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Medication time out as a strategy for patient safety: reducing medication errors

Medication time out como estratégia para a segurança do paciente: reduzindo erros de medicação

Medication time out como una estrategia para la seguridad del paciente: reducir los errores de medicación

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ABSTRACT

Objectives: to analyze the implementation of the medication time out strategy to reduce medication errors. **Methods:** this is a quantitative, cross-sectional, inferential study, with direct observation of the implementation of the medication time out strategy, carried out in a cardiac intensive care unit of a university hospital in Rio de Janeiro. **Results:** 234 prescriptions with 2,799 medications were observed. Of the prescriptions analyzed, 143 (61%) had at least one change with the use of the strategy. In the prescriptions altered, 290 medications had some type of change, and 104 (35.9%) changes were related to potentially harmful medication. During the application of the strategy, prescriptions with polypharmacy had 1.8 times greater chance of presenting an error (p-value = 0.031), which reinforces the importance of the strategy for prescriptions with multiple medications. **Conclusions:** the implementation of the medication time out strategy contributed to the interception of a high number of medication errors, using few human and material resources.
Descriptors: Patient Safety; Medication Errors; Risk Management; Strategies; Patient Care Team.

RESUMO

Objetivos: analisar a implantação da estratégia *medication time out* para redução de erros relacionados a medicamentos. **Métodos:** trata-se de um estudo quantitativo, transversal, inferencial, com observação direta da realização da estratégia *medication time out*, realizado em uma unidade cardiointensiva de um hospital universitário do Rio de Janeiro. **Resultados:** foram observadas 234 prescrições, com 2.799 medicamentos. Das prescrições analisadas, 143 (61%) sofreram pelo menos uma alteração com a utilização da estratégia. Nas prescrições alteradas, 290 medicamentos sofreram algum tipo de alteração, sendo 104 (35,9%) relacionadas a medicamentos potencialmente perigosos. Durante a aplicação da estratégia, prescrições com polifarmácia apresentaram 1,8 vezes maior chance de ocorrência de erro (p valor=0,031), o que reforça a importância da estratégia para prescrições com múltiplos medicamentos. **Conclusões:** a implantação da estratégia *medication time out* contribuiu para a interceptação de um número elevado de erros de medicação, utilizando poucos recursos humanos e materiais.
Descritores: Segurança do Paciente; Erros de Medicação; Gestão de Riscos; Estratégias; Equipe de Assistência ao Paciente.

RESUMEN

Objetivos: analizar la implantación de la estrategia *medication time out* para disminuir los errores relacionados a la medicación. **Métodos:** se trata de un estudio cuantitativo, transversal, inferencial, con observación directa de la realización de la estrategia *medication time out*, llevado a cabo en una unidad de cuidados intensivos de cardiología de un hospital universitario de Río de Janeiro. **Resultados:** se observaron 234 prescripciones con 2.799 medicamentos. De las prescripciones analizadas, 143 (61%) sufrieron por lo menos una alteración con la utilización de la estrategia. En las prescripciones alteradas, 290 medicamentos tuvieron algún tipo de variación, de las cuales 104 (35,9%) estaban relacionadas con medicamentos potencialmente peligrosos. Durante la aplicación de la estrategia, las recetas con polifarmacia presentaban una probabilidad de error 1,8 veces mayor (valor p = 0,031), lo que refuerza la importancia de la estrategia para las recetas con múltiples fármacos. **Conclusiones:** la aplicación de la estrategia *medication time out* contribuyó a la interceptación de un elevado número de errores de medicación, valiéndose de pocos recursos humanos y materiales.
Descriptores: Seguridad del Paciente; Errores de Medicación; Gestión de Riesgos; Estrategias; Grupo de Atención al Paciente.

INTRODUCTION

Currently, medication errors (ME) are considered one of the leading causes of adverse events in hospitals and one of the most frequent mistakes in healthcare[1]. A survey conducted in the state of Pennsylvania, in the United States of America, found a total of 44,177 reports of ME in 2014, which accounted for 18.3% of all reported adverse events. Among the ME occurrences recorded in this report, 185 generated severe and/or permanent harm to patients and 04 resulted in the patient's death[2].

