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Medication discrepancies identified during medication reconciliation among medical patients at a tertiary care hospital

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1. Introduction

The Institute for Healthcare Improvement's five Million Lives Campaign (InstituteforHealthcareImprovement, 2006), as well as The Joint Commission (JointCommission, 2012), has acknowledged the importance of medication reconciliation making it a priority for national patient safety goals. Both organizations have recommended medication reconciliation as a proven method to reduce adverse drug events.

Medication reconciliation is defined as "the process of identifying the most accurate list of all medications a patient is taking, including the name, dosage, frequency, and route of each medication, and using this list to provide the correct medications for the patient anywhere within the health care system" (Delate et al., 2008; Varkey et al., 2007). The ultimate goal of medication reconciliation is to prevent adverse drug events and facilitate continuity of optimal pharmaceutical care for patients at all interfaces of care including admission, transition and/or discharge (Coleman et al., 2005; Grimes et al., 2011; Herrero-Herrero and Garcia-Aparicio, 2011; Nickerson et al., 2005). The aim of medication reconciliation is to eliminate undocumented intentional discrepancies and unintentional discrepancies by reconciling all medications, at all interfaces of care. Approximately 60% of medication errors and up to 20% of adverse drug events occur at discharge (Herrero-Herrero and Garcia-Aparicio, 2011; Karapinar-Carkit et al., 2009; Wong et al., 2008). Discharge is a particularly vulnerable stage since patients are abruptly expected to assume full responsibilities of their medications (Coleman et al., 2005; Karapinar-Carkit et al., 2009; Wong et al., 2008). Severe illness, polypharmacy, cognitive impairment, and variable health literacy can elevate the risk (Coleman et al., 2005).

To prepare an accurate list of medications, numerous sources of information are used including pill bottles, the patient and family members, outpatient records, electronic medical records, and pharmacy records (Salanitro et al., 2012). Discrepancies between information sources can be intended therapeutic changes or unintended discrepancies which can be considered as medication errors (Vira et al., 2006). The most common types of discrepancies at discharge are incomplete, inaccurate, or illegible discharge instructions and omission of medications (Murphy et al., 2009; Walker et al., 2009; Wong et al., 2008). Several studies support medication reconciliation as a mean to reduce adverse drug events and improve medications use safety (Climente-Marti et al., 2010; Herrero-Herrero and Garcia-Aparicio, 2011; Pippins et al., 2008). About 6–12% of adverse drug events result in emergency department visits and 5% in hospital readmissions (Cua and Kripalani, 2008; Schnipper et al., 2006).

In Saudi Arabia, the medication discrepancies at admission were reported to be 37% (Abuyassin et al., 2011). Only a few studies are available on the value and practice of medication reconciliation from health care institutions outside USA and Europe. A recent study demonstrated a relatively low awareness of the con-

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cept and policy of medication reconciliation process among pharmacists (Hammour et al., 2016). There are also hardly any data from Saudi Arabia and from developing countries that discuss medication reconciliation process at discharge from the hospital.

The present study was conducted to evaluate the incidence and characteristics of discharge medication discrepancies that are identified by pharmacists during medication reconciliation, and also to identify risk factors for discrepancies among medical patients at a tertiary care hospital in Saudi Arabia. The impact of incorporating reconciliation service at discharge was also examined by investigating the resolution of unintentional discrepancies.

2. Methods

2.1. Participants and setting

This prospective observational study was conducted over a period of 8 weeks at King Abdul-Aziz Medical City, a 1025 bed tertiary care hospital in Riyadh, Saudi Arabia.

All adult patients (16 years and older) with at least one prescribed medication who were discharged from the internal medicine wards during the study period were included. The study was approved by the Institutional Review Board at King Abdullah International Medical Research Center (KAIMRC), and all patients provided a written consent for participation.

2.2. Definition and significance of medication discrepancy

A discharge medication discrepancy was defined as any difference identified between the medications list on discharge prescription and the medications list from patient history, Medication Administration Record (MAR) or home medications list.

