Original Article

TEXTO & CONTEXTO ENFERMAGEM
TEXT & CONTEXT NURSING TEXTO & CONTEXTO ENFERMERÍA

RISK FACTORS IN MEDICATION ERRORS IN A HIGH-COMPLEXITY CHILEAN PUBLIC HOSPITAL

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ABSTRACT

Objective: to identify the risk factors in medication errors in a high-complexity chilean public hospital.
Method: a research study with a quantitative approach; an exploratory, descriptive and cross-sectional study, with retrospective temporal cuts. The study population consisted of 50 reports of adverse events related with the medication administration process generated between 2014 and 2017 in the Medical and Surgery services of the Magallanes Clinical Hospital, Chile. The classification of the National Coordinating Council for Medication Error Reporting and Prevention was used for data collecting, performed during May and June 2018, and the data were analyzed by means of descriptive statistics.
Results: among those involved in the medication errors, the following professions are predominant: nurses, 21 (42%); Medical and Surgery nursing technicians, 18 (36%), and nursing technicians working in the Pharmacy, 7 (14%). The most frequent medication errors were the following: medication transcription, 16 (32%); preparation, 13 (26%); and administration, 11 (22%). The following risk factors stand out in the notified cases: communication and interpretation problems, 13 (26%); incorrect interpretation of the prescription at dispensation, 7 (14%); factors associated with work organization such as insufficient compliance with the priority safety practices, 11 (22%), and individual factors, 9 (18%).
Conclusion: more information is required about medication errors to identify the risk factors and to establish strategies for their prevention; consequently, the notification of adverse events must be promoted as a preventive measure.

DESCRIPTORS: Patient safety. Medication errors. Nursing care. Nursing. Adverse events.

HOW CITED: Cárcamo AMP, Tourinho FSV, Alves TF. Risk factors in medication errors in a high-complexity chilean public hospital. Texto Contexto Enferm [Internet]. 2020 [cited YEAR MONTH DAY]; 29(Spe):e20190241. Available from: https://doi.org/10.1590/1980-265X-TCE-2019-0241

FACTORES DE RIESGO EN ERRORES DE MEDICACIÓN EN UN HOSPITAL PÚBLICO CHILENO DE ALTA COMPLEJIDADE

RESUMEN

Objetivo: identificar los factores de riesgo en errores de medicación, en un hospital público de alta complejidad en Chile.
Método: investigación de abordaje cuantitativa, estudio de tipo exploratorio, descriptivo de corte transversal, de recorte temporal retrospectivo. La población de estudio estuvo compuesta por 50 reportes de eventos adversos relacionados con el proceso de administración de medicamentos generados en los servicios de medicina y cirugía del Hospital Clínico Magallanes, Chile, entre los años 2014 al 2017. Se utilizó para la recolección de datos la clasificación de la *National Coordinating Council for Medication Error Reporting and Preventions,* se realizó durante los meses de mayo y junio del 2018 y fueron analizados por medio de estadística descriptiva.
Resultados: los involucrados en los errores de medicación predomina enfermeros 21 (42%), técnicos de enfermería de medicina y cirugía 18 (36%) y Técnicos de enfermería que se desempeñan en farmacia 7 (14%); Los errores de medicación más frecuentes: transcripción 16 (32%), preparación 13 (26%) y administración de medicamentos 11 (22%). Destacan los siguientes factores de riesgo en los casos notificados: problemas de comunicación e interpretación 13 (26%), interpretación incorrecta de la prescripción en la dispensación 7 (14%), factores asociados a la organización del trabajo como insuficiente cumplimiento de las prácticas de seguridad prioritarias 11 (22%), factores individuales 9 (18%).
Conclusión: se requiere mayor información sobre errores de medicación para identificar los factores de riesgo y establecer estrategias para su prevención, así se debe promover la notificación de eventos adversos como medida preventiva.

DESCRIPTORES: Seguridad de paciente. Errores de medicación. Cuidados de enfermeira. Enfermería. Eventos adversos.

