Balkh International Journal of Natural Science

ISSN – P 0000 -0000 E: 0000- 0000
Vol. 1 NO.2 2025
URL: https://bjns.ba.edu.af/index.php/bjns

Evaluation of Price Variation and Affordability of the Commonly Prescribed Antibiotics in Private Pharmacies of Mazar-I-Sharif City, Afghanistan

AUTHORS: Seyawash Ayobi[1] Mohammad Rahimi [2]

1. Teaching Assistant, Pharmacology Department, Pharmacy Faculty, Balkh University, Mazar-e-Sharif,Afghanistan.
2. Teaching Assistant, Pharmaceutics Department, Pharmacy Faculty, Balkh University, Mazar-e-Sharif, Afghanistan.

Corresponding Author Name: Seyawash Ayobi
Balkh University, Mazar-e-Sharif, Afghanistan

Received: 13/1/2026 Accepted: 7/6/2026 Published: 19/7/2026

ABSTRACT

Access to affordable and reasonably priced antibiotics is a major public health concern in resource-limited countries like Afghanistan, where high drug prices contribute to significant out-of-pocket expenses and can compromise treatment adherence. This cross-sectional and descriptive study aimed to assess the price variation and affordability of 12 commonly prescribed antibiotics in 12 private pharmacies in Mazar-I-Sharif city, Afghanistan. The study found significant price discrepancies, with Cefixime 400mg tablets and Azithromycin 500mg tablets exhibiting the highest price ratios (7.86 and 8.0) and percentage price variations (685.71% and 700%), respectively. Several antibiotics, including Cefotaxime 500mg vial (18.67 days' wages), Ceftriaxone 1g vial (8.40), Ampicillin 1 g vial (6.67), Gentamicin 80mg/2ml ampoule (4.08), Amikacin 500mg/2ml ampoule (3.73), and Co-amoxiclav 625mg tablet

[1]. Email: syawash2014@gmail.com
Orcid iD: 0009-0003-3855-181
[2]. Email: m.rahimi78353@gmail.com
Orcid iD: 0009-0007-1797-1275

(1.63), were highly unaffordable, requiring the lowest-paid unskilled government employee (cleaner or security guard) to pay their multiple days' wages for a full treatment course with these antibiotics. Median price ratios (MPRs) for Gentamicin ampoule, Ampicillin vial, Ciprofloxacin tablet, and Ceftriaxone vial were found to be higher than the international reference price and exceeded the WHO/HAI acceptable threshold (MPR ≤ 2.5) for private-sector prices. Imported antibiotics, primarily from India (38.16%) and Pakistan (31.05%), dominated the Afghanistan Pharmaceutical market. In conclusion, essential antibiotics remain largely unaffordable in Mazar-I-Sharif city, exacerbated by brand variation, reliance on imports, and cumulative supply-chain mark-ups. Therefore, urgent policy interventions such as strong price controls, using regressive markups, tax reductions or exemptions for essential antibiotics, the promotion of domestically-made and generic antibiotics with guaranteed quality, and increased supply-chain price transparency are required to improve essential antibiotic access and affordability.

Keywords:Affordability, Antibiotics, Mazar-I-Sharif, Price variation, Private sector pharmacies.

1. INTRODUCTION

اَلْحَمْدُ للهِ رَبِّ العَالَمِينَ وَالصَّلاَةُ وَالسَّلَامُ عَلى سَيدِالْمُرْسَلِينَ وَعَلَى اَلِهِ وَصَحْبِهِ اَجْمَعِينَ.

Healthcare access is becoming more widely accepted as a basic human right. Equitable and prompt access to essential drugs for priority illnesses is needed for the fulfillment of this right. Therefore, the World Health Organization (WHO) defined essential medications as those that meet the individual's basic healthcare needs and must be regularly accessible in sufficient quantities, in suitable dosage forms, of assured quality, and at reasonable prices (Masresha et al., 2024). Moreover, the United Nations' Sustainable Development Goals (SDGs) include access to high-quality, reasonably priced, and safe medications. To achieve this goal, the WHO has created a Global Action Plan that aims to improve the affordability of essential medications and increase access to them by 80% (Schäfermann et al., 2020). In low- and middle-income countries, the majority of a household's budget is spent on medications. Access to medications in underdeveloped nations could be greatly improved by the availability, affordability, and price of drugs (Farahani et al., 2018). Antibiotics are essential antibacterial medications that are used to treat and prevent bacterial infections (Wu et al., 2018). According to WHO medication utilization studies, antibiotics are one of the most commonly utilized

classes of drugs and are found in 15-25% of prescriptions in developing nations with high infectious illness rates (Natt, 2021).

Worldwide, consumption of antibiotics between 2000 and 2018 has increased by 46% and reached 14.3 defined daily doses (DDDs) per 1000 residents per day (Browne et al., 2021). The World Health Organization (WHO) defines the defined daily dose (DDD) as the assumed daily maintenance dose for a medication used for its main indication in adults (WHO, 2023). In low- and middle-income countries (LMICs), pharmaceutical supply chains play a significant role in determining the cost of medications. Additional expenses, such as transportation, storage, insurance, handling fees, taxes, and profit margins, accumulate at each level of the supply chain as medications travel from producers to exporters, importers, customs officials, wholesalers, distributors, and retail pharmacies. Patients pay a significantly higher ultimate retail price as a result of these accumulated markups. Additionally, ineffective supply-chain management, dispersed distribution networks, and a lack of price transparency may raise the cost of medications and make them less affordable, particularly in nations with lax pharmaceutical regulations and a high reliance on imported medications (Ewen et al., 2017; MSH, 2016; Saleem et al., 2021; WHO, 2015).

