# QUALITY INDICATORS IN CRITICALLY ILL PATIENTS

## 2017 UPDATE

Sociedad Española de Medicina Intensvia, Crítica y Unidades Coronarias

(SEMICYUC)

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SOCIEDAD ESPAÑOLA DE MEDICINA INTENSIVA CRÍTICA Y UNIDADES CORONARIAS (SEMICYUC)

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# PREFACE

Intensive medicine aims to offer critically ill patients the safest quality care possible according to their needs, guaranteeing that care will be appropriate, sustainable, ethical, and respectful of the patient's autonomy. Intensive medicine is one of the main components of modern health systems. The growing demand for this resource accounts for a high proportion of health expenditures.

The quality of care has slowly but surely become the focus of the health system, and in recent years patient safety has gained more prominence as one of the key dimensions of quality. In intensive medicine, the interest in safety is even more evident, not only because of its social and economic impact, but also because some of the dimensions of quality take on a more intense significance in critically ill patients: greater vulnerability, limited accessibility, equality in the distribution of resources, scant scientific evidence, and limited efficiency. Other aspects have also become more important in recent years; these include critical care outside intensive care units (ICU), preventive action through early detection of patients at risk of deterioration, follow-up of patients and family members after discharge, the humanization of healthcare, and the identification of practices that add no effective value and can harm patients.

Quality in healthcare can be defined as the degree to which the care delivered to an individual and to the community increases the probability of desirable health outcomes coherent with current professional knowledge. Or, to put it more simply, quality assessment should reflect the discordance betwe en the results that should be obtained and those that are actually obtained. Quality in healthcare is defined as the dimension of healthcare that guarantees that it is safe, appropriate, effective, efficient, accessible, equitable, and patient centered[1]. Although the final goal of medicine is to cover the patient's medical needs, it should also consider the expectations of the family and friends, of healthcare professionals, of the institution, and of society.

Intensive medicine has been a specialty in Spain for more than 30 years, making it possible to improve the care of critical patients. During these years, scientific and technological advances, especially in monitoring and support for organ failure, have brought about important changes in the manageme nt of these patients. Although these changes have no doubt improved the effectiveness of intensive medicine, they have also made it more dangerous. In the words of Cyril Chantler "Medicine used tobe simple, ineffective and relatively safe. It is now complex, effective and potentially dangerous"[2]. This statement is even truer for intensive medicine. The challenge in coming years should be to forge the effectiveness of intensive medicine with the other dimensions of quality, and if safety conflicts with one of them, to be guided by the Hippocratic maxim "First, do no harm".

Until relatively recently, health systems were not focused on measuring quality. Often reliable information that would enable a process to be evaluated did not exist or could not be accessed by managers let alone by healthcare professionals. The lack of information makes it difficult to monitor quality effectively, to determine how often patients receive appropriate care, or to check whether initiatives to improve quality are effective. Monitoring systems make it possible to periodically measure and evaluate important aspects of care through quality indicators, which represent a basic unit of control. Quality indicators are instruments of measurement that identify the presence of a phenomenon or event and its intensity; as such, they should be reliable, objective, acceptable, relevant, and based on evidence. The aim of monitoring is to identify problems or situations that can potentially be improved or deviations from standardized practice. The indicators function as

[1] Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st Century. Washington, DC: National Academy Press; 2001.

[2] Chantler C. The role and education of doctors in the delivery of health care. Lancet. 1999;3;353:1178-81

alarm signals that warn us of this possibility.

Critical care professionals' dedication to improving quality and evaluating results has long been evident, at times through local or individual initiatives and often through initiatives supported by our scientific society. Through its administrative boards and work groups, the Spanish Society of Intensive Care and Coronary Units (SEMICYUC) has led the multidisciplinary development of policies to ensure quality and safety in critical patients, focusing on specific activities in the areas of research and training, and working closely together in many projects with the Ministry of Health. Along the same lines, the first version of SEMICYUC's quality indicators in 2005 was elaborated through the work of t he work groups, under the direction of the Work Group for Planning, Organization, and Management and in close collaboration with and methodological support of the Avedis Donabedian University Institute, a prestigious center with extensive experience in improving quality and safety. This excellent collaborative project resulted in the development of 120 quality indicators that have served as a reference, being incorporated into many critical care departments in our country and even into some of the informati on systems that are being implemented in our environment. This document has been referenced by various scientific societies and included in some of their web pages (e.g., the European Society of Intensive Care Medicine or the government of Chile's Observatory of Good Healthcare Practice) Moreover, the Indian Society of Critical Care Medicine, the German Society for Anaesthesiology and Intensive Care Medicine, and the German Interdisciplinary Association of Intensive Care and Emergency Medicine have elaborat ed their own quality indicators for critical care, explicitly referencing the SEMICYUC's indicators and using the methodology we reported for their elaboration.

Quality indicators must be periodically reviewed and revised in accordance with changes in clinical practice and scientific evidence. The first update of the SEMICYUC's indicators was published in 2011 and then included in the National Quality Measures Clearinghouse (NQMC) of the United States' Agency for Healthcare Research and Quality (AHRQ).

The present 2017 revision aims to bring the indicators up to date through methods similar to those used in the previous phase with the collaboration of many professionals through the SEMICYUC's work groups and the participation of the Spanish Society of Intensive care and Coronary Unit Nursing (SEEIUC). The thorough review of the scientific evidence together with the contributions of experts in the different areas have led to the development of 140 quality indicators. In function of the changes in the scientific evidence, many of those present in earlier versions have been updated, some have been eliminated, and other new ones have been incorporated. From these 140, we have also selected 25 key indicators.

Future developments will include electronic-based indicators that can be incorporated into clinical and administrative information systems to facilitate the monitoring of quality.

The SEMICYUC will promote the use of the quality indicators through its work groups with the aim of developing standards that enable the comparison of results.

We thank Dr. María Cruz Martín Delgado, Dr. Jesús Blanco Varela, Dr. Lluís Cabré Pericas, Dr. Pedro Galdos Anuncibay, Dr. Federico Gordo Vidal, Dr. María Bodí Saera, Dr. Vicente Gómez Tello, and Dr. Manuel Herrera Gutiérrez for coordinating this project and the rest of the professionals who participated in this update, in the 2011 update, and in the original 2005 version.

We hope that these indicators serve as a tool for all critical professionals and depa rtments that consider quality essential in the care of critical patients.

SEMICYUC Board of Directors
María Cruz Martín Delgado (Coordinator)
Madrid, May 2017

# INTRODUCTION

## CONCEPTS AND EVOLUTION OF QUALITY IMPROVEMENT

The improvement of the quality of healthcare has been a major concern for healthcare professionals for many years, if not from the inception of the medical professional itself. We have long strived for excellence, albeit not always through specific and recognized methodologies.

The development of instruments that enable quality to be measured has been essential in the transformation of this concern into a way of working. Once it became possible to measure the level of quality, the focus shifted from quality control to quality assurance. Later, from the 1990s, we have progressed toward total quality systems.

Nevertheless, this evolution has not always followed a precise chronological order; rather, different phases have overlapped and coincided. As in many other areas, when we discuss quality of care we must bear in mind that classification is useful in that it helps us to situat e ourselves at a theoretical level and to understand the order of events, although they do not always precisely describe a fact or real situation.

As the concept of health itself has evolved, the focus has shifted from the most basic approaches grounded in the individual relationship between the physician and the patient to more general approaches that include not only the totality of services provided by healthcare professionals but that have also incorporated care of the entire community and by extension the concepts of efficiency and equity in the distribution of healthcare resources and the ethics of decision making.

The first documented events in the history of the assessment of the quality of care date to the second half of the 19th century, when Florence Nightingale studied the mortality rates of military hospitals during the Crimean war.

Another forerunner in this field was Ernest Codman, cofounder of the American College of Surgeons, who in 1912 developed a method in the United States that allowed the outcomes of surgical intervention to be measured and classified.

Another well-known reference is the definition of the “Minimum Standard” by the American College of Surgeons in 1918, which specified the minimum standards that hospitals needed to fulfill and laid the foundation for the system of accreditation in the United States.

Another noteworthy event was the creation of the Joint Commission on the Accreditation of Hospitals (JCAH) in 1951. Comprised of a consortium of American professional colleges, the JCAH first undertook to accredit those hospitals that voluntarily applied for accreditation and met pre-established standards of quality. Throughout its evolution, the JCAH has promoted the development of different methodologies in the area of quality and has extended their scope to include other types of healthcare centers; for this reason, the organization changed its name and is currently called the Joint Commission on Accreditation of Healthcare Organizations (JCAHO).

One important development in methodology in the 1950s was the formulation of the medical audit, a new method for evaluating quality, by Paul Lembcke a surgeon at Johns Hopkins University School of Medicine. Lembcke, deeply concerned about the variability in outcomes observed in his daily practice, established what would lead to explicit criteria to enable comparison among centers and professionals and a systematic approach to data collection that included verification and study design.

Later, the establishment of federal programs to provide healthcare to the elderly (MEDICARE in 1965) and to the economically disadvantaged (MEDICAID in 1966) with the stipulation that these programs would only recognize hospitals with JCAHO accreditation represented another step forward.

The work done by J. Williamson in the 1970s also deserves mention. Williamson introduced a new methodology based on the concept of "achievable benefit not achieved" (ABNA), which measures the difference between the standards of diagnosis and treatment considered desirable and that actually achieved, measured through reviewing clinical histories and patients' conditions as well as through questionnaires in which patients themselves report their condition. Williamson carried out part of his work in primary care (hypertension, etc.), establishing the "desirable results" of care and placing special emphasis on the improvement of the quality obtained after it was evaluated. This marked the beginning of the stage of quality assurance, after the earlier stage that was more focused on evaluation than on improvement.

However, R. Brook is without a doubt one of the authors that has had the greatest impact on the change in perspective toward quality assurance. Brook established long-term follow-up of patients and showed the low correlation between the healthcare process and outcomes. Brook's studies led to the development of methods to establish the appropriateness of procedures, one of the most interesting contributions, as they brought about the hypothesis that enab led variability to be explained (payment systems, training of professionals, etc.) and the way to approach this variability from the viewpoint of studies on quality.

This brief historical review would not be complete without mentioning Professor Avedis Donabedian, who has undertaken numerous studies and helped to rethink the concepts of quality in healthcare -- from the classification of methods of quality assessment in structure, process and outcome in 1966 to reflection about the impact of the industrial model of quality on the healthcare model in 1992. His contributions, both theoretical and practical, have been invaluable for those professionals working to improve the quality of care.

Like Donabedian, Heather Palmer has been instrumental in defining the dimensions of quality that have had a decisive influence on the conceptualization of this discipline.

## PRACTICAL EXPERIENCES

The practical application of theoretical formulations on quality in healthcare has taken place in many countries around the world. Apart from the United States, noteworthy experiences have taken place in Canada, Australia, the Netherlands, the United Kingdom, Portugal, Italy, France, Mexico, Argentina…and also here in Spain.

The Spanish experience begins in 1982 with the implementation of the first Quality Program in the Hospital de la Santa Creu i Sant Pau in Barcelona, although some important initiative s had preceded this on a less systematic, smaller scale.

From this first experience, the subject of quality was progressively introduced in other hospitals, as well as at other levels of healthcare, such as primary care, social -healthcare, and mental health. In Spain, two noteworthy projects are the creation of the Spanish Society for Quality in 1984 and, at the level of primary care, the development of the "Programa Ibérico" together with Portugal that enabled the implementation of improvement programs in over 300 centers by combining strategies for training, incentives, and follow-up.

Also noteworthy is the contribution of the Avedis Donabedian Foundation, whose basic mission since its creation in 1990 has been to collaborate with professionals and healthcare centers, public administrations, professional associations, and other public and private institutions in the healthcare sector with the aim of improving the quality of care.
The consolidation of the methodology of bioethics also represents an important advance that will influence the field of quality by redefining the criteria for good practice in many circumstances.

On the other hand, the public administrations, both of the Spanish central government with the "General Healthcare Law" of 1986 and the governments of Spain's Autonomous Communities with various laws and ordinances in their regions, have also promoted and favored the implementation of quality assessment and improvement programs throughout the different levels of healthcare.

## EXPERIENCES WITH IN DICATORS

During the 1980s, the JCAHO required all centers applying for accreditation to have integrated quality plans for the entire center. This requirement initially met with strong opposition, leading to the establishment in 1986 of a standard that implemented systems for monitoring quality of care and its methodological development.

These systems for monitoring quality are conceived as an overall evaluation of an entire department and not only of the areas in which problems might be detected. In order to apply them, the type of care performed by a particular department or center must be defined by a process of dimensioning, the main work areas need to be established, and indicators that enable them to be measured must be created. These indicators are assessed pe riodically and provide an overview of the quality of care in a department as well as enable action to be taken when necessary. They were applied basically to the evaluation of different specialties and less intensely at the level of entire centers.

The JCAHO started to develop a system of outcome indicators integrated into the accreditation system, and these allowed different service providers to be compared. To this end, an ambitious project was undertaken to develop indicators and this continued through the mid-1990s.

The JCAHO's strategy along these lines had limited success due to the appearance of other systems of indicators on a nationwide level in the United States. The JCAHO currently employs its own system of indicators called ORYX, which is revised and updated periodically, with a total of 52 indicators in 2004. Other countries, especially Australia, have, through their own scientific societies, also advanced greatly in the development of outcome indicators that allow different centers to be compared.

In 1990, the University Hospital Consortium, comprising over 50 university hospitals located throughout the United States, developed a compendium of clinical indicators that encompassed most medical specialties and that included nearly 100 indicators in gynecology and obstetrics, elaborated by a committee of experts and used by all members of the Consortium.

In 1991, "Monitoring with Indicators" was published by J.G. Caroll, and this influential work has since been updated several times.

In 1995 the Australian Council of Healthcare Standards introduced clinical indicators for intensive care units elaborated by the Australian and New Zealand Intensive Care Society into its assessment program.

Other experiences closer to home that have resulted from initiatives by scientific societies in Spain are:

a) 1993: Catalan Society of Family and Community Medicine with the publication of "Criteria for Quality in Primary Healthcare", which contains a list of quality indicators for different work areas of primary care.
b) 1999: The Spanish Society of Gynecologists and Obstetricians with Quality of Care Indicators for Gynecology and Obstetrics, covering all areas of these specialties.
c) 2001: Catalan Society of Emergency Medicine with the project "Emergency Departments: Indicators for Measuring the Quality of Care", financed by the Agency for the Evaluation of Medical Technology and Research and embraced by the Spanish Society of Emergency Medicine.
d) 2003: Spanish Society for Pediatric Emergencies, with the adaptation of the 2001 general emergency indicators to the pediatric area.
e) 2003: Spanish Society for Palliative Care Medicine (SECPAL), with Quality Indicators for Palliative Care.
f) 2006: Development of the process and outcome indicators to evaluate clinical practice in oncology.
g) 2010: GEDISA's indicators of the quality of care of persons infected with HIV/AIDS.

# METHODOLOGY FOR EVALUATION AND IMPROVEMENT OF QUALITY: "MONTIORING SYSTEMS"

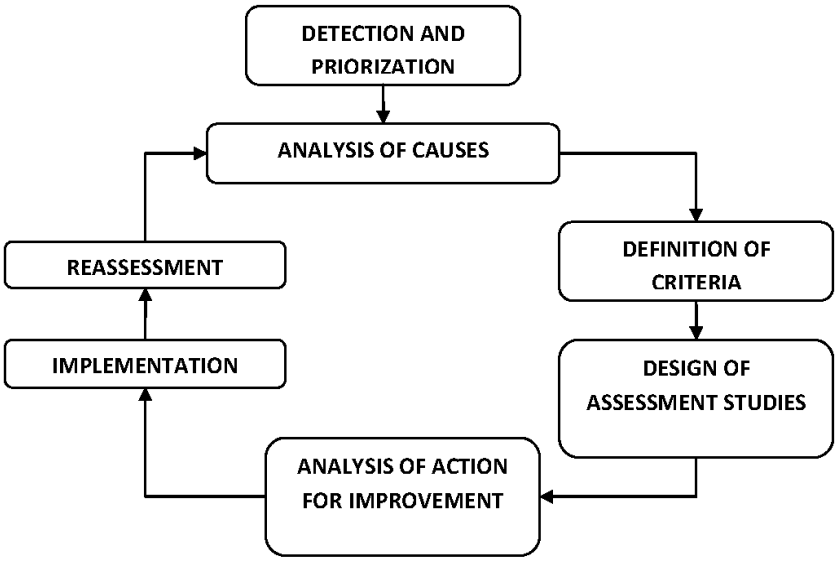
There are two basic approaches to the evaluation and improvement of the quality of care.

a. The first is the so-called "**room for improvement**" model, which begins with the identification of problems, followed by their analysis and proposals for improvement, conceptually based on W. Edwards Deming's cycle of evaluation and improvement, better known as PDCA (Plan, Do, Check, Act), adapted by Header Palmer (Figure 1).
b. The second is the "**monitoring systems**" approach, used to detect problems and periodically evaluate performance, the fundamental element of which is the "INDICATOR".

When we work with the "room for improvement" model we try to answer the question: What could we or what should we improve? By contrast, the underlying question of the "monitoring systems" approach is: of everything that we do, what is most important and how can we assure that we are doing it well enough?

In any case, these approaches are complementary and it is common to work with both of them in parallel. Monitoring systems can be viewed as a way to seek opportunities for improvement: whenever the results of monitoring do not meet the expected standard, we detect an opportunity for improvement and enter the PDCA cycle.

Figure 1.




## MONITORING SYSTEMS

A monitoring system periodically measures and evaluates relevant aspects of care by means of quality indicators, which are the basic unit of a monitoring system.

Indicators are, therefore, instruments of measurement that indicate the presence of a phenomenon or event and its intensity.

A monitoring system requires that the type of care performed first be defined by the process of dimensioning, which consists of establishing the principal ca re areas and then elaborating the indicators that will enable the outcome of the healthcare process to be measured.

Monitoring allows us to make sure that “the basics are alright”. This system is based on repeated quantitative measurements. Variations seen in successive results for an indicator cannot be interpreted directly: these variations might be random, in which case we refer to them as endogenous or systemic causes, or they might be caused by aspects related to people, professionals, organization, environment, etc., in which case we refer to them as exogenous or extrasystemic causes. The latter are what show us those aspects on which we need to work to improve the quality of care delivered.

In any case, the final objective in monitoring is to identify problems, situations that can potentially be improved, or deviations from the standard, and indicators serve to call our attention to this problem or sound an alarm to warn us of this possibility.

We could say that an indicator is a criterion for quality, albeit a very specific one, and therefore all of the conditions and characteristics recommended for the construction of criteria (acceptable, comprehensible, relevant, measurable, etc.) apply to indicators. Likewise, we speak of indicators as applying to structure, process, and outcome depending on the area of evaluation.

Given that an indicator is an instrument of measurement that is used systematically and that its result will be used in managing quality, it is essential to ensure that it reflects reality and is useful. To this end, all indicators must comprise the following three characteristics or properties:

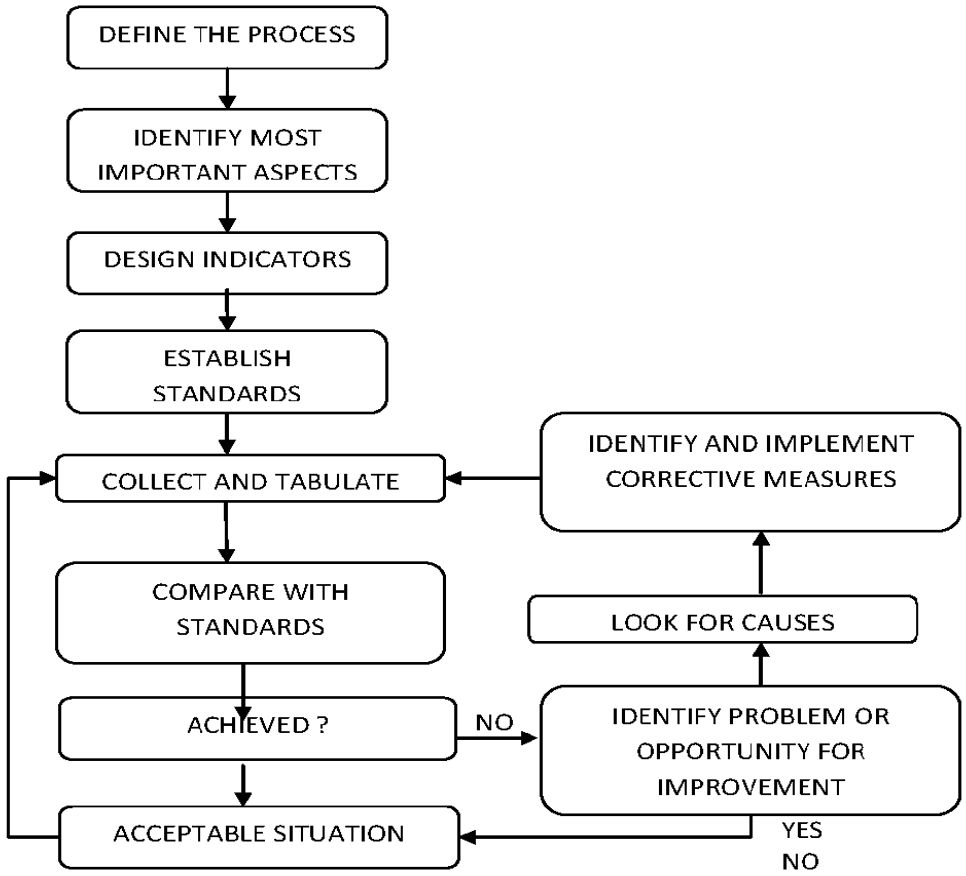
1. Validity: An indicator is valid when it fulfills the aim of identifying situations in which quality of care can be improved. We also speak of face validity as the extent to which an indicator is intelligible. Can its meaning and importance be understood without long, drawn-out explanations?

