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Research Paper

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Drug Utilization and Cost Analysis of Acute Respiratory Infection (ARI) Treatments at Soedirman Primary Clinic

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Abstract

Background: Acute Respiratory Tract Infections (ARTI) are one of the leading causes of patient visits to primary healthcare centers (40-60%), with inappropriate medication use often leading to wasteful therapy costs. Klinik Pratama Soedirman reports ARTI as the highest outpatient diagnosis, yet there has been no comprehensive evaluation of prescribing patterns and therapy costs. **Objectives:** This study aimed to analyze the prescribing patterns of medications and their impact on ARTI therapy costs at Klinik Pratama Soedirman during the period from March to August 2024. **Methods:** A descriptive analytic study with a cross-sectional design was conducted using secondary data in the form of ARTI patients' medical records and financial reports from Klinik Pratama Soedirman. Data were analyzed using univariate and bivariate methods. **Key findings:** Among the 277 samples analyzed, ARTI therapy with antibiotics had an average cost per prescription of IDR 19,086.76 ± 4,798.39, while prescriptions without antibiotics averaged IDR 15,508.62 ± 5,509.55, with a p-value of 0.000. Prescriptions without antibiotics showed an average cost of supportive therapy with steroids of IDR 14,184.78 ± 4,977.01 and without steroids of IDR 15,750.00 ± 7,337.64, with a p-value of 0.855. Meanwhile, ARTI therapy with antibiotics had an average cost of supportive therapy with steroids of IDR 19,064.17 ± 4,525.45 and without steroids of IDR 19,218.75 ± 6,246.21, with a p-value of 0.631. **Conclusions:** There is a difference in therapy costs between ARTI prescriptions with and without antibiotics, but no difference in therapy costs between prescriptions with and without steroids in ARTI patients at Klinik Pratama Soedirman.

Keywords: prescribing pattern, cost of therapy, ARTI

Introduction

ARI (Acute Respiratory Infection) is one of the leading causes of morbidity and mortality from infectious diseases, with around four million people dying from ARI each year (Pranata et al, 2020). In Indonesia, ARI is among the diseases with a high prevalence. Data from Riskesdas 2018 showed there were 1,017,290 ARI cases with a mortality rate reaching 17% each year [1,2]. Central Java Province ranks among the top three after West Java and East Java with 132,565 cases or 13.03% [3]. This disease is one of the factors contributing to patient visits to hospitals (15–30%) and health centers (Puskesmas) (40–60%) [4].

The prescription of medication plays an important role in the process of providing drugs for patients who receive examinations from doctors at health facilities. Medication use must be rational, according to the condition and needs of the patient so that the patient receives the right medication: in its type, dose, and duration of use, with costs that are affordable for both individuals and the community [5]. Variations in drug use among ARI patients lead to differences in treatment costs for each patient, which in turn affects the overall health cost burden [6]. Survey results indicate that antibiotics for ARI are among the ten most commonly used medications. In addition, steroids, recommended for ARI to suppress inflammation, are indicated as one of the primary causes of polypharmacy. The high incidence and use of these medications lead to an increase in their provision at health services, directly impacting the rising costs of drug procurement [7–9]. A study reported that 25%–70% of total healthcare expenditure in developing countries is spent on medicines. WHO estimates that rational use of medicines could result in cost efficiencies of approximately 50%–70% [10].

A clinic is a healthcare facility that provides individual health services, including basic and/or specialist care. In the era of the National Health Insurance (JKN), clinics play a significant role as one of the Primary Healthcare Facilities (FKTP). Soedirman Primary Clinic is a healthcare center under the Business Management Agency of Jenderal Soedirman University, located in South Purwokerto [11]. Based on data from Soedirman Primary Clinic from March to August 2024, acute upper respiratory infection, unspecified, was the most common outpatient diagnosis among general patients, followed by common cold and dyspepsia [12].

Based on the description above, the high prevalence of

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acute respiratory infections (ARI) necessitates attention to ARI drug prescription patterns, especially as they will affect the burden of treatment costs. Existing studies only describe the average costs needed but have not provided a cost comparison of therapies, particularly between ARI prescriptions involving antibiotics and steroids. The aim of this study is to analyze the cost comparison of ARI therapy between prescriptions with antibiotics and steroids. The results of this research are expected to be used as evaluation material for ARI drug prescriptions at Soedirman Primary Clinic.

