results and germ maps)	√	–
	Other antibiotics are more effective	–	√ (IVA)
Toxicity	Antibiotics are safe/non-toxic	√	–
	Other antibiotics are less toxic	–	√ (IVB)
Cost	Cheap antibiotics	√	–
	Other antibiotics are cheaper	–	√ (IVC)
Spectrum	Narrow spectrum antibiotics	√	–
	Other antibiotics have a narrower spectrum	–	√ (IVD)
Duration	Appropriate duration	√	–
	Duration is too long (> 14 d)	–	√ (IIIA)
	Duration is too short (< 2 d)	–	√ (IIIB)
Dose	Proper dose	√	–
	Inproper dose	–	√ (IIA)
Interval	Proper interval	√	–
	Inproper interval	–	√ (IIB)
Route	Proper route	√	–
	Inproper route	–	√ (IIC)
Time	Proper time	√	–
	Inproper time	–	√ (I)

Based on the Pharmaceutical Care Network Europe V8.02 (PCNE V8.02), the Drug Related Problems (DRPs) has five domains TABLE 2, i.e. problem type (P), cause (C), intervention (I), acceptance of intervention (A), and outcome (O). In this study the rationality of antibiotic use was only investigated based on the problems types (P) and causes (C) of DRPs. In depth interviews with doctors who prescribe antibiotics and pharmacists who provide prescribing services were also conducted.

Data analysis

Data of the rationality of antibiotic prescriptions analysis were presented

as frequency or percentage. Descriptive analysis was then conducted to determine the rationality of the antibiotics prescription based on Gyssens and PCNE criteria.

RESULTS

TABLE 3 shows the characteristics of patients with pneumonia at RSPAU Dr. Suhardi Hardjolukito, Yogyakarta in 2021-2022. Most patients were men (56.3%) and their final education was at the elementary-high school level (49.4%). The discharge condition of pneumonia patients improved mostly (86.3%). A total of 65% of pneumonia patients have one comorbidity.

TABLE 2. Pharmaceutical Care Network Europe V8.02 (PCNE V8.02)

Class	Code V8.02	Primary domain
Problems	P1	Treatment effectiveness
	P2	Treatment safety
	P3	Others
Causes	C1	Drug selection
	C2	Drug form
	C3	Dose selection
	C4	Treatment duration
	C5	Dispensing
	C6	Drug use/process
	C7	Patient related
	C8	Other
Planned interventions	I0	No intervention
	I1	At prescriber level
	I2	At patient level
	I3	At drug level
	I4	Other
Intervention acceptance	A1	Intervention accepted
	A2	Intervention not accepted
	A3	Other
Status of the DRP	O0	Problem status unknown
	O1	Problem solved
	O2	Problem partially solved
	O3	Problem not solved

TABLE 3. Characteristics of pneumonia patients (n=160) at RSPAU Dr. Suhardi Hardjolukito, Yogyakarta in 2021-2022

Variable	Quantity
Gender [n (%)]	
• Female	70 (43.8)
• Male	90 (56.3)
Age (mean \pm SD yr)	50.38 \pm 21.08
Weight (mean \pm SD kg)	53.77 \pm 24.64
Education [n (%)]	
• Unknown	53 (33.1)
• Elementary-highschool	79 (49.4)
• Diploma- doctoral	28 (17.5)
Discharge from hospital [n (%)]	
• Unknown	2 (1.3)
• Healed	7 (4.4)
• Improved	138 (86.3)
• Not healed	5 (3.1)
• Die	8 (5.0)
Comorbidity [n (%)]	
• 1 comorbidity	104 (65.0)
• >1 comorbidity	56 (35.0)
Length of stay (mean \pm SD d)	9.60 \pm 6.281

TABLE 4. Gyssens criteria analysis of antibiotics prescription in pneumonia patients at RSPAU Dr. Suhardi Hardjolukito 2021-2022 (n=134)

Gyssens parameters	Irrational (category I–VI)	n (%)
Incomplete data	VI	4 (2.90)
Not indicated of antibiotics	V	3 (2.23)
Medications prescribed cost more than substitute medications.	IVC	11 (8.20)
Less duration of medications	IIIB	26 (19.40)
Appropriate use of antibiotics	0	88 (65.67)
Total		160 (100)

Furthermore, the rational of antibiotic prescription based on PCNE criteria analysis (TABLE 5) was 65.28% and the others were irrational (34.72%). The irrational of antibiotic prescription consisted of 1) untreated symptoms or indications (8.33%), 2) treatment issues related to cost-effectiveness (1.39%), 3) too short duration of medications (23.61%), and 4) incorrect medication administration or dosage interval timing (1.39%).

The rational of antibiotic prescription on pneumonia patients based on Gyssens criteria analysis (TABLE 4) was 65.67%, and the others were irrational (34.33%). The irrational of antibiotic prescription consisted of 1) in complete of antibiotic prescription (2.90%), 2) antibiotics not indicated (2.23%), 3) medications prescribed cost more than substitute medications (8.20%), and 4) less duration of medications (19.40%).