2. Sensitivity: When it detects ALL cases in which a real situation or problem with quality of care occurs.

3. Specificity: When it detects ONLY those cases in which there are problems related to quality of care.

These aspects must be taken into consideration when constructing indicators. Only those with the highest level of validity, sensitivity, and specificity should be chosen.
The steps involved in designing a monitoring system are shown in Figure 2.

Figure 2.




**DEFINE THE PROCESS**. This consists of specifying the area of care to be monitored. Activities, professionals, structures, circuits, etc. involved in the process should be specified. This will guarantee that no important aspect that can be improved will be ignored. When dealing with a department, it corresponds to the dimensioning phase that aims to provide a complete map of the department itself. If the starting point is the improvement cycle, the process is already defined in the improvement cycle itself.

**IDENTIFY THE MOST IMPORTANT ASPECTS**. This is a matter of prioritizing the most important aspects related to the previously defined process or processes. Different criteria can be used for prioritization, e.g.:

- Number of users or patients affected
- Risk for the patient involved in the process
- Activity identified as problematic

**DESIGN THE INDICATORS AND ESTABLISH STANDARDS**. The quality indicator is a quantitative measure used as a guide to control and evaluate the quality of the most important aspects of care. Its design should include a description of the different aspects that ensure its validity and reliability. Table 1 provides a brief description of these aspects, and a more complete definition is found in Section 5.

Table 1

| SECTION | DEFINITION |
|---|---|
| Dimension | Important aspect of care assessed by the indicator |
| Justification | Usefulness of the indicator as a measurement of quality, related to its validity, i.e. does what we aim to measure make sense? |
| Formula | Mathematical expression |
| Explanation of terms | Definition of the terms in the formula that might be ambiguous |
| Population | Identification of the unit of study |
| Type | Structure, process, or outcome |
| Source of data | Origin and sequence of data obtainment |
| Standard | Desired level of fulfillment of the indicator |
| Commentaries | Includes reflections concerning validity and bibliographic references |

**BEGIN SYSTEMATIC MEASUREMENT** with collection and tabulation of results. The periodicity of measurement, which can vary in function of the type of event, its incidence, or the degree of interest for the organization and the accessibility of the information, should be decided on prior to beginning. Measurement normally takes place monthly or annually, and this will provide an estimation of the degree of fulfillment of the indicator.

**COMPARE WITH PREVIOUSLY ESTABLISHED STANDARDS**. Results should be compared with the reference standard as well as with prior measurements for this indicator. In the first case, substandard situations (i.e. when performance is below the minimum required) will be identified, and in the second case we can evaluate the evolution of the behavior of the indicator over time.

**INTERPRETATION OF RESULTS**. When the result of a comparison reveals a substandard situation or a worsening of results, this should be considered a call for attention or an alarm. As stated above, we must consider whether the cause is random (systemic or endogenous cause) or whether we face a problem or situation that can be improved (extrasystemic or exogenous cause), in which case it will be necessary to take action.

Sometimes the action to be taken is clear and obvious, but at other times it will be necessary to begin the steps of the cycle of evaluation again if the causes of the problem are unknown. This is the point where the monitoring system is complemented by the evaluation cycle to obtain the results expected for a quality evaluation and improvement program.

Once the causes have been identified and the actions proposed for improving quality have been implemented, systematic measurement of the indicator continues and we observe whether the desired improvements have been accomplished. In this case, we say that we have the indicator “under control” again.

# QUALITY INDICATORS IN CRITICALLY ILL PATIENTS

## OBJECTIVES

The main objective of this project is to provide healthcare professionals and managers with instruments to analyze the appropriateness of care for critically ill patients. To this end, we have used the document "Quality indicators in critically ill patients" elaborated by the SEMICYUC in collaboration with the Avedis Donabedian Foundation in 2005.

**Specific objectives:**

1. To identify important aspects of clinical practice in relation to critically ill patients in different healthcare environments.
2. To develop up-to-date evidence-based indicators related to structure, process, and outcome covering the different dimensions that make up the concept of quality of care.
3. To select fundamental or especially important indicators that can be applied in most crit ical care departments regardless of the level of complexity of the hospital and the specific conditions that it treats.

## METHODOLOGY OF ELABORATION (2005 VERSION)

Given that the current project is based on the document "Quality indicators in critically ill patients" elaborated in 2005, we give a brief explanation of the methodology used in the original project.

Creation of the work group. The quality indicators presented in the 2005 version were elaborated by a large group of professionals belonging to the SEMICYUC; all of the Society's work groups were represented, and the Avedis Donabedian Foundation oversaw and coordinated this project. The SEMICYUC invited these professionals to participate in the project because of their accredited knowledge and experience in specific areas of critical care. Initially, a single representative from each of the Society's work groups was recruited, but eventually many other members contributed their expertise on specific issues or were involved as consultants. Once the work group was formed and the objectives of the project defined, a training workshop was held to reach a consensus on the system of working and to ensure unity of concepts.

This project was put together in 12 successive meetings that took place over a 19-month period in which the participant's prior work performed individually was integrated and a consensus reached. Method of working. The project was carried out according to the above-described (Section 4) methodology. Each of the Society's work groups chose those aspects that they considered to be of fundamental importance.

Each group elaborated different indicators that dealt with the distinct aspects of the process and dimension of quality. After consultation among groups in the different work sessions, a consensus was reached regarding which indicators best fulfilled the conditions of validity, sensitivity, and specificity.

When the first draft was finished, it was submitted for review to a group of 16 critical care professionals who had not taken part in the previous process of design and who were therefore not influenced by the evaluations and opinions of the members of the work group. The different proposals were considered and discussed by the work group, who then decided whether or not to incorporate them into the definitive text. This final version was approved in April 2005 and includes a total of 120 indicators.

Of the 120 definitive indicators, the work group reached a consensus as to the 20 most important or fundamental for the specialty, which the SEMICYUC considers recommends should be applied in all critical care departments.

## METHODOLOGY FOR THE 2011 UPDATE

Once the SEMICYUC's Board of Directors considered it necessary to update the document "Quality indicators in critically ill patients", a group of 5 experts was assigned to coordinate the project. As in the first version, it was considered important to involve all the SEMICYUC's and SEEIUC's work groups. The project was carried out over a 24-month period from March 2009 through February 2011.

The strategy to achieve the objectives of the project was based on three fundamental pillars: Review of the SEMICYUC's 2005 document "Quality indicators in critically ill patients"

The Coordinating Group asked the SEMICYUC's and SEEIUC's different work groups to review the indicators developed in 2005, taking into evidence the current scientific evidence. The work groups were encouraged to include all their active members. In the first phase, the groups were asked to classify each of the indicator's as requiring:

a. Minor revision: apart from updating the bibliographic references, the indicator remains interesting and does not require substantial changes apart from updating the bibliographic references
b. Major revision: apart from updating the bibliographic references, some of the sections of the indicator require substantial changes.
c. Elimination: the indicator is no longer interesting
d. Work groups were also asked to propose new indicators where necessary, taking into account the characteristics of validity, sensitivity, and specificity.

For all the above, work groups were asked to explain the reasons underlying their decisions and to supply references from the literature to support them.

**1. Search for scientific evidence**

Working independently, the coordinating group thoroughly reviewed the literature for each of the indicators included in the 2005 version by systematically searching the PubMed /MEDLINE, EMBASE, and Cochrane Library databases for materials included from January 2005 through February 2011. A keyword associated with other terms was used to delimit the results for each indicator. The abstract for each result was analyzed, and the entire article was reviewed if the abstract indicated it might be relevant to the objectives of the project.

The coordinating group's literature review was compared with the review carried out by the work group.

**2. Expert consensus**

After the work groups' proposals and the various rounds of work conducted electronically between each work group's representative and the coordinating group, the first draft of the new document was elaborated.

Each member or the coordinating group assessed the draft independently. Then each of the proposals was considered in four meetings, where members discussed it and decided whether to incorporate it into the definitive text. Decisions were taken by consensus; proposals for which there were significant discrepancies were sent back to the work groups. The final version, with a total of 120 indicators, was approved in March 2011.

The coordinating group then used the Delphi method to establish a consensus about the 20

indicators that should be considered fundamental and applied in all critical care departments, regardless of the complexity of the hospital or the type of conditions treated. In the previous version, the team considered including in this group some indicators for specific conditions that, although not treated by all critical care departments, are very common and relevant because intensivists might treat them in the emergency department. And finally some of the indicators were classified as fundamental because compliance with them is still very far the established standards and the scientific evidence and expert consensus suggest an improvement is necessary in the short term. On the other hand, some very important indicators were not classified as fundamental because compliance with them is already very high.

## METHODOLOGY 2017 UPDATE

The methodology used in the most recent update is similar to that used in the 2011 update. A coordinating group of 8 experts was created and all of the SEMICYUC's and SEEIUC's work groups collaborated. From October 2015 through May 2017, the team reviewed and revised the 2011 document to bring it up to date.

The main changes with respect to earlier versions are that the quality indicators included in the nursing sections have been distributed among the corresponding work groups' blocks and a specific section has been created for patient safety indicators.

The strategy followed to obtain the objectives was based on three fundamental pillars: Review of the SEMICYUC's 2005 document "Quality indicators in critically ill patients"

The coordinating group asked the SEMICYUC's and SEEIUC's different work groups to review the revised indicators from the 2011 update, taking into evidence the current scientific evidence. The work groups were encouraged to include all their active members. In the first phase, the groups were asked to classify each of the indicator's as requiring:

a. Minor revision: apart from updating the bibliographic references, the indicator remains interesting and does not require substantial changes apart from updating the bibliographic references
b. Major revision: apart from updating the bibliographic references, some of the sectionsof the indicator require substantial changes.
c. Elimination: the indicator is no longer interesting
d. Work groups were also asked to propose new indicators where necessary, taking into account the characteristics of validity, sensitivity, and specificity.

   For all the above, work groups were asked to explain the reasons underlying their decisions and to supply references from the literature to support them.

Work groups were also asked to decide whether the indicator could be automatically collected by clinical information systems.

### 1. Search for scientific evidence

Working independently, the coordinating group thoroughly reviewed the literature for each of the indicators included in the 2011 version by systematically searching the PubMed /MEDLINE, EMBASE, and Cochrane Library databases for materials included from October 2015 through February 2017. A keyword associated with other terms was used to delimit the results for each indicator. The abstract for each result was analyzed, and the entire article was reviewed if the abstract indicated it might be relevant to the objectives of the project.

The coordinating group's literature review was compared with the review carried out by the work

group.

**2. Expert consensus**

After the work groups' proposals and the various rounds of work conducted electronically between each work group's representative and the coordinating group, the first draft of the new document was elaborated.

Each member of the coordinating group assessed the draft independently. Then each of the proposals was considered in two meetings, where members discussed it and decided whether to incorporate it into the definitive text. Decisions were taken by consensus; proposals for which there were significant discrepancies were sent back to the work groups. The final version, with a total of 140 indicators, was approved in May 2017.

The coordinating group then used the Delphi method to establish a consensus about the 25 indicators that should be considered fundamental and applied in all critical care departments, regardless of the complexity of the hospital or the type of conditions treated.

Once again, the newly revised version cannot be considered definitive: it will surely need to be reviewed and revised in the future as clinical practice and scientific evidence evolve.

## PRACTICAL APPLICATION OF THE PROPOSED MONITORING SYSTEM

Indicators are instruments for the improvement of quality and as such monitoring them should never be considered an end in and of itself. In other words, the measuring stage is necessary and sometimes essential to determine the level of the quality of care, but it is merely a means to an end: It enables us to take action to improve the weak points in the system and to select the most effective course of action, but measuring is never the final objective.

Having a set of indicators like the one presented here streamlines complicated processes involved in continual improvement, such as determining which aspects of care are fundamental and designing the instruments to measure them, and, above all, providing a point of reference (standard) with which to compare our practice.

The indicators are presented here in the same order as the Society's work groups, making it easy for them to be identified and for each department or professional to choose the ones th at seem most appropriate for their professional practice.

This is a large set of indicators, and it does not seem realistic or practical for any department to monitor all of them. Nevertheless, the authors considered it useful to elaborate and present a sufficient number of indicators to cover the most important aspects of all of the activities carried out within the specialty, leaving the choice of which ones to monitor systematically to each critical care department. We recommend monitoring a limited number of indicators at first and bearing in mind that a monitoring system is a commitment to both measurement and periodic evaluation of the results obtained.

As a general guideline, the following criteria might be useful in helping each department choose which indicators to employ:

- Variability in the healthcare practice within the department
- Known weak points
- Basic aspects of care

- Possibility of risks
- Existence of valid and reliable sources of information
- Possibility to generate results automatically.

It is not advisable to incorporate too many indicators at first, as this would make it difficult to follow them. Moreover, it is important to remember that it may at times be necessary to quantify the data manually, depending on the information technology implemented, and that this will require time and professional resources that may be unavailable in the early stages.

Another advantage of the progressive incorporation of indicators as the informatics system improves is that the team gains valuable experience in their use.

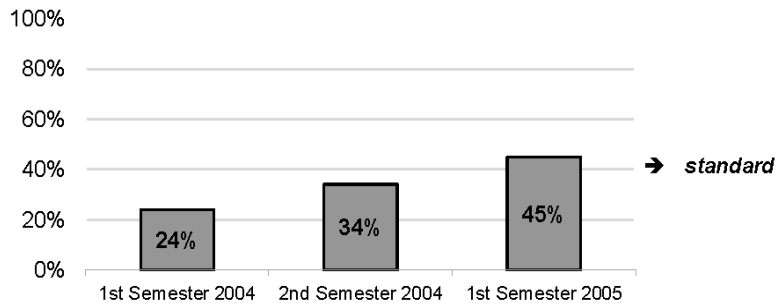
This approach also allows more and more professionals to become involved with the quality improvement program.

One possible option is to begin monitoring those indicators considered "fundamental" by the work groups. In a manner of speaking, these indicators represent not only those points that should be done properly, but also those for which it is essential to know the quality of care.
From the organizational point of view, it is convenient to assign the responsibility for monitoring the indicator or indicators for a particular process to a specific professional, usually a staff physician. The overall responsibility obviously falls always on the chief of the department, and he or she will distribute the responsibilities for monitoring the different indicators chosen among the staff.

This is usually done when the department elaborates its planning calendar, and the monitoring of indicators is incorporated as another objective for quality.

The person responsible for each indicator will verify the reliability of the source of data and will follow up the results at the established periodicity and report them to the rest of the department. It is helpful to present the results in the form of a graph that allows the evolution of the indicator over time and its relation to the standard of reference to be easily observed.

The following example shows the presentation of the results of the evolution of an indicator whose standard is 40%.




When the results are substandard or worsening, the person responsible for the indicator should propose the most appropriate course of action: this might entail direct measures to improve quality or it might be necessary to carry out a study to determine the causes of the poor results.

Actions should be well defined and planned, and a calendar for the individuals in charge of performing the proposed tasks should be elaborated.

| ACTIONS PROPOSED | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Monitoring the results of the indicator before and after the actions taken for improvement will show to what extent these measures have been effective.

It bears reminding that the adoption of a monitoring system using indicators implies the commitment of the entire department to act when the practice evaluated shows substandard results; the causes must be investigated and action taken to improve the quality of care. Otherwise, measurement becomes a meaningless routine that is useless for the clinical management of the department.

**USE OF THE PROPOSED INDICATORS**

This section aims to provide a more detailed definition of the components of the indicators and how to use them to measure healthcare practice.

**Dimension**: Characteristic or attribute of healthcare quality examined by means of this indicator.

**Justification**: Usefulness of the indicator as a measurement of quality. This is related to validity, i.e. does what we are measuring make sense? Will it help to identify areas that need to be improved?

**Formula**: Mathematical expression that reflects the results of the measurement; although often expressed as a percentage, it can also be expressed as a mean or an absolute frequency.

**Explanation of terms**: Definition of those aspects of the indicator expressed in the formula that might be ambiguous or open to various interpretations; for example, if an indicator mentions administering prophylaxis for gastrointestinal bleeding, the drugs to be used to achieve it are specified.

**Population**: Description of the unit of study that will be the object of measurement. It can refer to patients, examinations, visits, diagnoses, etc. Occasionally, it will be necessary to introduce exclusion criteria for the population thus defined. For instance, if we want to know how many patients with acute coronary syndrome and elevated ST segments (STEMI) have undergone early reperfusion, it will obviously be necessary to exclude patients with STEMI with indications to withhold life support

On the other hand, when quantifying the indicator, it is not always necessary or practical to carry out the measurement over the entire population defined during the entire period of the study (annual, biannual, etc.); in these cases a **sample** is reviewed.

This may be the case for indicators that describe the level of compliance with informed consent policies, early treatment of cardiovascular dysfunction, assessment of nutritional status, etc. In these cases it is not necessary to verify informed consent for each and every transfusion or technique performed; rather this can be done on a sample. In order to choose a sample, it is necessary to take into account the number of units necessary (size) and to ensure that the selection is random for the result to be considered representative of the entire population. If the sample is

collected appropriately, the value of the indicator will apply to the entire population. For some indicators, specific recommendations are provided for quantification using a sample, whether by selecting cases randomly or selecting sampling days. In the latter case, all of the cases produced on the sampling day will be included and care should be taken to include all days of the week.

**Type**: This refers to the classification of the indicator according to the focus of the evaluation, with three possibilities:

- Structure: used for indicators that measure aspects related to technological, organizational, or human resources necessary for care, as well as to the availability of protocols
- Process: used for indicators that evaluate the way in which care is delivered with the resources available, protocols, and scientific evidence
- Outcome: used for indicators that measure the consequences of the healthcare process, expressed in terms of complications, mortality, missed opportunities, failed circuits, quality of life, etc.

**Source of data**: Defines the origin of data and the sequence of data obtainment necessary to enable the indicator to be quantified. This is an important aspect, as the level of information management and processing will be different at each center, and this might determine whether or not it is possible to measure the indicator.

In this project, the concrete specifications for this section have been omitted, normally with a reference to the patient's clinical records, as information management and processing will be different at each center.

**Standard**: This reflects the desired level to be met for an indicator. It is not always easy to establish a standard, given the variability in the scientific evidence and reference sources consulted. In this project, the team of authors has made an effort to synthesize different information from diverse sources and has reached a consensus regarding the standard for each indicator with the idea that, rather than reflect the results of common practice, the standard should represent the level of good practice that should be expected in light of the scientific evidence while being, at the same time, achievable with the available resources.

In some cases the standard has been set at 100% or 0% when it is a matter of ensuring that the fundamentals are realized.

**Commentaries**: This section is reserved for reflections on the validity of the indicator or pointing out possible factors that might cause confusion that should be taken into account when interpreting the results. It also incorporates the most important bibliographic references consulted for the elaboration of the indicator and setting the standard.

