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RESEARCH ARTICLE

# ASSESSMENT OF WHO/INRUD CORE DRUG USE INDICATORS AT PUBLIC AND PRIVATE HEALTHCARE CENTRES IN LAHORE, PAKISTAN: A MULTICENTRE CROSS-SECTIONAL STUDY

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## ABSTRACT

**Background:** A key element of the pharmaceutical care plan is the appropriate use of medications. **Objectives:** Using the WHO/INRUD core drug use indicators, this study sought to evaluate medication usage trends at both public and private healthcare centres in the Lahore district of the Punjab province of Pakistan. **Methodology:** A cross-sectional and descriptive study design was adopted. For data collection, 399 prescriptions (199 prescriptions from public and 200 prescriptions from private healthcare facilities) were systematically sampled written from February to July 2022. To evaluate the prescription indicator, patient-care and facility-specific indicators, patients randomly selected from both public and private hospitals were examined and interviewed. For each of the WHO/INRUD indicators, we considered ideal criteria that have been published. **Results:** The average number of medicines prescribed each encounter was reported to be 6.26% in public hospitals and 4.14% in private hospitals among the prescribing indicators, generic medication, antibiotics, and the number of times patients received injections were prescribed, respectively, in 54%, 84%, and 89% of public hospitals and 19%, 61.7%, and 78% of private hospitals. In the public and private sectors, respectively, 71% and 97% of prescription drugs were from the list of essential drugs. The average consultation time was found to be 2.1 minutes in public hospitals and 3.2 minutes in private hospitals, while the average dispensing time was reported to be 37 seconds in public hospitals and 39 seconds in private hospitals. Of the total prescribed medicines, 84% and 97 % were dispensed in public and private hospitals respectively and the percent medicine adequately labelled was 100% in both healthcare facilities. Regarding patient awareness, 69% of patients in private hospitals and 42.5% of patients in public hospitals were aware of the proper dosage, frequency, and duration of the medications that were prescribed. In terms of facility-specific data, both public and private hospitals had 100% availability of the EDL copy and 82% stock of the important medications, respectively. **Conclusion:** Irrational use of drugs was observed in both public and private healthcare facilities. WHO/INRUD proposed 12 key initiatives to encourage rational use of medications must be put into practice as a result of present study.

**Keywords:** Irrational drugs-use, Prescribing practice, WHO/INRUD core drug use indicators, Quality use of medicines, Patient-care.

## INTRODUCTION

When used correctly, medications can improve patients' health and well-being (1). This makes them one of the most frequently used interventions in healthcare as seen in 74% of hospital outpatient visit (1). The World Health Organization (WHO) states that "patients acquire drugs suitable to their clinical needs, in dosages that satisfy their demands, for a sufficient duration of time, and at the lowest cost to them and their community" under the rational use of medications presumption (2, 3). The ultimate objective of appropriate medication usage is to improve clinical outcomes while promoting patient adherence. It also seeks to enhance patient care quality and lower drug therapy costs (3, 4).

In underdeveloped nations, the necessary medications are deficient for approximately one-third of the world's population. These regions have yet to establish mature monitoring and evaluation practices for drug usage. Conversely, inappropriate drug consumption occurs in excess of 50% of the global population (3, 5). Rational drug usage is influenced by a variety of variables, including economics, resources, workforce, culture, attitudes, and beliefs, information gaps, lax drug policies, the workload of health professionals, and improper drug advertising (6). Inadequate doses, inappropriate polypharmacy, poor use of antimicrobial agents, excessive use of injections when oral dosage forms are preferable, and failure to prescribe in accordance with the standard therapy guideline are only a few examples of irrational medication usage (STG) (7). Because of this, improper use of medications is an issue that affects all levels of healthcare and is widespread in practically every region of the world. As a result, there will be a rise in the incidence of illness and death, a decline in the standard of medical care, an increase in the price of therapy, adverse drug responses, an elevation in microbial resistance, unsatisfactory patient outcomes, and a waste of limited resources (1, 2).

To address these untoward conditions, a standard technique for some drug use indicators in healthcare settings was developed by WHO and INRUD in 1993 (8). The assessment of prescribing practices comprises several critical aspects that are categorized into three indicators: prescription indicators (five standards), patient care indicators (five standards), and facility indicators (two standards) (9, 10).

