



REVISIONES

Errors in the preparation and administration of medications: an integrative review of Latin American literature

Errores en la preparación y administración de medicamentos: una revisión integradora de la literatura Latinoamericana

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Palabras clave: Errores de Medicación; Composición de Medicamentos; Administración de Terapia de Medicación

ABSTRACT

Objective: To analyze the contents the scientific production of Latin American nurses regarding on preparation and administration of medical drugs from 2005 to 2011 using Latin American and Caribbean Center Information the Health Sciences (LILACS) y Electronics Scientific Library (SciELO) databases.

Methodology: The following research was an integrative review. Data collection was performed in the month of October 2012 and according to the inclusion criteria, were selected eight articles.

Results: The articles were analyzed in terms of objectives, methodological path, main results and suggestions for improvement. The analysis indicates exclusive production of Brazil, descriptive studies, conducted in hospitals and general suggestions as continuing education, error reporting and implementation of a safety culture.

Conclusions: Considering that aspects emphasized by the World Health Organization (OMS) to achieve safer care are: to find causes, to propose solutions and to evaluate the impact, it is concluded that production need of knowledge that effectively improve professional practice. Looking to the system, promoting researches with analytical studies will allow effective responses according to reality.

RESUMEN

Objetivo: Analizar, respecto su contenido, la producción científica de enfermeros latinoamericanos sobre error en la preparación y administración de medicamentos entre el año 2005 al 2011, en las bases de datos Centro Latinoamericano y del Caribe de Información en Ciencias de la Salud (LILACS) y Biblioteca Electrónica Científica (SciELO).

Metodología: Consistió en una revisión integradora. La recolección fue realizada en el mes de Octubre de 2012 y de acuerdo a los criterios de inclusión, fueron seleccionados ocho artículos.

Resultados: Los artículos fueron analizados en cuanto a los objetivos, trayectoria metodológica, principales resultados y propuestas de mejora. El análisis señala producción exclusiva de Brasil, estudios descriptivos, realizados en hospitales y con sugerencias generales como educación continua, notificación de los errores, implementación de una cultura de seguridad.

Conclusiones: Considerando los aspectos enfatizados por la Organización Mundial de Salud (OMS) para alcanzar una atención más segura: buscar causas, proponer soluciones y evaluar impacto, se concluye que la producción necesita conocimiento que efectivamente mejore la práctica. Impulsar la investigación analítica con la mirada al sistema permitirá el desarrollo de propuestas efectivas y de acorde a la realidad.

INTRODUCTION

The Patient Safety Programme, formerly World Alliance for Patient Safety, was created in 2004 by the World Health Organization (WHO) with the purpose of coordinating, disseminating and accelerating the improvements with regards to patient safety. Among the challenges and projects proposed in the programme, the research puts emphasis on the need for scientific data ranging from identification of problems to proposal and evaluation of strategies for the reduction and prevention of harm suffered by patients in health care⁽¹⁾.

According to WHO, among the priorities of developing countries is the generation of sufficient knowledge for the creation of effective local strategies, in addition to the reduction of risks⁽¹⁾.

In Latin America, the scientific production with regards to this subject has developed against sanitary accreditation and monitoring, as well as the efforts driven by the International Nursing Network in Patient Safety. In countries like Brazil, Chile, Colombia, and Argentina, among others, the International Network has exerted a strong influence on the production of evidence in order to give emphasis to the research based on the actual situation in the region.

Among the varied topics to investigate, medication errors are still considered to be the most frequent to occur in developing countries⁽¹⁾, where evidence shows that those events mainly happen in the stages of preparation and administration of medications⁽²⁻⁴⁾. The preparation and administration of medications is the sole responsibility of the nurse practitioner, and this is an important issue when trying to provide quality care without any risks⁽⁵⁻⁸⁾.

