



Medication Reconciliation and Medication Error Prevention in an Emergency Department of a Tertiary Care Hospital

Penumarthi Poornima, Pasala Reshma, T V Ramakrishnan¹,
Nagasubramanian Vanitha Rani*, G Shree Devi¹, and Roja Shree
Preethi Seshadri

Department of Pharmacy Practice, Faculty of Pharmacy, Sri Ramachandra University, Porur, Chennai-116, India

¹*Department of Accident and Emergency Medicine, Sri Ramachandra University, Porur, Chennai-116, India*

ABSTRACT

Objective: The study was conducted to assess the effectiveness of the medication reconciliation and medication error prevention in an emergency department of a tertiary care hospital. **Materials and Methods:** Patients of either sex, aged above 18 years admitted for more than 24 hours irrespective of their medical diagnosis and for whom medication reconciliation was done were included. Patients' home medication charts were compared with their current admission medication charts to check the number of home medications that were being continued to be administered during their hospital stay. Each home medication that was not ordered or commented on was deemed to represent a discrepancy. The discrepancies were classified according to the criteria of the Safer Healthcare Now! Campaign and reasons for not continuing the drug were also documented. The interventions were brought to the notice of the concerned physician. **Results:** Of 80 patients (43 males and 37 females; mean age 61 ± 15 years), 74 patients had medication discrepancies categorised as documented intentional discrepancies, undocumented intentional discrepancies and unintentional discrepancies and 6 patients had no discrepancies. There was a statistically significant association between number of home medications and discrepancies, both undocumented intentional discrepancies ($P=0.005$) and unintentional discrepancies ($P=0.049$). **Conclusion:** This study recommends the need for additional resources and educational initiatives for the health care professionals to improve medication reconciliation. For effective medication reconciliation, patients or their care takers must help the physicians and other health care professionals involved in reconciliation by bringing all their home medications at the time of hospital admissions.

Key words: Discrepancies, Medication reconciliation, Medication errors, Pharmacist intervention.

INTRODUCTION

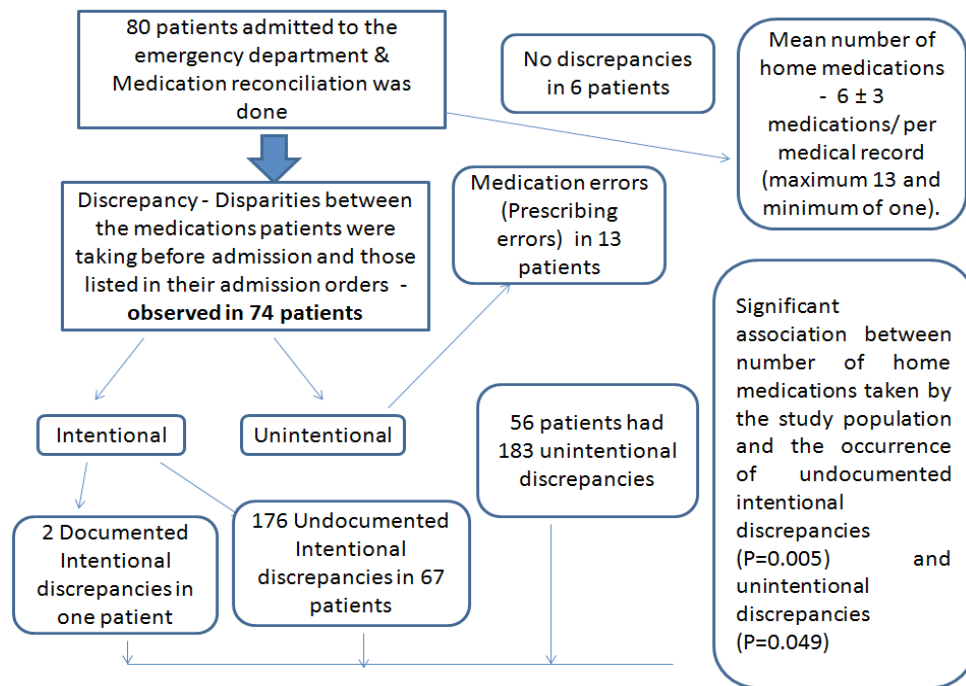
Although medications are vital to patient care, they can cause considerable morbidity and mortality if being irrationally used.¹ Patient safety has become a key component of quality of care in the recent years for patients and their families as well as for the health care professionals to provide safe, effective and efficient healthcare.² Nowadays it is very