FATORES DE RISCO EM ERROS DE MEDICAÇÃO EM UM HOSPITAL PÚBLICO CHILENO DE ALTA COMPLEXIDADE

RESUMO

Objetivo: identificar os fatores de risco para erros de medicação em um hospital público chileno de alta complexidade.
Método: estudo com abordagem quantitativa, exploratório, descritivo e transversal, com cortes temporais retrospectivos. A população do estudo consistiu em 50 notificações de eventos adversos relacionados ao processo de administração de medicamentos gerados entre 2014 e 2017 nos serviços de clínica médica e cirurgica do Hospital Clínico em *Magallanes*, Chile. A classificação do *National Coordinating Council for Medication Error Reporting and Prevention*s, foi utilizada para a coleta de dados, realizada em maio e Junho de 2018, e os dados foram analisados por meio de estatística descritiva.
Resultados: entre os envolvidos nos erros de medicação, as seguintes profissões são predominantes: enfermeiros, 21 (42%); Técnicos de enfermagem que atuam nas clínicas médicas e cirúrgicas, 18 (36%) e técnicos de enfermagem que atuam na Farmácia, 7 (14%). Os erros de medicação mais frequentes foram: transcrição de medicamentos, 16 (32%); preparação, 13 (26%); e administração, 11 (22%). Os seguintes fatores de risco se destacam nos casos notificados: problemas de comunicação e interpretação, 13 (26%); interpretação incorreta da prescrição na dispensação, 7 (14%); fatores associados à organização do trabalho, como cumprimento insuficiente das práticas prioritárias de segurança, 11 (22%), e fatores individuais, 9 (18%).
Conclusão: são necessárias mais informações sobre erros de medicação para identificar os fatores de risco e estabelecer estratégias para sua prevenção; consequentemente, a notificação de eventos adversos deve ser promovida como medida preventiva.

DESCRITORES: Segurança do paciente. Erros de medicação. Cuidados de enfermagem. Enfermagem. Eventos adversos.

INTRODUCTION

In 2005, the World Health Organization (WHO) created the World Alliance for Patient Safety, identifying six action fields. One of these action fields is the development of "Solutions for patient safety". One of these solutions is the prevention of Medication Errors (MEs), by prioritizing research studies which allow identifying the safety problems that can be treated. According to the WHO, patient safety is the absence of preventable harms during the health care process.[1]

The first studies described the epidemiology of the adverse events and contributed to the United States Institute of Medicine publishing the "To err is human: Building a safer Health system" report in 2000. This report reveals that the main cause of death of at least 44,000 people, and maybe even up to 98,000 individuals per year, were medical errors, which could have been avoided.[2] At the same time, the importance must be considered of changing the approach to errors from a view centered on the individual to a systemic model.[3]

It is significant to point out that, in the United States of America, medication errors cause at least one death per day, as well as diverse harms in approximately 1.3 million people a year. Although it is estimated that low- and middle- income countries have similar adverse event indexes related to medications to those of high income countries, the number of lost healthy life years is approximately two times higher. It is calculated that the world cost associated to medication errors is US$42,000 millions a year, almost 1% of the world's health expenditure. Many countries lack reliable data, reason why they were collected in the initiative's scope.[4]

A great advancement to improve safety in patient care was incorporating the concept of human fault, which must be preceded by failures in the error contention barriers. The theory of human error sets forth that mistakes are of human nature, reason why the possibility is always present for them to occur; therefore, it is necessary to implement processes and strategies which allow intercepting or minimizing errors.[5]

Mistakes have six fundamental features: they are part of normal behavior; we all make mistakes daily; mistakes are not made on purpose; mistakes are unexpected accidents; mistakes are influenced by known factors, the following among them: habit, rush, fatigue, interruptions, anger, anxiety, boredom, and fear to the unknown; mistakes happen due to failures in systems, not because of human faults.[6]

