Literature Review:
Systematic or Integrative

Strategies to prevent risk-generating conditions related to drug administration: a scope review

Estratégias para prevenir condições geradoras de riscos relacionados à administração medicamentosa: uma revisão de escopo

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ABSTRACT | OBJECTIVE: To map safety strategies in the literature to prevent risk-generating conditions related to intravenous drug administration in critically ill patients. **METHODS AND MATERIALS:** This is a scoping review, following the methodology of the Joanna Briggs Institute (JBI), of studies published between 2012 and 2021, without language limitations or study design, with a search in the online databases Scielo, Medline/PubMed, LILACS, BVS and BDENF. **RESULTS:** 261 records were found, of which 11 were included in this review, identifying 8 strategies for preventing risk-generating conditions during intravenous drug administration. **CONCLUSION:** Possible strategies to be implemented in practice were listed, enabling the mitigation of errors in intravenous drug administration and increasing safety in infusion therapy in intensive units.

KEYWORDS: Nursing Care. Patient Safety. Administration, Intravenous. Intensive Care Units.

RESUMO | OBJETIVO: Mapear na literatura estratégias de segurança para prevenir condições geradoras de riscos relacionados à administração de medicamentos intravenosos em pacientes críticos. **MÉTODOS E MATERIAIS:** Trata-se de uma revisão de escopo, seguindo a metodologia do *Joanna Briggs Institute* (JBI), de estudos publicados entre 2012 e 2021, sem limitação de idioma ou desenho de estudo, com busca nas bases de dados online Scielo, Medline/PubMed, LILACS, BVS e BDENF. **RESULTADOS:** Foram encontrados 261 registros, dos quais 11 foram incluídos nesta revisão, identificando 8 estratégias para prevenção de condições geradoras de riscos durante a administração intravenosa de medicamentos. **CONCLUSÃO:** Foram elencadas estratégias possiveis de serem implementadas na prática, possibilitando a mitigação de erros na administração intravenosa de medicamentos e aumentando a segurança na terapia infusional em unidades intensivas.

PALAVRAS-CHAVE: Cuidados de enfermagem. Segurança do Paciente. Administração intravenosa. Unidade de Terapia Intensiva.

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Introduction

In recent years, patient safety has been a topic widely discussed in the health area, especially by professionals who work in specialized care, dealing daily with adverse events (AE). Patient safety is understood as "reducing, to an acceptable minimum, the risk of unnecessary harm associated with health care". On the other hand, AE were considered as intentional or unintentional incidents that may result in temporary or definitive damage to the patient.[1]

One of the main causes of preventable health damage worldwide are unsafe practices and the occurrence of drug incidents such as incorrect dosages or infusions, unclear instructions, use of inadequate abbreviations and illegible prescriptions. In this perspective, the World Health Organization (WHO) Third Global Patient Safety Challenge, *Medication Without Harm: Global Patient Safety Challenge on Medication Safety*, was launched as a global initiative, aiming to reduce by 50% the serious and preventable damages related to the use of medicines.[2]

Among the stages of the medication system, the administration of drugs is a constant process in health units and essential for ensuring the therapeutic effect of the drugs used. According to the WHO's estimations, the annual cost generated by errors with medicines is close to US$42 billion, which accounts for almost 1% of total health spending in the world. At the national level, the Instituto para Práticas Seguras no Uso de Medicamentos– ISMP (Institute for Safe Practices in Drug Use) reports the occurrence of 840,000 cases per year of hospitalization due to failure in the administration of medicines, which accounts for approximately 7% of total hospitalizations in the health system.[2,3]

Among the numerous incidents with drugs in the hospital environment stand out those that occur in the Intensive Care Unit (ICU), in which drug therapy is widely used for all patients. In this environment, the administration of drugs, including potentially dangerous ones, is, in most cases, the responsibility of nurses, and this professional is responsible for preventing incidents arising from therapy.[3-5] One study showed that 96% of patients admitted to the ICU and Intermediate Care Units (ICU), assessed, suffered some incident related to medication during the hospitalization period.[6]

Therefore, the procedures performed for drug administration require attention to the risks and conditions capable of producing damage, reversible or irreversible, to the patient. In healthcare practice, numerous factors increase the risks to the patient in the administration of medicines, among them: work overload; activity in irregular hours or long hours; physical and mental wear; lack of adherence to the right nine; poor hand hygiene; failure to perform the aseptic technique; administrative errors; interruptions; not guidance to companions; lack of communication between professionals; lack of materials or changes in physical space; errors or failure to register and check the drug; failures in professional education, among others.[3-5,7,8]

In this context, in order to reduce these risks and as motivation the knowledge of safe practice for the administration of intravenous drugs, this review aimed to map safety strategies in the literature to prevent risk-generating conditions related to the administration of intravenous drugs in critical patients.