Identified discrepancies were classified into either intended or unintended and then categorized into the following categories: omission, commission, changed dose, frequency or route, wrong duration or quantity and therapeutic duplication.

Patient clinical records were reviewed to determine if the discrepancies found were intentional or unintentional. An intentional discrepancy is one that the prescriber intentionally made to meet patient's need with documentation of the intended change in the clinical record, while unintentional discrepancy is one that accidentally made by the physician or pharmacist and/or lacked documentation in the clinical records. The prescriber was contacted in case of uncertainty.

Two investigators further classified independently unintentional discrepancies into major, moderate, and minor (Aburuz et al., 2011). Major discrepancy is the one detrimental for patient's outcome and will usually result in significant harm to the patient if current practice continued; including poor disease control, worse quality of life, increased symptoms, worse survival, and/or hospitalization. Moderate discrepancy is the one that could have an undesirable effect on patient's outcome. Minor discrepancy is the one that would probably have no effect on patient's outcome.

2.3. Medication reconciliation process

During the discharge process, an electronic discharge medications list is prepared and printed form the electronic health record, Quadra Med system®, that includes all the current medications, in addition to an extra space provided for adding new medications. The discharge medications unit at the central hospital pharmacy processes the prescriptions, and the prepared medications are then delivered to the respective units. The study pharmacist was then notified by the nurse through the paging system upon receiving the discharge medications in order to conduct medication reconciliation and counseling session for the patient. The pharmacist was well trained on the medications reconciliation process before the start of the study.

Assessment of discrepancies during the medication reconciliation process is conducted through comparing the discharge medications list that was obtained from Quadra Med system® against the following:

- Medications list from patient history that was obtained on admission
- The electronic Medications Administration Record (MAR)
- Home medications list provided by the discharge unit at the central pharmacy

The detected discrepancies were documented with their classes and types on a data collection instrument for each patient, together with patient's demographic and clinical data. The following patient data were collected: number of preadmission and discharge medications, age, gender, and number of comorbidities.

2.4. Statistical analysis

Data entry and analysis were carried out using SPSS® (Release 21.0.0.0, IBM, USA). The primary endpoint was the mean number of discrepancies per patient and the percentage of patients with at least one unintentional discrepancy. Secondary outcomes were the characteristics of identified medication discrepancies including: severity, frequency, and percentage of each discrepancy category. The impact of incorporating reconciliation service at discharge was examined by investigating the resolution of unintentional discrepancies. Risk factors for unintentional discrepancy were also determined using ANOVA or Chi-square test as appropriate. Continuous variables were expressed as mean (SD) whereas categorical variables were expressed as frequency (%). The following potential risk factors were examined: gender, number of preadmission and discharge medications, age, and number of comorbidities. P value less than 0.05 was considered statistically significant.

3. Results

During the study period, 173 patients were discharged and met the inclusion criteria. Discrepancies were found in 121 (70%) patients. Demographic and clinical characteristics of patients with discrepancies are summarized in Table 1. About 70% of patients were elderly, and 54% were female. Most common admission diagnosis include stroke (11%), decompensated heart failure (10%) or pneumonia (aspiration pneumonia, community acquired pneumonia or hospital-acquired pneumonia) (9%). Poly-pharmacy (>5 medications) was seen in almost 85% of patients. Demographic characteristics of patients without discrepancies were similar to those with discrepancies, where 52% were female and the majority were elderly (71%).

Among the 121 patients, 568 medication discrepancies (intentional and unintentional) were identified with a mean (SD) of 4.7 (2.8) discrepancies per patient. Eighteen percent (n = 22) of these patients presented with at least one unintentional discrepancy. The frequency of unintentional discrepancies was 34 (6% of total discrepancies).

Examples of the unintentional medication discrepancies are presented in Table 2. The frequencies of the different categories of unintentional discrepancies are shown in Fig. 1. The most common unintentional discrepancy was the omission of medications where it was identified 23 times (68%).

