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Article

Patients' medication reconciliation in a university hospital

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Medication reconciliation is a strategy to minimize medication errors at the transition points of care. This study aimed to demonstrate the effectiveness of medication reconciliation in identifying and resolving drug discrepancies in the admission of adult patients to a university hospital. The study was carried out in a 300-bed large general public hospital, in which a reconciled list was created between drugs prescribed at admission and those used at pre-admission, adapting prescriptions from the pharmacotherapeutic guidelines of the hospital studied and the patients' clinical conditions. One hundred seven patients were included, of which 67,3% were women, with a mean age of 56 years. Two hundred twenty-nine discrepancies were found in 92 patients; of these, 21.4% were unintentional in 31.8% of patients. The pharmacist performed 49 interventions, and 47 were accepted. Medication omission was the highest occurrence (63.2%), followed by a different dose (24.5%). Thirteen (26.5%) of the 49 unintentional discrepancies included high-alert medications according to ISMP Brazil classification. Medication reconciliation emerges as an important opportunity for the review of pharmacotherapy at transition points of care, based on the high number of unintentional discrepancies identified and resolved. During the drug reconciliation process, the interventions prevented the drugs from being misused or omitted during the patient's hospitalization and possibly after discharge.

Keywords: Medication reconciliation. Medication Error. Patient safety. Discrepancies. Pharmacists' intervention.

INTRODUCTION

The Joint Commission of the American Health Organization (JCAHO) acknowledged in 2003 that medication reconciliation contributes to the safe use of medicines and includes, for the first time, this measure as a strategy to improve patient safety. This is described as a process for obtaining a complete, accurate, and updated list of medications used by each patient at admission, transfer, and discharge (The Joint Commission on Accreditation of Healthcare Organizations, 2008).

In 2006, the World Health Organization (WHO) promoted the High 5s project to address critical concerns and promote patient safety actions. One of the lines of this project is to ensure appropriate medications in the transitions of care: medication reconciliation (World Health Organization, 2008). In 2017, the WHO launched the Global Patient Safety Challenge: "Medication Without Harm", which also points out three priority categories of actions: the transition of care by establishing medication reconciliation as an instrument to reduce medication errors in these shifting points (World Health Organization, 2017). In 2013, The Brazilian Ministry of Health established the National Patient Safety Program (PNSP) and included medication reconciliation to minimize medication errors at the transition points of care (Brasil, 2013).

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In a systematic review, Redmond et al. (2018) showed that there is much evidence pointing to the drug reconciliation process reducing drug discrepancies at care transition points. However, few health facilities are financially equipped to obtain the best possible medical history on each patient's admission, and obtaining the medical history is only one step in this process. Medication reconciliation requires sufficient professionals to perform patient education, communication with other health care points, and interventions to resolve medication discrepancies. Also, it is a complex process that affects intra-institutional workflows and involves a multidisciplinary team, which makes it challenging to implement (Pevnick, Shane, Schnipper, 2016).

This study aimed to show the effectiveness of drug reconciliation in identifying and resolving drug discrepancies in the admission of adult patients to a university hospital.

The Research Ethics Committee of the University Hospital approved the research under opinion Nº 1.352.341.

METHOD

The study was carried out in a 300-bed large general public hospital, outpatient of medium and high complexity reference without emergency service. The study was done in all six adult care wards of the University Hospital (oncohematology, infectology, medical clinic, cardiology, psychiatry, and nephrology wards) staffed with clinical pharmacists, in northeastern Brazil, from June to August 2016.

In this study, we included adult patients over 18 years of age admitted to the University Hospital who used at least three medicines before hospitalization, who remained at the facility for at least 24 hours and patients who could be interviewed or had a relative or caregiver to provide the data.

Clinical pharmacists of each facility ward collected data. The medication reconciliation form adapted from Ketchum, Grass and Padwojski (2005) was completed and treatments were reviewed within 24 hours after hospitalization. The first medical prescription was compared to the best possible medication history for patients admitted. The unintentional discrepancies identified were discussed with the prescriber for clarifications and prescription change when necessary.

All the discrepancies and interventions performed by the pharmacists were described in the specific field of the medication reconciliation form. The following data were collected from the medical record and during the interview: patient's name, clinical facility, age, gender, the reason for hospitalization, morbidities, medicines used in pre-admission, and medicines prescribed. Data were analyzed following information collection, and the discrepancies were categorized as proposed by the World Health Organization, 2014, into intentional and unintentional discrepancy.

The unintentional discrepancy is when the prescriber unintentionally changed, added, or omitted a medication that the patient was taking before admission. Unintentional discrepancies have the potential to become medication errors that can lead to adverse events.

