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The role of the hospital pharmacy in preventing medication errors in Brazilian hospitals

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Abstract. In recent years, medication errors have received considerable attention from healthcare professionals, health institutions, and health authorities worldwide. The purpose of this work was to identify preventive strategies to prevent drug-dispensing errors and harms to patients in Brazilian hospitals. An integrative review was conducted on Scientific Electronic Library Online, Google Scholar, Medical Literature Analysis and Retrieval System Online Database and Portal of Periodicals of the Coordination for the Improvement of Higher Education using the following keywords: medication errors, dispensing errors, and hospital pharmacy. 96 papers were first selected and after analysis, those that did not fulfill the inclusion criteria, that is discussion of dispensing errors in a hospital setting or evaluation or suggestions of preventive drug- dispensing actions, were excluded, and only 11 papers were included in this review. Low implementation actions to prevent dispensing medication errors were the most common. In general, hospitals have been adopting safer dispensing systems namely unit-dose drug dispensing system, medication reconciliation, potentially dangerous drugs supervision, development of guidebooks of properly drug storage and medication prepare and dispensing, double checks during dispensing and differentiation similar pronunciation and spelling drugs. All strategies were found to be in accordance with international recommendations to prevent medication and dispensing errors.
Keywords: medication errors; hospital pharmacy

Introduction

Medication errors have gained attention from professionals, institutions, and health authorities throughout the world since the Institute of Medicine report released a report in 2000 entitled "*To Err Is Human: Building a Safer Health System*" highlighting the need of creating strategies to prevent medication errors to improve patient safety. Previous reports from Harvard Medical Practice on patient safety matter stated that in 1994, at least 98 thousand Americans were affected by adverse events in hospitals (KOHN, CORRIGAN, DONALDSON, 2000). In 2007, another report pointed out that in the US hospitalized patients were susceptible to one medication error per day (ANACLETO, ROSA, NEIVA, MARTINS, 2017). In 2017, the World Health Organization (WHO) released the third Global Patient Safety Challenge, focused on reducing by 50% medication-related issues in five years. The general strategic was to improve the health system, making it safer and effective at all phases that include practice of medication: prescription, dispensing, administration, and monitoring (WHO, 2017).

Mistakes in the healthcare system may cause serious injuries namely death or permanent impairment, these major harms usually receive a lot of attention, however, errors leading to minor to mild harms also must be taken into consideration since indicate problems in the medication dispensing system and may lead to severe damages. Patients undergoing polypharmacy, especially those in use of insulin and heparin, are at higher risk of errors.

Medication errors may become an economic burden on both patients and healthcare system as increase hospitalization time and healthcare expenses. A survey carried out by WHO estimated an annual cost of US$ 42 billion related to medication errors, which corresponds to approximately 1% of health expenditures worldwide (WHO, 2017). A study released in 2018 by Vilela and Jericó reported that medication errors, and other several drug-related adverse events, accounted for US$ 617,493,770.36 in medication, human resources, and hospital charges (VILELA, JERICÓ, 2018).

Investigating healthcare mistakes involve integrative matters, cognitive psychology, human and ergonomic factors, group work and organizational sociology (LEAPE, 1999). Experts in human factors have been investigating what influences the occurrence of errors (LEAPE, 1999; BULHÕES 2001) and the reports show that lack of communication and management and organizational issues are among the main causes of medication errors (BATES, 1995; MIASSO, GROU, CASSIANI, CAMARGO SILVA, FAKIH, 2006).

In order to develop safer techniques in the drug-use process, minimize errors and make the system more efficient, it is highly recommended to identify the riskiest stages in the medication chain; to achieve such accomplishment, the WHO recommend five goals as follows (WHO, 2017):

1. Identify the stages in the medication chain that avoidable errors occur and improve the monitoring system to detect the errors.
2. Develop actions that improve prescription, dispensing, preparation, administration and monitoring practices.
3. Develop guidelines and tools to support a safer medication use and reduce avoidable harms.
4. Engage patients, health professionals and industry to pursue for solutions.
5. Empower patients and families to become a barrier over the medication errors by asking questions about medication and procedures.

