Study and evaluation of medication errors in a tertiary care teaching hospital

Binu Mathew[1]*, Rajendra Singh Airee[1], Jibily Joy[1], Cherukuri Sri Sindhu[1], Rajput Nayan Raj Priya[1], Sarfaraz MD[2]

1 Department of Pharmacy practice, N.E.T. Pharmacy College, Raichur, Karnataka
2 Asst. Prof. Department of Pharmaceutics, N.E.T. Pharmacy College, Raichur, Karnataka

*Corresponding author:

Email : binum2@gmail.com
Tel.: +91-8971698943

ABSTRACT

This study was conducted to detect and evaluate the incidence, types of medication errors and to assess the severity of medication errors in Navodaya Medical College Hospital & Research Centre, Raichur, Karnataka. It was a prospective observational study of 6 months duration. Patients who were admitted to general ward, semi ward and ICU ward irrespective of age, sex and conditions were included in the study. In-patients records of patients were reviewed during their hospital stay. Detected medication errors were documented and evaluated. A total of 600 cases of the patients were randomly selected, 89 medication errors were detected in 76 patients, in this 68(89.47%) cases had only one error and remaining 8(10.53%) had more than one error during their hospital stay. A total 89 medication error were observed among them 57.3% were errors in prescribing medication, 12.36% were errors in medication dispensing and 30.34% were errors in medication administration. Most of the medication errors were 57.30% due to physicians, 30.37% due to Nurses and 12.36% due to Pharmacists. The causes for prescribing errors were due to 33.34% class duplication, for dispensing error 72.73% due to wrong dose and for administration error 70.37% due to omission error. Majority of medication error were belonging to antibiotics 26.97%.On evaluation of severity, majority of medication errors, 73.03% were classified as category, Error, No harm followed by 26.97% were in category No error.The study concluded that 14.3% medication error were detected during study period and revealed that pharmacist can play a major role in preventing these errors by early detection.

INTRODUCTION

Pharmaceutical care is the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve patient's quality of life. Any suboptimum therapy leads to medication error. The adverse drug event and medication errors are most common types of injuries experienced by hospitalized patients. Such events may be related to professional practice, healthcare products, procedures and systems. [1]Medication misadventures can occur anywhere in the health care system from prescriber to dispenser to administration and finally to patient use, the simple truth is that many errors are preventable. According to studies cited in the institute of Medicine report, "To Err is Human; Building a Safer Health System" 44,000 to 98,000 Americans die each year as a result of medical errors. [2]

The National Coordinating Council for Medication has defined medication error 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 to professional practice, health care products, procedures and systems including prescribing, order communication, product labeling, packaging, nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use. Medical mistakes that include medication errors have raised concerns about medication safety. Due to high consumption of medicines and self-treatment by all, especially the ageing population, the issue of proper medication use and safety for public health concerns globally. [3] Medication errors are a well-known problem in hospitals. Studies have shown that medication errors and adverse drug reactions (ADRs) are one of the main causes for adverse

events in hospitals leading to disability and death in up to 6.5% of hospital admissions. The literature on medication errors lacks universally accepted definitions of medication errors as well as different methods and criteria, leaving us with an incomplete knowledge of the actual rate of medication errors. Likewise, criteria for assessing the potential clinical consequences of medication errors vary in different studies. In addition, no studies have investigated medication errors in more stages of the medication process by selecting the most appropriate and valid methods at each stage.[4] Elder patients may be more vulnerable to medication errors because of the larger number of medication administered on daily basis, and the number of opportunities for error is substantial in places such as nursing homes were the incidences rates range from 1.19-7.26 incidents per residence month. [5] Various factors identified for medication errors are illegible orders, non-availability of patient information, inadequate medical knowledge, and increased patient load, failure to monitor drug concentration or drug therapy, and not accounting for changes in renal and cardiac functions. The literature review in India, shows there were very few studies was carried out. [6] Improvement in medication error prevention systems requires accurate reporting, regular analysis, and protection of reporters. An optimal detection system would be accurate, inexpensive, and involving technology and practices readily available to the majority of hospitals. [7] There is a definite role of Clinical pharmacists in reduction of medication errors by examining and evaluating the root causes of medication errors, analyzing aggregate data to determine trends, significance, frequency, outcomes of medication errors and communicate the results of the medication error program to healthcare practitioners, patients, and caregivers. [3] Even though the literature reports a number of studies on identifying medication errors in various hospitals in abroad, the data available on such situation in India is limited. Hence, the present study was conducted to detect and evaluate the incidence of medication errors and to categorize them based on NCCMERP guidelines in tertiary care teaching hospital.