In resource-limited countries, where infectious illnesses continue to be a leading cause of morbidity and death, access to affordable essential antibiotics remains a significant challenge for public health. The high price of these essential drugs frequently leads to financial hardship and raises many households' out-of-pocket medical expenses (Shree et al., 2025). Studies indicate that patients in high-income nations pay less than one day's wages for a month's supply of vital diabetes drugs, but patients in low-income countries must spend several days' wages (Husain et al., 2020). For instance, patients in low- and middle-income nations must pay their 80.3 days' earnings for the median cost of a one-month treatment course of cardiovascular drugs, whereas patients with better purchasing power in high-income nations pay just 1.8 days' earnings for this purpose (Babar et al., 2019). In general, private pharmacies have significantly greater pricing fluctuations than public ones. For example, a study conducted in Delhi, India, found that certain medications were 28 times more expensive in private pharmacies than in public ones (Kotwani, 2013). Patients who are unable to pay for the complete course of prescribed antibiotic therapy often decrease doses to prolong the supply, discontinue antibiotic therapy before completion, or self-select less expensive but questionable quality antibiotics. By subjecting bacteria to subtherapeutic medication concentrations, these actions directly lead to the development

of antibiotic resistance (Gautham et al., 2024; Lohith et al., 2024; Torres et al., 2019).

Globally, antibiotic prices vary significantly between various regions and pricing systems. There are significant discrepancies between commercial markets and regulatory frameworks, according to research on antibiotic cost differences. For instance, the maximum market price of antibiotics in India can exceed permitted ceilings by up to 14.73 times, with Ofloxacin 400mg indicating the highest variation (Shree et al., 2025). Furthermore, significant price variations between frequently prescribed medications were identified by research conducted in India. Amikacin and amoxicillin-clavulanic acid showed the largest percentage price differences at 354.9% and 321.4%, respectively. This indicates that careful brand selection within the same antibiotic class can result in substantial savings in costs (Attar et al., 2025). Moreover, ceftriaxone prices varied from 20 to 270 Afghanis, with an average of 69.80 Afghanis, according to a study conducted in Kabul on 40 brands of ceftriaxone sourced from 12 distinct nations. There was no discernible variation in the efficacy of different brands, suggesting potential cost-saving options via the selection of less expensive but bioequivalent substitutes (Naimi et al., 2016). Also, cost-saving has been found to be the main cause of improper antibiotic use in a study on patients' self-medication habits in Kabul, Afghanistan (Negarandeh et al., 2021). Previous research has demonstrated that inappropriate antibiotic use and antimicrobial resistance can be caused by inadequate access to and affordability of antibiotics, as well as by rising antibiotic consumption worldwide. This underscores the necessity of both affordable access and efficient antimicrobial stewardship (Browne et al., 2021; Saleem et al., 2021; WHO, 2022).

The Afghanistan Food and Drugs Authority (AFDA) reports that over 95% of Afghanistan's medications are imported from nations like Pakistan, India, Iran, and the Middle East. This is a reflection of the country's pharmaceutical industry's limited capacity, and inhabitants have expressed concerns about the growing cost of essential medications (AFDA, 2020). Despite regulation by the AFDA, a newly established authority, a considerable price difference persists among branded generic drugs of the same strength and formulation. Both doctors and patients are concerned about the high pricing of antibiotics, which can considerably affect patient compliance with therapy. Prescribers frequently ignore these price variations, which might result in unnecessary increases in treatment costs without providing any additional therapeutic advantages. Since antibiotics are among the most often used and necessary medications in the world for the treatment of bacterial illnesses, and these diseases continue to be a

major cause of morbidity and mortality in low- and middle- income countries, the antibiotics were chosen for this study.

Mazar-i-Sharif city was selected as the study site because it is one of the largest urban and commercial centers in Afghanistan, with a substantial number of private pharmacies and a diverse pharmaceutical market. As a regional hub for surrounding provinces, the city reflects a wide range of prescribing and purchasing practices, making it suitable for examining antibiotic price variation and affordability. Its accessibility and feasibility for data collection allowed for a reliable and comprehensive assessment. Research on drug prices and affordability has been conducted in several countries, but Afghanistan lacks comprehensive evidence. Existing Afghan studies have focused on self-medication, public perceptions, or price variation of a single drug like ceftriaxone. No study has yet examined the overall price variation of commonly prescribed antibiotics in private pharmacies. Therefore, the present study aims to quantitatively assess the price variation and affordability of commonly prescribed antibiotics rather than their availability across private pharmacies in Mazar-I-Sharif city over 2 months, in order to fill those gaps in pricing and affordability by analyzing retail prices that can inform evidence-based policy interventions to improve access to essential antibiotics.

2. MATERIALS AND METHODS

This cross-sectional and descriptive survey was conducted from November to December 2025 in order to obtain the retail price of different brands of 12 commonly prescribed antibiotics using a convenience sampling method of 12 private pharmacies from a total of 677 private retail pharmacies in different areas of Mazar-I-Sharif city, Balkh Province, Afghanistan. Previous studies conducted by Bhandari & Bhandary, Karve & Paul, and Meena & Jayanthi in India used the national drug database to obtain the retail price of antibiotics (Bhandari & Bhandary, 2019; Karve & Paul, 2016; Meena & Jayanthi, 2021). Unfortunately, in Afghanistan, there is no such reliable information source about the antibiotic price. Moreover, many private pharmacies refuse to provide information about the retail price, including antibiotics, which makes implementation of the systematic sampling method difficult. Therefore, we collected data from 12 pharmacies that were willing to provide complete information about the retail price of 12 commonly used antibiotics, which were selected from the national essential medicine list of Afghanistan (NEML) and previously conducted studies in various locations of Afghanistan (Ehsan, 2024; MoPH, 2014; Negarandeh et al., 2021).