With regard to medication errors, before 2004, the scientific production was based on studies mainly related to determining the types of errors, the possible causes and the consequences on the patient. According to WHO, the need to acknowledge the magnitude of the problem is crucial to determining the priorities, but this is only the first

step. Looking for causes, proposing solutions and assessing the impact are the emphasis for achieving safer care ⁽¹⁾.

Considering the aforementioned and the responsibility of nurse practitioners in providing safe care with regards to the preparation and administration of medications, the following question arises: What did the Latin American nurses research from 2005 to 2011 with regards to error in the preparation and administration of medications? The purpose of this study was to identify, in terms of content, the scientific production pertaining to error in the preparation and administration of medications by the nurse practitioners at the Latin American level, from 2005 to 2011, based on data obtained from the Latin American and Caribbean Center on Health Sciences Information (LILACS) and the Scientific Electronic Library Online (SciELO).

Being aware of what is researched and knowing the results obtained from such research, helps to identify the needs and weaknesses of the level of knowledge of Latin American nursing on the subject.

MATERIAL AND METHOD

In order to answer the question mentioned above, a comprehensive review was conducted that enables the summary of knowledge produced in a certain subject, as well as identifies the gaps of knowledge that need to be filled in by future research ⁽⁹⁾. The descriptors used for gathering the information that were selected using the health terminology (DeCS) of the Virtual Health Library (BIREME) are: "Medication Errors", "Medication Composition" and "Medication Therapy Administration". In addition, two uncontrolled descriptors "administration of medications" and "preparation of medications" were used.

The determined inclusion criteria were: related to the topic of medication preparation and administration stages conducted by nurses, full articles released from 2005 to 2011 of Latin American origin, published in the LILACS and SciELO databases in Spanish and/or Portuguese.

The year for starting the data collection was 2005 due to the impulse and motivation for scientific production with regards to patient safety driven by the Patient Safety Programme (WHO) in 2004. LILACS and SciELO databases were chosen because they have publications mainly of Latin American origin, in response to the objective of the study.

The data collection was conducted in October 2012. From 2005 through 2011, the advanced search (iAH form) was used in the LILACS database (<http://lilacs.bvsalud.org/>), and the comprehensive search was used in SciELO (<http://www.scielo.org/php/index.php>) by typing the descriptors: "medication errors", followed by "medication composition" and "medication therapy administration", as well as the uncontrolled descriptors "medication preparation" and "medication administration". There were 15 studies found and inserted in an instrument including the following items: article title, publication year, authors, language, database and country.

After selecting the articles, a thorough reading was conducted to select the studies pertaining to the inclusion criteria: full articles related to the topic of medication

preparation and administration stages, conducted by nurse practitioners, the language being Portuguese and/or Spanish.

Of the 15 studies found, seven were rejected because they did not meet the inclusion criteria. Three of these were not directly related to the topic of medication preparation and administration, despite having been conducted by nurse practitioners, and four were not conducted by nurses. It should be noted that it is possible to access the full content of all the articles.

RESULTS

Considering the inclusion criteria, Table 1 shows eight selected articles. Four of these (50.0%) were mentioned in the two databases (LILACS and SCIELO); the rest (4 – 50.0%) only in LILACS. As regards the year of publication, it is observed that more than 50% of the publications were from years 2010 and 2011, and there were no publications found from 2005. All the studies are from Brazil, and more than 60% (62.5%) are written in Portuguese and Spanish.

Table 1 Articles selected according to inclusion criteria, Santiago de Chile 2012.

