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Coronavirus Pandemic

The quantitative evaluation of antibiotic utilization in community health centers during the COVID-19 pandemic: a cross-sectional multicenter study

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Abstract

Introduction: Uncertainty and rapid changes in treatment guidelines are influencing factors for medication use during the COVID-19 pandemic. Therefore, this study aimed to evaluate antibiotic utilization in Community Health Centers (CHCs) between 2020 and 2021.

Methodology: Prescription data from adult outpatient visits (≥ 18 years) receiving prescription services at 35 CHCs in South Jakarta, Malang regency, and Bengkulu city, comprising 796,598 prescriptions, were examined using the ATC/DDD methodology and DU90% analysis. These regions were purposively selected to represent three distinct healthcare archetypes, namely metropolitan (South Jakarta), rural-urban continuum (Malang Regency), and regional cities outside Java (Bengkulu City). Wilcoxon signed-rank and Chi-square tests were used to determine statistical differences between years.

Results: The proportion of adult patient visits receiving a minimum of one antibiotic prescription decreased by 1.56% in 2021 ($p < 0.001$). Malang Regency recorded the highest rates, decreasing by 2.24% in 2021. Furthermore, the highest DDD values for all antibiotics each year were recorded in South Jakarta, except for Cefadroxil, which peaked in Malang regency. Six antibiotics were constituted in the DU90% segment, with Amoxicillin accounting for over 50% of prescriptions and reaching 425 DDD/1000 patient visits/year in South Jakarta in 2020. In 2021, Azithromycin prescriptions increased significantly by 7.51%, as shown by a p of 0.0161. The average prescribing rate (14.57%) remained below the WHO optimal indicator (< 30%).

Conclusions: Antibiotic use in CHCs declined during the pandemic, but there was a significant increase in Azithromycin prescriptions.

Key words: Antibiotic use; COVID-19; community health care; antimicrobial stewardship.

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Introduction

Antibiotic resistance is a serious global health problem, with the irrational use of these medications being the main cause [1]. Several studies reported alarming trends of antibiotic consumption, which were correlated to its irrational use [2,3]. In many regions, including Southeast Asia, the COVID-19 pandemic caused a significant rise in antibiotic consumption, especially in Indonesia, despite the minimal occurrence of secondary bacterial infections in patients [4,5]. This trend has raised concerns about the potential exacerbation of antimicrobial resistance (AMR). During the pandemic, the implementation of stewardship programs has shown the increasing rationality of antibiotic prescriptions [6]. In many countries, there was a significant increase in the prescription of antibiotics, including Meropenem, Moxifloxacin, Piperacillin/Tazobactam, and Azithromycin during the pandemic [7].

At the beginning of the COVID-19 pandemic, there was an absence of an evidence-based global guideline for its treatment. Therefore, the Indonesian government, in collaboration with several medical professional organizations, issued national guidelines for COVID-19 management [8–12]. The use of antibiotics is regulated in these guidelines, aiming to control the irrational use. The dynamic updates of these guidelines reflected the evolving clinical evidence but also influenced local prescribing behaviors. A study in Australia found that government policy interventions in 2020 improved the rational use of antibiotics with a decrease in the number of antibiotic prescriptions given [13].

Previous studies have shown that Indonesia still struggles with the rational use of antibiotics. There was a high number of antibiotic prescriptions in primary health centers in Indonesia [14]. Community health centers (CHCs) are the frontline of healthcare, often encountering challenges, such as diagnostic uncertainty and high patient volumes, which may lead to empirical prescribing patterns. Evaluating antibiotic prescriptions in CHCs is important because these facilities are among the most accessible in the community. Therefore, this study aimed to provide a multidimensional evaluation of antibiotic prescriptions at 35 CHCs between 2020 and 2021. The selected regions represent three distinct geographical and demographic archetypes, namely metropolitan (South Jakarta), rural-urban continuum (Malang Regency), and regional city outside Java (Bengkulu City), considering the changes of national COVID-19 treatment guidelines during the same period.

