Research Paper

Prescribing Errors in Prescription Orders Containing Non-steroidal Antiinflammatory Drugs: A Comparative Study in Different Hospitals of District Khairpur, Sindh, Pakistan

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Prescribing errors are one of the leading causes of diminished therapeutic outcomes even resulting in treatment failures. The Present study is a comparative evaluation of prescribing errors in non-steroidal antiinflammatory drugs containing prescriptions in four different health care facilities of District Khairpur, Sindh, Pakistan, since these drugs are among the widely-misused drugs. A total of 479 prescriptions, which were written in the primary health care facilities, public hospitals, university hospital and private hospitals were collected, compared and analysed for common omission and commission prescribing errors as per prescription writing guidelines/parameters established by the World Health Organization, The drug information book and the British National Formulary. Only 21 (4.4%) prescriptions consisting of 9 prescriptions of the university hospital and 12 prescriptions of the private hospitals were found error free and the rest 458 (95.6%) prescriptions from different health care facilities contained different types of omission and commission errors. In omission errors, patient diagnosis, registration number of the prescriber and duration of therapy was missing in 84, 88.9 and 82.8% prescriptions, respectively. Among commission errors, 85.2% of prescriptions were ambiguously written. A significant percentage of these errors were found in routine practice. As compared to all health care facilities, it was alarmingly found that, more number of prescribing errors were found in prescriptions of primary healthcare facilities followed by public hospitals followed by the university hospital and least number of prescribing errors were found in prescriptions of private hospitals. Computerized physician order entry and continuous educational training programs for prescribers to be executed in order to decrease these vital prescribing errors, besides that evaluation of prescriptions by pharmacists for prescribing errors can diminish the magnitude of these grave and life threatening errors.

Key words: Comparison of prescribing errors, Khairpur, NSAIDs, medication errors, outpatients prescriptions

A prescription is a written request or an order to a pharmacist by a physician, veterinarian, dentist or any other properly registered medical practitioner for medications[1]. Prescriptions are requests for drugs or medications prescribed by legally qualified prescribers. Drugs are mainly classified into two legal categories, i.e., prescription drugs or legend drugs, and non-prescription drugs or over the counter (OTC) drugs[2]. Prescriptions are very important because they become a medico-legal document once they are signed by the legal prescribing authority and thus they are mandatory to be written completely, legibly and also free of error[3]. The legal requirements for writing a standard prescription differ from region to region.

Generally a prescription should include (a) name, qualification, contact number, address, registration number and signature of the prescriber, (b) name, gender, age, weight and diagnosis of the patient, (c) original brand or generic name of drugs, dosage form, strength, frequency, dose, duration of therapy, quantity of drug to be dispensed and (d) date, directions for use, and specific cautions required to be taken for use[3,4]. The prescriber is not always a doctor but can also

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be a paramedical staff such as a medical assistant, a technician, a midwife or a nurse. The dispenser is not always a pharmacist but can be a pharmacy technician, a pharmacy assistant or a nurse. Each country has its own standards for the minimum information required to include in the prescription and its own laws and regulations to define which drugs require a prescription and who is eligible to prescribe. Medication errors are the errors resulting in inappropriate use or while the medication is in the control of health care professionals and patients[5]. Medication errors may be committed by both experienced and inexperienced professionals including pharmacists, doctors, nurses, supportive personnel (e.g., pharmacy technicians), students, clerical personnel (e.g., ward clerks), administrators, drug manufacturers, patients and their caregivers and others. The occurrence of medication errors is unknown; valid comparisons of different studies on medication errors are extremely difficult because of differences in variables, measurements, populations and methods[6]. Prescribing error is an error that occurs as a result of a prescribing decision or that the in process of prescription writing, which might result in an accidental significant reduction in the therapeutic outcome of treatment and might also increase the risk or harm[7]. Prescribing errors can be classified into two main groups: a) omission errors which include those errors in which there is incomplete or missing information in the prescription as well as prescriptions, which are unreadable and prescriptions that do not conform to legal requirements and b) commission errors, which include incorrect or wrongly written information in the prescription[8,9].

