

# Prevalence and Characteristics of Prescribing Errors in a Libyan Hospital: A Retrospective Observational Study

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## ABSTRACT

Background: Patient safety is a topical issue globally. A number of studies have been conducted on drug safety, however, there have been currently no Libyan published studies on the occurrence and characteristics of prescribing errors (PEs) in hospitals. Objective: The aim of this study was to determine the prevalence, type and severity of PEs at Al Afia Hospital, Libya. Methods: This was a retrospective study that reviewed 55 adult inpatients folders in the Surgical, Ophthalmic and Medicine wards from November 21 – December 20, 2023 at Al Afia Hospital. Information on PEs was obtained from archived patient records in the hospital. Data collected have information on PEs according to prescribing error scenarios of the Delphi technique. Data on patient demographics and prescribing characteristics were captured. The collected data were analyzed using IBM SPSS Statistics, Version 26. Results: Within the period of review; a total of 216 handwritten prescriptions were documented to have been served and 737 PEs were recorded. Prescriptions with illegible writing frequency were the highest (53.3%) in reviewed records. Also, 69.1% of all errors were rated as minor, 18.2% as moderate, and 12.7% as severe. Most of the errors mentioned were related to antihypertensive agents (16.8%), antibiotics (11%), and analgesics (10.3%). The Medicine Ward had the highest (554 error per 100 prescriptions). Conclusion: There is the need for more investigations in PEs in Libyan hospitals. Additionally, regular training on prescription writing, installation of electronic prescribing (e-prescription) systems along with mandatory pharmacist-led medication are relevant.

**Keywords:** Prescribing Errors, Medication Safety, Inpatients, Libya, Africa, Healthcare Quality, Pharmacist Intervention.

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## INTRODUCTION

Patient safety is a fundamental right and this is to be an absolute priority in all healthcare settings. However, in many developing countries, there are considerable challenges to patient safety due to lack of comprehensive healthcare or facilities. Patient safety may be compromised as a result of medication misadventures in the healthcare settings; some of which include medication errors (MEs) which may lead to significant clinical, economic, and social consequences<sup>1</sup>. In the United Kingdom (UK), MEs cost the National Health Service (NHS) £98 million<sup>2</sup>. There is, however, a dearth of information on cost associated with MEs in most African and Middle East countries.

Medication management is a complex process that includes numerous stages, such as procurement, storage, prescription, dispensing, administration and monitoring<sup>3</sup>. Usually, prescribing errors (PEs) are known to occur at the initial stage of the medication use process when prescriptions are written or ordered<sup>4</sup>, accounting up to 50% of all MEs<sup>2</sup>. PEs can be omissions, commissions, and

knowledge-based errors. Omission errors means missing essential prescription components like dosage, route, or patient identifiers, and commission errors means incorrectly written components, such as dose or frequency, while knowledge-based errors involve drug-drug interactions, allergies, or failure to integrate relevant patient information<sup>2</sup>. There are a number of studies that have reported PEs: several in developed countries, and a few in the Middle Eastern and African countries. In England, it is estimated that 237 million MEs occur annually, 66 million are potentially clinically significant<sup>5</sup>. In Saudi Arabia, there are reported PEs in temporary hospitals during Hajj pilgrimage. They found out that the prevalence of PEs was 83.72%<sup>6</sup>. Also in Jordan, it is assessed the rate, prevalence, and/or incidence of MEs in different clinical settings. They indicated that PEs ranged from 0.1% to 96%<sup>7</sup>. Furthermore, in Ethiopia, it is documented PEs in medical wards of a specialized hospital. They showed that the most common stage was physician ordering (32.4%)<sup>8</sup>. There has, however, been no study that has looked at the prevalence or characteristics of PEs in Libyan hospitals.