TABLE 5. PCNE criteria analysis of antibiotics prescription in pneumonia patients (n=134) at RSPAU Dr. Suhardi Hardjolukito in 2021-2022

Variable	Code V8.01	n (%)
Untreated symptoms or indications	P1.3	6 (8.33)
Treatment issues related to cost-effectiveness	P3.1	1 (1.39)
Too short duration of medication	C4.1	1 (23.61)
Incorrect medication administration or dosage interval timing	C6.1	1 (1.39)
Appropriate/wise use of antibiotics	-	47 (65.28)
Total		72 (100)

DISCUSSION

A total 160 pneumonia patient prescriptions were selected in this study. Due to inadequate and incomplete data, 26 prescriptions were excluded. Some of the pneumonia patients with COVID-19 infection were included in this study. In this study, the rational antibiotic prescriptions based on the Gyssens and PCNE criteria were 65.7% and 65.26%, respectively.

Studies concerning rationality of the use antibiotics in pneumonia patient have been conducted in some Hospital in Indonesia with various results. A study conducted in Inpatient Wards at H Abdul Moeloek Distric Hospital, Lampung in 2025 reported that the rational use of antibiotics in pneumonia patients based on Gyssens criteria was 44.7%.¹⁷ Another study in pneumonia patients conducted at the Pediatric Intensive Care Unit, Hermina Private Hospital, Bekasi reported that the rational use of antibiotics evaluated by using Gyseens method by RASPRO concept achieved 63.03%.¹⁸ A study about the rationality of antibiotics use in adult patients with CAP at the Prof. Dr. RD Kandou General Hospital, Manado within the period of June 2017-May 2018 reported that in general the antibiotics use was rational evaluated by using DDD WHO criteria. The most prescribed antibiotic classes were beta-lactam, macrolides, and fluoroquinolone, meanwhile the most

prescribed antibiotics were ceftriaxone and azithromycin.¹⁹ A study conducted in Inpatient Wards at Dr. Soeselo District Hospital, Slawi, Central Jawa reported that the rational use antibiotics evaluated by Gyssens method was only 20.2%.²⁰

In this study, the irrational antibiotic prescriptions based on both the Gyssens and PCNE criteria were still observed (TABLE 4 and 5). The irrational of antibiotic based on Gyssens method consisted of 2.90% category VI (in complete of antibiotic prescription, 2.23% category V (antibiotics not indicated), 8.20% category IVC (medications prescribed cost more than substitute medications), and 19.40% category IIIB (less duration of medications). In addition, the irrational of antibiotic based on PCNE method consisted of 8.33% code P1.3 (untreated symptoms or indications), 1.39% code P3.1 (treatment issues related to cost-effectiveness), 23.61% code C4.1 (too short duration of medications), and 1.39% code C6.1 (incorrect medication administration or dosage interval timing). Rusmini¹⁷ reported that the irrational antibiotics use on pneumonia patients at H Abdul Moeloek Distric Hospital, Lampung is 55.3% consisting of 47.1% category IVA (other antibiotics are more effective) and 8.2% category IVD (other antibiotics have a narrower spectrum). A study conducted at Dr. Soeselo Distric Hospital, Slawi showed 79.8% of antibiotics use on pneumonia patients were irrational.²⁰

Although the rationality of antibiotic prescription on pneumonia patients is relatively high (>65%) in this study, however, its irrationality of the antibiotic prescription is also still high. The biggest proportion of the irrationality based on the Gyssens method (19.4%) was at category IIIB (less duration of medications) similar to the PCNE (23.61%) method at code C4.1 (too short duration). This result is consistent with the result of a study conducted at the Universitas Erlangga Hospital, Surabaya which reported that the most common irrational was category IIIB.²¹ The most common irrational antibiotics use of category IIIB (76.9%) was also reported CAP patients at the Universitas Airlangga Hospital, Surabaya.²¹ Antibiotics should be administered until clinical improvement is achieved and is strongly recommended to be administered according to the guideline. The less or short duration of the antibiotic administration could contribute to antimicrobial resistance and nosocomial infection.²²

Antibiotic prescription practice in hospital is a complex practice that is influenced by many factors. Clinical guidelines, previous patient experience, physician experience, colleagues' prescribing practice, pharmaceutical pressure, time pressure, and financial considerations could influence the antibiotic prescription.^{22,23} Intervention should be conducted to improve the irrational of antibiotic prescription in hospital for example through continuous medical education and training to promote the rational of antibiotic prescription.

CONCLUSION

In conclusion, in general, the antibiotics prescription on pneumonia patients at the RSPAU Dr. Suhardi Hardjolukito was rational. The rationality reaches 65.67% based on Gyssens method and 65.28% based on PCNE. However, this rationality can

still be improved through continuous medical education and training.

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