Since the WHO/INRUD indicators are a proven standard instrument, and the measurements are reproducible (4), they have been effectively adopted in more than 30 underdeveloped countries (11). However, real-world experience demonstrates that pharmaceutical care significantly falls short of the benchmarks outlined by various global research, especially in developing nations, despite WHO guidelines (9). Identifying the categories, scope, and underlying causes of irrational medication usage constitutes the essential measures for curbing its prevalence (2). In light of globally observed inappropriate drug usage practices (4, 13), as well as those at the local level (14), the present project was designed with the aim of examining drug usage patterns.

This examination utilizes the WHO/INRUD core drug usage indicators while emphasizing comparisons between public and private hospitals in Lahore, Punjab, Pakistan. To the best of our knowledge, a study from Pakistan has so far compared the main private hospitals' drug use policies using the common core drug use indicators to the tertiary health-care canters. The measured values might serve as standards for medical institutions and a foundation for future studies on the efficacy of medication use. The results of this study are expected to assist policymakers in revising medical-related regulations and putting in place suitable initiatives to encourage the prudent use of medications.

## METHODOLOGY

### Study design and settings

From February to July 2022, a multi-canter facility-based descriptive cross-sectional research was carried out to assess the effectiveness of a number of healthcare facilities, focusing on prescribing indicators, patient care indicators, and facility indicators focused on the WHO core drug-use indicators. A three-level framework with primary, secondary, and tertiary level services has been used to deliver healthcare in District Lahore, Pakistan. This study was performed in out-patient departments (OPDs) and emergency wards of

several public tertiary care hospitals and private sector hospitals in Lahore including Mayo hospital, Jinnah hospital, Rasheed hospital and the University of Lahore teaching hospital. Lahore is one of Pakistan's largest district with a population of over 13 million and thousands of bed-capacity hospitals providing healthcare facilities to patients from all over the country (10).

**Study outcome measures**

Zhang and Zhi created three distinct indices - the Index of Rational Drug Prescribing (IRDP), the Index of Rational Patient-Care Drug Use (IRPCDU), and the Index of Rational Facility-Specific Drug Use (IRFSDU) - to facilitate a comprehensive evaluation of appropriate drug utilization in healthcare. These indices were formulated with the objective of conducting a thorough assessment of healthcare practices (11, 12). The following formula was used to calculate the non-polypharmacy, efficient antibiotic, and injection risk indices.

$$\text{Index} = \frac{\text{Optimal value (WHO standard)}}{\text{Observed value}}$$

The ideal values to calculate the scores for non-polypharmacy, prudent antibiotic usage, and injection safety were reported to be 1.8, 26.8, and 24.1, respectively as described Table 1.

The remaining indices, including the index of generic drug prescription, the index of prescription from a list of essential medicines, the time for consultation index, the time for dispensing index, the dispensed medicines index, the index of essential medicine list availability, the index of patient knowledge the index of key medicines availability, the index of medicine labelling, were calculated by using following formula.

$$\text{Index} = \frac{\text{Observed value (WHO standard)}}{\text{Optimal value}}$$

The ideal values for computing the indices for prescribing generic drugs, choosing medicines from a list of vital medicines, dispensing genuine medications, patient understanding of proper doses, medication labelling, and accessibility of important medications were taken into consideration as 100. Moreover, 10 minutes and 90 seconds, respectively, were determined to be the ideal values for the computation of the consultation and dispensing time metrics (8).

The index values of all prescription indicators were added to determine the Index of Rational Drug Prescribing (IRDP) for all OPDs. The IRDP values were used to rate the OPDs from 1 to 10. (Rank 1 for the higher IRDP value and rank 10 for the lower IRDP). Both the Index of Rational Facility-Specific Drug Usage (IRFSDU) and the Index of Rational Patient-Care Drug Use (IRPCDU) were computed in a similar manner. Lastly, the sum of IRDP, IRPCDU, and IRFSDU was added to get the Index of Rational Drug Use (IRDU) for all OPDs. Following that, OPDs were rated using the IRDU indices. In terms of ethical medication usage, the OPD with the highest IRDU value was presumed to perform the best (13).

