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RATIONALITY EVALUATION OF ANTIBIOTIC USE IN PEDIATRIC PNEUMONIA AT HOSPITALS IN INDONESIA

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Abstract

Indonesia is a developing country that has high morbidity and mortality rates due to infectious diseases, one of which is pneumonia. This study aims to describe the use of antibiotics, to determine the rationality of antibiotic use using the Gyssens method, and to determine the relationship between the rationality of antibiotic use on the therapeutic outcomes of pediatric pneumonia patients in one of the public hospitals and private hospitals in Indonesia without PPRA at the same time. This study is a cross sectional study with retrospective data collection from the patient's medical record. The analysis was carried out descriptively and analytically with the Chi-square method to see the relationship between rational use of antibiotics and therapeutic outcomes. A single antibiotic which is generally used in one of the hospitals and private hospitals in Indonesia is Ampicillin. In addition, antibiotics that are often prescribed are Ceftriaxone and Cefotaxim). The use of antibiotics in Public Hospitals found 83 irrational use of antibiotics (81,4%) and 75 total uses of antibiotics (86,2%) in Private Hospitals. Irrational category III A (long duration) mostly occurs in two hospitals. The results of the research on the relationship between rationality and therapeutic outcome were analyzed by Chi-square. The results showed that the rationality of empirical antibiotic therapy significantly improved therapeutic outcomes (p=0.008) in one of the hospitals in Indonesia. The results of research conducted in one of the Indonesian private hospitals obtained p value = 0,153.

Keywords: *Pneumonia, Pediatrics, Antibiotics, Rationale, Hospitals*

1. INTRODUCTION

Infectious diseases caused by bacteria are one of the main causes of morbidity and mortality in developing countries. Indonesia is a developing country that has high morbidity and mortality rates due to various infectious diseases, one of which is pneumonia. In 2015, WHO reported that almost 6 million children under five died and pneumonia was the cause of 920,136 under-five deaths worldwide with a percentage of 16%. Currently, Indonesia is ranked 10th in the world in cases of under-five mortality due to pneumonia. In 2016, the percentage of deaths from all children under five based on data from Puskesmas in Indonesia was higher than in previous years, reaching 22.23% (Ministry of Health of the Republic of Indonesia, 2016).

The ability to treat infectious diseases with antimicrobials is an important component of medicine. Antimicrobial drugs or antibiotics are among the most successful drugs in reducing mortality in severe infections (ECDC, 2013). The use of antibiotics in patients with special conditions such as pediatrics requires high vigilance and attention. Giving drug therapy to children cannot only be based on age and body surface area. The function of metabolizing organs and enzymes in children is different from that of adults (Arfania et al., 2015). Irrationality in the use of antibiotics can be bad and detrimental to patients and related health services. The Antimicrobial Resistant Research in Indonesia (AMRIN-Study) states that out of 2,494 individuals in the community, 43% of Escherichia coli are resistant to various types of antibiotics including: ampicillin (34%), cotrimoxazole (29%) and chloramphenicol (25%). A total of 781 patients who were hospitalized found that 81% of

Escherichia coli were resistant to various types of antibiotics, namely ampicillin (73%), cotrimoxazole (56%), chloramphenicol (43%), ciprofloxacin (22%), and gentamicin (18%) (Ministry of Health of the Republic of Indonesia, 2016)

In Indonesia, the government issued PMK No. 8 of 2015 namely the Antimicrobial Resistance Control Program (PPRA) which must be implemented by all hospitals, both government and private. The rationale for using antibiotics affects the success of therapy by showing better clinical outcomes than irrational ones. The results of the use of antibiotics are not the right dose of 78.6% and the frequency of drug administration is not right 28.6% in a hospital in Surabaya (Apriyanti, 2016).

Ongoing research is needed in an effort to develop effective interventions to identify and address these problems. In addition to identifying the use of antibiotics, this study aims to compare the results of the evaluation of the rationality of the use of antibiotics in pediatric pneumonia in hospitals that have established a PPRA team and those that have not formed an PPRA team.

