ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 13, Issue, 02, pp.16212-16223, February, 2021

DOI: https://doi.org/10.24941/ijcr.40829.02.2021

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

PRESCRIPTION ERRORS AMONG PHYSICIANS IN MOH PRIMARY HEALTH CARE CENTERS, MAKKAH AL-MUKARRAMAH, ANALYTIC CROSS-SECTIONAL STUDY 2019-2020

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ARTICLE INFO

Article History:
Received 18th November, 2020
Received in revised form
29th December, 2020
Accepted 17th January, 2021
Published online 26th February, 2021

Key Words:

Prescription Errors, Primary Health Care, Errors of Commission, Prescriber, Omission Error.

ABSTRACT

Background: Prescribing errors are common, rarely fatal but can prolong the duration of illness. Additionally, illegible hand writing or using uncommon abbreviations can lead to prescribing inappropriate medications. **Objectives**: To evaluate prescription writing skills of physicians working in primary health care centers, Ministry of Health (MOH). **Methods**: Multi-center analytical cross-sectional study was carried out including a random representative sample of manual prescriptions issued by physicians working at MOH primary health care centers inside Makkah Al-Mukarramah. A self-constructed validated checklist was used to assess the prescriber's certificate and job description, legibility of hand writing and fulfillment of certain information about the prescriber, the patient and the medications. **Results**: The study included 348 prescriptions; more than half of them (57.2%) were written by specialists. All words were legible among 29% of prescriptions whereas among 15.2%, only few words were legible. Patients` name was written and prescriber`s signature was present in all prescriptions while patient weight was present in minority of prescriptions (4%). Prescriber`s stamp was present in 88.5% of prescriptions. Overall, only 0.9% of prescriptions were without errors of minor omission and 39.7% of prescriptions were without errors of major omission in the first drug and only 5.5% in the 6th drug. **Conclusion**: Different types of prescription errors are quite common among primary healthcare physicians in Makkah. Fortunately, minor errors are more frequent than major errors. Errors in general were more frequent among resident, MBBS holder and low experienced physicians.

Citation: ***Dr. Kholoud Alharbi and Dr. Saud Alzahrani.*** **2021.** "Prescription errors among physicians in moh primary health care centers, makkah al-mukarramah, analytic cross-sectional study 2019-2020.", *International Journal of Current Research*, 13, (01), 16212-16223.

INTRODUCTION

Primary health care center is the first place where people visit to seek health care service; it covers most of the health requirements for individuals through their life. PHC centers with highly-qualified physicians improve health outcome, therefore it essential to evaluate the quality of health services provided by the PHC workers, one of those services is drug prescription. Prescription writing is an important skill that must be mastered by each physician to ensure patient safety and high-quality care. Prescribing errors are common, rarely fatal but can prolong the duration of illness (if the patient does not receive the medication in the correct dose for right duration). Illegible hand writing or using uncommon abbreviations can lead to prescribing inappropriate medications.

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Lack of knowledge about common drug-drug interactions increases the risk of hospitalization leading to higher costs. Fortunately, most of those errors are potentially preventable by adherence to standards of prescription writing skills.

Prescription: Prescription is the piece of paper that contains instructions from a prescriber (which is usually a physician) to a dispenser [(1)].

Prescription Components: To ensure safe drug prescribing, the prescription should contain the following components [(2)]:

- Patient's name, age, sex, weight and allergies.
- Diagnosis.
- Date of the prescription as the prescription will be valid for limited duration (usually three to six months), in some countries the prescription has no time-limited validity.
- Generic name and strength of the drug (concentration in each milliliter, tablets or suppository)
- Dosage form, total amount (abbreviations should be standard as: g for gram, ml for milliliter).

- Frequency and duration.
- Prescriber's signature and stamp.

Definition of Prescription Errors: There are many definitions for prescription errors, one of the most validated definition was obtained from a Delphi process, (a form of committee) which stated that 'a clinically meaningful prescription error occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant (i) reduction in the probability of treatment being timely and effective; or (ii) increase in the risk of harm when compared with generally accepted practice'[(4)]. The previous definition excludes prescription errors that do not cause significant increase in the risk of harm. To improve the quality of care in health care system, it is important to detect all errors whether those errors cause significant or minor risk of harm. Knowledge about prevalence of prescription errors in Saudi Arabia is lacking as there are few studies evaluated this problem in Saudi Arabia. A cross-sectional study in Riyadh city by Khoja et al found that 11.6% of prescriptions in primary health care centers contained errors[(3)]. In Middle East there is a retrospective study in Bahrain found that 60.2% of prescriptions contain errors[(4)].

Classification of Prescription Errors: There are many classification systems for prescription errors. This classification of prescription errors is obtained from a previous study done in Bahrain [(5)].They are classified into four types: errors of commission, errors of major omission, errors of minor omission and integration errors. Commission errors include those related to incorrect drug information as incorrect strength, dose, dosage form or duration. Major omission errors are defined as deficiency or illegibility of any part of the prescription body (missed or illegible dose, strength or duration of therapy). Deficiency of date of prescription, patients age, sex, doctor's identifier number or stamp are considered minor errors of omissions. Integration errors (knowledge-based errors) are due to failure of the prescriber to obtain history about current medication use or allergies which leads to drug-drug interactions or drug allergies. As the researcher is interested in prescription writing skills, this study will evaluate the prevalence of major and minor omission errors in the issued prescriptions.

Electronic Health in Saudi Arabia: Electronic health (E-Health) is defined by the WHO as the safe utilization of information and communication technologies in health and health-related fields including knowledge, researches and education. The E-Health has great impact on the health care system, it helps to improve the quality of care by providing secure and reliable information, reduces the repetition of investigations and prescriptions minimizes prescribing errors.
Most of MOH PHC centers in Saudi Arabia are working manually, in 2018 the MOH starts to implement a roadmap to make more than 2900 PHCCs use health information system (HIS)[(6)]. The HIS is used by the nurses, doctors, radiologist, lab technician and pharmacist. They use it to document and save the progress notes, investigation results, radiological imaging and prescriptions including patient's medications.

Aim of the Study

To evaluate prescription writing skills of physicians working in MOH primary health care centers. Consequently, improving this critical issue in PHC centers.