Article Title	Pub. Year	Authors	Language	Database	Country
Eventos adversos causados por medicamentos en un hospital sentinela del Estado de Goiás. Brasil.	2011	Ana Elisa Bauer de Camargo Adriano Max Moreira Reis Adrinana Inocenti Maso Jania Oliveira Santos Silvia Helena De Bortoli C.	Spanish Portuguese	SCIELO LILACS	Brazil
Análisis de causa raíz: evaluación de errores de medicación en un Hospital Unrversitario.	2010	Thayta Cardoso Alux T. Silvia Helena De Bottoli C.	Portuguese Spanish	ULACS SCIELO	Brazil
Erros na administracao de antibióticos em unidade de terapia intensiva de hospital de ensino.	2010	Maria Cristina Soares R. Ludmilla de Castro Oliveira	Portuguese	ULACS	Brazil
Identificación y análisis de los errores de medication en seis Hospitales Brasileños.	2010	Silvia Helena De Bortoli C. Aline Aparecida Silvia M. Ana Elisa Bauer De Camargo Flávio Trevisan Fakh Simone Perufo Opitz Thalyta Cardoso Alux T.	Portuguese Spanish	ULACS SCIELO	Brazil
Percepción del equipo de enfermería sobre factores causantes de errores en la administración de medicamentos.	2010	Juliana Nogueira Franco Gabriele Ribeiro María D'Inncenzio Brícida Pompeo Amaral Barros	Portuguese Spanish	ULACS	Brazil
Preparación y administración de medicamentos: Análisis de cuestionamiento e informaciones del equipo de Enfermería.	2007	Daniela Odnicki da Silva Cris Renata Grou Adriana Inocenti Miasso Silvia Helena De Bortoli C.	Spanish Portuguese	ULACS	Brazil
Consecuencia de los errores de medicación en unidades de cuidados intensivos - semi intensivos.	2006	María Cecilia Toffoletto Kátia Grillo Padilha	Portuguese	ULACS	Brazil

El proceso de preparación y administración de medicamentos: Identificación de problemas para proponer mejoras y prevenir errores de medicación.

2006

Adriana Inocenti Miasso
Ana Elisa Bauer de Camargo
Silvia Helena de Bortoli C.
Cris Renata Grou
Regina Célia de Oliveira
Flávio Trevisan Fakihi

Portuguese

ULACS
SCIELO

Brazil

Regarding the content, the articles were analyzed in relation to the objectives, methodological path, main results and improvement proposals.

Based on the analysis of the eight selected articles, the article *Eventos adversos causados por medicamentos en Hospital centinela del Estado de Goiás, Brasil* ⁽¹⁰⁾ (Adverse events caused by medications in Centinela Hospital, Goiás State, Brazil), written in Brazil, consists of a descriptive study with retrospective data, conducted in the third level of care, whose objective was to identify the medication errors that occurred in the administration process and to classify them according to type. Of a total of 230 errors, the result in relation to the prevalence was a 64.3%. With regards to the causal factors, the study indicates that these were related to factors intrinsic to the nurse team, as well as factors related to the dispensing of drugs by the pharmacy, in addition to medication shortage, this being the main determinant of omission errors. As a proposal, it is suggested to introduce modern concepts of material logistics which avoid the medication shortage, to create a patient oriented safety culture, a safety committee leading the event searches and adopting risk analysis methodologies, as well as the continuous training of their professionals for the pharmaceutical area focused on care practice.

The article *Análisis de causa raíz: evaluación de errores de medicación en un Hospital Universitario* ⁽¹¹⁾ (Root cause analysis: evaluation of medication errors in a University Hospital), makes reference to a descriptive study with cross description and the method used is Root-Cause. The aim of the study was to identify and analyze the types of medication errors observed in the medication doses that were prepared and administered in a different way than they were prescribed, and propose strategies and suggestions to avoid these errors. Results indicate that 24.3% of the errors correspond to those related to wrong dose, 22.9% to wrong time, and 13.5% to unauthorized medications. Wrong technique represents 12.2%, wrong route represents 4.1%, extra dose represents 5.4%, and wrong prescription and missed dose correspond to 4.1% respectively. In the study there is no information about the degree of harm caused to patients due to medication administration errors committed; however, among causal factors are the distribution of different medications or in doses different from the prescribed dose, overwork, lack of supervision and indication confirmation. For each one of the errors committed, a preventive method was suggested, which varies from the distribution of medications in single doses, the use of bar codes to confirm the medication to be used, and the organization of the tasks for the nurse practitioners, among others.

