
ASSESSMENT OF THE USE OF ANTIBIOTICS IN PATIENTS PNEUMONIA INPATIENT IN SULTAN AGUNG RSI SEMARANG WITH METHOD ATC/DDD

Andrey Wahyudi ¹⁾; Sulih Pertiwi ¹⁾

1) Undergraduate Program of Pharmacy, Faculty of Health, Ngudi Waluyo University, Ungaran
Regency, Centre of Java, Indonesia

* Correspondence to: andreywahyudi4@gmail.com

Abstract: Pneumonia is an acute infectious disease that attacks the lung tissue, caused by viruses, bacteria, fungi and parasites that cause inflammation of the lung parenchyma and accumulation of inflammation in the respiratory tract. One of the treatments for pneumonia is antibiotics. It is necessary to control antibiotic resistance by evaluating antibiotics. This study purposed to evaluating the profile of antibiotic used in quantitative method to pneumonia patients at RSI Sultan Agung Semarang which was calculated using the ATC/DDD method. This research conducted retrospective cohort with cross sectional design. The sampling technique was used total sampling on 34 Pneumonia inpatients obtained from patient medical record. Subsequently, patient data analyzed by quantitatively using the ATC/DDD method. There are 5 types a single antibiotics used for pneumonia therapy, namely Levofloxacin (50%), Ceftriaxone (14.71%), Moxifloxacin (14.71%), Cefoperazone (11.76%), Meropenem (2.94%), and 2 types was used in combination, namely Loevofloxacin + Ciprofloxacin (2.94%) and Meropenem + Cefotaxime (2.94%). The value of DDD/100 days of hospitalization was 70.5 DDD/100 days of hospitalization with the highest antibiotic, namely Levofloxacin, of 40 DDD/100 days of hospitalization. Antibiotics included in the 90% segment were Levofloxacin (56.74%) and Moxifloxacin (18.71%). The most widely used antibiotic in pneumonia patients is Levofloxacin (50%). The total value of DDD/100 days of hospitalization for 1 period is 70.5 DDD/100 days of hospitalization. Antibiotics included in the 90% segment are Levofloxacin and Moxifloxacin

Keywords: Pneumonia, Antibiotic, ATC/DDD

INTRODUCTION

Infection is a condition caused by the attack and multiplication of microorganisms (bacteria, viruses and parasites) that basically do not originate from within the body. Infection can occur in only one area of the body and can spread through the blood so that it becomes comprehensive or causes symptoms of disease (Ladyani & Zahra, 2018). One of the most common infectious diseases is Acute Respiratory Infection (ARI). ARI is an acute respiratory disease which includes the upper respiratory tract such as rhinitis, pharyngitis and otitis as well as the lower respiratory tract such as laryngitis, bronchitis, bronchiolitis and pneumonia which can last for 14 days (Padila *et.al.*, 2019).

Pneumonia is defined as an inflammation of the lungs caused by microorganisms (bacteria, fungi, parasites), excluding *Mycobacterium tuberculosis*. Pneumonia treatment consists of antibiotic therapy, supportive therapy, and anti-inflammatory therapy. Antibiotic therapy is given based on microorganism data and susceptibility test results. The effect of antibiotics is useful for killing and inhibiting the growth of



bacteria and viruses, so for empirical antibiotics to be used in hospitalized pneumonia patients, namely the betalactam group, 2nd generation cephalosporins, and iv respiratory fluoroquinolones (Mulyana, 2019).

Evaluation of the use of antibiotics in pneumonia is carried out by obtaining data from medical records that will be collected and evaluated using standard methods. The standard method is in accordance with WHO guidelines for evaluating the use of antibiotics quantitatively, namely using Anatomical therapeutic Classification (ATC) / Defined Daily Dosage (DDD). ATC is a drug clarification system based on its pharmacology, chemical compounds and therapeutic functions which are then interpreted in units of DDD/100 patient-days. DDD is the assumption of the average dose per day of antibiotic use for pneumonia patients in adults (Prasetyo & Kusumaratni, 2018).

