

# Impact of Medication Reconciliation upon Discharge on Reducing Medication Errors

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## Abstract

**Background:** Medication errors at the time of hospital admission and discharge are common and can lead to preventable adverse drug events. Medication reconciliation is a technique for identifying discrepancies in drug regimens, forming prescribing decisions and preventing medication errors. Accurate and complete medication reconciliation is an important patient safety issue which can prevent harm.

**Objective:** To determine the incidence and characteristics of unintentional medication discrepancies and to describe the potential impact of medication reconciliation to identify and rectify medication errors at the time of hospital discharge.

**Design and setting:** Retrospective study conducted at King Faisal Specialist Hospital (KFSH) in Jeddah from the period of July 2010 till June 2011.

**Patients:** 100 patients were selected from each month (February, March, April-2010) making a total of 300.

**Method:** Data was retrieved from the outpatient pharmacy, discharge section where medication reconciliation is conducted and records are kept in a monthly filing system. Medication discrepancies at discharge were determined by comparing medications lists at discharge with pre-admission and in-patient medications. All variances were classified as intended or unintended (medication errors). The primary outcome was the number and type of these unintentional discrepancies.

**Results:** Majority of patients were under internal medicine and lowest percentage being in pediatrics. Mean number of discharge medications was 8 (SD  $\pm$  3). Total number of discrepancies was 200 (8.6%). 108 (34.67%) patients had discrepancies. Out of these, 93 (86.1%) were adults and 15 (13.9%) were children. Omission error was the most common type of discrepancy (63%), and drug interactions (0.3%) was the least. Improper dose was the most common prescribing error (32.4%), and improper frequency (15.1%) was the least. 19.3% of patients had at least 1 discrepancy. Most of the discrepancies were under internal medicine and cardiology. Most discrepancies were noticed in the month of February.

**Conclusion:** Unintended medication variances at the time of hospital discharge are common. Medication reconciliation was a successful tool in detecting and rectifying discharge medication errors.

**Keywords:** Medication reconciliation; Medication discrepancies; Medication errors; Discharge reconciliation

## Introduction

Medication Reconciliation is a process of identifying the most accurate list of all medications a patient is taking-including name, dosage, frequency, and route and using this list to provide correct medications for patients anywhere within the health care system. It involves comparing the patient's current list of medications against the physician's admission, transfer, and/or discharge orders [1].

This reconciliation is done whenever new medications are ordered or existing orders are rewritten at every transition of care, in order to avoid medication errors such as omissions, duplications, dosing errors, or drug interactions [2].

Reconciliation is considered a Hospitals' National Patient Safety Goal since 2005 established by the Joint Commission on Accreditation of Health Care Organizations (JCAHO) [2,3].

The goals of medication reconciliation are:

- Provision and maintenance of an accurate and current record (best possible medication history) of what medications a patient is taking.
- Correction of discrepancies between physician orders and what is being taken.

- Prevention of adverse events and potential patient harm [4].

This process comprises 7 steps: 1) Develop a list of current medications; 2) Develop a list of medications to be prescribed; 3) Compare the medications on the two lists with the goal of identifying, preventing, and resolving drug related problems; 4) Document discrepancies between the two lists, whether they are intentional or unintentional; 5) Make clinical decisions based on the comparison; 6) Contact the ordering prescriber and reconcile medications within a specified time frame; and 7) Communicate the new list to appropriate caregivers and to the patient in a clear concise form.

It is still a challenge for healthcare professionals to perform effective and consistent medication reconciliation at different interfaces of care;

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approximately 60% of all medication errors in the hospital occur at admission, intra-hospital transfer, or discharge. At these points of care, where responsibility for a patient is transferred between healthcare professionals, a patient may be vulnerable to medication discrepancies that may lead to errors and adverse drug events. Discharge is a particularly vulnerable transitional interface when patients are at a high risk of such medication discrepancies [5].

Failure to reconcile medications may be compounded by the practice of writing “blanket” orders, such as “resume pre-op medications,” which are highly error prone and may cause adverse drug events. Such orders are explicitly prohibited by the Joint Commission’s Medication Management standards.