**Data collection**

Patients receiving outpatient prescriptions from the study site, regardless of age or gender, were selected using a systematic random sample approach, with patient encounters at each hospital serving as the survey population (4). Out of a total of 1000 prescriptions among these hospitals, approximately 399 prescriptions were randomly chosen, comprising 199 prescriptions from the public sector and 200 from private hospitals. Standardized and validated data collection forms were employed to gather data specific to prescribing, patient care, and facility indicators (11). To ensure consistent and reliable data collection, the research team received comprehensive guidance on collecting quantitative data. The WHO drug use-evaluation indicators were employed to gather information in an organized and concise manner. The team was trained to use an organized checklist to assess various indicators, including prescribing, patient care, health facility, and completeness of prescriptions.

Prescribing indicators: The WHO's recommended values for the metrics related to prescription, patient care, and facility-specific factors were implemented (8). To prevent potential unconscious bias from seasonal changes or disruptions in the drug supply cycle, the study's confrontations were evenly distributed over the entire study period, which was divided into four quarters. Specifically, 25

prescriptions were selected from each quarter to ensure a fair distribution. The sample was restricted to contacts involving both acute and chronic diseases, demonstrating a range of patient ages and health situations. The research did not include patients that were referred or given vaccinations. The ideal consultation and dispensing periods for this trial were set at 10 minutes and 100 seconds, respectively.

Patient-care indicators: Patients who visited OPDs of the selected hospitals were invited to investigate the patient-care indicators. Throughout the course of the clinic hours, 200 individuals altogether, representing a variety of acute illness conditions and age groups, were randomly chosen. Members from the research team, who had received training, provided respondents with an explanation of the study's objectives and obtained their consent prior to commencing data collection. Subsequently, the patients who had consented were both observed and interviewed to gather the necessary information.

Facility-specific indicators: In both public and private hospitals, pharmacy staff often dispenses medications to patients at the pharmacy counter. One staff member per hospital was chosen for the facility-specific indicators, and the willing respondents were interrogated to get the necessary data.

**Data quality-control measures**

The WHO recommendations were followed to assure data reliability, and experts properly reviewed obtained data to prevent missing parameters. The data-collecting forms were checked by the senior members of the research team, who also verified that the data had been properly recorded and analysed.

**Operational definitions**

Prescription: A prescription refers to a documented and signed order for medication, provided by a duly licensed or registered healthcare provider that authorizes a patient to obtain medication from a dispensing facility. Number of medicines per prescription: For the purposes of this study, medical supplies such as gloves and syringes, as well as well-known treatment combinations like triple therapy for H. pylori, were excluded from the medication count, as they were considered as one.

**Table 1. Core drug use indicators and their optimal values**

| Core drug use indicators | Optimal values |
|---|---|
| Prescribing Indicators | |
| Average number of drugs prescribed per patient encounter | 1.6–1.8 |
| Percent medicines prescribed by generic name | 100 |
| Percent encounters with an antibiotic prescribed | 20.0–26.8 |
| Percent encounters with an injection prescribed | 13.4–24.1 |
| Percent medicines prescribed from essential medicines list or formulary | 100 |
| Patient-Care Indicators | |
| Average consultation time (minutes) | ≥10 |
| Average dispensing time (seconds) | ≥90 |
| Percent medicines actually dispensed | 100 |
| Percent medicines adequately labelled | 100 |
| Percent patients with knowledge of correct doses | 100 |
| Facility-Specific Indicators | |
| Availability of essential medicines list or formulary to practitioners | 100 |
| Percent key medicines available | 100 |

Patient knowledge: In order to gauge a patient's medication knowledge, survey respondents were asked about their understanding of the appropriate dosage, frequency of administration, treatment duration, and reasons for a prescription for a specific medication.

Generic name: To standardize medication names in this study, generic names were used for a few commonly prescribed anti-tuberculosis medications, rather than brand names like Myrin-P.

Labelling: Adequate labelling of medication is considered to include essential information such as the generic name, strength, dosage, amount dispensed, instructions for use, expiry date, patient name, storage requirements, and specific precautions.

**Data analysis**

Data analysis was done using the Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, version 21.0, Armonk, NY: IBM Corp.). The data were presented using descriptive statistics including frequencies, percentages, means, and standard deviation. The ANOVA test was used to determine the differences between public and private healthcare centers and by using p 0.05, the statistical significance was calculated.

**Ethical considerations**

The Pharmacy Research Ethics Committee (PREC) of the faculty of pharmacy, University of Lahore, Lahore, Punjab, Pakistan, provided ethical permission (Reference no: REC-2021-03H).

