Ind. J. Pharm. Edu. Res, 2023; 57(1s):s153-s159.
https://www.ijper.org

Original Article

Medication Reconciliation Practices in Two Multispeciality Hospitals

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ABSTRACT

Background: Medication errors are common and can compromise patient safety. Commonly seen at discharge, they can be identified and resolved even during admission. Medication reconciliation is recommended to prevent errors arising from medication discrepancies. Aim: To conduct medication reconciliation in two multispeciality hospitals and classify the identified medication discrepancies according to their potential to cause harm. **Materials and Methods:** This prospective interventional study was carried out in medicine and surgery departments of two urban hospitals over a period of six months. Patients who satisfied the criteria were enrolled and medication reconciliation was performed. Interventions were provided whenever necessary. The identified discrepancies were then given to an expert panel for classifying them based on their potential to cause harm. **Results:** 580 medication discrepancies were identified from a total 372 patients, drug interaction (*n*=345, 61.6%) was the most commonly observed discrepancy, followed by omission error (*n*=127, 12.9%). The medication discrepancies observed from both the hospitals were found to be statistically not significant (*p*=0.246). From a total of 580 discrepancies, 454 (78.27%) discrepancies were Significant, 80 (13.79%) Serious and 46 (7.93%) Not Significant. **Conclusion:** The results of our study show that there are discrepancies in medication use when the patient transitions in a hospital. It is recommended that medication reconciliation practices be performed by clinical pharmacist during the hospital stay to ensure continuity of healthcare and for patient safety. An electronic medical record capable of capturing and continuously updating medication information may be a long-term solution. To achieve this, professional development of clinical pharmacists is of paramount importance.

Keywords: Medication reconciliation, Clinical pharmacist, Medication discrepancies, Medication errors.

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Received: 14-10-2022;
Revised: 03-12-2022;
Accepted: 10-01-2023.

INTRODUCTION

The process of continuous medication management is an important patient safety concern across the world. It is also a complex process that requires information-sharing, good communication among the providers, patients, and families across different settings.[1] Since drug prescribing and reconciliation relies upon an accurate medication history, proper history taking can avoid medication errors; it is estimated that about 20% of medication errors result in patient harm.[2,3] Differences in treatment regimens in different healthcare settings can lead to extended hospitalization, readmissions and even death.[1] Medication reconciliation is reported to be the most important intervention to minimize the occurrence of unintended medication discrepancies at points of transition in healthcare.[4] It is purported to be a robust process to spot and put right any discrepancies before they do any harm and increase healthcare costs.[5]

Medication reconciliation has been available since 2005.[6] Several international patient safety organizations such as the World Health Organization (WHO), the Joint Commission International (JCI) and Institute for Health Care Improvement (IHI) have encouraged the establishing of medication reconciliation processes at each transition of patient in the hospital to improve patient safety.[7,8]

In line with The Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the process of reconciliation of medications is defined as "the process of comparing the medications a patient is taking (and should be taking) with newly ordered medications" in order to straighten out disparities or potential problems.[9] It is recommended that the reconciliation process be carried out when patients are transferred between

DOI: 10.5530/ijper.57.1s.18

health care settings or whenever a medication is discontinued or changed.[5]

Discrepancies occur more commonly at the time of discharge and medications like cardiovascular drugs, drugs that act on the central nervous system, Other drugs like antibiotics, opioid analgesics, anti-hypertensives, anticoagulants, antidiabetic drugs, antipsychotics, and immunosuppressives are likely to cause potential damage to patients.[10] The main reasons for a high number of reconciliation errors are aging, lack of understanding of treatment with medications, variable health literacy, low recall ability, difficulties in communicating a particular language, gaps in the drug history, multiple medical records for each patient, increased length of hospital stay, comorbidities, therapy with multiple drugs, complexity of medication names, doses and frequencies.[11-13]

Pharmacists, by their knowledge and training, are ideal individuals who can identify wrong doses and routes of administration, and therapeutic duplications by obtaining medication histories and thereby assist in the reconciliation process. There are reports from literature stating that in comparison with physicians working alone, physicians working along with pharmacists during the admission process can significantly improve the accuracy of a medication history.[4,14]

The objective of this study was to perform medication reconciliation, using the developed medication reconciliation forms and to classify identified medication discrepancies based on their potential to cause patient harm.