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Furthermore, PEs are identified as a major cause of avoidable harm, frequently leading to adverse drug events (ADEs) that extend the time a patient must remain in a facility<sup>9</sup>. In England, avoidable ADEs account for approximately 181,626 hospital bed-days<sup>5</sup>. Studies conducted in Africa and the Middle East have reported that the length of a hospital stay is both a significant risk factor for MEs and a frequent consequence of medication-related harm. In Ethiopia research found that a hospital stay of  $\geq 7$  days more than doubled the odds of a medication error. This is because as the patient's hospital stay is prolonged, the patient is exposed to more frequent drug-related therapies and passes through repeated cycles of the medication use process (prescribing, transcribing, dispensing, and administration), increasing the statistical probability of a failure. Longer stays are often associated with more severe medical cases, which require a higher number of medications (polypharmacy); this complexity further escalates the risk of PEs<sup>8</sup>. Moreover, in Saudi Arabia, a study found that the majority of MEs occurred in the inpatient department (66.34%), emphasizing that the complexity of hospitalized patients with multiple diseases and medications increases the risk of error<sup>10</sup>. This emphasizes the urgent need for sufficient information about PEs in Libyan hospitals.

Previous studies have reported that PEs affect up to 50% of hospital admissions leading to potential serious harm and increased hospitalization times<sup>11</sup>. In England, it has been reported that avoidable ADEs could lead to about 1,708 deaths annually<sup>5</sup>. In a study to identify common MEs, their contributing factors, and effective prevention strategies at Saudi hospitals, it was reported that PEs remain consistently high<sup>12</sup>. PEs are known to occur when incomplete orders or incorrect instructions, which account for about 70% of MEs<sup>13</sup>. Previous studies have reported illegible handwritten prescriptions (IHPs), affecting over 1.5 million patients annually<sup>14</sup>. Several studies also underscore alarming rates of illegibility and incompleteness in IHPs, directly correlating with ADEs and mortality<sup>14</sup>. Furthermore, many studies in Libya highlighted that illegible handwriting remains a critical contributor to preventable errors. A study assessed errors in Handwritten Prescriptions in Libya, 20–30% of prescriptions exhibiting illegible drug names or dosages<sup>15</sup>. A recent study in Libya about impact of IHPs on Dispensing Errors, indicates that illegible handwriting contributes to high rates of misinterpretation and dispensing errors, posing substantial risks to patient safety<sup>14</sup>. These findings mirror studies that show IHP, leading to incorrect drug dispensing and mortality, with 7,000 annual U.S deaths<sup>14</sup>. This finding underscores the need to conduct a study looking at the prevalence or characteristics of PEs in Libyan hospitals. in Libya.

Indeed, patient safety and its associated factors are well documented and have been extensively studied in developed countries<sup>1</sup>. However, in the Middle East and Africa, the most studies related to MEs were relatively few in number or nonexistent<sup>1,4</sup>. To the best of our knowledge data on PEs and severity is not available in hospitals in

Libya. This study, therefore, sought to present data on medication misadventure (incidence and types of PEs and severity) in Al Afia Hospital in Libya.

## MATERIALS AND METHODS

### Study Design and Site

This study was a retrospective, single-centre, observational study with an explorative approach using data to assess PEs, types, and severity at Al Afia Hospital in Libya. The study was carried out at a tertiary care facility, known as the largest medical facility in the Al Jufrah municipality. Al Afia Hospital is one of the key Libyan hospitals under the Libyan ministry of health. The hospital is located in the Al Jufrah Municipality, with geographic coordinates of 29°07'16"N and 15°56'25"E, which is home to approximately 60,853 people and has a total land area of 117,410 km<sup>2</sup>. The site was chosen because the study sought a hospital that had a diverse patient base, a manual written record keeping system and providing the necessary data required by the study.

Al Afia Hospital was founded in 1983 and has a total bed capacity of 160 beds. For over four decades, it has been providing comprehensive health services to the residents of the Al-Jufrah Region (including Houn, Waddan, Sawknah, Zalla, and El-Fugha), as well as other cities in the central and southern regions of Libya such as Sirte, Sabha, Obari, Al Shatii, Wadi Atbah, Al Qatrun, among others.