The technological advancement of the last decade does not reduce the probability of errors; much to the contrary, when availing new treatments and technologies to the patients, the probability of risks and harms increase, reason why we must look for strategies to guarantee that care is safe and effective. Voluntary notification is a strategy to identify MEs; it is performed by the involved staff or by the person who detects the error in the process by focusing its analysis on what happened and not on who did it: it is not of a punitive character but of an educational one.[7]

The notification of MEs must be encouraged in order to have more information which allows for the analysis, correction, and prevention of these events. The staff must involve in the process, identifying the medication errors when it happens without fearing disciplinary measures when notifying them.[8]

In Chile, the authors of a study conducted with adult patients in a high-complexity center detected 30.4% of errors that affected nearly one third (29.8%) of the patients, though none of the errors put them at risk.[9]

The Magallanes Clinical Hospital (*Hospital Clínico de Magallanes*, HCM) was quality certified in 2016, the Chilean system which guarantees quality care and safety to the users of the public and private services. The quality policy of the institution promotes the notification of adverse events as a measure of continuous improvement, with no punitive character for its employees; these MEs are notified in a report of adverse events.[10]

This health center was selected because the HCM is a reference center in the region, has all the specialties, and is a training center for Human Resources in health. Thus, the objective of this study was to identify the risk factors in medication errors in a high-complexity Chilean public hospital.

METHOD

A quantitative research, an exploratory, descriptive, and cross-sectional study of retrospective temporal cut, which is developed in a Medical-Surgical service of a high-complexity Clinical Hospital in the city of Punta Arenas, Chile.

The study population consisted of all the reports of adverse events related to the medication administration process between 2014 and 2017 in the Medical and Surgery services of the HCM.

This period was established because, in this health institution the medication error reports are available since 2014 in the Quality Unit of the HCM; they are generated by voluntary notification of the clinical staff, that information being accessible.

In this way, the recording of 50 medication error reports was obtained; data was organized in a database in Microsoft Excel® spreadsheets, containing the information fields of the forms, namely: Collection of sociodemographic data of the staff involved in MEs (gender, age, training time in years, current job position, work sector, and shift system, among others); Collection of sociodemographic data of patients related to MEs (gender, age, length of hospitalization in days when the ME occurred, diagnosis at admission, place where the ME was generated, place where the ME was discovered, if the ME was discovered before administering the medication, if there were any consequences for the patient, if the patient had to remain more days in the hospital due to the ME and, finally, who discovered the ME); Collection of data related to the medication administration process (medication prescription, dispensation, transcription, preparation, and administration).

Subsequently, data was exported to a spreadsheet in a free access statistical software program where they were coded, tabulated, and analyzed by means of descriptive statistics (measures of central tendency and relative frequency).

The inclusion criteria considered were all the medication errors notified by the clinical staff related to the Medical and Surgery services. Similarly, medications errors associated with adverse drug reaction and the records of notification of adverse events with illegible handwriting were established as exclusion criteria.

For data collection, the classification of the National Coordinating Council for Medication Error and Prevention (NCCMERP) was used, with its terminology and classification of MEs having been standardized in Spain.

Data collection was performed between May and June 2018, and data was analyzed by means of descriptive statistics, which allowed obtaining sociodemographic information of the staff and patients involved in the MEs. Then they were classified according to the process in which the error started (prescription, dispensation, transcription, preparation, and/or administration) and, subsequently, they were categorized according to their severity following the NCCMERP. For analysis purposes, the collected data was entered into an MS Excel® spreadsheet for their analysis and classification.

RESULTS

Fifty reports of adverse events related to medication errors were analyzed. The distribution of the clinical staff involved in medication errors allows observing that the nurses are the professionals with the highest participation frequency, 21 (42%), followed by Medical nursing technicians, 18 (36%) and by nursing technicians working in the pharmacy, 7 (14%) (Table 1).

