

# Incidence of medication error associated with the use of beta-blockers in Pakistan

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**Abstract:** Medication errors (ME) are human errors, which are very frequent in cardiovascular patients and result in patient morbidity and mortality. This study was focused to evaluate the quality of prescriptions and to emphasize the placement of clinical pharmacist in health care team. This study was carried out in different outpatient settings of (in) Karachi, Pakistan. The study period was June'2011 till June'2012. Retrospective data was analyzed for the outpatients' prescription of beta blocker drugs. During the study, prescriptions (n=450) were collected from different outpatient settings of (in) Karachi, Pakistan. Prescription containing beta-blockers were analyzed for the essential elements to be mentioned in prescription. Drug-drug interactions were identified by the Micromedex.2.0 Drug-Reax database and severity of medication error was determined by NCCMERP Index. A total of 1627 medication errors were identified in 450 prescriptions. The most frequent error was not mentioning the patient's weight (95%), followed by missing diagnosis (79.4%) and drug-drug interactions (69.5%). Twenty-two prescriptions were placed in the most severe category I (4.88%). Average number of drugs per prescription was 4.76. Significant difference was observed ( $\chi^2=52.418$ ,  $p<0.05$ ) using SPSS 19 for those prescription orders having more than 5 drugs with Beta-blockers. This indicates that the errors in prescription such as drug-drug interactions, wrong dose etc. was significantly increased with the number of drugs per prescription. Results showed that medication errors are very frequent in prescription written in outpatient setting of various hospitals and clinics in Karachi. This shows that the irrational prescribing is a common practice in developing countries. Placement of skilled pharmacist in the health care system is the only solution for avoidance of these medication related problems.

**Keywords:** Medication error, prescriptions, clinical pharmacist, outpatient, health care system, Pakistan.

## INTRODUCTION

Prescription is a request for drugs or medications prescribed by legally qualified prescribers. Medications are classified into two legal categories, i.e. prescription drugs or legend drugs and non-prescription drugs or (over the counter drug) OTC drugs (Scott, 2005). In several developing countries, studies are conducted to show the irrational and or illogical (or illogical), with many inappropriate prescribing and dispensing practices. These include incomplete prescriptions, drug-drug interactions, wrong dose and poly-pharmacy (Awad *et al.*, 2006; Eltayeb *et al.*, 2005; Quick *et al.*, 2002). It is necessary to introduce the pharmaceutical care in developing countries to aid in solving the problems related to medication (Farris *et al.*, 2005). Medication errors are the errors, leading to inappropriate use or harm while the medication is in the control of health care professional and patients (NCCMERP, 1995).

Occurrence of one or more ME is a daily matter in hospitals and clinics, including omission error, wrong dose error, and wrong route error. Safe use of medications is thus, administration of a drug following right instructions to the right patient at right time using right route at right site with right rate in a right dosage form with right technique. The most common factor(s)

contributing in occurrence of ME are related to administration, personnel, techniques, facility, To avoid administration related factors, hospitals and clinic administration must have clear-cut policies regarding drug use. Lack of pharmacists in critical areas as well as involvement of non-professional personnel in areas requiring professional judgment may be the factor resulting in ME. These occur during the medication process and shows the risk factors in most clinical practices for ADR (Adverse drug reaction) is a major health concern (Bond *et al.*, 2001; Cox *et al.*, 2001; Leape *et al.*, 1998; Lesar *et al.*, 1997). ME can cause Adverse drug reactions, which lead to the total risk of the different diseases. These ME not only harm the treatment outcome but also increase the cost of treatment.

In the outpatient settings or practices, the use of drug and its adverse effect have not been well monitored. Drug-drug interaction, drug-food interaction and other chemical agents can change the therapeutic effect of medicines. In one study it was concluded that in outpatients setting the ME were abundant and related with patients taken 10.9 medication and they have (32%) adverse effects (Friedman *et al.*, 2007). These errors were more prevalent in outpatient setting because more procedures take place and these procedures have not been well monitored (Lapetina and Armstrong, 2002).