The Joint Commission’s sentinel event database includes more than 350 medication errors resulting in death or major injury. Of those, 63% related to breakdowns in communication, and approximately half of those would have been avoided through effective medication reconciliation [2].

Pharmacists are the key health care providers for dealing with patient’s medications. It is important that pharmacists collaborate with each other, other health care providers, and their patients to prevent errors and promote safe health care [4].

Many studies have examined medication discrepancies on hospital admission and only a few studies have investigated medication discrepancies and reconciliation at discharge [1]. One study showed that 70.7% of patients had at least one unintentional discrepancy at hospital discharge. The most common unintentional discrepancies were incomplete prescription requiring clarification, which could result in a patient delay in obtaining medications (49.5%), and omission of medications (22.9%) [5].

Another study in critical care found that errors at the time of discharge from a critical care unit were virtually eliminated by a reconciliation process [6].

The objectives of our study are to retrospectively measure the incidence of unintentional medication discrepancy at hospital discharge and to identify the characteristics of these discrepancies, describing the impact of a medication reconciliation process on eliminating medication errors.

## Method

### Study design and setting

This retrospective study was conducted at KFSH-Jeddah from the period July 2010 to June 2011. Data was retrieved from the outpatient pharmacy, discharge section, where medication reconciliation is conducted and records are kept in a monthly filing system.

Reconciliation usual practice involves nursing and pharmacy, the nurse faxes the patient’s pre admission medication history, and the discharge pharmacist checks inpatient medications through the computerized MyCare system, and compares them with the discharge prescription.

The pharmacist then fills a form with the number of medications at admission and discharge showing the discrepancies if any and its origin then verifies it with the physician. Any intervention made by the pharmacist for unintended discrepancies is documented.

This study was done by accessing the discharge records and if any information was missing, the MyCare computer system was used. Data was collected for 3 months (February to April-2010).

## Measures

Data was collected in a data collection sheet which included the following points: Gender, age, diagnosis, location, medications, number of discrepancies, type of discrepancies (improper dose, frequency and duration, incorrect medication, omission error, drug interactions, duplication), and clinical intervention by the pharmacist.

The Primary Outcome was the number and type of unintentional discrepancies between preadmission or admission medications and discharge medications. Secondary outcomes included number of patients with at least one unintended medication discrepancy on hospital discharge and causes of discrepancies.

Pre-admission and in-patient medications were compared with discharge orders and written instructions. Any difference seen between the medications listed on discharge prescriptions and the pre admission or in patient medications was considered to be a discharge medication discrepancy. All variances or discrepancies were classified as intended or unintended. Unintended variances were considered as medication errors and were further classified according to their type (omission, prescribing error, duplication, drug interaction). Prescribing errors where further divided into improper dose, improper frequency, improper duration and incorrect medication.

Medication discrepancies were assessed through comparison of a best possible medication discharge list with the actual discharge prescriptions.

## Subject selection

100 patients were selected from each month, making a total of 300 patients for the data collection period. Inclusion criteria include patients discharged from the hospital with prescriptions, and were receiving 3 or more medications during admission for more than 48 hours.

We excluded patients discharged without prescriptions, patients who died during hospitalization or transferred from or to another institution, or another unit within the same hospital.

## Statistical analysis

Percentage of discrepancies was calculated as: Number of unintended discrepancies/Total number of medications. Specific percentage for each type of discrepancy and percentage of patients with discrepancies were determined. Mean number and standard deviations of discharge medications were calculated. Statistical analysis was performed using SPSS software.

## Results

Three-hundred patients were included in this study, 158 were females comprising 52.7% of the sample and 142 were males (47.3%). Out of these 242 were adults and 58 were children. The number and percentage of patients in each location is presented in Table 1. Majority of patients were under internal medicine, and lowest percentage was taken from pediatrics.

## Discrepancies

Mean number of discharge medications was 8 (SD  $\pm$  3), and 108 (36%) patients had discrepancies. Out of these, 93 (86.1%) were adults and 15 (13.9%) were pediatrics. In total there were 2294 discharge medications, of these 200 (8.7%) had an unintentional discrepancy.