There can be several consequences to ME. They can be trivial and cause no harm to the patient, but can also cause mild and reversible harm, severe harm, permanent disabilities and, in extreme cases, can result in the patient's death[1]. In addition to direct harm to patients, ME are associated with increased length of stay, increased hospital costs, complications in the clinical course, and severe psychological complications, both for the patient that experienced the ME and for the professional who made the error[3-4].

Globally, it is estimated that medication errors generate an annual financial loss of around US$ 42 billion[1]. For this reason, it is extremely important to discuss and research mechanisms that can prevent errors in healthcare environments and make the health system safer and less prone to errors[1].

From the choice of treatment, prescription, dispensing, preparation, and administration, most ME can be prevented and avoided. Professionals in charge must ensure the implementation of strategies that are effective in preventing these errors[5-6].

Given the severity of the situation presented, the prevention and reduction of ME are extremely important to guarantee the quality of health care. Aiming to increase medication safety in healthcare institutions, the World Health Organization (WHO) launched, in 2017, the third global challenge for patient safety, with the theme medication without harm[1].

In this context, the theme of the present study is medication safety, and its object of study is the implementation and analysis of a strategy to reduce errors related to medication.

Several checking strategies have been used with high-risk patients, such as the surgical safety checklist, implemented by the World Health Organization after the publication of the second patient safety goal[7]. A similar strategy for medication safety was implemented by American researchers, who used a medication time out strategy for checking prescriptions, aiming to avoid medication errors while still in the prescription stage. This strategy resulted in the interception of several ME before their occurrence[8]. In Brazil, no study testing the use of a similar strategy was found. Therefore, this research is justified due to its innovative and current perspective.

OBJECTIVES

To analyze the implementation of the medication time out strategy to reduce the occurrence of medication-related incidents.

METHODS

Ethical Aspects

The project was submitted to the Research Ethics Committee of the institution where it was carried out and was approved. In compliance with the recommendations of Resolution 466/12, of the National Health Council (CNS), the professionals who participated in the study were asked to sign the informed consent term after reading and being aware of the risks and benefits of the study. All professionals involved agreed to participate in the study.

The present study was not sponsored by third parties, it was financed by the authors.

Design, setting and location

This is a quantitative, cross-sectional, inferential study, with direct observation of the implementation of the medication time out strategy. As this is a study that aims to improve the quality of health care and increase patient safety, the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0)[9] were used to guide the writing of the manuscript.

Data collection began in March 2019 and was carried out until August 2019, totaling 06 months. The study was carried out in a tertiary university hospital located in the city of Rio de Janeiro. The hospital serves patients from the city and surrounding areas. The sector chosen for the development of the research was the cardiac intensive unit, which has 09 hospital beds for critically ill patients.

In the study setting, multi-professional rounds are held in the morning, for the discussion of clinical cases after daily assessment of patients. The medication time out strategy was implemented at the end of multi-professional rounds.

Sample, inclusion and exclusion criteria

The sample consisted of drug prescriptions of patients admitted to the intensive care unit studied. The following inclusion criteria were considered: prescriptions for patients admitted to the hospital's cardiac intensive unit, which were discussed at the time of the multidisciplinary round. The members of the rounds varied according to the work scales. On-call nurses and nursing technicians, day-care nurses, on-call physical therapists, on-call and day-care physicians, nutritionist and, eventually, psychologists and social workers were part of the multidisciplinary rounds. The exclusion criteria was prescriptions with less than five drugs, as it is understood that they do not faithfully represent the population of patients hospitalized in cardiac intensive units.

A simple random sample was used to calculate the sampling, using the number of prescriptions performed in the sector during the last six months as population, considering 01 prescription per bed per day. The source population was defined as 1,642 prescriptions.