Table 1 – Clinical health staff involved in medication errors with patients in the Magallanes Clinical Hospital, Chile, 2018. (n=50)

Health Clinic Staff	n	%
Position		
Physician	3	6
Chemical Pharmacist	0	0
Nurse	21	42
Medicine-Surgery Nursing Technician	18	36
Nursing Assistant	1	2
Pharmacy Nursing Technician	7	14
Gender		
Female	27	81.9
Male	6	18.1
Ages		
20-35	17	47.2
36-50	14	39
51-65	5	13.8
66->	0	0
Total	36*	100
Time of training (years)		
1	1	2
2-3	25	50
4-5	21	42
8->	3	6
Time working in the hospital		
0-5	18	72
6-10	5	20
11-15	1	4
16->	1	4
Total	25*	100
Work sector in the hospital		
Medicine	18	36
Surgery	25	50
Pharmacy	7	14
Work system		
Day shift	1	2.5
12-hour shift	39	97.5
Total	40*	100

*The numbers below the total of the clinical health staff involved in medication errors are due to the lack of information in the ME reports.

Regarding the sociodemographic distribution of the staff involved in the MEs, 27 (81.9%) are of the female gender, and 17 (47.2%) members of the staff are between 20 and 35 years old; in relation to their training time, 25 (50%) have 2 to 3 years of training and 21 (42%), 4 to 5 (Table 1).

As regards the time that the staff has been working in the HCM, 18 (72%) members have been there from 0 to 5 years and 5 (20%) have been working from 6 to 10 years. In relation to the distribution by sector in which they work in the Hospital, most of them were in Surgery, 25 (50%); Medicine, 18 (36%); and Pharmacy, 7 (14%). The 12-hour shift system is the one with the most representativeness, 39 (97.5%) (Table 1).

As regards the sociodemographic data of the patients involved in ME reports, they were mostly women, 30 (60%), the number of notifications rises over the age of 61 years old, 32 (64%), more than 50% of the MEs are notified between admission and the 5th day of hospitalization, 26 (52%); in relation to the patients' diagnoses, circulatory diseases correspond to 12 (24%), followed by trauma diseases, 11 22%) and, finally, by infectious diseases, 9 (18%) (Table 2).

Table 2 – Sociodemographic information of patients involved in medication errors in the Magallanes Clinical Hospital, Chile, 2018. (n=50)

Patients involved	**n**	**%**
Gender		
Female	30	60
Male	20	40
Ages		
20-40	8	16
41-60	10	20
≥61	32	64
Days of hospitalization and MEs		
0-5	26	52
6-15	18	36
≥16	6	12
1 Circulatory Diseases	12	24
2 Trauma Diseases	11	22
3 Infectious Diseases	9	18
4 Neoplastic Diseases	7	14
5 Metabolic Diseases	3	6
Others	8	16

As regards the main medication errors according to the stage of the process in which they were identified, the following results were found: medication transcription,16 MEs (32%), medication preparation,13 MEs (26%), medication administration,11 MEs (22%), medication dispensation,7 MEs (14%), medication prescription being the stage of the process in this study with the fewest cases of MEs, 3 (6%) (Table 3).

Table 3 – Main medication errors in the Magallanes Clinical Hospital, Chile, 2018 (n=50)

Medication errors	n	%
Prescription	3	6
Dispensation	7	14
Transcription	16	32
Preparation	13	26
Administration	11	22
Total	50	100

Among the main cause of error in the medication administration process is the problem of communication and interpretation of the medical prescription during transcription, 13 (26%) cases, a situation present in medication dispensation which does not fit the medical prescription, 7 (14%) cases (Table 4).

Table 4 – Causes or risk factors of medication errors in the Magallanes Clinical Hospital, Chile, 2018. (n=50)

Causes of medication errors	n	%
Communication and interpretation problems		
Incorrect interpretation of the medical prescription in the Nursing transcription	13	26
Incorrect interpretation of the medical prescription during dispensation	7	14
Contributing factors associated to the work system		
Deficient compliance with the priority safety practices. (Verification of the correct processes)	11	22
Individual factors		
Lapsus/Distraction	9	18
Lack of knowledge/information about the medication	2	4
Lack of knowledge/information about the patient	8	16
Total	50	100

In relation to the error consequences, the error caused no harm to the patient in 41 (82%) cases; the error occurred but did not reach the patient in 4 (8%) cases and, finally, the error reached the patient, did not cause any harm, but required monitoring in 5 cases (10%).