Objectives

- To estimate the prevalence of prescription errors among physicians working at Ministry of Health PHC centers in Makkah Al-Mukarramah, 2019.
- To compare the prevalence of each type of prescription errors between physicians with different degrees working at MOH primary health care centers in Makkah Al-Mukarramah.

LITERATURE REVIEW

(Aljasmi, Almalood and Al Ansari 2013) in a retrospective study of randomly selected prescriptions between March and May 2013 from PHC pharmacy at Bahrain Defense Force Hospital, Bahrain .This study divided prescription errors into: errors of major omission, errors of minor omission ,errors of commission, errors of integration and skill-related errors. A total of 379 prescriptions were reviewed, 60.2% (228) of analyzed prescriptions contained errors. The total number of the prescribed drugs was 992 drugs, 439 (44.3%) of them contained errors. The frequency of minor errors of omission is 38(9.9%),30 of them (7.9%) are missed physician's stamp . Errors of major omission account for the majority of errors in the prescribed drugs 73.6%(N=323), the frequency of illegible hand writing in the prescribed medications was 62 (14.1%), the number of the nonstandard abbreviations was 13) 3% .(Errors of commission was 9.3%(N=41), among this type of errors inappropriate frequency of dosing was the most common error) 4.8% .(The frequency of minor omission errors among the issued prescriptions are shown in table 1

Table 1. The frequency of errors of minor omission

Type of omission error	Frequency (percentage)
Physician's stamp	30 (7.9%)
Patient's name	2 (0.5%)
Patient's Age	2 (0.5%)
Patient's Sex	2 (0.5%)
Date of the prescription	2 (0.5%)
Total	38(9.9%)

They recommended to conduct further studies in the future to identify the cause of those errors and to compare the frequency of prescription errors before and after the use of electronic prescribing system and whether the electronic prescriptions will make change in the patient outcome or not[(4)]. (Khaja, Sequeira, Al-Ansari and Damanhori 2004-2005) in a study to evaluate the prescription writing skills of 26 residents in the final year family practice residency program in Bahrain, errors are classified into errors of major and minor omission, errors of commission and integration errors. This study aimed to compare the prescribing skills of residents who have graduated from medical school of problem-based learning curriculum versus traditional medical school (that followed non-problem based curriculum).The number of dispensed prescriptions is 2692, they contained 5880 drugs and were collected from three PHCCs in May 2004 (1323 prescriptions issued by 12 residents) and in May 2005 (1369 prescriptions issued by 14 residents).

They showed that 88.1% (2372) of the prescriptions had errors of major omission, commission or integration errors. 4447 (75.6%) out of the 5880 drugs were associated with drug related errors. Major errors of omission were found in (4972)

69.6% of the prescribed medications, the most frequent subtype is missed dosage form (39.4%), followed by the duration of treatment in (18.5%), strength of the drug in 8% and the frequency in 3.7 % of the prescribed medications. 1759 (24.7%) of the drugs were with errors of commission, 19.9% of the drugs had incorrect dosing frequency, 2.2% incorrect dose or strength, 1.5% incorrect dosage form and 1.1% incorrect length of treatment. They observed that 86% of the medications were written with the brand names and 95.5% of the (as required) medications were without dosing frequency.

It was concluded that the residents showed deficiency in the prescribing skills, which necessitates the engagement of the family practice residents in workshops and courses during the residency years to improve their skills[5]. (Babatunde, Akinbodewa, Akinboye and Adejumo 2014-2015) in a descriptive cross-sectional study, a total of 3,545 prescriptions were reviewed, those prescriptions were issued by 31 doctors including consultants, medical officers and house officers in The Kidney Care Center, in Ondo State, Southwest Nigeria. The participants doctors were blinded to the study during the period of the research. In this study the researchers used a different classification for prescription errors: errors of illegitimacy, errors of omission, errors of style and errors of wrong dose[6].

Error of illegitimacy is defined by absence of one or more of the following items: date, prescriber's name, patient's name, sex and age. Errors of omission defined as deficiency of dose, dosage form or dosage frequency. Errors of style include illegible hand writing or using non-standard abbreviations. Error of wrong dose is defined as incorrect dosage. A total of 2,660 (75.0%) prescriptions were found to have at least one error. Errors of illegitimacy were the most common type of errors, they were found in 1388 (52.2%), followed by errors of omission in 1,221 (45.9%) of prescriptions. Wrong dose was present in 51 (1.9%) prescriptions. Errors of style was not found in any prescription. In this study most intravenous infusions and parenteral injections are deficient in frequency, strength and duration. Among the physicians, prescription errors were more frequent in prescriptions issued by the house officers (83.34%), and lowest in the occurrence rate among consultants (48.26%).

This is illustrated by the presence of highest level of knowledge and experience among the consultants. They explained that the high prevalence of the prescribing errors in this study compared with other studies is due to the inclusion of errors of illegitimacy as most physicians consider them minor errors (will not cause significant patient's harm). They concluded that errors of omission and illegitimacy are more frequent than serious errors such as wrong dose. They recommend establishment of medication quality assurance unit in the center, using a uniform prescription paper to reduce omission errors, repeated review of the prescriptions by the pharmacist before dispensing the medications. They suggest periodic auditing of prescriptions[7].

(Khoja, Neyaz, Qureshi, Magzoub, Haycox and Walley 2011) in a cross-sectional study to evaluate the extent of prescription errors in PHC, evaluated prescriptions were issued by physicians in 5 governmental and 5 private primary health care clinics during one working day in Riyadh city. 2836 prescriptions from private clinics and 2463 from governmental clinics were analyzed after simple randomization. In this study the researchers used different classification system. Neville et al.'s classification of prescription errors divided prescription errors into four categories according to its seriousness: type A (potentially serious to patient); type B (major nuisance - pharmacist/doctor contact required); type C (minor nuisance - pharmacist must use professional judgement); and type D (trivial)[8].

