

Quantitative Evaluation of Antibiotics Use Trend in One Puskesmas in Bengkulu City: ATC/DDD and DU 90% Methods

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ABSTRACT

Irrational use of antibiotics results in decreased effectiveness of antibiotics due to inappropriate use of therapeutic doses or methods of use. This causes the bacteria to become resistant to antibiotic therapy. Periodic evaluation of antibiotic use is necessary. This study aims to evaluate the use of antibiotics quantitatively in one of the Puskesmas in Bengkulu City in 2021. This type of research is descriptive research. The sample used is an antibiotic prescription in 2021 and is taken by total sampling. This research uses the Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) and Drugs Utilization 90% (DU 90%) methods. The results obtained were the number of prescriptions containing antibiotics as many as 1422 prescriptions (18.40%) of the total prescriptions (7730 prescriptions). The antibiotic prescriptions consisted of 1205 prescriptions for oral preparations and 217 prescriptions for topical preparations. There are 9 types of antibiotics used during 2021, namely Amoxicillin, Ciprofloxacin, Cefixime, Chloramphenicol, Gentamicin, Oxytetracycline, Levofloxacin, Tetracycline, and Tiamphenicol. The most widely used antibiotic was Amoxicillin (92.28%) with a DDDs per 1000 inhabitants per day value of 429.27 followed by Ciprofloxacin (5.06%) with a DDD value of 30.47. So it can be concluded that the most use of antibiotics in 2021 in one of the Puskesmas in Bengkulu City is Amoxicillin.

Keywords: Antibiotics, Anatomical Therapeutic Chemical, Defined Daily Dose, Drugs Utilization 90%, Puskesmas

Introduction

Indonesia is a tropical country that is very suitable for the spread of bacteria. This causes a high incidence of infections, especially those caused by bacteria. The main treatment for bacterial infections is using antibiotics. A study analyzing the use of antibiotics from 2000 to 2010 showed an increase of up to 36% (Van Boeckel *et al.*, 2014). In another study, it was found that an average of 30.1% of patients in the United Kingdom received an antibiotic prescription at least one antibiotic per year (Shallcross *et al.*, 2017). Research using data on antibiotic consumption in 76 countries from 2000 to 2015 and one of the countries is Indonesia shows an increase in the use of antibiotics based on the value of defined daily doses (DDD) from 21.1 billion DDD in 2000 to 34.8 billion DDD in 2015 (Klein *et al.*, 2018).

The high use of antibiotics should be evaluated periodically. Irrational use of antibiotics will cause problems such as resistance. Evaluation of drug use can be done qualitatively and quantitatively. Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) is the recommended method for evaluating drug use (WHO Collaborating Centre for Drug Statistics Methodology, 2022). DDD can be defined as the average daily maintenance dose used for the diagnosis of major infections in adults. Research evaluating the use of antibiotics in Indonesia is still

limited. The Indonesian government recommends that evaluations be carried out in hospitals. However, at the Puskesmas as the first health facility, it was only limited to recording the use of antibiotics in patients with acute respiratory infections and diarrhea.

The occurrence of the Covid-19 pandemic is also predicted to increase the use of antibiotics in health facilities. Monitoring the use of antibiotics quantitatively at the Puskesmas in Bengkulu City has never been carried out. This underlies the purpose of this study, namely to evaluate the use of antibiotics quantitatively using the ATC/DDD method.

Method

This study is an observational study with retrospective data. Data collection was done by purposive sampling. The data used were antibiotic prescriptions received by outpatients at one of the Puskesmas in Bengkulu City in 2021. The data collected in this study were the name of the antibiotic, the dosage form, the dose, and the drug use regimen. Data analysis using Microsoft Excel with ATC/DDD method and Drugs Utilization 90% (DU 90%). The data obtained were analyzed using DDD units/1000 patients per day (WHO Collaborating Centre for Drug Statistics Methodology, 2022). The ATC/DDD code for antibiotics used during the study period can be