When analyzing each type of discrepancies (Tables 2a-2c), it was found that omission error was the most common type of discrepancy

Location	N (%)
Internal Medicine	78 (26)
Cardiology	62 (20.7)
Surgery	40 (13.3)
Ob/Gyn	39 (13)
Neuroscience	31 (10.3)
Oncology	29 (9.7)
Pediatrics	21 (7)

**Table 1:** The number and percentage of patients in different studied locations.

Type of discrepancy	Number of Patients (%)	Number of discrepancies (%)
Omission error	68 (63)	126 (63)
Prescribing error	35 (32.4)	68 (34)
Duplication	4 (3.7)	5 (2.5)
Drug interactions	1 (0.9)	1 (0.5)
Total	108 (100)	200 (100)

**Table 2a:** Number and percentage of patients with different types of discrepancies.

(63%), followed by prescribing error (32.4%), duplication (1.3%), and the least being drug interactions (0.3%). Furthermore, improper dose was the most common prescribing error (32.4%), followed by incorrect medication (24.7%), improper duration (23.3%), and the least being improper frequency (15.1%).

Moreover, 19.3% of patients had at least 1 discrepancy, and 0.3% had 9 discrepancies as a maximum number (Table 3).

## Subgroup Analysis

### Location

Most of the discrepancies were under internal medicine and cardiology. When looking at the sample as a whole (N=300), most discrepancies were found under internal medicine (11.3%), followed by cardiology (6.75), oncology (5%), surgery (4.7%), Ob/Gyn (4%), neuroscience (3.3%) and finally pediatrics (1%). This reflects distribution of the patients in the sample and also in the hospital.

However, when comparing each department separately, oncology had the highest percentage of discrepancies within specialty (Table 4). This may be explained by the small number of oncology patients within the sample (29) and the type of patients included which have multiple medications for other chronic conditions other than cancer.

Figure 1 show the frequency of discrepancies in each location, frequency was divided in 3 groups: 1, 2-4, 5-7. No patients had 8 discrepancies and only 1 patient had 9 which were omitted from the figure.

### Month

43 patients had discrepancies in February with 97 discrepancies (12%), 32 patients had discrepancies in March with 53 discrepancies (7.1%), 33 patients had discrepancies in April with 50 discrepancies (6.8%) (Table 5).

## Discussion

Medication reconciliation at hospital discharge requires multiple comparisons between different parameters, including pre-admission medications, inpatient medications and medications to be started at discharge. This process is complex and time consuming especially if patients have multiple comorbidities and medications.

We found that reconciliation prevented 200 (8.7%) discrepancies upon discharge. In our study 19.3% of patients had at least 1 medication

discrepancy, with a total of 36% of patients with any number or type of discrepancies. Other studies have similar results with even higher percentage of discrepancies.

In a Canadian study Cornish et al. [7] found that on admission, 53.6% of patients had at least one unintended medication discrepancy. These discrepancies on admission may result in inappropriate medication therapy during the hospital stay, which often carries over to discharge. Foss et al. [8]. Conducted a study in Denmark which demonstrated that 48% of all drugs had a discrepancy when medication lists were compared between the hospital and patient immediately following discharge. In addition, the likelihood for harm increases if an error remains unresolved after discharge. In USA, Gleason et al. [9] found that 22% of discrepancies could have led to patient harm in the hospital, while 59% of the discrepancies could have potentially caused harm if they remained unresolved after discharge [9].

Furthermore, the home care department of one hospital [10] in USA discovered that 77% of all patients were discharged with inadequate medication instructions. Medication reconciliation systems and processes have successfully reduced medication errors in many health care organizations [2].

In fact not all hospitals in Saudi Arabia conduct medication reconciliation. Our study demonstrates the importance of implementing this process, and its benefit in preventing patient harms which; in our opinion; outweighs its cost. By detecting and rectifying these errors, medication reconciliation minimized potential patient harm and may even prevent readmission due to mostly omission error.