The study showed that 18.7% of the evaluated prescriptions contained errors. Type D errors were the most common type in both governmental and private clinics 8.5% and 11.2% respectively, on the contrary type A errors were the least frequent type in both governmental and private clinics 0.1% and 0.2% respectively. Most of the type A errors were due to prescribing drugs above its maximum recommended dose, as the physicians wrote incorrect medication dose by a factor of 10, for example 200 mg omeprazole instead of 20 mg omeprazole. The most common errors were type B followed by type C. In type B the dispenser must contact the prescriber for clarification such as missed strength of dose or illegible handwriting of same item, 7% of all prescribed drugs were associated with type B errors. They found that there was no statistical difference in the frequency of type A errors between the governmental and private clinics, they attributed this result to the infrequency of such errors. They concluded that most of errors were trivial, and the incidence of life-threatening errors was small. They recommended to implement strategies to minimize prescription errors in Saudi Arabia[9].

METHODOLOGY

MATERIALS AND METHODS

Study Design: Multi-center analytical cross-sectional study was carried out.

Study Area: Makkah Al-Mukarramah is located in the Western Region in Saudi Arabia, it is the holiest city for all Muslims around the world. Every year, about two million pilgrims visit Makkah to perform Hajj. PHC institutions started in Makkah more than 35 years ago, they provide health care services for about 1.5 million people. There are 3 main sectors in Makkah Al-Mukarramah that provide primary health care services, including the Ministry of Health (MOH), the Ministry of Interior Health Services(MOI) and the National Guard Health Services(NG).About 85 MOH PHC centers work under the supervision of The General Directorate of Heath Affairs in Makkah. In the past, those centers were divided into seven sectors: Az-Zahir, Al-Kaakiyah, Al-Adel, Al-Sharaya, Al-Jumum, Khulays and Al-Kamel. Most of the PHCCs in first four sectors are located inside Makkah city.This study was conducted at randomly selected MOH primary health care centers inside Makkah city (Al-Aziziya AlSharqyah, Al-Kaakiyah, Al-Sharayaa and Al-Maqrah).

Study Population: All manual prescriptions issued by physicians working at MOH primary health care centers inside Makkah Al-Mukarramah.

Inclusion Criteria: Prescriptions written by the physicians in the Ministry of Health PHC centers in Makkah city were eligible.

Exclusion Criteria

- Prescription forms of chronic diseases (hypertension and diabetes).
- Prescription written by physiciansof unknown degree.
- Prescriptions written by dentists.
- Electronic prescriptions.

Sample Size: The sample size was calculated by using Raosoft statistical program after estimating the number of written prescriptions during the period of data collection (383 prescriptions). The confidence interval was 95% and the margin of error was 5%.

Sampling Technique : The researcher used the previous sectors to divide the MOH primary health care centers inside Makkah city into 4 strata, each one of the four strata was represented by single primary health care center that is selected by simple random sampling technique. The PHCCs outside Makkah city were excluded from the sampling process .Afterwards, the sample size was distributed over these 4 sectors equally. The prescriptions were collected from the selected centers , the exclusion criteria were applied to the collected prescriptions.

Data Collection Tool (Instrument): The researcher used a self-constructed validated checklist to assess the following:

- The prescriber's certificate and job description.
- Legibility of hand writing.
- Fulfillment of certain information about the prescriber, the patient and the medications.

Data Collection Technique: After obtaining the ethical approval, the researcher communicated with the director and the pharmacists in the selected PHC centers prior to the day of data collection. They were informed about the purpose of the study and the data collection technique. In advance, the researcher requested prescriptions collection from the pharmacists in charge in each selected center during the period of data collection.

All prescriptions issued by the working physicians at the end of the selected working days (During the month of December) in each center were collected by the pharmacists in charge, then were given to the researcher. The physicians were informed about the study after the collection and before the analysis of the written prescriptions. The researcher distributed the informed consent form to all physicians who work in those centers during the period of data collection. For the physicians who refuse to participate in the study, their prescriptions were not subjected to analysis and they were returned to the PHCCs, the aim of this step is to make the prescribers blinded to the study. The exclusion criteria were applied and the excluded prescriptions were returned to PHCCs. Certain data such as the physician's and patient's name were anonymized so identity of the patients or the prescribers was not collected for analysis. The researcher evaluated each one of the collected prescriptions by a validated checklist to assess the following:

- The prescriber's certificate (Bachelor of Medicine, Bachelor of Surgery "MBBS", Saudi Board of Family Medicine or others), job title and years of experience.
- Legibility of hand writing which is defined as the degree to which hand writing is easily read. It was assessed by a numeric rating scale as the following:
- On first reading, all words are legible.
- On first reading, most words are legible.
- On first reading, only few words are legible.
- Filling of the following items: Patient's data (name, age, sex, weight, allergies), diagnosis, date of prescription, drug information (generic name, strength of the drug, dosage form, total amount, frequency and duration),prescriber's signature and stamp. If the researcher notices errors that might cause patient's harm such as incorrect dose or possible drug-drug interactions during the analysis, she contacted the pharmacist in charge about that error, if the error was not observed and corrected by the pharmacist in advance, the patient was contacted by the researcher for the correction.

All prescriptions were returned to the PHCCs at the end of data collection.

Study Variables

Dependent Variables

- The prevalence of prescription errors among physicians working at PHC centers.
- The legibility of hand writing.
- The fulfillment of the following items:
- Patient's data (name, age,sex, weight and allergies).
- Diagnosis
- Date of the prescription
- Drug information (generic name, the strength of the drug, dosage form,total amount, frequency and duration).
- Prescriber's signature and stamp.

Date of the prescription

- Druginformation (generic name, the strength of the drug, dosage form,total amount, frequency and duration).
- Prescriber's signatureand stamp.

Independent Variables

- The prescriber's job title.
- The prescriber's certificates.
- The prescriber's years of experience.

Data Entry and Analysis

- Data were analyzed by using Statistical Package for the Social sciences (SPSS) program version 25 for Windows.
- Chi-square statistical test was used to test for the association between each type of prescription errors and physicians` characteristics.
- A p- value of less than 0.05 was considered as statistically significant.

Pilot Study/Pretesting: A pilot study was conducted at one of MOH primary health care centers (Kudai PHCC), by using the same data collection tool and technique. As a feedback, no faults were found in the data collection tool or technique.