# LIST OF INDICATORS

THOSE CONSIDERED FUNDAMENTAL ARE IN RED

## CARDIAC CARE AND CPR

1. Early administration of acetylsalicylic acid in acute coronary syndrome
2. Early administration of beta-blockers in acute myocardial infarction
3. Risk stratification in acute coronary syndrome
4. Urgent invasive strategy in unstable non-ST-elevation myocardial infarction
5. Reperfusion techniques in ST-elevation myocardial infarction
6. Door-needle (thrombolysis) time in ST-elevation myocardial infarction
7. Door-balloon time in primary percutaneous coronary intervention
8. Hospital mortality in ST-elevation myocardial infarction
9. Temperature control after cardiac arrest
10. Use of the Utstein template
11. Registry of quality indicators in heart surgery
12. Incidence of early complications in the implantation of devices to treat and/or prevent arrhythmias

## ACUTE RESPIRATORY FAILURE

13. Incidence of barotraumas
14. Ventilator circuit change at 7 days
15. Indications for prone positioning in acute respiratory distress syndrome (ARDS)
16. Pressure ulcers in patients in prone position
17. Spontaneous breathing trial
18. Semirecumbent position in patients undergoing invasive mechanical ventilation
19. Changing heat-and-moisture exchangers
20. Self-extubation
21. Unplanned extubation during maneuvers
22. Reintubation
23. Indicating noninvasive ventilation in exacerbations of hypercapnic chronic respiratory failure
24. Skin lesions related with facemasks for noninvasive mechanical ventilation
25. Lung-protective ventilation in acute respiratory distress syndrome (ARDS)
26. Appropriate endotracheal suctioning
27. Endotracheal tube cuff pressure

## NEUROCRITICAL CARE AND TRAUMATOLOGY

28. Severe trauma attended by the critical care department
29. Tracheal intubation in patients with severe traumatic brain injury and Glasgow Coma Score < 9 during the first 24 hours
30. Surgical intervention in traumatic brain injury with subdural hematoma and/or epidural hematoma
31. Monitoring intracranial pressure in patients with severe traumatic brain injury with pathological CT findings
32. Mortality in severe traumatic brain injury
33. Early osteosynthesis in fractures of the femoral diaphysis
34. Early surgical fixation of open fractures
35. Early diagnosis of subarachnoid hemorrhage
36. Administration of nimodipine in subarachnoid hemorrhage
37. ICU-acquired weakness
38. Intravenous fibrinolysis in acute ischemic stroke

39. Door-to-needle time in acute ischemic stroke in candidates for thrombolytic treatment
40. Use of somatosensory evoked potentials in post-anoxic encephalopathy
41. Early control of systolic blood pressure in spontaneous intracerebral hemorrhage

## INFECTIOUS DISEASES

42. Catheter-related bloodstream infections
43. Catheter-related urinary tract infections
44. Ventilator-associated pneumonia
45. Early resuscitation in severe sepsis / septic shock
46. Early antibiotic treatment in sepsis
47. Inappropriate empirical antibiotic treatment for infections treated in the ICU
48. Methicillin-resistant Staphylococcus aureus infections
49. Multiresistant Pseudomonas aeruginosa infections
50. Indications for isolation
51. Blood culture contamination
52. Compliance with hand hygiene measures

## METABOLISM AND NUTRITION

53. Complications of total parenteral nutrition: hyperglycemia
54. Complications of total parenteral nutrition: liver dysfunction
55. Maintaining appropriate blood glucose levels
56. Severe hypoglycemia
57. Identification of patients with nutritional risk
58. Assessment of nutritional status
59. Calorie and protein requirements in critical patients
60. Early enteral nutrition
61. Monitoring enteral nutrition
62. Withdrawing obstructed feeding tubes
63. Appropriate use of parenteral nutrition
64. Refeeding syndrome
65. Prophylaxis against stress ulcers in critical patients receiving enteral nutrition

## NEPHROLOGIC CARE

66. Stratification of acute kidney injury in critical patients
67. Prevention of contrast-induced nephropathy
68. Identification of patients with risk factors for developing acute kidney injury
69. Indication of renal replacement therapy in patients with AKIN Stage 3 acute kidney injury
70. Dynamic dosing during renal replacement therapy
71. Estimation of the glomerular filtration rate through creatinine clearance in critical patients with acute kidney injury
72. Use of dopamine in acute kidney injury

## SEDATION AND ANALGESIA

73. Monitoring sedation
74. Appropriate sedation
75. Considering interruption of sedation daily
76. Monitoring pain in patients who can communicate
77. Monitoring pain in patients who cannot communicate
78. Inappropriate use of neuromuscular blockers

79. Monitoring the use of neuromuscular blockers
80. Monitoring sedation during the use of neuromuscular blockers
81. Identification of delirium
82. Nonpharmacological prevention of delirium
83. Maximum doses of opioids and sedatives

### BLOOD COMPONENTS

84. Informed consent for the transfusion of blood components
85. Inappropriate transfusion of fresh-frozen plasma
86. Inappropriate transfusion of platelet-rich plasma
87. Inappropriate transfusion of packed red blood cells
88. Overtransfusion of packed red blood cells

### TOXICOLOGY

89. Correct indications and methods of digestive decontamination in acute intoxication
90. Minimum stock of antidotes in the critical care department and/or hospital pharmacy
91. Early appropriate renal replacement therapy in acute intoxication
92. Psychiatric assessment in voluntary acute intoxications in suicide attempts
93. Bronchoaspiration of activated charcoal

### TRANSPLANTS

94. Brain dead donors
95. Evaluation of potential organ donors after cardiac death after limiting life support
96. Monitoring potential organ donors
97. Diagnosing brain death

### SAFETY

98. Adverse events during intrahospital transport
99. Checklist in intrahospital transport
100. Management of monitoring alarms
101. Accidental falls
102. Medication errors in the ICU
103. Accidental removal of vascular catheters
104. Crash cart review
105. Using a valid scale to assess the risk of developing pressure ulcers
106. Incidence of pressure ulcers
107. Prevention of venous thromboembolism
108. Unequivocal identification
109. Walkrounds with supervisors

### BIOETHICS

110. Appropriate end-of-life care
111. Information to families of ICU patients
112. Information from nursing staff to patients' families
113. Incorporation of advance directives in decision making
114. Compliance with written informed consent
115. Limiting life support
116. Use of restraints

## PLANNING, ORGANIZATION, AND MANAGEMENT

117. Daily rounds for multidisciplinary teams
118. Patient handoffs
119. Suspension of scheduled surgery
120. Premature or unplanned ICU discharge
121. Delayed discharge from the ICU
122. Delayed admission to the ICU
123. Unscheduled readmission to the ICU
124. Survey about perceived quality on discharge from the ICU
125. Database for minimum ICU dataset
126. Compliance with ICU nursing registries
127. Nursing report at discharge
128. Standardized mortality rate
129. Autopsy rate
130. ICU staff orientation plan
131. Presence of an intensivist in the ICU 24/7
132. System for notification of adverse events
133. Flexible visiting hours
134. Burnout syndrome

## TECHNOLOGY ASSESSMENT AND RESEARCH METHODS

135. Clinical information system
136. Availability of multifunction ultrasonography

## CONTINUING MEDICAL EDUCATION, TEACHING, AND RESEARCH

137. Existence of basic protocols
138. Research activity
139. Scientific publications
140. Continuing medical education

## FUNDAMENTAL INDICATORS

| INDICATOR | Indicator nº | Relevant group or subspecialty |
|---|---|---|
| 1. Reperfusion techniques in ST-elevation myocardial infarction | 5 | Cardiac care |
| 2. Indications for prone positioning in acute respiratory distress syndrome | 15 | Respiratory care |
| 3. Indicating noninvasive ventilation in exacerbations of hypercapnic chronic respiratory failure | 23 | Respiratory care |
| 4. Lung-protective ventilation in acute respiratory distress syndrome | 25 | Respiratory care |
| 5. ICU-acquired weakness | 37 | Neurocritical care and traumatology |
| 6. Catheter-associated bloodstream infections | 42 | Infectious diseases |
| 7. Ventilator-associated pneumonia | 44 | Infectious diseases |
| 8. Early resuscitation in sepsis /septic shock | 45 | Infectious diseases |
| 9. Early antibiotic treatment in sepsis | 46 | Infectious diseases |
| 10. Compliance with hand hygiene measures | 52 | Infectious diseases |
| 11. Maintaining appropriate blood glucose levels | 55 | Metabolism and nutrition |
| 12. Early enteral nutrition | 60 | Metabolism and nutrition |
| 13. Stratification of acute kidney injury in critical patients | 66 | Nephrologic care |
| 14. Appropriate sedation | 74 | Sedation, analgesia and delirium |
| 15. Identification of delirium | 81 | Sedation, analgesia and delirium |
| 16. Inappropriate transfusion of packed red blood cells | 87 | Blood products |
| 17. Brain dead donors | 94 | Transplants |
| 18. Prevention of venous thromboembolism | 107 | Safety |
| 19. Incorporation of advance directives in decision making | 113 | Bioethics |
| 20. Compliance with written informed consent | 114 | Bioethics t |
| 21. Daily rounds for multidisciplinary teams | 117 | Planning, organization, and management |
| 22. Presence of an intensivist in the ICU 24/7 | 131 | Planning, organization, and management |
| 23.System for notification of adverse events | 132 | Planning, organization, and management |
| 24. Flexible visiting hours | 133 | Planning, organization, and management |
| 25. Existence of basic protocols | 137 | Education, teaching, and research |

# THE INDICATORS

## CARDIAC CARE AND CPR

### INDICATOR Nº 1

| | |
|---|---|
| **Indicator** | **EARLY ADMINISTRATION OF ACETYLSALICYLIC ACID (ASA) IN ACUTE CORONARY SYNDROME (ACS)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Administering ASA decreases mortality and reinfarction in patients with ACS, so it is mandatory unless there are contraindications. |
| **Formula** | nº of patients with ACS administered ASA in the first 24 hours<br>---------- x 100<br>nº of patients with ACS discharged from critical care |
| **Explanation of terms** | **24 hours**: time interval from onset of pain to administration of ASA. Administration can take place in the hospital or before arriving at the hospital.<br>**ASA**: non-enteric coated acetylsalicylic acid |
| **Population** | All patients with ACS discharged from critical care during the period reviewed<br>**Exclusion criteria:**<br>• Patients with contraindications for ASA<br>• Patients admitted to critical care > 24 hours after onset |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Electronic prescription. ARIAM Registry |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Authors /Task Force Members, Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti<br>. F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Land- messer U, Mehilli J, Mukherjee D, Storey RF, Windecker S. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST- segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC).Eur Heart J.2015 Aug 29. pii: ehv320<br>. Amsterdam EA, Wenger NK, Brindis RG, Casey DE Jr, Ganiats TG, Holmes DR Jr, Jaffe AS, Jneid H, Kelly RF, Kontos MC, Levine GN, Liebson PR, Mukherjee D, Peterson ED, Sabatine MS, Smalling RW, Zieman SJ; ACC/AHA Task Force Members; Society for Cardiovascular Angiography and Interventions and the Society of Thoracic Surgeons. 2014 AHA/ACC guideline for the management of patients with non- ST-elevation acute coronary syndromes: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014 Dec 23;130(25):2354-94<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Ornato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST- elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan 29;127(4):529-55<br>. Felices-Abad F, Latour-Pérez J, Fuset-Cabanes MP, Ruano-Marco M, Cuñat-de la Hoz J, del Nogal-Sáez F; Grupo Ariam.[Quality indicators in the acute coronary syndrome for the analysis of the pre- and in-hospital care process]. Med Intensiva. 2010 Aug-Sep;34(6):397-417 |

## INDICATOR Nº 2

| | |
|---|---|
| **Indicator** | **ADMINISTRATION OF BETA-BLOCKERS IN ACUTE CORONARY SYNDROME (ACS)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Treatment with beta-blockers (metoprolol succinate, bisoprolol, or carvedilol) is associated with a reduction in the relative risk of progression of ACS to myocardial infarction, although no significant effect on mortality has been demonstrated. The benefit of indefinite treatment with beta-blockers after ST-segment elevation ACS (STE-ACS) and non-ST-segment elevation ACS (NSTE-ACS) is well established. |
| **Formula** | nº of patients with ACS administered beta-blockers during the ICU stay / nº of patients with ACS discharged from the ICU x 100 |
| **Explanation of terms** | **ACS:** Includes both STE-ACS and NSTE-ACS |
| **Population** | All patients with ACS discharged from critical care in the period reviewed<br>**Exclusion criteria**: patients with contraindications for beta-blockers: a) allergy to the drug; b) signs of heart failure, c) evidence of low output, d) increased risk of cardiogenic shock, e) other contraindications ( PR >240 ms, 2nd or 3rd degree atrioventricular block without pacemaker, active asthma, or bronchial hyperreactivity) |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Electronic prescription. ARIAM Registry |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Authors /Task Force Members, Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Land- messer U, Mehilli J, Mukherjee D, Storey RF, Windecker S. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC).Eur Heart J. 2015 Aug 29. pii: ehv320<br>. Amsterdam EA, Wenger NK, Brindis RG, Casey DE Jr, Ganiats TG, Holmes DR Jr, Jaffe AS, Jneid H, Kelly RF, Kontos MC, Levine GN, Liebson PR, Mukherjee D, Peterson ED, Sabatine MS, Smalling RW, Zieman SJ; ACC/AHA Task Force Members; Society for Cardiovascular Angiography and Interventions and the Society of Thoracic Surgeons. 2014 AHA/ACC guideline for the management of patients with non-ST- elevation acute coronary syndromes: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014 Dec 23;130(25):2354-94<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Or- nato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan 29;127(4):529-55 Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology (ESC), Steg PG, James SK, Atar D, Badano LP, Blömstrom- Lundqvist C, Borger MA, Di Mario C, Dickstein K, Ducrocq G, Fernandez-Aviles F, Gershlick AH, Giannuzzi P, Halvorsen S, Huber K, Juni P, Kastrati A, Knuuti J, Lenzen MJ, Mahaffey KW, Valgimigli M, van 't Hof A, Widimsky P, Zahger D. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2012. Oct;33(20):2569-619 |

## INDICATOR Nº 3

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|---|---|
| **Indicator** | **RISK STRATIFICATION IN ACUTE CORONARY SYNDROME (ACS)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Risk stratification in patients with ACS: a) facilitates decision making and enables the correct analysis of mortality; b) is useful in the analysis and interpretation of results, making it possible to detect the underuse of certain treatments in high risk groups; c) facilitates clinical research. |
| **Formula** | nº of patients with ACS classified according to risk<br>---------- x 100<br>nº of patients with ACS discharged from critical care |
| **Explanation of terms** | **Classified according to cardiovascular and hemorrhagic risk**: assignment to a risk group in function of a validated scale. The expanded TIMI score or GRACE is recommended for cardiovascular risk and CRUSADE for hemorrhagic risk. |
| **Population** | All patients with ACS discharged from critical care in the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Authors /Task Force Members, Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Landmes- ser U, Mehilli J, Mukherjee D, Storey RF, Windecker S. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC).Eur Heart J. 2015 Aug 29. pii: ehv320<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Or- nato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan.29;127(4):529-55<br>. Mehran R, Pocock SJ, Nikolsky E, Clayton T, Dangas GD, Kirtane AJ, Parise H, Fahy M, Manoukian SV, Feit F, Ohman ME, Witzenbichler B, Guagliumi G, Lansky AJ, Stone GW. A risk score to predict bleeding in patients with acute coronary syndromes. J Am Coll Cardiol. 2010 Jun. 8;55(23):2556-66<br>. Subherwal S, Bach RG, Chen AY, Gage BF, Rao SV, Newby LK, Wang TY, Gibler WB, Ohman EM, Roe MT, Pollack CV Jr, Peterson ED, Alexander KP. Baseline risk of major bleeding in non- ST- segment-elevation myocardial infarction: the CRUSADE (Can Rapid risk stratification of Unstable angina patients Suppress Adverse outcomes with Early implementation of the ACC/AHA Guidelines) Bleeding Score. Circulation. 2009 Apr 14;119(14):1873-82<br>. Eagle KA, Lim MJ, Dabbous OH, Pieper KS, Goldberg RJ, Van de Werf F, Goodman SG, Granger CB, Steg PG, Gore JM, Budaj A, Avezum A, Flather MD, Fox KA; GRACE Investigators. A validated prediction model for all forms of acute coronary syndrome: estimating the risk of 6-month postdischarge death in an international registry. JAMA. 2004 Jun 9;291(22):2727-33<br>. Antman EM, Cohen M, Bernink PJ, McCabe CH, Horacek T, Papuchis G, Mautner B, Corbalan R, Radley D, Braunwald E. The TIMI risk score for unstable angina/non-ST elevation MI: A method for prognostication and therapeutic decision making. JAMA. 2000 Aug 16;284(7):835-42 |

## INDICATOR Nº 4

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|---|---|
| **Indicator** | **URGENT INVASIVE STRATEGY IN UNSTABLE NON-ST-ELEVATION ACUTE CORONARY SYNDROME (NSTE-ACS)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Coronary angiography should be performed as soon as possible (urgent invasive strategy) in patients with severe unstable NSTE-ACS at admission or later when the complication appears. |
| **Formula** | $\frac{\text{nº of patients with unstable NSTE-ACS treated with urgent invasive strategy}}{\text{nº of patients with unstable NSTE-ACS discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Unstable NSTE-ACS**: severe patient not stabilized with optimal drug therapy who has one or more of the following symptoms:<br>Hemodynamic instability or cardiogenic shock<br>Persistent or recurrent angina<br>Severe rhythm disorders or cardiac arrest<br>Acute heart failure<br>Dynamic changes in the ST segment or recurrent T waves (especially intermittent ST elevation)<br>**Urgent invasive strategy:** invasive procedures indicated and performed within 4 hours of the criteria being fulfilled |
| **Population** | All patients with unstable NSTE-ACS discharged from critical care during the period reviewed<br>E**xclusion criterion**: orders to withhold life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Authors /Task Force Members, Roffi M, Patrono C, Collet JP, Mueller C, Valgimigli M, Andreotti F, Bax JJ, Borger MA, Brotons C, Chew DP, Gencer B, Hasenfuss G, Kjeldsen K, Lancellotti P, Landmesser U, Mehilli J, Mukherjee D, Storey RF, Windecker S. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: Task Force for the Management of Acute Coronary Syndromes in Patients Presenting without Persistent ST-Segment Elevation of the European Society of Cardiology (ESC). Eur Heart J. 2015 Aug 29. pii: ehv320<br>. 2014 ESC/EACTS Guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI). Eur J Cardiothorac Surg. 2014. Oct;46(4):517-92<br>. Felices-Abad F, Latour-Pérez J, Fuset-Cabanes MP, Ruano-Marco M, Cuñat-de la Hoz J, del Nogal- Sáez F; Grupo Ariam.[Quality indicators in the acute coronary syndrome for the analysis of the pre- and in-hospital care process]. Med Intensiva. 2010 Aug-Sep;34(6):397-417<br>. Civeira Murillo E, Del Nogal Saez F, Alvarez Ruiz AP, Ferrero Zorita J, Alcantara AG, Aguado GH, López Messa JB, Montón Rodríguez JA; Workgroup for Cardiac Care and CPR. [The recommendations regarding non-ST segment elevation acute coronary syndrome have been reviewed. SEMICYUC. Spanish Society for Intensive Medicine, Critical Care and Coronary Units]. Med Intensiva. 2010 Jan-Feb;34(1):22-45 |

## INDICATOR Nº 5 (FUNDAMENTAL INDICATOR)

| Indicator | REPERFUSION TECHNIQUES IN ST-ELEVATION ACUTE CORONARY SYNDROME (STE-ACS) |
|---|---|
| **Dimension** | Effectiveness, safety, appropriateness |
| **Justification** | Reperfusion with thrombolytic treatment or primary percutaneous coronary interventions (PCI) reduces the size of the infarct, improves ventricular function, and reduces morbidity and mortality in patients with STE-ACS. |
| **Formula** | nº of patients with STE-ACS who receive reperfusion treatment<br>---------- x 100<br>nº of patients con STE-ACS discharged from critical care |
| **Explanation of terms** | **Indications for reperfusion**: all patients with a history of angina < 12 h and persistent ST-segment elevation or new (suspected) complete left bundle branch block.<br>**Reperfusion treatment**: thrombolytic treatment or primary PCI |
| **Population** | All patients discharged from critical care with a diagnosis of STE-ACS during the study period<br>E**xclusion criteria**: orders to withhold life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | > 90% |
| **Commentaries** | References:<br>. 2014 ESC/EACTS Guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI).Eur J Cardiothorac Surg. 2014 Oct;46(4):517-92<br>. Sinnaeve PR, Armstrong PW, Gershlick AH, Goldstein P, Wilcox R, Lambert Y, Danays T, Soulat L, Halvorsen S, Ortiz FR, Vandenberghe K, Regelin A, Bluhmki E, Bogaerts K, Van de Werf F; STREAM investigators. ST-segment-elevation myocardial infarction patients randomized to a pharmaco-invasive strategy or primary percutaneous coronary intervention: Strategic Reperfusion Early After Myocardial Infarction (STREAM) 1-year mortality follow-up. Circulation. 2014 Sep. 30;130(14):1139-45<br>. Dianati Maleki N, Van de Werf F, Goldstein P, Adgey JA, Lambert Y, Sulimov V, Rosell-Ortiz F, Gershlick AH, Zheng Y, Westerhout CM, Armstrong PW. Aborted myocardial infarction in ST- elevation myocardial infarction: insights from the STrategic Reperfusion Early After Myocardial infarction trial. Heart. 2014 Oct;100(19):1543-9<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Or- nato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan 29;127(4):529-55 |

## INDICATOR Nº 6

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| **Indicator** | **DOOR-NEEDLE TIME (THROMBOLYSIS) IN ST-ELEVATION ACUTE CORONARY SYNDROME (STE-ACS)** |
| **Dimension** | Effectiveness, safety, appropriateness |
| **Justification** | Early administration of thrombolytic treatment in STE-ACS, when indicated, decreases the size of the infarct, improves residual ventricular function, and reduces morbidity and mortality. |
| **Formula** | nº of patients with STE-ACS with thrombolysis indicated and door-needle time ≤ 30 minutes<br>---------- x 100<br>nº of patients with STE-ACS w/ thrombolysis indicated |
| **Explanation of terms** | **Door-needle time:** the interval from entry in the emergency department (door) to the start of thrombolytic treatment (needle)<br>**Indication for thrombolytic treatment**:<br>Time from onset of STE-ACS < 12h, in absence of contraindications for thrombolysis: in hospitals without a catheterization laboratory and in emergency departments outside hospitals: 1) When a delay >120 min from the initial medical contact to balloon inflation is foreseen 2) In cases with early contact with the health system (within 2 h or symptom onset) and delay > 90 min from first medical contact to balloon inflation is foreseen |
| **Population** | All patients with STE-ACS w/ indications for thrombolytic treatment discharged from critical care during the period reviewed. Includes patients administered thrombolysis before hospital admission.<br>**Exclusion criteria**: orders to withhold life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | 100% |
| **Commentaries** | References:<br>. 2014 ESC/EACTS Guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI).Eur J Cardiothorac Surg. 2014 Oct;46(4):517-92<br>. Sinnaeve PR, Armstrong PW, Gershlick AH, Goldstein P, Wilcox R, Lambert Y, Danays T, Soulat L, Halvorsen S, Ortiz FR, Vandenberghe K, Regelin A, Bluhmki E, Bogaerts K, Van de Werf F; STREAM investigators. ST-segment-elevation myocardial infarction patients randomized to a pharmaco-invasive strategy or primary percutaneous coronary intervention: Strategic Reperfusion Early After Myocardial Infarction (STREAM) 1-year mortality follow-up. Circulation. 2014 Sep 30;130(14):1139-45<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Ornato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan 29;127(4):529-55 |