The sample was calculated using the simple random sampling virtual calculation platform on the Survey Monkey® website[10], considering a confidence rate of 95% and margin of error of 5%. Considering the data, a simple sample of 312 prescriptions to be analyzed was obtained.

Study protocol

Data were collected using forms elaborated based on the medication time out article[8]. During the data collection period, the software used for collecting, managing and sharing data was the Research Electronic Data Capture® (REDCap®)[11], created by

researchers in 2004, at the Vanderbilt University (Tennessee, USA) States), which includes data archiving for audit purposes and to ensure methodological rigor.

The study data were collected and managed using the REDCap tool and hosted on the server of the Biomedical Center of the State University of Rio de Janeiro. REDCap is a secure, online software platform designed to support data collection for the purposes of studies and research[11].

After discussing the clinical cases of each patient during the daily multi-professional rounds, the medication time out strategy was applied. The strategy consisted of reading the data of the medication prescription aloud, so that all members of the multi-professional team could act on the interception of possible errors in the prescription. The changes in prescriptions made during the application of the strategy were recorded in the data collection instrument.

Regarding the severity of the alterations, alterations with a high potential for harm were those including potentially harmful medications (PHMs). Timers available on cell phones were used to record the time spent implementing the strategy, using seconds as unit of time. The data related to the research were collected in two instruments (clinical data of the patients and changes in the prescription), to keep the data organized.

The patient's clinical data instrument was used to organize general information and contained variables related to the identification of the sample (sequential number of the sample generated by the software, number of the patient's medical record, date of prescription, total number of drugs per prescription), the characterization of patients (age, length of hospital stay), the time used for checking the prescription in seconds and whether all the drugs contained in the prescription were checked or not.

The instrument on changes in the prescription was used when there were changes in the drug prescription, with the objective of gathering information about the alterations made. The instrument could be repeated as many times as necessary in case more than one drug changed in the same prescription. The instrument contained the following variables related to changes in the prescription: name of the medication altered, class of the medication altered (with the following options to be selected: analgesics and/or antipyretics, antacids, antiplatelets, antiarrhythmic, antibiotics, anticoagulants, antidiarrheals , antiemetics, antihypertensives, anti-inflammatories, beta blockers, bronchodilators, diuretics, oral electrolytes, statins, oral hypoglycemic agents, insulins, psychotropics, vasoconstrictors, vasodilators, vitamins and other classes; if the answer was other classes, the description of the medication class was requested), type of alteration (inclusion of medication, exclusion of medication, alteration of route of administration, alteration of frequency of administration, alteration of the dose of the medication and degree of severity of the alteration, if PHMs or other groups of medications).

Analysis of results and statistics

After data collection, the data were exported from REDCap®[11] to Excel® spreadsheets[12], where they were organized and analyzed. Simple and inferential descriptive statistics were used as method of data analysis. Absolute and relative frequency, means, medians, standard deviation and maximum and minimum values of the collected variables were used, as applicable.

Odds ratio and chi-square test were calculated to identify the positive association between polypharmacy and the identification of errors in prescription. All association tests were performed on the digital, online and free platform www.openepi.com. A positive association was considered if the OR was greater than 1, and a protection measure was considered if the OR was equal to or less than 1. A p value less than or equal to 0.05 was considered statistically significant.

RESULTS

A total of 234 prescriptions were analyzed during multi-professional rounds using the medication time out strategy. Due to the incompatibility between the researchers' schedules and the time of the multi-professional rounds, it was not possible to obtain the total sample of 312 prescriptions; thus 234 prescriptions were collected, which corresponds to 75% of the intended sample.

Regarding the study subjects, the average age of patients admitted to the sector was 66.53 years. Regarding the length of stay, the average duration was 17.05 days, with a median of 10 days and standard deviation of 17.92 (Table 1). In the prescriptions analyzed, a total of 2,799 medications were identified, with a mean of 11.96 medications per prescription, a median of 12, minimum value of five, maximum of 21 and standard deviation of 3.10 (Table 1). The average time for prescription checking was 30.2 seconds, with a median of 27 seconds and standard deviation of 17.36 seconds, demonstrating that the strategy has a rapid application, with less than 1 minute per prescription (Table 1).