2. RESEARCH METHOD

2.1. Research Design

This study is an observational study with a cross-sectional method, data collection was carried out retrospectively for the period January 2017 - May 2018. Data were collected by taking medical records of pediatric pneumonia patients in June - December 2018. The study was conducted in two hospitals, namely public and private. one of the hospitals is already running the PPRA program.

2.2. Tools and Materials

2.2.1. Research Tools

a. Patient data collection sheet containing patient identity, medical record number, disease diagnosis, and medication given.
b. Gyssens flow chart (Gyssens classification).
c. Guidelines for Medical Services of the Indonesian Pediatrician Association 2009, Guidelines for the Use of Antibiotics in Child Pneumonia WHO 2014, Community-Acquired Pneumonia IDSA 2011, Pediatric Noenatal Dosage Handbook, BNF for Children 2017 and related journals.
d. Software SPSS version 23.

2.2.2. Research Material

Medical record data of pediatric pneumonia patients in hospitals inpatient installations with PPRA and without PPRA from January 2017 to May 2018.

2.3. Research Subject

Pediatric pneumonia patients who received antibiotics at the Public Hospitals with the PPRA Team and Private Hospitals without the PPRA Team from January 2017 to May 2018.
Inclusion criteria:

1. Patients aged 0-18 years, category of children according to WHO.
2. Patients with a diagnosis of pneumonia and receiving antibiotic therapy in the inpatient ward during this period.
3. Complete medical record data, including at least the patient's identity, diagnosis of disease, drugs given, temperature, respiratory rate, laboratory tests.

While the exclusion criteria:

1. Patients who are discharged from the hospitals at their own request
2. Patients admitted for less than 48 hours (according to empiric therapy)
3. Patients with immunodeficiency conditions and other infections through the statement of the Patient Responsible Doctor (DPJP) in the medical record.

2.4. Research Variable

2.4.1. Independent variable

The independent variable in this study is the rationality of the use of antibiotics

2.4.2. Dependent variable

The dependent variable in this study was the outcome of therapy for pediatric pneumonia patients

2.4.3. Confounding Variables

Confounding Variables in this study were gender, age, type of antibiotic, type of hospitals, duration of antibiotic use.

2.5. Sampling Technique

The data collection technique was purposive sampling from medical records, the sample taken was a sample containing the elements desired by the researcher according to the inclusion criteria and not including the exclusion criteria.

The sample size was calculated based on the number of pediatric patients in 2017 with the main diagnosis of pneumonia (J18) 169 in public hospitals and 120 in private hospitals.

$$n = \frac{z^2 1 - \alpha/2P(1-P)N}{d^2(N-1) + z^2 1 - \alpha/2P(1-P)}$$

Description:

n = minimum sample size
P = the proportion of irrational events from Rahayu's research in 2014 is 50.3% (0.503)
Z21-α/2 = 95% confidence degree (1.96)
N = population size
d = precision (0,1)

The minimum sample in public hospitals with the number of pneumonia patients (J18) in 2017 is

$$n = \frac{1{,}96^2 x 0{,}503(1-0{,}503)169}{0{,}1^2(169-1)+1{,}96^2 x 0{,}503(1-0{,}503)} = \frac{162{,}30}{2{,}64} = 61.48\ 62 \text{ samples}$$

The minimum sample in a private hospital with the number of pneumonia patients (J18) in 2017 is

$$n = \frac{1{,}96^2 x 0{,}503(1-0{,}503)120}{0{,}1^2(120-1)+1{,}96^2 x 0{,}503(1-0{,}503)} = \frac{115{,}24}{2{,}15} = 53.6\ 54 \text{ samples}$$

2.6. Research Path

The steps in the research are as follows:

1. Preparation
2. Conducting Preliminary Study
3. Doing Data Selection
4. Performing Data Collection
5. Data analysis
   - Describe the characteristics of age, gender, duration of use of empiric antibiotics and length of hospitalization for pediatric pneumonia patients in the patient characteristics table.
   - Describing and presenting rationality by grouping the use of antibiotics according to the Gyssens with PPRA and without PPRA.
   - Analyzing the rationality of using antibiotics to improve therapeutic outcomes using Chi-square test statistics and Odd Ratio with SPSS program.

