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UPDATE IN INTENSIVE CARE MEDICINE: CRITICAL PATIENT SAFETY

Safe practices in Intensive Care Medicine, is zero risk possible?



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Abstract Incidents related to patient safety are a problem of great impact in Intensive Care Medicine (ICM). Multiple strategies have been developed to identify them, analyze, and develop policies aim at reducing their incidence and minimizing their effects and consequences. The development of a safety culture, an adequate organizational and structural design of the ICM, which contemplates the implementation of effective safe practices, with a provision of human resources adjusted to the care activity carried out and the periodic analysis of the different events and their factors, will allow us to bring the risk of critical patient care closer to zero, as would be desirable.

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PALABRAS CLAVE

Seguridad;
Incidentes;
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Prácticas seguras en los servicios de medicina intensiva. ¿Es posible el riesgo Zero?

Resumen Los incidentes relacionados con la seguridad del paciente suponen un problema de gran impacto en los servicios de Medicina Intensiva (SMI). Se han desarrollado múltiples estrategias a nivel internacional, nacional y local para identificarlos, analizarlos y desarrollar políticas encaminadas a disminuir su incidencia y a minimizar sus efectos y sus consecuencias. El desarrollo de la cultura de seguridad, un adecuado diseño organizativo y estructural de los SMI, que contemple la implantación de prácticas seguras efectivas, con una dotación de recursos

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humanos ajustada a la actividad asistencial desarrollada y el análisis periódico de los distintos eventos y sus factores, nos permitirán aproximar el riesgo de los cuidados del paciente crítico al cero, como sería deseable.

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Introduction

According to the World Health Organization (WHO), patient safety (PS) is defined as the reduction of unnecessary risk of harm associated with health care to an acceptable minimum, understood according to the scientific knowledge of the time, available resources, and the context in which it occurs.¹ Errors in health care practice are a significant cause of morbidity and mortality among the population. Since the WHO created the World Alliance for Patient Safety (WAPS) in 2004, numerous international strategies have been developed to reduce patient safety-related incidents (PSIs), and currently, safety and quality are key dimensions within the health care system of any country.²

Some of the PSIs cause harm to the patient, adverse events (AEs), while others don't, or at least, do not have negative consequences (incidents without harm-IWH).³ Most AEs are not caused by negligence, inadequate care, or lack of training or knowledge but by factors related to system design or organizational factors. They are rarely due to the action of a single individual. And, most importantly, they are preventable, at least 40% to 50%.⁴ One of the key aspects of effectively managing PS is to understand the underlying causes and to be aware that strategies can be developed to control contributing factors and address modifiable factors. Strategies aimed at PS in the health care system are based on promoting a safety culture at all levels of care, developing incident reporting and information systems, promoting safe health care practices, and promoting safety research. The consequences of PSIs have a profound impact on patients, workers, and the entire health care system. The incidence of AEs is associated with increased mortality and longer ICU and hospital stays, with the consequent costs that this entails.⁵ It is estimated that the damages caused reduce 0.7% the global economic growth while their indirect costs amount to several trillion euros annually.⁶ In addition to the direct economic impact, there is the impact caused by the decrease in the patient's functional capacity, the loss of quality-adjusted life years, and the legal demands derived from them. But they also entail an intangible cost; the loss of trust of patients and their families in health care professionals and institutions, and the appearance of the second victim of error among professionals themselves.^{7,8}

One of the objectives of Intensive Care Medicine Services (ICMS) is to provide critically ill patients with health care tailored to their needs, of quality, and as safely as possible. The increasing complexity of ICMS and their effectiveness inevitably entail an increased risk of PSIs.⁹ The clinical condition, severity, and vulnerability of the critically

ill patient; the application of increasingly complex procedures; the use of numerous high-risk medications; existing communication barriers; the massive flow of uninterrupted data that requires great attention, processing, and reaction capacity; workload; limited time to respond to changes in the physical condition of each patient; teamwork and multiple information transfers; mental overload, fatigue, and stress... all this makes ICMS the highest-risk area of the hospital.¹⁰ Around 100 actions are taken daily on each patient, and all of them have potential risks for them.¹¹

Incidence

The incidence of AEs in ICMS varies greatly from one study to another (between 15% up to 51%); this diversity is due to differences in the taxonomy of variables, the use of different event detection systems, as well as the different organization of each ICMS and the heterogeneity of different conditions and the severity of patients. Still, the incidence is, at least, twice as high as that of patients in the rest of the hospital.¹² It is essential to know their epidemiology to be able to identify those areas of risk, analyze them, and treat them.