In addition to its inpatient services, the hospital provides the following out-patient services in several areas, including but not limited to: medicine, general surgery, ophthalmology, gynecology and pediatrics. In-patient units of the hospital include: the Medicine Ward, Surgery Ward, and Ophthalmology Ward, as well as the Intensive Care Unit, Theater, Obstetrics and Gynecology, and Pediatrics. All of these wards are open 24 hours per day to accommodate patients who need urgent/emergency care, indicating the existence of a formalized patient management system.

However, despite this organizational framework, Libya has had problems with its healthcare system since it became unstable in 2011. Problems such as an insufficient number of facilities; shortages of basic drugs and medical equipment; and a loss of highly trained professionals have impacted the delivery of health services. Although there are ongoing attempts to improve health service quality in Libyan hospitals, problems stemming from the country's fragmented politics; uneven distribution of specialists; and resource shortages continue to affect health service delivery across Libya. For example, at Al Afia Hospital, shortages of essential supplies and employee turnover have limited capacity and forced many patients to visit larger urban and private medical facilities. This has resulted in fewer patient visits to Al Afia Hospital for treatment, which impacted the size of the study sample.

### Sample and Sampling Technique

This study adopted a convenience sampling method to ensure the selection of hospitalized patients from Al Afia

Hospital Houn during the study period. Patients' files were obtained from systematically archived records in the record room of the hospital. Relevant patient records were selected from the three hospital wards of surgical, ophthalmic, and medical wards using predefined inclusion/exclusion criteria to ensure consistency, from 21 November to 20 December 2023. The sample size was calculated using the online Raosoft sample size calculator with a 5% margin of error and a 95% confidence level, giving a sample size of 55. This method allowed the inclusion of a sufficient.

#### Inclusion and Exclusion Criteria

**Inclusion Criteria:** All inpatients (male and female) aged 18 years and above with complete handwritten prescribing folders (covering admission, inpatient, and discharge) were included.

**Exclusion Criteria:** Patients admitted for less than 24 hours or with incomplete medical records were excluded, as incomplete data could compromise accuracy of results and validity.

#### Data Collection

Parameters used to assess PEs in data were obtained from the British National Formulary (BNF) practical manual on guide to good prescribing<sup>16</sup>, and the clinical guidelines of Malaysian Ministry of Health Drug Formulary Manual<sup>17,18,19,20,21,22,23,24,25</sup>, in the absence of up-to-date national prescribing guidelines in Libya. PEs were captured according to the prescribing error scenarios of the Delphi Technique that adopted from previous study<sup>26</sup>, and then grouped as follows: illegible writing, dose omission, drug-drug interaction<sup>1</sup>. Data on PEs have information about patients.

Each error was evaluated for severity utilizing a modified version of the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP)<sup>27</sup> Index for Categorizing Medication Errors, which evaluates the error based upon the potential for patient harm:

- **Minor:** The error occurred, however the potential for harm was either non-existent or required no action.
- **Moderate:** The error occurred, and the potential for harm was considerable enough to warrant monitoring or minimal intervention to prevent harm.
- **Severe:** The error occurred, with the potential to result in severe patient injury or death.

#### Statistical Analysis

The collected data was analyzed using IBM SPSS Statistics (Version 26). Data was presented as descriptive statistics, including frequencies, and percentages.

#### Ethical Approval

Approval for the conduct of this research was obtained from the Deputy Vice Chancellor (Research & Innovation) of Lincoln University College, Malaysia (Ref. No.: LUC/Ethc/Admin/SP/012/701).

## RESULTS

#### Demographic Data of Participates

A total of 55 hospitalized patients files participated in the study. Detailed demographics of patients are presented in Table 1.

**Table 1.** Demographic data of hospitalised patients in the three wards from 21 November to 20 December 2023 at Al Afia Hospital Houn, Libya (N=55).

| Characteristic                  | Surgical ward      | Ophthalmic ward     | Medicine ward       |
|---------------------------------|--------------------|---------------------|---------------------|
| Number of patients (Percentage) | 14 (25%)           | 17 (31%)            | 24 (44%)            |
| Age Rang (years)                | 27- 74             | 52-87               | 18- 85              |
| Gender                          | 8 Male<br>6 Female | 7 Male<br>10 Female | 8 Male<br>16 Female |