Materials and Methods

This section must provide a detailed description of the materials and methods employed, ensuring that the study can be replicated by others. Include information on ethical approval, as well as the sources and purities of all chemicals utilized in the research. A dedicated subsection should fully describe the statistical methods applied to validate the study's outcomes. This aspect will undergo independent review by the Statistical Editor, who may request a reanalysis of the data. The suggested length is 500–1000 words.

Results

This study uses a descriptive analytic research type with a cross-sectional design and employs a retrospective approach using secondary data in the form of patient medical records and medication costs. The research sample consists of patients aged at least 12 years with a single ICD-10 diagnosis of J00 – J06 at Soedirman Primary Clinic during the March-August 2024 period. The variables used in this study are therapy costs, age, gender, health insurance, ARI (Acute Respiratory Infection) diagnosis based on ICD-10, antibiotic use, type of antibiotic, and supportive therapy. The sampling technique used is simple random sampling with the Slovin formula; out of a total of 884 patients who met the criteria, 277 samples were taken for this study.

Tools and Materials

This study uses electronic medical records and financial reports from the pharmacy department, which are then processed using the SPSS Statistics 26 computer program.

Research Procedure

The study was conducted after obtaining ethical approval from the Medical Ethics Committee of the Faculty of Medicine, Unsoed, with letter number 104/KEPK/PE/XI/2024, during the months of November to December 2024. The research began with the collection of medical records and financial reports. The collected data were sorted based on inclusion and exclusion criteria. After data analysis, samples diagnosed with ICD-10 J01, J03, J04, and J05 were excluded because they had very small sample sizes, specifically 2 samples for J01, 6 samples for J03, 1 sample for J04, and 0 samples for J05. The data collected were then processed and presented in tabular form.

Data Analysis

This study uses univariate and bivariate analyses. Univariate analysis is conducted to describe and present the variables based on ICD-10 diagnosis, age, gender, and health insurance. Subsequently, bivariate analysis is performed using the chi-square test to analyze the significance of the relationship between ICD-10 diagnoses and prescribing patterns, and the Mann-Whitney test to analyze the comparison of therapy costs in relation to prescribing patterns.

Discussion

Of the total 277 samples, the most common diagnosis was Acute Upper Respiratory Infections of Multiple and Unspecified Sites (J06), which accounted for 142 cases (51.3%). This was followed by Acute Nasopharyngitis (J00) with 74 cases (26.7%) and Acute Pharyngitis (J02) with 61 cases (22.0%) (Table 1). This is consistent with research conducted by Pietrzykowska et al. regarding respiratory tract infections in primary care facilities, which reported the highest prevalence for J06 at 59.7%, followed by J00 in 13.6% of patients [13]. A study conducted in China also stated that the J06 diagnosis represented the largest share of outpatient acute respiratory infection cases at 62.5% [14]. In line with existing research, based on medical records from Klinik Pratama Soedirman, J06 was the most frequent diagnosis at the clinic during the period from March to August 2024 [12].

Viewed from the patient characteristics (Table 2), women contributed the most cases of ARI with 197 cases (71.1%). This difference is quite significant compared to male patients, who only accounted for 80 cases (28.9%). These results are consistent with research conducted by Benedicta (2022) involving 143 patients, where the percentage comparison between female and male ARI patients was 53.85% and 46.15% respectively [15]. This gender comparison is aligned with the proportion of outpatient visits to the general clinic at Klinik Pratama Soedirman during the period of March – August 2024, where medical records show that the number of female outpatient visits was more than twice that of male visits, with 4,576 female outpatients compared to 2,069 male outpatients [12]. One theory suggests that gender correlates with disorders of the respiratory system. The difference in disease prevalence between genders can be caused by variations in anatomical structure, physiology, and hormonal systems between men and women. In addition, differences in disease frequency by gender can also be infl-

