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Decoding prescriptions: A closer look at common errors in clinical practice across community pharmacies of Northern Cyprus

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Abstract: Prescription documentation is essential for patient safety and medication efficacy. However, incomplete or illegible prescriptions can lead to errors, including drug-drug interactions (DDIs). This study evaluated the completeness, clarity and quality of handwritten and electronic prescriptions from community pharmacies in Northern Cyprus, assessing compliance with WHO guidelines. A total of 5,246 prescriptions from 23 pharmacies were analyzed over nine months, with 4,856 meeting inclusion criteria. Of these, 77% were handwritten and 23% electronic. Illegibility was an issue in 23.1% of handwritten prescriptions, increasing the risk of errors. Generic drug names were included in only 11.42% of handwritten and 26.95% of electronic prescriptions, reducing clarity. Potential DDIs were identified in 52.2% of cases, particularly involving anticoagulants and NSAIDs. Additionally, 3.9% of prescriptions showed evidence of DDIs. Antibiotics (28.03%) and analgesics (22.66%) were the most prescribed medications. While electronic prescriptions improved legibility, both formats lacked essential details. The study highlights the need for improved prescription practices, advocating for mandatory electronic prescribing, enhanced prescriber education and clinical decision support systems to reduce errors, improve patient safety and enhance prescription quality in community pharmacies.

Keywords: Medication errors, community pharmacies, prescription audit, prescription errors, rational prescribing.

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INTRODUCTION

Achieving targeted therapeutic outcomes through drug therapy depends mainly on its safety and efficacy and accuracy in the prescription is the cornerstone of this process (Hammad *et al*., 2024). Analysis of prescription errors is a crucial topic of attention in healthcare research since they are one of the most frequent and avoidable sources of patient harm (Kumar *et al*., 2019). These errors can lead to adverse drug reactions (ADRs) and jeopardize patient safety (Dongo and Kantaris, 2023). They include errors in selection of the drug, improper dosage, ignored drug-drug interactions (DDIs) and transcribing errors. Prescription errors are made more likely by the increasing complexity of pharmaceutical regimens, especially for patients with comorbidity. To reduce the risks involved, careful prescription analysis is required (Kumar *et al*., 2019).

Prescription errors are defined as the process that may result in inappropriate usage of drugs or patient harm (Nouri *et al*., 2024). Prescription errors one of the most challenging concerns in the healthcare system of both developed and developing countries. According to studies, these errors can occur at any phase of the pharmaceutical management like prescription, dispensing, administration, or monitoring. However, because they set off a series of events that have the potential to jeopardize the therapeutic process, prescribing errors are particularly concerning (Al-Worafi, 2023). Developing focused interventions and improving patient safety require an understanding of the type, frequency and contributing causes of prescription errors (Alrabadi *et al*., 2021).

Prescription error reasons are complex and frequently interrelated. Prescribers may make mistakes with drug selection or dosage because they are not up to date on the most recent clinical recommendations or the pharmacokinetics and pharmacodynamics of drugs (Mangoni and Jarmuzewska., 2021). Prescription decisions may become even more complex if patient-specific factors including age, renal or hepatic function and concurrent medical disorders are not adequately considered (Peeriga and Manubolu, 2024). The frequency of these errors is also influenced by systemic problems like time restraints, heavy workloads and limited interactions among healthcare professionals. Another major problem in many healthcare settings is the lack of consistency in prescription writing procedures, which is made worse by handwritten prescriptions that are difficult to read (Alahmadi *et al*., 2020).

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Prescription errors have extensive effects on the healthcare system as a whole in addition to individual patients. These errors may result in treatment failures, avoidable admissions, extended treatment periods, or even potentially fatal consequences for patients (Soori, 2024). Prescription errors are a systemic factor that raises healthcare expenses, decreases efficiency and erodes patient confidence in medical professionals (Ahsani *et al*., 2022) Medication errors, including prescription errors, are a global public health concern, according to the World Health Organization (WHO), which has called on healthcare systems to take preventative action to lessen their effect (WHO, 2021).

