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ORIGINAL ARTICLE

# Prevalence and factors associated with incidents related to medication in surgical patients

PREVALÊNCIA E FATORES ASSOCIADOS AOS INCIDENTES RELACIONADOS À MEDICAÇÃO EM PACIENTES CIRÚRGICOS

PREVALENCIA Y FACTORES ASOCIADOS CON LOS INCIDENTES RELACIONADOS A LA MEDICACIÓN EN PACIENTES QUIRÚRGICOS

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## ABSTRACT

The aim of this study was to estimate the prevalence and factors associated with the occurrence of incidents related to medication, registered in the medical records of patients admitted to a Surgical Clinic, in 2010. This is a cross-sectional study, conducted at a university hospital, with a sample of 735 hospitalizations. Was performed the categorization of types of incidents, multivariate analysis of regression logistic and calculated the prevalence. The prevalence of drug-related incidents was estimated at 48.0% and were identified, as factors related to the occurrence of these incidents: length of hospitalization more than four days, prescribed three or more medications per day and realization of surgery intervention. It is expected to have contributed for the professionals and area managers can identify risky situations and rethink their actions.

## DESCRIPTORS

Medication errors  
Patient safety  
Nursing  
Health management

## RESUMO

Estudo de corte transversal, conduzido em um hospital universitário, com amostra de 735 internações, cujo objetivo foi estimar a prevalência e os fatores associados à ocorrência de incidentes relacionados à medicação, registrados em prontuários de pacientes internados em uma clínica cirúrgica no ano de 2010. Foi realizada a categorização dos tipos de incidentes com apresentação das frequências absoluta e relativa, calculada a prevalência e realizada análise multivariada. A prevalência dos incidentes relacionados à medicação foi estimada em 48,0% e identificaram-se como fatores relacionados a sua ocorrência o tempo de internação igual ou superior a quatro dias, a prescrição de três ou mais medicamentos por dia e a realização de intervenção cirúrgica. Espera-se ter contribuído para que os profissionais e gestores da área possam identificar situações de risco e repensar sua atuação.

## DESCRIPTORES

Erros de medicação  
Segurança do paciente  
Enfermagem  
Gestão em saúde

## RESUMEN

Estudio de corte transversal, realizado en un Hospital docente, con una muestra de 735 internaciones, cuyo objetivo fue estimar la prevalencia y los factores asociados a la ocurrencia de incidentes relacionados a la medicación, registrados en las historias clínicas de los pacientes hospitalizados en el Servicio de Cirugía, en el año de 2010. Se realizó la categorización de los tipos de incidentes y fueron presentados la frecuencia absoluta y relativa, calculando la prevalencia y realizando el análisis multivariante. La prevalencia de los incidentes relacionados a la medicación se estimó en 48,0% y fueron identificados como factores relacionados a la ocurrencia de estos incidentes: tiempo de la hospitalización igual o superior a cuatro días, prescripción de tres o más medicamentos por día y realización de la intervención quirúrgica. Se espera haber contribuido para que los profesionales y administradores del área puedan identificar situaciones de riesgo y revisar su actuación.

## DESCRIPTORES

Errores de medicación  
Seguridad del paciente  
Enfermería  
Gestión en salud

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## INTRODUCTION

Currently, drug therapy has been widely used and more than 80% of individuals who seek health services are prescribed medications<sup>(1)</sup>. However, improper use and lack of safety standard during the administration of the drug can lead to serious incidents to patients<sup>(2)</sup>.

The World Health Organization (WHO) defines incidents as events or circumstances that may or may not cause harm to the patient<sup>(3)</sup>. Among the incidents related to medication we highlight the adverse effect and medication error, being the latter incident, an avoidable one<sup>(4)</sup>.