MATERIALS & METHODS

A prospective observational study was conducted for a period of 6 months in the various departments of Navodaya Medical College, Hospital and Research Centre, a 1000 bedded tertiary care teaching hospital at, Raichur, Karnataka, India, after obtaining the ethical clearance. All patients who were admitted to General Ward, Semi ward & ICU ward irrespective of any sex, age, conditions and patients who were willing to participate in the study between periods of November 2014 to April 2015 were included in the study. Case files of all the patients admitted were referred. Patients who were refusing to take medication and who were not willing to participate in the study were excluded from the study. Hospital and medical records, case sheet of the patients admitted in the hospital were used as sources for the study. Study materials used were Patient Profile Form (Includes patient prescription and administration details), Medication error reporting and documentation form and NCCMERP guidelines.

Study protocol

A standard medication error reporting form for incorporating medication errors details was prepared with slight modification from the standard USP medication error reporting and documentation form. The prescriptions were chosen randomly and/or the details were followed till discharge of the patients. The data for present study was collected by chart review method.

During the study inpatients case records was reviewed, which includes patients case history, diagnosis, physician medication order sheets, nurse medication administration records, progress chart, laboratory investigations and report of other diagnostic tests. This information was documented in the patient profile form. All the prescriptions were checked for errors by the Micromedex Drug-Reax database. The prescriptions were checked for incorrect dosing frequency, errors in dose, incomplete prescription, unrelated drug for the present state of disease, without knowing allergic conditions of the patients, inappropriate duration of therapy or the route of administration, monitoring error and drug drug interactions. Whenever medication error is identified, during the review, data from patient profile form is transferred to medication error reporting and documentation form.

Data Analysis

All medication errors documented were analysed for following parameters such as demographic status of patients, professionals involved in the errors, causes of medication errors, Incidence of medication errors, Types of medication errors and system wise distribution of errors. Medication errors were also assessed for its severity level by using the National Coordination Council for Medication Error Reporting Prevention Proposed Medication Error Index. [8] Each prescription was checked twice- once for medication errors. All the prescriptions were checked for errors using CIMS website (cimsasia.com), and these errors were confirmed by additional standard references (MICROMEDEX version 2, drug today handbook, and Drug digest website. Statistical analysis was done by using descriptive statistics. Data were collected in predesigned Microsoft excel 2010. For descriptive statistics, results were expressed in terms of percentages and presented using tables according to the types of tool used.

RESULTS

A total of 600 patients were randomly selected and followed for the present study. The cases were analysed based on the following parameters.

Demographic status of patient

Out of these 600 cases, 322(53.67%) were Females & 278(46.33%) were males. Medication errors were identified in 76(14.83%) patients, 39(51.32%) females and 37(48.68%) males as shown in Figure 1.

Age-wise distribution of medication errors

Out of 76 cases in which medication errors were identified, the demographic report of our study showed age-wise distribution (Table 1), 9(11.85%) patients were below <20 years of age, 26(34.21%) were age group between 20-40 years, 30(39.47%) were between 40-60 and 11(14.47%) patients were above 60 years.

Medication errors type-wise distribution

Our study shows (Fig. 2) that out of 89 medication errors, Prescribing error accounts for 51(57.30%), Administration error holds for 27(30.34%) and dispensing error holds for 11(12.36%).