The study "*Erros na administração de antibióticos em unidade de terapia intensiva de hospital de ensino*" ⁽¹²⁾, consists of a descriptive research conducted in one Intensive Care Unit (ICU) of a teaching hospital located in Brasilia, Brazil, between the years of 2006 and 2007. The objective was to verify the occurrence and characterize the errors in the administration of antibiotics, and the results indicate that 87.6% of the errors correspond to those committed in the process of preparation, 6.2% corresponds to errors in the schedule of administration and 6.2% to other types of errors. With regard to the errors in the preparation, these are related to the lack of disinfection of the

bottles of medicine and lack of hand washing prior to preparation. There is no evidence on the degree of harm caused to the patients. With regard to the causal factor, it is indicated as the combination of severity and time spent in the healthcare facility, as well as the work load of the nursing staff. Essential to avoiding errors, according to the authors of the study, they base on the change in the organization of health services to analyze the existing medication systems consistently and effectively, promoting patient safety. To this end, the occurrence of adverse events related to the medications must be informed in every attention unit.

The report entitled *Identificación y análisis de los errores de medicación en seis Hospitales Brasileños*⁽¹³⁾ (Identification and analysis of medication errors in six Brazilian hospitals), corresponds to a descriptive study, by means of direct observation in units of clinical medicine of six Brazilians hospitals, five of which are public and one private. The objective of this study was to identify the medication errors through the method of direct observation. The universe was the doses prescribed and administered in these units, during 30 days, with a minimum of 35 doses per day and the results were the following: in general, the errors related to the time corresponded to 53.8% and the wrong dose to 26.4%, followed by non-authorized medicines (9.8%), wrong route (8.5%) and wrong patient (1.5%). For every 1,000 medicines administered in the investigated units, 17 were different from the doctor's prescription. Causal factors include lack of hand washing, lack of disinfection of blisters and bottle-blisters, contamination of the syringe plunger, interruptions and distractions in the activity, many times incomplete transcription of the prescription in labels and tapes, preparation of medications beforehand, inadequate or inappropriate area with noise and poor lighting. There is no background information on the degree of harm caused to the patients, and strategies to prevent errors are not indicated in the study either; it only highlights the importance of investigating so as to be able to develop strategies to decrease the occurrence of medication errors.

In the study *Percepción del equipo de enfermería sobre factores causantes de errores en la administración de medicamentos*⁽¹⁴⁾ (Perception of the nurse team on factors that cause errors in the administration of medications), a descriptive and exploratory study was conducted, which had the aim of identifying the types of errors and the risk factors that occur during the process of administering drugs in a Brazilian general hospital. In order to accomplish this, a population of 52 members of the nursing team (10 nurses, 19 nurse technicians and 23 nursing auxiliaries) has been taken and it was found that the perception of the team was that medication errors are mainly due to administering the medication to wrong patient, wrong route, wrong drug, wrong time and wrong dose. With this information, it was determined that the causal factor was verbal prescription and miscalculation of medication, thus it is proposed to train professionals to avoid acronyms and abbreviations. This text has no data on the degree of harm.

In the text *Preparación y administración de medicamentos: Análisis de cuestionamiento e informaciones del equipo de Enfermería*⁽¹⁵⁾ (Preparation and administration of medications: Analysis of questioning and information of the nursing team), we performed a descriptive and exploratory study in a Brazilian university hospital, which analyzed the questions presented by nurse technicians and auxiliaries to the nurses during the preparation and administration of medications. The main questions submitted by the nursing auxiliaries and technicians were related to the dilution of the medicine (40.4%) and to the administration technique of the medication (15.7%). 35.5% of the responses provided by the nurses to nursing auxiliaries and

