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A Study on Medication Reconciliation and Its Prioritization in A Tertiary Care Hospital in South India

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ABSTRACT

Medication reconciliation is a comparison of the patient's current medication regimen against the physician's admission, transfer, and/or discharge orders to identify and correct discrepancies. This retrospective observational research from a period of 2016 to 2020 aims to study the medication reconciliation process and prioritize the areas in which medication reconciliation will be more beneficial. A total of 406 patients who fulfilled the inclusion and exclusion criteria were selected, comprising 248 (61%) males and 158(39%) females. Out of 406 patients, 228 (56.2%) patients had medication reconciliation errors. The errors were distributed in the respective reconciliation phases, on admission 50% errors, during hospital stay 20% errors, during transition of care 6.5% errors and 23.5% errors at discharge. The statistical analysis using the chi-square test reveals that, age and number of comorbidities ($p< 0.001$) had a significant association as also the number of comorbidities with errors in different phases ($p<0.01$). The common disease conditions observed with a higher number of reconciliation error includes Diabetes (34.4%), Hypertension (22.2%), and coronary artery disease (7.9%). The study concludes that Geriatric Patients and patients with a greater number of comorbidities are at higher risk for reconciliation error. So, priority should be given to those categories of patients. There was a significant number of medication reconciliation errors during the admission phase which frequently lead to errors throughout hospitalization and discharge. Hence equal importance should be given to the admission phase as that of other phases.

INTRODUCTION

The World Health Organization defines medication reconciliation as the ‘‘formal process in which health care professionals partner with patients to ensure accurate and complete medication information transfer at interfaces of care.’’ Medication reconciliation aids in the detection and prevention of discrepancies. The discrepancy may be caused due to disparities between medication orders taken before and those prescribed on admission. Medication reconciliation aims to provide accurate and complete medication information of patients to use it within and across the continuum of care to assure patient safety and quality of care. When there is a lack of coherence in obtaining and documenting medication histories and implementing medication reconciliation, various medication-related problems (MRPs) can occur. The MRPs that can be prevented by the medication reconciliation process include failure to receive a drug, ADEs, drug interactions and untreated indications. [5]

Drug omissions are the most prevalent form of medication error reported. A drug omission occurs when a patient does not receive the correct medication, either because the medication was not prescribed or because it was not administered. Drug omissions can occur at any stage during the hospitalization such as medications may be omitted from initial medication lists obtained upon admission, the prescriber may omit a drug when writing or entering orders, orders for medications may not be transcribed onto a paper medication administration record, pharmacy staff may fail to enter medication orders on to computer system, deliver medications to patient-centered areas, nurses may fail to administer the medications ordered. The consequence of a drug omission can vary from minor to severe harm depending on the medications and the patient’s medical conditions.[9]

In India, medication reconciliation is in its infancy stage. Despite the significance of medication reconciliation and its potential ramifications, the medical effects of these disparities have received significantly less attention. Med Rec services are time-consuming and the resources available to conduct the process are limited, patients at high risk should be identified and priority should be given to those categories of patients.[8]

AIM

Study the medication reconciliation process and prioritize the areas in which medication reconciliation will be more beneficial.

OBJECTIVES

1. Assess medication reconciliation on admission, during hospital stay, during the transition of care, and upon discharge.

2. Identify the areas of prioritization in medication reconciliation that will require more attention by health care providers.

REVIEW OF LITERATURE

Tatiane Continental (2021) conducted a prospective cross-sectional study between June 2018 and May 2019 on Medication Reconciliation during admission to university Hospital. There were discrepancies both intentional 89(8%) and unintentional 230 (20%) from a total of 1134 discrepancies. Out of a total of 318 medication interventions carried out, about 230 showed unintended medication discrepancies. Of these, 138 (60%) interventions were not accepted.[1] **Sara Al Khansa** et al (2016) conducted a retrospective study by taking the data from July 2010 till June 2011, to determine the incidence and characteristics of unintentional medication discrepancies and to identify and improve the medication errors at discharge by assessing the impact of medication reconciliation. 300 patients were selected for the study and out of these 108 (34.67%) patients had discrepancies. They found that the most common type of discrepancy was Omission error(63%), and the least was drug interaction (0.3%). The majority of the prescribing error was due to the Omission of drugs (32.4%), and the least was due to improper frequency (15.1%). Their study identified that internal medicine and cardiology departments had the most discrepancies. They proved that by identifying and correcting these errors, medication reconciliation reduced potential patient harm which outweighs its cost and prevented readmission. [21]

METHODOLOGY

STUDY SETTINGS

The retrospective observational study on medication reconciliation was carried out in various departments of Lourdes hospital, Post Graduate Institute of Medical Science and Research, Kochi, Kerala. It is a 500 bedded multispecialty tertiary care hospital with a wide range of amenities.

STUDY DURATION

An observational study was designed for a duration of 1 year using retrospective data from the previous five years, 2016-2020.

INCLUSION CRITERIA

- Patients of both genders and all age groups.

EXCLUSION CRITERIA

- Patients who have no pre-medication due to the absence of comorbidities.

STUDY DESIGN

The study was conducted after obtaining the approval of the Institutional ethics committee. A retrospective chart review was conducted from a random sample of patients admitted to various departments of a tertiary care academic teaching hospital**.** The patients were selected based on inclusion and exclusion criteria.

SAMPLE SIZE Sample size was calculated with the help of a statistician, a total of 406 patients were included in the study (the minimum sample size required was found to be 350).