A survey conducted in Italy found a high frequency of drug prescription errors and reported that 25% of prescriptions were incomplete and written ambiguously, 23.9% of prescriptions were not readable and information was incomplete or missing in 29.9% of prescriptions[10]. Another study was conducted in a hospital in New York State; the authors stated that about 402 common types of dosage form prescribing errors were mainly related to cardiovascular drugs.

The factors related to errors of these dosage forms include: insufficient caregivers and lack of knowledge of the patient, puzzling and inconsistent nomenclature, ignorance of the safety in medicine preparation and packaging design, product marketing and insufficient health care system processes to safeguard patients[11]. Prescription errors may lead to serious morbidities and mortalities. In another study from a teaching hospital, it was found that 23.7% of the patients were affected due to prescribing of contraindicated drugs and adversely interacting drugs, and in total 1.9% of prescriptions were potentially hazardous[12]. In a study conducted on prescription errors in 24 critical care units in United Kingdom, errors were found in 3141 (15%) of the prescriptions in a total of 21 589 prescriptions; among those errors, 916 (19.6%) were classified as potentially life threatening errors[13]. Further prescription errors may also lead to increment in cost of the therapy. Another study conducted in February 2000 evaluated 3540 prescription orders during a period of one week of interventions done by pharmacy staff aid in the investment of EUR 9867. They observed that 351 (9.9%) prescriptions contain prescribing errors[14]. In another study, investigators compared the risk of cardiovascular disease occurring in users and non-users of NSAIDs, concentrating on three commonly used drugs: diclofenac, naproxen and piroxicam. They observed that there is consistent increased risk of cardiovascular diseases in users of NSAIDs over non-users, and all three drugs had a higher risk of cardiovascular events[15]. Another study, published in September 2001, revealed that there is a 4.1 times increase in the risk of developing upper gastrointestinal problems if the NSAIDs are not used properly[16]. Similar type of study was also reported by Thomas *et al.*[17], which showed that patients who were using NSAIDs developed gastrointestinal side effects two fold more often (19.6%) as compared to a control group (9.5%).

NSAIDs are reported to cause serious cardiovascular and gastrointestinal problems, which can be decreased with proper and rational use. Many studies regarding prescribing errors are conducted worldwide, but unfortunately in Pakistan, data on prescribing errors is not well documented in literature and to the best of our knowledge not even a single study on comparative study of prescribing errors in prescription orders containing NSAIDs had been conducted ever in the district Khairpur. The aim of this study is to compare the extent of prescribing errors in prescription orders containing NSAIDs in different health care facilities of district Khairpur in order to improve rational prescribing and to decrease cardiovascular and gastrointestinal problems associated with improper use of NSAIDs.

MATERIALS AND METHODS

A total of 479 prescription orders containing NSAIDs from different health care facilities were collected

and compared for extent of prescribing errors. The prescriptions written out in various health care facilities including primary health care facilities (PHCFs), public hospitals (PHs), university hospital (UH) and private hospitals (PTEHs) in district Khairpur were collected, compared, reviewed and recorded by registered pharmacists on already pre-designed pro-forma and divided into two main error categories, i.e. omission errors and commission errors. Once all prescriptions were recorded and then compared and analysed for identifying errors as per prescription writing guidelines/parameters established by the World Health Organization[3], Authenticated drug references drug information book[18] and the British National Formulary (BNF)[19]. Among omission errors, important information related to the patient i.e., name, weight, diagnosis, and information related to prescriber i.e., name, qualification, signature and information related to drug i.e., dose, dosage form, strength were analysed and compared in different type of hospitals. Among commission errors, information related to incorrect dose, incorrect strength and incorrect frequency was also compared and identified. Furthermore, in our study information related to drug i.e., generic name, strength, dose, dosage form, frequency, direction of use was only limited to NSAIDs, since NSAIDs are misused widely[16]. Prescriptions for drug-drug interactions were evaluated by using the Micromedex.2.0. Drug-Reax database[20].

