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).
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 healthcare 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 (onc/oematology, 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
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...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).

| Characteristics                         | Value             |
|-----------------------------------------|-------------------|
| Gender                                  |                   |
| Male n (%)                              | 35 (32.7)         |
| Female n (%)                            | 72 (67.3)         |
| Age (mean)                              | 56 years          |
| ≥60 years n (%)                         | 48 (44.9)         |
| < 60 years n (%)                        | 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).
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.

### FIGURE I - Examples of unintentional discrepancies and interventions performed

| Type                  | Description                                                                 | Intervention               |
|-----------------------|-----------------------------------------------------------------------------|---------------------------|
| 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              |
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**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).
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.

### 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
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.

REFERENCES

Almanasreh E, Moles RE, Chen TF. The medication reconciliation process and classification of discrepancies: A systematic review affiliation. Br J Clin Pharmacol. 2016;82(3):645-58.

Brasil. Ministério da Saúde, Gabinete do Ministério. Portaria Nº 529, de 1º de abril de 2013. Institui o Programa Nacional de Segurança do Paciente (PNSP). Diário Oficial da União. Brasília 02 de abril 2013. Seção 1, p.43.

Buckley MS, Harinstein LM, Clark KB, Smithburger PL, Eckhardt DJ, Alexander E, et al. Impact of a clinical pharmacy admission medication reconciliation program on medication errors in 'high-risk' Patients. Ann Pharmacother. 2013;47(12):1599-1610.

Claeys C, Neve J, Tulkens, JPE, Spinewine A. content validity and inter-rater reliability of an instrument to characterize unintentional medication discrepancies. Drugs Aging. 2012;29(7):577-591.

Hellström LM, Bondesson A, Höglund PE, Eriksson T. Errors in medication history at hospital admission: prevalence and predicting factors. BMC Clin Pharmacol. 2012;12:1-9.

Instituto para práticas seguras no uso de medicamentos (ISMP). Medicamentos potencialmente perigosos de uso hospitalar e ambulatorial: listas atualizadas 2015. [Internet] ISSN: 2317-2312 4(3) Set. 2015. [cited 2017 June 20]: Available from: http://www.ismp-brasil.org/site/wp-content/uploads/2015/12/V4N3.pdf.

Instituto para práticas seguras no uso de medicamentos (ISMP). Medicamentos potencialmente perigosos: lista dos medicamentos para Instituições de longa permanência. [Internet] ISSN: 2317-2312 5(3) Set. 2016 [cited 2017 June 20]: Available from: https://www.ismp-brasil.org/site/wp-content/uploads/2016/09/Boletim_Agosto_Vol5_ISMP.pdf

Kalb K, Shalansky S, Legal M, Khan N, Ma I, Hunte G. Unintentional medication discrepancies associated with reliance on prescription databases for medication reconciliation on admission to a general medical ward. Can J Hosp Pharm. 2009;62(4):284–89.

Ketchum K, Grass CA, Padwojski A. Medication reconciliation: verifying medication orders and clarifying discrepancies should be standard practice. Am J Nurs. 2005;105(11):78-85.

Lea M, Barstad I, Mathiesen L, Mowe M, Molden E. Effect of Teaching and Checklist Implementation on Accuracy of Medication History Recording at Hospital Admission. Int J Clin Pharm. 2016;38(1):20-24.

Meguerditchian AN, Krotneva S, Reidel K, Huang A, Tamblyn R. Medication Reconciliation at Admission and Discharge: A Time and Motion Study. BMC Health Serv Res. 2013;13:485.

Mueller SK, Sponsler KC, Kripalani S, Schnipper JL. Hospital-based medication reconciliation practices: a systematic review. Arch Intern Med. 2012;172(14):1057-69.

Okerosi EK, Okalebo FA, Opana SA, Guantai AN. Prevalence and risk factors for medication discrepancies on admission of elderly diabetics at Kenyatta National Hospital, Kenya. Afr J Pharm Pharmacol. 2017;6(1):54-63.
Pevnick JM, Shane RE, Schnipper JL. The Problem with medication reconciliation. BMJ Qual Saf. 2016;25(9):726-30.

Quélenne C, Laurence B, Paya D, Blicklé JF, Gourieux B, Andrès E, et al. Potential clinical impact of medication discrepancies at hospital admission. Eur J Intern Med. 2013;24(6):530-5.

Redmond P, Grimes TC, McDonnell R, Boland F, Hughes C, Fahey T. Impact of medication reconciliation for improving transitions of care. Cochrane Database Syst Rev. 2018;8(8):1-125.

Reeve E, Shakib S, Hendrix I, Roberts MS, Wlese MD. Review of deprescribing processes and development of an evidence-based, patient-centred deprescribing process. Br J Clin Pharmacol. 2014;78(4):738-747.

Rentero L, Iniesta C, Uribeta E, Madrigal M, Pérez MD. Causas y Factores Asociados a los Errores de Conciliación en Servicios Médicos y Quirúrgicos. Farm Hosp. 2014;38(5):398-404.

Rey MBC, Prados YA, Gómez ES. Analysis of the Medication Reconciliation Process Conducted at Hospital Admission. Farm Hosp. 2016;40(4):246-59.

Ruiz BSJ, De Lucas LS, López-Giménez LR, Martínez BB, Larreategi SS, Txertudi AB, et al. Conciliación de la Medicación al Ingreso: Resultados e Identificación de Pacientes Diana. Rev Calid Asist. 2016;1-9.

Salameh L, Farha RA, Basheti I. Identification of medication discrepancies during hospital admission in Jordan: Prevalence and risk factors. Saudi Pharm J. 2018;26(1):125-132.

The Joint Commission on Accreditation of Healthcare Organizations. 2009 National Patient Safety Goals. Joint Commission Perspectives. 2008;28:1-30.

Unroe KT, Pfeiffenberger T, Riegelhaupt S, Jastrzembski J, Lokhnygina Y, Colón-Emeric C. Inpatient Medication Reconciliation at Admission and Discharge: A Retrospective Cohort Study of Age and Other Risk Factors for Medication Discrepancies. Am J Geriatr Pharmacother. 2010;8(2):115-26.

WHO Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC classification and DDD assignment 2016. Oslo, 2016.

World Health Organization. Implementation Guide Assuring Medication Accuracy at Transitions in Care. 2014

World Health Organization. Medication Without Harm. 2017. [cited 2017 October 20]. Available from: http://www.who.int/patientsafety/medication-safety/en/.

Zoni AC, García MED, Muñoz ABJ, Pérez RS, Martin P, Alonso AH. The Impact of medication reconciliation program at admission in an internal medicine department. Eur J Intern Med. 2012;23(8):696-700.

Received for publication on 19th October 2019

Accepted for publication on 04th July 2021