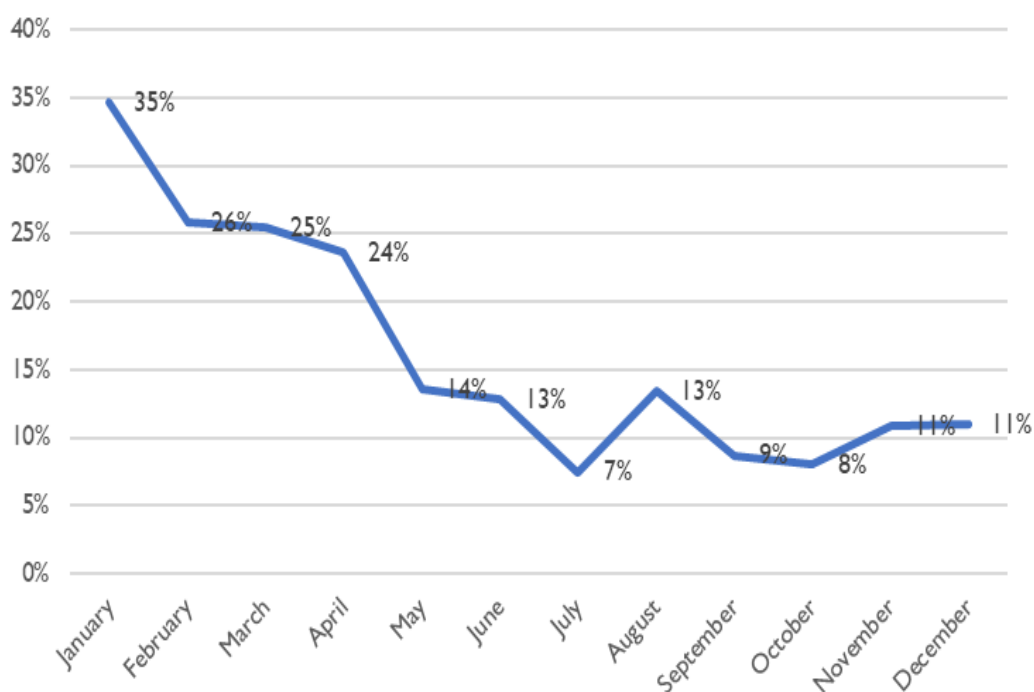
accessed via https://www.whocc.no/atc_ddd_index/. Prescription inclusion criteria used in this study were antibiotic prescriptions for adult patients and oral and injectable dosage forms. The exclusion criteria used were antibiotic prescriptions for pediatric patients and topical dosage forms. Interpretation of the results will be presented in the form of graphs and tables.

Result and Discussion

1. Trends in prescribing antibiotics in one of the Puskesmas in Bengkulu City

The results showed that the total number of prescriptions for outpatient services during 2021 amounted to 7730 prescription sheets and 1422 prescriptions, of

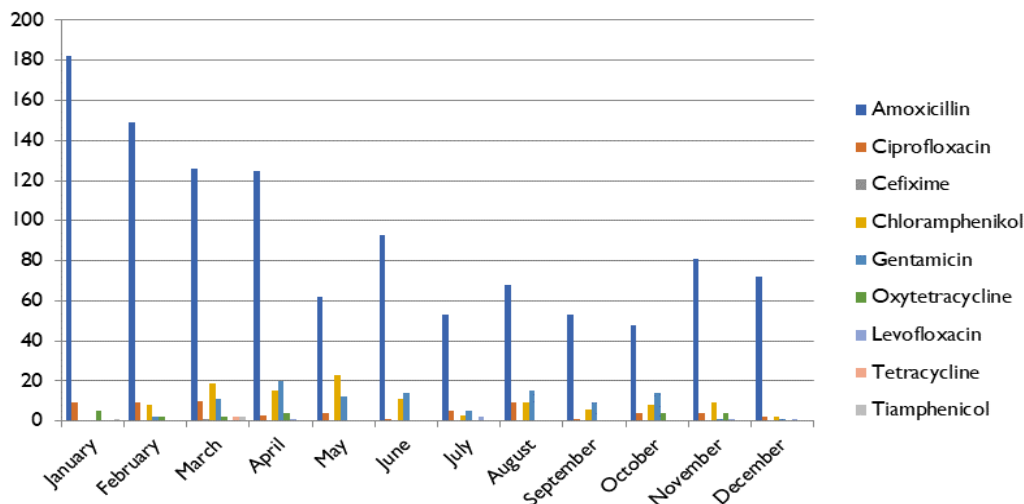
which were antibiotic prescriptions with a percentage of 18.40%. Based on Graph 1, it can be seen that there is a decreasing trend in the use of antibiotics in Puskesmas. The decline in the use of antibiotics until the end of 2021 is estimated to be due to a decrease in Covid-19 cases in the city of Bengkulu. Meanwhile, in January, there was an increase in Covid-19 cases (Pemerintah Provinsi Bengkulu, 2022). This is indirectly seen in the high use of antibiotics with a percentage of 16% of all antibiotic use during 2021. The majority of Covid-19 patients are given antibiotics for no apparent reason (Langford *et al.*, 2020).