Methodology

Study design

In this multicenter cross-sectional study, secondary data were collected from 35 CHCs located in three regions of Indonesia, namely the administrative city of South Jakarta, Malang Regency, and Bengkulu City. The selection of these regions was based on the distinct demographic and geographic characteristics to represent three healthcare archetypes. These healthcare archetypes included (1) South Jakarta as an urban metropolitan archetype with a population density of 15.758 people/km², a total area of 145.73 km², and a Human Development Index (HDI) of 84.90, (2) Malang Regency as a rural-urban continuum archetype with a population density of 863 people/km², a vast territory of 3.530.65 km², and an HDI of 70.36, and (3) Bengkulu City as a regional archetype outside Java with a population density of 2.462 people/km², a total area of 151.70 km², and an HDI of 80.36. The sampling targeted CHCs that maintained the most complete and verifiable records to ensure data integrity across various recording systems, including both electronic databases and validated manual registries. Prescription data were extracted from databases for the period of the COVID-19 pandemic in 2020 and 2021.

Ethics approval

Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Bengkulu (No. KEPK.BKL/004/02/2023).

Data collection and analysis

A total sampling method was adopted, including all eligible outpatient antibiotic prescription records from the participating CHCs. The inclusion criteria were (1) all systemic antibiotics, (2) antibiotics were prescribed for patients aged at least 18 years, and (3) complete records including the antibiotic name, prescribed dose, and dosage form. This study excluded antibiotics for pediatric patients, people with HIV/tuberculosis, and local treatment, such as rectal, topical, nasal, vaginal, or otic routes. No missing data were present in the analyzed dataset because only prescriptions with complete records (antibiotic name, dose, and dosage form) were included. Any prescriptions not entered by CHCs staff would not be captured and would be unavailable for analysis.

The collected antibiotics were grouped based on the Anatomical Therapeutic Chemical (ATC) classification. The ATC codes were accessed through a website by the WHO Collaborating Centre for Drug Statistics Methodology (www.whocc.no/atc_ddd_index/). Furthermore, the Defined Daily Dose (DDD) for each antibiotic was calculated as a core indicator, expressed as DDD per 1000 patient visits per year, using Microsoft Excel. The prescribing rate was calculated by dividing the number of visits with a minimum of one antibiotic prescription by the total number of adult outpatient visits receiving prescription services. The prescribed antibiotics were also ranked from largest to smallest and classified as falling within the Drug utilization 90% (DU90%) segment.

Data analysis was conducted using Version 28 of the SPSS software (IBM Corp., USA). The Wilcoxon signed-rank test was used to examine the disparity in antibiotic utilization between 2020 and 2021. Meanwhile, the Chi-square test was applied to compare the proportions of antibiotic prescriptions across the two years, as the paired DDD/1000-visit values were not presumed to follow a normal distribution (rendering a non-parametric paired test suitable). Prescription proportions were categorical and consequently

Table 1. Proportion of adult outpatient visits with at least one antibiotic prescription (%) in Community Health Centres, Indonesia, 2020–2021.

		Cluster			Total
		Administrative City of South Jakarta	Bengkulu City	Malang Regency	
2020	The number of patient visit	196.513	93.903	119.260	409.676
	Antibiotic prescriptions (%)	28.862 (14.68%)	11.394 (12.13%)	22.557 (18.91%)*	62.813 (15.33%)**
2021	The number of patient visit	177.417	103.801	105.704	386.922
	Antibiotic Prescriptions (%)	25.428 (14.33%)	10.222 (9.85%)	17.626 (16.67%)*	53.276 (13.77%)
TOTAL	The number of patient visit	373.930	197.704	224.964	796.598
	Antibiotic prescriptions (%)	54.290 (14.52%)	21.616 (10.93%)	40.183 (17.86%)	116.089 (14.57%)

Data are presented as number of prescriptions (percentage of total outpatient visits). Differences between 2020 and 2021 were analyzed using the Chi-square test. *Highest proportion of antibiotic prescriptions among regions in the same year. ** Highest proportion of total antibiotic prescriptions between years.

Table 2. Mean values were calculated based on aggregated outpatient visits from 35 Community Health Centers (n = 796,598 visits).

Cluster	Mean (%) 2020–2021	Change (%) 2021–2020	Trend Direction
South Jakarta City	14.51	-0.35	↓ Slight decrease
Bengkulu City	10.99	-2.28	↓ Significant decrease
Malang Regency	17.79	-2.24	↓ Significant decrease
Overall Mean	**14.43**	**-1.56**	↓ Moderate decrease

Annual change represents the absolute difference in prescribing proportion between 2021 and 2020. Statistical significance of annual changes was assessed using the Chi-square test.

analyzed using the Chi-square. In this analysis, a $p < 0.05$ was considered statistically significant.