In September 2004, the United States Pharmacopeia (USP) added three "Causes of Error" to its MEDMARX<sup>®</sup> reporting program to capture errors involving medication reconciliation failures. From

Frequency of omission error	Number of patients (%) (N=68)	% from patients with different types of discrepancies (N=108)	% from total study group (N=300)
1	37 (54.5)	34.3	12.3
2	17 (25)	15.7	5.7
3	8 (11.8)	7.4	2.7
4	4 (5.9)	3.7	1.3
6	1 (1.5)	0.9	0.3
9	1 (1.5)	0.9	0.3
Total	68 (100)	-	-

**Table 2b:** Number and percentage of patients with omission error according to frequency.

Prescribing error	Number of patients (%) (N=73)
Improper dose	27 (37)
Improper duration	17 (23.3)
Improper frequency	11 (15.1)
Incorrect medication	18 (24.7)
Total	73 (100)

**Table 2c:** Number and percentage of patients with different prescribing errors.

Number of discrepancy	Number of patients with discrepancies	% from total study group (N=300)
1	58	19.3
2	28	9.3
3	13	4.3
4	5	1.7
5-7 and 9	1 each	0.3 each

**Table 3:** Number and percentage of patients according to number of discrepancies.

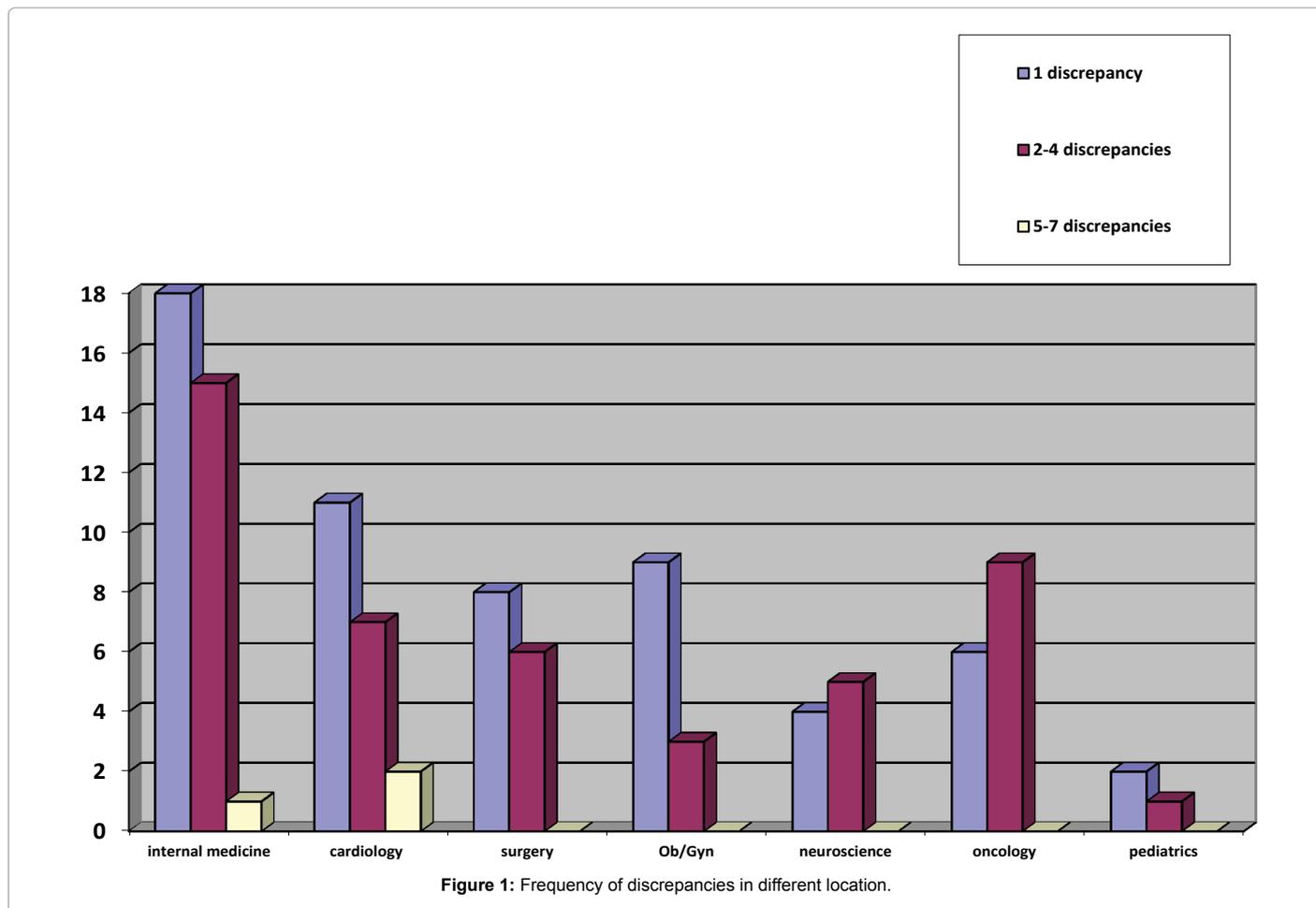


Figure 1: Frequency of discrepancies in different location.

Location	Number of patients reviewed	Number of patients with discrepancies (% from patients reviewed at location)	% from patients with different types of discrepancies (N=108)
Internal medicine	78	34 (43.6%)	31.5
Cardiology	62	20 (32.3%)	18.5
Surgery	40	14 (35%)	13
Ob/Gyn	39	12 (30.8%)	11.1
Neuroscience	31	10 (32.3%)	9.3
Oncology	29	15 (51.7%)	13.9
Pediatrics	21	3 (14.3%)	2.8
Total	300	108 (36%)	100

Table 4: Number and percentage of patients with discrepancies according to location.

Month	February	March	April
Number of prescribed medications	807	750	737
Number of discrepancies (% from prescribed medications)	97 (12)	53 (7.1)	50 (6.8)
% from total number of discrepancies (N=200)	48.5	26.5	25
*New interns and residents were on board			

Table 5: Number and percentage of discrepancies according to month.

September 2004 to July 2005, USP received 2,022 reports of medication reconciliation errors. Of those reports, 66% occurred during the patient's transition or transfer to another level of care, 22% occurred

during the patient's admission to the facility, and 12% occurred at the time of discharge [2].

Identifying the type and frequency of errors helps to improve the process used to detect, and rectify them. According to MEDMARX reported reconciliation errors, major types of errors involved improper dose/quantity, followed by omission error and prescribing error, while other less frequently reported types of error included: wrong drug, time, patient, administration technique, dosage form and extra dose or mislabeling [2]. In accordance with this, our results show that most common types of errors were omission errors followed by improper dose which is a prescribing error.