It is estimated that at least 1.5 million people in the U.S. are affected every year by medication errors, which leads to costs higher than 3.5 billion dollars to the health care system<sup>(5)</sup>. These rates are even more relevant in the context of surgical care, as 234 million surgeries are estimated to occur per year. The World Health Organization considers the perioperative administration of drugs complex, since the 11,000 medication errors in the perioperative registered in the United States, 5% resulted in damage to patients including death<sup>(5)</sup>.

However, it is very difficult to estimate the real extent of the damage attributable to medication errors in the perioperative period, as there is a possibility of underreporting of the consequences to the patient due to fear of punishment. Given the high rate of surgical procedures performed annually worldwide, it is believed that there is a substantial amount of patients affected by incidents related to drug interventions. It is estimated that hospitals spend on average 15-20% of their budgets to reverse complications caused by misuse of medicines<sup>(5-6)</sup>.

The risks associated with this therapy may be minimized by investing in the quality of prescribing and dispensing of medicines and integration of specialized knowledge and complementary expertise among professionals who prescribe and dispense those drugs, which allows the achievement of efficient and beneficial results to patients<sup>(2)</sup>.

This study seeks to contribute to the knowledge of the incidents that occur during the medication process, raising the professionals involved reflections on their care practices to adopt attitudes that promote a culture of safety. Furthermore, this study will present factors associated with the occurrence of incidents related to medication factors, currently considered a limited thematic in the scientific community.

Thus, this research aims to estimate the prevalence and factors associated with the occurrence of incidents related to medication registered from medical records of patients admitted to the surgical clinic of a teaching hospital.

## METHOD

Cross-sectional and retrospective study, conducted at the surgical clinic of a teaching hospital in the Sentinel

Hospital Network of the National Health Surveillance Agency. The hospital has a Risk Management sector and supports research to diagnose incidents, in order to develop educational activities and promote the culture of safety, a fact that motivated the development of this research at the institution.

The population included all patients admitted to the surgical clinic of the hospital during the year 2010, totaling 2,610 hospitalizations. The calculated sample size was 735 patients, whereas the prevalence of incidents of 10% estimated by WHO<sup>(7)</sup>, the statistical power of 95%, accuracy of 3%, a design effect of 2.0 and an increase of 10% due to possible losses during data collection. We used a probabilistic and systematic sampling.

Medical records of patients with hospital admission date from January 1st to December 31st 2010 were included. We considered only the incidents recorded in the prescription papers and clinical evolution, laboratory or imaging tests were not consulted.

The outcome variable was the incident related to medication. The independent variables were related to the patient (age, gender, comorbidities) and hospitalization (admission type, length of hospitalization, surgery, amount of medications prescribed/per day, catheters, daily clinical assessment of patient).

Data were collected between January and May of 2011. We used a structured questionnaire, reviewed by experts who are professors in the area of administration, who also develop researches on the topic. After suggested reformulations, a pilot-test was conducted through a retrospective analysis of 45 medical records, which were randomly selected in order to solve possible logistical and execution issues. Data obtained during the pilot-test were not used in this research. The final form used for data collection consisted of objective questions on the hospitalization characteristics and a table containing a place for notes for information about the incident.

Data were entered into a database built using the software Statistical Package for the Social Sciences, version 17.0 for Windows. The categorization of the types of incidents was conducted, the prevalence of the incident and their confidence intervals were calculated. Descriptive data analysis was performed and to identify factors associated with incident factors in univariate analysis, we used the chi-square and Fisher's exact test, when necessary, with the odds ratio (OR) as a measure of association. Multivariate logistic regression analysis was performed with gender, age, and with  $p < 0.10$  in the univariate analysis. Confidence intervals of 95 % were calculated and associations that had  $p$ -value  $< 0.05$  were considered statistically significant.

The study complied with national and international standards of ethics in human research and was approved by the ethics committee of the institution (Protocol No. 064 /2008).

## RESULTS

We analyzed 735 hospitalizations, which corresponds to 28.1% of patients admitted to the surgical clinic of the hospital in 2010, as shown in Table 1.