METHODS

This study purposed to evaluating the profile of antibiotic used in quantitative method to pneumonia patients aged 18-65 years at RSI Sultan Agung Semarang which was calculated using the ATC/DDD method. This research conducted retrospective cohort with cross sectional design in 2021. The sampling technique was used total sampling on 36 Pneumonia inpatients obtained from patient medical record. Subsequently, patient data analyzed by quantitatively using the ATC/DDD method.

Medical records of patients diagnosed with pneumonia in the absence of comorbidities and receiving antibiotic therapy. Complete medical record (age, sex, diagnosis, length of stay, drug data in the form of antibiotic name, dose, duration of administration, and route of administration). Pneumonia patients aged 18-65 years. Medical records of pneumonia patients who died or were referred to other hospitals. Patients with other infections

This study uses descriptive data analysis to provide an overview of the research results obtained. The resulting data will be obtained using Microsoft Excel 2021 and the data is presented in tabular form. The data obtained were analyzed quantitatively using the ATC/DDD (Anatomical Therapeutic Chemical / Defined Daily dose). Data analysis carried out includes:

1. The antibiotics used at RSI Sultan Agung Semarang are classified based on the ATC code.
2. The quantity of antibiotic use is calculated based on the quantity data of drug use from the Hospital management information system

Number of doses = Quantity used × Dosage Form

3. Retrieving inpatient data, the amount of drug use using the unit DDD/100 is calculated by the formula: DDD/100 days of hospitalization:

$$\frac{\text{Amount Antibiotics Used (gram)}}{\text{DDD WHO (gram)}} \times \frac{100}{\text{LOS}}$$

4. Calculating DU 90% use of each drug:

$$\text{DU 90\%} = \frac{\text{DDD/100}}{\text{Total}_{100}^{\text{DDD}} \text{days of hospitalization}} \times 100 \%$$

RESULT AND DISCUSSION

Research was conducted by taking medical record data hospitalized pneumonia patients with a sample of 34 patients obtained from the analysis using the LPD in accordance with the contents of the RSI Sultan Agung form Semarang



Patient Characteristics

Table 1. Patient Characteristics in RSI Sultan Agung Semarang Period January – December 2021

Characteristics Study	Amount (n=34)
Gender (%)	
Man	18 (52.94%)
Woman	16 (47.06%)
Age Range	
17-25	1 (2.94%)
26-35	1 (2.94%)
36-45	7 (20.59%)
46-55	7 (20.59%)
56-65	18 (52.94%)

Based on **Table 1** above, characteristics demographics patient pneumonia at RSI Sultan Agung Semarang from January to December 2021 by type sex obtained results that is patient man more than in female patients, namely 52.94%. patient with type male sex - males more than females with a ratio 2,1:1. Results study on patient pneumonia with type sex more men than women by 52.94% and 47.06%.

Profiles Use of Antibiotics

The antibiotic profiles use in pneumonia patients at RSI Sultan great Semarang period January – December 2021 looks at **Table 2**:

Table 2. Profile Use of Antibiotics

No	Class	n (%)	Antibiotics	n (%)
Single				
1	Fluroquinolones	22 (64,71)	Levofloxacin	17 (50)
			Moxifloxacin	5 (14,71)
2	Cephalosporins	9 (26,47)	Ceftriaxone	5 (14,71)
			Cefoperazone	4 (11,76)
3	Carbapenems	1 (1,94)	Meropenem	1 (2,94)
Combination				
1	Fluroquinolones	1 (2,94)	Levofloxacin + Ciprofloxacin	1 (2,94)
2	Carbapenems + Cephalosporins	1 (2,94)	Meropenem + Cefotaxime	1 (2,94)

Long Day Treat Stay / Length of Stay (LOS)

Method count LOS or long take care is with subtract (date out – date in) + 1 day, then value LOS each patient summed up for get score LOS total. Data LOS patient pneumonia in RSI Sultan great Semarang period January-December 2021 looks on Table 3 below:



Table 3. Amount Day treat stay Patient Pneumonia

Month	Number of Patients	LOS (days)
January	7	50
February	3	15
March	2	40
April	5	22
May	3	11
June	1	8
July	5	43
August	1	3
September	3	21
October	2	11
November	1	7
December	1	4
Total	34	235

In this study, the total LOS of pneumonia patients was obtained as much as 235 days. Calculation LOS this used on calculation score maid service recommended standard dose WHO. Rated DDD/100 days of hospitalization will be smaller if the total LOS value is greater. The more big score DDD/100 days of hospitalization the more big also level use antibiotics (Handayani et.al., 2021).