Graph 1. Percentage trend of prescribing antibiotics per month in one of the Puskesmas in Bengkulu City in 2021.

In 2021, in this study, there were 9 types of antibiotics prescribed, namely Amoxicillin, Ciprofloxacin, Cefixime, Chloramphenicol, Gentamicin, Oxytetracycline, Levofloxacin, Tetracycline, and Tiamphenicol (Graph 2). Of the 9 types of antibiotics prescribed, there are 2 antibiotics from the "Watch" class (Cefixime and Levofloxacin). Watch class antibiotics should not be prescribed at the Puskesmas. Watch group antibiotics have a higher ability to cause resistance events so they are only used in advanced health facilities or hospitals (Kementerian Kesehatan RI, 2021).

Puskesmas is a basic-level health facility in Indonesia. Most patients who seek treatment are patients who use National Health Insurance insurance. The use of antibiotics in Puskesmas is recommended to use empirical antibiotic therapy and has a broad spectrum. In this study, the most common type of antibiotic used in 2021 was Amoxicillin (92.28%). Amoxicillin can be used as empirical therapy in common bacterial infections. In addition, Amoxicillin is a broad-spectrum antibiotic that can kill Gram-positive and Gram-negative bacteria (White, 2004).



Graph 2. Antibiotic consumption patterns in one of the Puskesmas in Bengkulu City in 2021

2. Quantitative Analysis of Antibiotic Use

This study obtained a sample of 1422 antibiotic prescriptions consisting of 1205 oral prescriptions and 217 topical prescriptions. Quantitative evaluation using the ATC/DDD method, it can only be done using data on the use of drugs orally and by injection. This is because WHO does not include ATC codes for topical preparations because the number of doses given per day can be very high depending on the intensity and distribution of the disease.(WHO Collaborating Centre for Drug Statistics Methodology, 2022).

Based on data from observations at the Puskesmas, there are only 7 types of antibiotics that are oral dosage forms. The antibiotics are Amoxicillin, Ciprofloxacin,