#### General Information on Prescriptions Reviewed

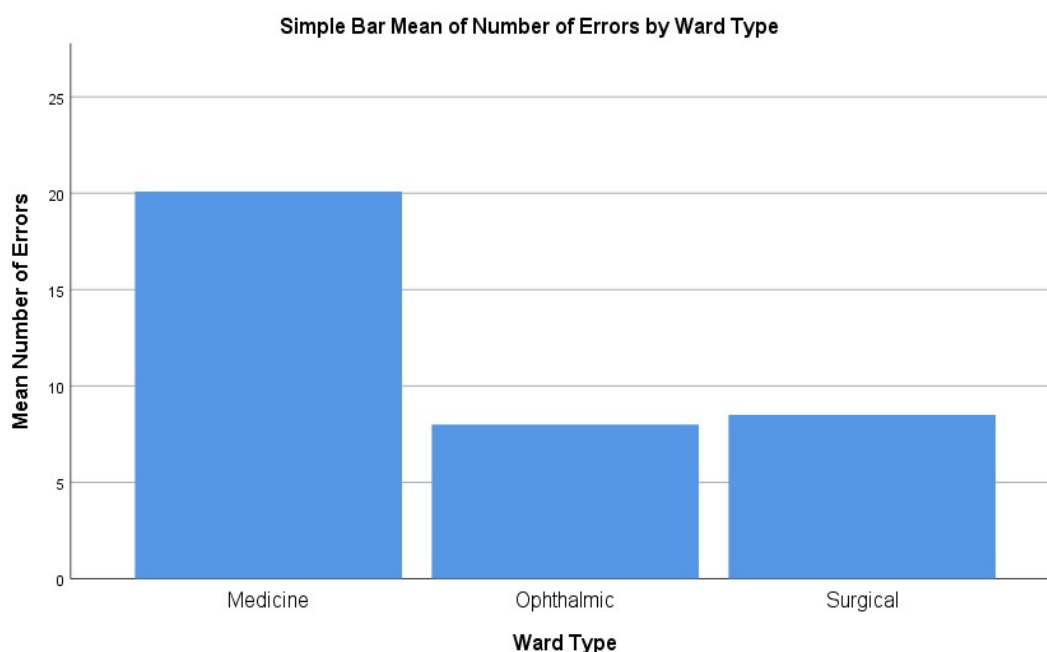
Within the period of review (November 21 to December 20, 2023); a total of 216 prescriptions were documented to have been served. The highest number of prescriptions

served was in the medicine ward (87 prescriptions). The highest frequency of PEs was in the medicine ward (482 prescribing errors) as shown in figure 1. Additional details of prescriptions reviewed and errors are shown in Table 2.

**Table 2.** Summary of prescriptions served and frequency of errors in the three wards at Al Afia Hospital (from November 21 to December 20, 2023).

| Parameter | Surgical | Ophthalmic | Medicine | Total |
|-----------|----------|------------|----------|-------|
|-----------|----------|------------|----------|-------|

|                                                                      | ward | ward | ward |       |
|----------------------------------------------------------------------|------|------|------|-------|
| Number of prescriptions served                                       | 48   | 81   | 87   | 216   |
| Number of prescribing errors documented                              | 119  | 136  | 482  | 737   |
| Frequency (error rate) of prescribing errors (per 100 prescriptions) | 248  | 168  | 554  | 341.2 |



**Figure 1:** Number of errors against ward type at Al Afia Hospital

#### Details of Prescribing Errors

Within the period of review (November 21-December 20, 2023); a total of 737 PEs were documented. Illegible writing frequency was the highest type of PEs (53.3%) in reviewed records. Additional details of PEs are summarized in Table 3.