**RESULTS**

**Prescribing indicators**

Drugs written by generic names, antibiotics, and number of times patients receives injections were found to be 54%, 84%, 89% from the public and 19%, 61.7%, 78% from private hospitals respectively. Injections prescribed per encounter were found to be more in public (89%) than in private sectors (78%). Drugs prescribed from the essential Drug list were 71% and 97% in public and private respectively. The number of medicines per prescription was found to be 6.26% from public hospitals and 4.14% from private hospitals (Table 2). Among all 167 prescriptions from public and 123 prescriptions from private hospitals contain the most common class of medication prescribed was antibiotics at 84% and 61.5% respectively. Cephalosporins penicillin and Azithromycin were the more frequently prescribed antibiotics in public hospitals & penicillin Azithromycin and metronidazole cefotaxime were more common in private hospitals prescriptions. For all prescription indicators, there was a statistically significant difference between public and private health care facilities (Table 2). The IRDP values show that the surgery and pulmonology OPDs was performing well in both public and private hospitals and paediatric and gynaecology OPD was also the leading department in the public as well as private health care facility. While the results of cardiology, dermatology and dental OPDs shows poor mean score and need improvement (Table 3).

**Patient-care indicators**

The typical consultation duration was 2.1(0.5±1.3) in public and 3.2(0.8±1.7) in private hospitals while average dispensing time was 37(6.2±3.5) in public and 39(6.3±3.5) in private hospitals were reported. Of the total prescribed medicines, 84% (5.27±2.442) and 97 % (4.05±2.8674) were dispensed in public and private hospitals respectively and percent medicine adequately labelled was 100% in both health care facilities. Regarding patient knowledge, 42.5 % (3.5±1.4) in public and 69% (4.2±2.2) in private hospitals patients knew about the correct dose, frequency, duration, and reasons for prescribed medicines. With the exception of the percentage of medicines with an acceptable label, every patient-care indicator showed a statistically significant difference between public and private hospitals (Table 4).

**Facility-specific indicators**

Both public and private hospitals had 100% availability of the essential drug list (EDL) copy and 82% availability of essential medications in stock, respectively. With the exception of the proportion of EDL copies available, there was a substantial difference between public and private health centers for every facility-specific measure. With the exception of the percentage of necessary medicine availability, there was a statistically significant difference between public and private hospitals for all facility-specific parameters (Table 4). The cardiology, paediatrics, gynaecology, and medicine OPDs in both private and public hospitals reported excellent performance than the dentistry, ENT, dermatology, and ophthalmology OPDs, according to the IRPCDU figures. Regarding facility-specific metrics, the gynaecology, cardiology, and paediatrics OPDs at the public hospital and the dermatology, ophthalmology, and surgery OPD in the private hospital both had substantially superior performance. The paediatrics, gynaecology, and pomology OPDs in both the public and private sectors had the highest rated IRDU values (Table 5).

**Table 2. WHO/INRUD prescribing indicators in public and private hospitals of Lahore.**

| Prescribing indicators | Public hospital (Mean±SD) | Private hospital (Mean±SD) | WHO/INRUD standard values | p-value |
|---|---|---|---|---|
| Percent drug prescribed by generic name | 54(0.53±0.672) | 19(0.80±1.450) | 100 | <0.005 |
| Percent prescriptions with Antibiotics prescribed | 84 (1.48±0.958) | 61.7 (0.86±0.833) | 20.0-26.8 | <0.005 |
| Percent prescriptions with injections prescribed | 89 (4.07 ±2.67) | 78(2.27±2.18) | 13.4-24.1 | <0.005 |
| Percent drugs prescribed from the essential drug list | 71 (4.45±3.30) | 97(4.03±2.99) | 100 | <0.005 |
| Average number of drugs prescribed per counter | 6.26(3.6±2.5) | 4.14(4.1±2.9620) | 1.6-1.8 | <0.005 |

