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Original article

Evaluation of Drug-use Pattern in a Tertiary Referral Hospital, Tripoli: A Prospective Cross-sectional Study Using WHO Core Drug-use Indicators

Eman Dyab[1]*, Masarra Abodeina[2], Mawadda Armeli[2], Shahed Belal[2], Fatima Dou[2], Fatima Matous[2]

[1]*Department of Pharmaceutics, Faculty of Pharmacy, University of Tripoli, Tripoli, Libya*
[2]*Faculty of Pharmacy, University of Tripoli, Tripoli, Libya*
Corresponding Email. *e.dyab@uot.edu.ly*

Abstract
Medications represent an essential component of medical treatment; however, their benefits hinge on rational use. This study evaluated the patterns of rational drug use at the University Hospital in Tripoli, Libya, using WHO prescribing and patient-care indicators. A prospective observational cross-sectional study was conducted using convenience sampling. Data from 1,200 encounters were collected from the outpatient clinics (n=600) and the central pharmacy (n=600) over seven months using standardized World Health Organization (WHO) detailed indicator forms. Additionally, 100 patient interviews were performed to assess their knowledge about the dispensed medications. Data were entered into a Microsoft Excel sheet and analyzed descriptively using frequencies, percentages, and averages. On average, three drugs were prescribed per encounter. Antibiotics and injections were identified in 24% and 18% of encounters, respectively. Generic names were used in 30% (n = 962) of the prescribed drugs (n = 3,168), and 56% of all drugs were prescribed from the Libyan Essential Medicines List (EML). On average, 6.44 minutes and 7 seconds were allocated to the patients by the physicians and the pharmacists, respectively. Actual dispensing occurred for only 28% (n = 380) of the total medications (n = 1358) requested at the central pharmacy, and only 40% (n = 153/380) of the dispensed medications were adequately labeled. Overall, only 36% of patients demonstrated adequate knowledge of their dispensed medications. Prescribing and dispensing practices at the hospital deviated significantly from the rational use standards across several indicators. Urgent interventions and policy reforms are required from all stakeholders to improve the situation.
Keywords. Rational Drug Use, WHO Indicators, Prescribing Indicators, Patient Care Indicators.

Introduction

Medications serve as an indispensable part of medical care within all healthcare systems. They are used as the primary intervention for the prevention, management, and cure of diseases. When utilized rationally, these products largely enhance patient outcomes and improve the overall quality of life [1]. The World Health Organization (WHO) states that rational use of medicines demands that patients receive medications that are suitable for their clinical needs, with a proper dosage regimen, and at the lowest possible cost to the patient and the community [2].

Despite these clear parameters, irrational drug use, characterized by the overuse, underuse, or misuse of medications, remains a pervasive global phenomenon. It is estimated that more than 50% of all medicines worldwide are prescribed, dispensed, or sold inappropriately, while half of all patients fail to take their medications as intended [3]. Such irrational practices lead to severe consequences, including the exacerbation of illness, an increased incidence of adverse drug reactions, and premature mortality [4]. Furthermore, irrational drug utilization exhausts national healthcare budgets and imposes significant out-of-pocket expenses on patients, particularly in low-resource settings where medications often constitute a major portion of household healthcare spending [5].

Common patterns of irrational use include polypharmacy, the excessive use of injections when oral formulations are appropriate, and non-adherence to clinical guidelines. To address these challenges, the WHO established “core drug-use indicators” as a standardized tool for objective assessment [6]. These include prescribing indicators to evaluate practitioner performance and patient-care indicators to measure the quality of the interaction between healthcare providers and patients.