technicians were incorrect or partially incorrect, so the study suggests to have the system restructured by institutional managers, in order to obtain improvements in human resources and the working environment, as well as to have the presence of a pharmacist, with a protocol of dilution, to have updated literature and internet access. The document *Consecuencia de los errores de medicación en unidades de cuidados intensivos-semi intensivos*⁽¹⁶⁾ (Consequence of medication errors in intensive or semi intensive care units), is a comparative, cross-sectional study with the purpose of characterizing medication errors and evaluating consequences in the severity of patient conditions and the nursing workload of two hospitals in the city of Sao Paulo, Brazil. In regard to the prevalence of wrong administration, 17.31% was due to inadequate dose, 3.85%, to wrong route of administration, 11.54% to wrong administration rate and 7.69% to wrong time. In regard to the preparation of medications, the prevalence was 23% due to missed dose, 21.15% to wrong drug, 9.61% to wrong concentration, 3.85% to wrong technique, and 1.92% to expired medication. On the other hand, during the implementation of this study, there were no changes identified with regard to the severity of the patient's conditions. However, it did show an increase in the workload of the nursing team, resulting in tiredness and neglect.

Based on the analysis of the article *El proceso de preparación y administración de medicamento: identificación de problemas para proponer mejoras y prevenir errores de medicación*⁽¹⁷⁾ (Process for the preparation and administration of medication: identification of problems to suggest improvements and prevent medication errors), a descriptive and exploratory study, conducted in tertiary level of attention, in the service of clinical medicine units of 4 Brazilian hospitals, which aimed to analyze the process of preparation and administration of medications by identifying existing problems and suggestions for improvement based on investigated data, experience of team members and the researched literature. The study showed results of prevalence of administration error of various hospitals, where there were different results as: Hosp. A: 39.7%, Hosp. B: 14.7%, Hosp. C: 31.9%, Hosp. D: 22.6%. Based on the preparation of medications, the result was the following: Hosp. A: 14.1%, Hosp. B: 19.7%, Hosp. C: 46.8%, Hosp D: 47.8%. With reference to the types of errors in the administration phase, its consequence was due to errors in the administration technique, errors in communication with the patient, errors in the identification of the patient, errors in the technique for performing other activities at the same time as the administration. On the other hand, the errors found in the preparation stage were due to preparing medications beforehand, failure to identify material or medication, interruptions in the preparation, errors in planning the task, errors in safety during the preparation technique, errors in identifying the medication. In relation to these errors in the administration and preparation of medications, there is a causal factor associated, the environment, noise, heat, extreme psychological stress, and organization. To contribute to the improvement, and decrease the medication errors, it was suggested to offer courses of continuous training and effective presence of the nurse in the process to improve the quality and safety in the care of patients.

DISCUSSION

The analysis of the results indicates that most of the publications are from the past two years (2010-2011)⁽¹⁰⁻¹⁴⁾ in contrast to year 2005, in which there were no publications on the subject, revealing the success of the impulse driven by the Patient Safety Programme on the importance of research in areas related to patient safety.

With regard to the origin of the articles, there is a higher number of productions originating from Brazil⁽¹⁰⁻¹⁷⁾, most likely due to the higher number of postgraduate programs when compared to other Latin American countries. The production of knowledge based on a discipline is directly related to the doctoral programs and the training of doctors, who are considered to have the main role in leading and teaching research.

Most goals showed similarities in relation to identifying and quantifying the types of errors in the preparation and administration of medications⁽¹⁰⁻¹⁷⁾, presenting a strong consistency with the types of studies proposed, where it was observed that all were descriptive, under the quantitative paradigm. Quantitative and empirically verifiable data with regards to medication errors reveal facts that enable an accurate diagnosis for the effectiveness of local interventions in clinical practice. However, the descriptive studies do not allow you to respond to the demands of proposals for improvement, implementation, and evaluation and must be replaced with analytical and explanatory studies. Latin American nurses should be encouraged to conduct researches that produce profound changes in clinical practice, despite the difficulties and shortage of resources.