Considering the relevance of the theme for the multiple complications arising from AE and the deficit of production and dissemination of knowledge focusing on nursing performance, the article contributes to increase safety and improve the quality of care to the critical patient, dependent on the nursing team. This results in a reduction in the number of AE and errors in intravenous drug administration, resulting in a reduction in additional costs to the hospital or patient and a reduction in hospitalization time. It is also intended to contribute to professional training and dissemination of correct techniques and good clinical practices for assistance to the population.

Methods

This is a work carried out through a scope review based on the methodological frameworks for Scoping Review of the Joanna Briggs Institute (JBI). The review protocol was registered in the Open Science Framework (OSF) platform, under DOI 10.17605/OSF.IO/68JNH.[9]

For the development of this methodology, a guiding question was constructed using the PCC strategy, an acronym for Population, Concept and Context. Therefore, the following question was formulated: "What are the safety strategies to mitigate the risk-generating conditions related to the administration of intravenous drugs in critical patients?". Defining: P - critical patients, hospitalized in ICU; C - administration of intravenous drugs by nursing professional, and C - safety strategies to mitigate risk-generating conditions.

In September 2021, the Scientific Electronic Library (SCIELO), National Library of Medicine (PubMed), Nursing Database (BDENF), Latin American and Caribbean Literature in Health Sciences (LILACS) and Virtual Health Library (VHL) databases were searched. A search was conducted on a platform of gray literature such as World Cat and Opengray, as recommended by JBI guidelines. In all searches were correlated the descriptors "Risk Factors", "Medication Errors", "Nursing Care" and synonymous, in order to find scientific evidence to answer the research question proposed in this study.

To identify the search terms were consulted the controlled vocabularies of the health area Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH). The period chosen to recover articles published was the last 10 years (2012-2021). No language and study design filters were applied. The search strategy was developed with the help of a librarian from the Research Support Center at the Health Complex of the *Universidade do Estado do Rio de Janeiro* (CAPCS UERJ).

Chart 1. Structured search strategy according to the selected bases. Rio de Janeiro, RJ, Brazil, 2022

	SEARCH STRATEGY	N
PUBMED	(((Risk Factors[mh] OR Risk Factor*[tiab] OR Factors Associated[tiab] OR Risk Condition*[tiab] OR Risks[tiab] OR Five Rights[tiab] OR Nine Rights[tiab] OR Causes[ti]) AND (Medication Errors[mj] OR Medication Error*[tiab] OR Drug Error*[tiab] OR Drug Use Error*[tiab] OR Drug Administration[tiab] OR Medication Administration[tiab] OR Route Error*[tiab])) AND (Nursing Care[mh] OR Nursing[tiab] OR Nurse*[tiab])) AND ("2012/09/16"[PDAT]: "2021/09/16"[PDAT])	175
BVS/LILACS e BDENF	("risk factor" OR "risk factors" OR "factors associated" OR "risk conditions" OR risks OR "five rights" OR "nine rights" OR causes OR "fator de risco" OR "fatores de risco" OR "fatoresassociados" OR "condições de risco" OR riscos OR "cincocertos" OR "novecertos" OR causas OR "factor de riesgo" OR "factores de riesgo" OR "factores asociados" OR "condiciones de riesgo" OR riesgos) AND ("medication errors" OR "medication error" OR "drug errors" OR "drug use errors" OR "drug administration" OR "medication administration" OR "route errors" OR "erros de medicação" OR "erro de administração de medicamentos" OR "errores de medicación" OR "error de administración de medicamentos" OR "administração de medicamentos" OR "administração de drogas") AND ("nursing care" OR nursing OR nurse* OR "cuidado de enfermagem" OR enfermagem OR enfermeir* OR enfermeria OR enfermer*) AND (db:("LILACS" OR "BDENF")) AND (year_cluster:[2012 TO 2021])	39
SCIELO	("risk factor" OR "risk factors" OR "factors associated" OR "risk conditions" OR risks OR "five rights" OR "nine rights" OR causes OR "fator de risco" OR "fatores de risco" OR "fatores associados" OR "condições de risco" OR riscos OR "cincocertos" OR "novecertos" OR causas OR "factor de riesgo" OR "factores de riesgo" OR "factores asociados" OR "condiciones de riesgo" OR riesgos) AND ("medication errors" OR "medication error" OR "drug errors" OR "drug use errors" OR "drug administration" OR "medication administration" OR "route errors" OR "erros de medicação" OR "erro de administração de medicamentos" OR "errores de medicación" OR "error de administración de medicamentos" OR "administração de medicamentos" OR "administração de drogas") AND ("nursing care" OR nursing OR nurse* OR "cuidado de enfermagem" OR enfermagem OR enfermeir* OR enfermeria OR enfermer*)	47