**Table 1** - Characterization of patients admitted to the surgical clinic of a teaching hospital in 2010 - Goiania, GO, 2013

VARIABLE	N	%
<b>Gender</b>		
Male	295	40.1
Female	440	59.9
<b>Age</b>		
0 to 14 years	38	5.1
15 to 59 years	493	67.1
60 years old or more	204	27.8
<b>Comorbidities</b>		
Yes	310	42.2
No	405	55.1
Lack of information	20	2.7
<b>Type of admission</b>		
Urgency	129	17.6
Elective	606	82.4
<b>Medical expertise</b>		
General surgery	137	18.6
Urology	101	13.7
Gynecology	97	13.2
Otorhinolaryngology	95	12.9
Proctology	82	11.2
Vascular surgery	75	10.2
Mastology	54	7.3
Maxillofacial	26	3.5
Cardiac surgery	23	3.2
Neurology	20	2.7
Other	25	3.5
<b>Length of hospitalization</b>		
1-3 days	406	55.2
4-97 days	329	44.8
<b>Number of prescribed drugs</b>		
Up to 2 drugs per day	410	55.8
3 or more drugs per day	325	44.2
<b>Total</b>	<b>735</b>	<b>100</b>

There was a predominance of female patients (59.9%), aged between 15 and 59 years old (67.1%) with a median of 47 years. In 55.1% of admissions, patients had comorbidities and in 2.7% this information was absent, indicating problems in performing anamnesis, which can compromise the quality of care provided to patients. The most frequent type of admission (82.4%) were elective hospitalization, being predominant specialties of General Surgery (18.6%), Urology (13.7%) and Gynecology (13.2%). The length of hospitalization in 55.2% of patients was from one to three days, with a median of three days. The number of prescribed drugs was two per day for 55.8% of hospitalizations, ranging from 1 to 14, with a mean of 2.6 drugs/day.

In 353 hospitalization, there was exposure to at least one kind of incident related to medication, a prevalence was estimated of 48.0% (353/735; CI: 44.4 to 51.6). The types of incidents related to medication from medical records and hospitalized patients who were exposed to each incident are presented in Table 2.

**Table 2** - Incidents related to medication that occurred during hospitalization in the surgical clinic of a teaching hospital in 2010 - Goiania, GO, 2013

INCIDENTS	HOSPITALIZATIONS	
	N	%
Omission of dose	254	34.6
Absence of checking medications	215	29.3
Lack of medicine	70	9.5
Discontinuation of drugs	57	7.8
Adverse effect to drugs	23	3.1
Incorrect prescription of medicines	15	2.0
Medication administered at the wrong time	8	1.1
Dose administration of not prescribed drug	5	0.7
Administration of different drug from prescribed	2	0.3
Administration of medication in the wrong patient	1	0.1
Administration of medication in the wrong place	1	0.1

The most frequent incident was the omission of dose, observed in 34.6% hospitalizations. The absence of checking medications occurred in 29.3% and lack of medicine in the unit was recorded at least once in 9.5% of hospitalizations. Another incident identified in 7.8% hospitalizations was the discontinuation of drugs, which may indicate flaws in prescribing or management the unit, related to forecasting and the provision of medicines to meet the needs of hospitalized patients.

Although in small proportions, it was also verified the occurrence of other incidents in the medication process as adverse effects (3.1%), incorrect prescription (2.0%), wrong time (1.1%), dose administration of not prescribed drugs (0.7%), administration of medication in the wrong patient (0.1%), and administration of medication in the wrong place (0.1%), which points to systemic failures. No data on the consequences of incidents for patients were found.

As shown in Table 3, the incident related to the medication has a multifactorial characteristic.

Univariate analysis showed factors associated with the occurrence of incidents related to medication in people who: were over 45 years old, had a length of hospitalization greater than or equal to four days, urgency hospitalization, had comorbidities, number of medications prescribed per day greater than or equal to three and performed surgical intervention. The independent variables for the occurrence of incidents related to medication can be seen in Table 4.

