Original Research

Dispensing errors in community pharmacies in the United Arab Emirates: investigating incidence, types, severity, and causes

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Abstract

Background: Medication dispensing is a fundamental function of community pharmacies, and errors that occur during the dispensing process are a major threat to patient safety. However, to date there has been no national study of medication dispensing errors in the United Arab Emirates (UAE).

Objective: The study aimed to investigate the incidence, types, clinical significance, causes and predictors of medication dispensing errors.

Methods: The study was conducted in randomly selected community pharmacies (n=350) across all regions of UAE over six months using a mixed-method approach, incorporating prospective disguised observation of dispensing errors and interviews with pharmacists regarding the causes of errors. A multidisciplinary committee, which included an otolaryngologist, a general practitioner and a clinical pharmacist, evaluated the severity of errors. SPSS (Version 26) was used for data analysis.

Results: The overall rate of medication dispensing errors was 6.7% (n=30912/ 464222), of which 2.6% (n=12274/464222) were prescription-related errors and 4.1% (n= 18638/464222) pharmacist counselling errors. The most common type of prescription-related errors was wrong quantity (30.0%), whereas the most common pharmacist counselling error was wrong drug (32.1%). The majority of errors were caused by medicine replaced with near expire one (24.7%) followed by look-alike/sound-alike drugs (22.3%). The majority of errors were moderate (46.8%) and minor (44.5%); 8.7% were serious errors. Predictors of medication dispensing errors were: grade A pharmacies (dispensing ⍰ 60 prescriptions a day (OR 2.1; 95%CI 1.4-3.6; p=0.03) and prescriptions containing ≥4 medication orders (OR 2.5; 95%CI 1.7-4.3; p=0.01).

Conclusions: Medication dispensing errors are common in the UAE and our findings can be generalised and considered as a reference to launch training programmes on safe medication dispensing practice.

Keywords

Medication Errors; Pharmacies; Professional Practice; Pharmacists; Patient Safety; Quality of Health Care; Prospective Studies; United Arab Emirates

INTRODUCTION

Medication dispensing is the essence of pharmacy practice, and errors that occur during the dispensing process are a major concern for the pharmacy profession.[1,2] A medication dispensing error (MDE) can be defined as: 'any unintended deviation from an interpretable written prescription or medication order.[3-5] Both content and labeling errors are included. Any unintended deviation from professional or regulatory references, or guidelines affecting dispensing procedures, is also considered a dispensing error'. The incidence of MDEs in community pharmacies in the UK and the USA ranges from 0.04% to 24%.[1] In the literature, MDEs rates in hospitals varied between countries (0.015%–33.5%).[6] This wide variation in the rate of errors can be attributed to multiple factors including the type of dispensing system, method of error detection, and operational definitions, including error definition and classification.[1]

A recent Jordanian study exhibited that more than half of MDEs (52.6%) in community pharmacies are moderate in severity and 8.6% of errors are serious.[7] Another study conducted in the UK indicated that MDEs can be harmful to the patients.[5] In addition to the physical harm, medication errors in general have contributed to the erosion of patient trust in healthcare providers.[8] The most common types of MDEs reported in the USA community setting were: wrong strength, incorrect formulation, and labelling errors.[2,9-11] In the UK, MDEs in the community pharmacies most commonly involved the supply of the wrong drug, strength, and formulation.[4,5,12] In Denmark, a low incidence of MDEs was detected, but many of these errors were clinically serious.[13] The causes of MDEs have been investigated in various countries and factors, such as pharmacists fatigue and work overload, have been highlighted as contributory factors.[14-16] Moreover, poor physician handwriting was reported by community pharmacists in Jordan as a major risk factor for MDEs.[17]

Among the developing countries, medication errors, particularly dispensing errors are common.[7,18,19] Dispensing of antibiotics without prescriptions and based on inappropriate reasons has been documented in Mozambique.[20] In Ghana, patients were satisfied with the dispensing process in community pharmacies.[21]

In the UAE, most community pharmacists are young male, held a bachelor degree and had been in practice for less

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than 10 years.[22] Most pharmacies open 7 days per week with an average working day of 13 hours. The lack of physicians' recognition of the pharmacist skills was considered as a barrier to the provision of enhanced pharmacy services.[22] In addition, many prescribed medicines have been dispensed independently by the pharmacist to the patient without an order from a physician. Although illegal, this is a common practice in the UAE, with the exception of narcotic analgesics and hypnotic-anxiolytics.[22]

As in most developing countries, community pharmacists in the United Arab Emirates (UAE) commonly dispense a wide range of prescription-only medicines without physician order.[23] Furthermore, the dispensing process is not automated and no patient medicine records are kept.[24] Therefore, a high incidence and different types of MDEs may be anticipated in community pharmacies in the UAE.