uenced by factors such as differences in occupation, lifestyle, level of exposure, vulnerability, as well as use of health facilities, where women and children tend to access primary health services more frequently than men [16]. The highest frequency of ARI patients by age was found in the 18–25 year age group (81.2%), compared to those over 25 years (18.8%). Based on this data, the adolescent age group had a higher rate compared to adults. This figure is in line with research at Klinik Pratama Asty Sukoharjo, where ARI patients aged 12–25 years accounted for the largest percentage at 38.9%, followed by children at 38%, and adults at 23.1% [17]. The findings regarding the age distribution are also influenced by the overall number of general outpatient visits at Klinik Pratama Soedirman in the period of March – August 2024, where the highest visit rate was in the 12–25 year age group at 72.9% [12]. Health insurance plays an important role in factors affecting patient visits to healthcare facilities. The analysis shows that the majority of patients (92.1%) used BPJS as their health insurance, while the remaining 7% used non-BPJS insurance. According to a study by Irawan and Ainy (2024), the number of BPJS users at primary facilities is high, and this is significantly related to age, gender, perceptions of JKN, and service accessibility. Data from Puskesmas Kampung Baru from January to April 2024 showed that the number of BPJS participant visits was 5,543, while general patient visits totaled 666 [18]. This is consistent with the situation at Klinik Pratama Soedirman, where medical records show that out of all general outpatient visits from March to August 2024, 91.5% of visitors used BPJS as their health insurance [12].

Table 1 Distribution of Samples Based on ICD-10

Diagnosis ICD-10		Total	
Code	**Description**	**n**	**%**
J00	*Acute Nasopharyngitis*	74	26.7%
J02	*Acute Pharyngitis*	61	22.0%
J06	*Acute Upper Respiratory Infections of Multiple and Unspecified Sites*	142	51.3%
Total		277	100%

Table 2 Distribution of Samples Based on Demographic Characteristics

Sample Characteristics	Total	
	n	**%**
Gender		
Male	80	28.9%
Woman	197	71.1%
Age		
12-25 years old	225	81.2%
>25 years	52	18.8%
Health Insurance		
BPJS	255	92.1%
Non-BPJS	22	7.9%

Table 3 Relationship between ICD-10 Diagnosis and Antibiotic Use

Code ICD-10	Use of Antibiotics		P-Value
	Therapy with Antibiotics	Therapy without Antibiotics	
J00	40	34	
J02	53	8	0,000
J06	126	16	
Total	219	58	277

Table 4 Relationship between ICD-10 Diagnosis and Types of Antibiotics

Code ICD-10	Types of Antibiotics				P-Value
	Sefalosporin	Penisilin	Fluoroquinolon	Other antibiotics	
J00	24	7	8	1	
J02	18	18	13	4	0,089
J06	51	25	41	9	
Total	93	50	62	14	219

In this study, an analysis was conducted regarding the distribution of antibiotic therapy use, types of antibiotics, and supportive therapy with steroids based on ICD-10 diagnoses. According to the results, regarding therapy with and without antibiotics, diagnoses J06 and J02 received the most antibiotic therapy, with proportions of 88.8% and 86.9% respectively (Table 3). On the other hand, patients with diagnosis J00 had a lower proportion of antibiotic use, at 54.1%. This study showed a p-value of 0.000, indicating that the ICD-10 diagnosis in ARI determines the use of antibiotics. The percentage comparison among these three diagnoses is consistent with research conducted by Effendi and Evelin (2020), where the percentage of antibiotic use for diagnoses J02 and J06 was the highest among other ARI diagnoses, followed by diagnosis J00 [4]. In managing ARI, the use of antibiotics can accelerate the healing process compared to only providing supportive medication. Additionally, antibiotics also function to prevent secondary infections caused by bacteria [17]. Conversely, excessive or inappropriate use of antibiotics can trigger the development of resistance to certain bacteria, which can then spread through cross-infection. The impact of this antibiotic resistance includes increased morbidity, mortality, and healthcare costs [19].

In a study conducted by Pietrzykowska et al. (2021) on the diagnosis of Acute Upper Respiratory Infections of Multiple and Unspecified Sites (J06), there was a significant difference between patients who received antibiotics and those who did not, with 66.1% of patients being preescribed antibiotic therapy [13].