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There are many possibilities of ME or potential ADRs in cardiovascular patients. Cardiovascular medications have been known as the most common classes of drugs associated with medication errors and ADRs. The study was conducted on a cardiology clinics, the greater tendency for using cardiovascular drugs possibly increased the ME or potential ADR rate. The retrospective approach to identifying medication errors in cardiovascular patients used in our study and the severity of ME was also investigated to observe the risks of patient harm. The clinical pharmacist was precisely skilled in cardiovascular medications and also participated in health care team including physicians and nurses on cardiology departments or settings. This involvement of pharmacist in the team allowed him to evaluate a large number of prescriptions for ME or ADRs and can positively impact on the avoidance of these ME to improve patient safety (Guchelaar *et al.*, 2005). MEs ultimately lose the confidence of patients on the health care system of the society. However, data regarding ME in Pakistan (Khowaja *et al.*, 2008; Shawahna and Rahman, 2008; Shiwani and Gadit, 2011) has (been) reported in literature but it is not very established especially regarding prescription with beta-blockers. This study was first in the country, focused to evaluate the quality of prescriptions of cardiovascular patients and to emphasize the placement of clinical pharmacist in health care team.

#### ***Aim of the study***

The aim of this study was to determine the incidence of ME in outpatients taking beta-blocker drugs. This will endorse the placement of clinical pharmacist in the health care team to prevent these medication related problems before occurring and to resolve problems that already exist as they are the highly trained & skilled health professionals.

## **MATERIALS AND METHODS**

#### ***Collection of prescription***

This study was carried out in different outpatient settings in Karachi where prescriptions containing beta-blocker drugs were collected and analyzed: The study period was June 2011 to June 2012. Prescriptions were analyzed for the essential elements to be included in the prescription order (BNF, 2000; De-Vries, 1995; Lacy *et al.*, 2001; Lofholm and Katzung, 2001) and the data was recorded.

#### ***Criteria for analysis of prescriptions***

Executing a safe and effective prescription order require communication of complete information to all anticipated readers. A complete order should contain at a minimum: patient name, patient specific data, generic and brand name of drug, medication strength in metric system, dosage form, amount to be dispensed in metric units, complete indication for use, including route of administration, duration, dosing, frequency, medication

purposes and number of authorized refill (Smith and Enright, 2005).

#### ***Checking of prescriptions***

Each prescription was checked once for identifying any medication error & then for the possibility of a drug-drug interaction in the prescription by the Micromedex.2.0. Drug-Reax database (DRUG-REAX, 2005).

#### ***NCCMERP Index for categorizing medication errors***

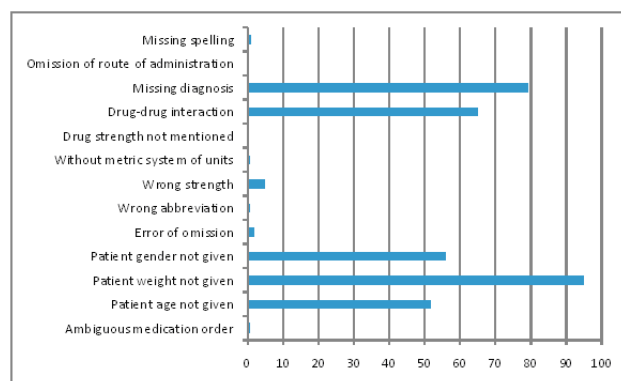
NCCMERP Index used for categorizing medication errors in beta-blocker prescriptions. Prescriptions with ME were classified from Category A: Event that have capacity to cause error, Category B: an error occurred but did not reached the patient, Category C: an error occurred that reached the patient but did not cause harm, Category D: an error occurred that reached the patient and required intervention to preclude harm, Category E: An error that may resulted in temporary harm, Category F: An error that may cause temporary harm and required hospitalization, Category G: an error that cause permanent harm, Category H: an error that required intervention to sustain life and Category I: An error that result in patient's death.

## **STATISTICAL ANALYSIS**

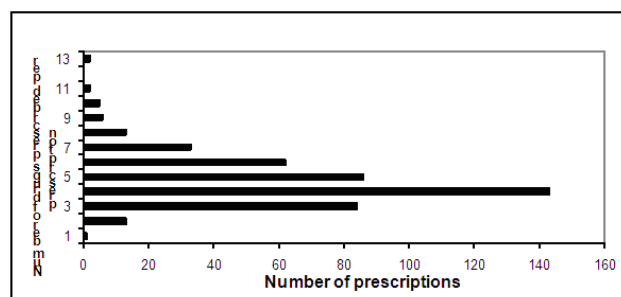
Chi-square test was performed using SPSS ver. 19.0 (SPSS ver.19.0) for comparing the frequency of errors especially drug-drug interaction in those prescription having less than 5 and  $\geq 5$  drugs. Frequencies were described as percentages (Lisby *et al.*, 2005). Statistical significance was observed ( $\chi^2=52.418$ ,  $p<0.05$ ) with a confidence interval of 95%.