The study aimed to assess the rate, nature, causes, severity, and predictors of MDEs.

METHODS

Study design

This was a prospective, observational study conducted over 6 months (from November 2019 to April 2020) in community pharmacies across all 7 regions of UAE. To avoid the Hawthorne effect, disguised direct observation of the pharmacy dispensary team was conducted; only the community pharmacy manager was informed about the objectives of our study, whereas the members of the pharmacy staff were told that our researchers would examine the patterns and nature of prescriptions.

Sample Size and Sampling Technique

The total number of community pharmacies in the UAE is 2625; consequently, the estimated sample size was 336 pharmacies, using Raosoft sample size calculator (http://www.raosoft.com/samplesize.html) with 95% confidence interval, 5% margin of error, and 50% the response distribution. We aimed to include 350 community pharmacies in our study. Pharmacies were divided in 3 geographical regions using proportionate random sampling: Capital, Northern and Central Region. These regions were also stratified into workers residential areas and non-workers residential areas. These areas have social and cultural differences. More than one-third (40.4%, 141/350) of the targeted pharmacies were included from the Northern region, 30.8% (108/350) from the Capital region, and 28.8% (101/350) from the Central region. To achieve the targeted sample, we approached 442 community pharmacies; 73 refused to participate and 19 pharmacies were excluded. Reasons for exclusion were: not operating on a regular basis; not providing easy access to the research team to observe the dispensing process, or having unsuitable conditions for conducting a research (small size, light workload). The nearest pharmacy in the area was approached to replace any pharmacy excluded from the study.

Definitions

The adopted definition of medication dispensing errors includes unintended deviations from the regulations or recognised references affecting the dispensing process. This definition includes only errors made by accident with no intention to cause harm to the patient. For instance, when the pharmacist changes the medicine to another to increase the profits but without knowing that this change can cause an allergy to this patient or can cause harm to the pregnant women. All these are included under "unintended errors".

Our study included only errors detected up to and including the point at which the medication was handed over to the patient or the patient's representative ('near-misses'). The operational definitions of MDEs were adopted from Cohen's classification of MDEs and tailored to our setting.[3] To meet the aim of our study, we expanded the scope of MDEs to include medications dispensed based on pharmacist's counselling; this type of error occurred when a prescription only medicine (POM), a pharmacy medicine (P) or a general sale list (GSL) medicine was prescribed independently by the pharmacist to the patient without an order from a physician. Hence, MDEs were divided into pharmacist counselling errors (PCEs) and prescription-related errors (PREs). All medications (with and without prescriptions) up to and including the point at which they were handed to the patient or the patient's representative were included in our study. A prescription with any type of prescribing error (intercepted or unintentionally dispensed) and incidents detected after the patient had taken possession of the medication were excluded.

Development of the study tools

Our study comprised two tools for investigation; a data collection form and a structured interview. A preliminary piloting was conducted in 6 community pharmacies from different regions for three days to ensure the reliability of the study tools. During piloting, the research team tested: (1) time needed for the study; (2) the accuracy of the data collection form; (3) the optimal approach for observing errors without affecting patient privacy; and 4) the cooperation of community pharmacists in-charge. As community pharmacies in the UAE did not operate an electronic system linking physician orders directly to the pharmacy; thus, types of errors related to this system, such as selection errors, were omitted from the data collection form. In addition, poor hand writing was removed from the causes of errors as handwritten prescriptions are banned in UAE. After piloting, the period of the study was increased from 7 to 10 days per pharmacy. Researchers were instructed to have no interaction with patients. The piloting study data were not included in the final data set.

A standardised data collection form was developed to include information about the prescription, such as: medication orders, type of error, staff grade and causes of errors. Amendments to the data collection form were performed following the pilot testing. The second tool for this study was a structured interview, which was developed after extensive review of the previous literature.[5,7,25,26] The aim of this tool is to evaluate the causes of errors by providing the staff pharmacists with a comprehensive list of the causes of MDEs. The staff pharmacists were asked to choose one or more of the listed causes and to state if there are any causes not listed in the interview. No recording was conducted since it was simple and structured

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interview. The staff pharmacists were asked to sign a consent form showing their willingness to participate in the interview. The findings of the interview were coded and entered into the SPSS for analysis. Both tools were validated via a committee, which included a senior clinical pharmacist, a general practitioner, and a family medicine physician. All parts of the data collection form and the interview structure were meticulously reviewed, discussed, and some changes were made based on the committee recommendations e.g. adding extra causes to the interview structure.