DISCUSSION

MEs have a negative impact on the safety of the care provided to the patients; therefore, their study and analysis must be considered as a priority in health organizations. Their causes are multi-factorial and multidisciplinary, not only involving the Nursing team but also other professionals of the health team.[11]

According to the results obtained in this study, the Nursing staff is the most involved in the medication errors reported in the phases of medication transcription, preparation, and administration. Transcriptions are performed by the nurses and consist in transferring the medical indications to a card which is individualized per patient and includes the medication, dose, route, and time of administration.

In this study, some of the causes of error were verified: these transcriptions were not updated as a result of not reviewing the kardex daily, since cards were found of patients transferred to other beds without making the changes or without discarding cards of already discharged patients. Another cause of error in the transcription is directly related to the identification of the patient's bed, to the

transfer of the medical indication, dose, route and time of medication administration in 13 cases (26%) and, as a consequence, the subsequent stages were affected until detecting the fault.[12]

Medication administration is a stage which is shared between the professional and the nursing technician; in several studies, this stage of the process is the most susceptible to MEs. It is described as the process where more ME records exist and where the nurses are directly involved; it ranks third, 11 (22%), in our study. MEs occur when the Nursing staff that administers the medication does not check the indications which are transcribed in the card against the medical indications available in the Nursing records before administering the medications; this becomes worse when, in some cases, the patients' identities or beds are not verified before administering the medication.[11]

When analyzing the scientific literature from other countries on Nursing errors, the events related to medication stand out, since this professional category is mostly responsible for this activity, and the errors that occur have multiple causes associated.[13] Despite this internationally highlighted problem, it is necessary to state that Nursing can play an important role in the reduction of medication errors, by acting as a barrier against the errors specifically related to the medical prescription.[14]

In relation to the risk factors detected, the incorrect interpretation of the medical prescription during transcription stands out, 13 (26%), a process performed by the Nursing professional. Cases are found of medication dose errors and of administration frequency; this might be related to the work experience of the staff involved, so this factor might be present. The literature describes that young staff with limited clinical experience has an impact on the Nursing work, since this implies developing several activities simultaneously, which requires building various abilities such as concentration, memorization, and mental agility among others, all related to clinical experience.[15] Another study makes a reference to the higher number of MEs in beginner women nurses when compared to more experienced women nurses, as well as to the advantage of assembling teams taking into account the greater experience of the nurses to reduce the MEs.[16]

If we consider the individual risk factors present in the medication errors, like distractions or lapsus, they are found as a risk factor in nine cases (18%) and are related with wrong labeling of the medication, wrong patients for not verifying their names and indications, preparing medications different than the prescription, either because they were in the patient's drawer without verifying the name of the medication or because it is a medication with a similar presentation, not verifying indications, related to the verification of the correct processes, the cause of the lapsus is not specified if due to distractions, interruptions in the medication administration process, or for not knowing the patient or the medication.

A study mentions the importance of establishing an exclusive well-lit area for medication preparation in order to prevent interruptions or distractions and to control the work overload, conditions which can contribute to reducing the incidence of errors in medication preparation and administration.[17] The medications are prepared in the Nursing clinic, a space which is not considered as protected at the times when medications are prepared and where the staff is often interrupted when performing this activity.[17]

These individual risk factors are inter-related due to the aforementioned interruptions and distractions in the context of the Nursing work, which are also associated to lack of awareness and education towards the rest of the professionals, patients, and relatives, who are responsible for these interruptions during the medication administration process.[18]

The risk factors associated to the work system, such as non-compliance with the priority safety practices like verifying the correct processes before administering the medications, are found in 11 reports (22%), in spite of the fact that there is a protocol for the safe administration of medications.[19]