**Table 3. WHO/INRUD prescribing indicators with respective OPD wards in public and private hospitals of Lahore.**

| OPD wards | Prescribing indicators | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Percentage drug prescribed by generic name | | Percentage prescriptions with antibiotics prescribed | | Percentage prescriptions with injections prescribed | | Percentage drugs prescribed from the essential drug list | | Average number of drugs prescribed | |
| | Public hospital | Private Hospital | Public hospital | Private hospital | Public hospital | Private hospital | Public hospital | Private hospital | Public hospital | Private hospital |
| Dermatology | 34.5 | 10.4 | 89.9 | 68.0 | 66.8 | 55.2 | 75.5 | 89.7 | 6.9 | 5.2 |
| Ophthalmology | 44.2 | 12.5 | 77.6 | 55.1 | 69.2 | 62.3 | 70.3 | 99.7 | 5.5 | 2.6 |
| Gynaecology | 55.4 | 17.4 | 20.1 | 19.1 | 55.5 | 50.1 | 67.2 | 100.0 | 5.1 | 6.5 |
| Medical | 51.5 | 20.5 | 99.8 | 77.8 | 97.3 | 89.4 | 69.4 | 99.8 | 7.2 | 4.5 |
| Paediatrics | 40.4 | 26.2 | 81.2 | 35.1 | 89.1 | 79.1 | 70.0 | 100.0 | 6.5 | 4.2 |
| Cardiology | 25.1 | 19.4 | 60.1 | 33.4 | 98.4 | 75.0 | 82.9 | 96.6 | 8.5 | 6.8 |
| Dental | 16.2 | 18,5 | 92.1 | 66.1 | 78 | 75.9 | 65,4 | 94.7 | 4.5 | 3.5 |
| Pulmonology | 39.1 | 20.1 | 92.3 | 80.6 | 89.9 | 89.5 | 69.2 | 100.0 | 5.2 | 4.1 |
| Surgery | 47.2 | 15.8 | 94.1 | 60.1 | 98.3 | 95.5 | 59.8 | 99.9 | 4.5 | 2.5 |
| ENT | 18.3 | 19.5 | 80.4 | 73.1 | 72.1 | 85.2 | 55.9 | 100.0 | 6.7 | 2.4 |
| Mean | 49 | 19 | 84 | 61.7 | 89 | 78 | 71 | 97 | 6.26 | 4.14 |
| (SD) | (0.25) | (0.80) | (1.48) | (0.86) | (4.07) | (2.27) | (4.45) | (4.03) | (2.5) | (2.9) |

**Table 4. WHO/INRUD patient-care and facility-specific indicators in public and private hospitals of Lahore**

| Patient care and facility-specific indicators | Public hospital (Mean±SD) | Private hospital (Mean±SD) | WHO/INDUR Standard values | p-value |
|---|---|---|---|---|
| Average consultation time(minutes) | 2.1(0.5±1.3) | 3.2(0.8±1.7) | ≥10 | <0.005 |
| Average dispensing time(seconds) | 37(6.2±3.5) | 39(6.3±3.5) | ≥90 | <0.005 |
| Percent medicine actually Dispensed | 84 (5.27±2.442) | 97(4.05±2.86) | 100 | <0.005 |
| Percent medicine adequately labelled | 100(0.0) | 100(0.0) | 100 | ---- |
| Percent Patient with knowledge of the correct dose | 42.5(3.5±1.4) | 69(4.2±2.2) | 100 | <0.005 |
| Percentage Availability of essential drug list | 100(0.0) | 100(0.0) | 100 | ----- |
| Percentage of key medicines available | 82(5.37±2.742) | 82(5.37±2.742) | 100 | <0.005 |

**Table 5. WHO/INRUD patient-care and facility-specific indicators with respective OPD wards in public and private hospitals of Lahore.**