## INDICATOR Nº 7

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| **Indicator** | **DOOR-BALLOON TIME IN PRIMARY PERCUTANEOUS CORONARY INTERVENTION (PCI)** |
| **Dimension** | Effectiveness, safety, appropriateness |
| **Justification** | PCI is the treatment of choice for STE-ACS provided it is done early by an experienced team. Time from first medical contact (FMC) to balloon dilation should be ≤120 minutes and door-to-needle time should be ≤ 90 minutes, especially for patients that arrive at the hospital shortly after the onset of symptoms. |
| **Formula** | $\frac{\text{nº of patients with FMC-balloon time} \leq 120 \text{ minutes or door-balloon time} \leq 90 \text{ minutes*}}{\text{nº of patients with STE-ACS and PCI}} \times 100$ |
| **Explanation of terms** | **FMC-balloon time**: time from first medical contact to balloon inflation during PCI<br>**Door-balloon time**: time from patient's arrival at the hospital to balloon inflation during PCI<br>*≤ 90 minutes: patients with STE-ACS who arrive at the hospital within 2 hours of symptom onset |
| **Population** | All patients with STE-ACS and PCI discharged from critical care during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | 100% |
| **Commentaries** | The optimum time varies with the type of hospital (with or without catheterization laboratory):<br>- Hospital with catheterization laboratory: door-balloon time ≤ 60 min<br>- Hospital without catheterization laboratory: *Preferred times: 1) FMC-balloon ≤ 90 min; 2) If early arrival (≤ 2 h from symptom onset) ≤ 60 min; *Acceptable times: 1) FMC-balloon ≤ 120 min; 2) If early arrival (≤ 2 h from symptom onset) ≤ 90 min<br><br>References:<br>. 2014 ESC/EACTS Guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Asso- ciation of Percutaneous Cardiovascular Interventions (EAPCI).Eur J Cardiothorac Surg. 2014 Oct;46(4):517-92<br>. Sinnaeve PR, Armstrong PW, Gershlick AH, Goldstein P, Wilcox R, Lambert Y, Danays T, Soulat L, Halvorsen S, Ortiz FR, Vandenberghe K, Regelin A, Bluhmki E, Bogaerts K, Van de Werf F; STREAM investigators. ST-segment-elevation myocardial infarction patients randomized to a pharmaco-in- vasive strategy or primary percutaneous coronary intervention: Strategic Reperfusion Early After Myocardial Infarction (STREAM) 1-year mortality follow-up. Circulation. 2014 Sep 30;130(14):1139-45<br>. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, Ettinger SM, Fang JC, Fesmire FM, Franklin BA, Granger CB, Krumholz HM, Linderbaum JA, Morrow DA, Newby LK, Or- nato JP, Ou N, Radford MJ, Tamis-Holland JE, Tommaso JE, Tracy CM, Woo YJ, Zhao DX; CF/AHA Task Force. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013 Jan 29;127(4):529-55 |

## INDICATOR Nº 8

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| **Indicator** | **HOSPITAL MORTALITY IN ACUTE CORONARY SYNDROME (ACS)** |
| **Dimension** | Safety |
| **Justification** | Although mortality in ACS depends on many factors, it is associated with the appropriateness of treatment, so it is considered a quality indicator. |
| **Formula** | a) nº of patients discharged from critical care with main diagnosis of STE-ACS who die / nº of patients discharged from critical care with main diagnosis of STE-ACS x 100<br><br>b) nº of patients discharged from critical care with main diagnosis of NSTE-ACS who die / nº of patients discharged from critical care with main diagnosis of NSTE-ACS x 100 |
| **Explanation of terms** | Patients who die in the hospital, whether in the ICU or on wards after discharge (Hospital mortality) |
| **Population** | a) All patients with a main diagnosis of STE-ACS discharged from the critical care department (to another ward, to their homes, or due to death) during the period reviewed.<br>b) All patients with a main diagnosis of NSTE-ACS discharged from the critical care department (to another ward, to their homes, or due to death) during the period reviewed.<br>**Exclusion criteria:**<br>Patients transferred to other hospitals, (due to difficulties in follow-up)<br>Patients with secondary diagnosis of STE-ACS or NSTE-ACS are not included, because the literature supporting the standard only considers STE-ACS or NSTE-ACS as a main diagnosis. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information systems. ARIAM Registry |
| **Standard** | < 7% (STE-ACS) and < 5.5% (NSTE-ACS); includes patients with cardiac arrest and Killip IV |
| **Commentaries** | References:<br>. SEMICYUC. ARIAM 2013 report<br>. http://www.semicyuc.org/sites/default/files/ariam_2013_web_0.pdf<br>. Hoenig MR, Aroney CN, Scott IA. Early invasive versus conservative strategies for unstable angina and non-ST elevation myocardial infarction in the stent era. Cochrane Database Syst Rev. 2010 Mar 17;(3):CD004815<br>. Manari A, Ortolani P, Guastaroba P, Casella G, Vignali L, Varani E, et al. A. Clinical impact of an inter- hospital transfer strategy in patients with ST-elevation myocardial infarction undergoing primary angioplasty: the Emilia-Romagna ST-segment elevation acute myocardial infarction network. Eur Heart J. 2008 Aug;29(15):1834-42<br>. Eagle KA, Nallamothu BK, Mehta RH, Granger CB, Steg PG, Van de Werf F, et al.; Global Registry of Acute Coronary Events (GRACE) Investigators. Trends in acute reperfusion therapy for ST-segment elevation myocardial infarction from 1999 to 2006: we are getting better but we have got a long way to go. Eur Heart J. 2008 Mar;29(5):609-17<br>. Fox KA, Steg PG, Eagle KA, Goodman SG, Anderson FA Jr, Granger CB, et al.; GRACE Investigators. Decline in rates of death and heart failure in acute coronary syndromes, 1999-2006. JAMA. 2007 May 2;297(17):1892-900 |

## INDICATOR Nº 9

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| **Indicator** | **TEMPERATURE CONTROL AFTER CARDIAC ARREST** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Hyperthermia in the first 48 h after cardiac arrest (CA) is associated with poor prognosis. Induced hypothermia has not proven to improve survival or neurologic outcome, but the latest CPR guidelines (October 2015) strongly recommend maintaining temperature constantly ≤ 36º although the evidence from studies done to date is only moderate. |
| **Formula** | $\frac{\text{nº of patients with CA resuscitated whose temperature is controlled}}{\text{nº of patients with CA resuscitated discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Temperature control**: strict control to maintain temperature constantly ≤ 36º in the first 48h after CA |
| **Population** | All patients with CA after recovery of effective circulation during the period reviewed. Both shockable and non-shockable rhythms are included. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. ARIAM Registry |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Nolan JP, Soar J, Cariou A, Cronberg T, Moulaert VR, Deakin CD, Bottiger BW, Friberg H, Sunde K, Sandroni C. European Resuscitation Council and European Society of Intensive Care Medicine Guidelines for Post-resuscitation Care 2015: Section 5 of the European Resuscitation Council Guidelines for Resuscitation 2015. Resuscitation. 2015 Oct;95:202-22<br>. Winters SA, Wolf KH, Kettinger SA, Seif EK, Jones JS, Bacon-Baguley T. Assessment of risk factors for post-rewarming "rebound hyperthermia" in cardiac arrest patients undergoing therapeutic hypothermia. Resuscitation. 2013 Sep;84(9):1245-9<br>. Diringer MN, Reaven NL, Funk SE, Uman GC. Elevated body temperature independently contributes to increased length of stay in neurologic intensive care unit patients. Crit Care Med. 2004 Jul;32(7):1489-95<br>. Langhelle A, Tyvold SS, Lexow K, Hapnes SA, Sunde K, Steen PA. In-hospital factors associated with improved outcome after out-of-hospital cardiac arrest. A comparison between four regions in Norway. Resuscitation. 2003 Mar;56(3):247-63 |

## INDICATOR Nº 10

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| **Indicator** | **USE OF THE UTSTEIN TEMPLATE** |
| **Dimension** | Appropriateness |
| **Justification** | Data collection after cardiac arrest (CA) enables statistical analysis of in-hospital morbidity and mortality. The Utstein style is a uniform system of data recollection that allows the healthcare response to CA to be known precisely, improved, and compared between centers |
| **Formula** | $\frac{\text{nº of CA alerts with UTSTEIN template correctly completed}}{\text{nº of CA alerts}} \times 100$ |
| **Explanation of terms** | UTSTEIN template correctly completed: all template variables recorded<br>CA alerts: Includes:<br>CA with or without emergency code (EC) activation<br>CA with unjustified EC activation<br>This indicator is only applicable to critical care departments that form part of the hospital's CAresuscitation team |
| **Population** | All CA alerts attended at the hospital during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Hospital records. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Perkins GD, Jacobs IG, Nadkarni VM, Berg RA, Bhanji F, Biarent D, Bossaert LL, Brett SJ, Chamberlain D, de Caen AR, Deakin CD, Finn JC, Gräsner JT, Hazinski MF, Iwami T, Koster RW, Lim SH, Huei-Ming Ma M, McNally BF, Morley PT, Morrison LJ, Monsieurs KG, Montgomery W, Nichol G, Okada K, Eng Hock Ong M, Travers AH, Nolan JP; Utstein Collaborators. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update of the Utstein Resuscitation Registry Templates for Out-of-Hospital Cardiac Arrest: a statement for healthcare professionals from a task force of the International Liaison Committee on Resuscitation (American Heart Association, European Resuscitation Council, Australian and New Zealand Council on Resuscitation, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa, Resuscitation Council of Asia); and the American Heart Association Emergency Cardiovascular Care Committee and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation. Circulation. 2015 Sep 29;132(13):1286-300<br>. Socias Crespí L, Ceniceros Rozalén MI, Rubio Roca P, Martínez Cuellar N, García Sánchez A, Ripoll Vera T, Lesmes Serrano A. [Epidemiological characteristics of out-of-hospital cardiorespiratory arrest recorded by the 061 emergencies system (SAMU) in the Balearic Islands (Spain), 2009-2012]. Med Intensiva. 2015 May;39(4):199-206<br>. Herrera M, López F, González H, Domínguez P, García C, Bocanegra C. [Results of the first year of experience of the cardiopulmonary resuscitation program "Juan Ramón Jiménez" Hospital (Huelva)] Med Intensiva. 2010 Apr;34(3):170-81 |

## INDICATOR Nº 11

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| **Indicator** | **REGISTRY OF QUALITY INDICATORS IN HEART SURGERY** |
| **Dimension** | Safety, effectiveness |
| **Justification** | All units with heart surgery are recommended to have a specific registry for some process and outcome indicators that enable the quality of care to be assessed as well as "benchmarking" with other units. |
| **Formula** | YES/NO |
| **Explanation of terms** | The registry should include, at least, the following indicators:<br>Nº of reinterventions<br>Prolonged mechanical ventilation: > 48 hours<br>Surgical wound infection<br>Perioperative cerebrovascular accidents<br>Perioperative acute myocardial infarction<br>Postoperative low cardiac output syndrome<br>Postoperative renal insufficiency<br>Risk-adjusted hospital mortality |
| **Population** | Patients admitted to the critical care department after scheduled or urgent heart surgery during the period reviewed. |
| **Type** | Structure |
| **Source of data** | Clinical documentation. Hospital records. Clinical information system. Multicenter registries. |
| **Standard** | SI (100%) |
| **Commentaries** | References:<br>. Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015 Oct;100(4):1315-25<br>. Chu D, Chan P, Wei LM, Cook CC, Gleason TG, Morell VO, Badhwar V. The Effect of Comprehensive Society of Thoracic Surgeons Quality Improvement on Outcomes and Failure to Rescue. Ann Thorac Surg. 2015 Dec;100(6):2147-50<br>. Pérez Vela JL, Martín Benítez JC, Carrasco González M, de la Cal López MA, Hinojosa Pérez R, Sagredo Meneses V, del Nogal Saez F; SEMICYUC's Workgroup for Cardiac Care and CPR. [Clinical practice guide for the management of low cardiac output syndrome in the postoperative period of heart surgery]. Med Intensiva. 2012 May;36(4):e1-44<br>. Ferris TG, Torchiana DF. Public release of clinical outcomes data—online CABG report cards. N Engl J Med. 2010 Oct 21;363(17):1593-5<br>. Shroyer AL, McDonald GO, Wagner BD, Johnson R, Schade LM, Bell MR, Grover FL. Improving quality of care in cardiac surgery: evaluating risk factors, processes of care, structures of care, and outcomes. Semin Cardiothorac Vasc Anesth. 2008 Sep;12(3):140-52<br>. Shahian DM, Edwards FH, Ferraris VA, Haan CK, Rich JB, Normand SL, DeLong ER, O'Brien SM, Shewan CM, Dokholyan RS, Peterson ED; Society of Thoracic Surgeons Quality Measurement Task Force. Quality measurement in adult cardiac surgery: part 1--Conceptual framework and measure selection. Ann Thorac Surg. 2007 Apr;83(4 Suppl):S3-12 |

## INDICATOR Nº 12

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| **Indicator** | **INCIDENCE OF EARLY COMPLICATIONS IN THE IMPLANTATION OF DEVICES TO TREAT AND/OR PREVENT ARRHYTHMIAS** |
| **Dimension** | Safety |
| **Justification** | The appearance of complications related with the technique in patients in whom devices to treat and/or prevent arrhythmias are implanted is associated with increased mortality. |
| **Formula** | $\frac{\text{nº of patients with early complications after device implantation}}{\text{nº of patients undergoing device implantation}} \times 100$ |
| **Explanation of terms** | D**evices to treat and/or prevent arrhythmias**: permanent pacemakers, implantable cardioverter defibrillator (ICD), and devices for cardiac resynchronization therapy<br>The following are considered **early complications** (before hospital discharge) :<br>Arterial puncture<br>Chamber perforation<br>Pneumothorax<br>Electrode dislocation<br>Infection is not included because it is generally considered a late complication. |
| **Population** | All patients discharged from critical care after implantation of devices to treat and/or prevent arrhythmias during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Critical care clinical documentation. Clinical information system. MAMI pacemaker register |
| **Standard** | < 2% |
| **Commentaries** | References:<br>. Urra FG, Luque Lezcano AO; Cardiologic Intensive Care and Cardiopulmonary Resuscitation Section of the Spanish Society of Intensive Care Medicine, Critical and Coronary Units (GTCICy RCP-SEMICYUC). MAMI registration report 1996-2010. Cardiol J. 2012;19(6):603-11<br>. Poole JE, Gleva MJ, Mela T, Chung MK, Uslan DZ, Borge R, Gottipaty V, Shinn T, Dan D, Feldman LA, Seide H, Winston SA, Gallagher JJ, Langberg JJ, Mitchell K, Holcomb R; REPLACE Registry Investigators. Complication rates associated with pacemaker or implantable cardioverter-defibrillator generator replacements and upgrade procedures: results from the REPLACE registry. Circulation 2010 Oct 19;122(16):1553-61 |

## ACUTE RESPIRATORY FAILURE

### INDICATOR Nº 13

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|---|---|
| **Indicator** | **INCIDENCE OF BAROTRAUMA** |
| **Dimension** | Safety |
| **Justification** | The appearance of barotrauma in patients on invasive mechanical ventilation (MV) is independently associated with increased risk of death. |
| **Formula** | nº of cases of barotrauma<br>---------- x 1000<br>total days of invasive MV in patients on MV > 12 h |
| **Explanation of terms** | B**arotrauma** is defined as the appearance of at least one of the following findings in relation with MV:<br>interstitial emphysema<br>pneumothorax<br>pneumomediastinum<br>subcutaneous emphysema<br>Barotrauma associated with the placement of a central line or with chest trauma is specifically excluded. |
| **Population** | Days of invasive MV in patients on MV > 12 h during the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | ≤ 0.5 of cases of barotrauma x 1000 days of invasive mechanical ventilation |
| **Commentaries** | References:<br>. Hsu CW, Sun SF, Lee DL, Chu KA, Lin HS. Clinical characteristics, hospital outcome and prognostic factors of patients with ventilator-related pneumothorax. Minerva Anestesiol. 2014 Jan;80(1):29-38<br>. Hsu CW, Sun SF. Iatrogenic pneumothorax related to mechanical ventilation.World J Crit Care Med. 2014 Feb 4;3(1):8-14<br>. Anzueto A, Frutos-Vivar F, Esteban A, Alía I, Brochard L, Stewart T, Benito S, Tobin MJ, Elizalde J, Palizas ç F, David CM, Pimentel J, González M, Soto L, D'Empaire G, Pelosi P. Incidence, risk factors and outcome of barotrauma in mechanically ventilated patients. Intensive Care Med. 2004 Apr;30(4):612-9<br>. Esteban A, Anzueto A, Frutos F, Alía I, Brochard L, Stewart TE, Benito S, Epstein SK, Apezteguía C, Nightingale P, Arroliga AC, Tobin MJ; Mechanical Ventilation International Study Group. Characteristics and outcomes in adult patients receiving mechanical ventilation: a 28-day international study. JAMA. 2002 Jan 16;287(3):345-55 |

## INDICATOR Nº 14

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|---|---|
| **Indicator** | **VENTILATOR CIRCUIT CHANGE AT 7 DAYS** |
| **Dimension** | Safety, efficiency |
| **Justification** | Routine circuit change is not recommended because it is associated with increased ventilator-associated pneumonia and increased costs. Circuits should not be changed more often than once every 7 days except in cases of malfunction or fouling or if the humidifying system is modified. |
| **Formula** | $\frac{\text{nº of circuits used}}{\text{total nº of days mechanical ventilation / 7}} \times 100$ |
| **Explanation of terms** | Day**s of mechanical ventilation / 7**: corresponds to the total number of 7-day blocks of mechanical ventilation |
| **Population** | All patients on mechanical ventilation during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Registry of consumables |
| **Standard** | < 100% |
| **Commentaries** | References:<br>. Quality Plan for the National Health System: Patient safety. March 2011<br>. Available at: http://www.semicyuc.org/sites/default/files/protocolo_nzero.pdf<br>. Han J, Liu Y. Effect of ventilator circuit changes on ventilator-associated pneumonia: a systematic review and meta-analysis. Respir Care. 2010 Apr;55(4):467-74<br>. Kaynar AM, Mathew JJ, Hudlin MM, Gingras DJ, Ritz RH, Jackson MR, Kacmarek RM, Kollef MH. Attitudes of respiratory therapists and nurses about measures to prevent ventilator-associated pneumonia: a multicenter, cross-sectional survey study. Respir Care. 2007 Dec;52(12):1687-94<br>. Branson RD. The ventilator circuit and ventilator-associated pneumonia. Respir Care. 2005 Jun;50(6):774-85 |

## INDICATOR Nº 15 (FUNDAMENTAL INDICATOR)

| Indicator | INDICATIONS FOR PRONE POSITIONING IN ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS) |
|---|---|
| **Dimension** | Effectiveness, safety |
| **Justification** | Prone positioning is associated with improved survival in comparison with supine positioning in patients with ARDS, especially in those who are most hypoxemic; thus, patients should be placed prone early and for a large proportion of time. |
| **Formula** | $\frac{\text{nº of patients with ARDS and indication for prone positioning in prone}}{\text{nº of patients with ARDS and indication for prone positioning}} \times 100$ |
| **Explanation of terms** | **ARDS:** according to the Berlin criteria (1)<br>**Indication for prone** positioning: patients with moderate-severe ARDS<br>**Prone:** early (< 48 h of fulfilling criteria) and prolonged (at least 16 h/day) |
| **Population** | All patients with moderate-severe ARDS during the period reviewed.<br>**Exclusion criteria**: patients with limitations on life support; patients with contraindications for prone positioning (unstable vertebral lesion, intracranial hypertension, severe hemodynamic instability) |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | > 90% |
| **Commentaries** | References:<br>(1) ARDS Definition Task Force, Ranieri VM, Rubenfeld GD, Thompson BT, Ferguson ND, Caldwell E, Fan E, Camporota L, Slutsky AS. Acute respiratory distress syndrome: the Berlin Definition. JAMA.2012 Jun 20;307(23):2526-33<br>. Bloomfield R, Noble DW, Sudlow A. Prone position for acute respiratory failure in adults. Cochrane Database Syst Rev. 2015 Nov 13;(11):CD008095. doi: 10.1002/14651858<br>. Guérin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, Mercier E, Badet M, Mercat A, Baudin O, Clavel M, Chatellier D, Jaber S, Rosselli S, Mancebo J, Sirodot M, Hilbert G, Bengler C, Richecoeur J, Gainnier M, Bayle F, Bourdin G, Leray V, Girard R, Baboi L, Ayzac L; PROSEVA Study Group. Prone positioning in severe acute respiratory distress syndrome. N Engl J Med. 2013 Jun 6;368(23):2159-68<br>. Taccone P, Pesenti A, Latini R, Polli F, Vagginelli F, Mietto C, Caspani L, Raimondi F, Bordone G, Iapichino G, Mancebo J, Guérin C, Ayzac L, Blanch L, Fumagalli R, Tognoni G, Gattinoni L; Prone- Supine II Study Group. Prone positioning in patients with moderate and severe acute respiratory distress syndrome: a randomized controlled trial. JAMA. 2009 Nov 11;302(18):1977-84<br>. Mancebo J, Fernández R, Blanch L, Rialp G, Gordo F, Ferrer M, Rodríguez F, Garro P, Ricart P, Vallverdú I, Gich I, Castaño J, Saura P, Domínguez G, Bonet A, Albert RK. A multicenter trial of prolonged prone ventilation in severe acute respiratory distress syndrome. Am J Respir Crit Care Med. 2006 Jun 1;173(11):1233-9 |