Subsequently, an Excel data collection form was developed based on past similar studies (Khan et al., 2022; Mir, 2016; Saleem et al., 2021; Shah et al., 2024; Sweileh et al., 2004), and distributed to surveyors (pharmacy students) who received adequate training on data collection principles. The form was used to collect variables such as retail price, brand name, pack size, price per pack, manufacturer, and country of origin for each antibiotic. The collected data were entered into MS Excel and analyzed using descriptive statistics, including minimum retail price, maximum retail price, price ratio (maximum retail price ÷ minimum retail price), percentage price variation [(maximum retail price - minimum retail price) ÷ minimum retail price x 100], median price, and median price ratio (MPR). The analyzed data were then visualized in tables and charts.

MPR was calculated by dividing the median local retial unit price of each antibiotic by the MSH (Management Science for Health) international reference supplier unit price of the antibiotic(MSH, 2016). The exchange rate of 1 USD = 66.50 AFN, as of December 2025, was used for currency conversion. According to the World Health Organization and Health Action International (WHO/HAI) methodology, the standard MPR ranges are as follows: for the public sector, the procurement price should be ≤ 1 and the patient price ≤ 1.5; for the private sector (retail pharmacies), the MPR should be ≤ 2.5 (Heidari et al., 2019). Antibiotics with only one available brand and topical formulations were excluded from the present study.

The WHO/HAI created a standardized technique for evaluating the affordability of antibiotics. The number of days' wages needed by the lowest-paid unskilled government employee (e.g., cleaner, security guard) to buy a complete standard course of treatment was used to determine the affordability of each antibiotic. If the treatment cost requires more than 1 day’s wage, the antibiotic is classified as unaffordable (Ghanbari et al., 2024). The World Health Organization's treatment recommendations, namely the WHO AWaRe antibiotic book (WHO, 2022), clinical guideline (MSF, 2024), and some previous research articles (Gautham et al., 2024; Gutema & Engidawork, 2018, 2018; Schäfermann et al., 2020) were used to set standard treatment regimens, including dose and duration. If the cost of a full course of treatment did not exceed the daily income (in the present study, it is 150 Afghanis) of the lowest-paid unskilled government employee (cleaner or security guard), the antibiotic was deemed affordable.

After data collection, we used a dedicated code for each private pharmacy in order to protect the identity of each pharmacy from public and government views and assessments. Furthermore, we did not share

information about surveyed private pharmacies with the public or other authorities; only the anonymous results were shared.

3. RESULTS

Significant price variation was observed across different antibiotic classes. Oral antibiotics, especially macrolides and cephalosporins, showed the greatest price variability, with Azithromycin 500mg tablet and Cefixime 400mg tablet exhibiting the highest price ratios and percentage price variations (7.86 and 685.71%) and (8 and 700%), respectively. Conversely, although their absolute prices remained high, injectable antibiotics like Ceftriaxone 1gram vial and Cefotaxime 500mg vial showed much less price variation. This suggests that the availability of several competing brands makes oral antibiotics more vulnerable to market-driven price variations (Table 1).

Injectable antibiotics typically showed higher median price ratios (MPRs) than oral antibiotics. Gentamicin 80mg/2ml (MPR = 5.01), Ampicillin 1000mg vial (MPR = 4.45), Ciprofloxacin 500mg tablet (MPR = 3.23), Ceftriaxone 1gram vial (MPR = 3.18), Metronidazole 400mg tablet (MPR = 2.55), and Amoxicillin 500mg capsule (MPR = 2.51) had MPR values above the WHO/HAI recommended level (Private sector ≤ 2.5), but several oral antibiotics, including Co-trimoxazole 480mg tablet (MPR=1.25) and Amoxicillin + Clavulanate 625mg tablet (MPR=1.37), stayed within recommended limit. This implies that most injectable antibiotics are comparatively more costly than their MSH international reference pricing, perhaps due to increased production, storage, and distribution costs (Table 2).

Regarding affordability, it was discovered that the lowest-paid unskilled government employee could not afford a significant percentage of the antibiotics under investigation. Six (50%) of the surveyed antibiotics including Cefotaxime 500mg vial (18.67 days' wages), Ceftriaxone 1g vial (8.40), Ampicillin 1 g vial (6.67), Gentamicin 80mg/2ml ampoule (4.08), Amikacin 500mg/2ml ampoule (3.73), and Co-amoxiclav 625mg tablet (1.63) were deemed unaffordable because a full course of therapy required more than one day's income. Interestingly, while the majority of oral antibiotics were reasonably priced, the majority of injectable antibiotics were considered unaffordable. This is a glaring discrepancy between dosage forms, with injectable treatments placing a substantially greater financial strain on patients (Table 3)

The antibiotic market in Mazar-I-Sharif city is highly import-dependent. The eight top countries of origin for the surveyed antibiotics were India (38.16%), Pakistan (31.05%), Turkey (11.58%), Iran (8.16%), Bangladesh

(4.74%), Hungary (1.84%), Korea (1.05%), and Tajikistan (0.79%). The lowest market shares were observed for Afghanistan, China, Germany, Vietnam, and the United Arab Emirates (UAE), each accounting for 0.53%. Altogether, these countries accounted for approximately 100% of the antibiotic market share in the surveyed private pharmacies. Antibiotic price variation and affordability in the local market may be impacted by this heavy reliance on a limited number of exporting countries (Figure 1). Overall, the results show distinct trends of significant price fluctuation, high MPRs, and restricted affordability, especially for injectable antibiotics, pointing to systemic pricing inefficiencies in the private pharmaceutical industry.

