*ejpmr, 2018,5(7), 363-369*

**SJIF Impact Factor 4.897**

**EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH**

www.ejpmr.com

**Research Article**

**ISSN 2394-3211**

**EJPMR**

# PREVALENCE AND PATTERNS OF MEDICATION ERRORS ACROSS THE PRIMARY HEALTH CARE CENTERS IN THE CAPITAL CITY OF SAUDI ARABIA

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**Article Received on 02/05/2018** **Article Revised on 23/05/2018** **Article Accepted on 12/06/2018**

## ABSTRACT

**Background**: Patient safety in public is concerned in health care systems throughout the world. Medication errors major problems in the care settings and are the common mistakes at any stage in the medical management. There are limited studies have been documented in the medication errors in the Saudi Arabia especially in primary health care centers. The present study aims to determine the extent and causes of the medication errors are made in primary health care centers in the Saudi Arabia. **Methods:** In this study, we have 994 prescriptions from 10 major health care centers from Riyadh. This study was carried during 21st January 2018-2nd February 2018, this study mainly documented the causes and types of medication errors in the selected primary health care centers with the help of the medication error form, which was certified from the general administration of pharmaceutical care from Ministry of Health, KSA. **Results:** A total of 994 prescriptions were analyzed from 10 PHCs. Overall medication errors were found on 174 out of 994 prescriptions (17.5%). Out of 174 study subjects,32(18.4%) were in the age group of 30-less than 50 years. Among 40.2% of patients, 13 types of medication errors were documented with improper dose. The missing of drug information was found in 41.4% of patients, which is the causes of medication error, 26.6% patients were with the cause of the workflow problem/environmental staffing. The dosage distribution of medication error is divided into four categories such as A, B, C and D. The class A of medication error is found to be 1.7%, B is 50.6%, C is 44.8% and D is 2.9%. The statistical data provide the significant distribution between the four types of medication errors ($p<0.0001$). **Conclusion:** In conclusion, medication errors play a major role in affecting the quality of health in our patients. The medication error rate was found to be 17.5%, which is high and should be managed in all the age groups. The results concluded from this study should be apparent and confirms rather than definitive.

**KEYWORDS:** Error, Medication error, Prescription error and primary health care centers.

## INTRODUCTION

Among the medical errors, medication errors are one type of error which is most common in affecting the iatrogenic injuries.[1] Medical error is a global health concern which costs billions of dollars per annum for the health care system.[2] Morbidity and mortality rates were increasing dramatically due to the medical errors. Compared to adults, children are more prone to medical errors due to medication dosing.[3] Around 1.5 million people are effected with the medication error throughout the year and majorly contributes the adverse events for the hospitalized patients. Earlier studies have reported the mistakes behind the errors and the common reason found to be not documenting the record for medical error.[4]

Saudi government constitution is obliging for implementing free healthcare services. The ministry of health provides health care services through primary health care centers throughout the kingdom.[5] In Saudi Arabia, the health care systems are managed by Ministry of Health with the high priority. The Saudi health care system ranks at 26th position as per WHO in the global world.[6,7] Quality of health care is a multidimensional concept and promotion of quality has always been an integral part of primary health care programs in the Saudi Arabia. The variations in quality of care is demanding in the kingdom of Saudi Arabia due to the rising cost for health services and public pressure for better services.[8] However, there is no record available in primary health care centers about the medication errors or prescribing errors, whereas, it is documented about 2-15% in the general hospitals.[9] The data on medication error has been under-reported in the Saudi Arabia specifically in the primary health care centers. In this study, we have engrossed on primary health care centers in order to explore and highlights the problems of medication errors. To address this deficiency, samples of prescription were

analyzed in various primary health care centers. The present study aims to determine the extent and causes of the medication errors are made in primary health care centers in the Saudi Arabia.