In Libya, the government provides free healthcare service through a universal coverage program to the population delivered via public healthcare settings. The Ministry of Health developed a national Essential Medicines List (EML) to guide procurement of medications based on the population’s needs. The most recent version of the EML was issued in 2019 [7]. The EML is intended to ensure that priority is given to medications that address the fundamental healthcare needs of the population, ensuring they are always available within the health system, in adequate amounts, and at a price the community can afford [8]. In 2021, the government allocated 2.7% of the national budget exclusively to medicines. Despite this significant spending, the healthcare system has faced prolonged challenges due to political and economic instability, leading to chronic supply chain disruptions and a lack of robust regulatory oversight. Previous research into medication use in Libya has predominantly focused on WHO prescribing indicators within primary healthcare centers [9], community pharmacies [10, 11], and a major pediatric hospital [12]. While

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these studies have documented persistent issues—such as low generic prescribing rates and significant polypharmacy—a critical knowledge gap remains regarding a comprehensive evaluation of both prescribing and patient-care metrics within general tertiary public hospitals. Unlike other facilities, tertiary referral hospitals face unique pressures, including high patient volumes and more complex clinical cases.

Most contemporary Libyan studies have overlooked the actual quality of the patient-provider interaction. Crucially, vital WHO patient-care indicators, including average consultation and dispensing times, labeling adequacy, and the patient's actual understanding of their treatment, have been largely neglected in recent literature. The most comprehensive data on these specific metrics in Libya dates to 2008 [13], leaving a decade-long void in current knowledge. Therefore, this study aimed to evaluate the patterns of rational drug use at Tripoli University Hospital (TUH) using the WHO core drug-use indicators. By investigating both prescribing habits and the patient-care interactions, this research seeks to identify systemic gaps and provide an evidence-based baseline to inform urgent policy reforms and intervention strategies in Libya.

Methods

Study Area, Design, and Period

This study was conducted in the Tripoli University Hospital (TUH). It is a major public referral and teaching hospital with a capacity of 1,200 beds, covering a wide range of specialties. It was established to the east of Tripoli, the capital of Libya, in 1996. Currently, it serves approximately 2 million people residing in Tripoli and nearby cities. We employed a prospective cross-sectional design using a direct observational technique. Data collection took place between September 2021 and March 2022. The study utilized standardized WHO prescribing and patient-care indicators to assess drug use patterns within the facility.

Study population and sampling

The study population consisted of patients who attended the hospital outpatient clinics and the central pharmacy during daytime working hours. In accordance with the WHO recommendations for healthcare facility assessments [6]. A convenience sample of 1,200 encounters was targeted. This included 600 encounters from the central pharmacy and 600 encounters from the outpatient clinics (excluding surgical clinic, pediatric oncology clinic, and adult oncology clinic, n=600). Additionally, one-on-one interviews were conducted with a sub-sample of 100 patients immediately after they had collected their prescribed medicines from the central pharmacy. Dispensing time and consultation time were measured using a stopwatch, with the healthcare providers kept unaware of the observation to prevent the Hawthorne effect. Before commencing the study, ethics approval was granted by the Scientific Research and Ethics Committee at the University of Tripoli (SREC-UOT), Ref No: SREC-UOT 08-2021. The participants' confidentiality was guaranteed by collecting no identifying information, such as name and address.

Data Collection and Analysis

Data were collected by five senior pharmacy students using a detailed standardized WHO prescribing and patient-care forms. The data collectors underwent a one-week training period under the supervision of the primary investigator, who monitored the entire process. This training focused on accurate collection of information and the structured entry of data into Microsoft Excel. The first ten encounters for each student served as a pilot (50 encounters in total); these encounters were excluded from the main study. The data were coded into a checklist form, entered into Microsoft Office Excel 2016, and checked for errors. Then they were summarized descriptively using averages, frequencies, and percentages, and presented in a tabular form as described by the WHO methodology [6].

Results

Prescribing indicators

A total of 3,168 medications were prescribed for 1,200 patients with an average of 3 per prescription. Approximately half of the encounters (n = 524, 43.7%) received a prescription containing more than two medications (Figure 1). Only 30% of medications were prescribed by their generic names, and 56% of the prescribed drugs were included on the Libyan EML. Furthermore, one or more antibiotics were prescribed in 24% of encounters, and 18% of the prescriptions contained at least one injectable dosage form. More details are shown in (Table 1).