Source: The authors (2022).

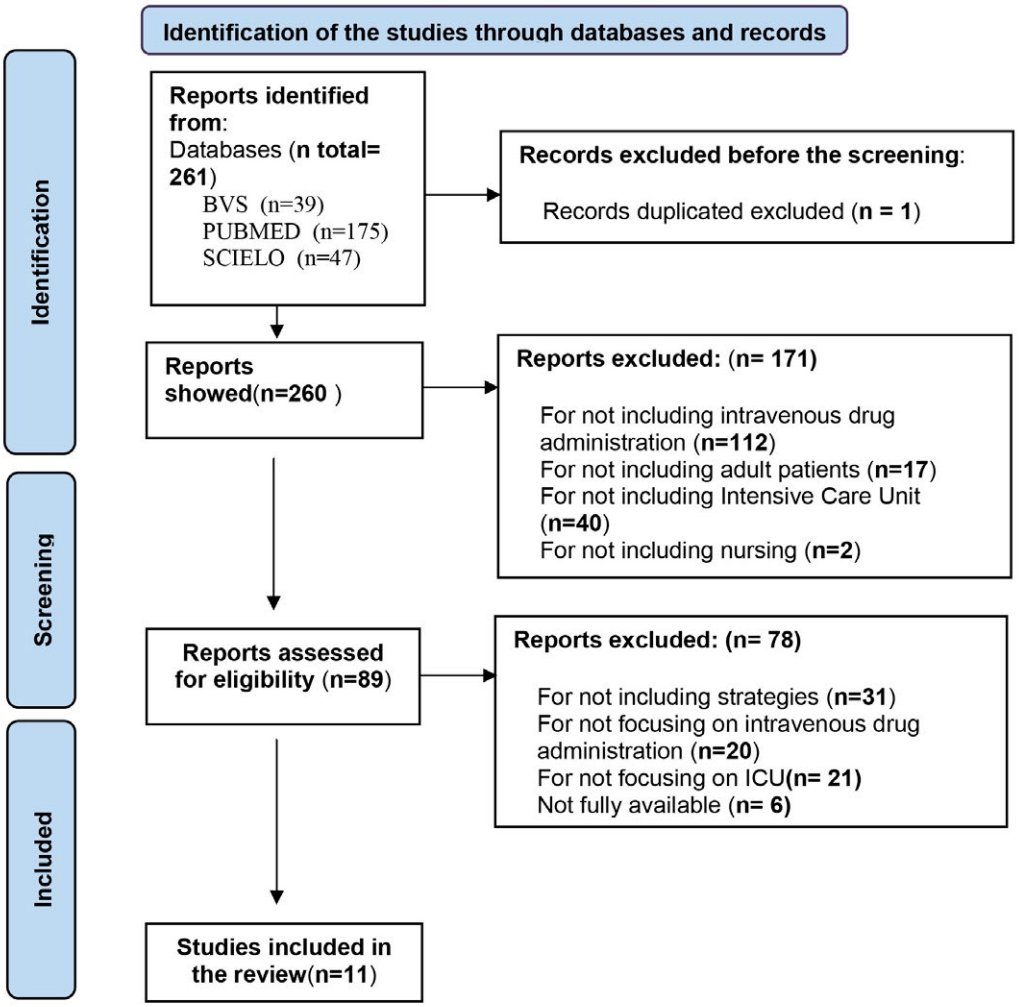
The review included articles fully available addressing the prevention of conditions that generate drug risks in intensive care units, that is, studies that describe prevention measures, good practices in intravenous administration. Publications that do not include strategies in adult intensive care units were excluded.