MATERIALS AND METHODS

The study was conducted in in patient wards (Medicine, Surgery) in Hospital 1 and Hospital 2 located in Mysuru, Karnataka, India. This was a prospective interventional study. The study was carried out for a period of six months from September 2019 to February 2020. Patients with at least one comorbid condition staying for at least 24 hr were included. Patients with mental instability and/or cognitive impairment, and those unwilling to participate were excluded from the study. Using Cochran's formula and keeping a margin of error of 5% and 95% confidence interval, we estimated the sample size to be 385. However, we followed a non-probability sampling method (convenience sampling) and did not fix a number for Hospital 1 and Hospital 2.

All in-patients who met the inclusive criteria were reviewed at the time of admission and discharge. On admission, data relating to patient demographics, past medical conditions, past medication history, allergic status, family and social histories were extracted within 24-48 hr. Self-reported medication adherence was assessed using the Morisky's 4-item adherence scale and those scoring below 3 were considered to have adherence issues. We modified the questionnaire to also include the reasons for non-adherence. Any reported medication adherence issues were addressed and patient counselling was performed. Past medications noted were compared with the present medications prescribed and discrepancies were sorted. Similarly, on discharge, medication reconciliation was performed and documented. Interventions were identified and documented.

The clinical significance of the medication discrepancies was determined through a consensus of an expert panel of 4 clinicians (2 specialists in internal medicine, 1 surgeon, 1 GP) and 3 hospital pharmacists. The panelists were asked to rate the significance of the discrepancies using the modified Pippins J *et al.* scale (I = not significant, II = significant, III = serious, IV = life threatening), then an average score was calculated and classified.[15] Patients were grouped gender wise with different age groups and the respective percentage proportion was calculated. Study patients were categorized and expressed in numbers and percentages based on the hospital and department to which they were admitted, number of comorbid conditions, family history, social history, use of Over The Counter (OTC)/herbal medications, their length of stay and the number of medications received before admission, during hospital stay and at discharge. Reasons for medication non-adherence were categorized and expressed in numbers and percentages. The number of medication reconciliations performed at admission and discharge and discrepancies identified were categorized.

The statistical analysis (Chi-square test) was performed by using Statistical Presentation System Software (IBM-SPSS) version 22.0. A p value <0.05 was considered as statistically significant. Discrepancies with potential to cause harm were classified appropriately and reported.

RESULTS

Out of 385 subjects selected for inclusion, 3 of them declined to participate and 10 subjects were transferred to other healthcare facilities within 24 hr of admission. A total of 372 patients formed the study sample, of which 148 (39.7%) patients were from Hospital 1 and 224 (60.3%) from Hospital 2.

The department wise distribution of patients from Hospital 1 was found to be 95 (64%) from medicine and 53 (36%) from surgery. Similarly, 168 (75%) patients were enrolled from the medicine department of Hospital 2 whereas 56 (25%) patients were from the surgery department. The majority of the participants from both Hospital 1 as well as 2 belonged to the age group of 61-80. The mean hospital stay for patients in Hospital 1 was 4 days and for those in Hospital 2 was 8 days (Table 1).

Among the 372 patients enrolled, the number of patients with a positive family history for comorbid conditions was 137 (37%). It was found that 143 (38.4%) patients had one comorbid condition, followed by 138 (37%) patients with two, 73 (19.6%) patients with three, 16 (4.3%) patients with four comorbid conditions and highest number of comorbid conditions- five were seen in

2 (0.5%) patients. The most common comorbid condition in the family histories of the patients was found to be Type 2 Diabetes Mellitus. 28 patients (38.8%) were found to have a history of alcohol and tobacco use followed by 27 patients (37.5%) with a history of tobacco use and 17 patients (23.6%) with a history of alcohol intake. 17 patients (5%) out of the total of 372 were found to have a history of OTC/Herbal drug use within the past one month. The most commonly used OTC medications were Ayurvedic drugs (29%), followed by Analgesics (17%), Antipyretics (12%), Cough syrups (12%) and Antidiarrhoeals (12%), whereas the least commonly used were Homeopathic drugs (6%), Antihistamines (6%) and Home remedies (6%). It was found that the average length of stay of patients in Hospital 1 was shorter than when compared with patients in Hospital 2. This may be because of differences in the severity of the disease at admission of the study population and hospital policies. A total of 580 discrepancies were identified from Hospital 1 and Hospital 2 from a total of 372 subjects. Discrepancies that were identified are as shown in Table 2.