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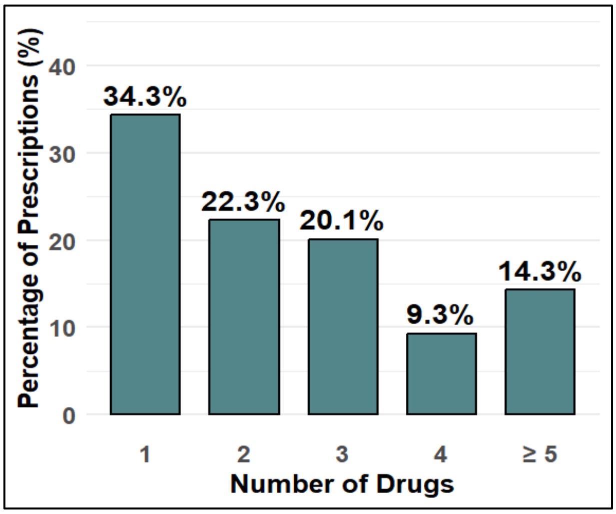

Figure 1. Number of prescribed drugs per prescription across 1,200 encounters

Table 1. Prescribing indicators and patient care indicators

Indicator	Total	%	Range	Average	Median	WHO standard
Number of prescribed drugs[a]	3,168	-	(1–13)	3	2	< 3
Drugs prescribed by generic name[a]	962	30%	(0–7)	1	0	100%
Drugs prescribed from EDL[a]	1761	56%	(0–10)	1	1	100%
Antibiotics prescribed [a]	287	24%	-	-	-	< 30%
Injections prescribed [a]	221	18%	-	-	-	< 10%
Consultation time (min)[b]	3,862.6	-	(1–30)	6.44	5.34	10
Dispensing time (sec.) (n = 312/600) [b]	2235	-	(0–120)	7	0	2
Drugs dispensed (n = 380/1,358)[b]	380	28%	(0–9)	0.63	1	100%
Adequately labelled[b]	153	40%	-	-	-	100%
Patients' Knowledge [c]		36%	-	-	-	100%

a Indicators calculated from 1,200 encounters.
b Indicators calculated from 600 encounters (either from the central pharmacy or the outpatient clinics).
c Proportions from the 100 interviews.
Abbreviations: EDL= Essential Drug List, WHO= The World Health Organization

The largest proportion of medications was prescribed for treating cardiovascular diseases (22%), followed by respiratory conditions (14%) and infections (13%). Among drugs prescribed for the cardiovascular system, 44% were classified as off-list (e.g., telmisartan, rosuvastatin, and ticagrelor). Similarly, off-list medications accounted for 40% of gastrointestinal prescriptions (e.g, pantoprazole), and 8% of endocrine prescriptions (e.g., vildagliptin, dapagliflozin, and empagliflozin). More details are presented in Table 2.

Table 2. Distribution of prescribed drugs by body system and proportion of off-list medications within each system

Body system	% of all prescribed drugs (n=3,168)	Examples of LEML off-list drugs	% off-list within system
Cardiovascular system	22%	Candesartan, Valsartan, Irbesartan, Atorvastatin, Rosuvastatin, Acetylsalicylic Acid, Acenocoumarol, Ramipril, Nebivolol, Ticagrelor, Molsidomine, Rivaroxaban.	44%
Respiratory system	14%	Loratidine, Betahistine, Cetirizine, Beclometasone, Bromhexine.	21%
Infection	13%	Miconazole, Sertaconazole, Vibramycin, Ketoconozale, Ciclopirox.	2%
Blood and nutrition	11%	Ascorbic Acid, Alpha Lipoic Acid, Chondroitin, Eicosapentaenoic Acid, Ginkgo Biloba.	13%
Central nervous system	9%	Meloxicam, Piroxicam, Ketoprofen, Etoricoxib, Indomethacin, Celecoxib, Naproxen, Opipramol, Pregabalin, Cinnarizine.	22%
Endocrine system	6%	Vildagliptin, Dapagliflozin, Empagliflozin, Glibenclamide, Mequitazine.	8%