The identification, selection, eligibility and inclusion of the articles was performed by two independent reviewers, through the free online software Rayyan (Qatar Computing Research Institute, Doha, Qatar), through title and abstract reading and subsequent full reading, eliminating articles according to pre-established criteria. The conflicts were resolved by a third reviewer. The search will be evidenced by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-scr). The presentation of the extracted data was made in a textual way, the synthesis of the data is presented in a chart, containing: authors, year of publication, country of origin, objectives, method, main results and strategies presented.

Results and discussion

After performing the searches in the databases, 261 records were identified. One duplicate was removed, totaling 260 records. When the eligibility criteria were applied, two reviewers selected 89 studies for full reading. At the end, 11 studies were included in this review, as described below in the PRISMA flowchart.

Figure 1. Flowchart of the evidence selection process. Rio de Janeiro, RJ, Brazil, 2022



Source: The PRISMA 2020 statement.[10]

The articles included in the review were published between 2014 and 2021; five (45.5%) have Brazil as their country of origin, while the other six (54.5%) are from the United States of America, Portugal, Korea, Iran, France and Canada. Regarding the method, four (36%) are integrative reviews, three (27%) are qualitative studies, three (27%) are quantitative studies and one (9%) is a case study.

Chart 2. Data extracted from included articles. Rio de Janeiro, RJ, Brazil, 2022 (to be continued)

Author/year of publication	Country of origin	Objectives	Method	Main results	Strategies presented
Hebbar KB, Colman N, Williams L, Pina J, Davis L, Bost JE, et al.; 2018.[11]	United States of America.	To improve adherence to best practices, decrease drug administration-related events, and decrease cost related to error rates.	Qualitative study.	Increased adherence to good safety practices, such as use of the five rights and independent double-checking, and reduced rates of adverse events during and after the training period.	To initiate a simulation program for drug administration training.
Bastos C, Barbieri MC.; 2020.[12]	Portugal.	To disseminate guidelines regarding the insertion and maintenance of peripheral venous catheters, preparation and administration of intravenous medications.	Literature review.	The lack of adherence to good practices is notable, which can be related to the low disclosure on the part of the health instuition and the dynamics of daily work.	To perform hand hygiene; disinfect the catheter connector; assess catheter patency; perform flushing after administering the drug; assess inflammatory signs at the site of administration.
Kang MJ, Jin Y, Jin T, Lee SM.; 2017.[13]	Korea.	To develop, use and evaluate adoption of an automated medication error risk assessment system.	Retrospective case-control study.	From the electronic patient records, it was possible to predict medication errors sensitive to situational and environmental risks. Avoiding the increase in the severity of the patient's condition and reducing additional costs.	To use technological drug management systems, such as bar codes, smart pumps; alarms and risk notification systems.
Farzi S, Irajpour A, Saghaei M, Ravaghi H.; 2017.[14]	Iran.	To explore and describe the causes of medication errors in Intensive Care Units	Descriptive qualitative study.	The causes of medication errors involve reduced attention to processes, illegible or incomplete prescriptions, insufficient knowledge, fatigue and interruptions, lack of identification of medications, poor communication between the team.	To increase communication, adopt computerized prescriptions, educate on drug safety, properly manage workload.
Berdot S, Vilfaillot A, Bezie Y, Perrin G, Berge M, Corny J, et al.; 2021.[15]	France.	To analyze medication errors and risk factors and assess the impact of using a "do not interrupt" vest in reducing errors during medication administration rounds.	Randomized study.	The use of a "do not interrupt" vest had no impact on reducing interruption or error rates in medication administration.	To develop behavioral strategies to manage disruptions, as well as intervening on a personal and organizational level.

Chart 2. Data extracted from included articles. Rio de Janeiro, RJ, Brazil, 2022 (conclusion)