**Table 3:** Frequency of the various prescription error types captured from November 21 to December 20, 2023 at Al-Afia Hospital

| Prescribing error type | Frequency (N) | Percent |
|------------------------|---------------|---------|
| Illegible writing      | 393           | 53.3%   |
| Dose omission          | 179           | 24.3%   |
| Drug-drug interaction  | 52            | 7.1%    |
| Others                 | 113           | 15.3%   |

#### Details of Prescribing Errors by Hospital Stay

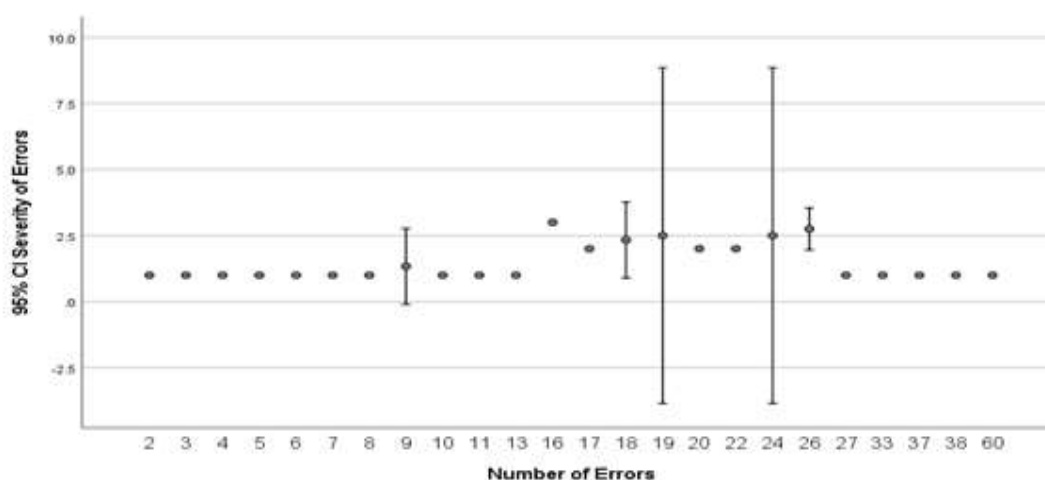
Pearson correlation analysis reveals a statistically significant positive relationship between the number of PEs and hospital stay duration ( $r = 0.644$ ,  $p < 0.001$ ),  $p$ -value  $< 0.001$  indicates this relationship is unlikely to be a random chance. This relationship is bidirectional in nature.

#### Details of Prescribing Error Severity

Data analysis showed that the mean severity score was 1.44 (SD = 0.714). The severity assessment revealed that most of the errors were minor at Al Afia Hospital within the period of review as shown in figure 2. However, moderate and severe were still significant errors. Other details of the severity are summarized in Table 4.

**Table 4:** Classification of prescription errors by severity

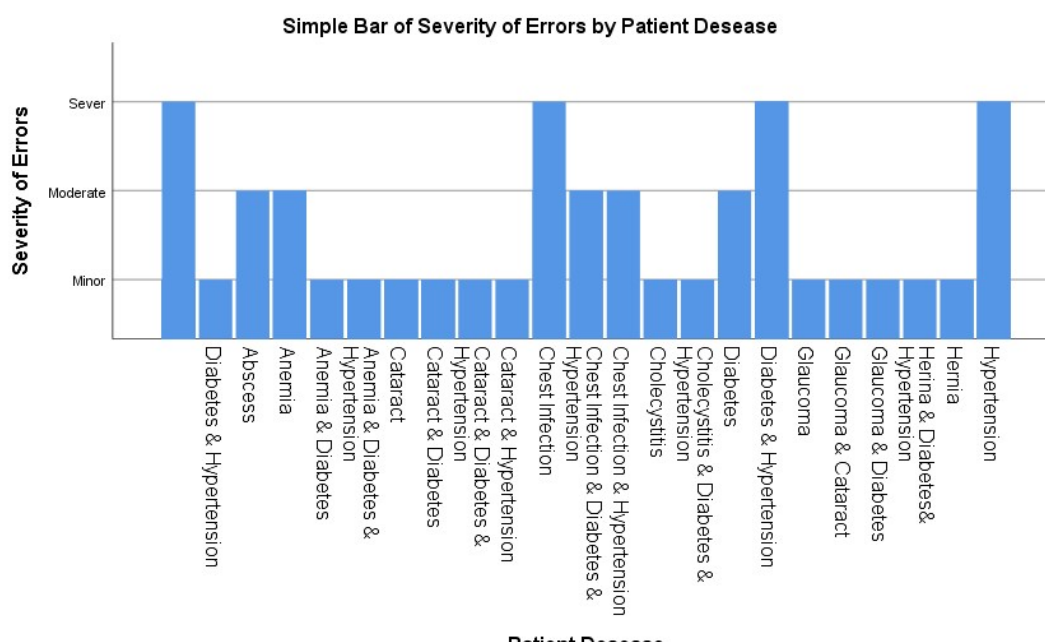
| Severity Level | Frequency (N) | Percent |
|----------------|---------------|---------|
| Minor          | 38            | 69.1%   |
| Moderate       | 10            | 18.2%   |
| Severe         | 7             | 12.7%   |