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Gastrointestinal system	5%	Pantoprazole, Esomeprazole, Sucralfate, Simeticone, and Meclozine.	40%
Genito-urinary system	4%	Sildenafil, Dapoxetine, Finasteride, Solifenacin, Alfuzosine.	36%
Immune system and malignant disease	4%		0%
Skin	4%	Potassium Permanganate, Zinc Oxide, Pimecrolimus, Lactic Acid, Salicylic Acid, Sulphur.	73%
Musculoskeletal system	3%	Glucosamine, Orphenadrine, Thiocolchicoside.	29%
Ear, nose, and oropharynx	2%	Xylometazoline, Ducosate Sodium, Lysozyme, Azelastine.	57%
Eye	1%	Carboxymethyl Cellulose, Glycerine, Brinzolamide, Brimonidine, Travoprost, and Timolol.	28%

The pattern of antibiotic prescribing, based on 319 prescribed ones, is presented in Table 3. Broad-spectrum antibiotics made up 78% of all prescribed antibiotics, while narrow-spectrum antibiotics represented 22%. The most prescribed antibiotics were amoxicillin/clavulanic acid (13%, broad-spectrum), tobramycin (13%, broad-spectrum), and fusidic acid and its derivatives (13%, narrow-spectrum). Ciprofloxacin (11%) and azithromycin (8%) were also frequently prescribed broad-spectrum antibiotics.

Table 3. Distribution of prescribed antibiotics based on their spectrum of activity

Product	**Count**	**Percentage**	**Spectrum** [14]
Amoxicillin + Clavulanic acid	41	13%	Broad-spectrum
Fusidic acid and its derivative	42	13%	Narrow Spectrum
Tobramycin	40	13%	Broad-spectrum
Ciprofloxacin	36	11%	Broad-spectrum
Azithromycin	24	8%	Broad-spectrum
Cefixime	20	6%	Broad-spectrum
Ceftriaxone	14	4%	Broad-spectrum
Clarithromycin	14	4%	Broad-spectrum
Chloramphenicol	11	3%	Broad-spectrum
Levofloxacin	11	3%	Broad-spectrum
Polymyxin + Neomycin	10	3%	Broad-spectrum
Sulfamethoxazole and Trimethoprim.	9	3%	Narrow-spectrum
Mupirocin	9	3%	Narrow -spectrum
Cefalexin	8	3%	Narrow-spectrum
Erythromycin	6	2%	Broad-spectrum
Amoxicillin	5	2%	Broad-spectrum
Oxytetracycline + Polymyxin B	3	1%	Broad-spectrum
Moxifloxacin	2	1%	Broad-spectrum
Nitrofurantoin	2	1%	Broad-spectrum
Ofloxacin	2	1%	Broad-spectrum
Vibramycin	2	1%	Broad-spectrum
Doxycycline	2	1%	Broad-spectrum
Cefotaxime	1	0%	Broad-spectrum
Clindamycin	1	0%	Narrow-spectrum
Gentamycin	1	0%	Broad-spectrum
Meropenem	1	0%	Broad-spectrum
Phenoxymethylpenicillin	1	0%	Narrow-spectrum
Vancomycin	1	0%	Narrow-spectrum
Total	319	100%	
Broad-spectrum	248	78%	
Narrow-spectrum	71	22%	

Patient care indicators

On average, the time that prescribers spent with the patients was 6.44 minutes, while the average dispensing time was 7 seconds. Out of a total of 1,358 prescribed medications, only 380 (28%) were supplied to the 600 patients from the central pharmacy, of which only 40% were adequately labeled. Among the 100 interviewees, the proportion of patients who possessed adequate knowledge of their

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treatment was 36%. (Table 1). Regarding specific knowledge components, only 41% of patients could correctly identify their medication by name. In contrast, the majority of participants demonstrated a clear understanding of the direction for use and the medication indication, with rates of 82% and 90%, respectively (Figure 2).