RESULTS

The study included 348 prescriptions. Personal characteristics of the physicians are summarized in Table 1. More than half of them (57.2%) were written by specialists. Almost one third of them by MBBS certified doctors (33.6%) and most of them by physicians with SBFM (66.4%); off them, 29% had also ABFM. The experience of most of them (58.6%) ranged between 6 and 10 years. Regarding legibility of hand writing, all words were legible among 29% of prescriptions whereas among 15.2%, only few words were legible as shown in Figure 1. None of the consultant`s prescription had legible hand writing of all words whereas 18.8% had few legible words compared to 45.3% and 12.8% among residents` prescriptions, respectively. Overall, the association between job title and legibility of hand writing was statistically significant, p<0.001. All words were legible among 45.3% of MBBS holders` prescriptions compared to 13.8% of SBFM holders` prescriptions. Also, few words were legible among 12.8% of MBBS doctors` prescriptions compared to 21.5% of that of SBFM holders, p<0.001. More than one-third (37.3%) of prescriptions written by physicians with experience ranged between 6 and 10 years compared to none of those of physicians with experience ranged between 11 and 15 years had eligible all words, p<0.001. Table 2

Table 1: Prescription`s classifications according physician characteristics (n=348)

	Frequency	Percentage
Job title		
Resident	117	33.6
Specialist	199	57.2
Consultant	32	9.2
Certificate		
MBBS	117	33.6
Saudi Board of Family Medicine (SBFM)	130	37.4
Both SBFM and Arab Board of Family Medicine (ABFM)	101	29.0
Experience (years)		
<5	61	17.5
6-10	204	58.6
11-15	15	4.3
>15	68	19.5

Errors of minor omission: From table 3, it is evident that patients` name was written and prescriber`s signature was present in all prescriptions while patient weight was present in minority of prescriptions (4%). Patient`s sex and diagnosis were written in 84.8% and 81.6% of prescriptions, respectively. Prescriber`s stamp was present in 88.5% of prescriptions. Overall, only 0.9% of prescriptions were without errors of minor omission as seen in Figure 2. Patient`s age was highest in prescriptions written by consultants (81.3%) and lowest by specialists (52.8%), p<0.001 while patient`s sex was highest in those written by specialists (91%) and lowest in those of consultants (68.8%), p<0.001. Patient`s weight was only written in specialists` prescriptions (7%), p=0.004. History of allergies was written by 68.8% and 41% of consultants` and residents` prescriptions, respectively, p=0.008.

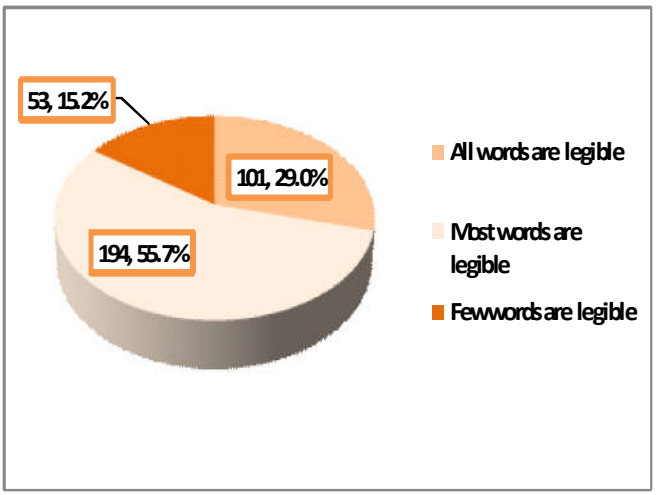

Figure 1. Legibility of hand writing of the participants

Diagnosis was written by majority of specialists` prescriptions (95.5%) compared to 58.1% of residents` ones, p<0.001. Prescriber`s stamp was present in all consultants` prescriptions compared to 81.9% of specialists` prescriptions, p<0.001. Table 4. Table 5 shows that patient`s age was highest in prescriptions written by MBBS holders (72.6%) and lowest by those of SBFM holders (50%), p=0.001 while patient`s weight was written by 8.5% of SBFM holders` prescriptions compared to none of MBBS holders, p=0.003.

History of allergies was written by majority of both SBFM and ABFM holders prescriptions (91.1%) compared to only 30% of only SBFM holders, p<0.001. Diagnosis was written by all SBFM holders compared to only 58.1% of MBBS holders, p<0.001. Date of prescription was highest written by SBFM and ABFM holders and lowest by only SBFM holders (90.1% versus 21.5%), p<0.001. Prescriber`s stamp was present in majority of MBBS holders` prescriptions (96.6%) compared to 78.5% of SBFM holders, p<0.001.

Patient`s age was reported by all prescriptions of physicians with 11-15 years experience compared to 55.9% of those with experience exceeded 15 years, p<0.001. Patient`s sex was written by majority of prescriptions written by physicians who had experience between 16 and 20 years (92.6%) compared to 59% among those whose experience less than 5 years, p<0.001. History of allergies was written by majority of prescriptions of high experienced physicians (92.6%) and only 31.9% of those with experience ranged between 5 and 10 years, p<0.001.

Diagnosis was written by all prescriptions of physicians whose experience ranged between 11 and 15 years and only 32.8% among low experiences physicians (<5 years), p<0.001. Date of prescription was written by majority of high experienced physicians (92.6%) compared to 38.7% of those with 6-10 years of experience, p<0.001. Table 6

Errors of major omission: Generic name of the drug: was written by 45.1% of the prescriptions regarding the first drug and only 10.3% regarding the sixth drug.