Access this article online

Journal Sponsor	Website: www.jyoungpharm.org
	DOI: 10.5530/jyp.2015.3.15

*Address for correspondence:

Mrs. Nagasubramanian Vanitha Rani, Lecturer, Department of Pharmacy Practice, Faculty of Pharmacy, Sri Ramachandra University, Porur, Chennai-116, India. Phone No : 9444584588, E-mail : vanithak9@rediffmail.com



Graphical Abstract

common to find differences between the pharmacological treatment of a hospital inpatient and the treatment that they were previously taking at home, as a result of which any difference found is defined as a discrepancy. The large majority of these discrepancies are caused due to the changes in the clinical condition of the patient.³ Medication discrepancies can occur at any point in the medication use process but the largest percentage of these discrepancies occurs during the prescribing phase.⁴ Disparities between the medications patients were taking before admission and those listed in their admission orders ranged from 30% to 70% in a recently published literature review.⁵ The literature also states that, more than half of hospital inpatients have at least one unintentional discrepancy (UD). Any UD is considered to be medication error.³

Medication errors are one of the leading causes of injury to hospital patients, with approximately two out of every 100 patients admitted to the hospital experiencing a preventable adverse drug event (ADE).⁶ 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.³ Errors are most common when patients are transferred from one level of care to another, and the likelihood of mistakes is higher in emergency departments because of the intrinsic nature of emergency care.² The factors contributing to medication errors in the emergency department are multiple patients being treated

concurrently, frequent reliance on verbal orders, wide range of drugs in use, variety of administration routes, wide variety of dangerous drugs and interruptions/distractions.⁷ The internationally recognized remedy for this situation is medication reconciliation.² In 2007, the joint commission on accreditation of health care organizations (JCAHO) acknowledged that reconciliation error compromise the safety of drug use and recommended hospitals to develop a system for obtaining patients complete pharmacotherapeutic records, to ensure they receive the necessary drugs for the new situation.⁸

The institute for Healthcare improvement has defined medication reconciliation as “a formal process of obtaining a complete and accurate list of each patient’s current home medications-including name, dosage, frequency and route-and comparing the physician’s admission, transfer, and/or discharge orders to that list.”⁹ The reconciling medication process is designed to prevent medication errors at patient transition points. It is a three-step process which includes 1) obtaining complete and accurate list of all possible home medications from each patient 2) comparing the list against the physician’s admission, transfer, and/or discharge orders 3) identifying and bringing any discrepancies to the attention of the physician and, if appropriate, making changes to the orders.¹⁰ However, obtaining complete medication use history depends on different factors, including the time available to conduct the interview, language barriers, and the severity of the patients’ illness,

the patients' cognitive status and the patients' familiarity of the medications.¹¹

Approximately 40% of medication errors are associated with lack of medication reconciliation often referred to as discrepancies, about 20% of which can be avoided. With increasing number of emergency department (ED) visits and overcrowding, implementation of medication reconciliation can be challenging leading to increasing number of discrepancies.¹² Through an appropriate reconciliation programme, around 80% of errors relating to medication and the potential harm caused by these errors could be reduced. This also helps to reassess regular treatment when the medical condition of a patient changes.¹³ An accurate medication list at hospital admission is essential for the evaluation and further treatment of patients. Studies have shown that this method reduces the number of discrepancies.¹⁴ Nationally, EDs have attempted several approaches to provide medication reconciliation, and have found that proper application of medication reconciliation can result in accurate documentation of patient medications and allergies, and improved prevention of medication errors such as omissions, duplications, dosing errors, or drug interactions.¹⁵

A study was conducted to identify the medication discrepancies and prescribing errors, thereby assess the effectiveness of the medication reconciliation process that may occur in the emergency department of a tertiary care hospital and do necessary intervention.

MATERIALS AND METHODS

A prospective study was conducted in the Accident and Emergency Medicine department of a tertiary care hospital after obtaining the approval of the Institutional ethics committee and the consent of the study population.

Study population: 80 patients admitted irrespective of their medical diagnosis.

Inclusion criteria

- Patients of either sex, aged above 18 years.
- Patients admitted in the emergency department for more than 24 hours irrespective of their medical diagnosis and for those the medication reconciliation was done.

Exclusion criteria

- Patients who get discharged or those expire within 24 h of admission.