3. RESULT AND DISCUSSION

3.1. Description of Pneumonia Patients

3.1.1. Characteristics of Pneumonia Patients

From September 2017 to March 2018 there were 66 pediatric pneumonia patients at Public Hospitals and 54 pediatric pneumonia patients at Private Hospitals who had met the inclusion criteria. Table 1 presents the characteristics of pediatric pneumonia patients in Public Hospitals that already have an PPRA Team, while Table 2 presents the characteristics of pediatric pneumonia patients in Private Hospitals where there is no PPRA Team (Antimicrobial Resistance Control Program).

Table 1 Characteristics of Pediatric Pneumonia Patients in Public Hospitals

Characteristics	Sum (n= 66)	Percentage (%) Group
Age		
0-1 years	42	63.6
2-10 years	18	27.3
11-19 years old	6	9.1
Gender		
Man	40	60.6
Woman	26	39.4
Duration of Use of Empirical Antibiotics		
3 - 5 days	37	56.1
6 - 10 days	21	31.8
11 - 15 days	8	12.1
LOS (Length of Stay)		
0 - 5 days	25	37.9
6 - 9 days	14	21.2
More than 9 days	27	40.9
Total	66	100.0

Table 2 Characteristics of Pediatric Pneumonia Patients in Private Hospitals

Characteristics	Total (n=54)	Percentage (%) Group
Age		
0 - 1 year	24	44.4
2 - 10 years	27	50.0
11 – 19 years old	3	5.6
6 - 18 years old	7	13.0
Gender		
Man	30	55.6
Woman	24	44.4
Duration of Use of Empirical Antibiotics		
3 - 5 days	30	55.6
6 - 10 days	24	44.4
11 - 15 days	0	0.0
LOS (Length of Stay)		
1 - 5 days	24	44.4
6 - 9 days	25	46.3
More than 9 days	5	9.3
Total	54	100.0

The results of data from two hospitals showed that there were more children with pneumonia in boys than girls, namely 55.6-60.6%. The age group who suffered from pneumonia more at Public Hospitals was more at the age of 2-10 years by 63.6%, and followed by the age 0-1 year. Data from Private Hospitals who suffered from pneumonia more at the age of 2-10 years by 50%, followed by 0-1 years. This study is in accordance with epidemiological data at the British Thoracic Society (BTS) in 2011 and the Indonesian Health Data Profile in 2017 which stated that childhood pneumonia was most often experienced by children aged 0-5 years with more males than females (Harris et al., 2011; Ministry of Health of the Republic of Indonesia, 2017). However, the mechanism why pneumonia is more common in men is not known.

The duration of the use of empirical antibiotics in Public Hospitals and Private Hospitals according to the WHO pediatric pneumonia therapy guidelines (2014) and Bradley et al. (2011) that empiric antibiotic use should be observed within 72 hours if there is improvement and can be continued for 5-10 days. Length of Stay (LOS) is also called Length of Day of Hospitalizations, LOS is calculated from the time the patient enters the hospitals until the patient returns home, either alive or dead (Carter & Potts, 2014). LOS in pediatric patients with pneumonia conditions from data from 2 hospitals is 0-5 days, and 6-9 days, few patients are hospitalized for more than 9 days. These data are in accordance with the results of previous studies regarding LOS of pneumonia patients in children < 9 days (Azhari et al., 2019). Pneumonia can be classified according to its radiological appearance and spread.