Author/year of publication	Country of origin	Objectives	Method	Main results	Strategies presented
Franco da Silva E, Faveri F, Lorenzini L.; 2014.[16]	Brazil.	To analyze national publications on medication errors in nursing practice.	Integrative Review.	The use of several terms for medication errors was evidenced, which creates confusion among professionals. The causes that give rise to the error, often attributed to nursing activities, may also be related to external factors.	Institute continuing education and computerize care processes.
Strudwick G, Reisdorfer E, Warnock C, Kalia K, Sulkers H, Clark C, et al.; 2018.[17]	Canada.	To understand the effect of barcode drug delivery technology on medication errors and how using the system can improve patient safety.	Integrative review.	Several publications related to the use and implementation of bar codes in the drug administration stage were identified.	To implement barcode medication administration.
Pena MM, Braga AT, Meireles ES, Vassao LGC, Melleiro MM.; 2016.[18]	Brazil.	To identify medication errors in a university hospital and analyze their main causes.	Retrospective descriptive quantitative study.	A total of 339 medication errors were identified, as follows: 137 due to wrong medication dispensing, 56 due to lack of medication records on the tape, 43 due to manual prescription changes, 29 due to medication delays, 28 due to administration errors, 25 due to duplicate prescriptions and 21 due to tape shortages for period medication records.	To reinforce communication, continuing education and compliance with policies and procedures related to the drug chain.
Santos LL, Camerini FG, Fassarella CS, Almeida LF, Setta DXB, Radighieri AR; 2021.[19]	Brazil.	To analyze the implementation of the medication time out strategy to reduce medication-related errors.	Cross-sectional quantitative study.	The implementation of the strategy contributed to the interception of a high number of medication errors, using few human and material resources.	To implement the 'Medication time out' strategy.
Magalhães AMM, Moura GMSS, Pasin SS, Funcke LB, Pardal BM, Kreling A; 2015.[20]	Brazil.	To conduct a survey of critical points in the medication process, their repercussions on the demands made to the nursing team and the risks related to patient safety.	Descriptive qualitative study.	The results indicated that the medication system plays a central role in the organization of nursing care, with professionals being the last barrier to detecting errors in the prescription and administration of medications.	Organizing the work shift and the use of new technologies to reduce medication errors.
Figueiredo TWB, Silva LAA, Brusamarello T, Oliveira ES, Santos T, Pontes L; 2018.[21]	Brazil.	To search for scientific evidence that addressed the main medication errors and their causes observed by nursing and describe the strategies used to promote drug safety in these institutions.	Integrative Review.	The human factor was evidenced as the main causes of errors, with 41 studies (34.2%), problems in relation to the system 37 (30.9%); and communication 22 (18.3%).	To implement safety protocols for drug preparation and administration, adopt the use of electronic prescriptions, include the pharmacist in the team, introduce training and guidance actions.

Source: The authors (2022).

From the results presented were identified and listed eight safety strategies for the administration of intravenous drugs. The most cited were those related to the use of technological systems of medicine management and continuing education for the health team, as presented in the table below.

Chart 3. Presentation of strategies mapped in the literature. Rio de Janeiro, RJ, 2022

Strategy	N. of articles
To use technological drug management systems.	5
To institute education and/or training of the health team.	5
To improve communication between the health team.	2
To implement safety protocols for drug preparation and administration.	2
To properly manage teams' workload.	2
To develop and deploy new behavioral strategies to manage disruptions.	1
To include pharmacist in the team.	1
To implement the 'Medication time out' strategy.	1

Source: The authors (2022).

Among the strategies identified, the one with the highest frequency was related to the need to use technological systems. In practice, technologies are increasingly present in public and private health environments, computerizing care processes. Their use is based on the possibility of generating safety and greater reliability to services, in addition to making feasible the mitigation of errors in the administration of drugs and adverse events, such as hospital infections.[13]

A study that analyzed the use of an automated medication error risk assessment system (Auto-MERAS) found a predictive validity for errors of 0.80, ratifying the idea that computerized systems can be useful in preventing errors and injuries related to drug therapy.[13]

Among other technological tools used in care practice, the use of "intelligent" infusion pumps stands out. This technology allows the administration of drugs by bar code, have alarms and risk notification systems, can be connected to electronic prescription, clinical decision support systems and automated pharmacy systems. All these tools can act as barriers to incident prevention. However, some authors have detected that as these technologies are manipulated by humans, they require attention to the information entered, thus being also prone to errors and, despite the benefits, aspects of their application such as the high cost and need for changes in infrastructure should also be considered.[22,23]

Another strategy that was very evident in the publications included in the study refers to education and training of the health team. The insertion of new technologies during routine, the constant updates of protocols and the complexity of instruments and procedures involved in drug administration make education and/or continuing training the main strategy to requalify and develop nursing knowledge, risk identification and prevention of adverse events. A simple method, such as the placement of information leaflets and posters, resulted in a reduction in drug preparation and administration errors in the ICU sector in a hospital in Iran, increasing the quality score from 4.51 to 6.15.[24]

Among the learning methods there are seminars, observation, problem analysis, simulation, e-learning and blended learning, as ways to stimulate learning among professionals and promote updates in teams.[25] One trial showed that, after the application of the simulated training performed with ICU nurses, the rate of adverse events related to medication reduced from 2.5 events per month to 0.86.[11]