Intentional discrepancies are clinically understandable and appropriate discrepancies between the best possible medication history and admission orders based on the patient care plan.

A tool validated by Claeys *et al.* (2012) was adopted to characterize unintentional discrepancies. This tool sorts discrepancies into eleven different types: omission, addition, therapeutic replacement, dosage, administration frequency, administration route, formulation, administration time, duration of treatment, and others. Medicines initiated due to the patient's clinical condition were not considered discrepancies, but medicines initiated without clinical justification were deemed unintentional discrepancies.

The pharmacological classes most frequently involved in the discrepancies were identified using the Anatomical Therapeutic-Chemical (ATC) classification, in its first level regarding the site of action or system in which the drug acts, consisting of 14 main anatomical groups (WHO Collaborating Centre for Drug Statistics Methodology, 2016). High-alert medications (HAM) involved in the discrepancies were identified according

to the HAM lists used in hospitals, outpatient clinics, and long-stay institutions proposed by the Institute for Safe Medication Practices in Brazil (Instituto para práticas seguras no uso de medicamentos (ISMP) 2015, 2016).

A database was created in Microsoft Excel 2016, and results were analyzed through descriptive statistics.

RESULTS AND DISCUSSION

Two hundred forty-one patients were admitted during the study period (from June to August 2016) in the six wards of the University Hospital, and 107 patients were included because they met the proposed inclusion criteria. The mean age of patients was 56 years, with a range of 18-93 years. Seventy-two (67.3%) of the 107 patients were women, and 35 (32.7%) were men. (Table I).

TABLE I - Patient characteristics and distribution by admission ward (n = 107)

Characteristics	Value
Gender	
Male n (%)	35 (32.7)
Female n (%)	72 (67.3)
Age (mean) ≥60 years n (%) < 60 years n(%)	56 years 48 (44,9) 59 (55,1)
Number of prescription drugs (mean for patient)	659 (6)
Admission ward	
Cardiology n (%)	34 (31.8)
Medical Clinic n (%)	26 (24.3)
Nephrology n (%)	23 (21.5)
Oncohematology n (%)	10 (9.3)
Psychiatry n (%)	7 (6.5)
Infectology n (%)	7 (6.5)

In this study, 659 drugs were used by patients with an average of six drugs per patient, and the reconciliation process identified 229 discrepancies, of which 180 (78.6%) were intentional in 92 patients, and 49 (21.4%) were unintentional in 34 (31.8%) patients. In a similar study involving 380 patients, 1,884 discrepancies were found, of which 845 (45%) were unintentional and 1,039 intentional, and 293 (77%) patients had at least one unintentional discrepancy (Ruiz *et al*., 2016). Rey, Prado and Gomes (2016) found 312 unintentional discrepancies in more than half of the patients (59,5%) in a study with 220 patients, who used on average two drugs each. The number of drug discrepancies varies among studies, which may be related to the diverse concepts of drug discrepancies adopted in the different studies, as shown by the systematic review of Almanasreh, Moles and Chen (2016).

One hundred fifty-nine of the 180 intentional discrepancies were related to dose, frequency, administration route, or non-prescription per the patient's clinical need, and 21 discrepancies were related to therapeutic replacement because it was a drug that was not selected at the hospital. Claeys *et al*. (2012) proposed and validated a tool to characterize unintentional discrepancies. This tool sorted discrepancies into eleven different types. Thirty-one (63.2%) of the 49 unintentional discrepancies were omissions, and 12 (24.5%) were dose/frequency related, and six (12.2%) were related to medication currently used by the patient, but without indication, medication not selected at the hospital, and drug contraindication at admission (Figure I).

Dosage	A patient with a history of depression and systemic arterial hypertension. He was given spironolactone 25mg PO twice daily, and at home he was taking spironolactone 25mg PO once daily.	Dosage changed
Dosage	Patient diagnosed with acquired immunodeficiency syndrome (AIDS) and suspected of adjustment disorder or psychosis in previous hospitalization (one month ago). At pre-admission, he was using 2.5 mg haloperidol, at admission, 5 mg / day was prescribed.	Dosage changed
Drug contraindication	A patient with a history of arrhythmias associated with chronic Chagas cardiopathy. He was taking warfarin at home and was ordered warfarin at admission. However, in the laboratory examination performed before admission, the international normalized ratio (INR) was 10.17.	Drug cancelled
Drug without indication	A patient diagnosed with arterial hypertension and mitral insufficiency, was admitted due to tachycardia and dyspnea, used omeprazole at home and was prescribed at admission, but has no justification for using the medication.	Drug cancelled
Omission	Patient diagnosed with glaucoma. At pre-admission, the patient was using the 0.04 mg / mL travoprost ophthalmic solution, 01 drop / day, the medication was not prescribed at hospital admission.	Drug started
Omission	Patient diagnosed with dyslipidemia, systemic arterial hypertension, obesity and fibromyalgia. At pre-admission, he was using simvastatin 40mg / day, a medication not prescribed at hospital admission.	Drug started
Omission	A patient diagnosed with congestive heart failure, hypertension and diabetes, admitted due to nocturnal dyspnea, at pre-admission was using carvedilol and spironolactone, none of these drugs were prescribed at admission.	Drug started