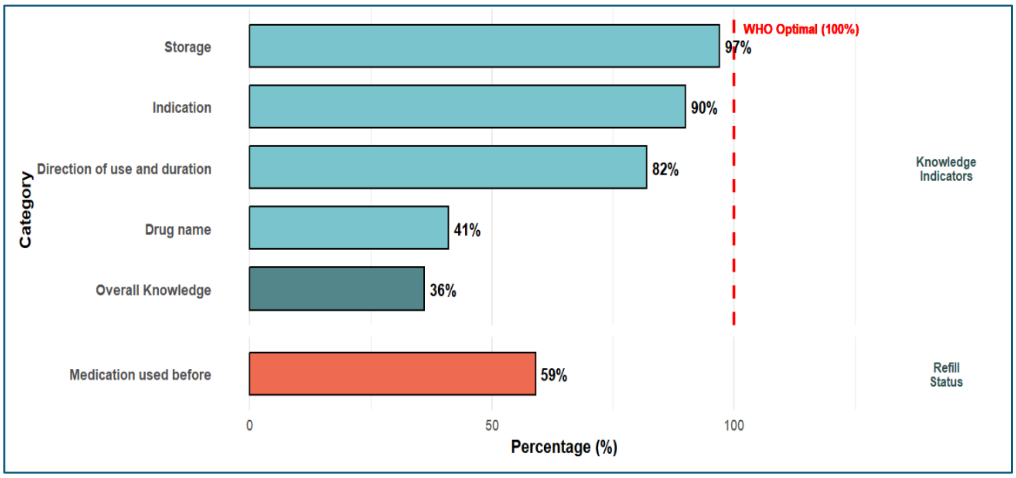

Figure 2. Assessment of patients' medication knowledge in relation to their refill status (n=100)

Discussion

The average number of medications per prescription (3.0) exceeds the WHO standard of two [15]. The observed overprescribing in this study could be attributed to inadequate training of healthcare staff, empirical prescribing practices, and a clinical focus on treating symptoms rather than underlying causes [16]. Such practices increase the risk of harm due to drug-drug interactions and adverse effects while contributing to poor patient adherence, unnecessary medication use, wastage, and higher costs [15]. Similar trends have been reported in other Libyan studies, including multiple healthcare centers (2.85)[13], general hospitals (4.7) [9], and community pharmacies at (3.0 [10] and 3.2 [11]). However, our finding differs from the result of a Libyan pediatric hospital, where a significantly lower rate of 1.52 was reported [12]. This difference might be related to the differing complexities of clinical conditions between adult and pediatric populations. Internationally, our result aligns with data from Sudan (3.98) [17] and Sri Linka (3.1) [18], though it remains higher than those reported in Ethiopia (2.5) [3] and the UAE (2.5) [19].

Only 30% of medications were prescribed by generic name, a percentage significantly lower than the WHO recommendation of 100% [15]. The use of generic products is encouraged globally, as they provide therapeutic bioequivalence at a substantially lower cost. The low generic prescribing in this facility forces patients—many of whom already face polypharmacy issues—to pay higher out-of-pocket expenses, ultimately impeding access to essential treatments. Possible contributing factors to this practice include a lack of physician trust in generic efficacy, weak enforcement of national drug policies, and the pervasive influence of pharmaceutical marketing on clinical decision-making [20]. Our finding is consistent with other Libyan studies, which reported generic prescribing rates of 5.47% [12], 10% [13], and 28.6% [9]. Internationally, our finding is significantly lower than those reported in Ghana (62.6%) [21], Pakistan (71.6%) [22], and the UAE (100%) [19].