Professional status wise distribution of medication errors

Out of the 89 medication errors, 27(30.34%) were due to Nurses, 11(12.36%) were due to Pharmacists and 51(57.30%) were due to Physicians as shown in Fig. 3.
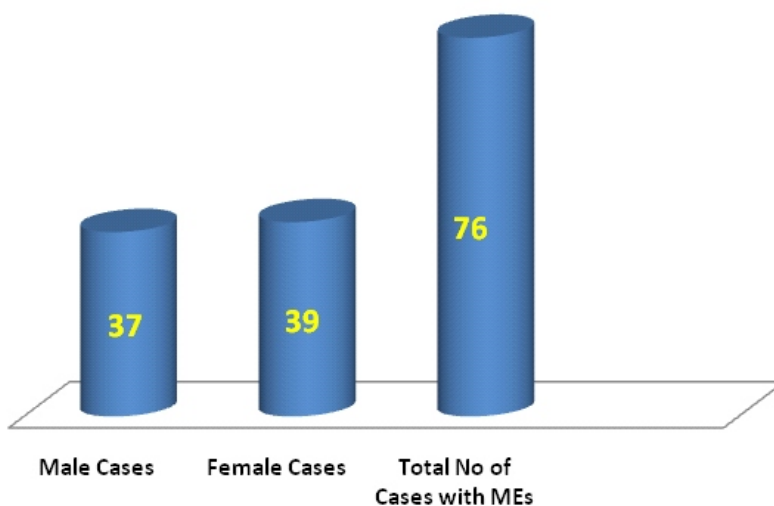
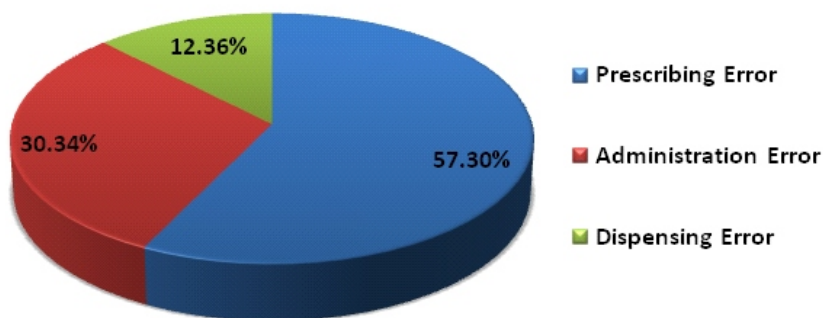**Fig. 1.** : Demographic status of cases with Medication Errors (MEs)