Although it is important to follow the correct processes in medication administration, it is also as true that the traditional research approach based only on their analysis does not reflect the complexity of the factors which intervene in the ME, such as: the human factor, the setting, and the organization. The complexity of the factors which intervene in the MEs hinders the identification of those that directly intervene when they occur, reason why it is of utmost importance to have clear definitions to report and identify them and not succumbing to under-notification for unawareness or for fear of being considered incompetent.[20] The notifier can also fear the reaction of the responsible individuals or of their colleagues.[21]

In this study, the ME reports respond to voluntary notifications, they are not actively monitored. It is possible that the number of medication errors reported by the women nurses is below the real figure.[22] Most of the ME notifications were done by Nursing professionals, who are directly involved in the process of medication administration.[23]

As regards the severity of the medication errors, it was found that 82% of the errors reached the patients without causing them any harm and that only 5% of the patients required monitoring, results which are close to those obtained in a study conducted in 2014 with values nearing 70% of MEs that reached the patients;[24] in another case, the results show that 42% of the errors reached the patients but without causing them any harm.[25]

We highlight that one of the limitations of this study refers to the sample size, since 50 reports of adverse events associated with medication errors were found, which contribute scarce information about both the origin and analysis of the events.

For this reason, as an improvement measure for future interventions and research studies, it is recommended to have an exclusive form for reporting medication errors which considers the essential elements to access more information that allows finding representative data which ease in the identification of the risk factors for the most frequent MEs, understand why they occur, and establish measures targeted at improving the process.

CONCLUSION

The most frequent MEs identified in this study are focused in the transcription phase, responsibility of the Nursing professional. This phase consists in transferring the medical indications to a card that allows organizing medication preparation and administration. An ME occurs when the review of these cards is not updated, the cards being filed in a kardex by time schedules. It is possible that the card is filed at a wrong time and that the medication is not administered, that the cards are not discarded when the indication is suspended or changed, or that they are not discarded when the patients are transferred to another place or when they are discharged. An ME can be generated in these cases, when confusing indications for another patient who begins to occupy that bed.

Other possibilities for MEs in the transfer of the medical indications are related to the following: wrong patient's name, wrong bed number, wrong medication name, wrong medication dose, wrong route of administration, wrong fractioning, and wrong time of administration.

It is important to consider that MEs are not only the result of human mistakes but also of the planning of the work system, the setting, and the availability and distribution of medications, among other factors.

Therefore, we can say that the causes of medication errors are multi-factorial and multidisciplinary, and are more related to the process than to the individual actions, reason why the intervention measures must focus on improving the organization's system.

A timely assessment of the ME risks in the reports constitutes by itself the main measure for the prevention of adverse events; however, there is under-notification, a worrying reality because it reduces the probability of detecting and stopping them before they reach the patient.

We recommend implementing active monitoring of medication errors, looking for them whether by means of prevalence cuts with review of clinical records, prescriptions dispensed by the Pharmacy, or programmed observation of the medication administration process, which is what provides the best result. Encouraging the notification of medication errors will provide us with an important input to identify medication errors and risk factors.

Finally, we must be motivated by the fact that MEs are preventable and avoidable; for that, the strategy we have to consider is the following: training, feedback on the results to the work teams with emphasis in the errors that occur due to failures in the systems and not due to human faults, not of a punitive character but of a formative one; this can foster an increase in the number of notifications of adverse events related to medication errors.

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NOTES

ORIGIN OF THE ARTICLE

Extracted from the dissertation - Risk Factors in Medication Errors in a High-Complexity Public Hospital of Punta Arenas, Magallanes Region, Chile, presented to the Post-Graduate Program in Nursing *Univerisdade Federal de Santa Catariana*, in 2019

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FUNDING INFORMATION

This study was financed by the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* - Brazil (CAPES) - Finance Code 001

APPROVAL OF ETHICS COMMITTEE IN RESEARCH

Approved by the Research Ethics Committee of the Universidad de Magallanes, under certificate No. 026/CEC/2018.

CONFLICT OF INTERESTS

There is no conflict of interest.

HISTORY

Received: August 25, 2019
Approved: February 19, 2020

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