Training is important for the clinical practice of professionals, ensuring the success of the implementation of another evident strategy related to the development and implementation of care protocols. Regarding drug therapy, the protocols guide nursing actions and other categories through standards and procedures that standardize the preparation and administration of drugs. In general, the protocols are developed by health institutions and regulatory and class bodies, addressing the recommendations that should be standardized for this procedure. A study that evaluated the implementation of a protocol for the preparation and administration of intravenous drugs in a medical center in the Netherlands observed that there was an improvement in the average score of the experimental and control group of nurses (T = -2.20).[26]

Another strategy identified and that promotes improvements in safety standards is effective communication, which, when performed properly can prevent errors, such as those related to potentially dangerous medications, interactions and events related to the transfer of care. In the context of medication are included verbal, written or digital communication, through medical records, between the nursing team, with pharmacists, doctors and with patients themselves. To facilitate communication, making it objective and clear, the SBAR technique, an acronym described by the Joint Commission as "situation, brief history, evaluation and recommendation", is used in the health area, standardizing the interaction among the multidisciplinary team.[27]

The management of the workload of nursing teams is also a relevant factor regarding patient safety, as it is one of the causes of medication errors. Any lapse in this management can cause failures in the administration of drugs, change of drugs at the time of administration and the administration of medication with wrong solution.

Studies show that the higher the workload of nursing professionals, the greater the chance of adverse events.[28] A 2016 study, including sixteen ICUs from seven hospitals affiliated with the Isfahan University of Medical Sciences in Iran, reported that most of the errors related to drug administration were related to drowsiness, fatigue, speech and interruptions of the nurse during the administration of the drug.[14] Thus, proper management of workload allows workers not to exceed their limits and reach extreme fatigue, mitigating the exhaustion of teams and consequently reducing the chances of adverse events.

The inclusion of a pharmacist in the team is another strategy to mitigate errors in drug administration. In Brazil, doctors are responsible for prescribing drugs in intensive care units and the nursing team implements the decision of doctors. Thus, the pharmacist can provide information, propose the rational use of medicines, monitor the prescription of medicines and supervise the preparation and administration. The insertion of a pharmaceutical professional in the team represents an important barrier in the system of drug administration that helps to find and avoid possible errors.[29]

Another strategy found is the medication time out which is a low cost strategy consisting of reading aloud the medical prescription for all multiprofessional team, enabling the interception of some possible failure present in the prescription, Therefore, it is possible to perform an early detection of failures or errors, avoiding the progression of the error. In a study conducted in a cardiointensive unit of a university hospital in Rio de Janeiro that used the medication time out strategy, 234 prescriptions were observed, with 2,799 drugs. Of the 234 prescriptions, 143 (61%) suffered some change during reading, with 41.4% excluding drugs, and 34.8% increasing new medications.[19]

Interruptions during the nursing process are responsible for inattention and result in errors. To manage these interruptions was developed the vest "do not interrupt", worn over the clothes of health professionals with the phrase "Do not interrupt, I am preparing medication". Some studies point to the use of educational instruments as explanatory poster and clarification on the use of vest for patients and families.[15] In this context, the strategy consists of the use of the vest during the preparation and administration of the drug, so that there are no interruptions during this process, avoiding errors that occur at times when the professional needs to divide attention between the preparation of the drug and patients, companions and/or co-workers.[30]

Conclusion

Based on the studies included in this scope review, eight strategies that can be used by nursing and other health professionals to prevent errors and incidents in the stage of intravenous drug administration in critical patients were identified, use of technological systems of medicine management, education and/or continuing training, improvement of communication, implementation of safety protocols, adequacy of workload, management of interruptions, strategy Medication Time Out and inclusion of a pharmacist in the team.

The present study was limited by showing few strategies that were actually applied and tested, most studies cite strategies as recommendations for clinical practice. Also, the inclusion of studies only performed in adult critical patients was a limitation.

As a recommendation, the need to implement the strategies listed in the literature in care practice stands out. Current trials testing strategies should be developed to prevent errors during medication, including national research, in order to assess the clinical effectiveness of such strategies.

Authors' contributions

Silva TGP, Costa BDS and Camerini FG participated in the design of the project and the research question, methodological design, data collection and analysis, interpretation and presentation of the results and writing of the scientific article. Gonçalves CGF contributed to data collection and analysis. Henrique DM and Fassarella CS assisted in the final review and normalization of the article. All authors have reviewed and approved the final version and are in agreement with its publication.