**Table 3** - Univariate association between exposure variables and the occurrence of incidents related to medication in patients admitted to the Surgical Clinic of the University Hospital in 2010 - Goiania, GO, 2013

EXPOSURE VARIABLES	INCIDENT		OR	95% CI	p
	Exposure/Total	%			
<b>Gender</b>					
Male	143/295	48.5	1.09	0.82 – 1.48	0.534
Female	203/440	46.1			
<b>Age</b>					
45 years old or more	228/391	36.6	2.45	1.82 – 3.30	0
Up to 45 years old	125/344	58.3			
<b>Comorbidities</b>					
Yes	186/310	60	2.48	1.84 – 3.35	0
No	160/425	37.6			
<b>Type of admission</b>					
Urgency	73/129	56.6	1.59	1.08 – 2.33	0.017
Elective	273/606	45			
<b>Length of hospitalization</b>					
Four or more days	247/329	75.1	9.34	6.67 – 13.09	0
One to three days	99/406	24.4			
<b>Medicines prescribed per day</b>					
Three or more	226/325	69.5	5.52	4.01 – 7.58	0
Up to two per day	120/410	29.2			
<b>Surgical intervention</b>					
Yes	275/634	43.4	0.32	0.21 – 0.51	0
No	71/101	70.3			
<b>Catheter Use</b>					
Yes	312/673	46.3	0.71	0.42 – 1.20	0.201
No	34/62	54.8			
<b>Daily evolution of the patient's condition</b>					
Yes	247/522	47.3	0.97	0.70 – 1.33	0.836
No	99/213	46.5			

A relationship was observed between the occurrence of incidents involving drugs and length of hospitalization less than four days, the prescription of three or more medications per day and performance of any surgical interventions.

The length of hospitalization greater than four days ( $p=0.000$ ) showed a risk of incident 6.12 times greater than the length of hospitalization up to three days and 75.1% of hospitalizations over four days were exposed to a drug-related incident versus 24.4% exposure among hospitalizations with up to three days.

The prescription of three or more medications per day ( $p=0.000$ ) contributed to the occurrence of incidents related to medication, increasing the risk by 3.32 times. Among hospitalizations with three or more medication prescriptions per day, 69.5% were exposed to an incident while hospitalized people with up to two medications prescriptions per day, exposure was 29.2% (Table 4).

The performance of surgical interventions ( $p=0.041$ ) also indicated a risk factor for the occurrence of incidents related to medication, increasing chances in 1.78 times. Although 70.3% of hospitalizations for surgical intervention have been exposed to an incident, the number of exposure among patients who did not undergo surgery was higher.

## DISCUSSION

The characterization of patients at the surgical clinic resembles other studies, especially regarding the predominance of female patients, and young adults<sup>(8-9)</sup>. Most patients had no comorbidities and elective admissions predominated, which is a characteristic in this type of hospital, unlike the results of studies in which the focus was the urgent and emergency care<sup>(9)</sup>.

In 55.8% of hospitalizations two medications were prescribed per day, ranging from 1 to 14 and a mean of 2.6/day. The need to use multiple drugs can be attributed to the treatment of comorbidities or complications incurred during hospitalization, related to the clinical status of the patient or the surgical procedure.