Table 3 Diagnosis of Children in Hospitals and Private Hospitals

Diagnosis	Frequency	Frequency
	Public Hospitals (n=66; %)	**Private Hospitals(n=54; %)**
Single		
Pneumonia	19 (28.8)	22 (40.7)
Bronchopneumonia	2 (3,0)	10 (18.5)
Pneumonia With Accompanying		
+ Fever Seizure	12 (18.2)	2 (3,7)
+ Diarrhea	3 (4.5)	3 (5,6)
+ Anemia	1 (1.5)	1 (1.9)
+ Asthma	1 (1.5)	10 (18.5)
+ CHD	15 (22.7)	
+ Hyperthyroid	1 (1.5)	
+ Malnutrition	1 (1.5)	
+ Dengue Fever	1 (1.5)	
+ Herpes	1 (1.5)	
+ Contact Dermatitis	1 (1.5)	
+ Diarrhea + Seizure Fever	2 (3,0)	
+ Asthma + Obesity	1 (1.5)	
+ Diarrhea + Malnutrition	1 (1.5)	
+ MRSA + LBW + Malnutrition	1 (1.5)	
Bronchopneumonia with accompanying	1 (1.5)	2 (3,7)
+ Fever Seizure		1 (1.9)
+ Diarrhea		1 (1.9)
+ Otitis Media		2 (3,7)
+ Asthma	1 (1.5)	
+ CHD	1 (1.5)	
+ Herpes		

From Table 3, it can be seen the various co-morbidities of pediatric patients in public hospitals and private hospitals. One patient may suffer from more than one comorbidity. Pediatric pneumonia patients in public hospitals have more variety of comorbidities, this is because it is a government-owned hospitals as the main referral in the surrounding area. The disease with the greatest prevalence in public hospitals is congenital heart disease (CHD) which is 24.2%. Congenital Heart Disease (CHD) is a congenital disease that most often occurs in children due to abnormalities in the structure of the heart or the function of the circulation of the heart that are brought from birth due to disturbances or failure of the development of heart structures in the early stages of fetal development (Galvis et al., 2021).

The biggest co-morbidity that occurs in private hospitals is asthma, which is 22.20%. People with asthma had an increased prevalence of S. pneumoniae carriers in an observational study by Esposito in 2015 (Zaidi & Blakey, 2019).

3.2. Pattern of Antibiotic Use

Antibiotics for empirical therapy is the use of antibiotics in cases where the exact type of bacteria is not known (Regulation of the Minister of Health of the Republic of Indonesia

Number 8 of 2015 Concerning Antimicrobial Resistance Control Program in Hospitals, 2015). The pattern of empirical antibiotic use in hospitals and private hospitals in pediatric wards can be seen in Table 4. In table 4 we can know that the single antibiotic which is generally used in hospitals and private hospitals is Ampicillin as many as 18 (27.3%) and 22 (40.7%). In addition, antibiotics that are often prescribed are third-generation cephalosporins (Ceftriaxone in 12 cases or 18.2% of patients at Public Hospitals and Cefotaxime in 4 cases or 7.4% of patients at Private Hostpital). These results are in accordance with the management of pneumonia from the 2009 Indonesian Pediatrician Association Medical Service Guidelines (Indonesia, 2009).

Table 4 Patterns of Empirical Antibiotic Use in Pediatric Pneumonia at Public Hospitals

Antibiotic Regimen	Public Hospitals	Private Hospitals
Single		
Ampicillin	18 (27.3)	22 (40.7)
Cefriaxone	12 (18.2)	1 (1.9)
Cefoperazone	1 (1.5)	
Cefotaxime		4 (7,4)
Cefixime		2 (3,7)
Amoxicillin		1 (1.9)
Combination		
Ampicillin+Metronidazole	1 (1.5)	
Ampicillin + Gentamicin	20 (30.3)	9 (16.7)
Ampicillin + Cefixime	1 (1.5)	
Ampicillin + Cetriaxone	1 (1.5)	
Ampicillin + Cefoperazone	1 (1.5)	
Ampicillin + Ceftazidime	1 (1.5)	
Ampicillin + Cefepime	1 (1.5)	
Ceftriaxone + Cefoperazone	1 (1.5)	
Ceftriaxone + Metronidazole	3 (4.5)	
Cefoperazone + Metronidazole	1 (1.5)	
Cefepime + Azithromycin	1 (1.5)	
Meropenem + Cotrimoxazole	2 (3,0)	
Ampicillin + Chloramphenicol		3 (5,6)
Ceftriaxone + Amikacin		1 (1.9)
Ceftriaxone + Azithromycin		2 (3,7)
Ampicillin + Cefotaxime		1 (1.9)
Ampicillin + Gentamicin + Chloramphenicol	1 (1.5)	6 (11,1)
Ampicillin + Gentamicin + Amoxicillin (PO)		1 (1.9)
Ampicillin + Ceftriaxone + Chloramphenicol		1 (1.9)
Ampicillin + Cefotaxime + Meropenem		
Total	66 (100)	54 (100)