The same can be said about the level of care where the investigations were conducted. It is remarkable the preference for hospitals⁽¹⁰⁻¹⁷⁾, where the number of procedures related to the preparation and administration of medications exceeds any other level, facilitating the collection of evidence. In addition, specialized care, where quick action is required, due to the characteristics of complexity of the patients and the requirement of a sophisticated attention drug therapy, there is a growing exposure to a variety of risks that threaten the safety of patients, which justifies the prioritization of researchers to work more in this environment. However, it is important to begin to widen the scope when it refers to medication errors. In the context of primary health care, scientific evidence⁽¹⁸⁻¹⁹⁾ shows reasonably reliable results, however, the effects on individuals highlight the importance of actions to improve the safety of care at this level of attention.

Based on the results, an important element to discuss is related to the conceptualizations and taxonomies used in the research. Definitions of medication errors and taxonomies of world-known international organizations, such as the *Institute for Safe Medication Practice* (ISMP)[™], *American Society of Hospital Pharmacists* (ASHP)^(10,12) and the *National Coordinating Council about Medication Error and Prevention* (NCC MERP)^(12-14,16), were found. The WHO's Patient Safety Programme published in 2009 the report *Marco Conceptual para la Seguridad del Paciente*⁽²⁰⁾ (Conceptual framework for the safety of the patient), still little-known by the Latin American nurses, that consists of the definition of concepts with regard to patient safety grouped in an internationally recognized classification, with the purpose to standardize and categorize concepts that facilitate the measurements, comparisons, analysis and interpretations of the various activities carried out with respect to patient safety.

In turn, analyzed research accounts for considering the phenomenon as an important topic and under the full responsibility of the nursing discipline. The preparation and administration of medications is identified as a nursing exclusive care, and nurse practitioners are seen as main characters in the generation of knowledge regarding the topic. However, it should not be forgotten that the preparation and administration of medications is the last of the various phases of the process of administration of the

drugs, where other health professionals such as doctors and pharmacists have their moment to stand out. So, working together with other professionals enables a more systemic understanding of the problem, by providing the findings with regard to the causal factors and consequential proposals for intervention.

In regard to the causal factors and suggestions for improvement, despite the weakness of descriptive studies on the determination of causal factors, studies report general suggestions as continuous education^(10,14), notification of errors⁽¹²⁾, and implementation of a safety culture (17). The study *Análisis de causa raíz: evaluación de errores de medicación en un Hospital Universitario*⁽¹¹⁾ (Root cause analysis: evaluation of medication errors in a University Hospital), suggests recommendations based on the root cause analysis of errors, methodology used for the systematic analysis of events, where the errors are investigated from the unsafe act of nursing personnel to the decisions made at the managerial level. The clear and objective analysis of the events, without intending to determine who was to blame, allows for the identification of the causes, enabling the creation of strategies for improving the system⁽²¹⁾.

The knowledge produced in Latin America still consists of determining and identifying errors without a clear identification of using the results. The preparation and administration of medications is a well known procedure and routine for nursing personnel. Medication errors do not always cause harm to the patients, and therefore are not always considered. The break in the medication administration process chain due to the lack of communication and the absence of effective processes are still very critical points in the health services in Latin America and that will surely lead to mostly preventable medication errors.

CONCLUSIONS

The investigation with regard to medication errors in Latin America is still in an early stage. Although the comprehensive review was carried out only in two databases, these reflect significant scientific journals in the region. Another finding is related to the exclusive production of Brazilian studies, with absence of evidence with regard to the situation in the remaining countries.

The absence of studies that propose local strategies and evaluate their effectiveness in improving the practice is reflected by the weakness of the nurses in systematizing, organizing and implementing the results. The distance that still persists between the academy and the assistance, the low possibility of involvement of the clinical nurse in obtaining of evidence, and the lack of support and interest on the part of the clinical directors on the researched topic are factors that impede the changes proposed by the evidence.

Considering that the aspects emphasized by WHO to achieve a safer care are to find the causes, suggest solutions and evaluate the impact, it can be concluded that the Latin American nurses should encourage research with the use of analytical studies and by looking at the system in the search for the actual causes, allowing the development of proposals if not generalizable, but effective and consistent with the reality.

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