| OPD wards | Patient-care and facility-specific indicators | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average consultation time (minutes) | | Average dispensing time (seconds) | | Percentage medicine actually dispensed | | Percentage medicine adequately labelled | | Percentage patient with knowledge of the correct dose | | Percentage availability of essential medicines list | | Percentage of key medicines available | |
| | Public hospital | Private hospital | Public hospital | Private hospital | Public hospital | Private hospital | Public hospital | Private hospital | Public hospital | Private hospital | Public Hospital | Private hospital | Public hospital | Private hospital |
| Dermatology | 1.2 | 1.5 | 22.0 | 25.5 | 75.8 | 97.1 | 100.0 | 100.0 | 40.5 | 78.8 | 100.0 | 100.0 | 100 | 100 |
| Ophthalmology | 1.3 | 1.4 | 21.0 | 28.3 | 67.8 | 88.5 | 100.0 | 100.0 | 37.7 | 65.7 | 100.0 | 100.0 | 72.0 | 69.1 |
| Gynaecology | 2.3 | 3.4 | 35.0 | 41.2 | 100.0 | 100.0 | 100.0 | 100.0 | 45.0 | 72.6 | 100.0 | 100.0 | 81.5 | 83.9 |
| Medical | 1.3 | 2.2 | 25.0 | 35.5 | 98.0 | 100.0 | 100.0 | 100.0 | 40.2 | 55.5 | 100.0 | 100.0 | 80.8 | 80.6 |
| Paediatrics | 2.2 | 3.1 | 38.5 | 38.8 | 77.0 | 100.1 | 100.0 | 100.0 | 39.0 | 67,9 | 100.0 | 100.0 | 56.8 | 65.4 |
| Cardiology | 1.4 | 1.7 | 40.6 | 45.7 | 100.0 | 100.0 | 100.0 | 100.0 | 48.4 | 69.7 | 100.0 | 100.0 | 55.5 | 55,8 |
| Dental | 0.9 | 1.1 | 25.5 | 22.5 | 75.0 | 89.1 | 100.0 | 100.0 | 30.5 | 60.5 | 100.0 | 100.0 | 79.3 | 79.2 |
| Pulmonology | 1.1 | 1.2 | 35.5 | 33,4 | 87.5 | 97.1 | 100.0 | 100.0 | 35.0 | 60 | 100.0 | 100.0 | 82.1 | 83.7 |
| surgery | 1.0 | 1.4 | 20.4 | 27,4 | 96.0 | 100.0 | 100.0 | 100.0 | 25.5 | 71.4 | 100.0 | 100.0 | 64.3 | 65.8 |
| ENT | 1.3 | 1.7 | 28.6 | 25,8 | 70.1 | 93.0 | 100.0 | 100.0 | 36.8 | 66,2 | 100.0 | 100.0 | 55.9 | 61.7 |
| MEAN(SD) | 2.1(0.5) | 3.2(0.8) | 37(6.2) | 39(6.3) | 84 (5.27) | 97(4.05) | 100(0.0) | 100(0.0) | 42.5(3.5) | 69(4.2) | 100(0.0) | 100(0.0) | 82(5.3) | 82(5.3) |

## DISCUSSION

The World Health Organization (WHO) states that utterly irrational medication practices are widespread and eventually have adverse effects on patients, more than half of all medications are improperly prescribed, administered, or sold. These activities are thought to be especially common in healthcare facilities in developing countries, where procedures for regular monitoring of medication usage are still being developed. In this present study, the WHO/INRUD prescribing, patient care and facility care indicators were used to identify current treatment practices in both public and private facilities that may assist in resolving issues with drug treatment. In Pakistan, there isn't much study on this issue. The results of this study will also contribute to our assessment of the present condition of drug treatment practices and will provide a foundation for ongoing monitoring of drug therapy in developing nations.

### Prescribing indicators

WHO highly emphasized on prescribing the generic drugs rather than brand ledgers, this approach is intended to ensure economic benefits to patients and facilitates accessible provision of drugs, and improve communication among healthcare providers including physicians, pharmacists, and others. According to the study's findings, 54% of medications were administered by generic name per encounter in public healthcare facilities whereas only 19% were done so in private ones. This difference between public and private hospitals was statistically significant ($p \leq 0.05$), which shows private hospitals follow more generic prescribing rather than public hospitals. Overall, both health care facility sectors show very low score as compared to WHO recommended optimal value (100%) (Table 1) for the generic drug prescribed.

In most of developing countries this value was below 40% like, generic drug prescribing in Andorra at 6%(14), India at11.5%(15), Uzbekistan at 38.3% (16) and Yemen at 39.2%(17). The decreasing trend of generic prescribing in public hospitals may be attributed to a number of factors, including prescribers' trust in branded products, the influence of pharmaceutical companies, extensive promotional activities on prescribers, decisions, and the lack of legal requirements to prescribe generic drugs demonstrate the patient's ignorance about the usage of generic drugs. Nevertheless, the lower rates of generic prescriptions for private facilities might be attributed to the desire of prescribers to meet the demands of their patients who could mistakenly believe that more expensive drugs are more efficient.