Quantitative Use Antibiotics

Quantitative use of antibiotics in pneumonia patients at RSI Sultan Agung Semarang for the January - December 2021 period in DDD/100 days of hospitalization look on **Table 4** below:

Table 4. Calculation DDD Value of Antibiotics

No	Code ATC	Antibiotics	Route of Administration	DDD WHO (gram)	Antibiotics Used (gram)	LOS (Day)	DDD/100 days of hospitalization
1.	J01MA12	Levofloxacin	IV	0,5	47	235	40
2.	J01MA14	Moxifloxacin	IV	0,4	12,4		13,19
3.	J01DD04	Ceftriaxone	IV	2	29		6,17
4.	J01DH02	Meropenem	IV	2	21		4,46
5.	J01DD12	Cefoperazone	IV	4	40		4,25
6.	J01MA02	Ciprofloxacin	IV	1	5		2,12
7.	J01DD01	Cefotaxime	IV	2	29		0,31
Total							70,5

On **Table 4** above, total score DDD/100 days of hospitalization in this study was 70.5 DDD/100 days of hospitalization. Based on the calculation results, the highest DDD value on table above was Levofloxacin (40 DDD/100 days of hospitalization) and the lowest was Cefotaxime (0.31 DDD/day of hospitalization). Profile DDD/100 days of hospitalization based on Group can see in **Figure 1**:



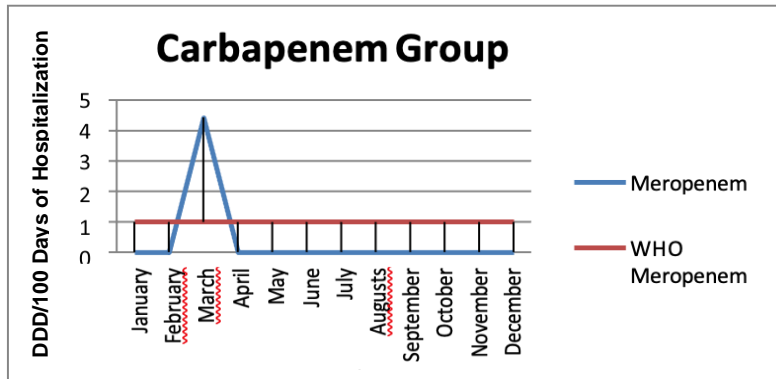


Figure 1. DDD/100 days of hospitalization Carbapenem Groups

Antibiotics class Carbapenems which used on study that is Meropenem. **Figure 1** shown that use Meropenem antibiotics there is on month March that is 4.46 DDD/100 days.

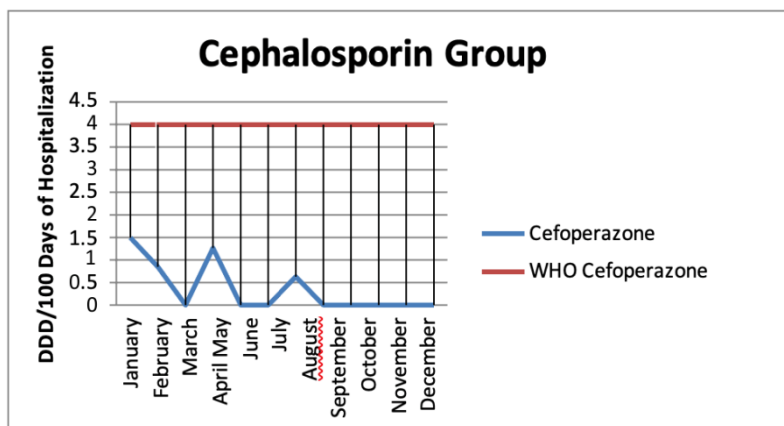


Figure 2. Profile of DDD/100 days of hospitalization, Group Cephalosporins (Cefoperazone)

Antibiotics class Cephalosporins which used on study that is Cefoperazone. **Figure 2** shown that the highest use of Cefoperazone antibiotics in January 2021 that is 1.50 DDD/100 days