Of the 234 prescriptions analyzed, the majority were altered during the application of medication time out (143; 61.6%). Among the prescriptions with alterations, there were 290 (10%) medications that were altered with the application of the strategy (Table 2).

The most frequent types of changes were exclusion of medication, with 120 cases (41.4%), and inclusion of medication, with 101 cases (34.8%). Change of route was the least common alteration, with 02 (0.7%) changes (Table 2). Of the 290 alterations, 104 (35.9%) were related to PHM (Table 2).

Regarding the medication classes that were altered during the strategy, antibiotics stood out, with 40 (13.79%) changes, followed by diuretics, with 37 changes (12.76%). Anticoagulants were in the third place, with 29 (10%) changes. The medication class that had the least changes was bronchodilators, with 3 (1.03%) occurrences. It is worth noting that antacids, antidiarrheals, non-steroidal anti-inflammatory drugs, oral hypoglycemic agents and vitamins were not altered during the application of the strategy (Table 3).

Other classes had 40 (13.7%) changes, with 11 (3.79%) changes in corticosteroid drugs, followed by 11 in inotropic drugs (3.79%) and 05 in laxatives (0.34%). Antianemics, nitrates, enemas, antiflatulent agents, antispasmodics, hemoderivatives, neprilysin inhibitors and angiotensin receptor blockers, digitalis, antiulcer agents, glycoside, and neuromuscular blockers had 01 (0.34%) change each (Table 3).

Regarding polypharmacy, the association between prescriptions containing 10 or more drugs, considered polypharmacy, and the occurrence of changes in the prescription was tested, aiming to verify the ratio between the presence of the polypharmacy and changes in the prescription (Table 4). The odds ratio demonstrated a positive and significant association (OR=1.8; p-value=0.031) between

polypharmacy and the frequency of changes in the prescription, meaning that prescriptions with polypharmacy were 1.8 times more likely to be altered with the application of the medication time out strategy when compared to prescriptions with less than 10 items.

Table 1 – Characteristics of the identification variables of the population analyzed, time for prescription checking and prescribed drugs, Rio de Janeiro, Rio de Janeiro, Brazil, 2019, (N=234)

	Mean	Median	Standard Deviation	Minimum	Maximum
Checking time (seconds)	30.02	26.5	17.36	07	115
Age of patients (years)	66.53	69	11.71	20	85
Length of hospital stay (days)	17.05	10	17.92	01	68
Prescribed drugs	11.96	12	3.10	05	21

Table 2 – Changes made with the application of the medication time out strategy in the prescriptions analyzed, Rio de Janeiro, Rio de Janeiro, Brazil, 2019

Characterization	n	%
Altered prescriptions (N=234)		
Yes	143	61.11
No	91	38.89
Altered medications (N=2799)		
Yes	290	10.36
No	2509	89.64
Types of alteration (N=290)		
Exclusion of medications	120	41.38
Inclusion of medications	101	34.83
Alteration of dose	44	15.17
Alteration of frequency	23	7.93
Alteration of route	02	0.69
Degree of severity of the alteration (N=290)		
Potentially harmful medications	104	35.86
Other groups	186	64.14

Table 3 – Frequency of medication classes altered with the application of the medication time out strategy, Rio de Janeiro, Rio de Janeiro, Brazil, 2019, (N=290)

Classes of medications altered	n	%
Antibiotics	40	13.79
Diuretics	37	12.76
Anticoagulants	29	10.00
Oral electrolytes	25	8.62
Antihypertensives	23	7.93
Beta blockers	18	6.21
Antiarrhythmics	15	5.17
Psychotropics	13	4.48
Analgesics and/or antipyretics	10	3.45
Antiemetics	09	3.10
Vasoconstrictors	09	3.10
Insulin	07	2.41
Antiplatelets	04	1.38
Statins	04	1.38
Vasodilators	04	1.38
Bronchodilators	03	1.03
Other classes	40	13.79

DISCUSSION

The mean age of patients admitted to the cardiac intensive care unit where the study was conducted was 66.53 years. This finding is consistent with the literature on patients admitted to cardiac intensive care units. Three studies found pointed to a mean age similar to the profile of the patients studied, with ages varying between 55, 63 and 67.8 years among inpatients[13-15].