Following studies on the analysis of AEs in ICMS,^{13–15} the European Society of Intensive Care Medicine (ESICM) publishes the consensus document: "Patient Safety in Intensive Care Medicine: the Declaration of Vienna", recognizing the need to develop strategies to prevent and/or mitigate AEs in critically ill patients and to engage professionals in improving the quality and safety of care.¹⁶

Contributing factors

Since many PSIs are preventable, analyzing contributing factors allows us to detect system failures and improve defenses against error. In a post hoc analysis of the Safety and Risk in Critically Ill Patients (SYREC) study, contributing factors reported in relation to PSIs were analyzed.¹⁷ The most frequent ones were those associated with the patient (complexity, severity...), working conditions (new staff, time pressure, excessive workload...), individual professional factors (lack of motivation, stress, cognitive factors...), and training and education (lack of knowledge, lack of supervision...).

All these contributing factors can be grouped into two main categories: those related to the structure and organization of the unit, and those related to the care process. The relationship between workload and outcome is one of

the most relevant factors to consider from the perspective of structure and organization. Although it remains a topic of discussion, the literature well describes the relationship between nurse-patient ratio and nosocomial infection,^{18,19} postoperative complications,²⁰ and medication errors.¹⁵

Safe practices are a series of recommendations for good clinical practice in various areas of health care, aimed at preventing and avoiding AEs, thus improving the quality of care. The deficit in the implementation of safe practices has been associated with organizational factors. In a recent study involving 40 Spanish ICUs that completed the “Self-Assessment Questionnaire for Medication Safety in Intensive Care Services”, a low degree of implementation of effective safe practices in medication use was identified.²¹ The questionnaire evaluates 147 items grouped into 10 key elements. The mean score of the complete questionnaire in the ICUs was 49.2% of the maximum possible value. Key elements related to the addition of pharmacists to ICMS as well as the training of professionals in safety practices obtained the lowest scores (31.2% and 33.2%, respectively). Other key elements associated with accessibility to patient and medication information, standardization, storage and drug distribution, and quality and risk management programs scored <50%. Therefore, it is necessary, from the perspective of the organizational and structural design of ICUs, to consider the implementation of effective safe practices and a staffing level adjusted to the care activity developed.

Contributing factors related to the health care process refer to teamwork, communication, and collaboration aspects. They are generally more difficult to quantify and often underestimated.²² Therefore, we have less evidence on how these factors contribute to error occurrence. However, we know that deficits in the quality and/or quantity of information are intimately related to error occurrence. Critical patient care requires collaboration, coordination, and communication from the entire care team.²³ The exchange and frequent updating of information on the patient’s clinical status are necessary. Moreover, multiple tasks often need to be performed simultaneously or a task needs to be changed, which carries the risk of fragmented attention. It is precisely this need for continuous information and fragmented attention that leads to inefficient or inaccurate communication and the opportunity for error.

Risk reduction strategies

The Patient Safety Strategy of the National Health System (NHS) for the period 2015–2020 established 6 strategic lines.²⁴

Line No. 1 aims to improve safety culture, human and organizational factors by developing safety plans, promoting professional leadership to ensure goal achievement, facilitating safety climate assessment and result dissemination, as well as providing safety training to all professionals involved in patient care.

Line No. 2 refers to the implementation of safe practices aimed primarily at promoting safe drug use, preventing health care-related infections, avoiding harm associated with surgery or patient care, as well as ensuring safe patient identification, effective communication, or safe use of ionizing radiation (Table 1).

Line No. 3 refers to risk management and incident reporting and learning systems, by promoting the creation of risk management units and the implementation and development of incident reporting systems, promoting the development of strategies to improve and encourage reporting and subsequent dissemination of information throughout the organization, while ensuring the protection of professionals participating in information systems.

Lines No. 4, 5, and 6 respectively address patient and citizen participation, research, and international participation in patient safety.

Since there are often multiple contributing factors involved in the occurrence of PSIs, from a practical standpoint, incident-minimizing strategies need to take a multimodal approach.

In a recent study conducted in a center with 9 ICUs where incident reporting decreased during the SARS-CoV-2 pandemic, a multimodal strategy was designed to increase PSI reporting.²⁵ The strategy included the creation of a safety leader in the ICU, interactive patient safety boards, access to safety training and information via QR codes, and planning of regular feedback sessions. Following the implementation of the strategy, PSI reporting increased by 48% (40 vs 27 notifications/1000 patient-days). Although the safety climate measure did not change (80% of health care staff rated patient safety as good after strategy implementation vs 78% in the baseline period), significant improvements were observed in subcomponents related to the learning culture and support for personnel involved in incidents.