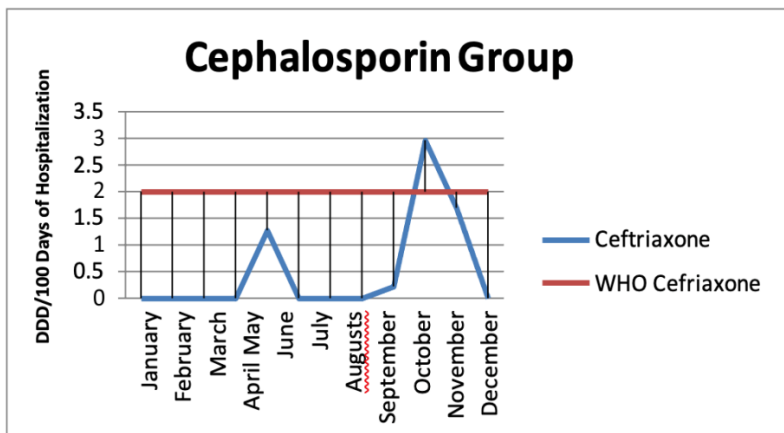


Figure 3. Profile of DDD/100 Days of Hospitalization Cephalosporin Group (Ceftriaxone)

Antibiotics class Cephalosporins which used on study that is Ceftriaxone. **Figure 3** shown that use antibiotics ceftriaxone highest in October 2021 that is 2.97 DDD/100 days



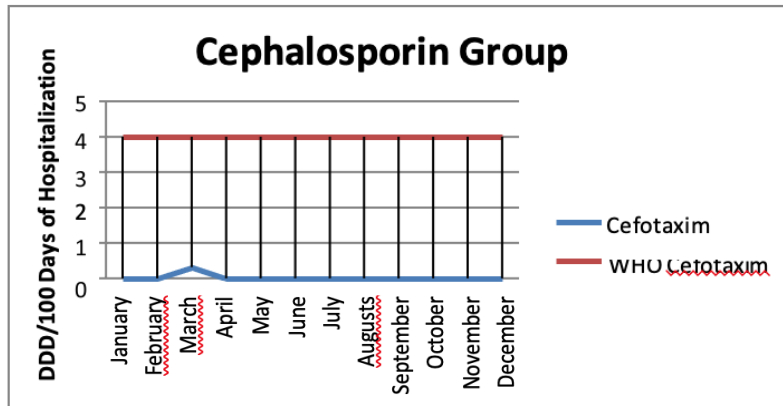


Figure 4. Profile of DDD/100 days of hospitalization Cephalosporin Group (Cefotaxime)

Antibiotics class Cephalosporins which used on study that is Ceftriaxone. **Figure 4** shown that use antibiotics ceftriaxone highest in March 2021 that is 0.31 DDD/100 days.

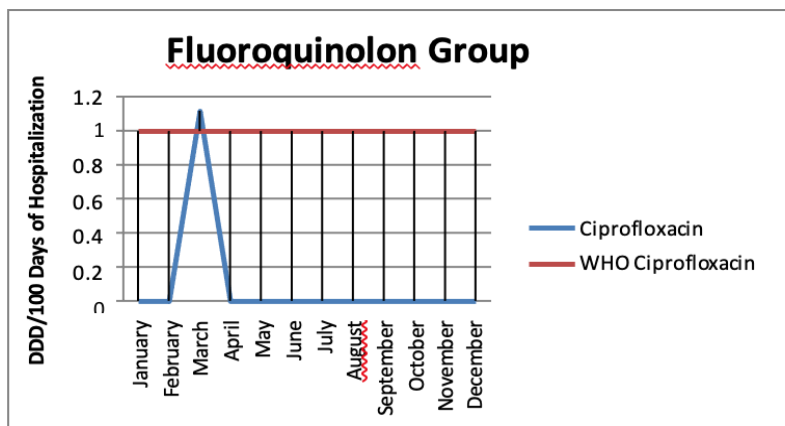


Figure 6. Profile of DDD/100 Days of Hospitalization Flouroquinolone Group (Ciprofloxain)