Results

Antibiotic prescribing patterns

Analysis of antibiotic prescription patterns from selected CHCs in three regions of Indonesia showed a consistent downward trend from 2020 to 2021 (Table 1). Table 1 shows the proportion of outpatient visits with a minimum of one antibiotic prescription across the three regions in 2020 and 2021. In 2020, the highest proportion of antibiotic prescriptions relative to the number of patient visits occurred in Malang Regency (18.91%). In 2021, all three regions experienced a decline, with Malang Regency remaining the highest (16.67%). The average of the antibiotic prescribing rate decreased from 15.33% in 2020 to 13.77% in 2021 ($p < 0.001$, Chi-square test). As shown in Table 2, the average proportion of antibiotic prescriptions across the three regions reached 14.57% during the study period, which remained within the WHO optimal indicator of < 30%.

Drug utilization 90% (DU90%)

The DU90% analysis in Table 3 showed a significant shift in the antibiotic prescribing patterns between 2020 and 2021. The results showed that the DU90% analysis of antibiotic use at the CHCs in 2020 and 2021 exhibited a significant difference in usage patterns. The number of Amoxicillin prescriptions decreased significantly by 8.18% from 2020 to 2021. However, there was an increase in the utilization of Azithromycin, Ciprofloxacin, and Cefadroxil. Azithromycin prescribing increased sharply by 7.51% ($p = 0.0161$), coinciding with the COVID-19 pandemic. The utilization of Ciprofloxacin showed a trend towards the use of broad-spectrum antibiotics. The use of Sulfamethoxazole-Trimethoprim remained relatively stable but experienced a slight decrease.

Antibiotic consumption, measured as DDD per 1,000 patient visits per year, varied significantly across regions and years (Figure 1). DDD values in this study were calculated per 1,000 patient visits annually rather than population size. Therefore, high DDD values did not reflect disease severity, treatment appropriateness, or clinical outcomes, but rather showed the volume of antibiotic consumption relative to outpatient visits. Total consumption declined in all regions from 2020 to 2021, with the largest reductions in Bengkulu city (-2.28%) and Malang Regency (-2.24%). The total reduction in antibiotic consumption was statistically significant ($p < 0.001$, Wilcoxon signed-rank test), and there was a decrease in the proportion. Regional comparisons also showed significant differences ($p < 0.01$), with recording consumption ($p < 0.05$), while Bengkulu city had the lowest.

Amoxicillin consumption decreased in all regions, and the most significant decline was observed in Bengkulu, from 370 to 281 DDD/1,000 patient visits/year ($\Delta = -89$ pp). However, the use of antibiotics increased significantly, particularly in Bengkulu City, which increased rapidly by more than 340%. The use of Azithromycin showed a significant increase in 2021, especially in South Jakarta, with growth exceeding 1750%, and in Malang Regency at more than 1000%. Erythromycin and Sulfamethoxazole-Trimethoprim experienced a decline in most regions.

Discussion

In general, the results of this study show a moderate reduction (1.56%) in antibiotic use in primary health care facilities during the COVID-19 pandemic in

Table 3. Drug utilization 90% for antibiotic utilization in 35 Community Health Centers during 2020-2021.

Antibiotic (ATC Code)	2020 (%)	2021 (%)	Change (%)	Trend
Amoxicillin (J01CA04)	68.11	59.93	↓ 8.18	Decreasing
Ciprofloxacin (J01MA02)	10.07	12.44	↑ 2.37	Increasing
Sulfamethoxazole-Trimethoprim (J01EE01)	6.77	6.25	↓ 0.52	Stable-Decreasing
Azithromycin (J01FA10)	0.73	8.24	↑ 7.51	Sharp Increase
Erythromycin (J01FA01)	5.08	3.43	↓ 1.65	Decreasing
Cefadroxil (J01DB05)	2.22	2.29	↑ 0.07	Stable

Percentages represent the proportion of total antibiotic consumption within the DU90% segment for each year. DU90% analysis was performed by ranking antibiotics based on DDD values from highest to lowest, following WHO methodology. DU90% analysis is descriptive; no inferential statistical testing was applied.