Table 1
Demographic and clinical characteristics of the study sample (n = 121).

Characteristic	Value
Age, n (%)	
16–35 years	15 (12.3)
36–55 years	11 (9.1)
56–75 years	65 (53.7)
≥76 years	30 (24.3)
Gender, n (%)	
Female	65 (53.7)
Number of discharge medication, n (%)	
1–5	19 (15.7)
6–10	52 (43.0)
>10	50 (41.3)
Co-morbidities, n (mean per patient)	298 (2.46)
Primary Diagnosis, n (%)	
Stroke	13 (10.8)
Decompensated heart failure	12 (10.0)
Pneumonia (Aspiration, Community Acquired and Hospital Acquired Pneumonias)	11 (9.0)
Urinary tract infection	7 (5.8)
Electrolyte imbalance	6 (4.9)
Other infections	5 (4.1)
Seizure	5 (4.1)
Transient Ischemic Attack (TIA)	5 (4.1)
Chronic obstructive pulmonary disease exacerbation	5 (4.1)
Sepsis	4 (3.3)
Acute Kidney Injury (AKI)	3 (2.4)
Cancer (lung, breast)	3 (2.4)
Hypertension emergency	3 (2.4)
Asthma exacerbation	3 (2.4)
Dehydration	2 (1.6)
Jaundice	2 (1.6)
Other	20 (16.5)
Diagnosis not available	12 (10.0)

Unintentional discrepancies were most commonly identified when comparing discharge medications list versus the patient history (53%), followed by MAR (35%) and least identified when compared with the home medications list (12%).

Most of the identified unintentional discrepancies were classified as Major [26 (76%)], whereas the others were considered moderate in severity.

All identified unintentional discrepancies were discussed and clarified with responsible staff including physicians, nurses or pharmacists and subsequent corrective actions were implemented. All omitted medications were restarted. All wrong frequencies, wrong durations, duplications, and commissions were corrected.

The incidence of unintentional discrepancies was not associated with the patients' gender, number of preadmission medications, age, or number of comorbidities. However, the incidence of unintentional discrepancies was significantly associated with the number of discharge medications (mean number of unintentional discrepancies (SD) for those receiving ≤5 medications was 0.05 (0.2) VS 0.3 (0.8) for those receiving >5 medications, p = 0.004). In addition, only one patient (5%) had unintentional discrepancies of those receiving ≤5 medications compared with 21 patients (21%) of those receiving >5 medications (OR = 4.7) indicating that patients receiving >5 medications have approximately five times the possibility of unintentional discrepancy.

4. Discussion

This study describes medication discrepancies identified by a pharmacist during medication reconciliation among medical patients at hospital discharge. This study has the advantage of a prospective design; where there was an opportunity for immediate corrective action for identified unintentional discrepancies.

The main finding of this study is that 4.7 (2.8) discrepancies were identified per patient and 22 patients (18%) had at least one unintentional discrepancy. Published studies varied widely regarding the prevalence of unintentional discrepancies. Some studies reported a much higher prevalence of more than 50% (Grimes et al., 2011; Karapinar-Carkit et al., 2009; Wong et al., 2008), while other studies reported a similar prevalence (Climente-Marti et al., 2010; Coleman et al., 2005; Walker et al., 2009). The lower number in the current study compared with some studies could be attributed to the use of electronic medical records system at the study site (Grimes et al., 2011) and also to the availability of clinical pharmacy services which can significantly reduce medication discrepancies (Walker et al., 2009).

Most of the discrepancies were considered major and had the potential to cause significant harm. Similarly, Grimes et al. (2011) have classified most of the discrepancies as moderate or minor.

The study highlighted the value of incorporation of reconciliation service at discharge, where all identified unintentional discrepancies were discussed and clarified with responsible staff including physicians or nurses or pharmacists and a subsequent corrective action was implemented. All unintentional discrepancies were resolved before discharge. Hence, medication reconciliation supported by pharmacists can be very useful in resolving

Table 2
Examples of identified unintentional medication discrepancies.