Table 1: Price variation of the commonly prescribed antibiotics in Private Pharmacies of Mazar-I-Sharif City

Table 2: Median retail price/unit, international reference price (AFN), and median price ratio (MPR) for the antibiotics in Private Pharmacies of Mazar-I-Sharif City

Antibiotic	Formulation & strength	Minimum retail price (AFN)	Maximum retail price	Price ratio	Percentage price variation
Amoxicillin	500mg, Capsule	3.00	16.00	5.33	433.33
Amoxicillin + Clavulanate	500+125mg, Tablet	8.33	33.33	4.00	300.00
Azithromycin	500mg, Tablet	8.33	66.67	8.00	700.00
Ciprofloxacin	500mg, Tablet	4.00	20.00	5.00	400.00
Cefixime	400mg, Tablet	6.00	47.14	7.86	685.71
Ceftriaxone	1000mg, Vial	50.00	180.00	3.60	260.00
Cefotaxime	500mg, Vial	50.00	150.00	3.00	200.00
Co-trimoxazole	400+80mg, Tablet	1.00	6.00	6.00	500.00
Gentamicin	80mg/2ml, Ampoule	10.00	40.00	4.00	300.00
Amikacin	500mg/2ml, Ampoule	20.00	70.00	3.50	250.00
Metronidazole	400mg, Tablet	1.00	5.50	5.50	450.00
Ampicillin	1000mg, Vial	30.00	90.00	3.00	200.00

Antibiotic	Formulation	Strength	Median retail price per unit	MSH international reference price per unit	Median price ratio (MPR)
Amoxicillin	Capsule	500mg	5	2.00	2.51
Amoxicillin + Clavulanate	Tablet	500+125mg	15	10.91	1.37
Azithromycin	Tablet	500mg	22.5	15.08	1.49
Ciprofloxacin	Tablet	500mg	8	2.48	3.23
Cefixime	Tablet	400mg	13	22.14	0.59
Ceftriaxone	Vial	1000mg	90	28.27	3.18
Cefotaxime	Vial	500mg	90	36.16	2.49
Co-trimoxazole	Tablet	400+80mg	1	0.80	1.25
Gentamicin	Ampoule	80mg/2ml	20	3.99	5.01
Amikacin	Ampoule	500mg/2ml	30	41.83	0.72
Metronidazole	Tablet	400mg	2	0.78	2.55
Ampicillin	Vial	1000mg	50	11.24	4.45

Table 3: Calculation of affordability using the daily wage of the lowest-paid unskilled government employee

Indication	Antibiotic	Unit (formulation & strength)	Median retail price per unit	Treatment duration	Units per day	Total units for treatment (units per day x treatment duration)	Total treatment price (total units x unit price)	Day's wage for treatment
Adult Respiratory Infection	Amoxicillin	500mg, Capsule	5	7	3	21	105	0.70
Adult Respiratory Infection	Amoxicillin + Clavulanate	500+125mg, Tablet	11.66	7	3	21	245	1.63
5 Defined Daily Doses (DDD)	Azithromycin	500mg, Tablet	22.5	5	0.6	3	67.5	0.45

0.47	0.61	8.40	18.67	0.19	4.08	3.73	0.40	6.67
70	91	1260	2800	28	612.5	560	60	1000
14	7	14	28	28	30.625	14	30	20
2	1	2	4	4	4.375	2	3	4
7	7	7	7	7	7	7	10	5
5	8	90	100	1	20	40	2	50
500mg, Tablet	400mg, Tablet	1000mg, Vial	500mg, Vial	400+80mg, Tablet	80mg/2ml, Ampoule	500mg/2ml, Ampoule	400mg, Tablet	1000mg, Vial
Ciprofloxacin	Cefixime	Ceftriaxone	Cefotaxime	Co-trimoxazole	Gentamicin	Amikacin	Metronidazole	Ampicillin
Uncomplicated acute UTI in women	7 Defined Daily Doses (DDD)	Severe Community Acquired Pneumonia (CAP)	CNS Infection	Respiratory Tract Infections	Sepsis of unknown origin	Sepsis of unknown origin	Amoebiasis/Giardiasis GIT	Severe Community Acquired Pneumonia (CAP)

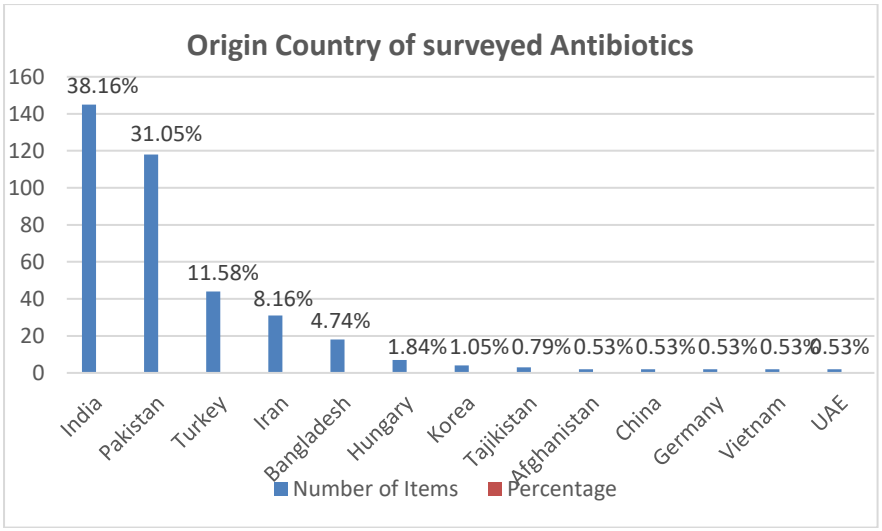

Figure 1: Origin country of surveyed antibiotics in private pharmacies of Mazar-I-Sharif City