FIGURE I - Examples of unintentional discrepancies and interventions performed

Omission was the most frequent unintentional discrepancy found in this study and other studies (Ruiz *et al.*, 2016; Hellström *et al.*, 2012; Buckley *et al.*, 2013; Kalb *et al.*, 2009). In a systematic review with 95 papers considering different transition points of care, medication omission was the most identified discrepancy in 60 papers (Almanasreh, Moles, Chen, 2016). The prescription of different doses between medications used by patients at pre-admission and those prescribed at admission was the second type of unintentional discrepancy found in this study and, according to Ruiz *et al.* (2016), "dose, route, or frequency discrepancy" were the most frequent, followed by medication omission.

All discrepancies were discussed with prescribers, and interventions were suggested for those classified as unintentional. The clinical pharmacist performed 49 interventions in the 34 patients who had some unintentional discrepancy, and of these, 47 (96%) were accepted. The types of medication-related interventions were drug started (63.2%), dosage/ frequency changed (24.5%), therapeutic substitution/cancelled (12.2%). The ward with the greatest number of discrepancies was cardiology, with 42.9% (n=21) of discrepancies involving 13 patients. (Table II).

The interventions performed during the drug reconciliation process in this study prevented the drugs from being misused or omitted during the patient's hospitalization and possibly after discharge. Salameh, Farha and Basheti (2018) demonstrated that unintended discrepancies could cause harm to patients and therefore require interventions to prevent the error from reaching the patient.

TABLE II - Number of Patients with unintentional discrepancies, and interventions accepted by hospital wards

Hospital wards	Nº of Patients with discrepancies (%)	Unintentional discrepancies (%)	Interventions accepted (%)
Cardiology	13 (38,2)	21 (42.9)	21 (44.7)
Nephrology	8 (23,5)	11 (22.4)	11 (23.4)
Medical clinic	7 (20,6)	11 (22.4)	11 (23.4)
Psychiatry	3 (8,8)	3 (6.1)	2 (4.3)
Oncohematology	2 (5,8)	2 (4.1)	1 (2.1)
Infectology	1 (2,9)	1 (2.0)	1 (2.1)
Total	34 (100)	49 (100)	47 (100)

In the study by Rey, Prado and Gomez (2016), 312 unintentional discrepancies were identified; 231 (74%) were reported to the prescriber, and only 93 discrepancies (35.4% of those reported) were accepted. Lea *et al.* (2016) performed a before-after study, in which, in the first period, pharmacists identified 133 discrepancies, 90 (67.3) were discussed with prescribers, and 72 (80%) were accepted. In the second period, 221 discrepancies were identified; 188 (85%) were discussed and 160 (85.1%) were accepted. These authors consider that collaboration between pharmacists and physicians can improve the accuracy and safety of inpatient medication use. This study recorded a high intervention acceptance rate (96%), which can be explained by clinical pharmacists in the wards participating in the study.

Doctors identified drugs with no clinical indication in fifteen patients and were thus not prescribed since they were considered intentional discrepancies; pharmacists identified three drugs that the patient was using without indication, which were maintained by the physician in the admission prescription and considered an unintentional discrepancy. Eighteen patients (16.8%) used drugs without clinical indication; two of them had four drugs suspended due to the lack of clinical indication, totaling 25 drugs that patients used without a clinical indication. Omeprazole was the most suspended drug – seven patients were using this medication without indication. Deprescription is the practice of identifying and discontinuing unnecessary, ineffective, unsafe, or potentially inappropriate medications. Obtaining a comprehensive medication history is the first step of the patient-centered deprescribing process and is fundamental for any medication-optimizing activity (Reeve *et al*., 2014)

Thirteen (26.5%) of the 49 unintentional discrepancies, included HAM per ISMP Brazil classification (2015, 2016), with six drugs: digoxin, warfarin, and metformin in three (6.5%) discrepancies each, methotrexate in two (4.3%) and rivaroxaban and gliclazide with only one (2.1%) discrepancy each. In the study by Quélennec *et al.* (2013), 5.8% (n=10) of the discrepant drugs were HAM according to ISMP classification. HAMs are those with an increased risk of causing significant harm to the patient when there is an error in the use process. While errors may or may not be more familiar with these drugs, the consequences of an error are more devastating for patients (Instituto para práticas seguras no uso de medicamentos (ISMP), 2015).