## **RESULTS**

A total of 450 prescriptions were included in this study. In two cases the medication forms were missing, 1627 ME were detected in 450 prescriptions. The most frequent ME was that the patient's weight not mentioned (95%), followed by missing diagnosis (79.4%) and drug-drug interaction (65.2%). Ambiguous orders, potentially leading to an overdose, were found in 1.1% of prescription. Numbers and percentages of prescription having different types of ME are mentioned in table 1. Totally, 2140 drugs were prescribed in 450 prescriptions. The average number of drugs per prescription was 4.76. Furthermore, there was a statistically significant association between the drug-drug interaction and the number of drugs prescribed per prescription ( $p<0.0001$ ). It was noted that 4.22% and 4.88% of prescriptions have severity index of H and I, respectively (table 2). These severity indexes showed the irrational prescribing practices and medical negligence in Pakistan.



**Fig. 1:** Percentages of prescriptions having different medication error.



**Fig. 2:** Prescriptions having different drugs prescribed with Beta-blocker.

**Table 1:** Incidence of medication error in the prescriptions analyzed.

S#	Name of Error	Incidence of error N (%) <sup>a</sup>
1	Ambiguous medication order	5(1.1)
2	Patient age not given	235(52.1)
3	Patient weight not given	429(95.1)
4	Patient gender not given	254(56.3)
5	Error of omission	9(2)
6	Wrong abbreviation	4(0.9)
7	Wrong strength	24(5.3)
8	Without metric system of units	5(1.1)
9	Drug strength not mentioned	3(0.7)
10	Drug-drug interaction	294(65.2)
11	Missing diagnosis	358(79.4)
12	Omission of route of administration	1(0.2)
13	Missing spelling	6(1.3)
Total number of errors:		1627

<sup>a</sup>Number and percentage of prescriptions having medication error.

Errors, which were 0%, are not mentioned in the above table.

## DISCUSSION

Medication errors can occur all over the medical profession within the practice of providing prescription or

non-prescription drugs to patients. The physician has the liability of staying knowledge about the medications he or she is prescribing. A pharmacist has expected to dispense the correct drug in correct doses. Nurses must know enough about medications to identify inaccurate prescriptions or dangerous drug combinations. Prescribing role of the pharmacist is not well established in most of the countries only physician has the authority to order prescription. Due to this, medication error rate is increasing day by day and causing injury and even death worldwide. Major reason of medication error is the error in prescription writing.

**Table 2:** Severity Index of 450 prescriptions of beta-blocker drugs

Severity Index	No. of Prescriptions	Percentage (%)
A	NIL	NIL
B	168	37.33
C	63	14
D	178	39.57
E	NIL	NIL
F	NIL	NIL
G	NIL	NIL
H	19	4.22
I	22	4.88
Total	450	100

Medication errors are avoidable human error that could be harmful to the patients (Lehmann and Kim, 2006). ME not only affect the success of medication therapy (Hennessy *et al.*, 2003; Jenkison, 2002; Lapointe and Jollis, 2003) but also increase the cost of treatment. It is necessary to determine the frequency and the type of the medication error. The present study was planned to analyze prescriptions and identify ME associated with beta-blockers. The prevalence of hypertension has greatly increased in South Asia including Pakistan (Singh *et al.*, 2000). Keeping in view this increased prevalence of hypertension; prescriptions having beta-blocker were selected for the present study.

During the present study, 450 prescriptions were analyzed. All these prescriptions have beta-blockers. Out of 450 prescriptions, 52%, 95% and 56.3% of prescriptions did not have patient information such as patient age, weight and gender, respectively. Age and sex of the patient especially in the case of children is important for the pharmacist in checking the dose and frequency of the medicine. Children and infants are particularly at risk of medication errors mainly due to incorrect dosage, because of the need to modify dosages based on age and weight. The commonest ME in a study conducted in Brazil was the wrong route of administration followed by lack of patient information (22.8%) and not having date on prescription (4.35%) (Gimenes *et al.*, 2011). Another study revealed that 95% of prescriptions

were incomplete including medication date (Siqueira *et al.*, 2011). It was also noted that route of administration was not mentioned in 0.2% of prescriptions analyzed. Another researcher also reported this type of omission of drug/dose and dosage form (Pote *et al.*, 2007). Wrong strength of drug was found in 5.3% of prescriptions, whereas strength of drug was missing in only 0.7% of prescriptions. Diagnosis of patient was not mentioned in 79.4% of prescriptions contributing to the second most frequent ME in this study (table 1).