Indonesia. A comparable trend was reported in a study from Poland, in which improved diagnostic certainty for viral infections during the pandemic was suggested as a contributing factor to reduced antibiotic prescribing [15]. Another study in China also suggests that the reduction in patient visits resulting from healthcare service restrictions during the COVID-19 pandemic contributed to the observed decrease in antibiotic prescriptions, particularly in rural regions [16].

Across the three study regions, Bengkulu City consistently showed lower antibiotic utilization compared with South Jakarta and Malang Regency. Representing a rural-urban continuum, Malang Regency recorded the highest proportion of antibiotic prescriptions, followed by South Jakarta. These regional variations reflected differences in healthcare access, patient volume, and local prescribing practices rather than differences in disease burden alone.

The World Health Organization (WHO) recommends a set of prescribing indicators in assessing antibiotic use. An indicator specifies that the percentage of patient encounters in which an antibiotic is prescribed should be below 30%. In this study, the proportion of antibiotic prescriptions in CHCs during both 2020 and 2021 remained within the recommended threshold. The observed antibiotic prescribing rates were lower than those reported in several other Southeast Asian countries (18-22%). However, such comparisons should be interpreted cautiously due to differences in study design, settings, and methodologies [17].

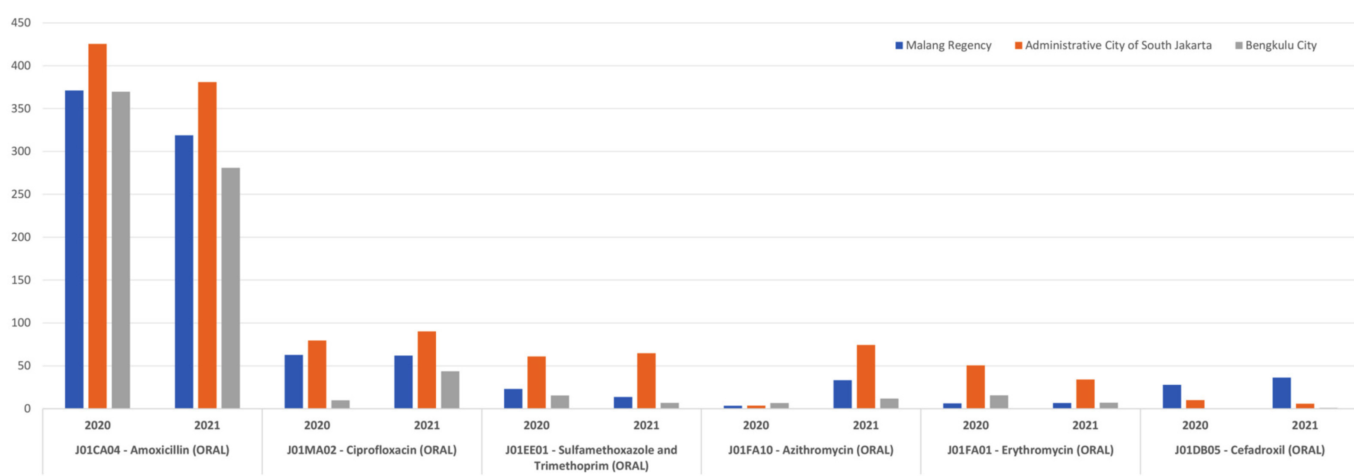
Antibiotic prescribing during the COVID-19 pandemic may have been influenced by clinicians' concerns regarding potential secondary bacterial infections among patients with COVID-19. However, excessive or inappropriate antibiotic use carries a significant risk of accelerating AMR [18,19]. Evidence from previous studies shows that although a high proportion of COVID-19 patients received antibiotics, the actual prevalence of bacterial co-infections was relatively low, necessitating more judicious prescribing practices [20]. Consequently, widespread empirical antibiotic use in this context appears largely unsupported, showing the importance of targeted antimicrobial stewardship (AMS) interventions. Changes in healthcare delivery and clinical workflows during the pandemic may have altered prescribing behaviours, thereby influencing antibiotic utilisation patterns.