Antibiotics class Flouroquinolon which used on study that is Moxifloxacin. **Figure 5** shown that use antibiotics highest Ciprofloxacin in March 2021 that is 1.12 DDD/100 days

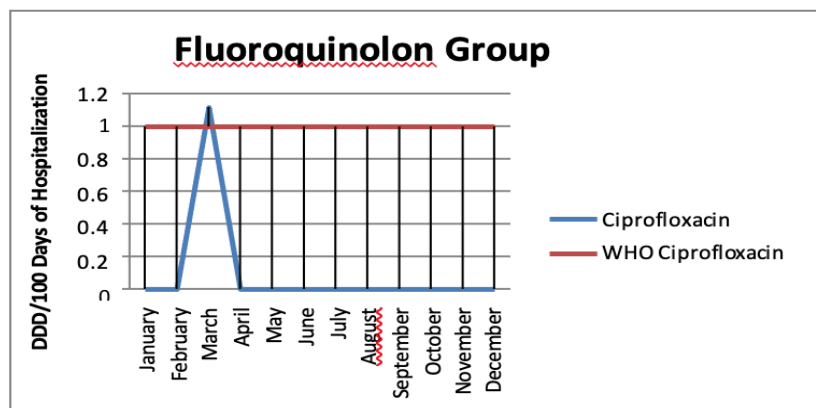


Figure 6. Profile of DDD/100 Days of Hospitalization Flouroquinolone Group (Moxifloxacin)

Antibiotics class Flouroquinolon which used on study that is Moxifloxacin. **Figure 6** shown that use antibiotics highest Moxifloxacin in July 2021 that is 8.09 DDD/100 days



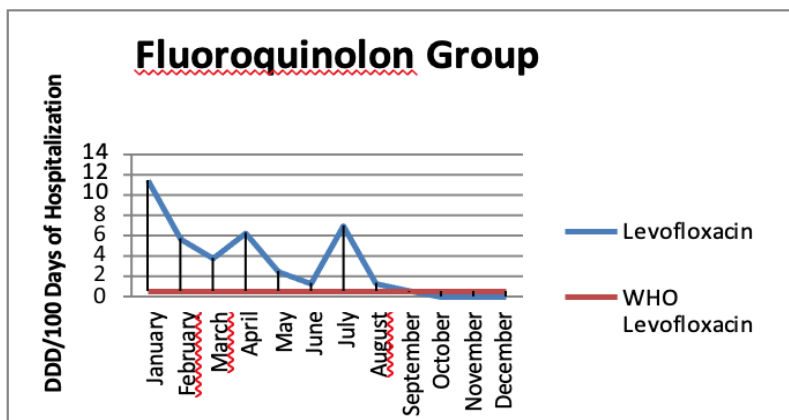


Figure 7. Profile of DDD/100 Days of Hospitalization Flouroquinolone Group (Levofloxacin)

Antibiotics class Flouroquinolon which used on study that is Moxifloxacin. **Figure 7** shown that use antibiotics highest Levofloxacin in January 2021 that is 11.48 DDD/100 days

DU 90% Profiles

DU 90% profiles use of antibiotics in pneumonia patients at RSI Sultan Agung Semarang in the period January - December 2021 could be seen on **Tabel 5** below:

Table 5. DU 90% Profiles

No	Code ATC	Type Antibiotics	Route	DDD/100 Days of Hospitalization	DU (%)	Calculation DU Cumulative	Cumulative	Du 90% Segment
1	J01MA12	Levofloxacin	IV	40	56,74	56,74	56,74	90
2	J01MA14	Moxifloxacin	IV	13,19	18.71	56.74 + 18.71	75,45	
3	J01DD04	Ceftriaxone	IV	6,17	8.75	75.45 + 8.75	84,2	
4	J01DH02	Meropenem	IV	4.46	6,33	84.2 + 6.33	90.53	
5	J01DD12	Cefoperazone	IV	4,25	6.03	90.53 + 6.03	96.56	10
6	J01MA02	Ciprofloxacin	IV	2,12	3.00	96.56 + 3.00	99.56	
7	J01DD01	Cefotaxime	IV	0.31	0.44	99.56 + 0.44	100	
Total							100 %	

Patient pneumonia in RSI Sultan great Semarang described based on 2 characteristics, that is type sex and age. Based on the patient's gender, male man more many than patient woman as big 52.94%. Patient pneumonia with type sex boy more many compared women with a ratio of 2, 1:1. Based on genetic factors, females have XX chromosomes while males have XY, with fewer chromosome X man have system immunity body which more susceptible than women are prone to infection. Because the X chromosome has a role microRNA function important in immunity body.