Conflict of interests

No financial, legal or political conflict involving third parties (government, companies and private foundations, etc.) has been declared for any aspect of the submitted work (including but not limited to grants and funding, participation in advisory board, study design, manuscript preparation, statistical analysis, etc.).

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References

1. Ministério da Saúde (Brazil). Agência Nacional de Vigilância Sanitária. Plano Integrado para a Gestão Sanitária da Segurança do Paciente em Serviços de Saúde: Monitoramento e Investigação de Eventos Adversos e Avaliação de Práticas de Segurança do Paciente [Internet]. Brasília: Ministério da Saúde; 2015. Available from: https://proqualis.net/relatorio/plano-integrado-para-gest%C3%A3o-sanit%C3%A1ria-da-seguran%C3%A7a-do-paciente-em-servi%C3%A7os-de-sa%C3%BAde

2. Organização Mundial da Saúde (WHO). Medication Without Harm - Global Patient Safety Challenge on Medication Safety [Internet]. WHO; 2017. Available from: https://www.who.int/initiatives/medication-without-harm

3. Gelsdorf L, Gaedke MA, Koepp J. Segurança do paciente na administração da antibioticoterapia em UTI Adulto: Reconhecendo as condições geradoras de risco. Rev Enferm At In Derme. 2021;95(33):e-21026. https://doi.org/10.31011/reaid-2021-v.95-n.33-art.964

4. Gonçalves LA, Andolhe R, Oliveira EMD, Barbosa RL, Faro ACM, Gallotti RMD, et al.Nursing allocation and adverse events/incidents in intensive care units. Rev. Esc. Enferm. USP. 2012;46(SPE):71-77. https://doi.org/10.1590/S0080-62342012000700011

5. Melo ABR. Enfermagem e segurança na terapia medicamentosa em unidades intensivas [dissertation] [Internet]. Rio de Janeiro: Universidade do Estado do Rio de Janeiro; 2007. [cited 2022 nov. 23]. Available from: https://www.bdtd.uerj.br:8443/bitstream/1/11315/1/Anna%20Bianca%20Ribeiro%20Melo.pdf

6. Toffoletto MC, Padilha KG. Consequences of medical errors in intensive and semi-intensive care units. Rev. Esc. Enferm. USP. 2006;40(2):247-252. https://doi.org/10.1590/S0080-62342006000200013

7. Novaretti MCZ, Santos EDV, Quitério LM, Daud-Gallotti RM. Nursing workload and occurrence of incidents and adverse events in ICU patients. Rev Bras Enferm. 2014;67(5):692-699. https://doi.org/10.1590/0034-7167.2014670504

8. Arboit EL, Camponogara S, Magnago TBS, Urbanetto JS, Beck CLC, Silva LAA. Factors contributing to the incident occurrence of security related to drug use in intensive care. Rev Pesq Cuid Fund. 2020;12:1030-1036. https://doi.org/10.9789/2175-5361.rpcfo.v12.7456

9. Camerini FG, Silva TGP, Costa BDS. Estratégias para reduzir condições geradoras de riscos relacionados a administração medicamentosa: um protocolo de revisão de escopo. 2022. https://doi.org/10.17605/OSF.IO/68JNH

10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372(71). https://doi.org/10.1136/bmj.n71

11. Hebbar KB, Colman N, Williams L, Pina J, Davis L, Bost JE, et al. A Quality Initiative: A System-Wide Reduction in Serious Medication Events Through Targeted Simulation Training. Simul Healthc. 2018;13(5):324-330. https://doi.org/10.1097/SIH.0000000000000321

12. Bastos C, Barbieri MC. Administration of intravenous medication in hospitals. Millenium. 2020;2(11):49-55. https://doi.org/10.29352/mill0211.05.00260

13. Kang MJ, Jin Y, Jin T, Lee SM. Automated Medication Error Risk Assessment System (Auto-MERAS). J Nurs Care Qual. 2017;33(1):86-93. https://doi.org/10.1097/NCQ.0000000000000266

14. Farzi S, Irajpour A, Saghaei M, Ravaghi H. Causes of Medication Errors in Intensive Care Units from the Perspective of Healthcare Professionals. J Res Pharm Prac. 2017;6(3): 158-165. https://doi.org/10.4103/jrpp.JRPP_17_47