Thus, the purpose of this study was to identify strategies to prevent medication errors in Brazilian hospitals focused on the practices in the hospital pharmacy.

Materials and Methods

A integrative review was carried out using the keywords: “medication errors”, “hospital pharmacy” and “medication dispensing” on multiple databases of scientific articles and electronic pages of health professional institutes such as Scientific Electronic Library Online (SciELO), Google Scholar, Medical Literature Analysis and Retrieval System Online Database, Portal of Periodicals of the Coordination for the Improvement of Higher Education, World Health Organization, Federal Council of Pharmacy and Regional Councils of Pharmacy, Regional Nursing Council, Institute for Safe Practices in the Use of Medicines, Ministry of Health, Virtual Health Library of the Ministry of Health, Municipal Health Department of Rio de Janeiro, Brazilian Society of Hospital Pharmacy and Health Services, Infarma Journal, Einstein Journal, Brazilian Journal of Hospital Pharmacy and Health Services, Journal of São Paulo School of Nursing, Oswaldo Cruz Institute, São Paulo Pediatrics Society, Papers from Pernambuco College of Health, Monographs from Federal University of Ouro Preto, Repository of Publications Faculty of Education and Environment, Electronic Publications from State University of Rio de Janeiro.

The search was carried out between April and November of 2020 and articles from 2013 to 2020 were selected for analysis. Only 96 articles were related to the keywords and those that did not focused on medication errors, hospital pharmacy and evaluation of prevention strategies were excluded. Finally, 11 articles were fully analyzed.

Results and discussion

Safety medication dispensing in a hospital pharmacy has been in discussing since the 60’s (Ribeiro, 2008). Ward-stock drug dispensing system is widely used in Brazilians hospitals; however, it consists of a major risk factor for medication errors. In this traditional system, medication is dispensed from the pharmacy to the nursing station from each department, hence the pharmacy has no access to the prescription and is not able to check it for possible mistakes, such as doses, route or time of administration (BRASIL,1994). A study (Vasconcelos et al, 2012) assessed several medical records and showed that 76.5% of 9,220 medication dispensed from the pharmacy were not used, causing loss of products due to inadequate storage and expiration.

In 2019, an exploratory descriptive study (Freire, 2019) investigated the knowledge of health professionals in medication dispensing in a maternity hospital in the Northeastern region of Brazil. The study showed that the hospital pharmacy used two system of dispensing medication: the traditional ward-stock drug dispensing system for radiology and endoscopy departments, emergency room and ambulatories; and a unit-dose drug dispensing system for inpatient units. However, the lack of a computerized system in the pharmacy was appointed as the cause of mistakes. In fact, 68% of the staff claimed to have witnessed dispensing errors, of which 84% reported errors in the doses administration; 56% observed expired medicines been dispensed; 20% reported inadequate storage of medication; 16% witnessed drug administration to the wrong patient; 4% observed a different dosage form from prescription been dispensed; and, finally, 52% of the staff of the pharmacy acknowledge to have made some of the above mistakes (FREIRE et al, 2019).

Another study (Silva and Rissato, 2013), comparing dispensing errors perceived by the staff of the pharmacy from actual errors after screening the medication dispensed, in a 100-bed capacity public hospital in the state of Parana revealed that the pharmacy used to dispense large-volume medication in the traditional system and small-volume medication were dispensed specifically for each patient in the clinics and surgical departments. The staff of the pharmacy who were directly involved in drug dispensing were interviewed and they pointed out that among the most frequent mistakes, 22% accounted for dispensing medication in a different concentration from prescribed; 20% of dispensing a different or not prescribed medication; also 20% of dispensing a different dosage form from prescription; 17.8% were related to variations in the drug administration time; and 11% of drug omission of dose (SILVA e RISSATO, 2013).