DATA COLLECTION TOOL

A specially designed data collection form. Patient data were extracted from medical records and the LOURDES MEDIWARE information system.

DATA COLLECTION

Patient data were gathered retrospectively which comprised the demographics of the patient (age, sex, allergy, height, and weight), chief complaints on admission, past medical and medication history, lab parameters, and drug therapy during the hospital stay, the transition of care, and discharge. The drug omission was identified and documented by reviewing disparities among on-admission medications, those started during the hospital stay, the transition of care, and discharge for which the available sources such as the quality system department, drug information center, medical records department, and Mediware software (hospital data software) were used. The prioritization of medication reconciliation areas in which the clinical pharmacist can contribute more towards patient safety was identified to optimize patient care.

STATISTICAL ANALYSIS

The collected data were compiled using Microsoft Excel and SPSS and presented using tables and graphs. Calculation of mean and SD were done by using statistical software and SPSS. The significance of the study results (<0.05) was assessed using the chi-square test.

RESULTS AND DISCUSSION:

A total of 406 patients were analyzed, which comprised 248 males and 158 females. Out of 406 patients, 228 (56.2%) patients had medication reconciliation errors (555 errors).

DISTRIBUTION OF ERRORS IN PATIENTS

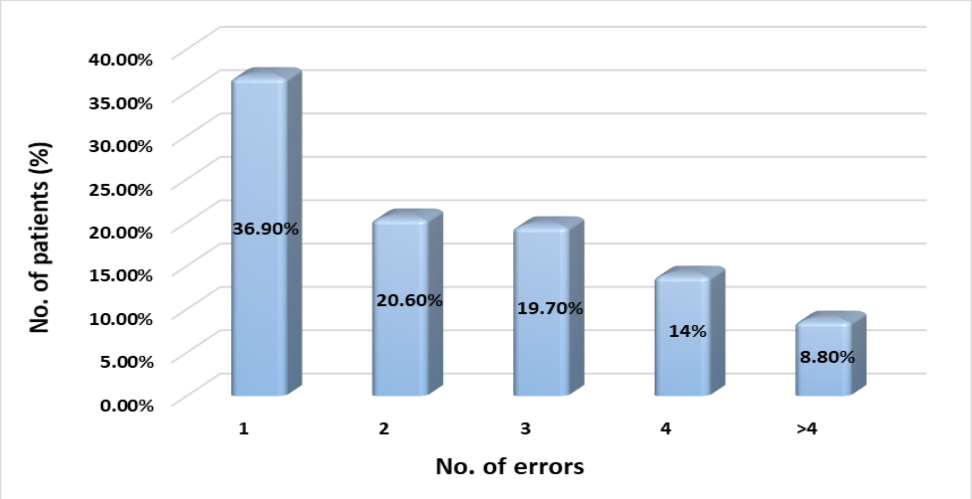

Figure 1: The distribution of errors among patients.

In our study, we found 555 medication reconciliation errors in 228 patients. 84 patients (36.90%) had a single error, 47 (20.6%) had two errors, 45 (19.7%) had three, 32 (14%) had four errors and 20 (8.8%) had more than four errors.

Like our findings, a study by Kristine M. Gleason in 2010 revealed that around 90 patients were found to have one error, 47(7%) of them showed two errors, three errors in 21(3%) patients and 13(2%)patients found to have four or more errors.[28]

GENDER DISTRIBUTION:

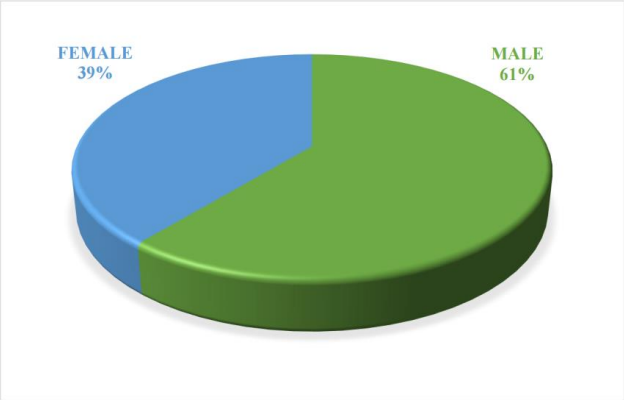

Figure 2: Gender distribution of patients

Our study consisted mostly of males 248 (61%) compared to females 158 (39%). Most errors were found in males 145 (58.5%) compared to females 83 (52.5%) but there was no significant association between gender and medication reconciliation error (P value=0.24). Likewise in a study conducted by Suzanne van der Gaag et al in 2017, it was revealed that there was no significant difference in gender (p = 0.199) and the number of patients with a medication change (p = 0.460).[32]