Only 56% of prescribed medications were listed in the national Essential Medicines List issued in 2019 [7]. This percentage is lower than the WHO recommendation of 100% [15]. The EML prioritizes affordable, clinically proven medications, which facilitates easier inventory control and more accurate prescribing [5]. The low utilization of the EML in this study is primarily driven by interrupted supplies and frequent stockouts, which force physicians to prescribe non-EML alternatives available in private community pharmacies. This is further exacerbated by a lack of trust in the efficacy of "low-cost" medications, limited awareness of the EML, the absence of a hospital formulary, and the influence of pharmaceutical marketing for newer products [23]. Additionally, weak regulatory enforcement and a lack of clinical audits often allow practitioners to bypass established guidelines without administrative consequences [24]. Adherence to the EML in previous Libyan studies has shown significant variation, ranging from 12.6% [11] to 61.3% [12] and 82.8% [9]. Internationally, EML utilization rates varied, with Nepal reporting 65% [25], Sri Lanka 68.8% [18], Pakistan 93.4% [22], Tanzania 96.7% [26], and Ethiopia achieving 100% [27].

A closer look at the off-list prescribed medications suggests a strong clinical preference for newer-generation drugs−such as candesartan, valsartan, ramipril, atorvastatin, esomeprazole, and pantoprazole−over the older, cost-effective equivalents listed on the EML (e.g., losartan, captopril, simvastatin, omeprazole). This practice significantly increases out-of-pocket expenditures for patients, which can become a barrier to treatment access [24], potentially leading to poor medication adherence and sub-optimal health outcomes.