## INDICATOR Nº 16

| | |
|---|---|
| **Indicator** | **PRESSURE ULCERS IN PATIENTS IN PRONE POSITION** |
| **Dimension** | Safety |
| **Justification** | The prone position is associated with better survival compared to the supine position in patients with ARDS. However, prone positioning is associated with a greater frequency of pressure ulcers. |
| **Formula** | $\frac{\text{nº of cases of pressure ulcers in patients with ARDS in prone}}{\text{total nº of days invasive mechanical ventilation in patients with ARDS in prone}} \times 1000$ |
| **Explanation of terms** | **Pressure ulcers:** those associated with prone positioning<br>**ARDS:** according to the Berlin criteria.(1)<br>**IMV**: invasive MV |
| **Population** | All days of invasive mechanical ventilation in patients with ARDS placed in the prone position during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 15 cases of pressure ulcers per 1000 days invasive mechanical ventilation |
| **Commentaries** | References:<br>A1) ARDS Definition Task Force, Ranieri VM, Rubenfeld GD, Thompson BT, Ferguson ND, Caldwell E, Fan E, Camporota L, Slutsky AS. Acute respiratory distress syndrome: the Berlin Definition. JAMA. 2012 Jun 20;307(23):2526-33<br>. Girard R, Baboi L, Ayzac L, Richard JC, Guérin C; Proseva trial group. The impact of patient positioning on pressure ulcers in patients with severe ARDS: results from a multicentre randomised controlled trial on prone positioning. Intensive Care Med. 2014 Mar;40(3):397-403<br>. Guérin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, Mercier E, Badet M, Mercat A, Baudin O, Clavel M, Chatellier D, Jaber S, Rosselli S, Mancebo J, Sirodot M, Hilbert G, Bengler C, Richecoeur J, Gainnier M, Bayle F, Bourdin G, Leray V, Girard R, Baboi L, Ayzac L; PROSEVA Study Group. Prone positioning in severe acute respiratory distress syndrome. N Engl J Med. 2013 Jun 6;368(23):2159-68<br>. Taccone P, Pesenti A, Latini R, Polli F, Vagginelli F, Mietto C, Caspani L, Raimondi F, Bordone G, Iapichino G, Mancebo J, Guérin C, Ayzac L, Blanch L, Fumagalli R, Tognoni G, Gattinoni L; Prone-Supine II Study Group. Prone positioning in patients with moderate and severe acute res- piratory distress syndrome: a randomized controlled trial. JAMA. 2009 Nov 11;302(18):1977-84· Branson RD. The ventilator circuit and ventilator-associated pneumonia. Respir Care. 2005<br>. Mancebo J, Fernández R, Blanch L, Rialp G, Gordo F, Ferrer M, Rodríguez F, Garro P, Ricart P, Vallverdú I, Gich I, Castaño J, Saura P, Domínguez G, Bonet A, Albert RK. A multicenter trial of prolonged prone ventilation in severe acute respiratory distress syndrome. Am J Respir Crit Care Med. 2006 Jun 1;173(11):1233-9<br>. Guerin C, Gaillard S, Lemasson S, Ayzac L, Girard R, Beuret P, Palmier B, Le QV, Sirodot M, Rosselli S, Cadiergue V, Sainty JM, Barbe P, Combourieu E, Debatty D, Rouffineau J, Ezingeard E, Millet O, Guelon D, Rodriguez L, Martin O, Renault A, Sibille JP, Kaidomar M. Effects of systematic prone positioning in hypoxemic acute respiratory failure: a randomized controlled trial. JAMA. 2004 Nov 17;292(19):2379-87 |

## INDICATOR Nº 17

| | |
|---|---|
| **Indicator** | **SPONTANEOUS BREATHING TRIAL** |
| **Dimension** | Safety, efficiency |
| **Justification** | The availability of a protocol for weaning from mechanical ventilation (MV) and conducting daily spontaneous breathing trials in patients undergoing MV significantly shortens the total time under MV and thus reduces the risks associated with MV. |
| **Formula** | nº of patients on invasive MV with daily spontaneous breathing trial<br>---------- x 100<br>nº of patients on invasive MV |
| **Explanation of terms** | **Spontaneous breathing trial**: scheduled attempt at disconnection from the ventilator with any of the following methods:<br>T-tube test<br>7 cm. H2O pressure support ventilation<br>5 cm. H2O continuous positive airway pressure (CPAP)<br>Synchronized intermittent mandatory ventilation (SIMV) is specifically excluded. |
| **Population** | All patients intubated during the period reviewed who meet the following criteria:<br>Resolution of the underlying condition<br>Adequate oxygenation and pH<br>Temperature < 38º C<br>Hemodynamic stability without the need for high doses of vasoactive amines<br>Adequate functioning of the respiratory musculature<br>Absence of metabolic and electrolyte disturbances<br>Absence of delirium and anxiety |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | > 90% |
| **Commentaries** | The authors consider it more practical to measure the indicator using "patients on MV" as the unit of analysis rather than "days of MV" because weaning trials are not usually registered in IT systems, and this approach facilitates the application of the exclusion criteria.<br>We recommend evaluating whether the trial has been performed daily in patients meeting the inclusion criteria (conducting trials on > 80% of days is considered acceptable.<br>References:<br>. Klompas M, Anderson D, Trick W, Babcock H, Kerlin MP, Li L, Sinkowitz-Cochran R, Ely EW, Jernigan J, Magill S, Lyles R, O'Neil C, Kitch BT, Arrington E, Balas MC, Kleinman K, Bruce C, Lankiewicz J, Murphy MV, E Cox C, Lautenbach E, Sexton D, Fraser V, Weinstein RA, Platt R; CDC Prevention Epicenters. The preventability of ventilator-associated events. The CDC Prevention Epicenters Wake Up and Breathe Collaborative. Am J Respir Crit Care Med. 2015 Feb 1;191(3):292-301<br>. Girard TD, Kress JP, Fuchs BD, Thomason JW, Schweickert WD, Pun BT, Taichman DB, Dunn JG, Pohlman AS, Kinniry PA, Jackson JC, Canonico AE, Light RW, Shintani AK, Thompson JL, Gordon SM, Hall JB, Dittus RS, Bernard GR, Ely EW. Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. Lancet. 2008 Jan 12;371(9607):126-34<br>. Esteban A, Frutos F, Tobin MJ, Alía I, Solsona JF, Valverdú I, Fernández R, de la Cal MA, Benito S, Tomás R, et al. A comparison of four methods of weaning patients from mechanical ventilation. Spanish Lung Failure Collaborative Group. N Engl J Med. 1995 Feb 9;332(6):345-50 |

## INDICATOR Nº 18

| | |
|---|---|
| **Indicator** | **SEMIRECUMBENT POSITION IN PATIENTS UNDERGOING INVASIVE MECHANICAL VENTILATION (MV)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | The semirecumbent position might reduce the incidence of ventilator-associated pneumonia compared to the supine position. |
| **Formula** | nº of days on invasive MV positioned ≥ 20º<br>---------- x 100<br>nº of days on invasive MV |
| **Explanation of terms** | **Semirecumbent position**: headboard angle ≥ 20º<br>Continuous monitoring with devices that enable objective measurements is recommended. |
| **Population** | All patients on invasive MV during the period reviewed.<br>**Exclusion criteria:**<br>Prone positioning and clinical contraindications<br>When the position conflicts with nursing tasks, medical procedures, or the patient's wishes |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | > 90% |
| **Commentaries** | The authors recommend using sampling days to measure this indicator. References:<br>. Wang L, Li X, Yang Z, Tang X, Yuan Q, Deng L, Sun X. Semi-recumbent position versus supine position for the prevention of ventilator-associated pneumonia in adults requiring mechanical ventilation. Cochrane Database Syst Rev. 2016 Jan 8;(1):CD009946. doi:10.1002/14651858.CD009946.pub2<br>. Llaurado-Serra M, Ulldemolins M, Fernandez-Ballart J, Guell-Baro R, Valentí-Trulls T, Calpe- Damians N, Piñol-Tena A, Pi-Guerrero M, Paños-Espinosa C, Sandiumenge A, Jimenez-Herrera MF; CAP- CRI Study Group. Related factors to semi-recumbent position compliance and pressure ulcers in patients with invasive mechanical ventilation: An observational study (CAPCRI study). Int J Nurs Stud. 2016 Sep;61:198-208<br>. Torres A, Serra-Batlles J, Ros E, Piera C, Puig de la Bellacasa J, Cobos A, Lomeña F, Rodríguez- Roisin R. Pulmonary aspiration of gastric contents in patients receiving mechanical ventilation: the effect of body position. Ann Intern Med. 1992 Apr 1;116(7):540-3<br>. Niël-Weise BS, Gastmeier P, Kola A, Vonberg RP, Wille JC, van den Broek PJ; Bed Head Elevation Study Group. An evidence-based recommendation on bed head elevation for mechanically ventilated patients. Crit Care. 2011;15(2):R111. doi: 10.1186/cc1013<br>. Alexiou VG, Ierodiakonou V, Dimopoulos G, Falagas ME. Impact of patient position on the incidence of ventilator-associated pneumonia: a meta-analysis of randomized controlled trials. J Crit Care. 2009 Dec;24(4):515-22<br>. Drakulovic MB, Torres A, Bauer TT, Nicolas JM, Nogué S, Ferrer M. Supine body position as a risk factor for nosocomial pneumonia in mechanically ventilated patients: a randomised trial. Lancet. 1999 Nov 27;354(9193):1851-8 |

## INDICATOR Nº 19

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|---|---|
| **Indicator** | **CHANGING HEAT AND MOISTURE EXCHANGERS (HME)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | In the absence of malfunction or fouling, changing heat-and-moisture exchangers is not indicated before 48 h. Unnecessary or early replacement can increase the incidence of ventilator-associated pneumonia. |
| **Formula** | $\frac{\text{nº of patients on invasive MV with appropriate HME changing}}{\text{nº of patients on invasive MV with HME}} \times 100$ |
| **Explanation of terms** | **Appropriate replacement**: Indications for substitution<br>Use >48 h<br>Malfunctioning<br>Fouling |
| **Population** | All patients on invasive MV with HME during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Use of consumables. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Quality Plan for the National Health System: Patient safety. March 2011<br>. Available at: http://www.semicyuc.org/sites/default/files/protocolo_nzero.pdf<br>. Lorente L, Blot S, Rello J. New Issues and Controversies in the Prevention of Ventilator-associated Pneumonia. Am J Respir Crit Care Med. 2010 Oct 1;182(7):870-6<br>. Muscedere J, Dodek P, Keenan S, Fowler R, Cook D, Heyland D; VAP Guidelines Committee and the Canadian Critical Care Trials Group. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention. J Crit Care. 2008 Mar;23(1):126-37<br>. Boisson C, Viviand X, Arnaud S, Thomachot L, Miliani Y, Martin C. Changing a hydrophobic heat and moisture exchanger after 48 hours rather than 24 hours: a clinical and microbiological evaluation. Intensive Care Med. 1999 Nov;25(11):1237-4 |

## INDICATOR Nº 20

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|---|---|
| **Indicator** | **SELF-EXTUBATION** |
| **Dimension** | Safety |
| **Justification** | In patients undergoing invasive mechanical ventilation, self-extubation is an undesirable outcome because it is associated with a risk of reintubation and greater mortality. |
| **Formula** | $\frac{\text{nº of self-extubations}}{\text{total nº of days of intubation}} \times 1000$ |
| **Explanation of terms** | **Intubation**: any orotracheal or nasotracheal tube<br>**Self-extubation**: when the patient withdraws the tube, voluntarily or not. |
| **Population** | All days of intubation in patients who require invasive mechanical ventilation through an endotracheal tube during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 7 self-extubations per 1000 days of intubation |
| **Commentaries** | References:<br>. Pham JC, Williams TL, Sparnon EM, Cillie TK, Scharen HF, Marella WM. Ventilator-Related Adverse Events: A Taxonomy and Findings From 3 Incident Reporting Systems. Respir Care. 2016 May;61(5):621-31<br>. Da Silva PS, Fonseca MC. Unplanned endotracheal extubations in the intensive care unit: systematic review, critical appraisal, and evidence-based recommendations. Anesth Analg. 2012May;114(5):1003-14. doi: 10.1213/ANE.0b013e31824b0296. Epub 2012 Feb 24<br>. Peñuelas Ó, Frutos-Vivar F, Esteban A. Unplanned extubation in the ICU: a marker of quality assurance of mechanical ventilation. Crit Care. 2011 Mar 8;15(2):128. doi: 10.1186/cc10049<br>. De Groot RI, Dekkers OM, Herold IH, de Jonge E, Arbous MS. Risk factors and outcomes after unplanned extubations on the ICU: a case-control study. Crit Care. 2011;15(1):R19. doi: 10.1186/cc9964<br>. Bouza C, Garcia E, Diaz M, Segovia E, Rodriguez I. Unplanned extubation in orally intubated medical patients in the intensive care unit: a prospective cohort study. Heart Lung. 2007 Jul- Aug;36(4):270-6<br>. Carrión MI, Ayuso D, Marcos M, Paz Robles M, de la Cal MA, Alía I, Esteban A. Accidental removal of endotracheal and nasogastric tubes and intravascular catheters. Crit Care Med. 2000 Jan;28(1):63-6<br>. De Lassence A, Alberti C, Azoulay E, Le Miere E, Cheval C, Vincent F, Cohen Y, Garrouste- Orgeas M, Adrie C, Troche G, Timsit JF; OUTCOMEREA Study Group. Impact of unplanned extubation and reintubation after weaning on nosocomial pneumonia risk in the intensive care unit: a prospective multicenter study. Anesthesiology. 2002 Jul;97(1):148-56 |

## INDICATOR Nº 21

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|---|---|
| **Indicator** | **UNPLANNED EXTUBATION DURING MANEUVERS** |
| **Dimension** | Safety |
| **Justification** | Unplanned extubation is associated with a high rate of reintubation and with increased risk of nosocomial pneumonia and death. |
| **Formula** | $\frac{\text{nº of unplanned extubations during maneuvers}}{\text{total nº of days of intubation}} \times 1000$ |
| **Explanation of terms** | **Intubation:** any orotracheal or nasotracheal tube.<br>**Extubation during maneuvers**: accidental (unplanned) withdrawal of the endotracheal tube by healthcare staff (due to, e.g., changing patient's position, prone positioning, transfers, diagnostic or therapeutic procedures, hygiene, etc.). |
| **Population** | All days of intubation in patients who require invasive mechanical ventilation through an endotracheal tube in the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 3 extubations during maneuvers per 1000 days intubation |
| **ommentaries** | References:<br>. Pham JC, Williams TL, Sparnon EM, Cillie TK, Scharen HF, Marella WM. Ventilator-Related Adverse Events: A Taxonomy and Findings From 3 Incident Reporting Systems. Respir Care. 2016 May;61(5):621-31<br>. Da Silva PS, Fonseca MC. Unplanned endotracheal extubations in the intensive care unit: systematic review, critical appraisal, and evidence-based recommendations. Anesth Analg. 2012 May; 114(5):1003-14. doi: 10.1213/ANE. 0b013e31824b0296. Epub 2012 Feb 24<br>. De Groot RI, Dekkers OM, Herold IH, de Jonge E, Arbous MS. Risk factors and outcomes after unplanned extubations on the ICU: a case-control study. Crit Care. 2011;15(1):R19. doi: 10.1186/cc9964<br>. Peñuelas Ó, Frutos-Vivar F, Esteban A. Unplanned extubation in the ICU: a marker of quality assurance of mechanical ventilation. Crit Care. 2011 Mar 8;15(2):128. doi: 10.1186/cc10049<br>. Bouza C, Garcia E, Diaz M, Segovia E, Rodriguez I. Unplanned extubation in orally intubated medical patients in the intensive care unit: a prospective cohort study. Heart Lung. 2007 Jul- Aug;36(4):270-6<br>. De Lassence A, Alberti C, Azoulay E, Le Miere E, Cheval C, Vincent F, Cohen Y, Garrouste-Orgeas M, Adrie C, Troche G, Timsit JF; OUTCOMEREA Study Group. Impact of unplanned extubation and reintubation after weaning on nosocomial pneumonia risk in the intensive care unit: a prospective multicenter study. Anesthesiology. 2002 Jul;97(1):148-56<br>. Carrión MI, Ayuso D, Marcos M, Paz Robles M, de la Cal MA, Alía I, Esteban A. Accidental removal of endotracheal and nasogastric tubes and intravascular catheters. Crit Care Med. 2000 Jan;28(1):63-6 |

## INDICATOR Nº 22

| | |
|---|---|
| **Indicator** | **REINTUBATION** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Reintubation for extubation failure is associated with longer stays and greater mortality |
| **Formula** | nº of reintubations<br>---------- x 100<br>total nº of planned extubations |
| **Explanation of terms** | **Planned extubation**: intentional extubation by a healthcare professional. Excludes self-extubation and accidental extubation.<br>**Reintubation**: the need to reintubate within 48 h or extubation. |
| **Population** | All planned extubations during the period reviewed.<br>**Exclusion criteria**:<br>Extubations to withdrawal life support.<br>Reintubation for surgical reintervention. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 12% |
| **Commentaries** | References:<br>. Frutos-Vivar F, Esteban A, Apezteguia C, González M, Arabi Y, Restrepo MI, Gordo F, Santos C, Alhashemi JA, Pérez F, Peñuelas O, Anzueto A. Outcome of reintubated patients after scheduled extubation. J Crit Care. 2011 Oct;26(5):502-9<br>. Peñuelas O, Frutos-Vivar F, Fernández C, Anzueto A, Epstein SK, Apezteguía C, González M, Nin N, Raymondos K, Tomicic V, Desmery P, Arabi Y, Pelosi P, Kuiper M, Jibaja M, Matamis D, Fergu- son ND, Esteban A; Ventila Group. Characteristics and outcomes of ventilated patients according to time to liberation from mechanical ventilation. Am J Respir Crit Care Med. 2011 Aug15;184(4):430-7<br>. Frutos-Vivar F, Ferguson ND, Esteban A, Epstein SK, Arabi Y, Apezteguía C, González M, Hill NS, Nava S, D'Empaire G, Anzueto A. Risk factors for extubation failure in patients following a successful spontaneous breathing trial. Chest. 2006 Dec;130(6):1664-71<br>. Gowardman JR, Huntington D, Whiting J. The effect of extubation failure on outcome in a multidisciplinary Australian intensive care unit. Crit Care Resusc. 2006 Dec;8(4):328-33<br>. Epstein SK, Ciubotaru RL, Wong JB. Effect of failed extubation on the outcome of mechanical ventilation. Chest. 1997 Jul;112(1):186-92 |