The DU90% analysis in Table 3 identified six primary antibiotics constituting the DU90% segment, namely Amoxicillin, Ciprofloxacin, Sulfamethoxazole-Trimethoprim, Azithromycin, Erythromycin, and Cefadroxil. Amoxicillin remained the most frequently used antibiotic, reflecting its role as a first-line agent within the 'Access' category of the WHO AWaRe classification.

Amoxicillin (J01CA04)

Among other antibiotics (Figure 1), Amoxicillin had the highest consumption across all three regions, but its utilization declined during the study period. South Jakarta consistently showed the highest consumption of Amoxicillin, showing a decline in all data study regions, with reductions of Malang regency (Δ = -5.4 pp), South Jakarta (Δ = -4.3 pp), and Bengkulu City (Δ = -9.2 pp). Although the Amoxicillin utilization was very high, there was no significant increase (p = 0.0555) during the pandemic. The DDD/1000 patient visits/year value for Amoxicillin at all study sites also

Figure 1. Antibiotic consumption expressed as Defined Daily Dose (DDD) per 1,000 adult outpatient visits per year in Community Health Centers across three Indonesian regions, 2020 and 2021.



declined.

Restrictions on face-to-face consultations may have contributed to this downward trend in prescribing patterns during the pandemic [21]. This decline in Amoxicillin utilization indicates a shift towards other antibiotics, such as Ciprofloxacin and Azithromycin. High DDD values for amoxicillin should not automatically be interpreted as inappropriate use, as the DDD method does not take into account clinical indications, dose adjustments, or the appropriateness of treatment at the individual patient level.

The COVID-19 pandemic has notably impacted the overprescription of Amoxicillin and other antibiotics, largely stemming from the misunderstanding of bacterial infections that occur alongside viral illnesses. A systematic review revealed that 67% of hospitalized COVID-19 patients were administered antibiotics, with 80% of these prescriptions lacking supporting evidence of bacterial co-infection [22]. The overprescription of antibiotics poses a significant risk of increased AMR, showing the need for rational antibiotic use and enhanced surveillance to address these problems [23].

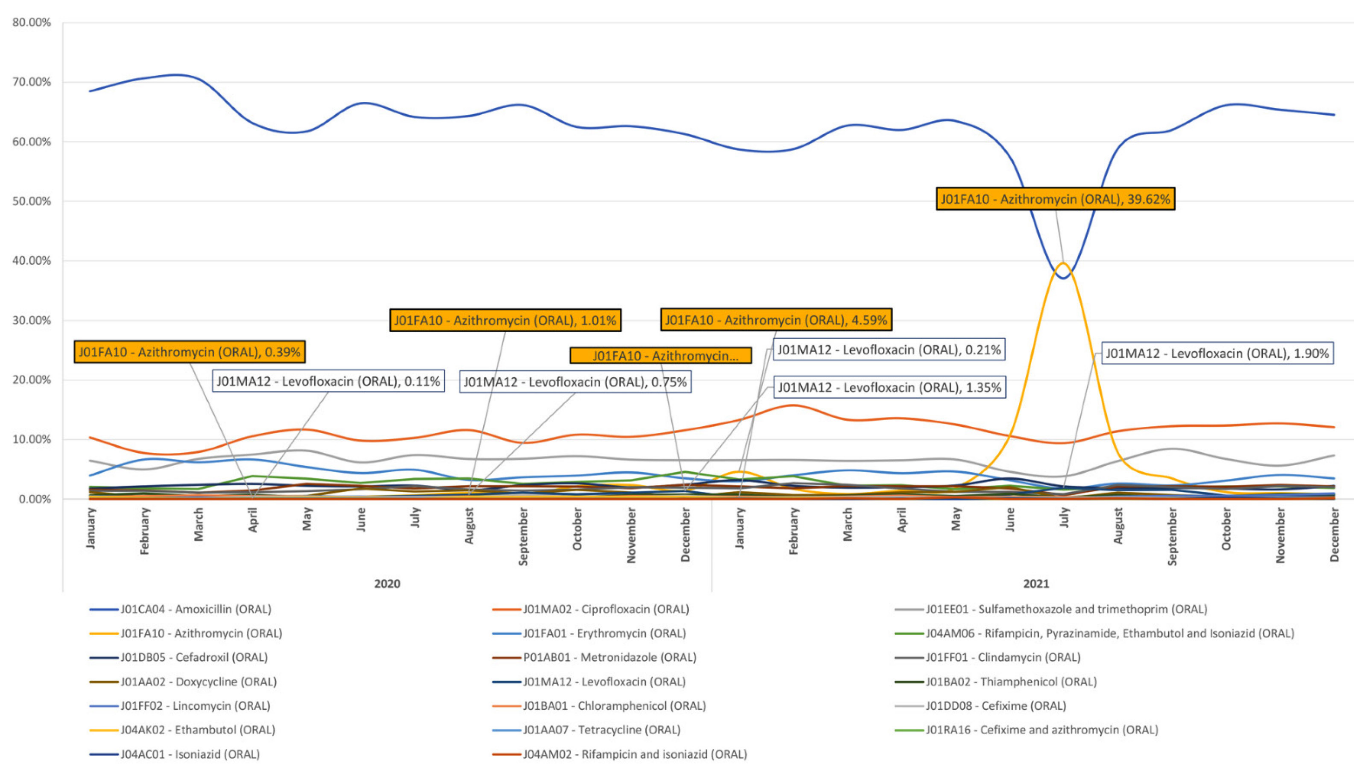
Ciprofloxacin (J01MA02)