Data analysis:

Microsoft office 2010 and SPSS version 20.0 was used for comparison analysis and results of these prescribing errors are shown in percentage.

RESULTS AND DISCUSSION

A total of 479 prescription orders containing NSAIDs were collected, the data of each prescription on pro-forma was recorded and compared for extent of prescribing errors and analysed retrospectively. Of the 479 prescriptions, 153 (32%) in PHCFs, 107 (22.3%) in PHs, 106 (22.1%) in UH and 113 (23.6%) in PTEHs were written out. All prescriptions were assessed for the existence of vital elements to be present in the manually written prescription orders. All parameters were important to include while writing the patient prescriptions. Only 21 (4.4%) prescriptions, 9 prescriptions of the UH and 12 prescriptions of PTEHs were found error free and the remaining 458 (95.6%) prescriptions contained different types of errors and 458 prescriptions containing errors were further evaluated and compared in detail. This prevalence rate of error free prescriptions agrees with Shumaila *et al.*[21], who reported that only 4.5% of prescriptions contained no errors. In the present study, we found that the patient diagnosis was not mentioned in a total of 84% prescriptions, while compared to all health care facilities, missing to mention diagnosis was the highest in prescriptions of PHCFs (98.7%) and lowest in (39.6%) prescriptions of PTEHs. Shumaila *et al.*[21] reported that in 86% of prescriptions, the diagnosis was absent and our findings were higher than those obtained in studies by Shagufta *et al.*[22] and Ghoto *et al.*[23]. These authors reported that 75.9 and 69.58% of prescriptions respectively were missing the patient diagnosis. Patient weight, patient age, and patient sex were not written in 83.2, 60 and 52.4% of prescriptions, respectively in total. Regarding patient age and sex, the results of this study agreed to those reported by shagufta *et al.*[22], who reported that 57.2 and 61.3% prescriptions were missing the age and sex, while Phalke *et al*.[24] reported 11 and 10% and Ghoto *et al.*[23] reported 25.17% and 44.05% prescriptions respectively had not mentioned the age and sex. While compared to all health care facilities, missing of patient weight, patient age and patient sex was highest in prescriptions of PHCFs (99.3, 98, and 92.8%, respectively) and patient weight, patient age and patient sex was lowest in (43.6%) prescriptions of PTEHs, (7.5%) prescriptions of PHs and (6.2%) prescriptions of UH, respectively. Shumaila *et al.*[21] and Mugoyela and Mwita[9] also reported that in 83.9 and 93.8% prescriptions, respectively the weight of the patient was not mentioned. The same findings also agreed with those reported by Phalke *et al*.[24] and Irshaid *et al.*[25]. The name of the patient was mentioned in the majority of prescriptions (97.4%), being highest in (99%) prescriptions of PTEHs and lowest in (96.1%) prescriptions of PHCFs as reported by Shagufta *et al.*[22], Phalke *et al.*[24] and Irshaid *et al.*[25], which was similar to our findings regarding the presence of the name of patients in prescriptions. They reported that 96.5, 97 and 94.6% of prescriptions respectively contained the name of patient as shown in Table 1.