Data collection

Each research pharmacist collected data for 10 days (9am-5pm) at a designated pharmacy. At the beginning of each observational day, the research pharmacists observed each dispensing process and categorise it into erroneous dispensing or non-erroneous dispensing. The erroneous dispensing process or medication dispensing errors were categorised based on the prescriber into pharmacist counselling errors and prescription-related errors. These two major parts were further categorised based on the adopted operational definitions of medication dispensing errors. The true aims of our study were disguised from the staff pharmacists and they were told that our researchers evaluate the nature and patterns of prescriptions. At the end of each research day, the main investigator and co-investigator reviewed and confirmed the detected errors against the designed operational definitions of medication dispensing errors; those not matching the criteria were excluded from the final dataset. In order to investigate the incidence and predictors of MDEs, the research team recorded the total number of prescriptions and medications dispensed during the study period at each pharmacy. At the end of each observational period, the researcher conducted a structured interview with the pharmacy staff who committed errors to investigate the causes of intercepted MDEs and associated circumstances.

Recruited community pharmacy managers signed a consent form indicating their willingness to participate. The data collectors were instructed to observe the error, document it, and then ask the pharmacist to review the medication order looking for any discrepancy just to look like a coincident. If the staff pharmacist fails to discover or correct the error himself, the researchers were asked to intervene. Furthermore, the data collectors were asked to call the process off if they felt that the true aims of the study are compromised. To keep the data collection disguised, the pharmacy staff were not asked to fill a consent form, since it is unethical to provide the pharmacy staff with a consent form containing fake information about the objectives of the study. Research pharmacists were paid after data collection was completed.

Training of the research pharmacists

At the beginning of the study, the research team was composed of 21 licensed pharmacists, of which 3 were not be able to complete their tasks due to practical and personal reasons. Those pharmacists were given training on patient safety and the professional practice of dispensing medications by the principal investigator (OMI). This training comprised of three lectures (2 hours) on adverse drug events and medication errors, particularly dispensing errors (types, classification, and clinical significance), and two workshops (3 hours) on detecting dispensing errors, accurate completion of the data collection form, and correct use of operational definitions.

Clinical significance of the MDEs

A multidisciplinary committee, comprising an otolaryngologist, a general practitioner and a clinical pharmacist, rated the severity of the errors. Those specialists were chosen based on the most common types of medications dispensed by pharmacies during the study. We adopted a validated method for rating and quantifying the responses of the committee.[27] Based on Raosoft's sample size calculator, 380 incidents from the collected MDEs were randomly selected for evaluation of clinical severity. Committee members were then asked to rate severity on a 10-pointscale from 0 (no effect) to 10 (death) and the mean score across all judges was used as an index of clinical severity. Categorisation of potential severity was adopted from a previous study; a score of less than 3 represented a minor error, a score between 3 and 7 a moderate error, and a score of more than 7 a serious error.[5] As for MDEs causes, the reported answers were categorised with their cumulative percentages. The Kappa statistic was used to test the interrater reliability of the committee members. A Kappa value of below 0.5 was considered bad reliability, between 0.5 - 0.7 moderate reliability, between 0.7 - 0.8 good reliability, and above 0.8 great reliability.[28]

Data analysis

Data were coded and entered into the SPSS version 24 (IBM, Chicago, IL, US) by the investigator. Descriptive results are presented as proportions (%) with 95% CIs, while logistic regression results are presented as odd ratios (ORs) with 95% CI. Chi-square test was used to measure the difference in erroneous medications across PCEs and PREs. Statistical significance was considered at p-value<0.05 (with a confidence limit at 95%).