## METHODS

*Study design and setting*

The ethical approval for this study was received from general administration for researchers and studies at ministry of Health, Riyadh, Saudi Arabia. This was a prospective study implemented in ten primary care in the capital city of Saudi Arabia. There are five health care sectors located in the Riyadh City and each one is responsible for 15-30 primary health care centers. We have opted couple of primary health care centers from each health sector. The 10 primary health care centers are (i) Al-Rabwa, (ii) Gobira, (iii) Al-Urood, (iv) Al-Masif, (v) Al-Rawda, (vi) Al-Nassim Al-Sharqi, (vii) Bader-I, (viii) Bader-II, (ix) Al-Badiaa and (x) Dohra Al-Badiaa. This study was carried out for a shorter period of time starting from 21$^{st}$ January 2018-2$^{nd}$ February 2018. In this study, mainly we have documented the causes and types of medication errors in the selected primary health care centers with the help of the medication error form, which was certified from general administration of pharmaceutical care from Ministry of Health, KSA. This study included all of the prescriptions that were prescribed in the 10 PHCs, Visitors who do not have files in PHCs were excluded. In this study, finally, we have recruited 994 prescriptions from 10 primary health care centers.

***Study measurement***

In this study, qualified pharmacists were recorded the details of all the incidents that ensued during the process of dispensing with the medication error form, which consists of the information about the patients age, patient's diagnosis, medication name, medication class, dosage form, route of administration, package contain, type of error, cause of error, severity of error and the circumstances associated with the error. All the medication error was reviewed by tow of senior clinical pharmacists before the entry of the data.

***SPSS data***

All the data were entered into SPSS statistical software (version 21.0). Descriptive statistics such as frequencies and percentages were used to describe the categorical variables. Pearson chi-square tests was used to compare the distribution of 4 classes of medication error. P-value of <0.05was used to report the statistical significance. The 95% confidence intervals were calculated for the proportion of 4 classes of medication error.

## RESULTS

A total of 994 prescriptions were analyzed from 10 PHCs. Overall medication errors were found on 174 out of 994 prescriptions (17.5%). Out of 174 study subjects, 32(18.4%) were in the age group of 30-less than 50 years, 30(17.2%) were in the age group of 5-less than 10 years, 23(13.2%) were in the age group of less than 5 years. Most of the subjects (77.6%) have given medication in the form of tablet/capsule/ oral liquid towards their medication. And more than 50% of the medications contains bottle (59.8%) in the medication package(Table 1). The diagnosis was ascertained for all these subjects, which consists of URTI (14.4%), diabetes mellitus (6.9%) hypertension (5.7%), Asthma (6.3%), for both of Tonsillitis and Allergy (5.2%) and other diagnosis (42.5%)(Table 2). The distribution of drugs prescribed to the study subjects were Paracetamol 120mg/5ml syrup (11.5%), Loratidine10mg tablet (7.5%), Amoxicillin 250mg/5ml syrup (6.9%), Oral Rehydration Salt(ORS) sachet (6.3%), Chlorpheniramine 2mg/5ml syrup (5.2%) and more than 50% of them have been prescribed with other drugs(Table3). The drug class was noticed as antibiotics (20.7%), Analgesics (17.2%), antihistamine medications (15.5%) and 31.6% with other class of drugs (Table 4).

In this study, 13 type of medication errors were observed, in which 70 patients (40.2%) have been 'administered with wrong dose', 35(20.1%) with 'wrong frequency', 23 (13.2%) were 'not following warning advice when administering (eg. take with or after food),21(12.1%) with wrong dosage form, And the remaining subjects with other type of medication errors. The causes of medication errors were also observed, where the cause of "drug information missing" was found in 72(41.4%) patients, 48(26.6%) were with the cause of 'environmental, staffing or workflow problem'. 29(16.7%) were with the cause of 'inexperienced personnel', and 25(14.4%) were with clinical information missing (age, weight, allergy, vitals, Lab, pregnancy, diagnosis) (Table 5).