AGE DISTRIBUTION

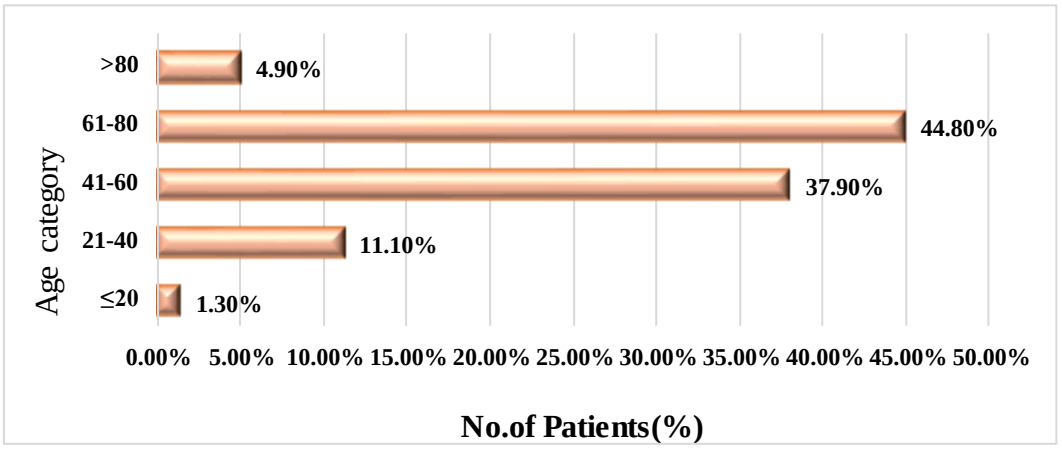

Figure 3: Age distribution of patients

The Mean age of the patients was 58.9 ± 15.2 ranging, from 13 to 93 years. 5 (1.3%) patients were under the age category of less than or equal to 20yrs, 45 (11.10%) patients in 21-40yrs,

154 (37.9%) patients in 41-60, 182 (44.8%) in 61-80yrs, 20 (4.9%) patients above 80 yrs. Most of the patients 182 (44.8%) were under the age category of 61-80 years in our study.

MEDICATION RECONCILIATION ERRORS IN DIFFERENT PHASES:

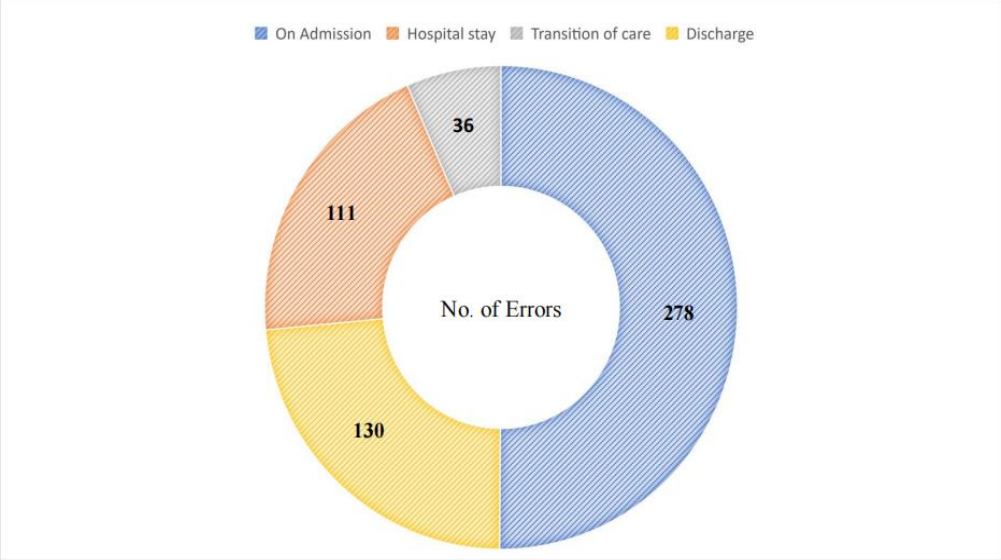

Figure 4: Distribution of errors in different phases of Med Rec

In our study, we observed that the majority of errors were in the phase of admission, 278 (50.1%) and we found 111 (20%) errors during hospital stay, 36 (6.5%) during the transition of care, and 130 (23.4%) upon discharge.

Medication Reconciliation errors – On Admission

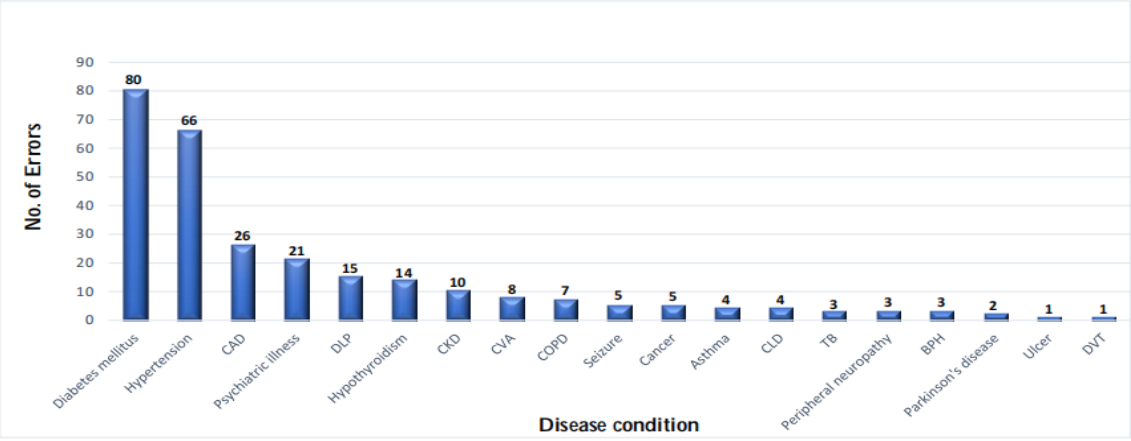

Figure 5: The distribution of disease conditions among admission errors

According to our study, we found a total of 278 errors (50%) on admission. The most frequent conditions associated with reconciliation errors were Diabetes (80), Hypertension (66), and coronary artery disease (26). In our study, 181 patients (44.6%) had incomplete medication history on charts. Kaitlin R. Stockton et al 2017 conducted a similar study in which, the medication reconciliation forms for the past medication history were left blank in 67.8% of the charts. Likewise, a study conducted by Cécile Chung et al in 2019 reported that omission (70.1%) of the pre-admission medication was the most common type of discrepancy.[2]