Multivariable logistic regression is a reasonable model to describe the relationship between an outcome and a set of predictors. Importantly, in multiple logistic regression, the predictor variables may be of any data level (categorical, ordinal, or continuous). A major use of this technique is to examine a series of predictor variables to determine those that best predict a certain outcome.[29] In our study multivariable logistic regression was conducted to investigate significant predictors for dispensing errors (dependent variable). Independent variables, chosen from the literature and available variables at the time of the study were pharmacy grade (based on the number of items dispensed a day), location, type (chain or independent), experience of pharmacy staff, day of the week, medication category, and number of medications on a prescription. Only significant variables were discussed in the results. Factors that determine the logistic regression validity, such as sample size, multicollinearity, and homoscedasticity were tested. We used the variance inflation factor (VIF) to measure the correlation between the independent variables in the regression model. In this test, the number of inflated variances caused by multicollinearity is

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Table 1. Categorisation and characteristics of pharmacies, prescriptions, dispensed items and dispensing errors.

Item	Capital region	Central region	Northern region	Total
Pharmacy characteristics; N (%)				
Location				
Workers residential area	23 (21.3%)	32 (31.7%)	36 (25.5%)	91 (26.0%)
Non-workers residential area	85 (78.7%)	69 (68.3%)	105 (74.5%)	259 (74.0%)
Grade				
A*	24 (22.2%)	19 (18.8%)	11 (7.8%)	54 (15.4%)
B*	72 (66.7%)	68 (67.3%)	91 (64.5%)	231 (66.0%)
C*	12 (11.1%)	14 (13.9%)	39 (27.7%)	65 (18.6%)
Staff experience				
< 5 Years	61 (56.5%)	52 (51.5%)	67 (47.5%)	180 (51.4%)
> 5 Years	47 (43.5%)	49 (48.5%)	74 (52.5%)	170 (48.6%)
Type				
Chain	71 (65.7%)	65 (64.4%)	61 (43.3%)	197 (56.3%)
Independent	37 (34.3%)	36 (35.6%)	80 (56.7%)	153 (43.7%)
Dispensing characteristics				
Number of prescriptions {A}	27,605	24,952	28,964	81,521
Number of medication orders per prescription {B}				
1	----	----	----	13,125 (16.1%)
2	----	----	----	19,605 (24.1%)
3	----	----	----	25,764 (31.6%)
≥ 4	----	----	----	23,027 (28.2%)
Medications dispensed based on prescriptions {C}	81,733	69,861	93,268	244,862
Medications dispensed based on pharmacist's counselling {D}	69,742	71,563	78,055	219,360
Total number of dispensed medications {E}	151,475	141,424	171,323	464,222
Dispensed items during days of the week				
Saturday	----	----	----	49688 (10.7%)
Sunday	----	----	----	88621 (19.1%)
Monday	----	----	----	69557 (15.0%)
Tuesday	----	----	----	63975 (13.8%)
Wednesday	----	----	----	54866 (11.8%)
Thursday	----	----	----	137515 (29.6%)
Medication dispensing errors				
MDEs based on prescriptions {F}	2,957	3,415	5,902	12,274
MDEs based on pharmacist's counselling {G}	5,294	4,963	8,381	18,638
Total MDEs {H}	8,251	8,378	14,283	30,912
MDEs % incidence {J=H/E ×100}	5.4%	5.9%	8.3%	6.7%

A: dispenses ≥70 prescriptions/day; B: dispenses 15-69 prescriptions/day; C: dispenses ≤14 prescriptions/day; MDEs: Medication dispensing errors

measured; VIFs≤3 refers to low correlation between independent variables, and thus the regression results are more reliable.[30] In addition, Breusch-Pagan test was used to measure the homoscedasticity which describes a situation in which the error term (that is, the "noise" or random disturbance in the relationship between the independent variables and the dependent variable) is the same across all values of the independent variables. This assumption was considered not violated at p>0.05.[31]

RESULTS

Of 350 pharmacies included in our study, 26.0% (n=91/350) were located in workers residential areas and approximately two-thirds (66.0%, n=231/350) dispensed 15-69 prescriptions a day. A high proportion of items (29.6%, n= 137515/464222) were dispensed on Thursday compared to other days (Table 1).

Of the 350 pharmacies included, 684 community pharmacy staff were observed, of which 574 accepted to be interviewed. The majority of the staff held a Bachelor degree (563; 82.3%). Pharmacy managers (n=350) were not observed since they were told about the aims of the study.