All the medication errors were classified into four classes (class A, class B, class C & class D), in which 88(50.6%) of the errors were of class B, 78(44.8%) of the errors were of class C, and 5(2.9%) were of class D and the data provides evidence of statistical significance in the distribution of 4 class of medication errors ($\chi 2$= 144.67, p<0.0001). That is there is highly statistically significant difference in the proportions of four classes of errors (Table 6).

The distribution of dosage form of medication in relation to the 4 classes of medication errors shows most the dosage form (tablet/capsule/oral liquid; cream/ointment/gel/paste; and other form dosages) related to the class B and class C medication errors. Very few dosage forms were related to Class A and Class D medication errors. Similar pattern of relation was observed between the route of administration and 4 classes of medication errors, where the "oral" route of administration was related to class B and class C medication error, and other route of administrations were also related to the class B and class C type of medication errors. All the 194 mediation errors were observed in 174 patients across the 10 PHC's. Out of these 10 PHC"s,

PHC 4 and PHC 7 had 27 patients each, and PHC 9 and PHC 10 had 24 & 23 patients each, whereas remaining PHC's had less than 20 patients. Among the 13 medication errors, all the 10 PHC's had "Wrong dose dispensed or administered" as medication errors in higher proportion of patients, followed by "Wrong frequency", ""Wrong dosage form" and 'not following advice when administering eg., take with or after food". The distribution of type of medication errors in relation to classification of medication errors indicates, approximately 165 out of 174 errors of Class B and Class C relates to most of the 13 type of medication errors, only 8 errors of Class A and Class D relates to very few of 13 type of medication errors.

Out of 10 PHC's, the highest number of medication errors were observed in PHC 4 (27 errors), PHC 7 (27 errors), PHC 9 (24 errors) and PHC 10 (23 errors). In PHC 4, 16 (59.3%) and 11 (40.7%) were classified as class B and class C medication errors, in PHC 7, 16(59.3%) and 11 (40.7%) were classified as class B and class C medication errors, in PHC 9, 12(50%) and 12 (50%) were classified as class B and class C medication errors and in PHC 10, 14(60.9%) and 9 (39.1%) were classified as class B and class C mediation errors. And in other PHC's also these two classes (B and C) of medication errors were observed (Fig.1).

**Table.1: Distribution of age groups, dosage form and package details (n=174),**

| Study variables | No.(%) |
|---|---|
| **Age groups** | |
| 1-less than 5 | 23(13.2) |
| 5- less than 10 | 30(17.2) |
| 10- less than 15 | 10(5.7) |
| 15- less than 20 | 5(2.9) |
| 20-less than 25 | 9(5.2) |
| 25- less than 30 | 8(4.6) |
| 30- less than 50 | 32(18.4) |
| 50-less than 55 | 17(9.8) |
| 55-less than60 | 8(4.6) |
| 60-less than 65 | 8(4.6) |
| 65-less than 75 | 3(1.7) |
| 75 -less than 85 | 3(1.7) |
| 85 and more | 2(1.1) |
| less than 1 year | 16(9.2) |
| **Dosage form** | |
| Tablet/Capsule/Oral Liquid | 135(77.6) |
| Cream/ointment/Gel/Paste | 8(4.6) |
| Aerosol/Inhalation/Drops | 22(12.6) |
| Injectable(IV/IM/ET/SC) | 1(0.6) |
| Suppository | 6(3.4) |
| Other | 2(1.1) |
| **Package contain** | |
| Unit dose | 69(39.7) |
| Bottle | 104(59.8) |
| Single dose vial/ampoule | 1(0.6) |

**Table.2: Distribution of patient's diagnosis.**

| Patient's diagnosis | No. | % |
|---|---|---|
| URTI | 25 | 14.4 |
| HTN | 10 | 5.7 |
| DM | 12 | 6.9 |
| Allergy | 9 | 5.2 |
| Asthma | 11 | 6.3 |
| Fever | 8 | 4.6 |
| Tonsillitis | 9 | 5.2 |
| Vaccination | 8 | 4.6 |
| Influenza | 8 | 4.6 |
| Others* | 74 | 42.5 |