## INDICATOR Nº 23 (FUNDAMENTAL INDICATOR)

| Indicator | INDICATING NONINVASIVE VENTILATION IN EXACERBATIONS OF HYPERCAPNIC CHRONIC RESPIRATORY FAILURE |
|---|---|
| **Dimension** | Effectiveness, safety, efficiency |
| **Justification** | The use noninvasive ventilation (NIV) in acute exacerbations of hypercapnic chronic respiratory failure is associated with a decreased need for orotracheal intubation, decreased mortality, and decreased hospital stay. |
| **Formula** | nº of patients diagnosed with acute exacerbations of hypercapnic chronic respiratory failure treated with early NIV<br>----------x100<br>nº of patients diagnosed with acute exacerbations of hypercapnic chronic respiratory failure |
| **Explanation of terms** | **Early NIV**: initiated within 2 hours of admission |
| **Population** | All patients diagnosed with acute exacerbations of hypercapnic chronic respiratory failure discharged from the ICU during the period reviewed.<br>**Exclusion criteria**: contraindications for NIV:<br>Coma (GSC ≤8).<br>Shock.<br>Intolerance to the technique.<br>Facial lesions that contraindicate the use of a facemask (if a helmet is unavailable).<br>Inadequate management of tracheal secretions. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | > 95% |
| **Commentaries** | References:<br>. Demoule A, Chevret S, Carlucci A, Kouatchet A, Jaber S, Meziani F, Schmidt M, Schnell D, Clergue C, Aboab J, Rabbat A, Eon B, Guérin C, Georges H, Zuber B, Dellamonica J, Das V, Cousson J, Perez D, Brochard L, Azoulay E; oVNI Study Group; REVA Network (Research Network in Mechanical Ventilation). Changing use of noninvasive ventilation in critically ill patients: trends over 15 years in francophone countries. Intensive Care Med. 2016 Jan;42(1):82-92<br>. Schnell D, Timsit JF, Darmon M, Vesin A, Goldgran-Toledano D, Dumenil AS, Garrouste-Orgeas M, Adrie C, Bouadma L, Planquette B, Cohen Y, Schwebel C, Soufir L, Jamali S, Souweine B, Azoulay E. Noninvasive mechanical ventilation in acute respiratory failure: trends in use and outcomes. Intensive Care Med. 2014 Apr;40(4):582-91<br>. Keenan SP, Sinuff T, Burns KE, Muscedere J, Kutsogiannis J, Mehta S, Cook DJ, Ayas N, Adhikari NK, Hand L, Scales DC, Pagnotta R, Lazosky L, Rocker G, Dial S, Laupland K, Sanders K, Dodek P; Canadian Critical Care Trials Group/Canadian Critical Care Society Noninvasive Ventilation Guidelines Group. Clinical practice guidelines for the use of noninvasive positive-pressure ventilation and noninvasive continuous positive airway pressure in the acute care setting. CMAJ. 2011 Feb 22;183(3):E195-214<br>. Esteban A, Frutos-Vivar F, Muriel A, Ferguson ND, Peñuelas O, Abraira V, Raymondos K, Rios F, Nin N, Apezteguía C, Violi DA, Thille AW, Brochard L, González M, Villagomez AJ, Hurtado J, Davies AR, Du B, Maggiore SM, Pelosi P, Soto L, Tomicic V, D'Empaire G, Matamis D, Abroug F, Moreno RP, Soares MA, Arabi Y, Sandi F, Jibaja M, Amin P, Koh Y, Kuiper MA, Bülow HH, Zeggwagh AA, Anzueto A. Evolution of mortality over time in patients receiving mechanical ventilation. Am J Respir Crit Care Med. 2013 Jul 15;188(2):220-30<br>. Raurell-Torredà M, Argilaga-Molero E, Colomer-Plana M, Ródenas-Fransico A, Ruiz-Garcia MT, Uya Muntaña J. Optimising non-invasive mechanical ventilation: Which unit should care for these patients? A cohort study. Aust Crit Care. 2016 Sep 6. pii: S1036-7314(16)30078-9. doi: 10.1016/j. aucc.2016.08.005 |

## INDICATOR Nº 24

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|---|---|
| **Indicator** | **SKIN LESIONS RELATED WITH FACEMASKS FOR NONINVASIVE MECHANICAL VENTILATION (NIV)** |
| **Dimension** | Safety |
| **Justification** | To minimize the incidence of facial ulcers (basically on the bridge of the nose), it is necessary to select the appropriate interface, place the harness optimally, individualize the size to the patient's facial characteristics, and rotate the interface. |
| **Formula** | $\frac{\text{nº of patients with facial lesions at the interface pressure points}}{\text{nº of patients undergoing NIV}} \times 100$ |
| **Explanation of terms** | **Facial lesions**: skin wounds (grades I through IV) secondary to clinical devices. |
| **Population** | All patients treated with NIV discharged from the ICU during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 7% |
| **Commentaries** | References:<br>. Raurell Torredà M; Romero-Collado A, Rodríguez-Palma M, Farrés-Tarafa M, Martí JD, Hurtado- Pardos B, Peñarrubia-San Florencio L, Saez-Paredes P, Esquinas AM. [Prevention and treatment of skin lesions associated with non-invasive mechanical ventilation. Recommendations of experts.] Enferm Intensiva. 2017 Jan 30. pii: S1130-2399(17)30001-9. doi:10.1016/j.enfi.2016.12.001<br>. Silva RM, Timenetsky KT, Neves RC, Shigemichi LH, Kanda SS, Maekawa C, Silva E, Eid RA. Adaptation to different noninvasive ventilation masks in critically ill patients. J Bras Pneumol. 2013 Jun-Aug;39(4):469-75<br>. Carron M, Freo U, BaHammam AS, Dellweg D, Guarracino F, Cosentini R, Feltracco P, Vianello A, Ori C, Esquinas A. Complications of non-invasive ventilation techniques: a comprehensive qualitative review of randomized trials. Br J Anaesth. 2013 Jun;110(6):896-914<br>. Pisani L, Carlucci A, Nava S. Interfaces for noninvasive mechanical ventilation: technical aspects and efficiency. Minerva Anestesiol. 2012 Oct;78(10):1154-61 |

## INDICATOR Nº 25 (FUNDAMENTAL INDICATOR)

| Indicator | LUNG-PROTECTIVE VENTILATION IN ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS) |
|---|---|
| **Dimension** | Safety |
| **Justification** | Lung-protective ventilation can improve survival in patients with ARDS |
| **Formula** | nº of patients with ARDS receiving invasive mechanical ventilation with lung-protective strategies / nº of patients with ARDS receiving invasive mechanical ventilation x 100 |
| **Explanation of terms** | **ARDS**: according to the Berlin criteria (1)<br>**Lung-protective strategies**: Ventilation with Vt <8 ml /kg (ideal weight) and plateau pressure <30 cmH2O |
| **Population** | All patients with ARDS undergoing invasive mechanical ventilation> 24 h discharged from the ICU during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | > 90% |
| **Commentaries** | References:<br>(1) ARDS Definition Task Force, Ranieri VM, Rubenfeld GD, Thompson BT, Ferguson ND, Caldwell E,<br>Fan E, Camporota L, Slutsky AS. Acute respiratory distress syndrome: the Berlin Definition. JAMA.2012 Jun 20;307(23):2526-33<br>. Petrucci N, De Feo C. Lung protective ventilation strategy for the acute respiratory distress syndrome. Cochrane Database Syst Rev. 2013 Feb 28;(2):CD003844. doi: 10.1002/14651858<br>. Villar J, Blanco J, Añón JM, Santos-Bouza A, Blanch L, Ambrós A, Gandía F, Carriedo D, Mosteiro F, Basaldúa S, Fernández RL, Kacmarek RM; ALIEN Network. The ALIEN study: incidence and outcome of acute respiratory distress syndrome in the era of lung protective ventilation. Intensive Care Med. 2011 Dec;37(12):1932-41<br>. Deans KJ, Minneci PC, Cui X, Banks SM, Natanson C, Eichacker PQ. Mechanical ventilation in ARDS: One size does not fit all.Crit Care Med. 2005 May;33(5):1141-3<br>. Rubenfeld GD, Cooper C, Carter G, Thompson BT, Hudson LD. Barriers to providing lung-protective ventilation to patients with acute lung injury. Crit Care Med. 2004 Jun;32(6):1289-93<br>. Eichacker PQ, Gerstenberger EP, Banks SM, Cui X, Natanson C. Meta-analysis of acute lung injury and acute respiratory distress syndrome trials testing low tidal volumes. Am J Respir Crit Care Med. 2002 Dec 1;166(11):1510-4 |

## INDICATOR Nº 26

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|---|---|
| **Indicator** | **APPROPRIATE ENDOTRACHEAL SUCTIONING** |
| **Dimension** | Safety |
| **Justification** | Using the proper technique in bronchial aspiration helps to reduce the incidence of ventilator-associated pneumonia (VAP). VAP is associated with increased morbidity, mortality, length of stay, and costs. |
| **Formula** | nº of suctioning procedures complying with guidelines<br>---------- x 100<br>total nº of suctioning procedures |
| **Explanation of terms** | **Evidence-based recommendations:**<br>Aspirate secretions only when necessary<br>Use an aspiration tube that occupies less than half the lumen of the artificial airway<br>Use the lowest possible aspiration pressure (normally about 80-120 mmHg)<br>The procedure should not take longer than 15 seconds<br>Hyperoxygenate and hyperventilate before and after bronchial aspiration<br>(at least for 30 seconds')<br>Perform the procedure with a closed suctioning system in patients with high PEEP<br>Use a sterile technique: use goggles and masks to protect the professional, use disposable tubes<br>and sterile gloves, wash hands before the procedure<br>Aspirate the oropharynx to finalize the procedure<br>Check the ventilator cuff pressure<br>*__Artificial airway__: endotracheal tube and tracheostomy tube |
| **Population** | All aspirations in patients with an artificial airway during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Direct observation |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Leddy R, Wilkinson JM. Endotracheal suctioning practices of nurses and respiratory therapists: How well do they align with clinical practice guidelines? Can J Respir Ther. 2015;51(3):60-4<br>. Pedersen CM, Rosendahl-Nielsen M, Hjermind J, Egerod I. Endotracheal suctioning of the adult intubated patient–what is the evidence? Intensive Crit Care Nurs. 2009 Feb;25(1):21-30<br>. Caruso P, Denari S, Ruiz SA, Demarzo SE, Deheinzelin D. Saline instillation before tracheal suctioning decreases the incidence of ventilator-associated pneumonia. Crit Care Med. 2009 Jan;37(1):32-8<br>. Niël-Weise BS, Snoeren RL, van den Broek PJ. Policies for endotracheal suctioning of patients receiving mechanical ventilation: a systematic review of randomized controlled trials. Infect Control Hosp Epidemiol. 2007 May;28(5):531-6 |

## INDICATOR Nº 27

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|---|---|
| **Indicator** | **ENDOTRACHEAL TUBE CUFF PRESSURE** |
| **Dimension** | Safety |
| **Justification** | One fundamental function of cuff pressure is to seal the airway and prevent the aspiration of the contents of the pharynx into the trachea. Excessively low endotracheal-tube or tracheostomy-tube cuff pressure does not permit efficacious mechanical ventilation, increases the risk of microaspirations and the risk of developing ventilator-associated pneumonia, and makes patients more susceptible to accidental extubation or displacement of the artificial airway. Excessively high pressure (>30 cmH20) could damage the tracheal mucosa and cause severe complications such as bleeding or rupture. |
| **Formula** | nº of cuff measurements within the recommended range<br>---------- x 100<br>total nº of cuff measurements |
| **Explanation of terms** | Evidence-based recommendations<br>Maintain cuff pressure between 20 cmH2O and 30 cmH2O<br>Check cuff pressure at least once every shift (every 8 h), either manually or through continuous monitoring. If manually, also check cuff pressure whenever the endotracheal tube is moved and before modifying the height of the head of the bed. |
| **Population** | All cuff pressure controls during the period reviewed in patients with an artificial airway and inflatable cuff |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Direct observation. |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Rouzé A, Jaillette E, Nseir S. Continuous control of tracheal cuff pressure: an effective measure to prevent ventilator-associated pneumonia? Crit Care. 2014 Sep 6;18(5):512<br>. Lizy C, Swinnen W, Labeau S, Poelaert J, Vogelaers D, Vandewoude K, Dulhunty J, Blot S. Cuff pressure of endotracheal tubes after changes in body position in critically ill patients treated with mechanical ventilation. Am J Crit Care. 2014 Jan;23(1):e1-8. doi: 10.4037/ajcc2014489<br>. Lorente L, Lecuona M, Jiménez A, Lorenzo L, Roca I, Cabrera J, Llanos C, Mora ML. Continuous endotracheal tube cuff pressure control system protects against ventilator-associated pneumonia. Crit Care. 2014 Apr 21;18(2):R77. doi: 10.1186/cc13837<br>. Rose L, Redl L. Minimal occlusive volume cuff inflation: a survey of current practice. Intensive Crit Care Nurs. 2008;24(6):359-65<br>. Tablan OC, Anderson LJ, Besser R, Bridges G, Hajjeh R. CDC guidelines for prevent health care associated pneumonia. 2004;53(RR03):1-36.<br>. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5303a1.htm |

## NEUROCRITICAL CARE AND TRAUMATOLOGY

### INDICATOR Nº 28

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|---|---|
| **Indicator** | **SEVERE TRAUMA ATTENDED BY THE CRITICAL CARE DEPARTMENT** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Initial hospital evaluation by a multidisciplinary team improves the prognosis of patients with severe trauma. Intensivists have the specific competencies to lead this process. |
| **Formula** | nº of severe trauma patients evaluated by a multidisciplinary team<br>---------- x 100<br>total nº of patients with severe trauma in the hospital (emergency department and ICU) |
| **Explanation of terms** | **Severe trauma:** trauma resulting in serious lesions scoring ≤ 11 on the Revised Trauma Score (RTS)(1) at triage and/or ≥ 16 on the Injury Severity Score (ISS) (2)<br>**Multidisciplinary team**: including at least professionals from the emergency, surgery, traumatology, diagnostic imaging, and critical care departments. |
| **Population** | Patients with severe trauma discharged from the hospital during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>(1) Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score.J Trauma. 1989 May;29(5):623-9<br>(2) Baker SP, O'Neill B, Haddon W, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma 1974 Mar;14(3):187-96<br>. Chico-Fernández M, Terceros-Almanza LL, Mudarra-Reche CC Innovation and new trends in critical trauma disease. Med Intensiva. 2015 Apr;39(3):179-88<br>. Truhlář A, Deakin CD, Soar J, Khalifa GE, Alfonzo A, Bierens JJ, Brattebø G, Brugger H, Dunning J, Hunyadi-Antičević S, Koster RW, Lockey DJ, Lott C, Paal P, Perkins GD, Sandroni C, Thies KC, Zideman DA, Nolan JP; Cardiac arrest in special circumstances section Collaborators. European Resuscitation Council Guidelines for Resuscitation 2015: Section 4. Cardiac arrest in special circumstances. Resuscitation. 2015 Oct;95:148-201<br>. Tiel Groenestege-Kreb D, van Maarseveen O, Leenen L. Trauma team.Br J Anaesth. 2014 Aug;113(2):258-65<br>. McCullough AL, Haycock JC, Forward DP, Moran CG. Early management of the severely injured major trauma patient. Br J Anaesth. 2014 Aug;113(2):234-41<br>. Marco P. Asistencia al paciente politraumatizado: el liderazgo del intensivista. Med Intensiva 1999;23:111-113<br>. Alerta seguridad Fundación Avedis Donabedian: Traumatismo infravalorado en urgencias. http://fad.onmedic.net/Portals/0/SafetyAt/Alerta%202%20Trauma_v2.PDF |

## INDICATOR Nº 29

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|---|---|
| **Indicator** | **TRACHEAL INTUBATION IN PATIENTS WITH SEVERE TRAUMATIC BRAIN INJURY AND GLASGOW COMA SCORE <9 DURING THE FIRST 24 HOURS** |
| **Dimension** | Safety |
| **Justification** | Inadequate control of hypoxemia in severe traumatic brain injury (TBI) increases secondary brain lesions, worsening the prognosis for survival and function.<br>Tracheal intubation in patients with severe TBI is well established in clinical guidelines. |
| **Formula** | $\frac{\text{nº of patients with severe TBI intubated}}{\text{nº of patients with severe TBI}} \times 100$ |
| **Explanation of terms** | **Severe TBI**: Glasgow Coma Score < 9<br>This indicator should be evaluated only within 24 h of the traumatic incident |
| **Population** | All patients with severe TBI (GCS <9) discharged from critical care in the period reviewed.<br>**Exclusion criteria:** patients admitted to critical care > 24 h after the trauma. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2016 Sep 20. [Epub ahead of print]<br>. Beckers SK, Brokmann JC, Rossaint R. Airway and ventilator management in trauma patients. Curr Opin Crit Care. 2014 Dec;20(6):626-31<br>. Alted López E, Bermejo Aznárez S, Fernández MC. [Updates on severe traumatic brain injury management] Med Intensiva. 2009 Jan-Feb;33(1):16-30 |

## INDICATOR Nº 30

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| **Indicator** | **SURGICAL INTERVENTION IN TRAUMATIC BRAIN INJURY (TBI) WITH SUBDURAL HEMATOMA (SDH) AND/OR EPIDURAL HEMATOMA (EDH)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Delays in surgical treatment of subdural and epidural hematomas in TBI with signs of intracranial hypertension are associated with worse outcomes and increased mortality. |
| **Formula** | nº of patients with TBI and SDH or EDH with intracranial hypertension undergoing surgical intervention within < 2 h<br>---------- x 100<br>nº of patients with TBI and SDH or EDH with intracranial hypertension with indications for surgical intervention |
| **Explanation of terms** | **2 hours**: time period from CT examination (time stated on CT images) to surgery<br>**Indications for surgery**: based on clinical and radiological criteria for intracranial hypertension **Clinical criteria**: GSC <9; focal deficits, anisocoria or dilated pupils; ICP > 20 mmHg **Radiological criteria**:<br>EDH: > 30 cc volume; > 15 mm thickness; > 5 mm displacement of the midline<br>SDH: > 10 mm thickness; > 5 mm displacement of the midline |
| **Population** | All patients with TBI and EDH / SDH and indication for surgery discharged from critical care during the period reviewed<br>**Exclusion criteria**: orders to limit or withhold treatment or life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2016 Sep 20. [Epub ahead of print]<br>. Alted López E, Bermejo Aznárez S, Fernández MC. [Updates on severe traumatic brain injury management] Med Intensiva. 2009 Jan-Feb;33(1):16-30<br>. Compagnone C, Murray GD, Teasdale GM, Maas AI, Esposito D, Princi P, D'Avella D, Servadei F. The management of patients with intradural post-traumatic mass lesions: a multicenter survey of current approaches to surgical management in 729 patients coordinated by the European Brain Injury Consortium. Neurosurgery. 2007 Jul;61(1 Suppl):232-40 |

## INDICATOR Nº 31

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|---|---|
| **Indicator** | **MONITORING INTRACRANIAL PRESSURE (ICP) IN PATIENTS WITH SEVERE BRAIN INJURY WITH PATHOLOGICAL CT FINDINGS** |
| **Dimension** | Safety, effectiveness |
| **Justification** | The standard of care, monitoring ICP aims to ensure acceptable cerebral perfusion pressure and reduce the risk of ischemic lesions secondary to increased ICP, reducing morbidity and mortality. Intracranial hypertension is associated with worse prognosis; monitoring ICP helps guide specific treatment with different therapeutic measures. |
| **Formula** | nº of patients with severe brain injury and pathological CT monitored with an ICP sensor<br>---------- x 100<br>nº of patients with severe brain injury and pathological CT |
| **Explanation of terms** | **Severe brain injury**: Glasgow Coma Scale < 9· To be assessed only in the first 24 h after trauma<br>**Pathological CT findings**: at least one of the following signs: hematomas, contusions, edema, or compression of the basal cisterns<br>**ICP monitoring**: using any standardized technique |
| **Population** | All patients with severe brain injury and pathological CT findings discharged from the ICU during the period reviewed<br>**Exclusion criteria:** orders to limit or withhold treatment or life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2016 Sep 20. [Epub ahead of print]<br>. Yuan Q, Wu X, Sun Y, Yu J, Li Z, Du Z, Mao Y, Zhou L, Hu J. Impact of intracranial pressure monitoring on mortality in patients with traumatic brain injury: a systematic review and meta- analysis. J Neurosurg. 2015 Mar;122(3):574-87<br>. Le Roux P. Intracranial pressure after the BEST TRIP trial: a call for more monitoring. Curr Opin Crit Care. 2014 Apr;20(2):141-7<br>. Farahvar A, Gerber LM, Chiu YL, Carney N, Härtl R, Ghajar J. Increased mortality in patients with severe traumatic brain injury treated without intracranial pressure monitoring. J Neurosurg. 2012 Oct;117(4):729-34<br>. Alted López E, Bermejo Aznárez S, Fernández MC. [Updates on severe traumatic brain injury management] Med Intensiva. 2009 Jan-Feb;33(1):16-30<br>. Andrews PJ, Citerio G, Longhi L, Polderman K, Sahuquillo J, Vajkoczy P; Neuro-Intensive Care and Emergency Medicine (NICEM) Section of the European Society of Intensive Care Medicine. NICEM consensus on neurological monitoring in acute neurological disease. Intensive Care Med. 2008 Aug;34(8):1362-70 |

## INDICATOR Nº 32

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|---|---|
| **Indicator** | **MORTALITY IN SEVERE TRAUMATIC BRAIN INJURY (TBI)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Standardized treatment based on clinical guidelines significantly decreases mortality in patients with severe TBI. |
| **Formula** | nº of in-hospital deaths in patients with severe TBI<br>---------- x 100<br>total nº of patients with severe TBI discharged from critical care |
| **Explanation of terms** | **Severe TBI**: Glasgow Coma Scale < 9<br>**In-hospital death**: regardless of where it occurs in the hospital |
| **Population** | All patients with severe TBI discharged from critical care during the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 35% |
| **Commentaries** | References:<br>. Carney N, Totten AM, O'Reilly C, Ullman JS, Hawryluk GW, Bell MJ, Bratton SL, Chesnut R, Harris OA, Kissoon N, Rubiano AM, Shutter L, Tasker RC, Vavilala MS, Wilberger J, Wright DW, Ghajar J. Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition. Neurosurgery. 2016 Sep 20. [Epub ahead of print]<br>. Farhad K, Khan HM, Ji AB, Yacoub HA, Qureshi AI, Souayah N. Trends in outcomes and hospitalization costs for traumatic brain injury in adult patients in the United States.J Neurotrauma. 2013 Jan 15;30(2):84-90<br>. Alted López E, Bermejo Aznárez S, Fernández MC. [Updates on severe traumatic brain injury management] Med Intensiva. 2009 Jan-Feb;33(1):16-30<br>. Mauritz W, Steltzer H, Bauer P, Dolanski-Aghamanoukjan L, Metnitz P. Monitoring of intracranial pressure in patients with severe traumatic brain injury: an Austrian prospective multicenter study. Intensive Care Med. 2008 Jul;34(7):1208-1<br>. Reviejo K, Arcega I, Txoperena G, Azaldegui F, Alberdi F, Lara G. [Analysis of prognostic factors of mortality in severe head injury. Proyecto Poliguitania]. Med Intensiva 2002;26(5):241-247 |