Twenty-nine drugs were involved with unintentional discrepancies. The most prevalent anatomical leading group in discrepancies was the cardiovascular system (lipid-modifying agents and those acting on the renin-angiotensin system) (Table III).

TABLE III - ATC classification*of medications in unintentional discrepancies

ATC Classification	Nº Drugs (%)	Nº Unintentional Discrepancies (%)
A – Alimentary Tract and Metabolism	3 (10.3)	6 (12.2)
B – Blood and Blood Forming Organs	5 (17.2)	10 (19.6)
C – Cardiovascular system	9 (31.0)	18 (36.7)
H - Systemic Hormonal Preparations, excluding Sex Hormones and Insulins	1 (3.4)	1 (2.0)
L – Antineoplastic and Immunomodulating Agents	3 (10.3)	4 (8.0)
N – Nervous System	6 (20.7)	7 (14.0)
R – Respiratory System	1 (3.4)	1 (2.0)
S – Sensory Organs	1 (3.4)	2 (4.0)
Total	29 (100)	49 (100)

*Anatomical Therapeutic Chemical

In a similar study, Rentero *et al.* (2014) identified that therapeutic groups with the most significant number of discrepancies were hypolipidemic drugs (12.4%), antihypertensive drugs acting on the renin-angiotensin system (10.6%), and psychotropic agents (9.1%) were identified as the most discrepant groups. Describing the class of medicines most involved with discrepancies, Unroe *et al.* (2010) identified that drugs acting on the cardiovascular system were 31% (n=25) of all discrepancies at admission, making them the more involved class. Buckley *et al.* (2013) identified that, among the discrepancies considered with potentially clinical severe consequences, most involved cardiovascular agents (38.9%) and psychotropic agents (30.6%).

In this study, the inclusion criteria included using at least three medicines at pre-admission and length of stay of more than 24h, a criterion adopted in other studies (Rentero *et al.*, 2014; Zoni *et al.*, 2012). Regarding the number of drugs, 33 (31%) patients used up to five drugs; of these, nine (18%) unintentional discrepancies were identified in seven patients. Seventy-four (69%) patients used more than five medications, and 40 (82%) unintentional discrepancies were identified in 27 patients.

In a systematic review by Mueller *et al.* (2012), including 26 studies, 13 papers focused on intervention in high-risk patients considering subgroups of elderly patients (55-80 years), polypharmacy, ranging from four to thirteen drugs and with more than three comorbidities. Also, many studies (Ruiz *et al.*, 2016; Buckley *et al.*, 2013; Okerosi *et al.*, 2017) aimed to identify risk factors for unintentional drug discrepancies, establishing a correlation between these discrepancies with variables such as age, comorbidities, and a high number of medications, to select patients with a higher risk of unintentional discrepancies. In this study, many unintended discrepancies were identified for patients using more than five medications.

Ruiz *et al.* (2016) argue that there is a great need for human resources for the medication reconciliation process. Meguerditchian *et al.* (2013) analyzed the time spent to perform the reconciliation process on admission and found an average of 46 minutes per patient reconciled, which may vary by type of ward and the professional performing the process. Considering this mean, Pevnick, Shane and Schnipper (2016) calculated that up to eleven full-time employees may be required for this process for a large hospital with 23,500 annual hospitalizations. Thus, the use of criteria to select patients with a greater need to reconcile would be helpful.

LIMITATIONS

One limitation of this study is that it was carried out in only a few university hospital wards, limiting the possibility of extrapolating research findings since it does not reflect the reality of many Brazilian hospitals. Also, no follow-up of patients was performed to verify whether resolved unintended discrepancies had a favorable clinical outcome.

CONCLUSION

Medication reconciliation is a significant opportunity to review pharmacotherapy at transition points of care and a tool to identify and resolve medication errors. In this study, pharmacists identified and informed the prescriber of 49 unintentional discrepancies in 34 of the 107 patients, and 47 were accepted and resolved. The interventions performed in this study prevented the drugs from being misused or omitted during the patient's hospitalization and possibly after discharge. Among the six studied wards, cardiology had the highest number of patients included and the more significant unintentional discrepancies. The medication reconciliation process requires sufficient human resources, strategies for conducting this process among them, and knowledge of the profile of patients in the different clinical hospital fields.

CONFLICTS OF INTEREST STATEMENT

The authors declare that they have no competing interests.

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