**Figure 2:** Severity of errors categorised by number of errors from 21 November to 20 December 2023 at Al Afia Hospital

#### Details of Prescribing Errors Severity by Patient Disease

All potentially harm errors (moderate and severe) occurred in patients complaining of the following diseases such as hypertension, diabetes and chest infection. Details of patient disease categorizing severity of errors are shown in Figure 3.



**Figure 3:** Categorization of severity of errors by patient disease from 21 November - 20 December 2023 at Al Afia Hospital.

#### Drug Classes Details Associated with Errors

PEs were most commonly associated with drugs such as Antihypertensive Agents, Antibiotics and Analgesics. Other details of PEs are summarized in Table 5.

**Table 5:** Drug classes associated with errors

| Drug class              | Frequency (N) | Percent |
|-------------------------|---------------|---------|
| Antibiotic              | 81            | 11%     |
| Antihypertensive agents | 124           | 16.8%   |
| Diuretic                | 50            | 6.8%    |
| Gastrointestinal drugs  | 47            | 6.4%    |
| Analgesics              | 76            | 10.3%   |
| Antiinflammatory        | 51            | 6.9%    |

|             |     |       |
|-------------|-----|-------|
| Antiglucoma | 20  | 2.7%  |
| Others      | 288 | 39.1% |

## DISCUSSION

In this retrospective study, considered as the first of its kind to evaluate medication related errors in Libya, we assessed PEs, types and severity at Al-Afia Hospital, Libya, from 21 November to 20 December 2023. From data collected; the total number of prescriptions served 216 prescriptions for 55 patients, the majority was in the medicine ward (n=87) and ophthalmic ward (n=81). This could be attributed to handling a broader range of included conditions in this study compared to the surgical ward (n=48) within the period of review.

In the current study, there was a significant high in PEs in the medicine ward. Although lower errors in the other wards, this still represents a significant proportion of errors. This underlines a major problem with patient safety at Al Afia Hospital, which needs the necessity of targeted interventions. Within the period of review (21 November to 20 December 2023); a total of 737 PEs were documented. This high in PEs may be as a result of an increase in the workload of prescribers. Studies have reported that increased workload could lead to errors due to stress. In a study that showed that the working environment and workload contribute greatly to errors. Increased workload appears to be a problem faced by most healthcare professionals in developing countries<sup>1</sup>.

The current study looked at PEs such as illegible writing, dose omission, amongst others. Illegible writing frequency was the highest (53.3%) within the study period. In a study that identified common MEs, their contributing factors, and effective prevention strategies in Saudi hospitals, errors recorded were wrong dose and improper dose that were the most frequent<sup>12</sup>. In the current study, records reviewed did not classify wrong dose and improper dose as PEs, hence, these indicators were not captured. PEs such as inappropriate dosing frequency, co-prescribing of the same drugs and wrong strength of medication may cause overdosing or underdosing. Overdosing of medicines is one of the common causes of ADEs<sup>1</sup>. This impact of MEs contributes to prolonged hospital stays and decreased quality of life for patients<sup>28</sup>. Underdosing may also cause poor patient outcomes and an increase in healthcare cost for the patient<sup>1</sup>.