A cross-sectional study was carried out in a large university hospital in the Northeastern region of Brazil with the objective to detect dispensing errors in the hospital pharmacy and recommend actions to prevent such errors. The hospital dispensed medication in a unit-dose drug dispensing system. A total of 1.077 prescriptions of 5.604 drugs were analyzed and 407 mistakes were identified.

The most frequent errors were related to divergences in the drug prescribed from the drug dispensed (36.9%); inadequate labelling (35.8%); and flaws in the dispensing records (27.3%). The most observed errors related to divergences in the drug prescribed from the drug dispensed were inferior quality (33.3%), omission of dose (30.7%), and wrong dose (26%) (MAIA et al, 2019).

In a unit-dose drug dispensing system, medication is dispensed at the right time of administration, in the correct dose, and administration is closely observed by a healthcare professional to monitor adverse effects, however it demands financial resources for qualified professionals, computerized systems and constant maintenance, but all of this require financial investment (RIBEIRO, 2008).

The "Medication Reconciliation" strategy to prevent harm. In this process, the patient's current medication is compared to the medications prescribed at the moment of hospitalization or in the patient's record, which is quite helpful in avoiding errors such as omissions, duplications, or overdoses. In a study carried out in the department of hematology and oncology in a 27-bed capacity public hospital in Porto Alegre assessed how the practice of Medication Reconciliation reduced medication discrepancies for hospitalized patients. 72 patients using a total of 227 different medicines were interviewed. The study indicated 120 (52.9%) medication's discrepancies, of which 83.3% intentional and 17.7%, unintentional. Benzodiazepines and opioids were among the medication found with some discrepancies (LINDENMEYER, GOULART, HEGELE, 2013).

A quantitative retrospective study (Santo et al, 2019) evaluated the implementation of a computerized Medication Reconciliation system, with pharmacists, nurses, and physicians collaborating, in a 1000-beds philanthropic hospital in Porto Alegre. At the time of hospital admission, a member of the nursing staff collected information about the patient's medications before admission. The information was then available for pharmacists, who also had access to the prescriptions; based on the data, Medication Reconciliation was conducted, and, if necessary, physicians were contacted to correct the errors. For this study, unintended discrepancies included: omission of dose, therapeutic duplication, change in dose, medication, frequency, or route of administration. A total of 1.368 electronic medical records were analyzed; 347 (25%) went through medical reconciliation, of which 106 (31%) had pharmaceutical intervention (SANTOS et al, 2019).

As for the "Financial investment for procedures, practices and technology to prevent harm", Rodrigues published a study, in 2020, in which he evaluated the Good Dispense Practices from six public hospitals in Pernambuco; the hospitals comprised of 2.178 beds, 71.57% of the public beds in Recife. The study pointed out that all hospital pharmacies met the requirement set by the Brazilian Society of Hospital Pharmacy and Health Services of, at least, one pharmacist per 50 beds, however none of the hospitals fulfilled the requirements of a staff of 10 pharmacy auxiliaries per 50 beds, thus overwhelming the pharmacists, thus being a possible source of medication errors (RODRIGUES, 2020). Among the strategies adopted to minimize errors, 100% of the hospitals ensured the participation of the pharmacist in the Patient Safety Commission, specifically created to identify, analyze, and detect adverse drug events. In 75% of the hospitals, the pharmacist oversaw the Pharmacy and Therapeutic Commission, responsible for selecting products and medicines according to the services offered in the hospital and develop guidebook to support medication storage, distribution, and use. In 50% of the hospitals, the pharmacists were members of the Hospital Infection Control Committee in order to monitor antimicrobials' use and dispensing and early detect and tackle problems of microbial resistance. Despite many studies have already established how efficient the clinical pharmacy services are in minimizing medication errors, containing costs and medicines waste, and promoting drug rational use, only 25% of the hospitals had a pharmacist in the role of medication reconciliation (COSTA et al, 2021). Managers pointed out that the lack of infrastructure was the reason for such low compliance with this important measure for patient's safety (RODRIGUES, 2020). All pharmacies in the hospitals took measures to monitor potentially dangerous drugs (PDD) and had detailed guidebook for correct drug storage, prepare and dispensing; 75% of the hospital pharmacies had developed strategies to distinguish medication with similar pronunciation and spelling. Although all pharmacies in this study used both ward-stock drug and unit-dose drug dispensing systems, due to lack of structure and human resources, only 50% relabeled fractioned drugs, and only other 50% double checked medication already dispensed. Indeed, this study highlighted the value of continuing education for professionals on dispensing and storage medication, as previous set by the Ordinance number 4,283/2010 from the Ministry of Health, but only 50% of the departments offered annual training, and 25% carried out training ever six months; 25% of the hospitals performed professionals training only on admission (BRASIL, 2010; RODRIGUES, 2020).