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Although the antibiotic prescribing rate finding reported in this study (24%) falls within the WHO acceptable limit (<30%) [15], the qualitative pattern of these prescriptions reveals a significant challenge related to the selection of the prescribed antibiotics. A vast majority of the prescribed antibiotics (78%) were broad-spectrum, which is consistent with a previous finding of 71% [9]. Clinical guidelines state that the narrow-spectrum options are preferred over broad-spectrum options, as they have a lower potential to cause superinfections and contribute less to bacterial resistance [14]. Heavy reliance on broad-spectrum options contributes to the rise of antimicrobial resistance, leading to the loss of valuable, cost-effective medications. Our finding regarding antibiotic prescribing practice is similar to those reported in the previous Libyan studies (20.56% [12], 25% [13], 30.4% [9], and 38.7% [11]), and represents a better situation than those reported in Sudan (53.7%) [17], Ethiopia (42%) [28], and Pakistan (48.9%) [22].
The rate of injectable medication prescribing (18%) was higher than the WHO-recommended limit[15]. Regulating this invasive therapy is essential to reduce the risk of blood-borne diseases, such as hepatitis B and even HIV/AIDS, for both patients and healthcare providers, while reducing the burden and cost of frequent visits to healthcare facilities [23]. Therefore, oral medications should be prioritized as the primary route of administration whenever clinically appropriate.[29]. Patient misconceptions and beliefs regarding the efficacy of injections have been reported as major contributors to the high usage of injections in both private and public healthcare facilities [23]. In comparison to other Libyan studies, our result was higher than the findings of 1.82% [11], 10% [9], and 16% [13], yet lower than 25.9% [12]. Globally, our findings are better than those reported in Sudan (57.6%) [17], Ethiopia (42.2%) [30], and Pakistan (48.9%) [22], while lower rates were reported in the UAE (3.14%) [19] and Ghana (8.3%) [21].
The contact time with patients by the prescriber (average consultation time: 6.44 minutes, ranging from 5 to 30 minutes) and the dispenser (average dispensing time: 7 seconds, ranging from 0 to 120 seconds) was extremely short and below the WHO-recommended cut-off values of at least 10 minutes and 90 seconds, respectively [5]. Such brevity precludes the ability to conduct full physical exams, provide necessary health education, and ensure meaningful physician-patient communication—all of which are required for safe prescribing [5]. Similarly, insufficient dispensing time hinders comprehensive patient education regarding therapy regimens and safety precautions [12]. A previous national study estimated that the consultation time ranged from 5 to 10 minutes, and the dispensing time ranged from 1 to 3 minutes.[13] The difference could be attributed to patient overload and low medication availability (28%). The impact of this brief contact is also noticeable in the patients' knowledge of their medications, which was very low at 36%. Similarly, short contact times were also recorded in other countries, including Pakistan (consultation time of 2.2 minutes; dispensing time of 38 seconds) [22], Sudan (consultation time of 6.6 minutes [31]; and dispensing time of 1.75 minutes [17]), and Ghana (consultation time of 8 minutes; dispensing time of 1.52 minutes) [21].
The dispensing rate of 28% observed in our study is alarmingly low, indicating a major breakdown in the medication use process at this hospital. This finding falls substantially below the 76% dispensing rate reported previously in a 2008 Libyan study [13], reflecting a concerning decline in health system performance within the country over time. Moreover, our rate is markedly lower than those documented in other limited-resource countries like Sudan (54%) [31], and far behind the high levels achieved in Pakistan (90%) [22], and Ethiopia (94%) [27]. Such a discrepancy cannot be explained by prescribing habits alone; rather, it points to severe systemic barriers, including the absence of a hospital formulary, a profound mismatch between prescribing patterns and LEML, and chronic supply disruptions (e.g., procurement failures, stock-outs, and logistical breakdowns). This critical failure likely undermines treatment outcomes and reduces patient trust in the healthcare system.
The labeling adequacy rate of 40% is substantially below the WHO-recommended ideal of 100%, posing a higher risk to patient safety, as improper labeling is a known contributor to medication errors and accidental misuse [32]. While our finding is higher than the rate reported in Ethiopia (10%)[27], it remains considerably lower than those reported in Sudan (65%)[17] and Sri Lanka (98.5%)[18]. The primary drivers for this low performance are likely a high patient-to-staff ratio and the limited time allocated for counselling, compounded by a lack of Arabic instructions on imported medications and a perceived lack of importance regarding the clinical role of labelling in patient safety. Furthermore, even labelled medications often present challenges due to manual handwriting, which leads to poor legibility and the omission of essential details [32].
There was a significant gap in patients' knowledge regarding their prescribed medications. Only 36% of patients possessed correct information. The lowest score was recorded for drug names (41%), while knowledge of the direction of use and indication was high (>80%). The poor recall of drug names can be explained by the extremely brief dispensing time, inadequate labeling, and the fact that most medications are imported without Arabic translations. Conversely, better knowledge of indication reflects that patients relate their chief complaints to the purpose of the medications. Furthermore, over half of the participants were returning patients who had used these medications chronically. Our current value remains higher than the 10% reported in a previous Libyan study [13]. Other studies reported better patient knowledge rate near the optimal value recommended by WHO 100% such as Ethiopia, 74.7% [33], and India, 80.8% [34].

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While this study provides a critical baseline for medication use patterns in Libya, several limitations exist. As a single-center study at a tertiary referral hospital, the findings cannot be generalized to the entire Libyan healthcare system, particularly primary or private care. Additionally, the cross-sectional design provides only a snapshot of clinical practice, failing to capture seasonal variations or long-term trends. Despite these constraints, the results offer essential insights for informing future longitudinal and multi-center research.

Conclusion

While some prescribing practices (such as antibiotic frequency) align with international standards, the overall medication-use process is characterized by significant irrationality. High rates of polypharmacy, a striking reliance on broad-spectrum antibiotics, and a profound neglect of generic prescribing highlight a departure from evidence-based clinical guidelines. Furthermore, a severe breakdown in patient-care indicators, specifically regarding the alarmingly low dispensing rate and the minimal contact time between pharmacists and patients. These systemic deficiencies, compounded by poor labeling and a lack of adherence to the National Essential Medicines List, not only compromise patient safety but also undermine the hospital's role as a leading referral and teaching institution. Urgent policy interventions, including the establishment of a hospital formulary and improved supply chain management, are essential to restore rational pharmaceutical care and ensure the effective use of limited healthcare resources in Libya.

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Conflicts of Interest

The authors declare no conflicts of interest.

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