The more many chromosome X, so the more many also microRNA which is owned (Laksono *et al.*, 2011). By because of that, more men susceptible got an infection like an infection lungs. In addition, men's activities are more outside the home than women who are usually only at home as housewives so they are rarely exposed to air polluted which could cause infection lungs.

Based on age, the highest pneumonia patients were aged 56-65 years 52.94%. This is because age is a factor predisposition pneumonia. The more increase age could cause loss of elasticity and decreased functional lung due to degenerative processes (aging) and lowers the body's resistance so that it is susceptible to infection (Hanifah *et al.*, 2021). Besides that, exists decline response immune could



impact also on prognosis occurrence of pneumonia. In early adulthood, namely aged 25-35 years, the immune system is included lymphocytes and other cells react strongly and quickly to infection so the body has power and stand which well and no range caught infection.

According to data profile use antibiotics, antibiotics which most many used is class Fluoroquinolones that is Levofloxacin (50%). Levofloxacin is an empiric treatment of inpatient pneumonia for CAP. Levofloxacin is antibiotics *respiratory fluoroquinolones* which very recommended with high level of evidence. Antibiotic therapy aims to eradicate the causative pathogen infection (Farida *et.al.*, 2020).

Lubis and Susilawati (2018) on their research mention the Length of Stay (LOS) is a term that usually used for show long patient take care stay on one period care. Data amount day take care stay patient you need it for could count use of antibiotics with units of DDD/100 days. Total LOS of pneumonia patients at RSI Sultan Agung Semarang in period January - December 2021 is 235 days like which listed on **Table 4** above.

WHO recommends DDD with units of DDD/100 days of hospitalization as a way to calculating the quantity of antibiotics used in hospitalized patients, while ATC only to know the antibiotic code (Trisia *et al.*, 2020). Total value of DDD in research this that is 70.5 DDD/100 day take care stay. Results the more low than Muhammad (2018) at Dr. Moewardi Surakarta in pneumonia patients in 2017 with a total value DDD/100 days of 111.87 DDD/100 days of hospitalization. The results obtained by researchers cannot compare the level of selectivity consumption of antibiotics with other hospitals. This is due to the different types house sick, where hospital Dr. Moewardi type A whereas RSI Sultan great Semarang type B.

Based on the results of calculating the DDD value in the **Table 5** above, the highest DDD value in this study, namely the use of Levofloxacin antibiotics of 40 DDD/100 day of hospitalization and the lowest was Cefotaxime of 0.31 DDD/day of hospitalization. Levofloxacin is antibiotics class Fluoroquinolone. Antibiotics this have activity which strong for oppose Streptococcus bacteria such as *S.pneumoniae*, *M.pneumoniae*, *C. pneumoniae*, *M.catarrhalis*. Levofloxacin also known as "the respiratory" antibiotics. *fluoroquinolones* highly recommended with a high level of evidence (Farida *et.al.*, 2020). While the antibiotic Cefotaxime has a DDD/100 days of hospitalization the lowest because this antibiotic has a low sensitivity based on pattern of antibiotic sensitivity in RSI Sultan Agung Semarang so that the prescription of antibiotics low. Height use antibiotics will cause happening resistance. resistance antibiotics influenced by height usage antibiotics, so that monitoring of antibiotic use is needed, especially for incoming antibiotics into the segment DU 90%.

The Method of DU 90% was grouping drugs which enter into the use. This method can be used if used simultaneously with ATC/DDD method. Assessment of drugs that enter into the target segment 90%. to emphasize the segment in terms of evaluation, control and use planning procurement medicine (Easy *et.al.*, 2016).