- Patients admitted in the emergency department for whom medication reconciliation was not done.
- Patients who were unconscious at time of admission or cognitively impaired.
- Paediatric patients.

Methods

Data including the demographics of the patients (age, sex), admission complaints, history of present illness, past medical and medication history were documented in the data collection Proforma specially designed for the study. The medication discrepancies and prescribing errors were also documented in the patient data collection form.

At the time of patient admission in the emergency department, as per current practice, the emergency nurse records the patient's home medication list (including drug name, dose, route, frequency, time last dose taken, ordered on admission/ordered on discharge) in the medical reconciliation form.

Following admission, patients' home medication charts were compared with their current admission medication charts to check the number of home medications that were being continued to be administered to the patients during their hospital stay. Each home medication that was not ordered or commented on was deemed to represent a discrepancy and the noted discrepancies were intervened to the concerned physician. Clinical judgment was applied to identify if there was an obvious reason for not ordering a drug. Then the discrepancies were noted and the reasons for not continuing the drug were documented.

The discrepancies were classified according to the criteria of the Safer Healthcare Now! Campaign:¹⁶

0=no discrepancy

1=documented intentional discrepancy

2=undocumented intentional discrepancy

3=unintentional discrepancy

The discrepancies were reviewed for confirmation and the above details were brought to the notice of the concerned physician.

The medical reconciliation process was completed within 24 hrs of patient admission.

The current drug chart was also verified for occurrence of

any prescribing errors.

As per American Society of Health system Pharmacists guidelines as follows

Prescribing error is defined as Incorrect drug selection (based on indications, contraindications, known allergies, existing drug therapy, and other factors), dose, dosage form, quantity, route, concentration, rate of administration, or instructions for use of a drug product ordered or authorized by physician (or other legitimate prescriber); illegible prescriptions or medication orders that lead to errors that reach the patient.^{17,18}

Statistical analysis

The data obtained were analysed using SPSS version 16.0. The baseline characteristics like age, sex, diagnosis, number of home medications, number of re-ordered medications, number of intentional and unintentional discrepancies, number of prescribing errors were expressed in descriptive statistics. The association between undocumented intentional discrepancies, unintentional discrepancies and variables age, admission diagnosis and number of home medications taken by the study population were assessed using Pearson's chi square test. A P value of ≤ 0.05 was considered to be statistically significant.

RESULTS

The study was conducted in 80 patients, of which 43 (54%) were males and 37 (46%) were females. The study population consisted of patients in the age range of 21–93 years; with the mean age of 61 ± 15 . Majority of the patients (38.7%) were in the age range of 51–65 years.

Of the 80 patients, 19 patients (23.7%) were admitted for cardiac emergencies which included congestive cardiac failure, coronary artery disease and atrial fibrillation; 18 patients (22.5%) were admitted for renal complications including chronic kidney disease; 13 patients (16.2%) were admitted for respiratory emergencies and infections including acute exacerbation of bronchial asthma, chronic obstructive pulmonary disease; 10 patients (12.5%) were admitted for CNS diseases including seizures; 7 patients (8.7%) were admitted for metabolic complications including thyroid complications, diabetic foot, diabetic ketoacidosis, diabetic neuropathy; 13 patients (16.2%) were admitted with other complications including road traffic accidents, gastric and liver diseases.

Among the 80 patients, 9 patients (11.3%) were taking 1

drug as home medication; 2 patients (2.5%) were taking 2 and 3 drugs each as home medications; 8 patients (10%) were taking 4 drugs as home medications; 12 patients (15%) were taking 5 drugs as home medications; 11 patients (13.8%) were taking 6 drugs as home medications; 11 patients (13.8%) were taking 7 drugs as home medications; 6 patients (7.5%) were taking 8 drugs as home medications; 5 patients (6.3%) were taking 9 drugs as home medications; 4 patients (5%) were taking 10 drugs as home medications; 3 patients (3.8%) were taking 11 drugs as home medications; 4 patients (5%) were taking 12 drugs as home medications; 3 patients (3.8%) were taking 13 drugs as home medications. Majority of the patients (15%) were taking 5 drugs as their home medications and the mean number of home medications for the study population was 6 ± 3 .