Without diagnosis chances of errors increases by ten fold. In our health care system especially in outpatient settings because of the work load physicians do not usually mention complete diagnosis of the patient in the prescription. This might result in drug-drug interaction and hypersensitivity reactions as the patient history and the disease he/she is suffering from is not mentioned. This may lead to the dispensing of sound-alike or look-alike drugs by the pharmacist.

The prescriptions analyzed during the study were classified based on NCCMERP categories regarding the severity of error. This severity index demonstrates the irrational prescribing and medical negligence. The most frequent category was D, which included 178 prescriptions (39.5%), followed by category B that included 168 prescriptions (37.33%). The most severe category I had 22 prescriptions (4.88%). The outcome of this category is permanent illness or patient death, which is very alarming.

Average number of drugs per prescription was 4.76. During the study, the total number of medications (2,140 drugs) prescribed in all the prescriptions (450) were analyzed for drug-drug interactions. Most of the prescriptions (31.7%) included four drugs, and then five and three drugs were prescribed in 19.1% and 18.6% prescriptions, respectively. 65.2% of prescriptions have drug-drug interactions. In a study conducted in India, the most frequent error reported was drug-drug interactions (68.2%), which was followed by incorrect dosing interval (12%) and dosing errors (9.5%) (Lisby *et al.*, 2005). Another researcher also reported ME in prescriptions given to the patients attending cardiovascular clinics and a large proportion of ME was involved administration error including improper dosing (Alexander *et al.*, 2009). A study conducted in Bahrain in 2012, observed ME of prescribing beta-blocker or diuretics or their combinations to patients receiving lipid lowering drugs and recommended to adopt effective measures to detect such type of harmful ME in prescriptions containing cardiovascular/anti diabetic drugs (Al Khaja *et al.*, 2012).

Statistical analysis of ME in 450 prescriptions revealed that the incidence of drug-drug interactions is significantly increased with the increase in the number of

the drugs per prescription ( $\chi^2=3.603^a$ ,  $p<0.0001$ ). Most prevalent drug-drug interactions as identified by José Antonio Corona-Rojo in 2009 was Acetyl salicylic acid and Captopril (53%) and also reported the association between drug-drug interactions and number of drugs per prescription (Corona-Rojo *et al.*, 2009). It was previously observed that the age and number of medications administered were the major risk factors for the incidences of medication errors (Evans *et al.*, 2005). It was revealed in different studies conducted in different part of the World that computerized physician order and use of software to analyze the prescriptions are better solutions to avoid the ME specially drug-drug interactions. A two phase study in USA (1998) documented reduction in adverse drug events by 17% (Bates *et al.*, 1998). Another four phase study was conducted by the same author in 1999 and reported large differences in ME including dose error, frequency error, substitution error as a result of use of computerized physician order entry (Bates *et al.*, 1999). It is well known fact that errors in the medication process can lead to adverse drug events, which can potentially harm the treatment outcome of patient. In the present study it was analyzed the drug-drug interactions and categorized prescriptions based on severity of error. It was noted that 4.22% and 4.88% of prescriptions have severity index of H and I, respectively (table 2). This severity index showed the irrational prescribing practices and medical negligence.

In developing communities, insufficient number of physicians and trained nursing staff is the contributing factor of the incidence of ME. Another reason for these ME is the lack of pharmacist placement in the health care system of such communities including Pakistan. Pharmacist as a member of health care team can play a vital role in avoiding these types of MEs. Evaluation and analysis of prescriptions is a major responsibility of clinical pharmacist, which ultimately reduce the incidence of such errors and would help in developing the confidence of patient on the health care system of Pakistan.

Pharmacists in health care systems are the key in coordinating an effective medication safety program. An awareness of patient safety and collaboration among health professionals will improve medication safety for patient (Kienle, 2004).

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