Comparison of patients in ICU and Ward with undocumented medication history upon admission

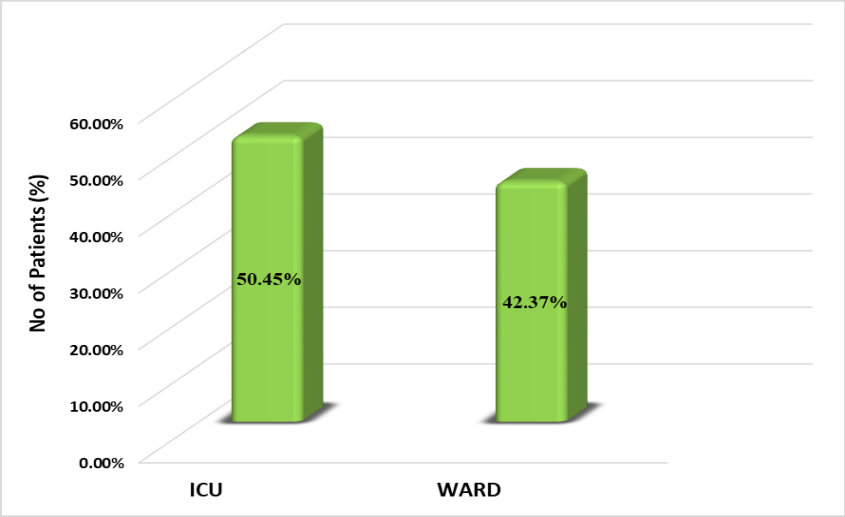

Figure 6: Percentage of patients with undocumented medication history, directly admitted to ICU and Ward.

In our study, we observed that 111 (27.3%) patients directly admitted to ICU had 50.45% of undocumented medication history errors and 295 (72.66%) patients who were directly admitted to ward had 42.37% errors.

AGE CATEGORY IN PATIENTS WITH UNDOCUMENTED

MEDICATION HISTORY:

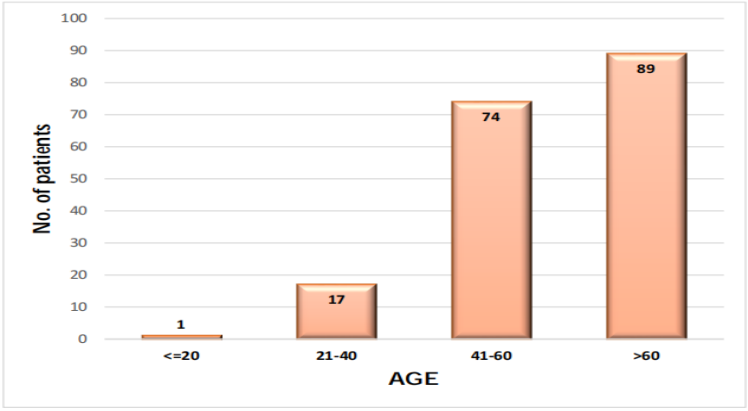

Figure 7: Age-wise categorization of patients with undocumented medication history.

We found that errors in past medication history increased with an increase in age. From figure 7, patients above 60 years had a higher number of errors. Similarly, a study by Unroe et al. in 2010 showed that age was a factor in the occurrence of discrepancies on admission.[27]

Omission error - during hospital stay:

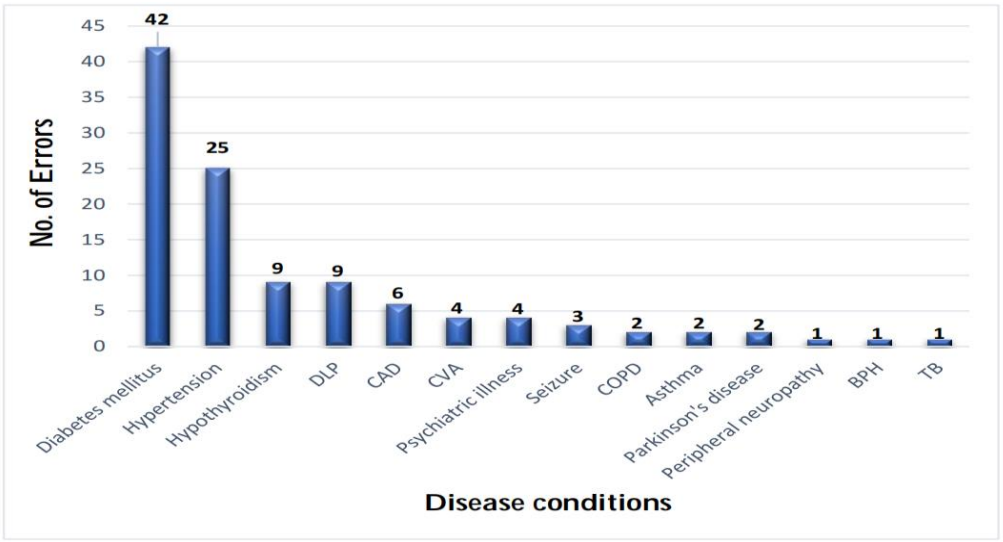

Figure 8: The distribution of disease conditions based on errors during hospital stay