4. DISCUSSION

According to the World Health Organization, people in Afghanistan pay over 75% of all medical costs out of pocket (WHO, 2020). One of the main challenges facing Afghan patients is the cost of medications. Therefore, while evaluating costs, it is important to take into account the price ratio, the percentage price variation, and affordability for each drug. The price ratio becomes significant when it exceeds 2, and the percentage price variation becomes significant when it exceeds 100% (Chitra et al., 2023). The WHO/HAI cutoff states that if a treatment course of antibiotics costs more than one day's wage of the lowest-paid unskilled government employee, it is unaffordable (Gautham et al., 2024). In many cases, patients receive prescriptions containing multiple antibiotics, and the existence of several sick family members leads to higher treatment costs and reduced affordability in Afghanistan.

We found significant discrepancies in the price ratio and percentage price variation among various brands of Azithromycin 500mg tablets (8 and 700%) and Cefixime 400mg tablets (7.86 and 685.71%), respectively. Our findings are similar to a study that found the highest price ratio and percentage price variation for Cefixime 200mg tablet (31.31 and 3031.05%), Azithromycin 500mg tablet (12.93 and 1192.61%) in India (Khan et al., 2022). Another study in the Indian pharmaceutical market revealed the highest cost ratio and cost variation for Azithromycin 500mg tablet (11.4 and 1049.8%), which is similar to our findings (Meena & Jayanthi, 2021). Also, another Indian research found that the cost ratio and

percentage cost ratio for Ciprofloxacin 500mg tablet (21 and 2000%), Cefixime 200mg tablet (8.7 and 775%) were the highest (Mir, 2016). Since most antibiotics are imported from India, these similarities indicate the transmission of price fluctuations from the source country (India) to the Afghan pharmaceutical market. Antibiotic pricing in Afghanistan is probably influenced by a number of interrelated factors outside the source-country price. These consist of supply chain inefficiencies, currency exchange fluctuations, wholesaler and retailer markups, and import tariffs.

Also, the present study found that the retail prices of several antibiotics, such as Gentamicin 80mg/2ml (MPR = 5.01), Ampicillin 1g vial (MPR = 4.45), Ciprofloxacin 500mg tablet (MPR = 3.23), Ceftriaxone 1gram vial (MPR = 3.18), Metronidazole 400mg tablet (MPR = 2.55), and Amoxicillin 500mg capsule (MPR = 2.51) were significantly higher compared to the international reference price (IRP) and exceeded the WHO/HAI acceptable threshold for private-sector prices (MPR $\leq$ 2.5). Similar findings have been reported in Ethiopia, where the median price ratio (MPR) of antibiotics such as Ampicillin 1g vial (MPR=4.5), Azithromycin 500mg tablet (4), Amoxicillin 500mg capsule (3.3), Ciprofloxacin 500mg tablet (2.5), Gentamicin 80mg/2ml (2), Co-trimoxazole 480mg tablet (2), Ceftriaxone 1g vial (1.5) were found higher (Gutema & Engidawork, 2018). The consistency of elevated MPRs in both countries suggests ongoing pricing inefficiencies in low-income nations' pharmaceutical markets, which might be related to import reliance, weak price regulation, and cumulative supply chain markups. Moreover, Certain antibiotics, such as Cefixime 400mg tablet (MPR = 0.59) and Amikacin 500mg/2ml ampoule (MPR = 0.72), showed median price ratios (MPRs) below 1, meaning that local median retail prices were less than the MSH international reference prices (IRPs). The availability of inexpensive generic products, especially from highly competitive manufacturing nations, and the limits of MSH reference pricing, which might not accurately reflect the lowest prices on the international market, may help to explain this. Reduced pricing may also result from private sector import policies and competitive market dynamics.

Previous research demonstrating significant variations in production costs and market prices for injectable medications supports the higher prices and MPRs of injectable antibiotics compared to oral formulations (Gotham et al., 2019). Also, injectable antibiotics are typically more expensive than oral antibiotics (Darwish Elhajji et al., 2023). The production of injectables requires complicated quality assurance, specialized facilities, and strict sterility regulations, all of which raise manufacturing costs. Fewer producers are another market aspect that reduces competition and drives

up prices. Despite making up a minor part of all antibiotic consumption in India, injectables accounted for a disproportionately large portion of spending due to higher unit pricing (Fazaludeen et al., 2024).