In 2015, a study evaluated the effectiveness of the unit-dose drug dispensing system in a 155-beds hospital; the hospital used an electronic prescribing system with bar coding verification. A total of 1,765 medication were reviewed and 51 potential errors were identified, comprising 2.89% of the inspected medicines; 17 out of 51 errors were related to PDD. The most frequent errors were omission of doses (37.25%); wrong medication dispensed (24.49%); underdose (17,65%), and overdose (13.73%). The low rate of dispensing errors (2.89%) suggests an adequate approach to prevent medication errors, including continuing education for professionals working with drug dispensing; placement of different dosage forms in separated rooms; use of Tall Man Lettering to differentiate look-alike and sound-alike drugs, and colored labels to identify PDD, controlled medication, and those that require temperature control (JAYME e CARNEIRO, 2016).

A study from 2019 (Vilela and Jerico,2019) emphasized the value of investing in technologies tools that improve prevention of medication errors. The study was performed in a 699-bed philanthropic hospital in the Southeastern region of Brazil; the hospital has an average of 40,733 consultations a year and adopts the unit-dose drug dispensing system. The study was divided into four parts and the purpose was to evaluate the costs and results of the implementation of the tools to prevent errors. Between 2007 and 2015, 13 preventive methodologies were adopted: five specifically for drug dispensing, including electronic dispensing, unit-dose packages, kits to organize drugs in the surgical department, labels, and colored packages to differentiate PDD dispensing and electronic prescribing – which is not directly related to medication dispensing but makes it safer – and medication conciliations. The financial investment was R$10,259.10; 29% (R$2,979,397.10) were for dispensing technologies; and 31% (R$ 3,252,263.11) for implementation of electronic prescribing. Before implementation of preventive technologies, the rate of dispensing errors was 2.4%, in 2015, after the preventive technologies were set,

the rate of errors was 0.06%, thus reducing 97.5% of medication errors (VILELA and JERICO, 2019).
Costa et al. (2021) also reviewed medication errors in hospitals and demonstrated how hospital quality programs and continuing education focused on safety culture in healthcare are crucial to avoid medication errors (COSTA et al, 2021).

Conclusion

In the present study, safety practices used by Brazilian hospital pharmacies to minimize medications errors were identified. The low implementation cost actions were the most observed, namely 1) unit-dose drug dispensing system and medication kits based on the procedure; 2) setting up pharmacist's clinical activities at the inpatient unit performing medication reconciliation and monitoring PDD use; 3) use of guidebook to storage, prepare and dispense medication properly; 4) double check medication before use; 5) differentiate look-alike and sound-alike medication by labeling and packing drugs in different color packages; 6) use of electronic prescribing and sufficient staff members in the pharmacy; 7) application of tools that improved acknowledgement of prescription information at the moment of drug dispensing. In fact, there is not only one strategy to make drug dispensing safer but implementing a set of preventive actions would minimize dispensing errors, reduce patient's harm and, thus, improve healthcare quality.

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