Our study demonstrated a total of 111 errors (20%) during the hospital stay and the most frequent disease condition involved in reconciliation errors were diabetes (42) and hypertension (25). A study conducted by Sara Al Khansa et al in 2016 reported that the most

common discrepancies consisted of medication omission in 68 (63%) patients[21]. A study conducted by S Belda-Rustarazo et al in 2015 revealed that 525 (64.5%) patients had at least one reconciliation error during the hospital stay and drug omission was the most frequent reconciliation error consisting of 73.6% errors.[14]

❖ **ERROR ON ADMISSION THAT CONTINUED DURING HOSPITAL STAY:**

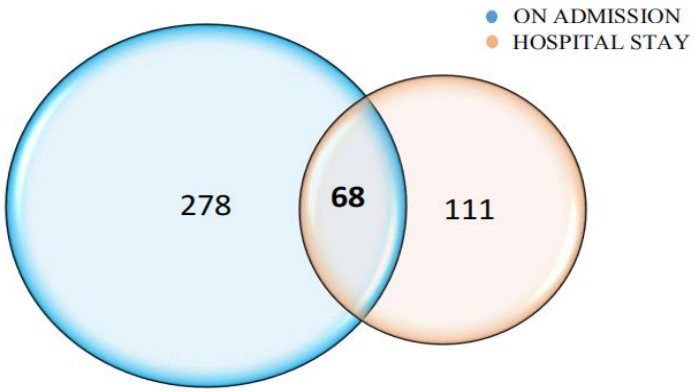

Figure 9: Error due to incomplete medication history that continued during hospital stay.

❖ **ERROR BETWEEN ADMISSION AND HOSPITAL STAY THAT CONTINUED TILL DISCHARGE**:

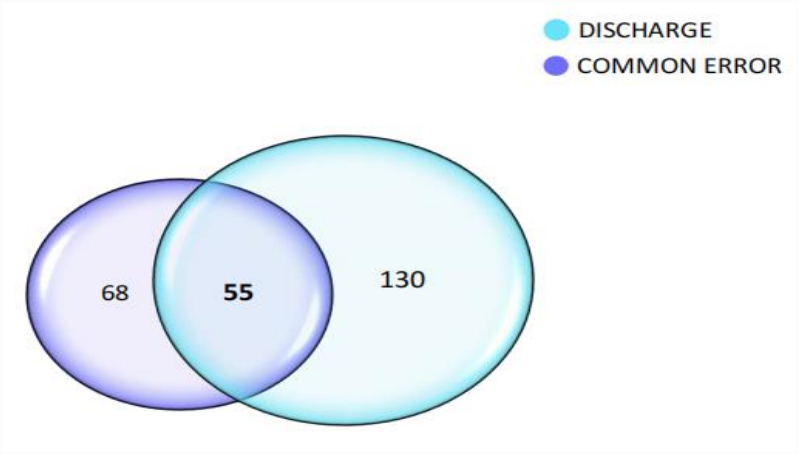

Figure 10 Error between admission and hospital stay that continued till discharge.

In our study, we found 68 omission errors (61.3%) in 61 patients (15.02%) during the hospital stay as a result of undocumented medication histories in charts. These errors due to lack of proper medication reconciliation caused the continuation of 55 errors (42.3%) in 41

patients (10.1%) till discharge. A similar study conducted by Kristine M. Gleason et al in 2010 showed that about 85% of patients had errors originating in medication histories, which were carried throughout their inpatient orders and almost half were omissions.[28] This evidence suggests that the medication reconciliation process during hospital admission is a very important tool that results in the reduction of medication reconciliation errors during the hospital stay.

Omission error- during the transition of care

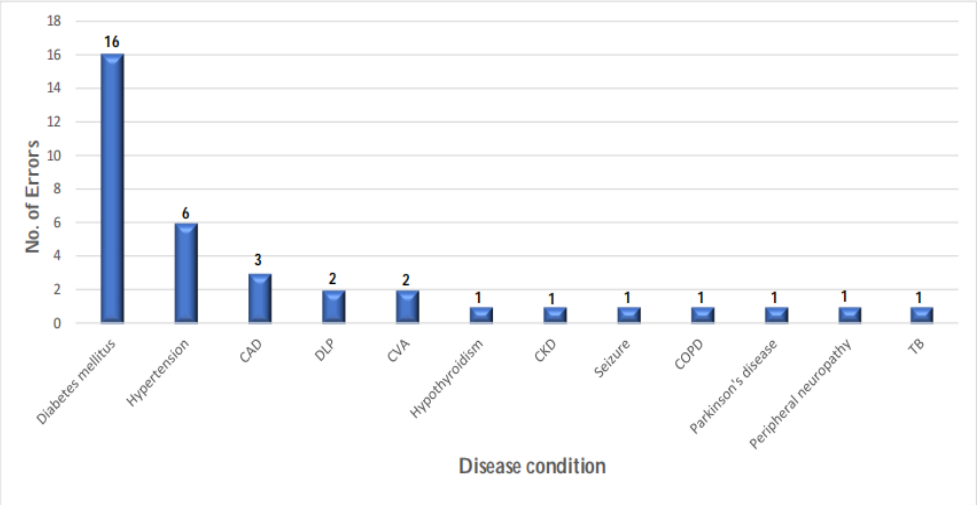

Figure 11: The distribution of disease conditions based on errors in the transition of care.