The mean length of hospital stay during the period of analysis was 17 days, with a maximum time of 88 days. Other studies show different results regarding mean length of stay, with shorter periods than those found in the unit studied. Two studies found length of stays around two days[13,15].

This divergence in relation to the length of stay can be explained by the profile of the patients in the unit where the study was conducted. The unit assists critical patients who have several comorbidities, and are, in general, critically ill patients, who demand a longer hospital stay and several assistance and therapeutic interventions.

The strategy was applied in a mean time of 30.2 seconds per prescription analyzed. An American study that used a strategy similar to that used in this study[8] found a mean time of 1.24 minutes for checking prescriptions. The discrepancy in the time for checking prescriptions may be due to possible differences in the profile of patients hospitalized in the units, as well as the agility and concentration of the team at the time of application. It is worth noting that the increased time of 30 seconds per patient for checking and implementing the strategy is small and has no significant impact on human and material resources.

During the application of the strategy implemented in the present study, 143 (61.6%) prescriptions were changed. The American study[8] registered changes in 179 meetings with the strategy, 51.6% of the total number of meetings. Both studies obtained similar values regarding the number of prescriptions changed, with changes in more than half of the prescriptions analyzed.

Regarding the type of alteration, exclusion of medications occurred in 41.4% of the cases. In another study[8], which analyzed a total of 285 altered medications, interruption occurred in 39.3%. Both studies found that most of the changes consisted in the suspension of incorrect drugs or medication that could be discontinued.

The inclusion of medications occurred in 34.8% of the alterations in the present study, in contrast to data from the American study, which found 16.5% of this type of change among drug prescription alterations. These data demonstrate a significant difference in the findings of both studies[8]. Despite of the difference in values, the most frequent changes in both studies were the exclusion and inclusion of drugs.

Table 4 – Association between polypharmacy and changes in the prescription, Rio de Janeiro, Rio de Janeiro, Brazil, 2019

Polypharmacy	Altered prescription		Odds Ratio	Confidence Interval	*p* value	Total	
	Yes	No				n	%
Yes	117	65	1.8	0.96-3.37	0.031	182	77.78
No	26	26				52	22.22
Total	143	91	-	-	-	234	100.00

Alterations of dose were made in 15.2% of cases. In a similar study, medication doses were altered in 13.3% of cases. In both studies, alteration of dose was the third most frequent alteration[8]. Another study found drug dose errors on 157 occasions in 5 months of observation[16].

In another study, dose errors were the most frequent according to the interviewed nurses, representing 49% of the ME found[17]. A study carried out at a private institution identified the occurrence of dose errors in 2.6% of 303 medications administered[18].

The less frequent type of alteration was the route of administration, corresponding to 0.7% of the alterations made. The American study showed that 5.3% of the changes were related to the route of administration[8]. Despite of the difference between the two studies, alteration in the route of administration was the less common type of alteration in the results.

The importance of the correct route of administration is highlighted since an incorrect route can lead to serious harm to patients. For example, the intravenous administration of oral drugs can lead the patient to death and is an extremely serious mistake. Therefore, professionals must pay constant attention to the route of administration. Among the medication errors published in the media and compiled in a study, 11 errors in the route of administration (64.70%) occurred due to solutions, medications, or diets, and all caused harm to the patient, including death in several cases[19]. Therefore, it is important to pay close attention to the route of administration when administering medications and/or diets.