Ciprofloxacin utilization rose (Table 2), suggesting an increased reliance on broad-spectrum fluoroquinolone agents. Regional variations in ciprofloxacin prescribing patterns were observed, and utilization increased across all study regions, with the most pronounced increase occurring in Bengkulu City (**Δ** = +9.79 pp), due to a shift from amoxicillin utilization. Statistical analysis of the pooled data showed a significant increase in ciprofloxacin consumption (p = 0.0094). In CHCs, ciprofloxacin is primarily prescribed for urinary tract infections (UTIs). It is also shown for diarrhea and gastroenteritis, which account for 13.2% of outpatient prescriptions [24].

Sulfamethoxazole-Trimethoprim (J01EE01)

Sulfamethoxazole-Trimethoprim, better known as Co-trimoxazole, is commonly used in primary healthcare to treat various infections, such as UTIs, skin and soft tissue infections (SSTIs), and respiratory tract infections. The use of Co-trimoxazole remained relatively stable (Table 3) because it still serves as a first-line alternative for several mild infections. This stability shows a fairly consistent treatment pattern and rational utilization. Co-trimoxazole has historically served as a standard treatment for uncomplicated UTIs. However, its prescribing has been impacted by increasing resistance and the introduction of alternative antibiotics [25].

Figure 2. Monthly trends of oral antibiotic utilization in Community Health Centers across three Indonesian regions, 2020–2021.



Azithromycin (J01FA10)

A marked spike in azithromycin utilization (Figure 2) was observed across all regions in July 2021, coinciding with the peak of the COVID-19 pandemic in Indonesia. During this period, azithromycin was widely prescribed, despite developing evidence of limited efficacy, for patients with suspected or confirmed COVID-19 and/or presumed secondary bacterial infections. The largest increases were observed in Malang Regency (Δ = + 4.93 pp) and South Jakarta (Δ = + 6.44 pp), while Bengkulu City showed a more modest rise (Δ = + 1.62 pp). In general, azithromycin utilization increased significantly from 2020 to 2021 (p = 0.0161, Chi-square test), showing a temporal shift in prescribing patterns during the pandemic.

Considering the cross-sectional nature of this study, causality cannot be inferred. However, the observed increase may be associated with empirical/off-label use during the pandemic and with contemporaneous national and professional COVID-19 guidance that included azithromycin in earlier editions. The first three editions of the National COVID-19 Management Guidelines (2020) listed azithromycin for patients with mild to severe symptoms [9–12]. The circulation of these recommendations may have contributed to increased prescribing at CHCs for patients presenting with COVID-19–like symptoms. These results show the need to critically review antibiotic use during public health emergencies to minimize unnecessary exposure and AMRrisk.