This study revealed the percentage of antibiotics prescribed per prescription was 84% in public and 61.5% in private sectors, which shows public facilities prescribed more antibiotics than private. Despite this, both facilities did not follow WHO guidelines as the proposed optimal value for an antibiotic prescribing is <30%. Practitioners are more likely to comply with patient requests for antibiotics in private settings because they don't want to lose out on clients, which may explain the greater prevalence of antibiotic prescriptions. Antibiotic overprescribing is a widespread issue that eventually results in negative medication responses and frequent hospital admissions (6). Concerns about public health are raised by the overuse and abuse of antibiotics, particularly in poor nations. There were not enough labs available in Pakistan's healthcare system to conduct microbiological tests. This could have an impact on how prescribers act, and as a result, they might be more likely to recommend broad-spectrum antibiotics to treat suspected infections. Other causes of overprescribing antibiotics include the absence of guidelines for clinical practice, the incompetence of the doctors and cultural attitudes in the community. While in case of other developing countries of Asian region, the parentage of antibiotics prescribed in India is 44.8%(18), Nepal is 43%(19), Burkina Faso is 33.1%(20), Burundi is 50%(21), Tanzania is 35.4% (22), Bangladesh is 25% (23) and Ethiopia is 24.9% (24).

The current study found that 89% of prescriptions in the public sector and 78.0% in the private sector had at least one injection, above the WHO-recommended reference value of 20%.However, particularly in locations where the infection is widespread, frequent and indiscriminate use of injections might raise the danger of transmitting blood-borne illnesses like hepatitis B and potentially HIV/AIDS. Sometimes patients in Pakistan's rural areas demanded that doctors prescribe injectable because they thought they would feel much better immediately. Our

findings were consistent with previous research conducted in 57.6% in Cambodia (57.6%) (21), 45.8% in India (15), 80% in Ghana (25) and 41.8% in Cameroon (26).

With regard to percentage of medicines prescribed from EML was 71% in public and 97% in private healthcare facilities, these figures fall short of the 100% WHO-recommended ideal value. These findings clearly show private hospital prescribing more drugs from EML. Yet, the documented suboptimal use of EML in public hospitals might be related to elements like inefficient EML distribution, insufficient health personnel sensitization, and a complete absence of enforcement measures. Rational medication is selecting medications from the WHO's EDL because they are more affordable and have a history of clinical usage and testing than more recent medications (6). Our study findings are similar conducted in Nepal (86.0%) (19), Burma (94.8%) (27), Mozambique (98.8%) (28), Mali (94.6%) (21), China (95.0%) (29), Bangladesh (85.0%) (23) and Colombia (94.2%) (21).

This study results revealed number of medicines prescribed per prescription was reported to be 6.26±2.50 from public hospitals and 4.14±2.9620 from private hospitals which is far more than the recommended WHO optima value of <3 drugs per encounter. The difference in public and private health care centres was statistically significant ($p \leq 0.05$). Here, drug prescribing per encounter was recorded higher in public as compared to private hospitals. Multipole medicines prescribed per patient or polypharmacy is a major problem in Pakistan. The possible reasons for polypharmacy such as inadequate ongoing therapeutics educational trainings, financial benefits to the prescribers, unavailability of clinical practice guidelines. Polypharmacy lead to rise in adverse drug interactions, dispensing errors and increases patient complaints. Furthermore, our findings were consistent to Ghana (4.8) (25), India (5.6) (30), Nigeria (5.2) (31) and Afghanistan (3.9) (32).

**Patient-care indicators**

According to the findings of the present study, the average consultation duration was 2.1 minutes in public hospitals and 3.2 minutes in private hospitals, which was inadequate in comparison to the WHO recommendation of 10 minutes (Table 1). The brief consultation time found in the current study may be due to doctors' workloads. For a thorough history taking, comprehensive physical examination, adequate health awareness, and effective doctor-patient contact, consultation duration within the recommended range is deemed sufficient. Current finding are in line with the studies conducted in Bangladesh 1 min (33), Sweden 3 min (34), Malawi 2.5 min (20) and Nigeria 2.9 min (35).

At both public and private hospitals, the average dispensing time was 37 and 39 seconds, respectively (dispensing time is the period of time between when a patient enters and exits the pharmacy counter). Waiting intervals are not provided. This is far below the WHO's suggested value of 90 seconds. A reduced distribution time is insufficient to convey comprehensive information regarding medication regimens, undesirable drug effects, and drug warnings, as well as suitable labelling. This could result in non-compliance and eventual negative outcomes. In our environment, a larger patient load was associated with a shorter dispensing time. Also, because none of the pharmacy employees were pharmacists, they had little opportunity to counsel the patients, which cut down on the dispensing time. Many research from diverse developing nations found conclusions that were quite comparable such as Nigeria (12.5) (35), Jordan (28.8 s) (34) Swaziland (18.1 s) (31) and Ethiopia (78 s) (24).