In the present study, the medication class with the greatest number of alterations was antibiotics, in 13.79% of the changes, followed by diuretics (12.75%), and anticoagulants, accounting for 10% of the changes. Another study reported a higher frequency of changes related to cardiovascular drugs (28.4%), analgesics (16.5%) and sedatives and/or antipsychotics (13.7%)[8]. Given that the studies were carried out in different contexts, this finding may indicate a different pattern in the choice of medication.

A study on ME conducted in a hospital in Brazil, in the state of São Paulo, found that the highest number of ME reported were with antibiotics, with 77 occurrences (25.2%), followed by gastric acid inhibitors, with 58 (19%) occurrences, and antihypertensive drugs, with 28 (9.2%)[20]. The presence of antibiotics at the top of the list of ME is similar to the findings of the present study, in which the class of medication with the most alterations was antibiotics.

The severity of the changes was classified as PHMs or not PHMs. Potentially harmful medications were altered on 35.9% of the occasions. A study pointed out the occurrence of errors with PHMs in 12.1% of the prescriptions analyzed. It is worth noting that PHMs have a greater chance of causing harm to the patient if they are used incorrectly or in an inconsiderate way[20].

It was found that the association between polypharmacy and alterations increases the chance of error in drug prescription by 1.8%. This demonstrates that professionals should pay closer attention to prescriptions with polypharmacy, so they can mitigate the chances of ME. A study with older adults with chronic diseases associated polypharmacy with the risk of ME and drug interactions, and also found a positive association between these two variables, which reinforces the finding of the present study[21].

Limitations of the study

The study was limited by the lack of literature that addressed the medication time out strategy, apart from one American study. As this is an innovative study, few articles on the strategy analyzed during this investigation have been published. In addition, the lack of studies addressing ME rates at national and global level was also a limitation for this research.

Another limitation of the study was the fact that multi-professional rounds only occurred during weekdays. During the weekends, there were no multi-professional rounds or prescription checking, which increases vulnerability to the occurrence of ME in the setting studied.

Due to the severe clinical conditions of patients admitted to the unit, the multi-professional round sometimes had to be interrupted or could not be performed due to complications in the unit, which was a limitation for the study. It is understood that in situations of imminent risk to the lives of patients under the care of the multidisciplinary team, stabilizing the patient's condition is an absolute and immediate priority. Therefore, the prescription check could not be carried out at such times. It is suggested that, in similar situations, prescription checking can occur as soon as the patient is stable.

Contributions to Nursing

Nursing is a profession directly responsible for quality and safety in the use of medications. The occurrence of ME directly and indirectly affects the patients under the care of the team, and has a negative impact for the professional who is involved in the ME.

The study carried out presented a tool for improving health care, decreasing the risk of ME and promoting safe and quality care. Thus, for the nursing team, the medication time out strategy represents a chance to intercept possible ME while still in the prescription stage and prevent the error from progressing to dispensing, preparation and administration, and ultimately reaching patients.

Nursing is an important part of ME prevention, and participation in the development and implementation of strategies for ME prevention should be a priority in the work of the nursing team.

CONCLUSIONS

The present study sought to analyze a structured strategy capable of reducing the occurrence of ME. The systematic implementation of the medication time out strategy contributed to the interception of a high number of ME using few human and material resources. The strategy showed great potential for use in healthcare units to avoid ME and improve the quality of health care. Further studies should be carried out to provide scientific evidence regarding the practical applicability, efficacy, and effectiveness of the strategy as a way of preventing ME in other settings.

Just like the surgical safety checklist, considered a successful strategy to prevent surgical errors, medication time out proved to be an effective strategy that requires few resources to be implemented and can lead to a significant reduction in the number of ME.

It is suggested that strategies to ensure patient safety, such as medication time out, are discussed and taught since the basic training courses, so that nursing professionals and other professionals from the multidisciplinary team can be aware that a safe care free of ME is a responsibility of the entire team. In this sense, some actions and strategies that can help providing quality care should be encouraged.

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