Prescriber's information is also one of the most important elements to be mentioned in standard prescriptions. Non-compliance of mentioning prescriber's information was quite high, for example the registration number, qualification, name, telephone number and address were found missing in 88.9, 87.1, 53.9, 41.3 and 34.3% of prescriptions respectively in all health care facilities. While compared to all health care facilities, missing of registration number, qualification

and name was highest in prescriptions of PHCFs (100, 100 and 87.6%) and lowest in prescriptions of PTEHs 57.4, 60.4 and 8.9%, respectively. Missing of telephone number and address was highest in prescriptions of PHs (85 and 93.7%) and lowest in prescriptions of PTEHs (4%) and UH (10.3%), respectively. Our findings agreed with those reported by Shumaila *et al.*[21], who also reported that 94.5 and 93.7% of prescriptions were missing the registration number and qualification. Our results of missing information about telephone number (41.3%) and name of prescriber (53.9%) were lower than the 76.5 and 68.7% reported by Shumaila *et al.*[21]. While in 89.7% prescriptions of all health care facilities, the signature of the prescriber was present, being highest and lowest in PHs (96.3) and PTEHs (86.1%), respectively. Our findings agree with those reported by Shumaila *et al.*[21], they reported that 11.3% prescriptions contained no signature while Sapkota *et al.*[26] reported that 28% prescriptions were missing signatures of prescribers (Table 2).

Drug information is a key part of the prescription. It is mandatory to properly mention drug information in prescriptions, otherwise life threatening adverse effects could occur. In the present study, large numbers of deficiencies regarding drug information were found in a majority of prescriptions. Duration of therapy was not mentioned in 82.8% of prescriptions, being highest and lowest in PHCFs (98.7) and PTEHs (44.6%), respectively, since usage of NSAIDs for longer duration can cause serious gastric irritation and drug-induced injuries. Banks *et al.*[27] reported that hepatotoxicity was apparent in 24% of patients after 1 mon, in 63% of patients by 3 mon and in 85% of patients by 6 mon after starting using diclofenac. Other important information, such as the strength, frequency and dose, were not mentioned in 59, 25.5 and 24.9% prescriptions, respectively. As many as 78.4% prescriptions were missing the information regarding direction for use of NSAIDs and similar results (74.9%) were reported by Shumaila *et al.*[21]. Likewise, Phalke and coworkers reported that this error is lower (45.9%) than us. Patients needed proper directions for using NSAIDs, since these drugs could be harmful if used on an empty stomach. These harmful consequences can be avoided by administrating these drugs with food. Mentioning of strength of drug is very vital for desired efficacy, since many strengths of same even brand name or generic name are available on market i.e., Brufen 200, 400, and 600 mg. Our findings regarding missing of strength of drugs in prescriptions corresponded to those reported by Shumaila *et al.*[21], which was 67.3% in contrast to those results (3.6%) reported by Stubbs and Taylor[28]. Dose determines efficacy of drug and very surprisingly these details were also found missing in 24.9% prescriptions. Missing of Direction to use, strength and dose were highest in prescriptions of PHCFs (97.4,

TABLE 1: INFORMATION OF PATIENT IN PRESCRIPTIONS

Information of patient	PHCFs		PHs		UH		PTEHs		Total	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Name	6 (3.9)	147 (96.1)	3 (2.8)	104 (97.2)	2 (2.0)	95 (98.0)	1 (1.0)	100 (99.0)	12 (2.6)	446 (97.4)
Weight	152 (99.3)	1 (0.7)	101 (94.4)	6 (5.6)	84 (86.6)	13 (13.4)	44 (43.6)	57 (56.4)	381 (83.2)	77 (16.8)
Diagnosis	151 (98.7)	2 (1.3)	105 (98.1)	2 (1.9)	89 (91.8)	8 (8.2)	40 (39.6)	61 (60.4)	385 (84.1)	73 (15.9)
Gender	142 (92.8)	11 (7.2)	78 (72.9)	29 (27.1)	6 (6.2)	91 (93.8)	14 (13.9)	87 (86.1)	240 (52.4)	218 (47.6)
Age	150 (98.0)	3 (2.0)	8 (7.5)	99 (92.5)	74 (76.3)	23 (23.7)	43 (42.6)	58 (57.4)	275 (60.0)	183 (40.0)
Total	153		107		97		101		458	