*Abscess, Acne, Acute lymphadenitis, allergic conjectivitis, Arthritis, back pain, bronchitis, Clean Wound, colitis, common cold, Conjunctivitis, Constipation, Cough, Dermatitis, Diarrhea, dyspepsia, Ear wax, Eczema, folliculitis, fungal infection, Gastroenteritis, Gingivitis, Haemorroids, Headache, HTN/BA, Muscle pain, myalgia, otitis media, pharyngitis, Stomach Ulcer, tonsillitis, UTI, Vaginal infection, Vit D deficiency, Vomiting & worm infection

**Table.3: Distribution of Drug name.**

| Name of drug | No. | % |
|---|---|---|
| Amoxicillin 250 mg/5ml | 12 | 6.9 |
| Chlorpheniramine2mg/5ml | 9 | 5.2 |
| Chlorpheniramine2mg/pseudoephedrine30mg | 7 | 4.0 |
| Dextromethorphan15mg/5ml | 8 | 4.6 |
| Loratidine10mg | 13 | 7.5 |
| ORS | 11 | 6.3 |
| Paracetamol120mg/5ml | 20 | 11.5 |
| Salbutamol Inhaler | 7 | 4.0 |
| Others* | 87 | 50% |

*Amlodipine5mg, Aspirin 81 mg, Atenolol100mg, Augmentin156/5ml, Augmentin625mg, Azithromycin250mg, Betadine vaginal wash, Captopril 25 mg, Cephalexin, Chloramphenicol eye drops, Chlorpheniramine4mg, Clarithromycin250mg, Diclofenac gel, Diclofenac50mg, Diphenhydramine7mg/5ml, Doxycycline100 mg, Ear wax removal drops, Erythromycin250mg, Frusemide40 mg instead of losec40mg, Fucidine Ointment, Gentamycin ear drops, Gentamycin ointment, Glibenclamide5mg, Gliclazide30mg, Glycerin suppositories 900 mg, Gynomiconazole sup, Hydrochlorothiazide25mg, Hydrocortisone1%, Ibuprofen400mg, Insulin 20 iu, Mebendazole100mg/5ml, Metformin500mg, Metformin750mg, Metoclopramide 10 mg, Metronidazole125/5ml, Mouth Wash Chlorhexidine, Nystatin 100,000 iu susp, Omeprazole 40 mg, Paracetamol125mg sup, Ranitidine150mg, Saxagliptin 5mg, Seretide Inhaler, Tribenoside/lidocaine, Ventolin instead of voltaren, Vit D drops &Xylometazoline nasal drops.

**Table.4: Distribution of Drug class**

| Name of drug class | No. | % |
|---|---|---|
| Analgesics | 30 | 17.2 |
| Antibiotics | 36 | 20.7 |
| Antihistamine drugs | 27 | 15.5 |
| B2 agonist short acting | 7 | 4.0 |
| Cough suppressant | 8 | 4.6 |
| Nutrients | 11 | 6.3 |
| Others* | 55 | 31.6 |

*ACEI, Anthelmintic, Antiemetic, Antifungal drugs, Antihaemorroids, Antihistamine/Decongestant, Antiplatelet, Antiseptic, B2 agonist short acting, Beta Blockers, Biguanides, Ca Channel Blockers, Corticosteroids, Decongestant, Diuretics, DPP-4 Inhibtors, Ear drops, Expectorant, H2blocker, laxative, PPI, Regular insulin, Sulphonylurea & Vitamines.