Table 2. Association between legibility of handwriting and personal characteristics of the physicians

	Legibility of hand writing			p-value
	All words N=101 N (%)	Most words N=194 N (%)	Few words N=53 N (%)	
Job title	53 (45.3)	49 (41.9)	15 (12.8)	
Resident (n=117)	48 (24.1)	119 (59.8)	32 (16.1)	<0.001
Specialist (n=199)	0 (0.0)	26 (81.3)	6 (18.8)	
Consultant (n=32)				
Certificate	53 (45.3)	49 (41.9)	15 (12.8)	
MBBS (n=117)	18 (13.8)	84 (64.6)	28 (21.5)	
SBFM (n=130)	30 (29.7)	61 (60.4)	10 (9.9)	<0.001
SBFM+ABFM (n=101)				
Experience (years)	13 (21.3)	40 (65.6)	8 (13.1)	
<5	76 (37.3)	93 (45.6)	35 (17.2)	
6-10	0 (0.0)	15 (100)	0 (0.0)	<0.001
11-15	12 (17.6)	46 (67.6)	10 (14.7)	
>15				

MBBS: Bachelor of Medicine, Bachelor of Surgery
SBFM: Saudi Board Family Medicine
ABFM: Arab Board Family Medicine

Table 3. Frequency of errors of minor omission in participants` prescriptions

	Categories	Frequency	Percentage
Patient`s name	Written	348	100
	Not written	0	0.0
Patient`s age	Written	216	62.1
	Not written	132	37.9
Patient`s sex	Written	295	84.8
	Not written	53	15.2
Patient`s weight	Written	14	4.0
	Not written	334	96.0
Allergies	Written	178	51.1
	Not written	170	48.9
Diagnosis	Written	284	81.6
	Not written	64	18.4
Date of prescription	Written	184	52.9
	Not written	164	47.1
Prescriber`s signature	Present	348	100
	Absent	0	0
Prescriber's stamp	Present	308	88.5
	Absent	40	11.5

Table 4. Association between prescriber`s job title and errors of minor omission in prescriptions

	Resident N=117 N (%)	Specialist N=199 N (%)	Consultant N=32 N (%)	p-value
Patient`s age	85 (72.6)	105 (52.8)	26 (81.3)	<0.001
Patient`s sex	92 (78.6)	181 (91.0)	22 (68.8)	<0.001
Patient`s weight	0 (0.0)	14 (7.0)	0 (0.0)	0.004
Allergies	48 (41.0)	108 (54.3)	22 (68.8)	0.008
Diagnosis	68 (58.1)	190 (95.5)	26 (81.3)	<0.001
Date of prescription	65 (55.6)	97 (48.7)	22 (68.8)	0.085
Prescriber's stamp	113 (96.6)	163 (81.9)	32 (100)	<0.001

Number and percentage of written/present items

Table 5. Association between prescriber`s qualification and errors of minor omission in prescriptions

	MBBS N=117 N (%)	SBFM N=130 N (%)	SBFM and ABFM N=101 N (%)	p-value
Patient`s age	85 (72.6)	65 (50.0)	66 (65.3)	0.001
Patient`s sex	92 (78.6)	112 (86.2)	91 (90.1)	0.054
Patient`s weight	0 (0.0)	11 (8.5)	3 (3.0)	0.003
Allergies	48 (41.0)	39 (30.0)	91 (90.1)	<0.001
Diagnosis	68 (58.1)	130 (100)	86 (85.1)	<0.001
Data of prescription	65 (55.6)	28 (21.5)	91 (90.1)	<0.001
Prescriber's stamp	113 (96.6)	102 (78.5)	93 (92.1)	<0.001

Number and percentage of written/present items

Table 6. Association between prescriber`s experience and errors of minor omission in prescriptions

	<5 N=61 N (%)	6-10 N=204 N (%)	11-15 N=15 N (%)	16-20 N=68 N (%)	p-value
Patient`s age	48 (78.7)	115 (56.4)	15 (100)	38 (55.9)	<0.001
Patient`s sex	36 (59.0)	186 (91.2)	10 (66.7)	63 (92.6)	<0.001
Patient`s weight	0 (0.0)	11 (5.4)	0 (0.0)	3 (4.4)	0.240
Allergies	40 (65.6)	65 (31.9)	10 (66.7)	63 (92.6)	<0.001
Diagnosis	20 (32.8)	196 (96.1)	15 (100)	53 (77.9)	<0.001
Data of prescription	32 (52.5)	79 (38.7)	10 (66.7)	63 (92.6)	<0.001
Prescriber's stamp	57 (93.4)	176 (86.3)	15 (100)	60 (88.2)	0.220

Number and percentage of written/present items

Table 7. Frequency of errors of major omission in participants` prescriptions

	Categories	Frequency	Percentage
First drug			
Generic name of the drug	Written Not written	157 191	45.1 54.9
Strength of the drug	Written Not written	256 92	73.6 26.4
Dosage form	Written Not written	325 23	93.4 6.6
Total amount	Written Not written	290 58	83.3 16.7
Frequency	Written Not written	348 0	100 0.0
Duration	Written Not written	299 49	85.9 14.1
Second drug			
Generic name of the drug	Written Not written	123 225	35.3 64.7
Strength of the drug	Written Not written	179 169	51.4 48.6
Dosage form	Written Not written	209 139	60.1 39.9
Total amount	Written Not written	199 149	57.2 42.8
Frequency	Written Not written	235 113	67.5 32.5
Duration	Written Not written	191 157	54.9 45.1
Third drug			
Generic name of the drug	Written Not written	81 267	23.3 76.7
Strength of the drug	Written Not written	95 253	27.3 72.7
Dosage form	Written Not written	172 176	49.4 50.6
Total amount	Written Not written	96 252	27.6 72.4
Frequency	Written Not written	181 167	52.0 48.0
Duration	Written Not written	148 200	42.5 57.5
Fourth drug			
Generic name of the drug	Written Not written	83 265	23.9 76.1
Strength of the drug	Written Not written	87 261	25.0 75.0
Dosage form	Written Not written	88 260	25.3 74.7
Total amount	Written Not written	100 248	28.7 71.3
Frequency	Written Not written	130 218	37.4 62.6
Duration	Written Not written	130 218	37.4 62.6
Fifth drug			

Continue…….