The 90% DU profile is obtained by dividing the DDD/100 days of hospitalization from something antibiotics with total DDD/100 day take care stay, all antibiotics which used on patient pneumonia in RSI Sultan great Semarang period January-December 2021 then multiplied by 100%. Percentage of antibiotic use obtained then accumulated and sorted from the highest percentage to the lowest percentage. 90% of the antibiotics that enter the DU segment are antibiotics that enter the DU segment accumulated 90%. DU profile 90% use of antibiotics in pneumonia patients at RSI Sultan Agung Semarang in period January-December 2021. Antibiotics included in the segment DU 90%, namely Levofloxacin (56.74%) and Moxifloxacin (18.31%), while antibiotics which enter in segment 10% that is Ceftriaxone (8.75%), Meropenem (6.33%), Cefoperazone (6.03%), Ciprofloxacin (3.00%), and Cefotaxime (0.44%).

Based on the results of this study, the data obtained can be used for measure consumption of antibiotics in hospitals and subsequent drug procurement. Evaluation obtained as base in make program policy use antibiotics. The high use of antibiotics is a risk factor for resistance antibiotics, so the use of the DU method 90% indirectly gives suggestions that the use of antibiotics that fall into the 90% DU segment can be controlled taking into account the pattern of antibiotic prescribing. The basis for selecting antibiotics should be in accordance with efficacy clinic, sensitivity, condition clinical patient, prioritize first-line or narrow -spectrum antibiotics for reduce pressure selection, availability in hospital formularies, conformity



with the diagnosis, results inspection microbiology (pattern microbes and sensitivities antibiotics), and use antibiotics that have minimal risk of occurrence infection.

CONCLUSION

Based on research evaluating the use of antibiotics with the ATC/DDD method that has been carried out, it can be concluded as follows:

1. The profile of antibiotic use in pneumonia patients at RSI Sultan Agung Semarang in period January - December 2021, namely there are seven types of antibiotics and the three groups with the highest use are Levofloxacin antibiotics (50%) of the Fluoroquinolone group
2. Evaluation of the use of antibiotics using the ATC/DDD method obtained a total value of DDD/100 days of hospitalization of 70.5 while the antibiotic that had the highest value of DDD/100 days of hospitalization was Levofloxacin of 40 with antibiotics entering the 90% segment, namely Levofloxacin (56, 74%) and Moxifloxacin (18.71%) intravenously.

AUTHOR CONTRIBUTION

Award to study program pharmacy, committee ethics Ngudi Waluyo University, and researchers in get research data until to making article For this, we express our gratitude and gratitude.

CONFLIC OF INTEREST

There are no conflicts of interest or the authors declare that the study was conducted in the absences of any commercial or financial relationships, authorship, institutional defamation that could be constructed as a potential conflict of interest.

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Be delivered saying thanks to researcher and passion researching for more other themes interesting in the future.

REFERENCES

- Aljufri, AQ, Yasin, NM, & Wahyono, D, 2021. Rationality of Empirical Antibiotic Therapy in Pneumonia Patients in the Inpatient Installation of RSUP Dr. Kariadi Semarang. *Pharmaceutical Magazine*, 17(1), 89. <https://doi.org/10.22146/farmaseutik.v17i1.53702>
- Amalia, L, 2019. Determinants of Pneumonia in Toddler Children at the Pataruman Health Center Iii Banjar City in 2018. *Hutama Medika Journal*, 1(1), 8–16.
- Anwar, A., & Dharmayanti, I, 2016. Pneumonia in Toddlers in Indonesia Pneumonia among. *National Journal of Public Health*, 29, 359–365.
- Arifianingsih, NN, Istirokhatun, T., & Susanto, H, 2014. Effect of Addition of Chitosan as an Anti-microbial Agent on the Preparation of Cellulose Acetate Membrane against Biofouling Caused by Gram Positive Bacteria. *Journal of Environmental Engineering*, 3(4), 1–6.
- Arlini, & Yunita, 2015. Community Diagnostics Acquired Pneumonia (CAP) and Current Management. Department of Pulmunology and Respiratory Medicine Faculty of Medicine, University of Syiah Kuala, 86–97.
- Bestari, MP, & Karuniawati, H, 2017. Evaluation of the Rationality and Effectiveness of Using Antibiotics in Pediatric Pneumonia Patients in the Inpatient Installation of Central Java Hospital Evaluation of