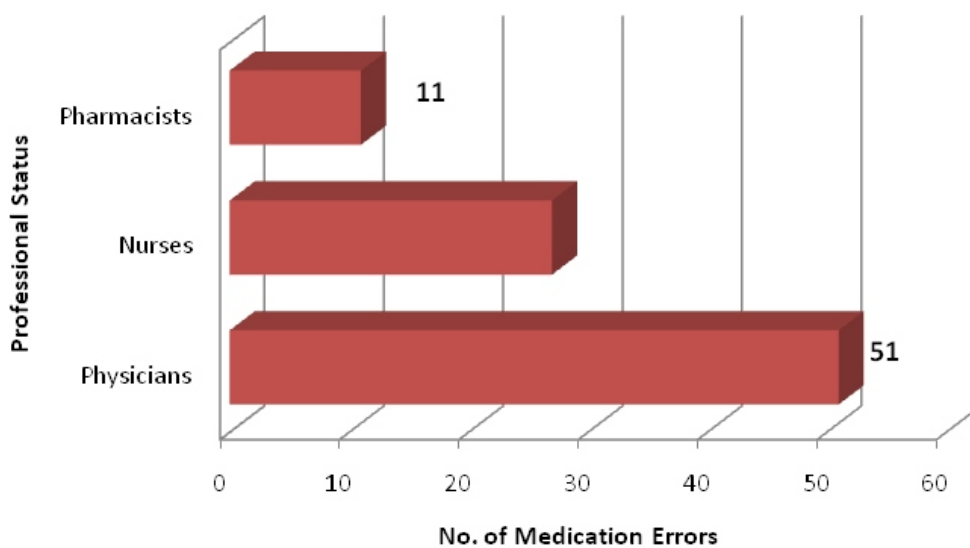**Fig. 2.** : Types of Medication Errors

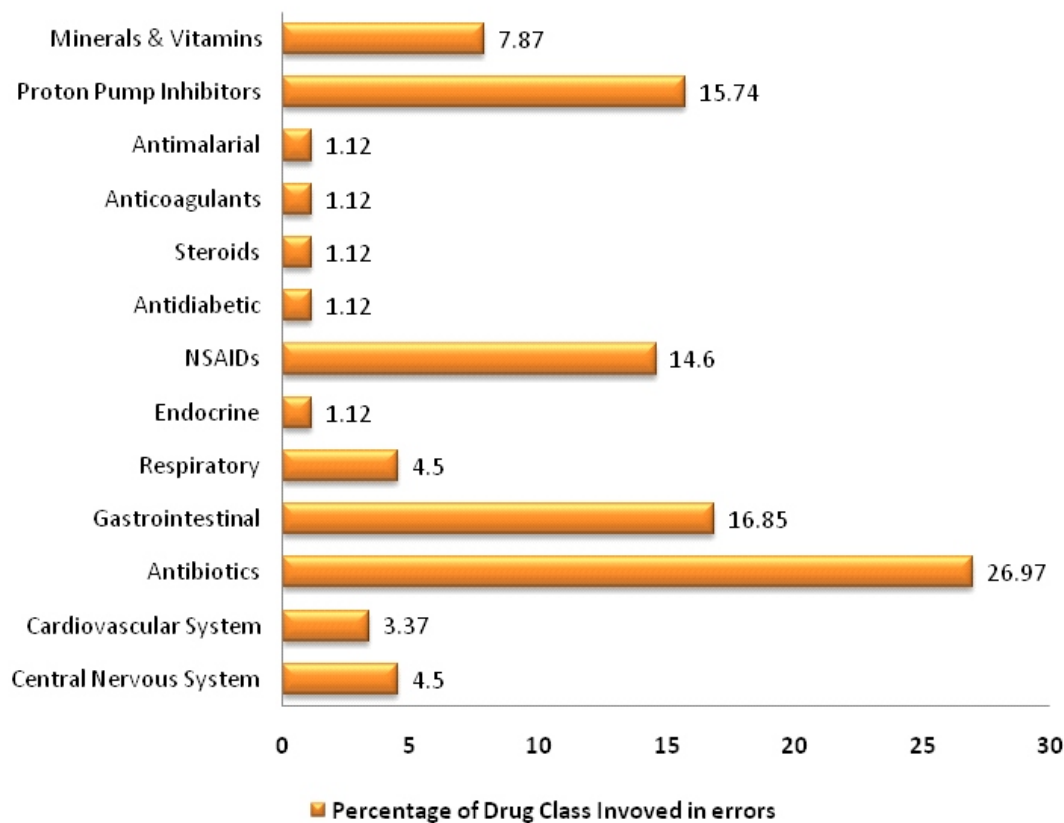**Fig. 3.** : Professional involved in Medication Errors

Fig. 4. : Class-wise categorization of drugs involved in Medication errors (N=89)

Table 1. : Age-wise distribution of medication errors

No. of Patients	<20 year	20-40 year	40-60 year	>60 year
600(Total number of patients followed)	56	189	276	79
76 (Patients with medication errors)	9(11.85%)	26(34.21%)	30(39.47%)	11(14.47%)

Root causes of medication errors

Root Cause Analysis (RCA) method is used for analysis of data, as it is a way to identify the cause that is most directly responsible for errors. The Joint Commission on Accreditation of Health Care Organizations (JCAHO) now requires all institutions to undertake RCA (Root Cause Analysis) of all sentinel events. RCAs are multidisciplinary reviews of serious errors, which help to identify underlying causes or factors that may have contributed to the medication errors, details shown in Table 2.

Medication class-wise categorization of drugs involved in medication errors

The majority of MEs were observed in antibiotics 24(26.97%), followed by gastrointestinal agents 15(16.85%), Proton Pump Inhibitors 14(15.74%), NSAIDs 13(14.6%), Minerals & Vitamins 7(7.87%), Respiratory agents 4(4.5%), Central Nervous System 4(4.5%), Cardiovascular system 3(3.37%), Antimalarial 1(1.12%), Anticoagulants 1(1.12%), Steroids 1(1.12%), Antidiabetic 1(1.12%), and Endocrine 1(1.12%), illustrated in Fig. 4.

Severity level assessment of medication errors

It was found that 24(26.97%) medication error were belonged to the severity level of No Error which comes under Category-A followed by 65(73.03%) were belonged to the severity level of Error, No Harm which comes under the Category-B 14(15.73%), Category C 38(42.69%), and Category D 13(14.61%) as shown in Table 3.The other levels of severity such as Error, Harm & Error, death were not identified during the study period.

Incidence of Medication errors

In total of 600 cases followed, 76 cases were identified with medication errors of 89, in this 68(89.47%) cases had only one error and remaining 8(10.53%) had more than one error during their hospital stay. The overall incidence of medication errors was found to be 14.83%.