Erythromycin (J01FA01)

Erythromycin utilization was more prevalent in South Jakarta in 2020, before declining in 2021, as shown in Table 3. This trend may be attributed to initial clinical protocols that favored erythromycin in 2020, which subsequently declined as clinical evidence evolved or as it was replaced by other macrolides, such as azithromycin. The observed reduction across all three regions suggests a broader shift in macrolide prescribing preferences within these primary healthcare settings. Previous studies have identified erythromycin as the most frequently prescribed antibiotic for upper respiratory tract infections in public primary care clinics [26].

Cefadroxil (J01DB05)

Cefadroxil utilization was relatively low compared to other antibiotics. The rise in Malang Regency may indicate a preference for cefadroxil for specific indications, while utilization in South Jakarta and Bengkulu City remained low or declined (Figure 2). Cefadroxil is frequently prescribed for respiratory tract infections, UTIs, and SSTIs. Prolonged antimicrobial exposure significantly contributes to the development of AMR, complicating therapeutic alternatives and escalating healthcare costs [27].

Although several studies reported that antibiotic prescribing increased globally during the pandemic, particularly in secondary care, these studies in primary care show a distinct trend. For instance, one study reported that 50.1% of hospitalized patients received antibiotics during the pandemic, compared to 36.4% in the pre-pandemic period [28]. This divergence shows the necessity for enhanced AMS and judicious prescribing practices to mitigate the risk of resistance. Achieving effective treatment while combating antibiotic resistance remains a significant challenge for healthcare systems worldwide.

Conclusions

In conclusion, antibiotic utilization in CHCs during the COVID-19 pandemic shows a general decline, but irrational practices persisted. This is shown by a sharp increase in Azithromycin utilization without strong evidence of bacterial co-infection. The trend reflects the influence of national treatment guidelines and diagnostic limitations in primary care. The results of this study show the importance of strengthening AMS programs, improving diagnostic capacity, and refining evidence-based policies to mitigate the risk of AMR in primary healthcare settings.

Study Limitation

First, the cross-sectional design does not allow for causal conclusions to be drawn between changes in national COVID-19 treatment guidelines and the observed patterns of antibiotic prescribing. Second, this study relies on prescription records from selected CHCs, which may limit its generalizability to other primary health care facilities in Indonesia. However, the multicenter design and standardized WHO ATC/DDD methodology provide valuable insights into antibiotic use trends during the COVID-19 pandemic.

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Author’s Contributions

Conception (ZM; AIWE; KCDPS), method (ZM; AIWE; KCDPS), Discussion and Corrections (ZM; AIWE; KCDPS; ALH; LAK)

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Conflict of interest
No conflict of interest is declared.

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Annex – Supplementary Items

Supplementary Table 1. Figure 1 dataset.

	J01CA04 - Amoxicillin (ORAL)		J01MA02 - Ciprofloxacin (ORAL)		J01EE01 - Sulfamethoxazole and Trimethoprim (ORAL)		J01FA10 - Azithromycin (ORAL)		J01FA01 - Erythromycin (ORAL)		J01DB05 - Cefadroxil (ORAL)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Malang Regency	371	319	63	62	23	14	3	33	6	7	28	36
Administrative City of South Jakarta	425	381	80	90	61	65	4	74	50	34	10	6
Bengkulu City	370	281	10	44	15	7	7	12	16	7	0	1

Supplementary Table 2. Figure 2 dataset.