TABLE 2: INFORMATION OF PRESCRIBER IN PRESCRIPTIONS

Information of prescriber	PHCFs		PHs		UH		PTEHs		Total	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Name	134 (87.6)	19 (12.4)	54 (50.5)	53 (49.5)	50 (51.5)	47 (48.5)	9 (8.9)	92 (91.1)	247 (53.9)	211 (46.1)
Address	23 (87.6)	130 (12.4)	100 (93.5)	7 (6.5)	10 (10.3)	87 (89.7)	24 (23.8)	77 (76.2)	157 (34.3)	301 (65.7)
Telephone number	53 (34.6)	100 (65.4)	91 (85)	16 (15)	41 (42.3)	56 (57.7)	4 (4)	97 (96)	189 (41.3)	269 (58.7)
Registration number	153 (100)	0 (0)	107 (100)	0 (0)	89 (91.8)	8 (8.2)	58 (57.4)	43 (42.6)	407 (88.9)	51 (11.1)
Qualification	153 (100)	0 (0)	107 (100)	0 (0)	78 (80.4)	19 (19.6)	61 (60.4)	40 (39.6)	399 (87.1)	59 (12.9)
Signature	12 (7.8)	141 (92.2)	4 (3.7)	103 (96.3)	17 (17.5)	80 (82.5)	14 13.9)	87 (86.1)	47 (10.3)	411 (89.7)
Total	153		107		97		101		458	

91.5 and 56.2%, respectively) and lowest in PTEHs (19.8, 4 and 4%, respectively). While missing of frequency was highest and lowest in prescriptions of UH (84.5 %) and PHs (5.6%), respectively. In most of the prescriptions, brand names (89.7%) were present, being highest and lowest in prescriptions of PTEHs (98 %) and UH (60.8%), respectively as shown in Table 3.

Generally, commission errors have been more important and might lead to life threatening consequences to the patient if ignored. Among commission errors, which are life threating, it was found that 85.2% prescriptions were with ambiguous order, which might result in fatal and serious problems. Shumaila *et al*.[21] reported this error in 77.7% of prescriptions and our results were in contrast to the 15% observed by Makonnen *et al.*[29]. Prescriptions with ambiguous order were highest and lowest in PHCFs (94.1%) and PTEHs (74.3%). Ambiguous or nonstandard abbreviations of drug names were also high, and we found the same error in 40% of prescriptions, which can result in very serious and fatal adverse effects. Our findings were found to be similar to those reported by Shumaila *et al.*[21]. They found 37.6% but Sapkota *et al.*[26] observed the same error in only 11.76% of prescriptions. Prescriptions mentioning dose, dosage form, strength, duration of therapy and frequency of use, were further evaluated for commission errors. Incorrect dose may also lead to failure of drug treatment i.e., under dosage may not produce desired effects and over dosage may cause serious toxic effects. In our study we found that 14.4% prescriptions had incorrect doses mentioned and incorrect dosage form was also quite high in 19.4% prescriptions. Correct frequency of drug is also very important in maintaining therapeutic concentration of drug in plasma, and correct frequency of drug was mentioned in 98.1% of prescriptions. During the writing of prescription, the prescriber must be careful about drug-drug interactions, because if they are not properly considered, these may not result in reduced therapeutic outcomes but it can result in death of the patient. Drug-drug interactions were found in 20.1% prescriptions and same results (19.5%) about this error reported by Shumaila *et al.*[21]. Mentioning of incorrect strength (10%) and duration (9.6%) of therapy was also high enough and noticeable. Comparison of commission errors among different health care facilities is presented in Table 4.