DISCUSSION

A medication error is an episode associated with use of medication that should be preventable through effective control system. The factor that increases the chance of medication errors

Table 2. : Root Causes of Medication Errors

Prescribing errors 51(57.30%)	
Illegible handwriting	15 (29.42%)
Wrong Brand name prescribed	3 (5.88%)
Transcription error	3 (5.88%)
No dose prescribed	6 (11.76%)
No frequency prescribed	4 (7.84%)
Class duplication	17 (33.34%)
Wrong Route/No Route	3 (5.88%)
Dispensing errors 11(12.36%)	
Wrong dose	8(72.73%)
Wrong medication	3(27.27%)
Administration errors 27(30.34%)	
Omission error	19(70.37%)
Wrong Time/ Dose Delay	7(25.93%)
Without order	1(3.70%)

Table 3. : Levels of severity of reported Medication errors (N=89)

Level of severity		Number of medication errors	Percentage (%)
No Error	Category A	24	26.97
Error, No harm	Category B	14(15.73%)	
	Category C	38(42.69%)	
	Category D	13(14.61%)	73.03
Error, harm	Category E	0	
	Category F	0	
	Category G	0	
	Category H	0	0.00
Error, Death	Category I	0	0.00

are the attributes of complex mechanisms involved in the prescribing, dispensing and administration of drugs. Many authors have reported mechanisms for reducing medication error include reduced reliance on memory, improved asses to drug information, simplification, standardization and training. Substantial evidence suggests that pharmacists in decentralized patient care setting can reduce the frequency of medication errors. The demographic reports of our study showed high incidence of medication errors in female 39 (51.32%) over males 37(48.67%) similar results were observed with study conducted by Shah CN and Solanki N. [3] This may be attributed to fact that more number of patient cases selected for study were females 322(53.67%) over males 278(46.33%) as shown in Figure 1.

Our study also found higher incidence of medication errors in age group between 40-60 years 30(39.47%) as shown in Table no. 1. This can be attributed to the fact that more number of patients (31.5%) visited the hospital during study period was also ranged between 40-60 years of the age groups as shown in Table 1. Similar results were observed in the study conducted by Leelavati

D. Acharya et al [9]but the study conducted by Massachusetts Board of registration in pharmacy[10] showed higher incidence of medication errors in patients ranged between 31-40 years of age. Our study showed that out of 76 cases of medication error, prescribing error holds maximum 51(57.3%) followed by administration error 27(30.34%) and dispensing error holds for 11(12.36%) as shown in Figure 2.The study conducted by Shah CN &Solanki N [3]showed that prescription errors are the most common among all types of errors which was also supporting for study results of higher numbers of prescribing error. Of the total 89 medication error identified in the study, 27 errors (30.34%) were due to nurses, 11(12.36%) were due to pharmacists and 51 (57.30%) were due to physicians as shown in Figure 3. Another study conducted by Karna et al showed that major error were due to nurses 61.6% followed by pharmacists and physicians. [11] Cause analysis for different types of medication errors were carried out and were given in Table no. 2.Of 51(57.3%) prescribing errors factors responsible for errors were illegible handwriting holds for 15 (29.42%), wrong brand name prescribed

accounts for 3(5.88%), transcription error 3(5.88%), no dose prescribed 6(11.76%), no frequency prescribed 4(7.84%), class duplication 17(33.34%) and no route of drug administration prescribed holds for 3(5.88%) prescribing errors. Our result highlights that class duplication 17(33.34%) as major prescribing errors whereas Shah CN and Solanki N [3]study showed no dosage form prescribed as major prescribing error. Of 11(12.36%) dispensing errors observed, wrong dose dispensed accounts for 8(72.73%) and wrong medication dispensed holds for 3(27.27%).Of 27(30.34%) administration errors observed, omission error were 19(70.37%), followed by wrong time/dose delay 7(25.93%) and drug administered without order 1(3.70%).The majority of the medication errors observed in antibiotics 24 (26.97%), followed by gastrointestinal agents 15(16.85%) and proton pump inhibitors 14(15.74%) as shown in Figure 4. The findings were consistent with the other Indian studies Karthikeyan M and Lalitha D[12] and Reddy P and Mandha M. [13] NCCMERP proposed medication error index was used to assess the severity of medication errors. It was found that the medication errors 65(73.03%) belonged to the category Error, No harm which comes under sub-category B 14(15.73%), sub-category C 38(42.69%) and sub-category D 13(14.61%) followed by 24 (26.97%) in the category No Error which comes under the sub-category A as shown in Table 3.The overall incidence of medication errors was found to be 14.83%. The incidence was similar when compared to other studies, where it ranges from 3 to 17%. Studies carried out by Leelavathi D. Acharya et al [9] on medication errors in tertiary care hospital showed a mean medication error rate was 17% and one other study carried out by Kenneth N. Barker al [14]on medication errors in nursing home and small hospitals showed a mean medication error rate of 12.2% and 11% respectively. This may be attributed to the fact of variation the method followed and variables such as hospital set-up, number of beds, duration of study and number of patients followed.