**Table 4** - Risk factors and their odds ratio values for the occurrence of incidents related to medication during hospitalization in the surgical clinic of a teaching hospital in 2010 - Goiania, GO, 2013

Risk Factors	ODDS RATIO (95% CI)			
	Not adjusted	p	Adjusted	p
Male gender	1.09 (0.82 – 1.48)	0	0.92 (0.64 – 1.32)	0.661
Age > 45 years old	2.45 (1.82 – 3.30)	0	1.31 (0.90 – 1.92)	0.16
Presence of comorbidities	2.48 (1.84 – 3.35)	0	0.94 (0.63 – 1.39)	0.757
Urgency admission	1.59 (1.08 – 2.33)	0.017	1.39 (0.85 – 2.27)	0.193
Hospitalization > 4 days	9.34 (6.67 – 13.09)	0	6.12 (4.23 – 8.84)	0
Medicines > 3 per day	5.51 (4.01 – 7.58)	0	3.32 (2.27 – 4.85)	0
Performance of surgical intervention	0.32 (0.21 – 0.51)	0	1.78 (1.02 – 3.10)	0.041

The characteristics of patients and hospitalizations of this study are specific and point to the need for individualized care planning. It is extremely important to characterize the profile of patients, therefore, the greater the severity and complexity of care required, the greater the chance of errors that compromise the quality of care<sup>(10)</sup>.

The prevalence of incidents related to medication was 48.0%. The medication error incident is the third most frequent arising from care. Retrospective studies have shown that their occurrence varies from 14.8 to 51.5% of reported events in large teaching hospitals<sup>(11-12)</sup>. The prevalence of these incidents in an observational study that evaluated the process of administration of antimicrobials was approximately 30.2%<sup>(13)</sup>. The difference between the values found may be related to the possibility of underreporting, since different sources of information and hospital culture may influence whether or not the record of the incident is documented.

Among the types of incidents, the omission of dose was more frequent. Prospective studies indicate that 14.0 to 28.0% of the records of drug incidents are due to omission of dose<sup>(14-15)</sup>. In retrospective studies, this rate reached 51.0%<sup>(16)</sup>. Studies conducted with health professionals indicate that up to 71.0% have detected incidents due to omission of dose<sup>(17)</sup>.

The absence of checking and lack of medicines suggest flaws in the organization of the service and the care process. National and international, prospective and retrospective studies, identified those same occurrences as faults during patient care, both in surgical environments as in other hospital units<sup>(18-19)</sup>.

Retrospective analysis of adverse effects notification in outpatients and hospitalized patients in a public hospital in northeastern Brazil showed that 72.0% of patients had an adverse effect and 15.0%, more than one. The occurrence of these events in hospitalized patients accounted for 54.1% of all notifications and only 1.5% was reported by the surgical clinic<sup>(8)</sup>.

Although in this study the incidents of administration of medicine in the wrong time, not prescribed dose, medication not prescribed, wrong patient, and wrong place have been recorded to a lesser proportion, the literature contains several studies that describe the high rate of these incidents<sup>(14,16,20-21)</sup>.

Prospective, observational study in a French teaching hospital found that in 27.6% of cases observed occurred at least one error in the medication process. The time errors accounted for 72.6% of the incidents and administration of unauthorized medicine product, administration in the wrong patient or non-prescribed drugs occurred in 3.7%<sup>(14)</sup>.

The time errors are the second most common incident, corresponding to 22.9% of the events, and rate of 13.5%<sup>(16,21)</sup>. Are also identified, although to a lesser extent,

errors in prescribing (4.1%), omission of dose (4.1%) and medication administered at the wrong patient (2.7%)<sup>(21)</sup>.

The nursing staff, while not responsible for the prescription, need to know the aspects involved in each step of the process because, when acting in the stages of preparation and administration, enables them to intercept errors that went unnoticed<sup>(10,22-23)</sup>. About 86% of medication errors can be intercepted by nurses and pharmacists and updating of knowledge is a strong ally in prevention<sup>(1,24)</sup>.

Prolonged hospitalization time, the use of multiple medications and surgical intervention constituted a risk factor for the occurrence of drug incidents. A retrospective analysis showed that the probability of surviving free from incidents related to medication administration during hospitalization process is inversely proportional to the amount of time patient remain hospitalized. For 30, 60 and 100 days of hospitalization, the probability of not suffering incident with medication was 96, 93 and 73%, respectively<sup>(10)</sup>. It is noteworthy, therefore, the importance of knowing the influence of the factor time in the occurrence of different outcomes.