In order to detect, categorize and resolve prescription errors, prescription analysis has become a crucial technique. It entails the methodical review of prescription data in order to identify departures from accepted standards, gauge compliance with evidence-based procedures and determine whether prescribed drugs are acceptable (Tantray, 2024). In addition to detecting errors, this procedure offers insightful information about prescription trends, which aids in identifying areas where clinical practice has to be improved (Cabri *et al*., 2021). A crucial component of contemporary pharmacology, prescription analysis also makes it easier to assess drug-drug interactions, particularly in patients following intricate regimens for chronic illnesses (Al-Worafi, 2023).

Prescription errors are analyzed using a variety of approaches, from human prescription record review to the use of electronic prescribing systems and databases of drug interactions. Prescription analysis has been transformed by electronic health records (EHRs) and computerized physician order entry (CPOE) systems, which allow for the real-time identification of possible errors, enhance legibility and standardize prescribing procedures. Furthermore, prescribers receive evidence-based recommendations when clinical decision support systems (CDSS) are integrated with electronic health records (EHRs), which lowers the possibility of errors. Notwithstanding these developments, difficulties still exist, especially in environments with low resources where electronic equipment might not be easily accessible (Yennyemb, 2023).

Prescription error is a significant concern in the healthcare setting. Researches indicate that there is at least one prescription error in 15-21% of prescriptions. The prevalence of prescription errors among hospitalized patients is 30%. The rate of prescribing errors in community healthcare setting has been estimated to be 11% (Gugnani *et al*., 2023).

There is lack of study related to prescription analysis in this region. Therefore, the present study has been conducted in six different community pharmacies of Guzelyurt and Lefke.

MATERIALS AND METHODS

Study design

A cross-sectional study was conducted to collect data from prescriptions for a period of 9 months with the goal of assessing the characteristics of the prescriptions and their compliance with World Health Organization (WHO) guidelines. The study aimed to provide an overview of prescribing practices in the selected regions.

Study setting

The study was conducted in 23 different community pharmacies focusing on prescriptions in Guzelyurt, Girne, Lefkosa and Lefke region of Cyprus. These pharmacies were selected based on convenience and their accessibility to prescription data within the study period. The study was approved by the European University of Lefke Institutional Review Board with Decision no: ÜEK/09/02/16/1723/3).

Study duration

Data was collected over a period of 9 months, starting from October, 2022 and ending on June, 2023. This timeframe allowed for the collection of a substantial number of prescriptions for analysis.

Study population

The study population consisted of prescriptions obtained from 23 different community pharmacies in the Guzelyurt, Girne, Lefkosa and Lefke region of Cyprus. In total, 5243 prescriptions were collected representing a wide range of prescriptions from various prescribers and patients. The prescriptions were analyzed to evaluate their compliance with standard medical guidelines and the quality of the information provided.

Inclusion criteria and exclusion criteria

Inclusion Criteria

- All prescriptions issued during the study period (October, 2022, to June, 2023) by prescribers in the selected pharmacies.
- Prescriptions that contained sufficient information, including drug name, dosage form, strength, quantity, route of administration and legibility for analysis.

Exclusion criteria

- Prescriptions with unclear drug-related data that could not be properly analyzed.
- Those prescriptions that did not follow standard prescription formats.

Data collection tools

Prescription forms: The primary tool for data collection was the physical prescription forms from the selected pharmacies. A structured data sheet was used to record the details of each prescription, including the following:

- **Patient information**: Name, age, weight, gender, address and contact details.
- **Prescriber information**: Name, designation, registration/license ID and contact information.

- **Date of prescription**: Prescription issue date.
- **Superscription**: Universal "Rx" symbol.
- **Inscription:** Drug name, strength, dosage form and quantity.
- **Subscription**: Pharmacist instructions.
- **Signatura (directions for use)**: Dosage, route of administration, frequency and duration.
- **Refill information:** Details on refills.
- Diagnosis, warnings and special instructions.
- Prescriber's signature and stamp.