**Table.5: Distribution of medication errors and its causes.**

| Outcome variables | No.(%) |
|---|---|
| **Type of medication errors(n=194)** | |
| Omission(yes) | 3(1.7) |
| Wrong dose dispensed or administered(yes) | 70(40.2) |
| Wrong patient (yes) | 1(0.6) |
| Given wrong medicine(yes) | 17(9.8) |
| Wrong dosage form(yes) | 21(12.1) |
| Wrong dose interval(yes) | 1(0.6) |
| Wrong strength/concentration(yes) | 16(9.2) |
| Wrong frequency(yes) | 35(20.1) |
| Wrong duration(yes) | 5(2.9) |
| Not following "warning" advice when administering e.g: take with or after food. (yes) | 23(13.2) |
| Prescribed or administrated of a medicine to the resident has a known allergy. (yes) | -- |
| Dispensed or administrated an expiry date medicine(yes) | 1(0.6) |
| Un-prescribed medicine-dispense or administrate authorized medicine to a patient(yes) | 1(0.6) |
| **Causes for medication errors(n=191)** | |
| Clinical information missing (age, weight, allergy, vitals, lab, pregnancy, diagnosis) | 25(14.4) |
| Drug information missing (outdated/absent references, inadequate computer screening, uncontrolled drug formulary) | 72(41.4) |
| Lack of policy or Failure to adhere to work procedure | 2(1.1) |
| Inexperienced personnel | 29(16.7) |
| Sound alike medication | 1(0.6) |
| Miscommunication of drug order (illegible Rx, ambiguous, incomplete, misheard order, misunderstanding, intimidation) | 2(1.1) |
| Stock arrangement/ storage problem (doses missing or expired, multiple concentrations, placed in the wrong bin) | 5(2.9) |
| Wrong labeling/ instruction on dispensing envelope or bottle/container | -- |
| Environmental, staffing or workflow problem (lighting, noise, clutter, interruption. staffing deficiency, workload, employee safety) | 48(26.6) |
| Look alike medication/packaging | 4(2.3) |

**Table .6 Distribution of Class of medication errors (n=174).**

| Class of medication error | No(%) | 95% Confidence interval for % | $X^2$-value | p-value |
|---|---|---|---|---|
| Class A | 3(1.7) | (0.35,4.92) | 144.67 | <0.0001 |
| Class B | 88(50.6) | (42.91,58.22) | | |
| Class C | 78(44.8) | (37.34,52.56) | | |
| Class D | 5(2.9) | 0.95,6.61) | | |

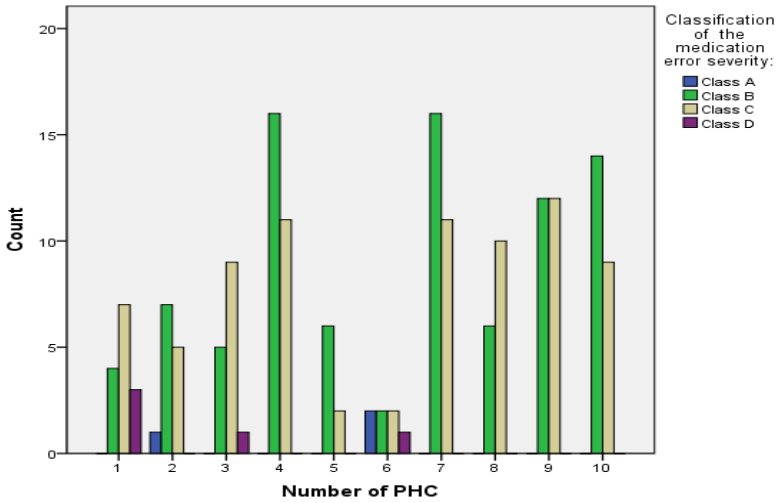


**Fig.1: Distribution of classification of medication errors severity in relation to PHC'.**

## DISCUSSION

Medication error is defined as any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient or consumer. Such events may be related professional practice, health care products, procedures, and systems, including prescribing, order communication, product labelling, packing and nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use.[10, 11] Medications are offered by physicians, clinicians, and healthcare services throughout the global world. There are many studies have been documented the medication errors in the hospitals but little information has been documented in the primary health care centers.[12]