Our study could not detect the causes of errors, but it was observed that errors increased with increasing number of medications (patients on multiple medications), as well as the number of patients at a certain location. This can be seen in Table 4 where most errors are noted under internal medicine, which constituted most of the sample and reflected the hospital admission pattern.

Furthermore, it was noticed that errors increased in February which could have been due to presence of new interns and residents in that period. Training and adaptation to the system decreased the number of errors in the following months.

Our study has some limitations. Firstly, the distribution of the sample in different locations were not equal, some locations had small

number of patients compared to others, e.g., pediatrics (21), oncology (29) versus internal medicine (78). However, this may be justified by the normal distribution of patients in the hospital. Secondly, only a small number of pediatric and oncology patients were included, which could limit adequate interpretation of data. Finally, this study focused only on reconciliation upon discharge, excluding reconciliation on admission and transfer; hence the situation was only partially covered.

On the other hand, our results have several implications. It draws attention to the most common types of errors and the most susceptible patients. It also proved further that medication reconciliation is a useful method for identifying and rectifying medication errors on discharge, and those medication errors and adverse drug events can be reduced when pharmacists perform effective reconciliation.

It was also reported that reconciliation on admission may help reduce errors upon discharge [3]. Once accurate admission medication information is obtained, a CPOE system could be very helpful in reducing errors at the time of discharge by generating automatic lists of medications used before and during the hospital admission. This would facilitate the reconciliation process by making all relevant medication information available at the time of discharge. Our future study will focus on the benefits of this process in our setting.

In summary, unintended medication discrepancies at the time of hospital discharge are common and significant. In this study, medication reconciliation by pharmacists was a useful method for detecting and rectifying discharge medication errors.

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