15. Berdot S, Vilfaillot A, Bezie Y, Perrin G, Berge M, Corny J, et al. Effectiveness of a 'do not interrupt' vest intervention to reduce medication errors during medication administration: a multicenter cluster randomized controlled trial. BMC Nurs. 2021;20(153):1-11. https://doi.org/10.1186/s12912-021-00671-7

16. Silva EF, Faveri F, Lorenzini L. Erro de medicação no exercício da enfermagem: uma revisão integrativa. Enferm Glob [Internet]. 2014;13(2):330-345. Available from: https://scielo.isciii.es/pdf/eg/v13n34/pt_revision1.pdf

17. Strudwick G, Reisdorfer E, Warnock C, Kalia K, Sulkers H, Clark C, et al. Factors Associated With Barcode Medication Administration Technology That Contribute to Patient Safety: An Integrative Review. Jour Nurs Car Qual. 2018;33(1):79-85. https://doi.org/10.1097/NCQ.0000000000000270

18. Pena MM, Braga AT, Meireles ES, Vassao LGC, Melleiro MM. Mapping of medication errors at a university hospital. Rev. Enferm UERJ. 2016;24(3):e7025. https://doi.org/10.12957/reuerj.2016.7095

19. Santos LL, Camerini FG, Fassarella CS, Almeida LF, Setta DXB, Radighieri AR. Medication time out as a strategy for patient safety: reducing medication errors. Rev Bras Enferm. 2021;74(1):e20200136. https://doi.org/10.1590/0034-7167-2020-0136

20. Magalhães AMM, Moura GMSS, Pasin SS, Funcke LB, Pardal BM, Kreling A. The medication process, workload and patient safety in inpatient units. Rev Esc Enferm USP. 2015;49(spe):43-50. https://doi.org/10.1590/S0080-623420150000700007

21. Figueiredo TWB, Silva LAA, Brusamarello T, Oliveira ES, Santos T, Pontes L. Tipos, causas e estratégias de intervenção frente a erros de medicação: uma revisão integrativa. Rev Enferm Atenç Saúd. 2018;7(2):155-175. https://doi.org/10.18554/reas.v7i2.2494

22. Kaushal R, Bates DW. Information technology and medication safety: what is the benefit?BMJ Qual Saf. 2002;11(3):261-265. http://dx.doi.org/10.1136/qhc.11.3.261

23. Bates DW, Cohen M, Leape LL, Overhage JM, Shabot MM, Sheridan T. Reducing the frequency of errors in medicine using information technology. Journ Ame Medic Inform Assoc. 2001;8(4):299-308. https://doi.org/10.1136/jamia.2001.0080299

24. Abbasinazari M, Zareh-Toranposhti S, Hassani A, Sistanizad M, Azizian H, Panahi Y. The effect of information provision on reduction of errors in intravenous drug preparation and administration by nurses in ICU and surgical wards. Acta Med Iran [Internet]. 2012;50(11):771-777. Available from: https://acta.tums.ac.ir/index.php/acta/article/view/3991

25. Reeves S. Why we need interprofessional education to improve the delivery of safe and effective care. Interf. 2016;20(56):185-196. https://doi.org/10.1590/1807-57622014.0092

26. Tromp M, Natsch S, van Achterberg T. The preparation and administration of intravenous drugs before and after protocol implementation. Pharm world scienc. 2009;31(3):413-420. https://doi.org/10.1007/s11096-008-9269-5

27. Instituto Brasileiro Para Segurança do Paciente. Como usar o método SBAR na transição do cuidado [Internet]. 2019. Available from: https://segurancadopaciente.com.br/qualidade-assist/como-usar-o-metodo-sbar-na-transicao-do-cuidado/

28. Needleman J, Buerhaus P, Pankratz S, Leibson CL, Stevens SR, Harris M. Nurse staffing and inpatient hospital mortality. N Engl J Med. 2011;364(11):1037-45. https://doi.org/10.1056/NEJMsa1001025

29. Teixeira TCA, Cassiani SHB. Root cause analysis: evaluation of medication errors at a university hospital. Rev Esc Enferm USP.2010;44(1):139-146. https://doi.org/10.1590/S0080-62342010000100020

30. Santana BS, Rodrigues BS, Stival MM, Rehem TCMSB, Lima LR, Grou Volpe CR. Interrupções no trabalho da enfermagem como fator de risco para erros de medicação. Avanc Enferm. 2019;37(1):56-64. http://dx.doi.org/10.15446/av.enferm.v37n1.71178