According to our study, the lowest-paid unskilled government employee (LPGE) could not afford several antibiotics. The most unaffordable antibiotics were Cefotaxime 500mg vial (18.67 days' wages), Ceftriaxone 1g vial (8.40), Ampicillin 1 g vial (6.67), Gentamicin 80mg/2ml ampoule (4.08), Amikacin 500mg/2ml ampoule (3.73), and Co-amoxiclav 625mg tablet (1.63). For example, the cost of a full course of cefotaxime for severe pneumonia would be 18.67 days' salary of LPGE, underscoring the substantial obstacles to obtaining essential drugs. These findings are consistent with previous studies: Saleem et al. reported that a complete treatment course of Cefotaxime was the most unaffordable antibiotic in the private sector in Lahore, Pakistan, which requires 8.1 days' wages for the lowest-paid unskilled government employee (Saleem et al., 2021). Similarly, another study reported that the required days' wages for a treatment course of Amoxiclav 625mg tablet were highly unaffordable (4.34 and 10.05) in Cameroon and the Democratic Republic of Congo, respectively (Schäfermann et al., 2020). Amoxiclav 625mg tablet was also reported to be the most unaffordable antibiotic that required 9.33 days' wages of LPGE in Malawi and 1.6 days' wages in India (Gautham et al., 2024; Khuluza & Heide, 2017). Lastly, a Ceftriaxone 1gram vial was reported unaffordable (average 11.08) in Hubei province, China (Wu et al., 2018). High retail price, cumulative supply chain markups, and the population's low income level, which raises the relative financial burden of treatment, are probably the main causes of the overall low affordability of numerous antibiotics. Poor affordability may reduce treatment adherence through incomplete or delayed antibiotic use, which can contribute to treatment failure and increased selection pressure for AMR. Improving affordability is therefore essential for effective antimicrobial stewardship and rational antibiotic use in low-resource settings (Browne et al., 2021; Saleem et al., 2021; Torres et al., 2019; WHO, 2022).

We found that the majority of surveyed antibiotics in private pharmacies of Mazar-I-Sharif city were procured from India (38.16%) and Pakistan (31.05%). Other contributing countries included Turkey (11.58%), Iran (8.16%), Bangladesh (4.74%), Hungary (1.84%), Korea (1.05%), and Tajikistan (0.79%). The remaining 2.65% of surveyed antibiotics were sourced from Afghanistan, China, Germany, Vietnam, and the United Arab Emirates (the UAE). Although the majority of these oral antibiotics are produced in Afghanistan, their low availability in private pharmacies indicates that patients, doctors, and retailers strongly prefer imported

medicines. This preference might limit the use of domestic production capacity, increase reliance on imports, and negatively impact the cost and long-term supply of essential antibiotics. Also, our findings are supported by the available literature. For instance, in 2019, Afghanistan imported antibiotics valued at USD 13,336,000 from India (Bjerke, 2022). Moreover, other lower-income countries such as Ethiopia, Yemen, and Mozambique bought antibiotics valued at 20.6 million, 17.9 million, and 12.4 million US dollars, respectively, from India (Bjerke, 2022). A study found that the available medications in the Tanzanian pharmaceutical market were manufactured mainly in India (69%), Tanzania (16%), and Kenya (15%) (Ewen et al., 2017).

The present study was limited to private-sector pharmacies in a single city (Mazar-I-Sharif) of Afghanistan, and therefore, the findings may not reflect public-sector practices or national-level trends in price variation and affordability of surveyed antibiotics. The small sample size and use of convenience sampling may limit the generalizability of the results. Price data collected at a single time point, which may not reflect seasonal or temporal price fluctuations. Furthermore, understanding patient access to essential drugs may be limited because the study did not thoroughly evaluate the actual availability of antibiotics in pharmacies. Lastly, the study did not evaluate the quality of antibiotics; therefore, while it reports pricing, it cannot provide evidence about their safety, effectiveness, or therapeutic value.

5. CONCLUSION

Essential antibiotics in private pharmacies of Mazar-i-Sharif were found to have variable prices and generally low affordability, with several medicines requiring multiple days' wages for a full treatment course.

Due to Afghanistan's significant reliance on imported antibiotics, especially those from India and Pakistan, the local market is subject to price variations from source nations. Inadequate pricing control, accumulating supply-chain markups, and low use of antibiotics made domestically all contribute to price increases and decreased affordability. Therefore, urgent policy interventions such as strong price controls, using regressive markups, tax reductions or exemptions for essential antibiotics, the promotion of domestically-made and generic antibiotics with guaranteed quality, and increased supply-chain price transparency are required to improve essential antibiotic access and affordability.

Suggestions

- Prescribers need to take drug price into account when writing prescriptions because different brands of the same generic antibiotic differ significantly in price. Patient compliance will improve if physicians prescribe the least expensive of the available effective brands.
- Frequent retail price control and evaluation for essential and lifesaving drugs in pharmacies of Mazar-I-Sharif city must be conducted to ensure their affordability by patients.
- Ministry of Public Health (MoPH) must encourage the use of domestically produced antibiotics: conduct awareness campaigns and quality assurance programs to increase patient, doctor, and retailer trust in locally produced antibiotics.
- A regressive pharmaceutical pricing policy should be implemented, as it can encourage the use of lower-priced (generic) antibiotics.

6. REFERENCES

AFDA. (2020). *Afghanistan Food and Drugs Authority (AFDA) |Afghanistan Food and Drug Authority*. https://www.afda.gov.af/index.php/en/afghanistan-food-and-drugs-authority-afda?utm_source=chatgpt.com

Attar, T. S., Bhavsar, N. P., Rathod, P. B., Shinde, A., & Nath, H. S. (2025). Cost Analysis of Antibiotic Prophylaxis in General Surgery Department of a Tertiary Care Hospital: A Prospective Cross-sectional Study. *Asian Journal of Public Health Practice*, *2*(2), 53. https://doi.org/10.4103/AJPHP.AJPHP_8_25

Babar, Z., Ramzan, S., El-Dahiyat, F., Tachmazidis, I., Adebisi, A., & Hasan, S. S. (2019). The Availability, Pricing, and Affordability of Essential Diabetes Medicines in 17 Low-, Middle-, and High-Income Countries. *Frontiers in Pharmacology*, *10*. https://doi.org/10.3389/fphar.2019.01375