Checklist: A checklist was developed based on the WHO guidelines for prescription writing, which was used to assess the conformity of prescriptions with international standards for clarity, completeness and legibility (Sheikh *et al*., 2017).

STATISTICAL ANALYSIS

The collected data was analyzed using descriptive statistical methods to evaluate prescription characteristics and their adherence to WHO guidelines. Frequency analysis was conducted to examine the distribution of drug names, dosage forms, strengths, quantities and routes of administration across 4,856 prescriptions. Legibility was assessed, categorizing prescriptions as either legible or illegible, with proportions calculated for each. Compliance with WHO guidelines were determined through a compliance score, with prescriptions classified as either compliant or non-compliant based on key criteria. The analysis focused on the drug-related information, including drug names, dosage form, dose, strength, quantity and route of administration. Personal information of both the prescribers and patients was kept confidential. Statistical software such as SPSS version 29 were utilized to analyze the data, generating frequency tables, charts and compliance reports to present the findings effectively.

RESULTS

A total of 5246 prescriptions were collected from 23 community pharmacies situated in the Guzelyurt, Girne, Lefkosa and Lefke regions of Cyprus over a 9-month period. Among these, 4,856 prescriptions met the inclusion criteria and were analyzed, while 390 were excluded for not meeting the required standards. Out of the total 4856 prescriptions analyzed, the majority (41.3%) originated from hospitals, followed by 18.4% from university hospitals and 2.4% from clinics. The remaining 37.9% were issued by other sectors and privately-owned facilities, including dentists and optometrists, or lacked identifiable sources. A total of 18,871 drugs were prescribed, with the number of drugs per prescription ranging from 1 to 7 and an average of 3.9 drugs per prescription as shown in table 1.

Majority of the prescriptions were hand written (77% prescriptions) whereas 23% were electronically typed. From the total of the handwritten prescriptions, 76.9% were readable, 16.7% were partially readable and 6.4% were illegible/barely readable. Because of these illegible and partially readable prescriptions, there were some drugs that were illegible as well. They summed up to a total of 3660 drugs (19.4%). Table 2 presents the demographic distribution of prescriptions, providing insights into key variables such as patient age, gender, weight, type of medication and prescriber type.

The analysis of electronic prescriptions revealed that most included key details. The address was available in 94.27% of prescriptions, while it was missing in 5.73%. Similarly, the prescriber's name was present in 98.66% of prescriptions, with only 1.34% lacking this information. Regarding the prescriber's designation, it was clearly stated in 91.77% of prescriptions, whereas 8.23% did not include it. Importantly, the license number was present and readable in all prescriptions, achieving a 100% availability rate.

The evaluation of handwritten prescriptions revealed the following details regarding the availability, non-availability and readability of key information. The address was available in 75.26% of prescriptions, not available in 24.74% and 17.87% were available but not readable. For the name of the prescriber, 89.81% were available, 10.19% were not available and none were categorized as available but unreadable. The designation was available in 48.83% of prescriptions, not available in 51.17% and 13.74% were available but unreadable. Lastly, the license number was available in 72.78% of prescriptions, not available in 27.22% and 1.94% were available but not readable. These findings highlight variability in the completeness and clarity of handwritten prescriptions, which may impact their clinical utility.

The analysis of electronic prescriptions showed that the date was present on 100% of prescriptions. The superscription (Rx) was available on 83.80% of prescriptions, while 16.20% lacked it. Additionally, the generic name was included in 26.95% of prescriptions, whereas 73.05% did not feature the generic name as shown in fig. 1.

The analysis of electronic prescriptions further revealed the availability of key elements as follows: The diagnosis was present in 89.34% of prescriptions, with 10.66% lacking this information. The prescriber's signature and stamp were included in 78.6% of prescriptions, while 21.4% were missing these essential details. Warnings and special instructions, however, were notably absent in the majority of prescriptions, with 90.16% not containing this information and only 9.84% included specific warnings or instructions. These findings highlight areas where electronic prescriptions could be improved to ensure more comprehensive documentation and enhance patient safety.