The extension of hospitalization may be due to a complication caused by error of the healthcare team<sup>(25)</sup>. Prolonged hospitalization period may be associated with anticipation of hospitalization or postponement of discharge for assurance of hospitalization, cancellation and rescheduling of surgery or need for exams. The prolongation of hospital stay also increases the likelihood of adverse events, whereas there is the patient's exposure to risk factors intrinsic to the hospital environment<sup>(10)</sup>.

Concomitant administration of various drugs in different dosages and presentations, can cause confusion to the professional and trigger an error. Retrospective study of patients hospitalized at the University of Pittsburgh, United States, found that patients receiving intravenous medications have 3% higher risk of having an adverse event and the risk increases with each drug dispensed<sup>(26)</sup>.

A realização de intervenção cirúrgica também foi identificada. The surgical intervention was also identified as factor associated with the occurrence of incidents related to medication, depending on patient characteristics and type of surgery, and the preparation of appropriate preoperative care and skill and qualification of the surgeon<sup>(25)</sup>. The most common postoperative complications are decreased cardiac output, renal failure, cardiac arrest, arrhythmia, pneumonia, hyperglycemia, heart failure and cerebrovascular accident<sup>(27)</sup>. Knowing the possible postoperatively complications assists the healthcare team to adopt a rapid response to reverse the worsening condition of the patient.

The study from the University of Pittsburgh found that patients with kidney injury, thrombocytopenia and those admitted emergently were, respectively, 16, three and two times higher probability of a related medication incident<sup>(26)</sup>.



Retrospective analysis of general care in health institutions in England found between the risk factors associated with drug incidents, male under 15 years or over 64 years and the number of single doses prescribed<sup>(28)</sup>.

The risks associated with surgical procedures require the creation of new interventions for clinical stabilization, including additional drug therapies, providing new risk situations, if the patient is not well monitored and properly assistance planning.

We observe, therefore, that the incidents related to medication administration are common and mild to moderate harm are more frequent<sup>(28)</sup>. However, when the patient's condition is critical, drug incidents are 2.9 times more likely to result in harm requiring intervention to support life, and 2.5 times more likely to result in permanent harm or death<sup>(15)</sup>.

Strategies to reduce these incidents should focus on staff training, the continued development of professionals, clinical leadership and improved patient's communication and security systems<sup>(24,28)</sup>.

Resolution No.36 of the National Health Surveillance Agency has required the installation of the Center for Patient Safety in health institutions. Notification of incidents arising out of care may contribute to production, systematization and dissemination of knowledge about the incidents, and fostering a culture of safety in training and practice of health<sup>(29)</sup>.

The disclosure of accurate concepts about the types of incidents and understanding that are mainly caused by inadequacies in work processes is a challenge and

at the same time, a need to direct the improvement of patient care<sup>(30)</sup>.

## CONCLUSION

The prevalence of incidents related to medication was 48.0%, highlighting the omission of dose, the absence of checking, lack of medication, discontinuation of medication, adverse effects and incorrect prescription. As factors associated to the occurrence of incidents we highlight the length of hospitalization greater than or equal to four days, the prescription of three or more medications per day and any surgical intervention. The identification of these factors associated is a unique contribution of this study and it may support the adoption of specific strategies that minimize the chances of occurrence of the incident related to medication at risk population.

The results can be generalized and methodology of this study can be used to investigate these incidents in other health units in order to estimate the actual extent of drug incidents in Brazil, as well as encourage the pursuit of appropriate preventive measures to the reality of our country.

The lack of policy development of the health care professionals team for the notification of incidents difficult their monitoring and is a present problem in the health sector with several implications for the quality of care.

The study has limitations in the method of retrospective analysis, since the record of the incident and especially the harm to the patient depends on the attitude of health professionals, moreover, influenced by the organizational culture of the institution where he/she works for.

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