Of the 80 patients, 77 patients were taking prescription medications, 23 patients were taking non-Prescription medications and 29 patients were taking nutritional supplements. Only the prescription medications were reconciled. The home medications were re ordered for 52 (65%) patients after their admission in the emergency department. Of the 52 patients for whom the home medications were re ordered, 10 patients (12.5%) had changes in their dose, 23 patients (28.7%) had changes in their dosing interval, 18 patients (22.5%) had changes in their route of administration.

Medication reconciliation was done in 80 patients, of which 74 patients had medication discrepancies categorised as documented intentional discrepancies, undocumented intentional discrepancies (changes done in dose, dosing interval and route of administration in the home medications) and unintentional discrepancies. In the study population, 6 patients had no discrepancies; 1 patient had 2 documented intentional discrepancies like olanzapine poisoning case where the patient's home medications olanzapine and nutritional supplements was stopped on admission in the emergency department with documented reason; 67 patients had 176 undocumented intentional discrepancies like withholding of nutritional supplements and withholding of oral hypoglycaemics as

Table 1: Types of Medication Discrepancies

Types of medication discrepancies	No of patients	No of discrepancies
No discrepancies	6	0
Documented intentional discrepancies	1	2
Undocumented intentional discrepancies	67	176
Unintentional discrepancies	56	183

Table 2: Age Versus Discrepancies

Age (years)	Mean no. of HM \pm SD	No of undocumented intentional discrepancies	P value	No of unintentional discrepancies	P value
21-35 (n=5)	6 \pm 5	7		10	
36-50 (n=15)	6 \pm 4	28		37	
51-65 (n=31)	7 \pm 3	44	0.29	71	0.79
66-80 (n=23)	6 \pm 3	41		55	
81-95 (n=6)	5 \pm 0.01	9		7	

* A P value of ≤ 0.05 was considered statistically significant

Table 3: Diagnosis Versus Discrepancies

Diagnosis	Mean no of HM \pm SD	No of undocumented intentional discrepancies	P Value	No of unintentional discrepancies	P Value
Cardiac (n=19)	7 \pm 3	29		58	
Renal (n=18)	6 \pm 3	27		40	
Respiratory (n=13)	4 \pm 2	23	0.20	25	0.57
CNS (n=10)	8 \pm 4	14		23	
Metabolic (n=7)	6 \pm 2	11		18	
Others (n=13)	6 \pm 3	23		17	

* A P value of ≤ 0.05 was considered statistically significant

insulin was given on admission, prescribing another drug of the same class that the patient was taking at home and changes done in their home medication including dose, dosing interval and route of administration; 56 patients had 183 unintentional discrepancies for which the reason for not re ordering the drug was not known. (Table 1).

Of the 80 patients, prescription errors were observed in 13 patients (16.2%). The types of prescribing errors found were drug dose not mentioned in 5 prescriptions, spelling mistake in drug name in 2 prescriptions, frequency not mentioned in 4 prescriptions, and route of administration not mentioned in 2 prescriptions.

In the age range of 21-35 years, the mean number of home medications were 6 ± 5 with 7 undocumented intentional discrepancies and 10 unintentional discrepancies, in the age range of 36-50 years the mean number of home medications were 6 ± 4 with 28 undocumented intentional discrepancies and 37 unintentional discrepancies, in the age range of 51-65 years the mean number of home medications were 7 ± 3 with 44 undocumented intentional discrepancies and 71 unintentional discrepancies, in the age range of 66-80 years the mean number of home medications were 6 ± 3 with 41 undocumented intentional discrepancies and 55 unintentional discrepancies, in the age range of 81-95 years the mean number of home medications were 5 ± 0 with 9 undocumented intentional discrepancies and 7 unintentional discrepancies. There was no statistically significant association between age and the occurrence

of undocumented intentional discrepancies ($P=0.29$) and unintentional discrepancies ($P=0.79$). (Table 2)

In patients with cardiac emergencies, the mean number of home medications were 7 ± 3 with 29 undocumented intentional discrepancies and 58 unintentional discrepancies, in patients with renal complications the mean number of home medications were 6 ± 3 with 27 undocumented intentional discrepancies and 40 unintentional discrepancies, in patients with respiratory complications the mean number of home medications were 4 ± 2 with 23 undocumented intentional discrepancies and 25 unintentional discrepancies, in patients with CNS complications the mean number of home medications were 8 ± 4 with 14 undocumented intentional discrepancies and 23 unintentional discrepancies, in patients with metabolic complications the mean number of home medications were 6 ± 2 with 11 undocumented intentional discrepancies and 18 unintentional discrepancies, in patients with other complications like gastric diseases, liver diseases, thyroid disorders the mean number of home medications were 6 ± 3 with 23 undocumented intentional discrepancies and 17 unintentional discrepancies. There was no statistically significant association between the admission diagnosis and the occurrence of undocumented intentional discrepancies ($P=0.20$) and unintentional discrepancies ($P=0.57$). (Table 3)