Table 1: Analysis of the number of drug(s) written in prescriptions

Number of drug(s) written in prescriptions	Number of prescriptions	Total number of drugs	Percentage (%)
1	100	100	0.53
2	478	956	5.06
3	1500	4500	23.84
4	1170	4680	24.80
5	805	4025	21.33
6	611	3266	17.31
7	192	1344	7.13
Total	4856	18871	100.0

Table 2: Demographic characteristics of prescriptions

Demographic Variable	Category	Number (n)	Percentage (%)
		4,856	100 %
Total Prescription	Electronic Prescription	1117	223%
	Handwritten Prescription	3739	77%
Gender	Male	1894	39%
	Female	2962	61%
Weight (kg)	Less than 20	17	0.35%
	21-40	826	17.62%
	41- 60	875	18.01%
	61-80	1213	24.97%
	81 and above	1925	39.64%
Age Group	0-20 years	322	28.83%
	21-40 years	257	23%
	41-60 years	201	18%
	Above 60 years	337	30.17%
Type of medication	Antibiotics	5289	28.03%
	Analgesics	4278	22.66%
	Cardiovascular	3914	20.75%
	Gastrointestinal	2574	13.64%
	Others	2816	14.92%

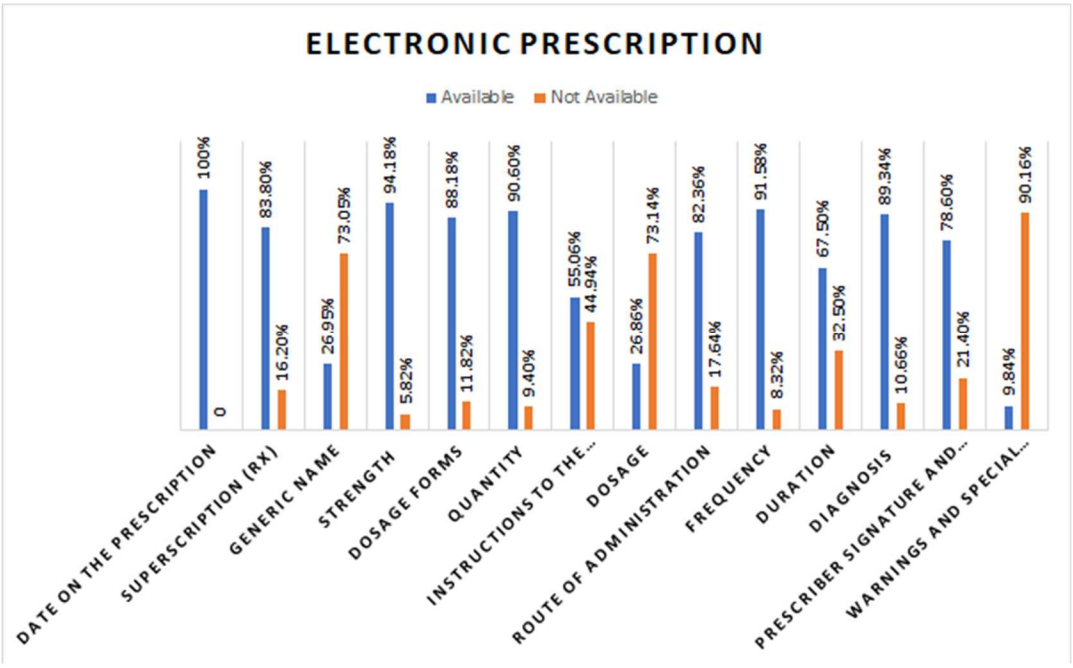

Fig. 1: Availability of key information in electronic prescriptions

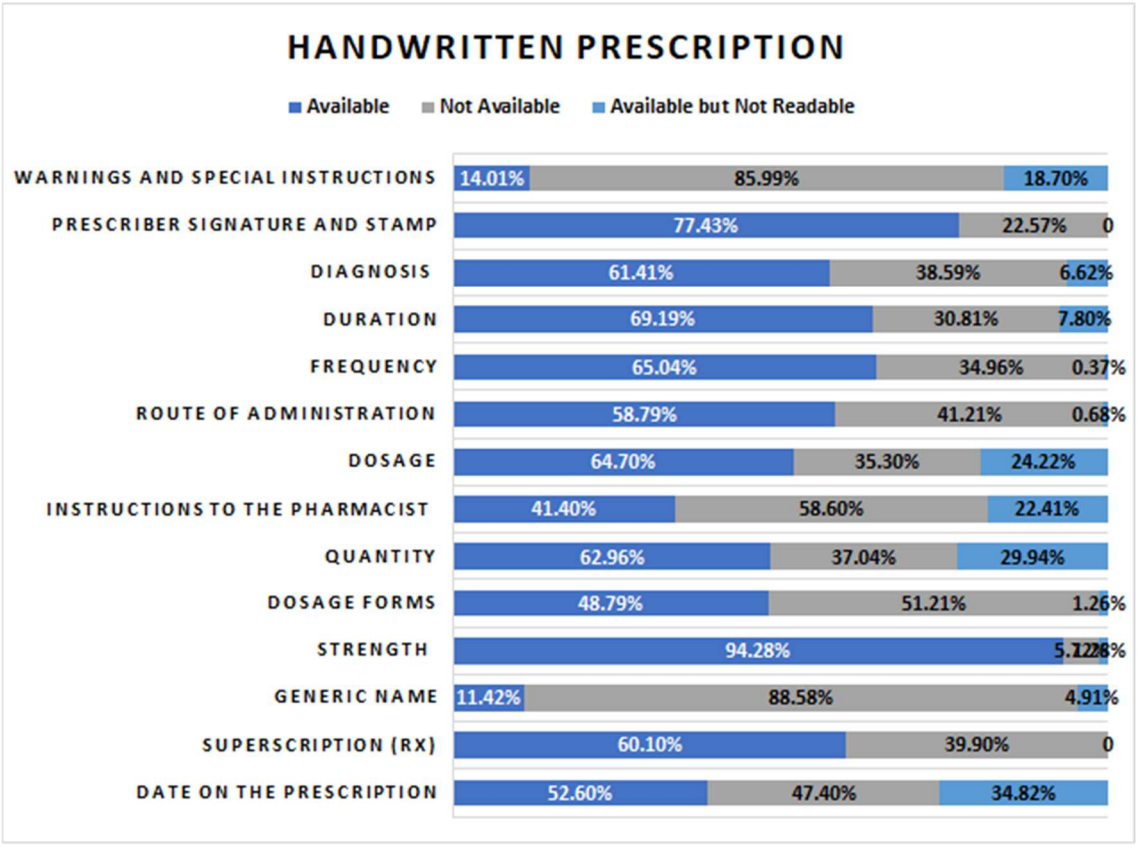

Fig. 2: Availability of key information in handwritten prescriptions

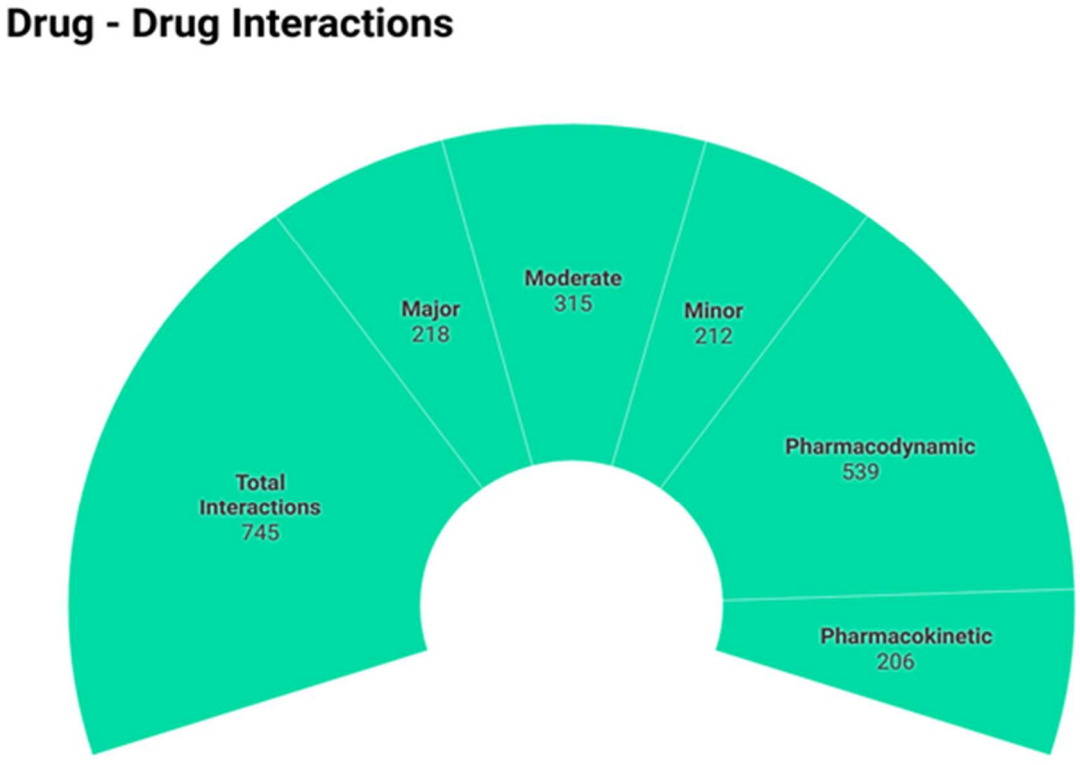

Fig. 3: Assessment of drug-drug interactions in prescriptions

The analysis of handwritten prescriptions showed the following details regarding the availability, non-availability and readability of key information: The generic name was available in 11.42% of prescriptions, not available in 88.58% and 4.91% were available but not readable. The strength of the prescribed