Table 1: Patient demographics and clinical characteristics.

	No. (%) of patients	
	Hospital 1	Hospital 2
Age (in years)		
21-40	5 (3.3%)	23 (10.26%)
41-60	62 (41.8%)	90 (40.17%)
61-80	75 (50.6%)	97 (43.3%)
81-100	6 (4.05%)	14 (6.25%)
Gender		
Male	108 (73%)	137 (61%)
Female	40 (27%)	87 (39%)
Mean hospital length of stay, days [SD]	4 [±2.35]	8 [±4.87]
Mean medication use before admission, number [SD]	2.96 [±1.68]	2.49 [±1.5]
Mean medication use at admission, number [SD]	5.41 [±2.18]	6.12 [±1.83]
Mean medication use at discharge, number [SD]	4.91 [±2.08]	5.46 [±2.01]
Discrepancies identified	231 (39.82%)	349 (60.17%)

Drug interactions (345 cases, 59.5%) accounted for maximum discrepancies identified, followed by omission errors (127 cases, 21.9%). Among the drug interactions, 122 cases (35.36%) were reported from Hospital 1, whereas 223 cases (64.63%) were from Hospital 2. The drug interactions were found to be higher in Hospital 2 as a majority of the subjects were from rural background and were found to consult multiple physicians and hence were prescribed with multiple medications, resulting in drug-drug interactions. This was not the case in Hospital 1, as a majority of the subjects were from urban settings and would consult only a single physician. Among the drug interactions identified, 193 (55.94%) were major, 142 (41.15%) were moderate and 10 (2.89%) were minor interactions.

Omission errors were the second most common discrepancies identified. 66 cases (51.96%) were reported from Hospital 1, whereas 61 cases (48.03%) were from Hospital 2. The drugs that were observed to be commonly omitted were anti hypertensives and anti diabetic drugs followed by IHD, Thyroid, Dyslipidemic, Parkinson's and CVA drugs. Subtherapeutic dosage and improper drug selection were the least commonly found discrepancies, each with 1 case from Hospital 2. An additional category was added to

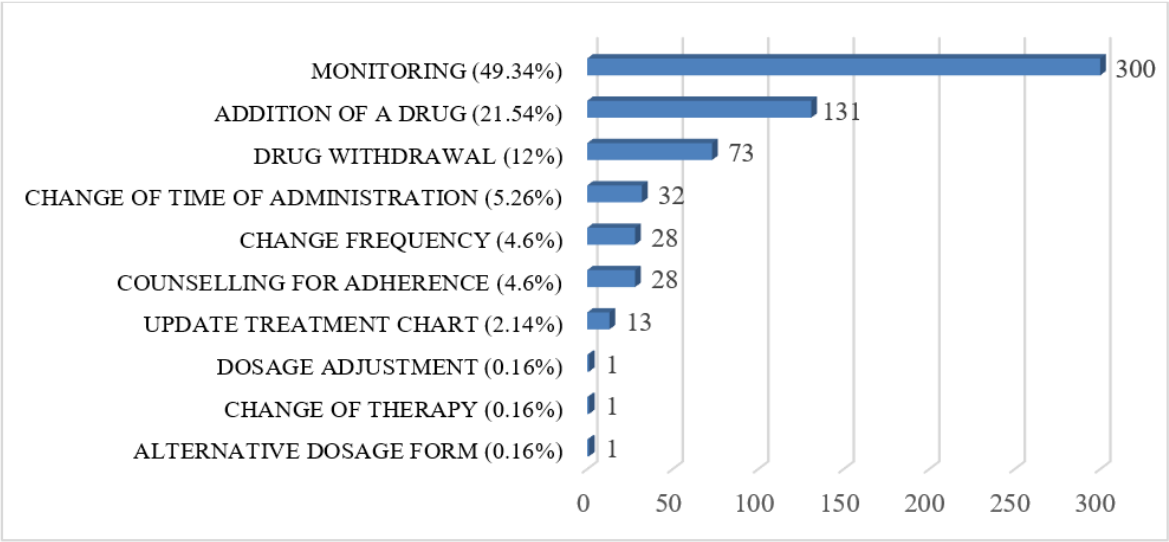

Figure 1: Interventions provided by the clinical pharmacists.