In this study, data analysis showed that as a result of prolonged hospitalization (mean = 5.80 days, range = 2-23) many patients may be exposed to higher risks of PEs due to increased medication exposure and potential documentation lapses. Additionally, the Pearson Correlation analysis demonstrated a statistically significant positive relationship between the number of PEs and hospital stay duration ( $r = 0.644$ ,  $p < 0.001$ ). Previous studies also corroborate this finding that ADEs caused by MEs contribute to prolonged hospitalization, increased healthcare expenditures, and decreased quality of life for patients<sup>28</sup>. The bidirectional nature of the relationship also suggests that longer hospital stays may increase the likelihood of PEs due to exposure to multiple medications

and shifts in care teams<sup>28</sup>. To reduce errors in prescription writing, hospitals should adopt electronic prescribing (e-prescription) systems to minimize illegible handwriting errors. In addition, checks should be put on targeted prescription oversight mechanisms, particularly for high-risk patients. In addition, pharmacists should be encouraged to discuss PEs with prescribers for appropriate and timely corrections to be made. Furthermore, provide ongoing prescriber training, and apply clear guidelines to improve daily practice. Errors would occur in any human institution, thus, it is noteworthy that captured errors should not be used to mete out punitive measures, but considered as an opportunity for prescribers for training and learning and enforce accreditation standards that prioritize medication safety.

For identified 737 PEs, data analysis showed that the mean severity score was 1.44 (SD = 0.714), suggesting that the impact of the medication error on patients ranged from minor discomfort to severe harm and even death<sup>28</sup>. Scatter plots demonstrated that the data displayed most patients experiencing a relatively constant number of low-severity errors with 69.1% classified as minor; while, there were a few cases of patients that experienced greater variability with 18.2% categorized as moderate and 12.7% as severe. However, moderate and severe were still significant errors. These patients that experienced severe errors may be experiencing either complex comorbidities, polypharmacy, or systemic problems in prescribing practices. The World Health Organization (WHO) also indicates that they represent urgent clinical risks that could lead to serious harm if not reduced<sup>12</sup>. Therefore, future analyses should further investigate the relationship between error severity and actual patient harm while emphasizing the importance of structured severity assessments to guide targeted efforts to reduce preventable MEs.

In the current study, out of 55 hospitalised patients at Al Afia Hospital, more than half of patients (56.4%) had acute and chronic illnesses either alone or in combination such as hypertension, diabetes and chest infection. The medicine ward had the highest record of this population (61.3%). The high occurrence of multiple comorbidities reflects the complexity of clinical management in this population, emphasizing the heightened risk for PEs due to polypharmacy. Studies corroborate that patients with multiple chronic conditions require multidrug regimens, increasing the risk for ADEs and prescribing mistakes<sup>29,30</sup>. Therefore, future studies that will design and implement preventative strategies to this population are recommended to reduce the risk of PEs.

Furthermore, the most PEs related drugs in this research have been identified as high-risk in this research. These are antihypertensive, antibiotic, and analgesic drugs. Several studies highlight antibiotics and cardiovascular drugs, including antihypertensives, as well as analgesics as among the most common medications associated with PEs<sup>12,31</sup>.

## CONCLUSION

Within the period of review; a total of 216 prescriptions were documented to have been served, and 737 PEs were recorded. PEs are extensively common at Al Afia Hospital, illegible writing frequency were the highest in reviewed records. Prolonged hospitalization may increase risk of PEs. Additionally, 18.2% and 12.7% of the PEs documented were classified as moderate and severe respectively within the period of review. Antihypertensive, antibiotic, and analgesic drugs had a significant risk of causing harm to patients. The results of the current study indicate that reducing PEs requires coordinated action at the clinical, institutional, and national levels. Adoption of electronic prescribing systems, strengthening the role of clinical pharmacists, providing ongoing prescriber training, and applying clear guidelines to improve daily practice are relevant in improving patient safety. Additional future research in PEs should be conducted using multi-center healthcares, explore the underlying causes for errors, evaluate targeted interventions to reduce PEs, and assess the economic burden of prescribing mistakes. These are recommendations from the current study, and which when implemented will lead to a safer and more efficient use of medications in Libya and provide evidence based improvements to the overall healthcare system.

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