The use of clinical information systems in the medication administration process—such as electronic prescription systems, reconciliation programs, automated medication dispensing, barcode tracking, has proven effective in reducing medication-related PSIs.²⁶ Furthermore, multidisciplinary work at the ICU setting (intensivists, pharmacists, nursing) by teams sharing a mental model in medication use (prescription, transcription, dispensing, administration, and monitoring) reduces the chances of medication errors.²⁷ In Spain, as an initiative arising from several scientific societies in the field of intensive care, hospital pharmacy, and patient organizations, the PREVEMED report was published, aimed at promoting the development and implementation of effective practices to improve medication safety in adult, pediatric, and neonatal critical care units, by developing recommendations for medication error prevention.²⁸ Alongside other measures aimed at improving safety culture (reporting systems, improvement plans, communication, etc.), periodic use of the “Self-Assessment Questionnaire for Medication Safety in Intensive Care Services” from the Institute for Safe Medication Practices (ISMP) is recommended.²⁹ A multidisciplinary approach, with the inclusion of a pharmacist, patient safety go-to personnel in units, patient and family involvement, and the existence of action plans for sentinel adverse effects, is also recommended. Processes to improve medication use at the ICU setting include prescription standardization, prior pharmaceutical validation before dispensing, centralized preparation, medication reconciliation, and standardization of infusion mixes across all hospital units. From a technological standpoint, implementation of medication traceability systems and standardization, as well as gravimetric systems in the preparation phase, especially in neonatal or pedi-

Table 1 Implementation of safe practices and specific objectives for their development.

Safe practices	Specific endpoints
Promote safe medication use	• Promote electronic prescription assisted by clinically proven decision support systems. • Foster the implementation of safe practices with high-risk drugs. • Promote drug reconciliation during health care transitions. • Drive initiatives to improve a safe use of drugs, especially in chronically polypharmacy and pediatric patients. • Promote the training of health care professionals on the safe use of drugs. • Encourage the training of patients/caregivers on drug use and their active participation in treatments. • Promote the reporting of drug related incidents through existing notification systems. • Promote self-assessment of the safety of the drug utilization system in health care centers. • Maintain and promote the expansion of the hand hygiene program of the Spanish National Health System (SNS) to all health care centers.
Promote safe practices to prevent and control health care-related infections	• Maintain and promote programs for preventing health care-related infections in critically ill patients and their extension to other hospitalization areas using surveillance and control systems available in health care centers. • Drive a program for the prevention and control of surgical site infections at the SNS level. • Promote and implement programs for rational and optimized use of antimicrobials. • Promote the prevention and control of antimicrobial resistance, with special attention to controlling the spread of multidrug-resistant microorganisms. • Support multidisciplinary strategies for early identification and treatment of sepsis. • Promote infection prevention and control programs in the field of socio-health care centers. • Promote surveillance systems for health care-related infections to enable monitoring of their evolution and comparability of results between centers and services.
Promote safe practices to prevent and control healthcare-associated infections	• Promote electronic prescription assisted by clinically proven decision support systems. • Foster the implementation of safe practices with high-risk medications. • Promote medication reconciliation during health care transitions. • Drive initiatives to improve the safety of medication use, especially in chronically polypharmacy patients and pediatric patients. • Promote the training of health care professionals on the safe use of medications. • Encourage the training of patients/caregivers on medication use and their active participation in treatments. • Promote the reporting of incidents related to medication use through existing notification systems. • Promote self-assessment of the safety of the medication utilization system in health care centers. • Maintain and promote the expansion of the hand hygiene program of the National Health System (SNS) to all health care centers. • Maintain and promote programs for preventing healthcare-associated infections in critically ill patients and their extension to other hospitalization areas using surveillance and control systems available in health care centers. • Drive a program for the prevention and control of surgical site infections at the SNS level. • Promote and implement programs for rational and optimized use of antimicrobials. • Promote the prevention and control of antimicrobial resistance, with special attention to controlling the spread of multidrug-resistant microorganisms. • Support multidisciplinary strategies for early identification and treatment of sepsis. • Promote infection prevention and control programs in the field of socio-health care centers. • Promote surveillance systems for healthcare-associated infections to enable monitoring of their evolution and comparability of results between centers and services.

Table 1 (Continued)

Safe practices	Specific endpoints
Promote the implementation of safe practices in surgery	• Promote the implementation and correct use of the Surgery Safety Checklist. • Promote the adoption of recommendations from the Helsinki Declaration on Patient Safety in Anesthesiology. • Encourage specific training in non-technical aspects (communication, teamwork, etc.) for surgical block professionals. • Enhance communication during patient transfer from operating rooms to recovery or intensive care units.
Promote the implementation of safe practices in patient care	• Encourage the development of individualized nursing care plans individualized for each patient. • Promote the inclusion of patient safety aspects in the patient's medical history care plan and discharge report.
Promote unequivocal patient identification	• Promote the unequivocal identification of the correct patient, correct procedure, and correct location. • Promote the unequivocal identification of patients with specific risks. • Ensure the unequivocal identification of biological samples crucial for diagnosis. • Encourage unequivocal identification of patient clinical documents.
Promote communication among professionals	• Promote standardized communication, both within units and during care transition (transfer), to ensure continuous and safe patient care.
Promote the design and development of strategies for addressing serious adverse events in health care centers	• Promote the development of strategies to manage serious adverse events and support the victims of such events. • Promote training for professionals to adequately develop these strategies.
Promote safe use of ionizing radiation in clinical procedures	• Promote actions to improve the processes of justification for the use of ionizing radiation, especially in patients younger than 18 years. • Promote Patient Safety in diagnostic and therapeutic procedures involving ionizing radiation. • Promote the detection and prevention of adverse events related to ionizing radiation, especially in radiotherapy and interventional radiological procedures.