Table 5 The Relationship Between ICD-10 Diagnosis and Steroid Therapy

Code ICD-10	The use of supportive therapy		P-Value
	Without steroids	With steroids	
J00	18	56	0,068
J02	8	53	
J06	18	124	
Total	44	233	277

Table 6 Average Therapy Costs Based on Antibiotic Prescription Patterns

Type of Therapy	Average Cost ± Standard Deviation (Thousand Rp)	P-value
Antibiotic therapy	19,09 ± 4,80	0,000
Therapy without antibiotics	14,50 ± 5,51	

Table 7 Average Therapy Costs Based on Steroid Prescription Patterns

Types of Therapy	Average Cost ± Standard Deviation (ThousandRp)	P-value
Therapy without antibiotics		
Supportive therapy with steroids	14,18 ± 4,97	0,855
Supportive therapy without steroids	15,75 ± 7,34	
Therapy with antibiotics		
Supportive therapy with steroids	19,06 ± 4,52	0,631
Supportive therapy without steroids	19,21 ± 6,25	

Acute Nasopharyngitis (J00), commonly known as the common cold, is a disease with symptoms such as mild fever, myalgia, headache, nasal congestion, rhinorrhea, sneezing, sore throat, and cough lasting up to 10 days [20]. This disease is mostly caused by viruses, with rhinovirus being the main causative agent [21]. Based on recommendations from the American Academy of Pediatrics, prescribing antibiotics for the common cold is not recommended, as studies have found no benefit from antibiotic prescriptions and only increased side effects [20]. Almost 90% of adults and 70% of children with Acute Pharyngitis (J02) are caused by viral infections. In cases of Acute Pharyngitis (J02) caused by bacteria, the main pathogen is group A beta-hemolytic streptococcus. The Infectious Diseases Society of America recommends diagnostic testing to confirm group A beta-hemolytic streptococcus infection before using antibiotics to avoid overuse. The American Academy of Family Physicians and the American College of Physicians recommend using the modified Centor criteria. Antibiotic therapy is recommended for patients with a score of 4 or 5 [20].

The selection of the appropriate type of antibiotic is crucial to ensure effective treatment of bacterial infections. Research findings show that cephalosporins are the most

frequently used antibiotics, accounting for 42.5% of total antibiotic use (Table 4). Based on the results of the chi-square analysis, a p-value of 0.089 was obtained, indicating that there is no significant relationship between the ICD-10 diagnosis of ARI and the type of antibiotic administered. According to research by Amarullah et al. (2022), the determination of the type of antibiotic is not solely based on the diagnosis; rather, in empirical therapy, the choice of type and dosage of antibiotic depends on available epidemiological data and patterns of bacterial resistance, the patient's clinical status, and the availability of antibiotics [22]. The results of this study are consistent with research conducted at Asty Sukoharjo Primary Clinic, where the most commonly prescribed antibiotic for ARI patients was cephalosporin, followed by penicillin [17]. Research indicates that cephalosporin antibiotics are used more frequently than penicillin antibiotics, as many patients have already developed resistance to the use of penicillin-type antibiotics [23].

Out of a total of 277 samples in this study, 233 samples (84.1%) received supportive therapy with steroids. When compared across the three diagnoses studied, the percentage differences in supportive therapy with steroids were not significantly different for each diagnosis. Diagnosis J06 had a percentage of 87.6%, J02 had 86.9%, and J00 had 76.7%. Based on the results of the bivariate chi-square test, the p-value was 0.068, indicating that there was no statistically significant relationship between the ICD-10 diagnosis and the administration of steroids (Table 5). These results are in accordance with clinical practice guidelines at primary healthcare facilities, where steroids can be given to suppress inflammatory reactions and thus accelerate clinical improvement [9]. Research conducted on outpatient ARI patients in the United States indicated that there is still limited evidence supporting the use of systemic steroids, and to date, there are no standardized recommendations for steroid administration in ARI cases [24].

The analysis of therapy costs and prescribing patterns conducted in this study covers three aspects: the difference in therapy cost with antibiotics and without antibiotics; the difference in therapy cost for prescriptions with antibiotics based on the use of supportive steroid therapy; and the difference in therapy costs for prescriptions without antibiotics based on the use of supportive steroid therapy. Based on the Mann-Whitney test, the difference in therapy costs for prescriptions with and without antibiotics had a p-value of 0.000, indicating a significant difference between therapy with antibiotics and therapy without antibiotics. The average total cost for therapy with antibiotics was Rp19,086.76 ± 4,798.39, while prescriptions without antibiotics had an average cost of Rp15,508.62 ± 5,509.55 (Table 6). Based on the standard deviation, prescriptions without antibiotics had greater variation in therapy costs compared to those with antibiotics. One study stated that antibiotics accounted for 58.92% of the total cost of all prescribed medications. It has been noted that if antibiotic use can be reduced by 50 percent, the average cost per episode of ARI can decrease by $1.64 [25]. In a study by Tsuzuki et al. (2020), based on the type of antibiotic, cephalosporins, macrolides, and fluoroquinolones accounted for more than 90% of the total cost of antibiotic prescriptions for ARI [26].