Bhandari, P. R., & Bhandary, A. (2019). Cost variation analysis of parenteral antibiotics in Indian pharmaceutical market. *International Journal of Basic & Clinical Pharmacology*, *8*(11), 2535–2540. https://doi.org/http://dx.doi.org/10.18203/2319-2003.ijbcp20194798

Bjerke, L. (2022). Antibiotic geographies and access to medicines: Tracing the role of India's pharmaceutical industry in global trade. *Social Science & Medicine*, *312*, 1–16. https://doi.org/10.1016/j.socscimed.2022.115386

Browne, A. J., Chipeta, M. G., Haines-Woodhouse, G., Kumaran, E. P. A., Hamadani, B. H. K., Zaraa, S., Henry, N. J., Deshpande, A., Reiner, R. C., Day, N. P. J., Lopez, A. D., Dunachie, S., Moore, C. E., Stergachis, A., Hay, S. I., & Dolecek, C. (2021). Global antibiotic consumption and usage in humans, 2000–18: A spatial modelling study. *The Lancet Planetary Health*, *5*(12), e893–e904. https://doi.org/10.1016/S2542-5196(21)00280-1

Chitra, B., Abhirami, J., & Anjali, M. A. (2023). Cost Minimisation Analysis of IV Antibiotics. *International Journal of Multidisciplinary Research*, *5*(4), 1–8.

Darwish Elhajji, F., Abuhasheesh, S., Al Rusasi, A., & Aldeyab, M. A. (2023). Overview of Availability, Cost, and Affordability of Antibiotics for Adults in Jordan: An AWaRe Classification Perspective. *Antibiotics*, *12*(11), 1576. https://doi.org/10.3390/antibiotics12111576

Ehsan, E. (2024). Public Willingness and Hesitancy to Take the COVID-19 Vaccine in Afghanistan. *The American Journal of Tropical Medicine and Hygiene*. https://doi.org/10.4269/AJTMH.21-0231

Ewen, M., Kaplan, W., Gedif, T., Justin-Temu, M., Vialle-Valentin, C., Mirza, Z., Regeer, B., Zweekhorst, M., & Laing, R. (2017). Prices and availability of locally produced and imported medicines in Ethiopia and Tanzania. *Journal of Pharmaceutical Policy and Practice*, *10*(7), 2–9. https://doi.org/10.1186/s40545-016-0095-1

Farahani, A. V., Salamzadeh, J., Rasekh, H. R., Najafi, S., & Mosadegh, V. (2018). The Availability and Affordability of Cardiovascular Medicines for Secondary Prevention in Tehran Province (Iran). *Iranian Journal of Pharmaceutical Research: IJPR*, *17*(Suppl), 64–72.

Fazaludeen, s, Ganesh, S., Klemperer, K., Yadav, P., & McDonnell, A. (2024). Injectable antibiotic use in India: Public-private share in volume

and cost. *Wellcome Open Research*, *9*, 70. https://doi.org/10.12688/wellcomeopenres.20633.1

Gautham, M., Bhattacharyya, S., Maity, S., Roy, M. B., Balasubramaniam, P., Ebata, A., & Bloom, G. (2024). "Just as curry is needed to eat rice, antibiotics are needed to cure fever"—A qualitative study of individual, community and health system-level influences on community antibiotic practices in rural West Bengal, India. *BMJ Open*, *14*(2), e076616. https://doi.org/10.1136/bmjopen-2023-076616

Ghanbari, A. R., Moazen, M., Azizi, A., Abdollahiasll, A., & Soleymani, F. (2024). Availability and affordability of selected medicines in the Islamic Republic of Iran. *Eastern Mediterranean Health Journal*, *30*(9), 632–640. https://doi.org/10.26719/2024.30.9.632

Gotham, D., Barber, M. J., & Hill, A. M. (2019). Estimation of cost-based prices for injectable medicines in the WHO Essential Medicines List. *BMJ Open*, *9*(9), e027780. https://doi.org/10.1136/bmjopen-2018-027780

Gutema, G., & Engidawork, E. (2018). Affordability of commonly prescribed antibiotics in a large tertiary teaching hospital in Ethiopia: A challenge for the national drug policy objective. *BMC Research Notes*, *11*(1), 925. https://doi.org/10.1186/s13104-018-4021-2

Heidari, E., Varmaghani, M., & Abdollahiasl, A. (2019). Availability, pricing and affordability of selected medicines for noncommunicable diseases. *Eastern Mediterranean Health Journal*, *25*(7), 473–480. https://doi.org/10.26719/emhj.18.068

Husain, M. J., Datta, B. K., Kostova, D., Joseph, K. T., Asma, S., Richter, P., Jaffe, M. G., & Kishore, S. P. (2020). Access to Cardiovascular Disease and Hypertension Medicines in Developing Countries: An Analysis of Essential Medicine Lists, Price, Availability, and Affordability. *Journal of the American Heart Association*, *9*(9), e015302. https://doi.org/10.1161/JAHA.119.015302

Karve, A. V., & Paul, K. B. (2016). Economic analysis of oral cephalosporins in the Indian market. *International Journal of Research*

in Medical Schiences, *4*(9), 4143–4149. https://doi.org/10.18203/2320-6012.ijrms20162950

Khan, F., Motiwala, Z., & Rauf Khan, S. (2022). Disparity between cost variation of antibiotics in northern and western India: A cross-sectional study. *International Archives of BioMedical and Clinical Research*, *8*(3), MB1–MB3. https://doi.org/10.21276/iabcr.2022.8.3.2