Our study identified 36(6.5%) errors during the transition of care. The condition with a higher number of errors was Diabetes (16). During the transition of care, any condition which was not treated on hospital admission can be corrected by a proper medication reconciliation process based on both the patient's ongoing medication chart and each medical condition.

Omission error- at discharge

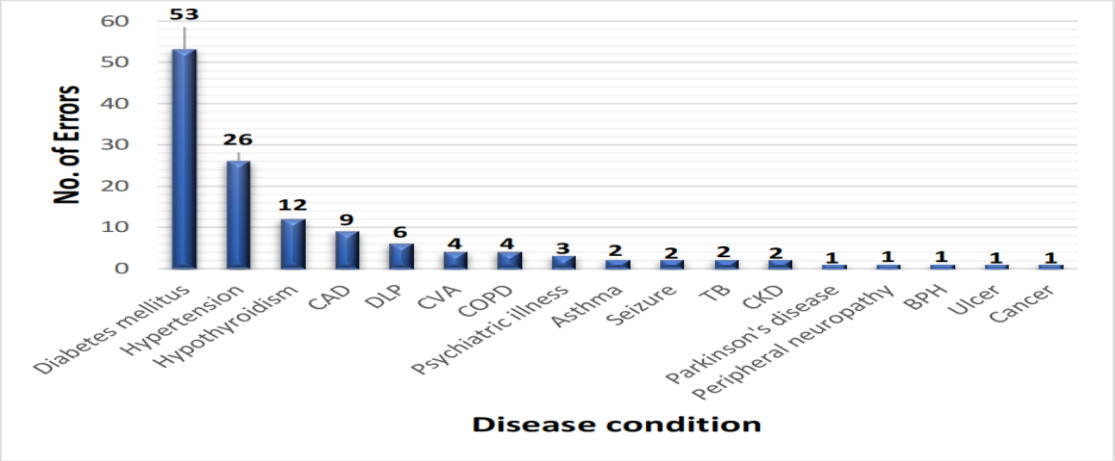

Figure 12: The distribution of disease conditions based on errors at discharge

In our study, 130 omission errors (23.4%) were found at discharge. Out of these Diabetes (53) and Hypertension (26) were the disease conditions with more errors.

PRIORITIZATION OF AREAS IN MEDICATION RECONCILIATION:

❖ **AGE CATEGORY AND NUMBER OF COMORBIDITIES:**

Table 1: Distribution of patients according to age and number of comorbidities.

AGE CATEGORY	NO. OF COMORBIDITIES		
	1	2	≥ 3
≤ 20	5	0	0
	4.8%	0.0%	0.0%
21-40	28	11	6
	26.9%	9.4%	3.2%
41-60	47	48	59
	45.2%	41.0%	31.9%
61-80	21	57	104
	20.2%	48.7%	56.2%
>80	3	1	16
	2.9%	0.9%	8.6%
Total	104	117	185

We observed that the number of comorbidities increases with advancing age. Three or more comorbidities were identified mostly in patients under the age category of 60 years and above. Age had a significant association with several comorbidities ($p<0.001$).

A study conducted by Kraus SK et al in 2017 reported that 52.5% of patients who were older with a higher number of comorbidities (i.e. hypertension, coronary artery disease, diabetes, and chronic kidney disease) had at least one medication discrepancy.[18]

Similarly, a study conducted by S Belda-Rustarazo et al in 2015 revealed that the risk of error on admission was higher in patients with more pre-admission drugs and more comorbidities.[14]

❖ **THE NUMBER OF COMORBIDITIES AND ERRORS IN DIFFERENT PHASES:**

Table 2: Distribution of patients based on number of comorbidities and error at different phases (on admission, during hospital stay, transition of care and discharge)

	No. of comorbidity			Total
	1	2	≥ 3	
No Error	51	58	69	178
	49.0%	49.6%	37.3%	43.8%
Error in any One phase	38	40	56	134
	36.5%	34.2%	30.3%	33.0%
Error in any Two phase	4	8	22	34
	3.8%	6.8%	11.9%	8.4%
Error in any Three phase	8	4	24	36
	7.7%	3.4%	13.0%	8.9%
Error in four phase	3	7	14	24
	2.9%	6.0%	7.6%	5.9%
Total	104	117	185	406

While analyzing the selected variables such as the number of comorbidity and errors using the chi-square test, the P-value was found to be less than 0.05 which indicates that there was a significant association between them. As the number of comorbidity rises so does the number of medications prescribed and therefore the number of errors as well. From our

findings, some comorbidities were significantly associated with errors in different phases. (p=0.01).

Also, a study conducted by Charlotte D. VAN DER LUIT in 2018 showed that, when univariate logistic regression analysis was carried out, there was a significant association between age (p<0.001) and medication discrepancies. Multivariate analysis revealed that the frequency of medication discrepancy had a significant association with age (p=0.004) and the number of pre-admission medications (p<0.001).[16]

In line with the above studies, our result also showed a similar association. Table 1 showed that number of comorbidities were statistically associated with the age group of patients and from Table2, we derived a significant association between comorbidity and error. Therefore age and comorbidity are factors involved in medication reconciliation errors. Our study showed that the majority of errors occurred in the age group of >60 years (*n* = 202, 57.9%). Likewise, a study conducted by Climente-Marti et al. in 2010 showed that the risk of UMD increases in older patients.[26]