Most of the 3 drug combination antibiotics were administered in private hospitals as many as 8 cases (14.9%) compared to hospitals with 1 case (1.5%). This is due to the PPRA

Team at Public Hospitals who will monitor the use of antibiotic drugs and the incidence of antibiotic resistance. However, the combination of antibiotics can also be detrimental because of the possible antagonistic effect between antibiotics, the possibility of superinfection, the possibility of increasing resistance, increasing toxicity, and increasing costs. The most widely used combination in empiric therapy for pediatric pneumonia is a beta-lactam antibiotic (ampicillin) and an aminoglycoside (gentamicin).

3.3. Evaluation of the Rationality of Antibiotic Use Using the Gyssens Line

This study evaluates the rationality of the use of antibiotics using the Gyssens pathway (Gyssens, 2005). The type of antibiotic that was evaluated in this study was the use of antibiotics empirically for the first 72 hours, then the outcome of therapy improved or did not improve based on the doctor's statement in the medical record. The use of empiric antibiotics can be continued for 3-5 days in patients with uncomplicated pneumonia if treatment outcomes show improvement. It is considered too long use if more than 5 days, specific microbiological tests are not immediately carried out and the antibiotics are not changed (Stuckey-Schrock et al., 2012). The antibiotics evaluated by the Gyssens method were seen from the antibiotics used by the patient. The results of the evaluation of the rationality of using the Gyssens method are shown in table 5. The number of patients analyzed in public hospitals was 66 patients with a total of 102 cases of antibiotic use, while in private hospitals there were 54 patients with 87 cases of antibiotic use.

Table 5 Evaluation of the Rationality of Use of Antibiotics using the Gyssens Method

Rationality	Public Hospitals (n=102, %)	Private Hospitals (n=87, %)
Rational	19 (18.6)	12 (13.8)
Irrational	83 (81.4)	75 (86.2)

Based on the rationality data in table 5, it was found that the use of antibiotic drugs in public hospitals was found to be 83 the number of irrational use of antibiotics (81.4%), and in private hospitals as many as 75 the use of antibiotics (86.2%). These results are in accordance with research conducted by Aryani (2016) that irrational use of antibiotics (68%) is higher than rational use of drugs (32%) (Suminar & Sutrisna, 2020). The results of the analysis of the use of antibiotics using the Gyssens qualitative method are shown in table 6.

Table 6 Results of Analysis of Antibiotic Use Using the Gyssens Qualitative Method

Category	Public Hospitals (n=102, %)	Private Hospital (n-87, %)
0	19 (18.6)	12 (13.8)
II A	-	7 (8.0)
II B	4 (3.9)	4 (4,6)
III A	19 (18.6)	14 (16.1)
III B	14 (13.7)	-
VI	-	9 (10,3)
IIA, II B	10 (9.8)	3 (3,4)
II A, III A	-	3 (3,4)
II A, III B	12 (11.8)	1 (1,1)
II B, III A	2 (2.0)	9 (10,3)

II B, III B	3 (2.9)	11 (12.6)
II A, II B, III A	-	9 (10,3)
II A, II B, III B	4 (3.9)	5 (5,7)
II A, II B, IV A, IV C, IV D	5 (4.9)	-