In the home medication range of 1-3, the total number of patients were 13 with 10 undocumented intentional discrepancies and 3 unintentional discrepancies, in the

Table 4: Number of Home Medications Vs Discrepancies

Home medication range	Number of patients	No of undocumented intentional discrepancies	P value	No of unintentional discrepancies	P value
1-3	13	10		3	
4-6	31	41		67	
7-9	22	43	0.005*	60	0.049*
10-12	11	28		30	
>12	3	4		14	

* A P value of ≤ 0.05 was considered as statistically significant.

home medication range of 4-6, the total number of patients were 31 with 41 undocumented intentional discrepancies and 67 unintentional discrepancies, in the home medication range of 7-9, the total number of patients were 22 with 43 undocumented intentional discrepancies and 60 unintentional discrepancies, in the home medication range of 10-12, the total number of patients were 11 with 28 undocumented intentional discrepancies and 30 unintentional discrepancies, in the home medication range of >12 the total number of patients were 3, with 4 undocumented intentional discrepancies and 14 unintentional discrepancies. There was a statistically significant association between number of home medications taken by the study population and the occurrence of undocumented intentional discrepancies ($P=0.005$) and unintentional discrepancies ($P=0.049$). (Table 4)

DISCUSSION

Medication reconciliation is considered as a formal process by which the complete and exact list of a patient's home medications is assessed together with their pharmacotherapeutic prescription following the hospital admission.^{19,20} An appropriate medication reconciliation program can reduce the medication errors to around 80% and also the potential harm caused by these errors.^{21,22}

The study was conducted in 80 patients (32%) out of 254 patients admitted in the emergency department with medical emergencies during the study period. These were the patients for whom medical reconciliation was done within 24 hours of emergency admission. The study population consisted of 54% of males and majority of the patients (39%) were in the age range of 51 to 65 years, followed by 66 to 80 years (29%), with the mean age of 61 ± 15 years. A study conducted by Lea Knez *et al* (2011), had a study population with a median age of 73 years and a male preponderance of 57.4%.²³

In the present study, majority of the patients were admitted

with medical emergencies like cardiac (24%) and renal complications (23%). A similar finding was observed in a study conducted by Jeffrey M Rothschild, *et al*, which stated medical emergencies like cardiovascular, respiratory and neurological complications as the main reasons for emergency admission.²⁴ A study done by Patricia L Cornish, *et al* also reported that medical emergencies like gastro intestinal, stroke and cardiac complications as the reasons for emergency admission.⁵

The range of home medications taken by majority of the study population was found to be 5 to 7. The mean number of home medications in the study population was found to be 6 ± 3 medications per medical record with a maximum of 13 and minimum of one. This finding is in accordance with the observations of studies done by Andrea J Kent, which reported of an average of 6 home medications per medical record^{25,26} which reported of an average of 7 ± 4 drugs in their home treatment with a maximum of 20 and a minimum of zero.

In the present study, 77 patients had prescription drugs as home medications, non-prescription drugs were taken by 23 patients as home medications and nutritional supplements by 29 patients. A study conducted²⁷ had reported an average of 6.6 ± 4 home medications on an average of which majority were prescription medications (mean medications of 4.8 ± 3.2) and then followed by OTC medications (mean medications of 1.8 ± 1.7).

Of 80 patients in the present study, the home medications were re ordered for 65% of patients on their admission and for the remaining 35% it was not re ordered. Of the 65% patients for whom the medications were re ordered, majority (29%) had a change in their dosing interval, 23% had a change in their route of administration and 13% had a change in their dose. A total of 361 medication discrepancies were identified in 74 patients. One patient had 2 documented intentional discrepancies, 67 patients had 176 undocumented intentional discrepancies, and 56 patients had 183 unintentional discrepancies. A study conducted²⁸ had identified 1483 discrepancies and 1475

discrepancies in 331 patients during stages 1 and 2 (pre and post of Pharmacist intervention on reconciliation) of the study respectively. There were 1351 intentional discrepancies and 132 unintentional discrepancies in stage 1 and 1393 intentional and 82 unintentional discrepancies in stage 2 of their study. Majority of the intentional discrepancies included substitution of another drug based on guidelines, changes made in the dose, dosing interval and route of administration. Similarly unintentional discrepancies included omission of drugs and duplication of drugs. In the present study also the major types of intentional discrepancies included changes in dose, dosing interval and route of administration. In a study conducted by Kelli Kalb, *et al*, a total of 30 unintentional discrepancies were identified in 12 patients, the number of discrepancies per patient ranging from 0 to 7.²⁹