Generic name of the drug	Written Not written	39 309	11.2 88.8
Strength of the drug	Written Not written	77 271	22.1 77.9
Dosage form	Written Not written	77 271	22.1 77.9
Total amount	Written Not written	72 279	20.7 79.3
Frequency	Written Not written	82 266	23.6 76.4
Duration	Written Not written	82 266	23.6 76.4
Sixth drug			
Generic name of the drug	Written Not written	36 312	10.3 89.7
Strength of the drug	Written Not written	27 321	7.8 92.2
Dosage form	Written Not written	41 307	11.8 88.2
Total amount	Written Not written	39 309	11.2 88.8
Frequency	Written Not written	44 304	12.6 87.4
Duration	Written Not written	44 304	12.6 87.4

Table 8. Association between participants` job title and errors of major omission in their prescriptions

	Resident N=117 N (%)	Specialist N=199 N (%)	Consultant N=32 N (%)	p-value
First drug				
Generic name of the drug	29(24.8)	125 (62.8)	3(9.4)	<0.001
Strength of the drug	45(38.5)	184(92.5)	27(84.4)	<0.001
Dosage form	104(88.9)	189(95.0)	32(100)	0.032
Total amount	83(70.9)	191(96.0)	16(50.0)	<0.001
Duration	68(58.1)	199(100)	32(100)	<0.001
Second drug				
Generic name of the drug	8 (6.8)	102 (51.3)	13 (40.6)	<0.001
Strength of the drug	18 (15.4)	134 (67.3)	27 (84.4)	<0.001
Dosage form	51 (43.6)	131 (65.8)	27 (84.4)	<0.001
Total amount	57 (48.7)	136 (68.3)	6 (18.8)	<0.001
Frequency	72 (61.5)	141 (70.9)	22 (68.8)	0.230
Duration	23 (19.7)	141 (70.9)	27 (84.4)	<0.001
Third drug				
Generic name of the drug	11 (9.4)	70 (35.2)	0 (0.0)	<0.001
Strength of the drug	10 (8.5)	61 (30.7)	24 (75.0)	<0.001
Dosage form	39 (33.3)	109 (54.8)	24 (75.0)	<0.001
Total amount	0 (0.0)	96 (48.2)	0 (0.0)	<0.001
Frequency	43 (36.8)	114 (57.3)	24 (75.0)	<0.001
Duration	10 (8.5)	114 (57.3)	24 (75.0)	<0.001
Fourth drug				
Generic name of the drug	29 (24.8)	51 (25.6)	3 (9.4)	0.129
Strength of the drug	7 (6.0)	67 (33.7)	13 (40.6)	<0.001
Dosage form	11 (9.4)	64(32.2)	13 (40.6)	<0.001
Total amount	25 (21.4)	67 (33.7)	8 (25.0)	0.058
Frequency	40 (34.2)	77 (38.7)	13 (40.6)	0.670
Duration	32 (27.4)	85 (42.7)	13 (40.6)	0.022
Fifth drug				
Generic name of the drug	0 (0.0)	34 (17.1)	5 (15.6)	<0.001
Strength of the drug	0 (0.0)	69 (34.7)	8 (25.0)	<0.001
Dosage form	0 (0.0)	69 (34.7)	8 (25.0)	<0.001
Total amount	0 (0.0)	64 (32.2)	8 (25.0)	<0.001
Frequency	0 (0.0)	74 (37.2)	8 (25.0)	<0.001
Duration	0 (0.0)	74 (37.2)	8 (25.0)	<0.001
Sixth drug				
Generic name of the drug	0 (0.0)	36 (18.1)	0 (0.0)	<0.001
Strength of the drug	0 (0.0)	24 (12.1)	3 (9.4)	0.001
Dosage form	0 (0.0)	41 (20.6)	0 (0.0)	<0.001
Total amount	0 (0.0)	36 (18.1)	3 (9.4)	<0.001
Frequency	0 (0.0)	41 (20.6)	3 (9.4)	<0.001
Duration	0 (0.0)	41 (20.6)	3 (9.4)	<0.001

Number and percentage of written/present items

Table 9. Association between participants` qualification and errors of major omission in their prescriptions

	MBBS N=117 N (%)	SBFM N=130 N (%)	SBFM and ABFM N=101 N (%)	p-value
First drug				
Generic name of the drug	29(24.8)	65(50.0)	63(62.4)	<0.001
Strength of the drug	45(38.5)	130(100)	81(80.2)	<0.001
Dosage form	104(88.9)	130(100)	91(90.1)	0.001
Total amount	83(70.9)	130(100)	77(76.2)	<0.001
Duration	68(58.1)	130(100)	101(100)	<0.001
Second drug				
Generic name of the drug	8 (6.8)	53 (40.8)	62 (61.4)	<0.001
Strength of the drug	18 (15.4)	92 (70.8)	69 (68.3)	<0.001
Dosage form	51 (43.6)	92 (70.8)	66 (65.3)	<0.001
Total amount	57 (48.7)	92 (70.8)	50 (49.5)	<0.001
Frequency	72 (61.5)	92 (70.8)	71 (70.3)	0.236
Duration	23 (19.7)	92 (70.8)	76 (75.2)	<0.001
Third drug				
Generic name of the drug	11 (9.4)	46 (35.4)	24 (23.8)	<0.001
Strength of the drug	10 (8.5)	26 (20.0)	59 (58.4)	<0.001
Dosage form	39 (33.3)	65 (50.0)	68 (67.3)	<0.001
Total amount	0 (0.0)	65 (50.0)	31 (30.7)	<0.001
Frequency	43 (36.8)	65 (50.0)	73 (72.3)	<0.001
Duration	10 (8.5)	65 (50.0)	73 (72.3)	<0.001
Fourth drug				
Generic name of the drug	29 (24.8)	28 (21.5)	26 (25.7)	0.727
Strength of the drug	7 (6.0)	57 (43.8)	23 (22.8)	<0.001
Dosage form	11 (9.4)	57 (43.8)	20 (19.8)	<0.001
Total amount	25 (21.4)	49 (37.7)	26 (25.7)	0.013
Frequency	40 (34.2)	49 (37.7)	41 (40.6)	0.619
Duration	32 (27.4)	57 (43.8)	41 (40.6)	0.020
Fifth drug				
Generic name of the drug	0 (0.0)	18 (13.8)	21 (20.8)	<0.001
Strength of the drug	0 (0.0)	46 (35.4)	31 (30.7)	<0.001
Dosage form	0 (0.0)	46 (35.4)	31 (30.7)	<0.001
Total amount	0 (0.0)	46 (35.4)	26 (25.7)	<0.001
Frequency	0 (0.0)	46 (35.4)	36 (35.6)	<0.001
Duration	0 (0.0)	46 (35.4)	36 (35.6)	<0.001
Sixth drug				
Generic name of the drug	0 (0.0)	18 (13.8)	18 (17.8)	<0.001
Strength of the drug	0 (0.0)	8 (6.2)	19 (18.8)	<0.001
Dosage form	0 (0.0)	18 (13.8)	23 (22.8)	<0.001
Total amount	0 (0.0)	18 (13.8)	21 (20.8)	<0.001
Frequency	0 (0.0)	18 (13.8)	26 (25.7)	<0.001
Duration	0 (0.0)	18 (13.8)	26 (25.7)	<0.001