Based on the average cost of therapy with steroids and without steroids (Table 7), for treatment without antibiotics, the average cost of therapy with steroids was Rp14,184.78 with a standard deviation of 4,977.01, while the average cost without steroids was Rp15,750.00 with a standard deviation of 7,337.63. Based on the standard deviation, therapy without steroids has a greater variation in therapy costs. Treatment with antibiotics involves higher costs. In this study, antibiotic therapy together with supportive therapy using steroids had an average cost of Rp19,064.17 with a standard deviation of 4,525.45. Not significantly different, the average cost of antibiotic therapy accompanied by supportive therapy without steroids was Rp19,218.75 with a standard deviation of 6,246.21. As in the group receiving therapy without antibiotics, therapy without steroids had a larger standard deviation, indicating a greater variation in costs in that group.

The therapy costs of the two groups, with and without antibiotics, were each compared using an unpaired two-sample comparative test. Since the normality test of the data in both groups showed a P value <0.05, data transformation was performed first. Transformation used the SQRT form because it suited the nature of the data distribution, which was moderate positive skewness. After transformation, the data still were not normally distributed, so the hypothesis test used was the Mann-Whitney test. The Mann-Whitney test was conducted to analyze whether there was a significant difference between supportive therapy with or without steroids. Based on this test, both groups showed no significant difference, as each had a p-value above 0.05, namely 0.855 for the therapy group without antibiotics and 0.631 for the group with antibiotics. Therefore, it can be concluded from this study that the provision of supportive therapy with or without steroids does not show a significant difference in terms of therapy costs.

There were two types of steroid therapies given in the sample: methylprednisolone and dexamethasone. According to price data from the Soedirman Primary Clinic's financial report, corticosteroid drugs containing methylprednisolone had a unit price range of Rp600 – Rp2,000, while drugs containing dexamethasone had a unit price range of 200 – 300 rupiah [12]. Based on this study, whether prescribed with antibiotics or without antibiotics, the provision of supportive therapy with steroids was less expensive. This contrasts with the findings of Ambarwati

et al. (2018), who stated that steroids were one of the causes of polypharmacy, which leads to an increased number of drugs to be provided in healthcare services and directly impacts the increase in drug procurement costs [8]. Higher prescription costs with supportive steroid therapy may be influenced by various factors. Findings from Suharmiati et al. (2019) indicate that age, health insurance, the number of drug items, and the use of generic drugs can be factors influencing the cost of drugs in prescriptions [27].

Conclusion

Most ARI patients at the Soedirman Primary Clinic are female, aged 12-25 years, and use BPJS health insurance. The most commonly found ICD-10 diagnosis is J06 (Acute upper respiratory infections of multiple and unspecified sites), followed by J00 (Acute nasopharyngitis) and J02 (Acute pharyngitis). The analysis shows a relationship between the ICD-10 diagnosis and the use of antibiotics, but no relationship was found between the ICD-10 diagnosis and either the type of antibiotic used or the administration of supportive steroid therapy. In addition, there is a difference in therapy costs between prescriptions with and without antibiotics, whereas in terms of steroid therapy, no cost difference was found between prescriptions with and without steroids. For future research, it is recommended to evaluate the effectiveness of prescribing patterns and the factors influencing therapy selection, both from clinical, financial, and patient preference aspects, by involving a more heterogeneous sample. The study should also classify first-time patients and those returning because their previous complaints have not improved to provide a more representative overview.

Supplementary Material

None

Author Contributions

M : Conceptualization, Methodology, Writing-Original Draft. **FWP** : Data Curation, Formal Analysis, Visualization. **JM** : Supervision, Writing- Review & Editing. **MAW** : Supervision, Writing- Review & Editing All authors should have approved the final version of the manuscript and agree to be accountable for their contributions.

Conflict of Interest

The authors have no financial conflicts of interest to declare.

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