The current study recruited the 994 prescriptions from the ten primary health care center in the capital city of the Saudi Arabia. The overall medication error rate was found to be 17.5% from the 994 prescriptions involved in this study, among which 32 (18.4%) the highest medication errors occurs in the age range of 30-50 years of age. More than 77% of the medication in this study were in the form of either tablet, capsule or in the oral liquid form. Among 40.2% of patients, 13 types of medication errors were documented with improper dose. The missing of drug information was found in 41.4% of patients, which is the causes of medication error, 26.6% of the patients were with the cause of workflow problem/environmental staffing. The inexperienced personnel causes were occurred in 16.7% and remaining 14.4% were occurred with the missing of the clinical information. The dosage distribution of medication error is divided into four categories such as A, B, C and D. The class A of medication error is found to be 1.7%, B is 50.6%, C is 44.8% and D is 2.9%. The statistical data provides the significant distribution between the four types of medication errors ($p<0.0001$).

The prevalence of medication error varies in the global population such as in UK, the prescription error rate was found to be 5%[13], whereas, in Sweden the error rate was 42%[14], and 18.7% was appeared in Saudi Arabia.[15] A study from Mexico has documented the 58% of prescription rate error.[16] Limited domestic studies have been documented within the kingdom of Saudi Arabia.[17-20]

A prior study by Chua et al[21], concluded the results that near misses happened six times more often than dispensing errors, pointing the importance of final checking in pharmacies[21] compared with 50.6% of class medication errors was near miss (Class B which is Actual Error-did not reach patient) in the current study followed by 44.8% of the errors were of class C.

In general, dosing errors are the most frequent type of medication error in pediatric population. Overdoses generally appears more in number than under-doses.[22-24] In this study, Wrong dose dispensed or administered were the first common type of error where the paracetamol syrup 120mg/5ml was the most drug dispensed with wrong dosing, second was wrong frequency and the third was not following warning advice when administering (eg. take with or after food). In a study showed that incorrect dose as the most common types of MEs, then, administering the incorrect drug to patient, and the third was wrong route of administration.[25] On the other phase, a different study showed wrong drug was considered as the most common type of MEs, then wrong dose, while the last one was omission or missing dose.[26] As Folli stated[27], pediatric patients and pediatric ICU patients received the greatest proportion of errant orders. In this study, children were at the highest risk of errors, 30.4% of all errors were in children less than 10 years old. This study showed that the most common medication category involved in MEs was antibiotics agents, and the result was consistent with other study which reported that anti-infective medications was the main common medication category.[28] However, two different studies found that

anti-infective agents were the second category involved in MEs.[25, 26]

The most common causes of MEs in our study were drug information missing (41.4%) followed by the cause of 'environmental, staffing or workflow problem (26.6%) which was similar to other study.[28] Alternative study showed that the most common causes of errors were performance and knowledge deficits (44%) and communication errors (15.8%).[25]

**Limitations**

The current study includes handful limitations. First, the study was only carried out in 10 PHCs that are not identical representative of other primary health care centers in Saudi Arabia. Therefore, research findings cannot be generalized. Second, the study period was 2 weeks which is considered to be a short period.

**Recommendations**

1. The occurrence of medication errors in Primary health care centers was significantly high. Dosing errors were the most common type of error, followed by the wrong frequency. Approximately, one third of the errors occurred in children.
2. Increase the awareness of MEs of health care practitioners, intensive educational and training courses in pharmacotherapy for practitioners are required
3. MOH should help PHCs in the development of preventive strategies as a means to safely provide medications, encourage reporting of medication errors, eliminate obstacles to reporting medication errors, and make an environment of medication safety for all primary health care centers patients.
4. broad-based studies are required to define the extent and results of medication errors in PHCs in Saudi Arabia.
5. In conclusion, medication errors play a major role in effecting the quality of health in our patients. The results concluded from this study should be apparent and confirms rather than definitive. Apart from this, current study has applied a particular classification system for prescription errors.

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