	2020												2021											
	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
J01CA04 - Amoxicillin	68.50	70.65	70.56	63.16	61.73	66.46	64.18	64.33	66.17	62.49	62.61	61.27	58.72	58.76	62.71	61.99	63.49	57.53	37.07	58.81	61.98	66.13	65.38	64.52
J01MA02 - Ciprofloxacin	10.34	7.74	7.91	10.54	11.67	9.83	10.28	11.58	9.45	10.82	10.46	11.56	13.28	15.74	13.34	13.57	12.52	10.60	9.40	11.39	12.24	12.35	12.70	12.08
J01EE01 - Sulfamethoxazole and trimethoprim	6.45	4.98	6.74	7.48	8.13	6.17	7.39	6.74	6.77	7.20	6.63	6.54	6.55	6.58	6.42	6.52	6.65	4.60	3.83	6.38	8.45	6.74	5.61	7.33
J01FA10 - Azithromycin	0.37	0.17	0.22	0.39	0.25	0.43	0.66	1.01	0.71	2.14	2.36	1.43	4.59	1.73	0.83	1.44	1.84	10.53	39.62	7.85	3.48	1.17	0.97	0.83
J01FA01 - Erythromycin	3.97	6.65	6.19	6.66	5.39	4.37	4.92	3.22	3.66	3.95	4.47	3.49	3.00	4.01	4.82	4.35	4.63	3.17	1.75	2.61	2.28	3.10	4.06	3.47
J04AM06 - Rifampicin, Pyrazinamide, Ethambutol and Isoniazid	2.06	1.80	1.70	3.86	3.43	2.70	3.36	3.46	2.57	2.87	3.15	4.57	3.29	3.84	2.26	2.34	1.68	2.25	1.59	2.01	1.90	2.14	2.12	1.87
J01DB05 - Cefadroxil	1.77	2.13	2.39	2.55	2.23	2.13	2.25	1.50	2.35	2.64	1.97	2.42	3.18	2.23	1.94	2.02	2.28	3.45	2.13	1.89	1.89	1.77	1.63	2.22
P01AB01 - Metronidazole	1.63	1.48	1.07	1.45	2.55	2.23	1.78	2.17	2.17	2.11	1.83	2.39	2.13	1.81	2.19	2.16	2.17	1.79	0.69	2.10	2.18	2.06	2.38	2.12
J01FF01 - Clindamycin	1.39	1.39	1.09	1.14	1.34	1.68	2.18	1.64	1.41	1.63	1.98	1.93	1.82	2.67	2.38	1.77	1.22	1.20	0.81	2.36	2.00	1.71	2.19	2.02
J01AA02 - Doxycycline	1.16	0.38	0.32	0.48	0.55	1.80	1.28	1.48	0.93	1.57	1.11	0.28	1.14	0.68	0.71	1.12	1.20	2.03	0.15	1.07	0.68	0.45	0.27	0.45
J01MA12 - Levofloxacin	0.31	0.22	0.16	0.11	0.56	0.38	0.57	0.75	1.07	0.82	1.05	1.35	0.21	0.38	0.28	0.30	0.53	0.76	1.90	1.50	1.57	0.59	0.48	0.69
J01BA02 - Thiamphenicol	0.66	0.95	0.54	0.76	0.37	0.43	0.20	0.51	0.73	0.30	0.72	0.78	0.77	0.37	0.62	0.82	0.54	0.90	0.33	0.71	0.27	0.55	0.83	0.85
J01FF02 - Lincomycin	0.52	0.42	0.30	0.22	0.39	0.45	0.17	0.32	0.53	0.24	0.36	0.43	0.37	0.35	0.38	0.50	0.39	0.32	0.10	0.45	0.60	0.58	0.72	0.94
J01BA01 - Chloramphenicol	0.35	0.55	0.66	0.54	0.51	0.29	0.33	0.47	0.31	0.30	0.53	0.53	0.43	0.31	0.45	0.62	0.35	0.40	0.37	0.21	0.21	0.20	0.22	0.22
J01DD08 - Cefixime	0.08	0.19	0.10	0.43	0.48	0.36	0.37	0.42	0.75	0.44	0.38	0.60	0.21	0.30	0.34	0.38	0.17	0.25	0.21	0.33	0.19	0.17	0.25	0.15
J04AK02 - Ethambutol	0.43	0.20	0.03	0.14	0.30	0.22	0.00	0.38	0.41	0.45	0.39	0.42	0.10	0.20	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J01AA07 - Tetracycline	0.01	0.06	0.01	0.09	0.12	0.07	0.06	0.00	0.03	0.03	0.00	0.00	0.07	0.00	0.03	0.01	0.02	0.07	0.05	0.05	0.04	0.01	0.10	0.08
J01RA16 - Cefixime and azithromycin	0.01	0.02	0.00	0.02	0.01	0.01	0.01	0.03	0.00	0.00	0.02	0.01	0.07	0.03	0.05	0.03	0.05	0.04	0.01	0.07	0.03	0.04	0.02	0.05
J04AC01 - Isoniazid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.10	0.00	0.09	0.00	0.23	0.05	0.02
J04AM02 - Rifampicin and isoniazid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.28	0.00	0.00	0.13	0.00	0.00	0.00	0.10

Values are expressed as percentage.