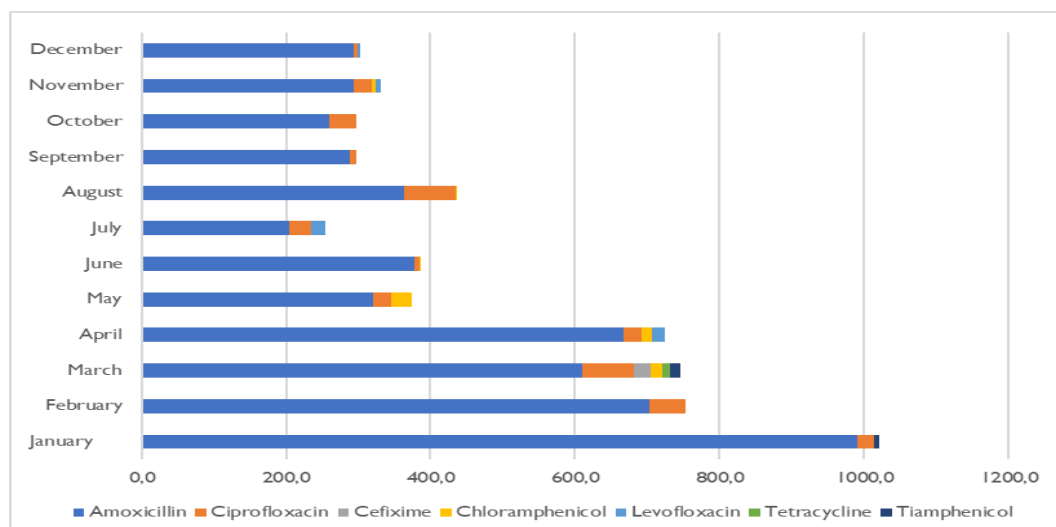
Cefixime, Chloramphenicol, Levofloxacin, Tetracycline, and Tiamphenicol. The quantitative usage pattern of these antibiotics in 2021 can be shown in the value of DDD/1000 patients per day (Table 1). Amoxicillin has a DDD value/1000 patients per day a year, which is quite high compared to other types of antibiotics, namely 429.27. These results can be interpreted that from 1000 outpatients in 2021, around 430 patients received Amoxicillin of 1.5 grams per day. Another study in several health centers outside Bengkulu also showed Amoxicillin to be the most prescribed antibiotic (Sholih, Sudarjat and Saula, 2019; Sitepu, Cahyono and Monica, 2020; Andriani, Martua and Andriani, 2021).

Table 1. Quantity of use of antibiotics in one of the Puskesmas in Bengkulu City with DDD/1000 patients per day in 2021

Antibiotics	ATC Code	DDD	DDD/1000	%	% Cumulative
Amoxicillin	J01CA04	3318,25	429,27	90,67%	90%
Ciprofloxacin	J01MA02	235,50	30,47	6,44%	
Chloramphenicol	J01BA01	41,33	5,35	1,13%	
Cefixime	J01DD08	12,50	1,62	0,34%	
Levofloxacin	J01MA12	34,00	4,40	0,93%	10%
Tiamphenicol	J01BA02	12,00	1,55	0,33%	
Tetracycline	J01AA07	6,00	0,78	0,16%	
Total		3659,58	473,43		

The use of antibiotics every month is fluctuating, but in January, the use of antibiotics, especially Amoxicillin, was very high compared to other types of antibiotics with a DDD value/1000 patients per day of 991 (Graph 3). This means that for every 1000 outpatients who seek treatment at the Puskesmas in January, there are 991 patients who receive an average of 1.5 grams of Amoxicillin per day. Amoxicillin can be used in the treatment of respiratory and digestive tract infections (Katzung,

Masters and Trevor, 2012). Amoxicillin is currently known to have a fairly high resistance level of 67.16%, so it was developed by combining it with clavulanic acid. Clavulanic acid is a -lactamase inhibitor that can protect amoxicillin from beta-lactamase hydrolysis reactions (Pratiwi, 2017). However, a study reported that Escherichia coli and Klebsiella pneumoniae were resistant to Amoxicillin-clavulanate (Martínez-Casanova et al., 2021).



Graph 3. Analysis of the quantity of antibiotic use in one of the Puskesmas in Bengkulu City every month with DDD/1000 patients per day in 2021

Drug Utilization (DU 90%) can be interpreted as a list of drugs that are included in the accumulation of 90% of drug use in a location. Based on Table 1, it is known that the type of antibiotic that is included in the 90% segment of antibiotic use in Puskesmas is Amoxicillin. The high use of Amoxicillin should receive more attention from health workers, especially doctors who prescribe antibiotics so that the effects of antibiotic resistance in the community can be controlled.

Conclusion

Based on the results of a quantitative evaluation of the use of antibiotics using the ATC/DDD and DU 90% methods, it is known that Amoxicillin has the highest DDD value/1000 patients per day in 2021. The number of monthly Amoxicillin prescriptions is also very high compared to other antibiotics.

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