Rationality and Effectiveness of Antibiotic Use in Hospitalized Pediatric Pneumonia Patients in. Indonesian Pharmaceutical Journal, 4(2), 62–70. <http://journals.ums.ac.id/index.php/pharmacon>

Bidara, F., Saputri, M., & Perwitasari, 2021. Study of the Use of Antibiotics in Pediatric Pneumonia Patients Using the Ddd and Du Method 90%. *Ibn Sina Scientific Journal (JIS): Pharmaceutical and Health Sciences*, 6(1), 108–115. <https://doi.org/10.36387/jiis.v6i1.644>

Cahyati *et.al*, 2019. Trends in Toddler Pneumonia in Semarang City in 2012-2018. *Higeia Journals Public Health*, 3(3), 408.

Farida, Y., Putri, VW, Hanafi, M., & Herdianti, NS, 2020. Patient Profile and Use of Antibiotics in Inpatient Community-Acquired Pneumonia Cases at the Academic Hospital in Sukoharjo Region. *JPSCR: Journal of Pharmaceutical Science and Clinical Research*, 5(2), 151. <https://doi.org/10.20961/jpscr.v5i2.39763>

Fisher Awaln, Ida Faridah, & Usep Saipul Ridwan, 2019. Factors Associated With Ventilation Associated Pneumonia (Vap) in a Population of Patients with Nerve Disorders in the ICU Room of RSU Banten Province in 2019. *Journal of Health*, 8(2), 42–56. <https://doi.org/10.37048/kesehatan.v8i2.140>

Flood, G, 2021. Udayana. The Encyclopedia of Philosophy of Religion, 8(4), 1–3. <https://doi.org/10.1002/9781119009924.eopr0398>

Handayani, EW, Luthfieasari , A., & Khuluq, MH (2021). Evaluation of Drug Use Antibiotics for Typhoid Fever in Adult Patients Hospitalized at RSUD Dr. Soedirman Kebumen with the ATC/ DDD method for the 2020 period. *Journal of Clinical Pharmacy and Science*, 1(1), 1. <https://doi.org/10.26753/jfks.v1i1.632>

Hanifah, S., Melyani, I., & Madalena, L, 2021. Evaluation of the Use of Antibiotics with the Atc / Ddd and Du90% Methods in Inpatients of Internal Medicine Medical Staff Groups at a Private Hospital in the City of Bandung. *Pharmaca* , 20(1), 21–26. https://www.whocc.no/atc_ddd_index/.

Humaida, R, 2014. Strategy To Handle Resistance of Antibiotics . *J Majority* , 3(7), 114–115. *Health Science, J., & Seyawati , A. (2018). Management of cases of cough and or difficulty*

Breathing:Literature Reviews . 2008, 30–52. Indriyani, N., Herman, D., Medison , I., Fitriana, DW, & Mizarti , D. (2022). Aspiration pneumonia nonfatal consequences drowning. *Journal of Human Care*, 7(1), 93–103.

Ladyani, F., & Zahra, M, 2018. Analysis of germ patterns and resistance patterns on the results of examination of resistance cultures in the clinical pathology laboratory of DR.H.Abdoel Hospital Moeloek Lampung province period January-July 2016. *Medical and Health Sciences*, 5(2), 77–88.

Laksono, SP, Qomariyah, & Purwaningsih, E, 2011. Percentage Distribution of Genetic Diseases and Diseases. *PharmaMedika Health Magazine*, 13(2), 267–271. <https://core.ac.uk/download/pdf/229000921.pdf>

Lia Yunita, S., & Novia Atmadani, 2021. Factors Influencing Knowledge and Behavior on Using Antibiotics in UMM Pharmacy Students. *Pharmaceutical Journal of Indonesia*, 6(2), 119–123. <https://doi.org/10.21776/ub.pji.2021.006.02.7>

Lubis, IK, & Susilawati, S. (2018). Length analysis Of Stay (Los) Based on Predictor Factors in Type II DM Patients at PKU Muhammadiyah Hospital, Yogyakarta. *Journal of Vocational Health*, 2(2), 161. <https://doi.org/10.22146/jkesvo.30330>