CONCLUSION

This study had presented a pattern of findings of medication prescribing errors in a private tertiary care teaching hospital in India. The present results point to the establishment of a medication error reporting system at each hospital and to share the data with other hospitals/healthcare settings. The role of a clinical pharmacist in this situation appears to be a strong intervention; and, the clinical pharmacist, initially, could only confine to identification of the medication errors. The outcome of this study may be of great help in drafting the regulatory policies to curb the problem of medication errors. The problem can be further minimized by sensitizing the prescribers to follow prescription writing practices as per 'WHO Guidelines on Good Prescribing. As this study demonstrates, there is a requirement of undertaking regular structured prescription audits to minimize prescription errors.

AKNOWLEDGEMENT

REFERENCES

1. Pote S, Tiwari P, Dcruz S. Medication prescribing in a public, teaching hospital in India: A prospective study, Pharmacy practice 2007; 5(1):17-20.

2. Agrawal P, Sachanb A, Rajeev KS, Jain P. Statistical Analysis of Medication Errors in Delhi, India. Indo Global Journal of Pharmaceutical Sciences 2012; 2(1): 88-97.

3. Shah CN, Solanki N. Clinical research: Medication errors and its root cause analysis in multispecialty hospital. International Journal of Pharmacy Teaching & Practices 2013; 4(4):838-43.

4. Lisby M, Nielsen LP, Mainz J. Errors in the medication process: frequency, type, and potential. International Journal for Quality in Health Care 2005; 17, (1): 1522.

5. Menendez MD, Alonso J, Rancano I, Corte JJ, V. Herranz, Vazquez F. Impact of computerized physician order entry on medication errors. Rev CalidAsist 2012:1-7.

6. Ahmad A, Patel I, Parimalakrishnan S, Mohanata GP, Parchuri A, Balkrishnan R. Assessment of medication errors in among patients visiting community pharmacies in rural areas of Chidambaram, Tamilnadu at South India: a prospective study.Int J Pharm 2013; 3(1): 53-58.

7. Ford CD, Killebrew J, Fugitt P, Jacobsen J, Prytas EM. Study of Medication Errors on a Community HospitalOncology Ward. Journal of oncology practice 2006; 2(4):149-54.

8. National Coordinating Council for Medication Error Reporting and Prevention. USP-ISMP Medication Error Reporting Program, USP; 2001.www.nccmerp.org.

9. LeelavathiD.Acharya, Javed SF, Padma GM. Rao. Study and evaluation of medication errors in a multi-disciplinary tertiary care south Indian teaching hospital. Indian journal of hospital pharmacy 2008,48: 54-58.

10. Medication error study [cited on 2015 April 2]. Available from: www.mass.gov/dpl/boards/ph/phstudy/04phres.htm

11. Karna K, Sharma S, Shivkumar I, Bhandari A. Study and evaluation of medication errors in a tertiary care teaching hospital-a baseline study. IntJ PharmPharmSci 2012 Oct 12; 4(5): 587-93.

12. Karthikeyan M, Lalitha D. A prospective observational study of medication errors in general medicine department in a tertiary care hospital. Drug Metab Drug interact 2013:1-9.

13. Reddy P, Mandha M. Medication errors: Identification, prevention and implementation of safe medication practice in a tertiary care teaching hospital. World Journal of Pharmacy and Pharmaceutical Sciences 2015, 4(03):1249-56.

14. Kenneth N.Barker, Robert L, Mikeal et al. Medication error in nursing homes and small hospitals. Am J HospPharm 1982; 39:987-91.