atric units, is recommended to ensure the accuracy of doses prepared for high-risk medications. Similarly, the implementation of training and awareness programs for medication use is recommended. Finally, the societies signing the document consider it of interest to develop an accreditation system for preventing medication errors at the ICU setting.

As mentioned in the section "Contributing factors", communication deficits are involved in a significant number of PSIs and are, therefore, an unavoidable cross-cutting factor that must be considered in all strategies aimed at reducing the number of incidents. High-performing teams are characterized by adequate communication, mutual feedback, understanding each team member's roles, anticipating the needs and behaviors of each member, managing conflicts among them, and providing mutual support.

There are tools and team strategies to improve team performance and patient safety. Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS™) is a systematic approach developed by the U.S. Department of Defense and the Agency for Health care Research and Quality (AHRQ) to integrate teamwork into the routine clinical practice and is designed to improve the quality, safety, and efficiency of health care.³⁰ TeamSTEPPS identifies 4 basic teamwork competencies: communication, leadership, situation monitoring, and mutual support to promote effective and accurate communication. Implementing TeamSTEPPS at the ICU setting improves team communication, leadership, mutual support, and team incident awareness, resulting in a reduction in PSIs and improvement in patient safety.

Recently, the Department of Health and Human Services (HHS) and AHRQ published strategies to reduce medical errors and improve patient safety.³¹ The document highlights the achievements of the Comprehensive Unit-based Safety Program (CUSP). CUSP focuses on improving safety culture, teamwork, and communication, along with a set of evidence-based technical interventions such as checklists and recommendations grouped into packages of measures. In 2004, this strategy proved effective in preventing bacteremia associated with vascular devices (BAVD) in a project conducted at the ICU setting in the state of Michigan, United States.³² Subsequently, AHRQ funded the nationwide implementation of CUSP, resulting in a 41% reduction in BAVD from 2008 through 2012.³¹ The tools from CUSP programs have become relevant to health care teams by placing them in the context of a hospital unit and promoting a safety culture. Since then, the effectiveness of this approach has been demonstrated in various care settings.

In Spain, the implementation of infection prevention programs related to devices in ICU patients ("Zero Programs") has significantly reduced the incidence density of primary bacteremia,³³ ventilator-associated pneumonia,³⁴ and acquisition of multidrug-resistant bacteria during patient admission to ICUs.³⁵ Following a CUSP approach adapted to the Spanish health care model, all these programs combine a clinical branch that includes recommendations proven effective in reducing infections, grouped into packages of measures, and a comprehensive safety plan with objectives to promote and reinforce safety culture in National Health Care System ICUs and create a network of ICUs applying safe practices with proven effectiveness. The comprehensive safety plan of the projects includes evaluating safety culture by periodically measuring safety climate in ICUs, safety edu-

cation, identifying defects in clinical practice, learning from errors through case analysis, and engaging management and administration through safety rounds. Units adhering to various projects have shown that it is possible to consolidate the decrease in infection rates over time.³⁶

The ultimate goal of prevention strategies is to reduce the likelihood of PSIs, for which it is necessary to design indicators to monitor the effect of these strategies. These indicators should not only provide information on the effectiveness of the measures (outcome indicators) but also allow us to measure the degree of implementation of these measures (process indicators). Quality indicators published by the Spanish Society of Intensive Care Medicine, Critical and Coronary Units (SEMICYUC) have served as a reference to provide quality and safe medicine to critically ill patients.³⁷

Conclusions

PSIs in ICUs have a multifactorial origin, and often involve several contributing factors in their occurrence. Many PSIs are preventable, so it is necessary to understand the factors involved in the genesis of incidents and establish strategies to prevent their occurrence. Given the characteristics of PSIs, these strategies must have a multimodal approach and consider both contributing factors related to structure and organization, as well as those related to the health care process, including teamwork and communication aspects. Although zero risk is unattainable, it should be considered as an objective, developing safe practices to strive for it. PSIs should be considered avoidable and not an inherent consequence of health care. Preventive strategies should be aimed not only at reducing the incidence of PSIs but also at minimizing the effects and consequences of these errors.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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