Khuluza, F., & Heide, L. (2017). Availability and affordability of antimalarial and antibiotic medicines in Malawi. *PLOS ONE*, *12*(4), 1–15. https://doi.org/10.1371/journal.pone.0175399

Kotwani, A. (2013). Where are we now: Assessing the price, availability and affordability of essential medicines in Delhi as India plans free medicine for all. *BMC Health Services Research*, *13*, 285. https://doi.org/10.1186/1472-6963-13-285

Lohith, G., Sanjana, V., Veena, R., & Shanmukananda, P. (2024). Cost variation analysis of various oral cephalosporins available in the Indian market. *National Journal of Physiology, Pharmacy and Pharmacology*, (0), 1. https://doi.org/10.5455/njppp.2024.14.02092202428032024

Masresha, R., Habte, F., Senbeta, M. F., Baye, A. M., Kassaw, C., & Beyene, M. G. (2024). Availability, price and affordability of essential medicines for managing cardiovascular disease in Addis Ababa, Ethiopia. *Scientific Reports*, *14*(1), 31357. https://doi.org/10.1038/s41598-024-82919-1

Meena, D. K., & Jayanthi, M. (2021). Cost analysis of different antibiotic brands available in indian market with reference to National List of Essential Medicines. *Indian Journal of Community Medicine*, *46*(1), 93–96. https://doi.org/10.4103/ijcm.IJCM_296_20

Mir, S. A. (2016). Cost Analysis of different brands of antimicrobial agents available in India. *International Journal of Basic & Clinical Pharmacology*, *5*(1), 85–89. https://doi.org/10.18203/2319-2003.ijbcp20160106

MoPH. (2014). *National Essential Medicine List of Afghanistan*. Ministry of Public Health.

MSF. (2024). *Clinical Guidelines: Diagnosis and treatment manual*. Médecins Sans Frontières.

MSH. (2016). *International Medical Products Price Guide*. Management Science for Health.

Naimi, H. M., Rasekh, H., Haem Rahimi, M., & Yousofi, H. (2016). Assessment of the price-efficacy relationship for multiple brands of ceftriaxone sodium in Kabul: A cross-sectional study. *BMC Research Notes*, *9*(1), 86. https://doi.org/10.1186/s13104-016-1904-y

Natt, N. K. (2021). An evaluation of price variation amongst different brands of antimicrobials and impact of this variation on fixation of ceiling price in India. *International Journal Dental and Medical Sciences Research*, *3*(3), 418–423. https://doi.org/10.35629/5252-0303418423

Negarandeh, R., Poortaghi, S., & Shayan, S. (2021). Prevalence and patterns of self-medication with antibiotics among visitors of central polyclinic of Kabul, Afghanistan. *Journal of Pharmaceutical Health Services Research*, *12*(2), 271–274. https://doi.org/10.1093/jphsr/rmaa015

Saleem, Z., Saeed, H., Akbar, Z., Saeed, A., Khalid, S., Farrukh, L., Irfan, A., Anam, A., Hassali, M. A., Rasheed, H., & Babar, Z. (2021). WHO key access antibiotics prices, availability and affordability in private sector pharmacies in Pakistan. *Cost Effectiveness and Resource Allocation*, *19*(1), 10. https://doi.org/10.1186/s12962-021-00263-x

Schäfermann, S., Neci, R., Ndze, E. N., Nyaah, F., Pondo, V. B., & Heide, L. (2020). Availability, prices and affordability of selected antibiotics and medicines against non-communicable diseases in western Cameroon and northeast DR Congo. *PLOS ONE*, *15*(1), 1–16. https://doi.org/10.1371/journal.pone.0227515

Shah, A., Patel, C., Shah, P., Patel, J., Sojitra, B., Pandya, S., & Shaikh, A. (2024). An Analysis of the Cost Variation Among Different Antimicrobial Agents: The Indian Scenario. *Cureus*, *7*(16), e64538. https://doi.org/DOI%2010.7759/cureus.64538

Shree, V., Jain, A., Gupta, D., Ahmad, S., & Sindhu, S. (2025). Antibiotic price disparities: A comparative analysis of Jan Aushadhi, National Pharmaceutical Pricing Authority and commercial markets. *Indian Journal of Physiology and Pharmacology*, *0*, 1–5. https://doi.org/10.25259/IJPP_138_2025

Sweileh, W., Jaradat, N., & Mustafa, A. (2004). Antibiotic Drug Cost Variation in Palestine: Physicians and Patients Dilemma. *An-Najah Univ.J.Res. (N.Sc.)*, *18*(1).

Torres, N. F., Solomon, V. P., & Middleton, L. E. (2019). Patterns of self-medication with antibiotics in Maputo City: A qualitative study. *Antimicrobial Resistance & Infection Control*, *8*(1), 161. https://doi.org/10.1186/s13756-019-0618-z

WHO. (2015). *WHO guideline on Country Pharmaceutical Pricing Policies*. WHO.

WHO. (2020). *Health Financing Policy Options for Action Afghanistan 2020*.

WHO. (2022). *The WHO AWaRe (Access, Watch, Reserve) antibiotic book*. World Health Organization. https://www.who.int/publications/i/item/9789240062382

WHO. (2023). *ATCDDD - Definition and general considerations*. https://atcddd.fhi.no/ddd/definition_and_general_considera/

Wu, G., Gong, S., Cai, H., & Ding, Y. (2018). The availability, price and affordability of essential antibacterials in Hubei province, China. *BMC Health Services Research*, *18*(1), 1013. https://doi.org/10.1186/s12913-018-3835-x