medication was present in 94.28% of prescriptions, absent in 5.72% and 1.28% were available but not readable. Regarding the dosage form, 48.79% of prescriptions included this information, 51.21% did not and 1.26% were available but not readable as shown in fig. 2. For handwritten prescriptions, the following percentages were observed based on a total of 3739 prescriptions: 3.34% had the refill information available (125 prescriptions), 96.66% did not have the refill information (3614 prescriptions). These findings highlight inconsistencies in the completeness and clarity of handwritten prescriptions.

The analysis of handwritten prescriptions revealed the following information regarding availability, non-availability and readability of key elements: The frequency of the medication was available in 65.04% of prescriptions, not available in 34.96% and 0.37% were available but not readable. The duration of the prescribed treatment was present in 69.19% of prescriptions, absent in 30.81% and 7.80% were available but unreadable. The diagnosis was included in 61.41% of prescriptions, missing in 38.59% and 6.62% were available but not readable. These findings emphasize the need for improved documentation and readability in handwritten prescriptions to ensure accurate patient care. Upon further analysis, it was observed that 3.9 % of the prescriptions contained potential drug-drug interactions (DDIs), raising significant concerns about patient safety as shown in fig. 3.

These interactions can lead to adverse effects or reduced therapeutic efficacy, depending on the drugs involved. Commonly identified interactions included those between anticoagulants and nonsteroidal anti-inflammatory drugs (NSAIDs), which increase the risk of bleeding. Among the total 52.2% of identified interactions, 36.3% were found in handwritten prescriptions, while 15.8% were detected in electronic prescriptions. Similarly, combinations of drugs affecting the central nervous system, such as sedatives and antidepressants, were also noted, accounting for 6.04% of interactions and potentially leading to excessive sedation or respiratory depression.

DISCUSSION

Prescription is an important document written by the doctors. It is their ethical duty to write legible prescription with complete information (Gugnani *et al*., 2023). The collection of 5,246 prescriptions, of which 4,856 met the inclusion criteria, highlights a broad sampling across diverse healthcare sectors as mentioned in Table 2. The predominance of hospital-originated prescriptions (41.3%) compared to those from university hospitals (18.4%) and clinics (2.4%) and (37.9%) reflects a centralized healthcare system and privately-owned facilities respectively. This trend aligns with studies emphasizing the critical role of hospital-based care in prescription generation, especially for complex or chronic conditions (Greenhalgh *et al*., 2016). The average of 3.9 drugs per prescription suggests a polypharmacy tendency, which is increasingly reported in community settings due to aging populations and comorbidities (Fisher *et al*., 2016).