Unlike the dispensing and consultation time, the percentage of drugs actually dispensed and drug labelling practice were found to be near to WHO recommended optimal values (100%). Private sector dispensed medicines more carefully as compared to public. The studies from Kuwait (97.9%) (36), Swaziland (99.1%)(31), Egypt (95.9%) (37), Niger (100%) (38) and Saudi Arabia (99.6%) (39) reported similar values. In case of medicine labelling, our study results are far better than Tanzania 20.1% (35), Kuwait 66.9% (36), China 95% (40) and Swaziland 55.9% (31).

The patients' knowledge of the correct dose was 42.5% in public and 69.0% in private hospitals, these numbers are bellow than the recommended WHO value of 100%, the difference in public and private hospitals was statistically significant ($p \leq 0.05$). Overall patients in private hospitals had better knowledge of the correct dose as compared

to a public one. Correct dose information on the part of the patient is crucial to preventing medication addiction and overuse as well as adverse events that might eventually harm the patient's health. According to our perspective, patients' insufficient medication knowledge may be connected to the work overload of healthcare professionals, patients' weak communication skills, and a shortage of competent pharmacists at pharmacies. Our findings are comparable with our studies conducted, in Tanzania (37.9%) (35), Cambodia (55%) (41) and Brazil (54%) (42).

**Facility-specific indicators**

The findings of the current study showed that copies of the EDL/formulary were available in both public and private institutions, which is consistent with the WHO recommendation for 100% availability of the EDL. Yet, only 82% of the essential medications were present in the stock, which was below the ideal level of 100% for both public and commercial healthcare institutions. Financial restrictions, an insufficient drug supply system, or subpar inventory management by the relevant personnel may all contribute to the limited availability of important medications. Patients who lack access to vital medications have negative effects on their health and out-of-pocket costs (6). The WHO advises doctors to stick to the medications indicated in the EDL/formulary while prescribing in order to provide good treatment. The results of our investigation, however, were virtually identical to our results. Other nations, reported comparable percentages of important medications being in stock for example Jordan (80%) (34), Swaziland (91.7%) (31), Egypt (78.3%) (37), Nigeria (90.9%) (31) and Cambodia (86.6%) (41).

**Limitations**

Due to our study's extremely constrained geographic and chronological nature, its findings cannot be generalized. On the one hand, the study was conducted just in an under populated metropolitan area. We didn't account for seasonal differences because we only conducted it over a brief period of time. However, our study adds to the existing literature by providing insights into drug utilization practices in a specific context of a low-to-middle-income country. The comparison between public and private sectors sheds light on areas where improvements are needed, such as rational prescribing, consultation times, and patient knowledge. These findings can be used to guide interventions and policies aimed at enhancing drug utilization practices.

## CONCLUSION

According to the current study's findings, both public and private healthcare centres observed utterly irrational medicine prescriptions. Yet, both public and private facilities had the EDL available, and the medications were properly labelled. The outcomes of our study underscore a pressing requirement for tailored interventions aimed at elevating drug utilization practices within the healthcare domain. This imperative is rooted in the identification of certain pivotal areas warranting focused improvement. Our findings thus advocate for strategic measures to be instituted, aligning with the overarching objective of optimizing patient care. Future research can delve deeper into the factors influencing irrational medicine prescriptions in both public and private healthcare centres. This may involve examining the roles of healthcare professionals, patient expectations, and economic incentives.

Policymakers are poised to play a pivotal role in this paradigm shift. Introducing comprehensive guidelines that incentivize generic drug prescription practices stands as a crucial measure. Furthermore, tackling the burgeoning concern of unnecessary antibiotic prescriptions through stringent regulations is imperative to curbing antimicrobial resistance. Additionally, an extension of consultation and dispensing durations holds promise in ameliorating the quality of patient-physician interactions, allowing for thorough discussions and informed decision-making.

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## DECLARATIONS

### Authors' Contributions

ZB and ML contributed to study concept, study design and data collection. AT contributed in data analysis and interpretation. OHK did the literature review and AS critically reviewed the manuscript. All the authors read and approved the final manuscript.

### Ethical Approval

The Pharmacy Research Ethics Committee (PREC) of the faculty of pharmacy, University of Lahore, Lahore, Punjab, Pakistan, provided ethical permission (Reference no: REC-2021-03H).

### Conflict of Interest

The authors declared no conflict of interest among them.


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