1. Category 0 (Rational)

   Based on data analysis, it was found that the number of rational antibiotic cases in public hospitals and private hospitals was 19 cases (18.6) and 12 cases (13.8). These results are not much different even though public hospitals have implemented PPRA while private hospitals have not implemented PPRA.
2. Category IIA (incorrect dose)

   The number of cases experiencing irrationality in category II A was 7 cases (8.0%) in patients in private hospitals. This irrationality also occurs not only 1 irrationality but also occurs along with other categories. In public hospitals, there was irrationality II A along with other categories as many as 31 cases divided into IIA with II B, II A with III B, II A with II B and II B, and IIA with II B, IV A, IV C, and IV D. An example of an inappropriate dose is a patient aged 1 year, weighing 10 kg receiving a combination of antibiotics ampicillin sulbactam (200 mg every 6 hours) and gentamicin (60 mg every 24 hours). Inappropriate administration of antibiotics occurs in ampicillin sulbactam. The dose of ampicillin-sulbactam for children recommended by the Pediatric and Neonatal Dosage Handbook is 100-200 mg/kgBW/day, so that this patient was included in the IIA underdose category. Patients weighing 10 kg should receive ampicillin-sulbactam 250-500 mg once or 1000-2000 mg per day, while these patients only receive 200 mg every 6 hours or 800 mg per day. Ampicillin sulbactam is a combination to overcome the resistance of bacteria producing beta-lactamase enzymes to ampicillin (Peechakara & Gupta, 2021).

   An example of a case of overdose in a patient aged 1 year with a body weight of 9.8 kg. According to the 2009 IDAI Medical Service Guidelines, the Pediatric and Neonatal Dosage Handbook, the dose of ampicillin is 25-50 mg/kgBW / 6 hours, which is 245 mg – 490 mg every 6 hours, while the patient is given 500 mg every 6 hours. In contrast to gentamicin which has a narrow therapeutic index with a peak concentration range of 8-10 mg/L and a valley concentration of 0.5-2 mg/L, which causes a small change in the dose can affect side effects and toxicity. The use of gentamicin is highly recommended to monitor the drug level in plasma to prevent toxic effects (Kang & Lee, 2009).
3. Category II B (Frequency does not match)

   There were 28 cases of giving antibiotics in public hospitals with inappropriate frequencies, while in private hospitals there were 41 cases with inappropriate frequencies. This case occurred in the administration of ampicillin which must be given 4 times a day but only given 3 times a day. And also, with the drugs gentamicin and ceftriaxone, the drug must be given in a single dose, but here it is given in divided doses. Giving antibiotics that are not suitable for the frequency of administration will affect the Time Dependent and Dose Dependent antibiotic drugs (Regulation of the Minister of Health, 2011). The irrationality of this category is less in hospitals that have implemented PPRA compared to hospitals that have not implemented PPRA.

4. Category III A (Long duration) and III B (short duration)

    Empirical antibiotic administration in pediatric pneumonia patients is considered too long if more than 10 days of antibiotic use does not show clinical improvement and microbiological examination is not performed. Empiric antibiotics should be continuously monitored for the first 72 hours, then continued use for 5-10 days if the patient shows clinical improvement (Stuckey-Schrock et al., 2012).

    In Public Hospitals there are 19 cases that fall into category III A, 2 cases that fall into category III A with II B. Meanwhile at Private Hospitals there are 14 cases that fall into category III A, 3 cases that fall into category III A with II A, 9 cases in category III A III A with II B, and 9 cases of category III A, II A, II B. Outcome of therapy should be monitored and evaluated in the first 3 days, then microbiological testing and antibiotic change should be carried out if there is no improvement due to the possibility of other infections, complications, even resistance (Soedarmo, 2012). Prolonged administration of antibiotics occurred in patients receiving the antibiotic ampicillin-sulbactam and in patients receiving ceftriaxone.