In the present study, prescribing errors were observed in 16% of patients and rectified on time hence no harm had occurred to the patients. This is similar to the reported,³⁰ with 18.48% of errors. But a study conducted,³¹ had findings in contrast to the present study. The former study had identified 939 (45%) of medication errors in 180 patients. Of these errors, 682 (73%) of the errors were categorized to have potential for no harm, but 257 (27%) of errors had potential for harm.

A similar study was conducted³² in 50 patients admitted in the emergency department to ascertain the level of reconciliation of medications and identification of medication errors and assess the impact on the level of reconciliation and prescribing error rates by pharmacist intervention within the emergency department. The mean age of the study population was found to be 64 years and the mean number of home medications was 7.6. In the pre intervention 159 prescribing errors were detected with omissions accounting to greater number. But in the Post intervention group only two errors were detected of which one was incomplete/ incorrect dose and one additional allergy detected.

There was no statistically significant association between the discrepancies and the patient characteristics like age and admission diagnosis, but the number of home medications had a significant association with the number of discrepancies. A similar finding was also reported,²⁸ which had stated that there was no association between variables like age, gender, day of admission, admission

diagnosis and the number of discrepancies.

The results of this study highlight the discrepancies in medication reconciliation. Although a patient's pre admission home medication is recorded at the time of admission by different health care professionals, it is often the case that this information is either fragmented in different documents in their medical record, or not well documented. Barriers to accurate medication reconciliation are complex and both patient and health care professionals centered. Patients may not realize the importance of medication reconciliation and hence may not give adequate information to the attending physician, or may not bring their medications or medication list at the time of emergency admission and also may not be familiar with the medication names and doses. Similarly factors like insufficient staff and time to devote to medication reconciliation may be health care professionals centered.

Pharmacists can play a significant role in performing the medication reconciliation in the emergency department which can also lead to opportunities for providing patients with medication related education like proper use of medications and techniques, the need for medications and the importance of knowing about their medications. A pharmacist's participation in medication reconciliation can reduce the number of medication discrepancies, medication errors and also would aid the physicians and other health care professionals in providing better patient care.

CONCLUSION

The study conducted in 80 patients admitted in the emergency department for whom medication reconciliation was done, had identified 381 medication discrepancies and 13 prescribing errors were identified and corrected. Only 6 patients did not have any discrepancies. Medication reconciliation is an important process to help prevent medication errors. This study recommends the need for additional resources and educational initiatives for the health care professionals to improve medication reconciliation. However for effective medication reconciliation, patients or their care takers also must take an active role in their own care by bringing all their home medications at the time of hospital admissions, thus helping the physicians and other health care professionals involved in reconciliation to obtain absolute medication history and provide better patient care.

Highlights of Paper

- Medication reconciliation is an important process to help prevent medication errors.
- Medication reconciliation was done in 32% (80) of the patients admitted in the emergency department with medical emergencies within 24 hours of emergency admission.
- The mean number of home medications in the study population was found to be 6 ± 3 medications per medical record with a maximum of 13 and minimum of one.
- Home medications were re ordered for 65% of patients on their admission.
- A total of 361 medication discrepancies were identified in 74 patients and 6 patients had no discrepancies.
- Prescribing errors were observed in 16% of patients and rectified on time hence no harm had occurred to the patients.
- Significant association between number of home medications and the occurrence of discrepancies.

Author Profile



- Vanitha Rani Nagasubramanian, is a Lecturer at the Department of Pharmacy Practice, Faculty of Pharmacy, Sri Ramachandra University, Chennai. Her research interest is in the areas of patient education, Pharmacoeconomics and prescription event monitoring. She has around 10 years of teaching experience and 25 research publications. She is currently pursuing her PhD in Pharmacy Practice in Sri Ramachandra University.

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