CONDITIONS AND ERRORS AT DIFFERENT PHASES

Table 3: Distribution of various conditions based on errors at different phase

Disease condition	On admission	Hospital stay	Transition of care	Discharge
ASTHMA	4	2	0	2
	1.44%	1.80%	0%	1.54%
BPH	3	1	0	1
	1.08%	0.90%	0%	0.77%
CAD	26	6	3	9
	9.35%	5.41%	8.33%	6.92%
CANCER	5	0	0	1
	1.80%	0%	0%	0.77%
CKD	10	0	1	2
	3.59%	0%	2.78%	1.54%
COPD	7	2	1	4
	2.52%	1.80%	2.78%	3.08%
CVA	8	4	2	4
	2.88%	3.60%	5.55%	3.08%
DIABETES MELLITUS	80	42	16	53
	28.78%	37.84%	44.44%	40.77%
DLP	15	9	2	6
	5.40%	8.11%	5.55%	4.61%

HYPERTENSION	66	25	6	26
	23.74%	22.52%	16.67%	20%
HYPOTHYROIDISM	14	9	1	12
	5.04%	8.11%	2.78%	9.23%
PSYCHIATRIC ILLNESS	21	4	0	3
	7.55%	3.60%	0%	2.31%
SEIZURE	5	3	1	2
	1.80%	2.70%	2.78%	1.54%
OTHERS	14	4	3	5
	5.04%	3.60%	8.33%	3.85%
TOTAL	278	111	36	130

The common disease conditions that were observed with reconciliation error include Diabetes 191 (34.4%), Hypertension 123(22.2%), Coronary artery disease 44(7.9%), and Hypothyroidism 36 (6.5%).

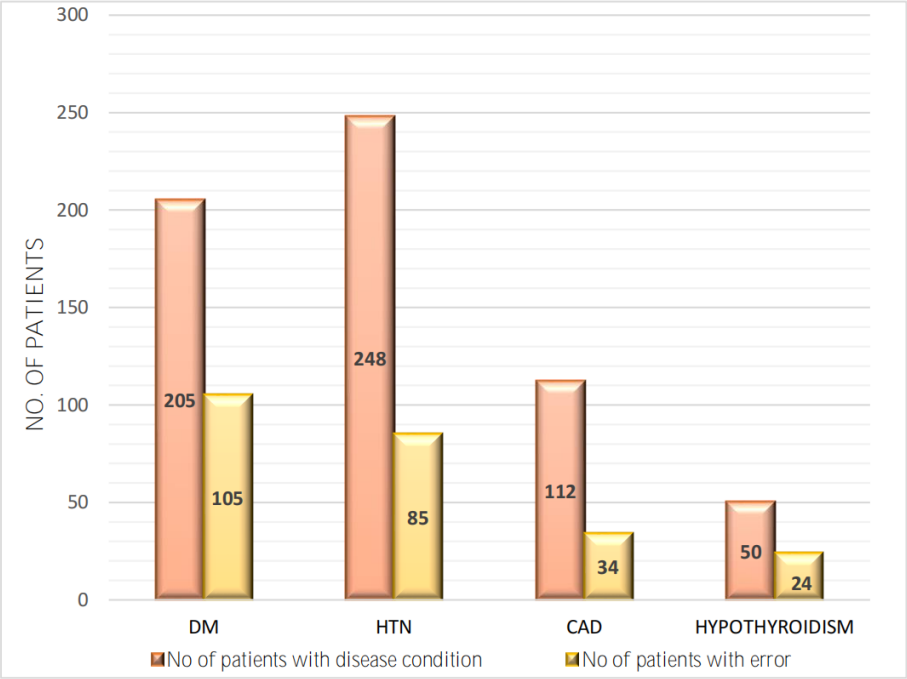

Figure 13: Distribution of patients with disease conditions and error

Medication reconciliation errors were seen in 51.20% (105) of diabetic patients (205), 34.27% (85) of hypertensive patients (248), 30.35% (34) of CAD patients (112) and 48% (24) of hypothyroid patients (50) respectively. Similarly, a study conducted by S. Doerper et al in 2015 reported the common medical conditions which included, 61% of patients (43 of

70 patients) with hypertension, 36% (25/70) were diabetics, 24% (17/70) had the coronary disease and 23% (16/70) had cardiac arrhythmia.[30]

A similar finding was reported by Emily Sotelo et al in 2021, the most common disease conditions were Hypertension 95 (85), Hyperlipidaemia 85 (76), and Diabetes 35 (31).[31]