    Cases that occurred were also giving antibiotics too short, the number of cases that occurred in hospitals were 14 cases of category III B, 12 cases of III B with II A, 3 cases III B with II B, and 4 cases III B with II A and II B. The use of drugs that are too short in duration occurs in ampicillin and gentamicin. In the literature, antibiotic therapy is empirically given for 5 days, but in the case of giving antibiotics to patients it is given in less than 5 days, i.e., 3-4 days.
5. Category IVA (there are other antibiotics that are more effective), IV C (there are cheaper antibiotics), and IV D (there are antibiotics that are more specific and have a narrower spectrum).

    Category IV A, IV C, and IV D occurred in 5 cases of antibiotic administration. This case occurred in a public hospital where the patient was treated with cefoperazone with metronidazole (1 case), ceftriaxone with metronidazole (3 cases), and ampicillin and metronidazole (1 case). Antibiotics that have categories IV A, IV C, and IV D are metronidazole, this drug is not recommended for the treatment of pneumonia in children. Therefore, from the results of the qualitative analysis using the Gyssens method, it was found that there are other drugs that are more effective, cheaper alternatives if used alone, and there are drugs with a narrower spectrum.
6. Category VI (data not complete)

    The results of the research data were 9 cases (10.3%) which were included in category 6, this occurred in the oral use of amoxicillin and amikacin injection which could not be analyzed because the data on the duration of drug use were not listed, so it could not be analyzed using the Gyssens method. because the data is incomplete.

3.4 The Relationship of Rationality with Therapeutic Outcomes

The results of the analysis of rational use of antibiotics with therapeutic outcomes are shown in the following table.

Table 7 Results of the Analysis of the Relationship between Antibiotic Rationality and Therapeutic Outcomes at Public and Private Hospitals

Hospitals	Rationality	Outcome of Therapy		P	OR (CI)
		Getting Better	Not Better		
Regional Hospitals	Rational	19	0	0.008	1,407
	Irrational	59	24		(CI :1,226-1,614)
Private Hospitals	Rational	10	2	0.153	0.282
	Irrational	71	4		(CI 0.046 1.742)

The results of the research on the relationship between rationality and therapeutic outcomes were analyzed by Chi-square. The results showed that the rationality of empirical antibiotic therapy significantly increased therapeutic outcomes (p=0.008) in hospitals. This is the same as in the previous study by Rahayu in 2014, the results of this study also significantly influenced the rationality of using antibiotics on the therapeutic outcomes of pediatric pneumonia patients. However, the results of research conducted in private hospitals obtained p value = 0.153, which means that there is no significant relationship between rational use of antibiotics and therapeutic outcomes. This is influenced by hospitals that run PPRA and have not run PPRA. At the public hospitals obtained descriptive data that patients who are rational will provide improved therapeutic outcomes, and from the results there were no patients who did not improve. Meanwhile, at private hospitals, the rational number of cases did not improve. This cannot be analyzed statistically because the number of patients and the number of cases that have occurred are different, and will result in missing if a statistical analysis is carried out.

4. CONCLUSION

To sum up everything that has been stated so far, it can be conclude that:

1) The single antibiotic commonly used in public hospitals and private hospitals was Ampicillin as many as 18 (27.3%) and 22 (40.7%). Additionally, antibiotics that are often prescribed are third-generation cephalosporins (Ceftriaxone in 12 cases or 18.2% of patients in public hospitals and Cefotaxime in 4 cases or 7.4% of patients in private hospitals).
2) The use of antibiotic drugs in public hospitals found 83 the number of irrational use of antibiotics (81.4%), and in private hospitals as many as 75 the number of antibiotics uses (86.2%). Irrational category III A (long duration) which occurs the most in two hospitals
3) The results of the research on the relationship between rationality and therapeutic outcomes were analyzed by Chi-square. The results revealed that the rationality of empirical antibiotic therapy significantly increased therapeutic outcomes (p=0.008) in hospitals. However, the results of research conducted in private hospitals obtained p value = 0.153, which means that there is no significant relationship between rational use of antibiotics and therapeutic outcomes.

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