## INDICATOR Nº 33

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|---|---|
| **Indicator** | **EARLY OSTEOSYNTHESIS IN FRACTURES OF THE FEMORAL DIAPHYSIS** |
| **Dimension** | Safety, continuity of care, effectiveness |
| **Justification** | Early stabilization of fractures of the femur in multiple trauma patients reduces mortality by decreasing the associated complications: sepsis, organ dysfunction, fat embolism, pulmonary thromboembolism, deterioration of the nutritional state, decubitus ulcers, etc. It also allows the patient to be moved earlier, reduces the needs for analgesics, facilitates nursing care, and reduces the length of the hospital stay. |
| **Formula** | $\frac{\text{nº of fractured femurs with indication for surgery treated within 24 h}}{\text{nº of fractured femurs with indication for surgery}} \times 100$ |
| **Explanation of terms** | **24h**: time from fracture to surgery<br>**Femur fracture with indication for surgery**: closed fracture of the femoral diaphysis |
| **Population** | All patients with closed fractures of the femoral diaphysis discharged from the critical care department during the period reviewed.<br>**Exclusion criteria:** instability contraindicating surgery. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Gandhi RR, Overton TL, Haut ER, Lau B, Vallier HA, Rohs T, Hasenboehler E, Lee JK, Alley D, Watters J, Rogers FB, Shafi S. Optimal timing of femur fracture stabilization in polytrauma patients: A practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg. 2014 Nov;77(5):787-795<br>. Nahm NJ, Vallier HA. Timing of definitive treatment of femoral shaft fractures in patients with multiple injuries: a systematic review of randomized and nonrandomized trials. J Trauma Acute Care Surg. 2012 Nov;73(5):1046-63<br>. Harvin JA, Harvin WH, Camp E, Caga-Anan Z, Burgess AR, Wade CE, Holcomb JB, Cotton BA. Early femur fracture fixation is associated with a reduction in pulmonary complications and hospital charges: a decade of experience with 1,376 diaphyseal femur fractures. J Trauma Acute Care Surg. 2012 Dec;73(6):1442-8<br>. Bone LB, Johnson KD, Weigelt J, Scheinberg R. Early versus delayed stabilization of femoral fractures: a prospective randomized study. 1989. Clin Orthop Relat Res. 2004 May;(422):11-6 |

## INDICATOR Nº 34

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|---|---|
| **Indicator** | **EARLY SURGICAL FIXATION OF OPEN FRACTURES** |
| **Dimension** | Safety, continuity of care, effectiveness |
| **Justification** | Early stabilization of open fractures reduces mortality by reducing associated complications, especially the risk of wound infection. It also allows the patient to be moved earlier, reduces the need for analgesics, facilitates nursing care, and reduces the length of the hospital stay. Although some have advocated emergency treatment in the first 6 to 8 h, recent studies conclude this approach is not fully justified. |
| **Formula** | $\frac{\text{nº of open fractures with surgical fixation within 24 h of admission}}{\text{nº of open fractures}} \times 100$ |
| **Explanation of terms** | **Early (within 24 h):** time from fracture to surgical intervention<br>Surgical fixation includes external fixation<br>**Open fracture**: any lesion in which the focus of the fracture communicates with the exterior through an opening through the skin and the rest of the tissues |
| **Population** | All patients with open fractures (femur, tibia, or upper limbs), discharged from critical care during the period reviewed.<br>**Exclusion criteria**:<br>Catastrophic injuries<br>Contraindications for surgery due to patient instability |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Srour M, Inaba K, Okoye O, Chan C, Skiada D, Schnüriger B, Trump M, Lam L, Demetriades D. Prospective evaluation of treatment of open fractures: effect of time to irrigation and debridement. JAMA Surg. 2015 Apr;150(4):332-6<br>. Schenker ML, Yannascoli S, Baldwin KD, Ahn J, Mehta S. Does timing to operative debridement affect infectious complications in open long-bone fractures? A systematic review. J Bone Joint Surg Am. 2012 Jun 20;94(12):1057-64<br>. Kazakos KJ, Verettas DJ, Tilkeridis K, Galanis VG, Xarchas KC, Dimitrakopoulou A. External fixation of femoral fractures in multiply injured intensive care unit patients. Acta Orthop Belg. 2006<br>. Jan;72(1):39-43 Spencer J, Smith A, Woods D. The effect of time delay on infection in open long-bone fractures: a 5-year prospective audit from a district general hospital. Ann R Coll Surg Engl. 2004 Mar;86(2):108-12 |

## INDICATOR Nº 35

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|---|---|
| **Indicator** | **EARLY DIAGNOSIS OF SUBARACHNOID HEMORRHAGE (SAH)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Early diagnosis and treatment of the cause of SAH improves outcomes by reducing complications such as rebleeding and enables the optimum treatment of other potential complications. CT angiography has high sensitivity and specificity for the diagnosis of cerebral aneurysms (especially those ≥ 3 mm), is available in most hospitals, and enables the optimum treatment of the aneurysm to be selected. When CT angiography cannot be done or shows no obvious cause of SAH, digital subtraction angiography (DSA) must be done; DSA remains the gold standard for diagnosing the cause of bleeding and selecting the best treatment option. |
| **Formula** | $\frac{\text{nº of patients with spontaneous SAH diagnosed by imaging within 24 h}}{\text{nº of patients with spontaneous SAH admitted to critical care}} \times 100$ |
| **Explanation of terms** | **Diagnosed by imaging**: CT angiography that demonstrated the presence of a lesion that explains the bleeding and allows an appropriate treatment to be chosen; otherwise, conventional cerebral angiography (DSA, with or without 3D reconstruction) must be done.<br>**24 h**: time from the onset of symptoms (NOT from admission) |
| **Population** | All patients with spontaneous SAH attended by the critical care department during the period reviewed, regardless of the severity of SAH on hospital admission.<br>**Exclusion criteria:**<br>Admission after the acute phase (> 48 h after onset)<br>Orders to limit life support |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Lagares A, Munarriz PM, Ibáñez J, Arikán F, Sarabia R, Morera J, Gabarrós A, Horcajadas Á; el Grupo de Patología Vascular de la SENEC. [Variability in the management of aneurysmal subarachnoid haemorrhage in Spain: Analysis of the prospective multicenter database from the Working Group on Neurovascular Diseases of the Spanish Society of Neurosurgery]. Neurocirugia (Astur). 2015 Jul-Aug;26(4):167-79<br>. Steiner T, Juvela S, Unterberg A, Jung C, Forsting M, Rinkel G; European Stroke Organization. European Stroke Organization guidelines for the management of intracranial aneurysms and sub- arachnoid haemorrhage. Cerebrovasc Dis. 2013;35(2):93-112<br>. Connolly ES Jr, Rabinstein AA, Carhuapoma JR, Derdeyn CP, Dion J, Higashida RT, Hoh BL, Kirkness CJ, Naidech AM, Ogilvy CS, Patel AB, Thompson BG, Vespa P; American Heart Association Stroke Council; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nur- sing; Council on Cardiovascular Surgery and Anesthesia; Council on Clinical Cardiology. Guidelines for the management of aneurysmal subarachnoid hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2012 Jun;43(6):1711-37<br>. Guerrero López F, de la Linde Valverde CM, Pino Sánchez FI. [General management in intensive care of patient with spontaneous subarachnoid hemorrhage]. Med Intensiva. 2008 Oct;32(7):342-5 |

## INDICATOR Nº 36

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|---|---|
| **Indicator** | **ADMINISTRATION OF NIMODIPINE IN SUBARACHNOID HEMORRHAGE** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Early nimodipine administration is efficacious (level I evidence) in reducing ischemic neurologic sequelae in patients with subarachnoid hemorrhage (SAH). The efficacy of nimodipine seems more related to a direct cellular mechanism than to reduced cerebral vasospasm. |
| **Formula** | nº of patients with aneurysmatic SAH treated with nimodipine / nº of patients with aneurysmatic SAH admitted to critical care x 100 |
| **Explanation of terms** | **Aneurysmatic SAH**: spontaneous, not traumatic, regardless of severity on hospital admission<br>**Treatment with nimodipine**: preferably oral or enteral; if not possible, then consider continuous intravenous administration. Initiate treatment within 12 h of diagnosis. |
| **Population** | All patients with aneurysmatic SAH attended by the critical care department during the period reviewed.<br>**Exclusion criteria**: intolerance to treatment due to difficult-to-control hypotension; severe, uncontrollable intracranial hypertension; orders to withhold treatment or life support; nonaneurysmatic perimesencephalic SAH. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Steiner T, Juvela S, Unterberg A, Jung C, Forsting M, Rinkel G; European Stroke Organization. European Stroke Organization guidelines for the management of intracranial aneurysms and subarachnoid haemorrhage. Cerebrovasc Dis. 2013;35(2):93-112<br>. Soppi V, Karamanakos PN, Koivisto T, Kurki MI, Vanninen R, Jaaskelainen JE, Rinne J. A randomized outcome study of enteral versus intravenous nimodipine in 171 patients after acute aneurysmal subarachnoid hemorrhage. World Neurosurg. 2012 Jul;78(1-2):101-9<br>. Connolly ES Jr, Rabinstein AA, Carhuapoma JR, Derdeyn CP, Dion J, Higashida RT, Hoh BL, Kirkness CJ, Naidech AM, Ogilvy CS, Patel AB, Thompson BG, Vespa P; American Heart Association Stroke Council; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular Nur- sing; Council on Cardiovascular Surgery and Anesthesia; Council on Clinical Cardiology. Guidelines for the management of aneurysmal subarachnoid hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2012 Jun;43(6):1711-37<br>. Dorhout Mees SM, Rinkel GJ, Feigin VL, Algra A, van den Bergh WM, Vermeulen M, van Gijn J. Calcium antagonists for aneurysmal subarachnoid haemorrhage. Cochrane Database Syst Rev. 2007 Jul 18;(3):CD000277 |

## INDICATOR Nº 37 (FUNDAMENTAL INDICATOR)

| Indicator | ICU-ACQUIRED WEAKNESS |
|---|---|
| **Dimension** | Safety |
| **Justification** | ICU-acquired weakness (ICU-AW) is especially common in patients with sepsis and organ dysfunction and prolonged mechanical ventilation. ICU-AW is associated not only with increased mortality, but also with prolonged mechanical ventilation (MV) and with significant long-term sequelae. |
| **Formula** | $\frac{\text{nº of patients undergoing MV > 7 days who develop ICU-AW}}{\text{nº of patients undergoing MV > 7 days}} \times 100$ |
| **Explanation of terms** | **ICU-AW**: generalized muscular weakness that develops in critical patients that cannot be attributed causes other than critical illness. It is diagnosed with clinical criteria: Medical Research Council (MRC) sum score < 48 in conscious and cooperative patients, regardless of whether accompanied by electrophysiological studies. |
| **Population** | All patients undergoing MV > 7 days during the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 25%–30% |
| **Commentaries** | References:<br>. Hermans G, Van den Berghe G. Clinical review: intensive care unit acquired weakness. Crit Care. 2015 Aug 5;19:274-283<br>. Baldwin CE, Bersten AD. Myopathic characteristics in septic mechanically ventilated patients. Curr Opin Clin Nutr Metab Care. 2015 May;18(3):240-7<br>. Fan E, Cheek F, Chlan L, Gosselink R, Hart N, Herridge MS, Hopkins RO, Hough CL, Kress JP, Latronico N, Moss M, Needham DM, Rich MM, Stevens RD, Wilson KC, Winkelman C, Zochodne DW, Ali NA; ATS Committee on ICU-acquired Weakness in Adults; American Thoracic Society. An official American Thoracic Society Clinical Practice guideline: the diagnosis of intensive care unit- ac- quired weakness in adults. Am J Respir Crit Care Med. 2014 Dec 15;190(12):1437-46<br>. Latronico N, Bolton CF. Critical illness polyneuropathy and myopathy: a major cause of muscle weakness and paralysis. Lancet Neurol. 2011 Oct;10(10):931-41<br>. Garnacho-Montero J, Amaya-Villar R, García-Garmendía JL, Madrazo-Osuna J, Ortiz-Leyba C. Effect of critical illness polyneuropathy on the withdrawal from mechanical ventilation and the length of stay in septic patients. Crit Care Med. 2005 Feb;33(2):349-54 |

## INDICATOR Nº 38

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|---|---|
| **Indicator** | **INTRAVENOUS THROMBOLYSIS IN ACUTE ISCHEMIC STROKE** |
| **Dimension** | Effectiveness |
| **Justification** | Intravenous thrombolysis with recombinant tissue plasminogen activator (rtPA) administered within 4.5 h of onset of acute ischemic stroke improves clinical and functional outcome. |
| **Formula** | nº of patients with acute ischemic stroke undergoing thrombolysis<br>---------- x 100<br>nº of patients with acute ischemic stroke |
| **Explanation of terms** | **Thrombolysis**: thrombolytic (rtPA) administration in accordance with established criteria |
| **Population** | All patients with ischemic stroke attended by the critical care department in the period reviewed.<br>**Exclusion criteria**: Contraindications for thrombolysis |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Alonso de Leciñana M, Egido JA, Casado I, Ribó M, Dávalos A, Masjuan J, Caniego JL, Martínez Vila E, Díez Tejedor E; ad hoc committee of the SEN Study Group for Cerebrovascular Diseases, Fuentes B, Álvarez-Sabin J, Arenillas J, Calleja S, Castellanos M, Castillo J, Díaz-Otero F, López- Fernández JC, Freijo M, Gállego J, García-Pastor A, Gil-Núñez A, Gilo F, Irimia P, Lago A, Maestre J, Martí- Fábregas J, Martínez-Sánchez P, Molina C, Morales A, Nombela F, Purroy F, Rodríguez- Yañez M, Roquer J, Rubio F, Segura T, Serena J, Simal P, Tejada J, Vivancos J; Spanish Neurological Society. Guidelines for the treatment of acute ischaemic stroke. Neurologia. 2014 Mar;29(2):102-22<br>. Smith EE, Saver JL, Alexander DN, Furie KL, Hopkins LN, Katzan IL, Mackey JS, Miller EL, Schwamm LH, Williams LS; AHA/ASA Stroke Performance Oversight Committee. Clinical performance me- asures for adults hospitalized with acute ischemic stroke: performance measures for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014 Nov;45(11):3472-98<br>. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, Khatri P, McMullan PW Jr, Qureshi AI, Rosenfield K, Scott PA, Summers DR, Wang DZ, Wintermark M, Yonas H; American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013 Mar;44(3):870-947<br>. Salvat-Plana M, Abilleira S, Jiménez C, Marta J, Gallofré M. [Prioritization of performance measures for assessment of hospital-based stroke care quality through a consensus method]. Rev Calid Asist 2011 May-Jun;26(3):174-83<br>. Hacke W, Kaste M, Bluhmki E, Brozman M, Dávalos A, Guidetti D, Larrue V, Lees KR, Medeghri Z, Machnig T, Schneider D, von Kummer R, Wahlgren N, Toni D; ECASS Investigators. Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke. N Engl J Med. 2008 Sep 25;359(13):1317-29 |

## INDICATOR Nº 39

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|---|---|
| **Indicator** | **DOOR-TO-NEEDLE TIME IN ACUTE ISCHEMIC STROKE IN CANDIDATES FOR THROMBOLYTIC TREATMENT** |
| **Dimension** | Effectiveness, appropriateness |
| **Justification** | The benefit of thrombolytic treatment for acute ischemic stroke depends on how early it is administered. |
| **Formula** | $\frac{\text{Patients with acute ischemic stroke receiving thrombolysis ≤60 min from arrival at the hospital}}{\text{Patients with acute ischemic stroke receiving thrombolysis}} \times 100$ |
| **Explanation of terms** | **Door-to-needle time**: time in minutes from the patient's arrival in the emergency department (door) to the administration of thrombolytic treatment (needle).<br>**Time of arrival at the hospital**: time when patient data are registered at admission |
| **Population** | All patients with acute ischemic stroke receiving thrombolytic treatment who are discharged from critical care during the period reviewed.<br>Exclusion criteria: Infarcts occurring in the hospital; patients transferred from other hospitals; a valid reason for delaying thrombolysis documented in the clinical history (need for intubation, treatment for intracranial hypertension, fluctuations in level of consciousness, initial rejection by patients or relatives). |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Alonso de Leciñana M, Egido JA, Casado I, Ribó M, Dávalos A, Masjuan J, et al; Spanish Neurological Society. Guidelines for the treatment of acute ischaemic stroke. Neurologia. 2014 Mar;29(2):102-22<br>. Smith EE, Saver JL, Alexander DN, Furie KL, Hopkins LN, Katzan IL, et al; AHA/ASA Stroke Performance Oversight Committee. Clinical performance measures for adults hospitalized with acute ischemic stroke: performance measures for healthcare professionals from the American Heart Association/ American Stroke Association. Stroke. 2014 Nov;45(11):3472-98<br>. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, Khatri P, et al; American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart<br>. Association/American Stroke Association. Stroke. 2013 Mar;44(3):870-947<br>. Salvat-Plana M, Abilleira S, Jiménez C, Marta J, Gallofré M. [Prioritization of performance measures for assessment of hospital-based stroke care quality through a consensus method]. Rev Calid Asist. 2011 May-Jun;26(3):174-83<br>. Desarrollo de un conjunto básico de indicatores de calidad de la atención del paciente con ictus a partir del consenso de expertos. Mercè Salvat-Plana, Sònia Abilleira Castells. Plan de Calidad para el Sistema Nacional de Salud del Ministerio de Sanidad, Política Social e Igualdad. Barcelona: Agència d'Informació, Avaluació i Qualitat en Salut de Cataluña. 2011. p; 24 cm.– (Informes de Evaluación de Tecnologías Sanitarias; AIAQS 2009/06) |

## INDICATOR Nº 40

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|---|---|
| **Indicator** | **USE OF SOMATOSENSORY EVOKED POTENTIALS (SEP) IN POST-ANOXIC ENCEPHALOPATHY** |
| **Dimension** | Appropriateness |
| **Justification** | To establish the neurologic prognosis in post-anoxic encephalopathy, it is essential to use a multimodal approach that includes clinical and electrophysiological examination in the first step and can be complemented with biomarkers and imaging studies. The bilateral absence of the N20 component of<br>the SEP in patients with absent photomotor reflex and response to pain from the third day can orient treatment, including the decision to limit treatment or life support. |
| **Formula** | nº of patients with post-anoxic encephalopathy undergoing SEP<br>---------- x 100<br>nº of patients with post-anoxic encephalopathy |
| **Explanation of terms** | **SEP:** recommended to be done after the third day |
| **Population** | All patients with post-anoxic encephalopathy during the period reviewed.<br>**Inclusion criteria:** All patients with post-anoxic encephalopathy lasting more than 3 days<br>**Exclusion criteria:** brain death |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Sandroni C, Geocadin RG. Neurological prognostication after cardiac arrest. Curr Opin Crit Care.2015 Jun;21(3):209-14<br>. Taccone F, Cronberg T, Friberg H, Greer D, Horn J, Oddo M, Scolletta S, Vincent JL. How to assess prognosis after cardiac arrest and therapeutic hypothermia. Crit Care. 2014 Jan 14;18(1):202. doi: 10.1186/cc13696<br>. Lee YC, Phan TG, Jolley DJ, Castley HC, Ingram DA, Reutens DC.Accuracy of clinical signs, SEP, and EEG in predicting outcome of hypoxic coma: a meta-analysis. Neurology. 2010 Feb 16;74(7):572-80<br>. Guérit JM. Neurophysiological testing in neurocritical care. Curr Opin Crit Care. 2010 Apr;16(2):98-104<br>. Rothstein TL. The utility of median somatosensory evoked potentials in anoxic-ischemic coma. Rev Neurosci. 2009;20(3-4):221-33<br>. Young GB. Clinical practice. Neurologic prognosis after cardiac arrest. N Engl J Med. 2009 Aug 6;361(6):605-11<br>. Recommendations of the SEMICYUC's 6th Consensus Conference post-anoxic persistent vegetative state in adults. Med Intensiva 2003 27(8)544-555 |