DISTRIBUTION OF PATIENTS WITH ERRORS IN VARIOUS DEPARTMENT

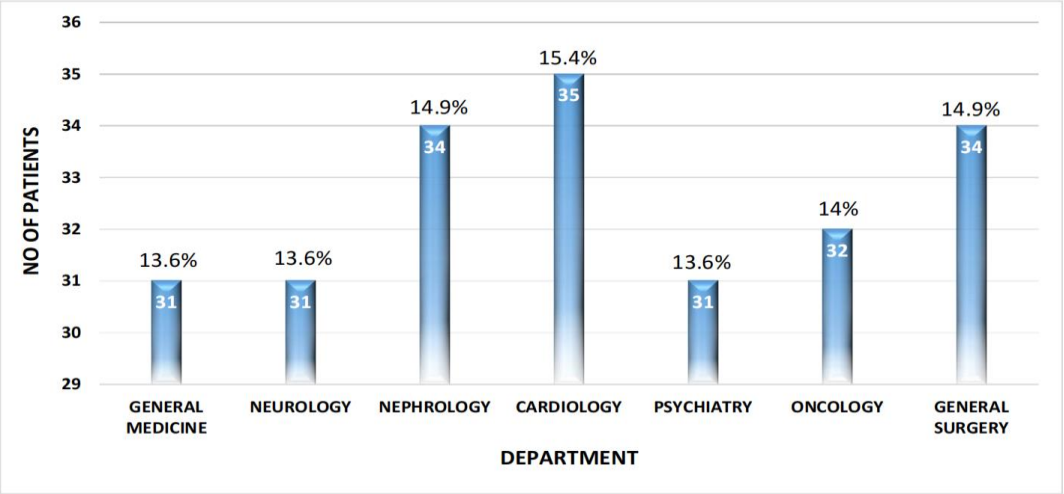

Figure 14: Distribution of 228 patients with errors in various departments.

Our study observed that the cardiology department had more patients, 35 (15.4%) with reconciliation errors.

Likewise, a study conducted by Sara Al Khansa et al in 2016, revealed that patients at internal medicine 34 (43.6%) and cardiology 20 (32.3%) departments had a higher number of medication reconciliation errors.[21]

Individual hospitals may find it difficult to completely execute medication reconciliation for every patient throughout the continuum due to a limited number of personnel, other job responsibilities, and time commitment. So prioritizing the patient for medication reconciliation will allow the clinical pharmacist to focus on those patients who require it the most. According to our research, Geriatric Patients and those with more comorbidities are more likely to have a reconciliation error. Also, Diabetes, Hypertension, Coronary artery disease, and Hypothyroidism were the conditions with more errors. So priority should be given to those patients.

YEAR-WISE DISTRIBUTION OF ERRORS IN DIFFERENT PHASES

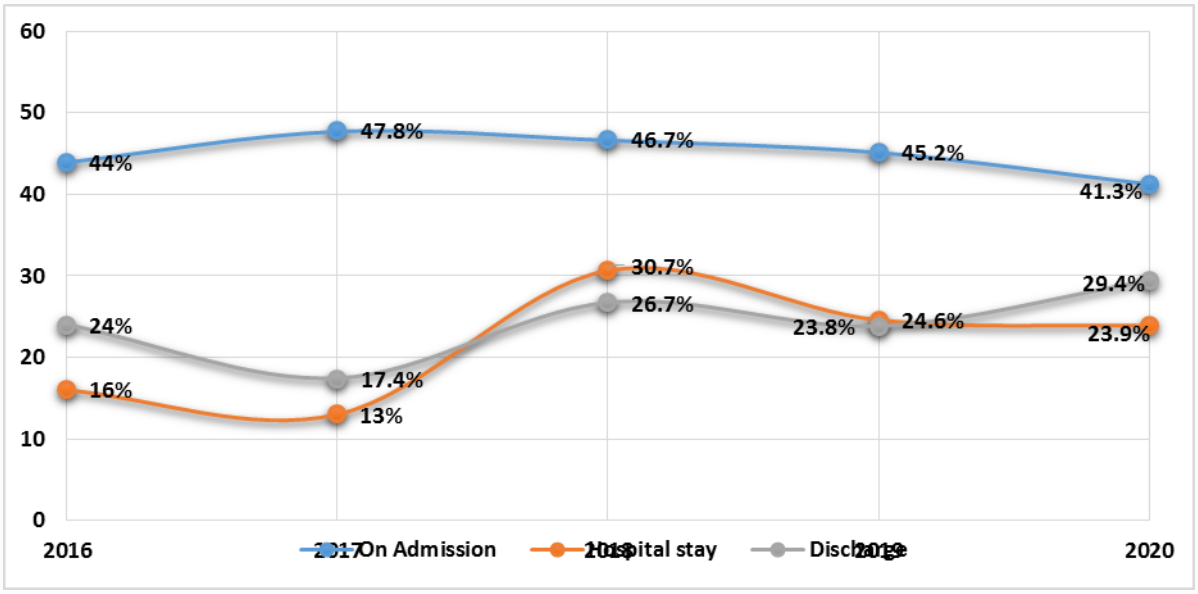

Figure 15: Year-wise distribution of patients (%) with error in different phases

This figure shows the year-wise distribution of patients (%) with an error occurring on admission, during hospital stay, and during discharge. From the five-year data, the phase of admission had more number of patients with errors.

Our study highlights the need for medication reconciliation at every touchpoint of care. According to our findings and previous studies, the phase of admission is the one which the health care professionals neglect and frequently leads to errors throughout hospitalization and discharge. So equal importance should be given to the admission phase as that of other phases(during a hospital stay, the transition of care, and discharge).

LIMITATION OF THE STUDY

❖ The retrospective data collection is typically constructed using existing databases from healthcare records, hence there is no interaction with patients.

❖ The pandemic consequences associated with COVID 19 affected our study.

❖ Our study is based on a single health care system thereby limiting the generalizability of results.

❖ We were unable to confirm the intentionality of the identified errors.

CONCLUSION

The study enlightens the importance of incorporating of medication reconciliation process at every care point, for that current medical documentation and working system must be reorganized. Medication reconciliation will be more beneficial by focusing on high-risk populations such as geriatric patients and those who are taking multiple drugs. Since medication reconciliation is a time-consuming process, it is really important to target efforts in those areas to minimize time spent and maximize the impact on patient safety and thus decrease the risk of morbidity and mortality.

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