The total number of MDEs was 30912 (6.7%; CI 95%, 4.3-8.6) intercepted in 464,222 dispensed medications; this included 12274 PREs (2.6%; 95%CI 1.2-3.5), and 18,638 PCEs (4.1%; CI 95%, 2.9-5.7). Rates of errors among regions

Table 2. Types of medication dispensing errors n=30912)

Types of errors	Pharmacist counselling errors	Prescription related errors	Total
Wrong drug	5,982 31.1%)	1,636 13.3%)	7,618 24.6%)
Wrong strength	4,253 22.8%)	1,576 12.8%)	5,829 18.9%)
Wrong dosage form	2,463 13.2%)	1,669 13.6%)	4,132 13.4%)
Wrong quantity	2,169 11.6%)	3,686 30.0%)	5,855 18.9%)
Omission	965 5.2%)	826 6.7%)	1,791 5.8%)
Wrong preparation	364 2.0%)	154 1.3%)	518 1.7%)
Deteriorated drug	502 2.7%)	423 3.5%)	929 3.0%)
Wrong instruction for drug usage	1,736 9.3%)	2,077 16.9%)	381 12.3%)
Labelling errors	204 1.1%)	227 1.9%)	431 1.4%)
TOTAL	18,638 60.3%)	12,274 39.7%)	30,912 100%)

Table 3. Therapeutic categorisation of erroneous medications n=30912)

Medication Category	Prescription related errors n (%)	Pharmacist's counseling errors n (%)	p-value of difference	Total
Analgesic	1,901 (15.5%)	3,368 (18.1%)	0.1	5,269 (17.0%)
Antibiotic	2,298 (18.7%)	3,026 (16.2%)	0.3	5,324 (17.2%)
Common cold medicine	469 (3.8%)	2,891 (15.5%)	**0.001**	3,360 (10.9%)
Antispasmodic	254 (2.1%)	622 (3.3%)	0.9	876 (2.8%)
Anticoagulant	368 (3.0%)	154 (0.8%)	0.07	522 (1.7%)
Antifungal	214 (1.8%)	527 (2.8%)	0.2	741 (2.4%)
Antihypertensive drug	1,872 (15.3%)	388 (2.1%)	**0.01**	2,260 (7.3%)
Anti-obesity medication	299 (2.4%)	1,023 (5.5%)	0.6	1,322 (4.3%)
Antiviral drug	151 (1.2%)	810 (4.3%)	0.08	961 (3.1%)
Anti-inflammatory	435 (3.5%)	1,456 (7.8%)	0.1	1,891 (6.1%)
Steroid	233 (1.9%)	293 (1.6%)	0.5	526 (1.7%)
Dietary supplements	397 (3.2%)	1,768 (9.5%)	**0.04**	2,165 (7.0%)
Anti-diabetic medication	2,048 (16.7%)	271 (1.5%)	**0.001**	2,319 (7.5%)
Antidiarrheal	487 (4.0%)	1,327 (7.1%)	0.2	1,814 (5.9%)
Antidepressant	178 (1.5%)	---	---	178 (0.6%)
Hormone	236 (1.9%)	289 (1.6%)	0.9	525 (1.7%)
Anticonvulsant	287 (2.3%)	---	---	287 (0.9%)
*Others	147 (1.2%)	425 (2.3%)	0.3	572 (1.9%)

* Any therapeutic category has less than 0.5% percentage

ranged from 5.4% to 8.3%. The majority of errors were made by pharmacists (76.5%; 23,641/30,912) followed by pharmacy assistants (23.5%; 7,271/30,912).

The most common types of PREs were wrong quantity (30.0%; 3,686/12,274) (Table 2), wrong instruction for drug usage (16.9%; 2,077/12,274) and wrong dosage form (13.6%; 1,669/12,274) errors. The least frequent type was wrong preparation (1.3%; 154/12274). Results showed that the most common types of PCEs were wrong drug (32.1%; 5,982/18,638), wrong strength (22.8%; 4,253/18,638), wrong dosage form (13.2%; 2,463/18,638) and wrong quantity (11.6%; 2,169/18,638) errors; the least common was labelling error (1.1%; 204/18,638).

Antibiotics (17.2%; 5,324/30,912) and analgesics (17.0%; 5,269/30,912) accounted for most of the erroneous medications (Table 3). There was no significant difference for erroneous medications between PREs and PCEs except for common cold medications (3.8% vs. 15.5%; p<0.05, respectively), antihypertensives (15.3% vs. 2.1%; p<0.05, respectively), dietary supplements (3.2% vs. 9.5%; p<0.05, respectively), and anti-diabetic medication (16.7% vs. 1.5%; p<0.05, respectively).