Number and percentage of written/present items

Table 10. Association between participants` experience and errors of major omission in their prescriptions

	<5 N=61 N (%)	6-10 N=204 N (%)	11-15 N=15 N (%)	16-20 N=68 N (%)	p-value
First drug					
Generic name of the drug	3(4.9)	104(51.0)	0(0.0)	50(73.5)	<0.001
Strength of the drug	3(4.9)	182(89.2)	10(66.7)	61(89.7)	<0.001
Dosage form	61(100)	181(88.7)	15(100)	68(100)	0.001
Total amount	41(67.2)	182(89.2)	10(66.7)	57(83.8)	<0.001
Duration	20(32.8)	196(96.1)	15(100)	68(100)	<0.001
Second drug					
Generic name of the drug	3 (4.9)	68 (33.3)	10 (66.7)	42 (61.8)	<0.001
Strength of the drug	3 (4.9)	117 (57.4)	15 (100)	44 (64.7)	<0.001
Dosage form	44 (72.1)	99 (48.5)	15 (100)	51 (75.0)	<0.001
Total amount	41 (67.2)	113 (55.4)	0 (0.0)	45 (66.2)	<0.001
Frequency	48 (78.7)	126 (61.8)	10 (66.7)	51 (75.0)	0.040
Duration	7 (11.5)	118 (57.8)	15 (100)	51 (75.0)	<0.001
Third drug					
Generic name of the drug	0 (0.0)	62 (30.4)	0 (0.0)	19 (27.9)	<0.001
Strength of the drug	7 (11.5)	34 (16.7)	15 (100)	39 (57.4)	<0.001
Dosage form	28 (45.9)	81 (39.7)	15 (100)	48 (70.6)	<0.001
Total amount	0 (0.0)	65 (31.9)	0 (0.0)	31 (45.8)	<0.001
Frequency	32 (52.5)	86 (42.2)	15 (100)	48 (70.6)	<0.001

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Duration	7 (11.5)	78 (38.2)	15 (100)	48 (70.6)	<0.001
Fourth drug					
Generic name of the drug	29 (47.5)	33 (16.2)	0 (0.0)	21 (30.9)	<0.001
Strength of the drug	3 (4.9)	71 (34.8)	10 (66.7)	3 (4.4)	<0.001
Dosage form	7 (11.5)	61 (29.9)	10 (66.7)	10 (14.7)	<0.001
Total amount	25 (41.0)	49 (24.0)	5 (33.3)	21 (30.9)	0.072
Frequency	32 (52.5)	67 (32.8)	10 (66.7)	21 (30.9)	0.002
Duration	32 (52.5)	67 (32.8)	10 (66.7)	21 (30.9)	0.002
Fifth drug					
Generic name of the drug	0 (0.0)	23 (11.3)	5 (33.3)	11 (16.2)	0.001
Strength of the drug	0 (0.0)	51 (25.0)	5 (33.3)	21 (30.9)	<0.001
Dosage form	0 (0.0)	51 (25.0)	5 (33.3)	21 (30.9)	<0.001
Total amount	0 (0.0)	46 (22.5)	5 (33.3)	21 (30.9)	<0.001
Frequency	0 (0.0)	56 (27.5)	5 (33.3)	21 (30.9)	<0.001
Duration	0 (0.0)	56 (27.5)	5 (33.3)	21 (30.9)	<0.001
Sixth drug					
Generic name of the drug	0 (0.0)	18 (8.8)	0 (0.0)	18 (26.5)	0.001
Strength of the drug	0 (0.0)	13 (6.4)	0 (0.0)	14 (20.6)	<0.001
Dosage form	0 (0.0)	23 (11.3)	0 (0.0)	18 (26.5)	<0.001
Total amount	0 (0.0)	18 (8.8)	0 (0.0)	21 (30.9)	<0.001
Frequency	0 (0.0)	23 (11.3)	0 (0.0)	21 (30.9)	<0.001
Duration	0 (0.0)	23 (11.3)	0 (0.0)	21 (30.9)	<0.001

Number and percentage of written/present items

Strength of the drug: was written by 73.6% of the prescriptions regarding the first drug compared to 7.8% regarding the sixth drug

Dosage form: was written regarding the first drug in majority of the prescriptions (93.4%) and 11.8% regarding the sixth drug.

Total amount: was written by 83.3% of prescriptions concerning the first drug and 11.2% of them concerning the sixth drug.

Frequency: was written in all prescriptions regarding the first drug and only 12.6% of them regarding the sixth drug.

Duration: was written in 85.9% of the prescriptions concerning the first drug and only 12.6% concerning the sixth drug. Table 7. Overall, 39.7% of prescriptions were without errors of major omission in the first drug and only 5.5% in the 6th drug. Figure 2

Factors associated with errors of major omission

Job title: Generic name of the drug was more written by specialists and lowest by either consultant or residents, based on the drug`s order, p<0.001 in most drugs. Strength of the drug was lowest written by residents and highest by either specialist or consultant, based on the drug`s order, p=0.001 or <0.001. Dosage form also was lowest written by residents and highest by either specialist or consultant, based on the drug`s order, p=0.032 or <0.001. Total amount of the drug was highest written by specialists and lowest by residents or consultants, based on the drug`s order, p=0.058 or <0.001. Frequency of the drug was higher written by either specialist or consultant and lowest by residents, p value ranged between 0.670 and <0.001. Duration of the treatment was written more by either specialists or consultants than residents, p-value ranged between 0.022 and <0.001. Table 8

Qualification: From Table 9, it is shown that generic name of the drug was less written by MBBS holders compared to SBFM or SBFM and ABFM holders, p-value ranged between 0.727 and <0.001. Strength of the drug was lowest written by <0.001. Similarly, dosage form also was lowest written by MBBS holders and highest by either those having SBFM or SBFM and ABFM, based on the drug`s order, p=0.001 or <0.001. Total amount of the drug was highest written by SBFM or SBFM and ABFM holders and lowest by MBBS holders, based on the drug`s order, p=0.013 or <0.001. Frequency of the drug was higher written by either SBFM or SBFM or ABFM holders and lowest by MBBS holders, p value ranged between 0.619 and <0.001. Duration of the treatment was written more by either SBFM or SBFM and ABFM holders than MBBS holders, p-value ranged between 0.020 and <0.001.