Table 2: Discrepancies Identified in Hospital 1 and Hospital 2.

Discrepancies Identified	Hospital 1	Hospital 2	Total
Omission Error (21.89%)	66 (51.96%)	61 (48.03%)	127
Drug Duplication (1.72%)	4 (40%)	6 (60%)	10
Drug Interaction (59.4%)	122 (35.36%)	223 (64.63%)	345
Adverse Drug Reaction (2.06%)	1 (8.33%)	11 (91.66%)	12
Untreated Indication (0.68%)	1 (25%)	3 (75%)	4
Drug use Without Indication (1.03%)	0	6 (100%)	6
Improper Drug Selection (0.17%)	0	1(100%)	1
Improper Frequency (4.82%)	16 (57.14%)	12 (42.85%)	28
Documentation Error (2.24%)	8 (61.53%)	5 (38.46%)	13
Subtherapeutic Dosage (0.17%)	0	1 (100%)	1
OTHERS (5.68%) (Improper time of administration, alternative Dosage Form)	13 (39.39%)	20 (60.60%)	33
Total	231 (39.82%)	349 (60.17%)	580

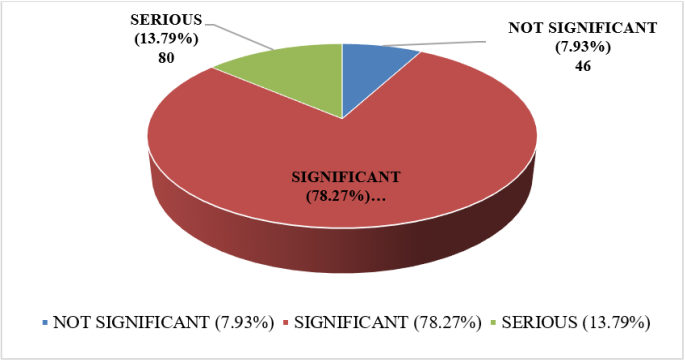

Figure 2: Classification of Identified 580 discrepancies.

the list of identified discrepancies, to include errors that did not come under the ones mentioned above. This category included improper time of administration with cases of Tab. Aspirin which was administered in the afternoon but shows better action when administered at night and alternative dosage form with a case of an 83 year old female subject who was discharged with an inhaler and a spacer, whereas nebulization therapy is more preferred in the elderly. The medication discrepancies observed from both Hospital 1 and Hospital 2 at admission as well as at discharge were found to be statistically not significant (p=0.246). At admission, the discrepancies identified from Medicine and Surgery departments of Hospital 1 and Hospital 2 were not significant statistically (p=0.443). Similarly, at discharge, the discrepancies identified from Medicine and Surgery departments of both hospitals were not significant statistically (p=0.225).

Assessment of Medication Adherence

Some common reasons for non-adherence in both the hospitals were found to be forgetfulness, purposeful omission, fear of needle, pain at injection site, and relatively high cost of drugs for patients from low economic backgrounds. Non-adherence in Hospital 2 (12%) patients was observed to be higher when compared to that in Hospital 1 (1%), as patients were unaware of their disease conditions and the importance of medication adherence. Due to the identification of medication adherence issues in the study population, patient counselling was performed for 28 patients.

Table 3: Description of the 30 identified discrepancies.

Not-Significant	1) Improper frequency of Proton Pump Inhibitors (2) 2) Drug Duplication at admission (1) 3) Drug Use Without Indication (1) 4) Others (Improper Time of Administration) (1)
Significant	1) Omission Error at admission (3) 2) Drug Duplication both at admission and at discharge (2) 3) Improper Frequency of Antibiotic (1) 4) ADRs (2) 5) Untreated Indication (4) 6) Drug Use Without Indication (2) 7) Documentation Error (2) 8) Drug Interaction-Major & Moderate (5) 9) Others (Improper Time of Administration) (1)
Serious	1) Omission Error at discharge (2) 2) Drug Interactions- Major (1)

Interventions made by Clinical Pharmacist

Among the identified 580 discrepancies that were assigned interventions, monitoring the interaction (300, 49.34%) was the most common intervention, followed by addition of a drug (131, 21.54%) for omission error and untreated indication. Interventions provided are depicted in Figure 1.