Type of discrepancy	Example	Number of discrepancies (% within unintentional discrepancies), n = 34
Omission	At home, patient was on darbepoetin alfa injection once weekly and ferrous sulfate capsules twice daily for his CKD associated anemia that were missed since admission till the discharge	23 (68)
Omission	Patient was on valsartan 80 mg orally once daily at home that was not ordered during admission	
Omission	The patient was on metformin 500 mg orally once daily, aspirin 81 mg orally once daily, tamsulosin 0.4 mg orally once daily and tolterodine 4 mg orally once daily that were all missed by physician since admission	
Omission	The patient was on zolpidem 2.5 mg orally at bedtime during admission, and the physician forgot to prescribe it on controlled prescription upon discharge	
Commission	Patient admitted with hypertension crisis, and his home medicine darbepoetin alfa injection (may aggravate his blood pressure) was held, upon discharge, the physician resumed it	4 (12)
Changed frequency	During admission, the patient was started on pregabalin 75 mg orally once daily for one week and then to be continued as 75 mg twice daily for three months, the label on the home medication provided from the pharmacy was 75 mg orally once daily for three months	3 (9)
Therapeutic duplication	During admission, the patient was on diltiazem 30 mg orally twice daily and Amlodipine 5 mg orally once daily (on hold), upon discharge the physician ordered both	3 (9)
Wrong duration	Patient was discharged on nimodipine 30 mg orally every 4 h for two months (nimodipine treatment duration should be 21 days)	1 (3)

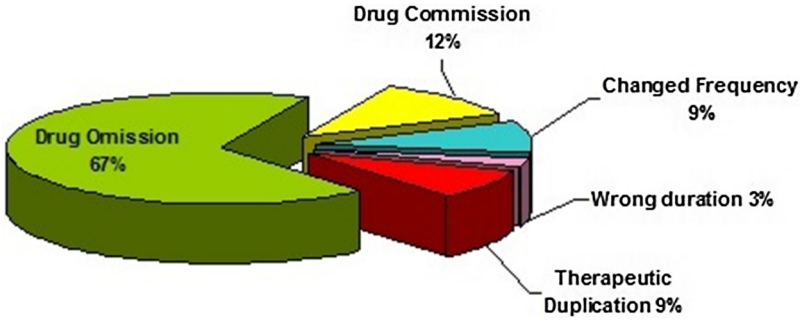

Fig. 1. Percentages of unintentional discrepancy categories (total number = 34).

unintentional medication discrepancies and subsequently may improve medications safety and efficacy (Kaboli et al., 2006).

Omission was identified as the most common unintentional discrepancy. Similarly, most published studies determined that omission is the most common type of discrepancy (Grimes et al., 2011; Herrero-Herrero and Garcia-Aparicio, 2011; Murphy et al., 2009; Walker et al., 2009; Wong et al., 2008). Perhaps, omission should be the primary concern when conducting medication reconciliation service.

In this study, the incidence of unintentional discrepancies was significantly associated only with the number of discharge medications. Coleman et al. (2005) have also found that the total number of medications and the presence of congestive heart failure were associated with medication discrepancies.

The study has several limitations. Medication reconciliation was conducted by only one pharmacist; this may raise concerns about observer bias. On the other hand, this was a single center study and the number of included patients was small which may limit the generalizability of the results.

This is the first study from Saudi Arabia that investigates and reveals the high prevalence of major medication discrepancies in discharge medications in hospitalized patients. Future experimental studies regarding the short and long term clinical impact of reconciliation service are needed. We also recommend exploring the cost-effectiveness of reconciliation services.

5. Conclusion

This study confirms that medication reconciliation is a critical component for the safe and effective patient care of hospitalized medical patients. Discrepancies at hospital discharge are common and in most cases of major potential harm. Having a qualified pharmacist to conduct medication reconciliation at discharge helps to identify these discrepancies and may improve the medication use safety, prescribing pattern and accordingly may contribute to reducing medication errors.

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