Experience: There was variation in writing generic name of the drug based on prescribers`` experience according to the drug`s order, p=0.001 or <0.001. Strength of the drug was highest written by physicians whose experience exceeded 11 years, p <0.001. Often, dosage form was less written by less experience physicians, p=0.001 or <0.001. Total amount of the drug was more written by more experienced physicians (11-20 years) in most drugs, p=0.072 or <0.001. Writing of the frequency of the drug was variable according to the prescribers`` experience in different drugs, p value ranged between 0.040 and <0.001. Duration of the treatment was written more by more experienced physicians, p-value ranged between 0.002 and <0.001. Table 10

DISCUSSION

It is fundamental for the healthcare system to evaluate healthcare services particularly at the primary healthcare settings to ensure offering highest care to patients[10]. Medication errors at primary healthcare system should be determined and reduced to improve the clinical outcomes, costs, and lawsuits, while enhance the trust level between customers and doctors[11]. This study was carried out to evaluate prescription writing skills of physicians working in MOH primary health care centers and accordingly set recommendations to improve the situation in Makkak, Saudi Arabia. In the present study, prescription errors were classified into errors of minor omission and errors of major omission. Minority of prescriptions (0.9%) were without errors of minor omission whereas 39.7% and 5.5% were without errors of major omission regarding the first and 6th drugs, respectively.

In a similar study carried out in Bahrain (2013)[4],60.2% analyzed primary health care prescriptions contained errors. The current study revealed that all words were legible in the prescription among 29% of physicians whereas among 15.2%, only few words were legible. In Bahrain[4], illegible hand writing in the prescribed medications was 14.1%, which is very close to our figure. The problem is more evident among consultants, SBFM and those with moderate experience (11-15 years) as none or less of them had all words legible. This problem could be easily solved by using electronic prescriptions. Concerning minor errors, the present study observed that almost all prescription had minor errors as patients` name was written and prescriber`s signature was present in all prescriptions while patient weight was present in minority of prescriptions (4%). In Bahrain [4], minor error omissions were present in only 9.9% of prescriptions; mainly the prescriber`s stamp.

The clear difference between the two studies is not true as in the Bahrain`s study they did not include patients` weight which was not written by the majority of our physicians. In a previous study carried out in Riyadh (2011), prescription errors were classified into four different type; type A (potentially serious to patient); type B (major nuisance - pharmacist/doctor contact required); type C (minor nuisance - pharmacist must use professional judgment); and type D (trivial) and they revealed that 18.7% of the evaluated prescriptions contained errors, type D errors were the most common type in both governmental and private clinics 8.5% and 11.2% respectively, on the contrary type A errors were the least frequent type in both governmental and private clinics 0.1% and 0.2% respectively. Most of the type "A" errors were due to prescribing drugs above its maximum recommended dose [8].In Nigeria [7], the authors classified prescription errors into 4 categories; error of illegitimacy (i.e. absence of one or more of the following items: date, prescriber's name, patient's name, sex and age), errors of omission (i.e. deficiency of dose, dosage form or dosage frequency), errors of style (i.e. illegible hand writing or using non-standard abbreviations) and error of wrong dose. So, comparison with the current study is difficult, however, 75% of prescriptions were found to have at least one of the aforementioned errors; errors of illegitimacy were the most common type of errors (52.2%), followed by errors of omission of prescriptions (45.9%) while wrong dose was present in 1.9% of prescriptions.

In the present study, 39.7% of prescriptions were without errors of major omission in the first drug and only 5.5% in the 6th drug. Errors of major omission were more frequently reported regarding the generic name, particularly in case of prescription of several drugs. In Lebanon, only 2.9% of drugs were prescribed by generic names rather than by their brand names[12]. This could be attributed to the fact that physicians in the PHC service prefer brand-name drugs over generic drugs[13].In some countries such as Niger, the physicians prescribe a high number of generic drugs[14].In Bahrain`s study, the majority of errors in the prescribed drugs were of major errors (73.6%) and inappropriate frequency of dosing was the most common error[4]. In accordance with others [4, 7], the present study observed that errors were nearly more reported by residents, those with MBBS qualification and low experienced physicians compared to their counterparts. This is could be explained higher level of knowledge and experience among others.

Strength and Limitation: Comparison between various studies and the present one is not practical due to using different ways in inclusion and classification of different types of errors in prescription. The study has some limitations. Among them, the number of prescribed drugs per prescription was not investigated; it seems that the average number of drugs in a prescription looks high as the number exceeded 6 drugs in a considerable proportion of prescriptions. Also, the study was carried out in Makkah city and therefore, the generalizability to others regions in Saudi Arabia is questionable. Despite of those limitations, the study is multi-centric and including sufficient number of prescriptions and its findings could be utilized by decision makers to improve the situations

Conclusion

Different types of prescription errors are quite common among primary healthcare physicians in Makkah. Fortunately minor errors are more frequent than major errors. Errors in general were more frequent among residents, MBBS holder and low experienced physicians. A considerable proportion of physicians had few legible words in their prescriptions.

Recommendations

- To reduce the omission errors, there should be a uniform prescription in primary healthcare centers.
- Reviewing of the prescription carefully by the pharmacist and discussion with physicians in case of major errors
- Auditing of physician`s prescription on regular intervals
- Replacing hand writing prescription by electronic ones as possible
- Future studies should investigate prescribing pattern in other regions of the Kingdom of Saudi Arabia and compare the frequency of errors before and after application of electronic prescriptions.

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