Results of the present study suggested that there were significant amount of prescription errors occurring routinely in out-patient clinical settings on a daily basis, which can be very serious or even fatal and same can be easily minimized if properly managed. It was also noticed that large number of omission errors and commission errors were found in PHCFs followed by PHs followed by UH and least number of prescribing errors were found in prescriptions of PTEHs. These errors were not only significantly affecting the therapeutic outcomes of treatment but also increasing the unnecessary cost expenditures and most of the errors were related to missing or incorrect information relating to the patient, prescriber and drug. Incorrect or missing information in prescriptions can easily cause incorrect dispensing, incorrect administration of medicine, drug abuse and drug interactions. We recommended that implementation of multiple strategies like electronic prescription writing system

TABLE 3: INFORMATION OF DRUG IN PRESCRIPTIONS

Information of drug	PHCFs		PHs		UH		PTEHs		Total	
	Absent	Present	Absent	Present	Absent	Present	Absent	Present	Absent	Present
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Brand name	4 (2.6)	149 (97.4)	3 (2.8)	104 (97.2)	38 (39.2)	59 (60.8)	2 (2)	99 (98)	47 (10.3)	411 (89.7)
Direction of use	149 (97.4)	4 (2.6)	104 (97.2)	3 (2.8)	86 (88.7)	11 (11.3)	20 (19.8)	81 (80.2)	359 (78.4)	99 (21.6)
Dose	86 (56.2)	67 (43.8)	7 (6.5)	100 (93.5)	17 (17.5)	80 (82.5)	4 (4)	97 (96)	114 (24.9)	344 (75.1)
Dosage form	44 (28.8)	109 (71.2)	12 (11.2)	95 (88.8)	3 (3.1)	94 (96.9)	2 (2)	99 (98)	61 (13.3)	397 (86.7)
Duration of therapy	151 (98.7)	2 (1.3)	99 (92.5)	8 (7.5)	84 (86.6)	13 (13.4)	45 (44.6)	56 (55.4)	379 (82.8)	79 (17.2)
Frequency of drugs	10 (6.5)	143 (93.5)	6 (5.6)	101 (94.4)	82 (84.5)	15 (15.5)	19 (18.8)	82 (81.2)	117 (25.5)	341 (74.5)
Strength, if more than one available	140 (91.5)	13 (8.5)	59 (55.1)	48 (44.9)	67 (69.1)	30 (30.9)	4 (4)	97 (96)	270 (59)	188 (41)
Total	153		107		97		101		458	

TABLE 4: INFORMATION OF COMMISSION ERRORS IN PRESCRIPTIONS

Commission errors	PHCFs	PHs	UH	PTEHs	Total
	Present	Present	Present	Present	Present
	n (%)	n (%)	n (%)	n (%)	n (%)
Ambiguous order	144 (94.1)	89 (83.2)	82 (84.5)	75 (74.3)	390 (85.2)
Incorrect dose	42 (27.5)	15 (14)	3 (3.1)	6 (6)	66 (14.4)
Incorrect dosage form	57 (37.2)	14 (13.1)	15 (15.5)	3 (3)	89 (19.4)
Incorrect strength	33 (21.6)	7 (6.5)	4 (4.1)	2 (2)	46 (10.0)
Incorrect duration of therapy	1 (0.7)	4 (3.7)	7 (7.2)	32 (32)	44 (9.6)
Ambiguous or nonstandard abbreviations of drug names	101 (66)	55 (51.4)	24 (24.7)	3 (3)	183 (40.0)
Incorrect spellings	44(85.2)	9 (8.4)	2 (2.1)	1 (1)	56(12.2)
Interaction of other drugs with NSAIDs in prescriptions	66 (28.8)	14 (13.1)	9 (9.3)	3 (3)	92(20.1)
Incorrect frequency	5 (3.3)	2 (1.9)	2 (1.2)	2 (2)	9 (9.1)
Total	153	107	97	101	458

or computer physician order entry (CPOE), continuous educational programs and training for all health professionals especially prescribers for improving the prescriptions writing guidelines/standards can significantly pay on minimizing of prescribing errors. Most of the institutions are already using computerized physician order entry systems and they observed that a significant proportion of errors were eliminated. The intervention of registered pharmacists can also play an important role in reducing and preventing these errors by evaluating the prescriptions.

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Conflict of interest:

The authors declare no conflicts of interest.

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