Acceptance of interventions at Hospital 2 was found to be 94% whereas at Hospital 1 it was 66%. This difference in acceptance of interventions was because at Hospital 2, there is an established clinical pharmacy service since 20 years and pharmacists and pharmacy interns are in close contact with HCPs, discussing treatment charts and any other patient medication problems openly. So, prescribers are more likely to accept interventions because of the rapport built with them.

Out of the identified 580 discrepancies, clinical significances of commonly occurring 30 medication discrepancies were determined through a consensus of an expert panel. According to the ratings provided by the panelists, 23 (77%) discrepancies were categorized as Significant, 4 (13%) were Serious and 3 (10%) were Not Significant. A description of the 30 identified discrepancies are given in Table 3.

Based on the rating by the panellists, the remaining 550 discrepancies were classified in a similar manner. 454 (78.27%) discrepancies were classified as Significant, 80 (13.79%) were classified as Serious and 46 (7.93%) were classified as Not Significant, as shown in Figure 2.

DISCUSSION

Our study results are similar to other published studies involving the process of medication reconciliation. A previous study showed that patients were directly admitted to medical or surgical units[7] hence medical and surgical units were chosen for our study as 80% of the patients are admitted in these departments in the study setting. In the current study the main purposes were to develop a medication reconciliation form which was used to record various data, to perform medication reconciliation process, prevent medication discrepancies by intervening whenever necessary and classifying the errors according to their potential to cause harm. During the study pharmacists interviewed the patients and collected the medication histories, clarified treatment orders and suggested alternatives to prevent medication discrepancies. As the study progressed, various discrepancies were found such as drug interactions (345 cases, 59.5%) that accounted for maximum discrepancies identified. Omission errors were the second most common discrepancies identified. 66 cases (51.96%) were reported from Hospital 1, whereas 61 cases (48.03%) were from Hospital 2. Subtherapeutic dosage and improper drug selection were the least commonly found discrepancies, with 1 case in Hospital 2. In other medication reconciliation studies conducted, omission errors dominates as the most common discrepancy rather than drug interactions. A study conducted by Rey and his colleagues, showed the chief discrepancy was omission error (54.5%), followed by subtherapeutic dosage (5.9%), drug used without indication (1.2%), drug duplication (0.4%), documentation error (0.2%) and drug interactions (0.2%).[8]

Among the drug interactions that were identified, 193 (55.94%) were major, 142 (41.15%) were moderate and 10 (2.89%) were minor interactions. In a study conducted by Babu *et al.*, 77 interactions were identified; among them there were a high percent of significant interactions (62.33%).[16]

A total of 127 omission errors were identified from both the hospitals with 66 (51.9%) from Hospital 1 and 61 (48%) from Hospital 2. The drugs that were omitted were anti hypertensives and anti diabetic drugs, IHD, Thyroid, Dyslipidemic, Parkinson's, CVA and CKD drugs. A study conducted by Mazar *et al.* showed the most frequent reconciliation error was omission and the commonly omitted drugs were Lipid-lowering (12.4%) and antihypertensive agents.[7] Drug duplication (10 cases) accounted for 2.07% of the total discrepancies identified, out of which (4) 40% were from Hospital 1 and (6) 60% were from Hospital 2. As per the study by Wong *et al.*, out of 105 unintentional discrepancies 2.9% of the errors were drug duplication.[17]

ADRs constituted 5.6% (12) of the total discrepancies, out of which 1 (8.33%) was from Hospital 1, and from Hospital 2, 11(91.66%). The most commonly occurred ADRs was the Insulin induced hypoglycemia followed by Piperacillin induced rashes and Furosemide induced hyponatremia. According to a study by Pfister *et al.*, 41 cases of ADR were reported. Some of them were furosemide induced hypokalemia, amlodipine induced edema.[18]

Out of the identified discrepancies, 4 (0.69%) were untreated indications, with 1 (25%) from Hospital 1 and 3 (75%) from Hospital 2. The study conducted by Ashjian *et al.*, showed 58 or 11.4% of patients with medication-related problems among whom untreated indications were seen in 9 patients.[19]