The major causes of MDEs were medicine replaced with near expire one (24.7%; 7,636/30,912) and Look-alike/Sound-alike drugs (22.3%; 6,901/30,912). The least frequent cause of errors was low staffing (1.8%; 569/30,912) (Table 4).

The majority of MDEs were moderate (46.8%; 178/380) and minor (44.5%; 169/380); while 8.7% (33/380) were serious errors (Table 5). Inter-rater reliability was strong and significant (Cohen's Kappa=0.74; p<0.05). Predictors of MDEs were: grade A pharmacies dispensing over 60 prescriptions a day (OR 2.1; 95%CI 1.4-3.6; p=0.03) and prescriptions containing over 4 medication orders (OR 2.5; 95%CI 1.7-4.3; p=0.01).

DISCUSSION

The overall rate of MDEs was 6.7%, which included 2.6% PREs and 4.1% PCEs. Although a formal statistical comparison is not possible, our results showed a higher dispensing error rate compared to other studies conducted in community pharmacies in the UK 3%, USA 1.7%, and Denmark 1/10000.[5,11,13] Our results also showed a higher error rate than studies conducted in hospitals in Thailand 1.67% and France 2.5%.[32,33] However, our findings showed a lower error rate than a study conducted in a general hospital in Brazil 81.8%.[25] The different methodological approaches, operational definitions and geographic locations might have contributed to the variation in rates between studies; hence, the difficulty in making direct comparisons. Our holistic operational definitions of MDEs, encompassing both PREs and PCEs, and our disguised direct observation approach, may well have contributed to the high MDE rate in our study. Moreover, health authorities in the UAE focus on controlling the dispensing of narcotic and

Table 4. Causes of medication dispensing errors n=30,912)

Cause	N %)
Look-alike/Sound-alike drugs	6,901 22.3%)
Medicine replaced with near expired one	7,636 24.7%)
Off-label use without counselling	3,652 11.8%)
Heavy workload	1,569 5.1%)
Interruptions	1,879 6.1%)
Low staffing	569 1.8%
Complex prescription	1,266 4.1%)
Day of the week	1,129 3.7%)
Inexperienced staff	3,569 11.5%)
Out of stock medicine replaced with another one	2,742 8.9%)

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Table 5. Examples of medication dispensing errors

Examples of errors as presented to the committee	Error Type	Error cause	Clinical significance
Amoxicillin 1g prescribed to be taken two times daily the pharmacist dispensed Amoxicillin 500mg and label stated 'take one tablet twice a day' PRE)	Wrong Strength	High workload	Minor
Pharmacist wrongly taught patient how to use Symbicort® inhaler PRE	Wrong Instruction	Inexperienced staff	Moderate
Pharmacist dispensed Lamotrigine Lamictal®) tablet doctor wrote Terbinafine tablet Lamisil®) PRE	Wrong drug	Similar packaging look-alike	Moderate
Pharmacist prescribed fusidic acid cream for ringworm PCE	wrong drug	Inexperienced staff	Serious
Folic acid 5mg prescribed for a male having fertility issue pharmacist dispensed folic acid 400mcg. PRE)	Wrong Strength	Inexperienced staff	Serious
Betamethasone cream prescribed for a patient suffering from eczema to be applied once a day for a week the label stated 'apply on a dry skin two times daily for one month'. PRE	Label errors dosage	Interruption	Serious
Pharmacist prescribed sertraline instead of cetirizine PCE	wrong drug	look-alike/ sound-alike	Serious
Pharmacy assistant prescribed diclofenac sodium 12.5mg suppository to a feverish 3-month old baby PCE	wrong drug	Inexperienced staff	Serious
Pharmacist dispensed Atenolol Tenormin®) tablet doctor wrote Atenolol + Chlorthalidone Tenoretic®) PRE	Wrong Drug	look-alike/ sound-alike	Moderate

PRE: Prescription related error; PCE; pharmacist counselling error

hypnotic medications, with much less oversight of over-the-counter and prescription medications; this may indirectly increase the rate of MDEs. In contrast, studies that used self-reported incident forms, surveys, or case note review for reporting errors cannot demonstrate a reliable incidence of errors, because these approaches are vulnerable to a broad range of biased behaviours leading to under detection of medication errors. In addition, the dispensing process in community pharmacies in the UAE is not supported by electronic systems, which may decrease some types of errors. We believe all these factors could influence the detected rate of errors considerably. Our findings are consistent with the findings of other studies conducted in community settings and in hospitals.[9,13,34-38]

A high rate of PCEs was detected in our study. Such errors were most commonly attributed to poor knowledge or inexperienced pharmacy staff. In the Middle East, pharmacists tend to provide pharmaceutical care, raising their profits by independently prescribing medications to patients. Unfortunately, though, pharmacists do not receive proper clinical training after graduation for their continuous professional development or to become licensed independent prescribers.