The distribution of prescribed drugs, with antibiotics (28.03%), analgesics (22.66%) and cardiovascular medications (20.75%) leading, mirrors global prescription trends. Over-reliance on antibiotics raises concerns about antimicrobial resistance (AMR), which has been identified as a significant public health issue. Rational prescribing practices and stewardship programs are essential to mitigate AMR risks (Shah and shah, 2023).

The findings of this study provide a comprehensive evaluation of the quality and completeness of both handwritten and electronic prescriptions in community pharmacies in Cyprus, alongside an analysis of drug-drug interactions (DDIs) as mentioned in table 1. These insights highlight gaps in prescription practices and their impact on patient safety. While electronic prescriptions were more readable and included more generic names (26.95% vs. 11.42% in handwritten prescriptions), both formats still relied heavily on brand names.

This variability can lead to drug selection inconsistencies and patient confusion, particularly when prescriptions are filled at different pharmacies. Prior studies emphasize the importance of using generic names to promote standardization and cost-effectiveness in prescribing (Nouri *et al*., 2024; Abdalla *et al*., 2024). Handwritten prescriptions, which accounted for the majority (77.04%) of the total analysed, demonstrated considerable variability in the completeness of essential information. For example, the prescriber's signature and stamp were absent in 21.4% of electronic prescriptions, while handwritten prescriptions often lacked key elements such as frequency (34.96%) and diagnosis (38.59%). Prescription errors are particularly alarming in this region due to the lack of regulatory enforcement for prescription standardization and the widespread reliance on handwritten prescriptions (77.04%). Poor legibility and incomplete documentation have been directly linked to medication errors, a leading cause of preventable morbidity and mortality.

These findings align with other studies that highlight the limitations of handwritten prescriptions, including legibility issues and incomplete documentation (Haque *et al*., 2016, Abdalla *et al*., 2024). Such shortcomings can lead to errors in dispensing and administration, jeopardizing patient safety. The high prevalence of illegible or partially readable handwritten prescriptions

(23.1%) is concerning, as poor legibility is linked to preventable medication errors. Transitioning to electronic prescribing systems can significantly reduce these errors by standardizing formats and automating essential checks (Zadeh, 2016; Schiff *et al*., 2018; Anzan *et al*., 2021).

A critical finding of this study is the identification of potential drug-drug interactions (DDIs) in the analyzed prescriptions. DDIs, particularly involving high-risk medications like anticoagulants and NSAIDs, pose a significant risk to patient safety. The study found frequent interactions between these drug classes, aligning with previous research that highlights the increased risk of gastrointestinal bleeding and other complications (Zang *et al*., 2017; Murtaza *et al*., 2016).

The variability in prescription quality highlights the need for ongoing education for healthcare professionals, focusing on rational prescribing, legible documentation and DDI identification. Training programs and the implementation of clinical decision support systems (CDSS) in electronic prescribing platforms can improve prescription quality and patient outcomes by providing real-time alerts for potential DDIs and incomplete entries (Shimu *et al*., 2024).

The study highlights the need for policy interventions to standardize prescription practices. Regulatory bodies should mandate electronic prescribing, especially in high-risk settings and integrate prescription audits into routine pharmacy practice to identify issues and provide feedback to prescribers (Tantray *et al*., 2024; Wasylewicz, 2023; WHO, 2023).

CONCLUSION

The study results highlight significant gaps in the completeness and clarity of both handwritten and electronic prescriptions in community pharmacies across Northern Cyprus. These findings further emphasize the urgent need for policy interventions and targeted prescriber training to improve prescription practices, minimize errors and enhance patient safety in community pharmacies.

Conflict of interest

All the authors declare no conflict of interest.

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