Drug use without indication was found only in Hospital 2, with 6 cases (2.5%). In a prospective, single-centre pilot study by Mazhar *et al.*, drug used without indication were 2.3% from medicine and 4.1% from surgery.[7] Improper drug selection was found only in Hospital 2, with 1 case (0.5%). Khalil *et al.* conducted a prospective parallel study, in which improper drug selection was one of the most common type of error (intervention group=14, control group=34).[20]

Improper frequency (28 cases) accounted for 4.8% of the total discrepancies identified, out of which 16 (57.14%) were from Hospital 1 and 12 (42.85%) were from Hospital 2. According to study by Wong *et al.*, at least one actual or potential unintentional discrepancy existed in 70.7% patients, among them 60 (8.6%) were improper frequency.[17]

Documentation errors found in both hospitals were 13 (2.24%) with 8 (61.53%) in Hospital 1 and 5 (38.46%) in Hospital 2. The documentation error was that the treatment chart had not been updated. In a study conducted by Babu *et al.* that consisted of two test groups and one control group, 34.72% documentation errors were found in the control group while, test groups 1 and 2 included 6.81% and 19.17% respectively.[16]

Subtherapeutic dosage was observed only in Hospital 2 with only 1 case (0.5%). According to a study by Pfister *et al.*, among 66% of the participants, 14 subtherapeutic dosage errors were identified.[18] The Others category included 33 (5.6%) cases, out of which 13 (39.39%) were from Hospital 1 and 20 (60.60%) were from Hospital 2. This category included improper time of administration.

As medication adherence was assessed, most of patients in Hospital 1 were aware about their disease conditions and medications, only 1% of the cases were non adherent due to two reasons, one case was due to forgetfulness and the other patient was purposely omitting the drugs. In Hospital 2, non-adherence to past medications was found to be 12% and more compared to Hospital 1 since most of the patients were unaware of their disease conditions and medications. Aside from forgetfulness and purposely omitting drugs, fear of needle (2 cases), pain at injection site (1 case) and relatively high costs of drugs (4 cases) for patients from low economic backgrounds were some of the reasons. Westberg and his colleagues conducted a study that showed medication adherence as a drug therapy problem, and found 147 cases of medication non adherence among 408 patients.[21]

Interventions were made for the discrepancies. Monitoring the interactions was the most common intervention, followed by addition of a drug. Acceptance of interventions were more in Hospital 1 (94%) than Hospital 2 (66%) due to the established clinical pharmacy services as well as rapport with HCPs and pharmacists in Hospital 2. Lau conducted a retrospective chart review, in which patient education was the most performed intervention (58%), followed by ordering new prescriptions or refill requests (49.9%), and provision of supportive care (32.6%).[22]

According to the ratings provided by the panellists 454 (78.27%) discrepancies were classified as Significant, 80 (13.79%) were classified as Serious and 46 (7.93%) were classified as Not Significant. Similar to ours, a study was conducted by Knez *et al.*, where an expert panel provided the clinical significance of medication errors. The rating of the errors was classified using a four-point scale (0 - not important to 3 - potentially fatal). More than half of the evaluable errors were rated as clinically important by the panel.[23]

This study had a few limitations, firstly the study was limited to conduction of Medication Reconciliation in medicine and surgery departments and consequently the type of problems identified may not be duplicated in other departments. Secondly unavailability of pharmacists at all points of transitions of the patient and thirdly the effectiveness of medication reconciliation and any interventions performed by pharmacists entirely depends on the accuracy of the information provided by the patient.

CONCLUSION

This study provides evidence that there exists discontinuity in drug therapy during patients' transitions within the hospital that can affect the safety of the patient. Discrepancies during patient transitions can be prevented by implementing medication reconciliation practice by clinical pharmacists in hospital settings. The presented results highlight the need for implementation of pharmacist provided medication reconciliation during the patient's stay in the hospital to ensure continuous provision of healthcare and improved patient safety. An electronic medical record capable of capturing, continuously updating medication information as well as providing pop-up reminders may help the pharmacist and the health care professionals as a long-term solution.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Cite this article: Syju AK, Abraham C, Korath PS, Jacob RS, Sanathan S, Arun A. Medication Reconciliation Practices in Two Multispeciality Hospitals. Indian J of Pharmaceutical Education and Research. 2023;57(1s):s153-s159.