In our study, a high rate of wrong quantity errors was detected in PREs (30.0%). Interruptions and work overload might have contributed to pharmacists ignoring the quantity of the medication prescribed. Wrong drug errors were the most commonly encountered type (32.1%) of PCEs, which is consistent with other studies.[4,12] This finding highlights the fact that pharmacists in the UAE have gaps in knowledge about the medication use, adverse effects, and contraindications. Therefore, a continuous education in pharmacotherapy, especially for outpatients is recommended. The major causes of MDEs were medicine replaced with near expire one (24.7%) and Look-alike/Sound-alike drugs (22.3%). These results were partially consistent with those of a UK study, at which look-alike errors were major causes of errors.[4] A previous study was conducted to discuss how drug name nomenclature and similar packaging between medicines can lead to MDEs, found that environmental risks and human factors can contribute to such errors. These factors are closely related to what we observed during our research.[39] Pharmacy managers in the UAE should consider technology and management solutions that could effectively limit, or eliminate, look-alike/sound-alike MDEs.

A significantly higher proportion of common cold medications and dietary supplements were involved in PCEs compared to PREs, whilst a significantly greater proportion of antihypertensives and anti-diabetic medications were involved in PREs compared to PCEs. In the UAE, most antihypertensives and anti-diabetics have similar packages; this might have caused confusion among pharmacists, particularly among inexperienced staff. Furthermore, poor training, irrational dispensing to increase profits, and lack of knowledge might have contributed to the high rate of errors during dispensing of common cold medicines and dietary supplements.

The majority of MDEs were rated as moderate and minor; only 8.7% of errors were serious. In a similar study conducted in the UK, most of the errors were assessed as minor 67% and moderate 32%.[5] In addition, nearly 45% of hospital MDEs were reported in a study as significant and serious.[33] Despite the similarity between our results and the literature, our approach may be more reliable as we included a significant number of incidents for the committee compared to the total number of errors.

The number of medication orders on a prescription (⍰4 medications) and busy pharmacies significantly predicted the occurrence of MDEs. The impact of these factors on the emergence of dispensing errors can be reduced by increasing staff numbers along with continuous pharmaceutical care training on the procedure of dispensing a prescription. Predictors of MDEs in community pharmacies have not been assessed in many studies.[4,5] A study showed that opportunities for errors in hospital pharmacies were higher in the pre-typed prescription order

forms (OR=4.5; p<0.001), in those with 9 or more drugs (OR=4.0; p<0.001), and with those for injectable drugs (OR=5.0; p<0.001).[25]

There is a paucity of research on MDEs in community pharmacies. This was one of the first studies in the Middle East to investigate the rate, types, causes, predictors and clinical severity of MDEs. Our results could be generalised due the study's robust sampling strategy that included randomly selected pharmacies from across all regions of the UAE. We adopted holistic and valid operational definitions of MDEs and used disguised direct observation of errors enhancing the validity of the findings. The study also added a new, previously unexplored perspective to the literature, investigating all MDEs types including those based on pharmacist's counselling and independent prescribing (PCEs), a common yet little researched practice in community pharmacies across the UAE and the Middle East. The main limitation of our research is the variation between research pharmacists in their ability to detect errors. Furthermore, the cross-sectional nature of our method provides descriptive evidence of dispensing incidents and causes without prompting additional insight to the solutions. In addition, the impact of staff training and information technology on MDEs was beyond the scope of this study's aims. Nevertheless, our data are likely to be reliable and our technique can be widely applied as a long-term method for detecting and reporting of MDEs. Further studies investigating the impact of outpatient electronic prescribing systems linked to community pharmacies on the rate of errors are recommended.

CONCLUSIONS

Medication dispensing errors occur (6.7% of all dispensed medications) in community pharmacies in the UAE and most reported errors are moderate. There is a need to improve the education of community pharmacists and their teams to ensure safe dispensing practice and to investigate potential interventions, such as electronic systems, to decrease the number of errors and reduce the risk of patient.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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