## INDICATOR Nº 41

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|---|---|
| **Indicator** | **EARLY CONTROL OF SYSTOLIC BLOOD PRESSURE IN SPONTANEOUS INTRACEREBRAL HEMORRHAGE (ICH)** |
| **Dimension** | Effectiveness |
| **Justification** | Recent studies show that strict control of systolic blood pressure (SBP) in patients with hypertension is associated with less hematoma growth in the initial phases of the disease and probably with a better prognosis in terms of morbidity and mortality. |
| **Formula** | $\frac{\text{nº of patients with spontaneous ICH and hypertension with early control of SBP}}{\text{nº of patients with spontaneous ICH and hypertension}} \times 100$ |
| **Explanation of terms** | **Hypertension:** SBP ≥ 180 mmHg<br>Early control of SBP: SBP < 180 mmHg in the first 6 hours. Compliance is defined as at least 80% of SBP determinations < 180 mmHg |
| **Population** | All patients with spontaneous ICH discharged from critical care during the period reviewed. **Exclusion criteria:** contraindication for lowering SBP (known renal artery stenosis / renal failure). SBP < 140 mmHg in these patients is associated with increased risk of side effects. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 80% |
| **Commentaries** | References:<br>. Qureshi AI, Palesch YY, Barsan WG, Hanley DF, Hsu CY, Martin RL, Moy CS, Silbergleit R, Steiner T, Suarez JI, Toyoda K, Wang Y, Yamamoto H, Yoon BW; ATACH-2 Trial Investigators and the Neurological Emergency Treatment Trials Network Intensive Blood-Pressure Lowering in Patients with Acute Cerebral Hemorrhage. N Engl J Med. 2016 Sep 15;375(11):1033-43<br>. Hemphill JC 3rd, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, Fung GL, Goldstein JN, Macdonald RL, Mitchell PH, Scott PA, Selim MH, Woo D; American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, and Council on Clinical Cardiology. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke.2015; 46(7):2032-60. doi: 10.1161/STR.0000000000000069<br>. Anderson CS, Heeley E, Huang Y, Wang J, Stapf C, Delcourt C, Lindley R, Robinson T, Lavados P, Neal B, Hata J, Arima H, Parsons M, Li Y, Wang J, Heritier S, Li Q, Woodward M, Simes RJ, Da- vis SM, Chalmers J; INTERACT2 Investigators. Rapid blood-pressure lowering in patients with acute intracerebral hemorrhage. N Engl J Med. 2013; 368(25):2355-65<br>. Rodriguez-Luna D, Piñeiro S, Rubiera M, Ribo M, Coscojuela P, Pagola J, Flores A, Muchada M, Ibarra B, Meler P, Sanjuan E, Hernandez-Guillamon M, Alvarez-Sabin J, Montaner J, Molina CA. Impact of blood pressure changes and course on hematoma growth in acute intracerebral hemorrhage. Eur J Neurol. 2013; 20(9):1277-83. doi: 10.1111/ene.12180<br>. Sakamoto Y, Koga M, Yamagami H, Okuda S, Okada Y, Kimura K, Shiokawa Y, Nakagawara J, Furui E, Hasegawa Y, Kario K, Arihiro S, Sato S, Kobayashi J, Tanaka E, Nagatsuka K, Minematsu K, To- yoda K; SAMURAI Study Investigators. Systolic blood pressure after intravenous antihypertensive treatment and clinical outcomes in hyperacute intracerebral hemorrhage: the stroke acute management with urgent risk-factor assessment and improvement-intracerebral hemorrhage study. Stroke. 2013; 44(7):1846-51. doi: 0.1161/STROKEAHA.113.001212 |

## INFECTIOUS DISEASES

### INDICATOR Nº 42 (FUNDAMENTAL INDICATOR)

| Indicator | CATHETER-RELATED BLOODSTREAM INFECTIONS |
|---|---|
| **Dimension** | Safety, effectiveness |
| **Justification** | The use of central venous catheters (CVC) is indispensable in the treatment of hospitalized patients. Infection is one of the most important complications of CVC use. Bacteremia due to CVC is the main cause of nosocomial bacteremia in ICUs, being the third cause of nosocomial infection (after pneumonia and urinary infections). Although its real impact has not been well established, it is estimated that bacteremia related to CVCs results in 10% mortality, ICU stays prolonged by 5-8 days, and increased use of ICU resources. These infections can be prevented. |
| **Formula** | $\frac{\text{nº of episodes of catheter-related bloodstream infections}}{\text{days of CVC total nº of CVC days}} \times 1000$ |
| **Explanation of terms** | **CVC-related bloodstream infections**: according to the CDC criteria and those used in the ENVIN-UCI study<br>**Exclusion criteria**: bloodstream infection from an unknown focus |
| **Population** | All days of CVC in patients discharged after having spent > 24 h in the ICU during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information systems. Microbiology laboratory or ENVIN |
| **Standard** | < 3 episodes per 1000 CVC days |
| **Commentaries** | Source for the standard: results of the ENVIN-UCI study. http://hws.vhebron.net/envin-helics/<br>References:<br>. Palomar M, Álvarez-Lerma F, Riera A, Díaz MT, Torres F, Agra Y, Larizgoitia I, Goeschel CA, Pronovost PJ; Bacteremia Zero Working Group. Impact of a national multimodal intervention to prevent catheter-related bloodstream infection in the ICU: the Spanish experience. Crit Care Med. 2013 Oct;41(10):2364-72 c b<br>. Pronovost PJ, Goeschel CA, Colantuoni E, Watson S, Lubomski LH, Berenholtz SM, Thompson DA, Sinopoli DJ, Cosgrove S, Sexton JB, Marsteller JA, Hyzy RC, Welsh R, Posa P, Schumacher K, Need- ham D.Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study. BMJ. 2010 Feb 4;340:c309. doi: 10.1136/bmj.c309<br>. Palomar Martínez M, Alvarez Lerma F, Riera Badía MA, León Gil C, López Pueyo MJ, Díaz Tobajas C, Sierra Camerino R, Benítez Ruiz L, Agra Varela Y; Grupo de Trabajo del Estudio Piloto «Bacteriemia Zero». [Prevention of bacteriema related with ICU catheters by multifactorial inter- vention: A report of the pilot study.] Med Intensiva. 2010 Dec;34(9):581-58<br>. Palomar M, Vaque J, Alvarez Lerma F, Pastor V, Olaechea P, Fernández-Crehuet J.[Nosocomial infection indicators] Med Clin (Barc). 2008 Dec;131 Suppl 3:48-55<br>. Pronovost P, Needham D, Berenholtz S, Sinopoli D, Chu H, Cosgrove S, Sexton B, Hyzy R, Welsh R, Roth G, Bander J, Kepros J, Goeschel C. An intervention to decrease catheter-related bloodstream infections in the ICU. N Engl J Med. 2006 Dec 28;355(26):2725-32<br>. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections,<br>. 1988. Am J Infect Control. 1988 Jun;16(3):128-40 |

## INDICATOR Nº 43

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|---|---|
| **Indicator** | **CATHETER-RELATED URINARY TRACT INFECTIONS (UTI)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | UTI related to urethral catheterization is one of the most common nosocomial infections in critical care (usually the second most common, after ventilator-associated pneumonia). Although its impact on mortality is lower than that of other nosocomial infections, UTI significantly increase morbidity, hospital stays, and costs. Like all nosocomial infections, UTI can be prevented. |
| **Formula** | nº of episodes of UTI<br>---------- x 1000 days of urinary catheter useTotal nº of days of urethral catheter use |
| **Explanation of terms** | **UTI**: according to the criteria published by the Centers for Disease Control (CDC) and used in the ENVIN-UCI study |
| **Population** | All days of urethral catheter use in patients discharged after being in the ICU for more than 24 h during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information systems. Microbiology laboratory or ENVIN program |
| **Standard** | < 4 episodes per 1000 days urinary catheter use |
| **Commentaries** | Source for the standard: results of the ENVIN-UCI study. http://hws.vhebron.net/envin-helics/<br>References:<br>. Saint S, Greene MT, Krein SL, Rogers MA, Ratz D, Fowler KE, Edson BS, Watson SR, Meyer- Lucas B, Masuga M, Faulkner K, Gould CV, Battles J, Fakih MG. A Program to Prevent Catheter- Associated Urinary Tract Infection in Acute Care. N Engl J Med. 2016 Jun 2;374(22):2111-9<br>. Olaechea PM, Insausti J, Blanco A, Luque P. [Epidemiology and impact of nosocomial infections.] Med Intensiva. 2010 May;34(4):256-267<br>. Hooton TM, Bradley SF, Cardenas DD, Colgan R, Geerlings SE, Rice JC, Saint S, Schaeffer AJ, Tambayh PA, Tenke P, Nicolle LE; Infectious Diseases Society of America. Diagnosis, preven- tion, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. Clin Infect Dis. 2010 Mar 1;50(5):625-63<br>. Bagshaw SM, Laupland KB. Epidemiology of intensive care unit-acquired urinary tract infections. Curr Opin Infect Dis. 2006 Feb;19(1):67-71<br>. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control. 1988 Jun;16(3):128-40 |

## INDICATOR Nº 44 (FUNDAMENTAL INDICATOR)

| Indicator | VENTILATOR-ASSOCIATED PNEUMONIA |
|---|---|
| **Dimension** | Safety and effectiveness |
| **Justification** | Ventilator-associated pneumonia (VAP) is normally the most common nosocomial infection in the ICU. The importance of monitoring this indicator derives both from its impact on mortality (approximately one third of patients developing VAP die as a result of the infection) and on morbidity, with an average increase of ICU stay of 4 days and increased costs.<br>Like all nosocomial infections, VAP can be prevented. |
| **Formula** | nº of episodes of VAP<br>---------- x 1000 days MV<br>Total nº days invasive mechanical ventilation |
| **Explanation of terms** | Ventilator-associated pneumonia: meeting the criteria published by the Centers for Disease Controland Prevention (CDC) and used in the ENVIN-UCI study and in the GTEI-SEMICYUC consensus document |
| **Population** | All days of invasive mechanical ventilation in patients spending > 24 h in the ICU during the period |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information systems. Microbiology laboratory or ENVIN program |
| **Standard** | < 7 episodes per 1000 days of MV |
| **Commentaries** | The standard is based on the results of the ENVIN-UCI study. http://hws.vhebron.net/envin-helics/<br>References:<br>. Álvarez Lerma F, Sánchez García M, Lorente L, Gordo F, Añón JM, Álvarez J, Palomar M, García R, Arias S, Vázquez-Calatayud M, Jam R; Sociedad Española de Medicina Intensiva; Sociedad Española de Enfermería Intensiva. [Guidelines for the prevention of ventilator-associated pneumonia and their implementation. The Spanish "Zero-VAP" bundle]. Med Intensiva. 2014 May;38(4):226-36<br>. Eom JS, Lee MS, Chun HK, Choi HJ, Jung SY, Kim YS, Yoon SJ, Kwak YG, Oh GB, Jeon MH, Park SY, Koo HS, Ju YS, Lee JS. The impact of a ventilator bundle on preventing ventilator- associated pneumonia: a multicenter study. Am J Infect Control. 2014 Jan;42(1):34-7<br>. Olaechea PM, Insausti J, Blanco A, Luque P. [Epidemiology and impact of nosocomial infections.] Med Intensiva. 2010 May;34(4):256-267<br>. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections, 1988. Am J Infect Control. 1988 Jun;16(3):128-40 |

## INDICATOR Nº 45 (FUNDAMENTAL INDICATOR)

| Indicator | EARLY RESUCITACIÓN IN SEVERE SEPSIS / SEPTIC SHOCK |
|---|---|
| **Dimension** | Effectiveness |
| **Justification** | Sepsis and septic shock (SS) are common in critical care departments, leading to high morbidity, mortality, and use of resources.<br>Different therapeutic measures in the first hours after onset have proven effective at decreasing mortality. |
| **Formula** | $\frac{\text{nº of patients with sepsis or SS in whom early resuscitation was optimized}}{\text{nº of patients with sepsis or SS discharged from critical care}} \times 100$ |
| **Explanation of terms** | Sepsis and SS defined according to standardized criteria (1)<br>**Optimized early resuscitation:** reaching all the following therapeutic goals within the first 6 h<br>MAP: > 65 mmHg<br>Diuresis: > 0.5 ml/kg/h<br>Normalization of lactate values<br>**First 6 h:** from the onset of symptoms, regardless of the patient's location:<br>Emergency department (entrance door), ICU, or others (diagnosis of sepsis, SS) |
| **Population** | All patients with sepsis/SS discharged from critical care during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. (1) Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS, Levy MM, Marshall JC, Martin GS, Opal SM, Rubenfeld GD, van der Poll T, Vincent JL, Angus DC. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016 Feb 23;315(8):801-10<br>. Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, Kumar A, Sevransky JE, Sprung CL, Nunnally ME, Rochwerg B, Rubenfeld GD, Angus DC, Annane D, Beale RJ, Bellinghan GJ, Bernard GR, Chiche JD, Coopersmith C, De Backer DP, French CJ, Fujishima S, Gerlach H, Hidalgo JL, Hollenberg SM, Jones AE, Karnad DR, Kleinpell RM, Koh Y, Lisboa TC, Machado FR, Marini JJ, Marshall JC, Mazuski JE, McIntyre LA, McLean AS, Mehta S, Moreno RP, Myburgh J, Navalesi P, Nishida O, Osborn TM, Perner A, Plunkett CM, Ranieri M, Schorr CA, Seckel MA, Seymour CW, Shieh L, Shukri KA, Simpson SQ, Singer M, Thompson BT, Townsend SR, Van der Poll T, Vincent JL, Wiersinga WJ, Zimmerman JL, Dellinger RP. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med. 2017 Mar;43(3):304-377<br>. Levy MM, Dellinger RP, Townsend SR, Linde-Zwirble WT, Marshall JC, Bion J, Schorr C, Artigas A, Ramsay G, Beale R, Parker MM, Gerlach H, Reinhart K, Silva E, Harvey M, Regan S, Angus DC; Surviving Sepsis Campaign. The Surviving Sepsis Campaign: results of an international guideline- based performance improvement program targeting severe sepsis. Crit Care Med. 2010 Feb;38(2):367-74<br>. Ferrer R, Artigas A, Levy MM, Blanco J, González-Díaz G, Garnacho-Montero J, Ibáñez J, Palencia E, Quintana M, de la Torre-Prados MV; Edusepsis Study Group. Improvement in process of care and outcome after a multicenter severe sepsis educational program in Spain. JAMA. 2008 May 21;299(19):2294-303 |

## INDICATOR Nº 46 (FUNDAMENTAL INDICATOR)

| Indicator | EARLY ANTIBIOTIC TREATMENT IN SEPSIS |
|---|---|
| **Dimension** | Effectiveness, safety |
| **Justification** | Early administration of antibiotics improves the prognosis of sepsis. Clinical guidelines recommend the administration of antibiotics within 1 h of diagnosis of sepsis (Grade E recommendation) |
| **Formula** | nº of patients with sepsis and early antibiotic administration / nº of patients with sepsis x 100 |
| **Explanation of terms** | **Sepsis**: defined according to standardized criteria (1)<br>**Early administration**: interval between detection of sepsis (wherever diagnosed: ICU, ward, or emergency department) and the administration of antibiotics < 1 h |
| **Population** | All patients with sepsis discharged from critical care during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | Blood cultures and specimens (depending on the suspected focus of sepsis) must be acquired before antibiotics are administered.<br>References:<br>. (1) Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, Bellomo R, Bernard GR, Chiche JD, Coopersmith CM, Hotchkiss RS, Levy MM, Marshall JC, Martin GS, Opal SM, Rubenfeld GD, van der Poll T, Vincent JL, Angus DC. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016 Feb 23;315(8):801-10<br>. Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, Kumar A, Sevransky JE, Sprung CL, Nunnally ME, Rochwerg B, Rubenfeld GD, Angus DC, Annane D, Beale RJ, Bellinghan GJ, Bernard GR, Chiche JD, Coopersmith C, De Backer DP, French CJ, Fujishima S, Gerlach H, Hidalgo JL, Hollenberg SM, Jones AE, Karnad DR, Kleinpell RM, Koh Y, Lisboa TC, Machado FR, Marini JJ, Marshall JC, Mazuski JE, McIntyre LA, McLean AS, Mehta S, Moreno RP, Myburgh J, Navalesi P, Ni- shida O, Osborn TM, Perner A, Plunkett CM, Ranieri M, Schorr CA, Seckel MA, Seymour CW, Shieh L, Shukri KA, Simpson SQ, Singer M, Thompson BT, Townsend SR, Van der Poll T, Vincent JL, Wiersinga WJ, Zimmerman JL, Dellinger RP. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med. 2017 Mar;43(3):304-377<br>. Ferrer R, Artigas A, Suarez D, Palencia E, Levy MM, Arenzana A, Pérez XL, Sirvent JM; Edusepsis Study Group. Effectiveness of treatments for severe sepsis: a prospective, multicenter, observational study. Am J Respir Crit Care Med. 2009 Nov 1;180(9):861-6<br>. Gaieski DF, Mikkelsen ME, Band RA, Pines JM, Massone R, Furia FF, Shofer FS, Goyal M. Impact of time to antibiotics on survival in patients with severe sepsis or septic shock in whom early goal-directed therapy was initiated in the emergency department. Crit Care Med. 2010 Apr;38(4):1045-53 |

## INDICATOR Nº 47

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|---|---|
| **Indicator** | **INAPPROPRIATE EMPIRICAL ANTIBIOTIC TREATMENT FOR INFECTIONS TREATED IN THE ICU** |
| **Dimension** | Safety, effectiveness |
| **Justification** | The administration of inappropriate empirical antibiotic treatment in nosocomial infections is associated with increased mortality. |
| **Formula** | nº of patients with infections administered inappropriate empirical antibiotic treatment / nº of patients with infections x 100 |
| **Explanation of terms** | **Empirical treatment**: administration of antibiotics within 24 h of onset of infection when the microorganism responsible is unknown.<br>Appropriate empirical antibiotic treatment:<br>1. When the antibiogram after starting treatment shows that:<br>. . According to accepted standards, at least one of the antibiotics administered acts against the microorganism identified<br>. . The microorganism identified is not resistant to the antibiotics administered<br>2. The antibiotic is administered in the correct dose and through the correct route<br>3. The antibiotic has good penetration into the focus of the infection |
| **Population** | All patients with infections discharged from critical care in the period reviewed.<br>**Excluded:** infections in which no microorganism has been identified |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Garnacho-Montero J, Gutiérrez-Pizarraya A, Escoresca-Ortega A, Fernández-Delgado E, López- Sánchez JM. Adequate antibiotic therapy prior to ICU admission in patients with severe sepsis and septic shock reduces hospital mortality. Crit Care. 2015 Aug 27;19:302<br>. Zilberberg MD, Shorr AF, Micek ST, Vazquez-Guillamet C, Kollef MH. Multi-drug resistance, inappropriate initial antibiotic therapy and mortality in Gram-negative severe sepsis and septic shock: a retrospective cohort study. Crit Care. 2014 Nov 21;18(6):596<br>. Hranjec T, Rosenberger LH, Swenson B, Metzger R, Flohr TR, Politano AD, Riccio LM, Popovsky KA, Sawyer RG. Aggressive versus conservative initiation of antimicrobial treatment in critically ill surgical patients with suspected intensive-care-unit-acquired infection: a quasi-experimental, before and after observational cohort study. Lancet Infect Dis. 2012 Oct;12(10):774-80<br>. Díaz-Martín A, Martínez-González ML, Ferrer R, Ortiz-Leyba C, Piacentini E, Lopez-Pueyo MJ, Martín-Loeches I, Levy MM, Artigas A, Garnacho-Montero J; Edusepsis Study Group. Antibiotic prescription patterns in the empiric therapy of severe sepsis: combination of antimicrobials with different mechanisms of action reduces mortality. Crit Care. 2012 Nov 18;16(6):R223<br>. Levy MM, Dellinger RP, Townsend SR, Linde-Zwirble WT, Marshall JC, Bion J, Schorr C, Artigas A, Ramsay G, Beale R, Parker MM, Gerlach H, Reinhart K, Silva E, Harvey M, Regan S, Angus DC; Surviving Sepsis Campaign. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. Crit Care Med. 2010 Feb;38(2):367-74 |

## INDICATOR Nº 48

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|---|---|
| **Indicator** | **METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) INFECTIONS** |
| **Dimension** | Safety, effectiveness |
| **Justification** | The development of resistant strains of bacteria is a growing problem. This is especially important in the ICU owing to the difficulties involved in adequate control of the infection (critically ill patients, multiple invasive maneuvers, lack of asepsis, admission of carriers) and the frequency of antibiotic use.<br>The appearance of multiresistant microorganisms, particularly methicillin-resistant *Staphylococcus aureus* (MRSA), is associated with increased morbidity and mortality. Applying an appropriate antibiotic policy and a system for monitoring infection can help to reduce the magnitude of the problem. |
| **Formula** | nº of episodes of MRSA infection<br>---------- x 100<br>total nº of infections* |
| **Explanation of terms** | **MRSA infection**: according to the criteria published by the CDC and used in the ENVIN-UCI study The following infections are included*: ventilator-associated pneumonia, urethral catheter-related UTI, primary bacteremia, and catheter-related blood stream infections.<br>**Resistance to methicillin/oxacillin**: *S. aureus* with MIC > 2 µg/ml |
| **Population** | All patients who spend more than 24 h in the ICU discharged during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 2.5% |
| **Commentaries** | References:<br>. The standard is based on the results of the ENVIN-UCI study. http://hws.vhebron.net/envin- helics/<br>. Russell D, Beekmann SE, Polgreen PM, Rubin Z, Uslan DZ. Routine Use of Contact Precautions for Methicillin-Resistant Staphylococcus aureus and Vancomycin-Resistant Enterococcus: Which Way Is the Pendulum Swinging? Infect Control Hosp Epidemiol. 2016 Jan;37(1):36-40<br>. Ziakas PD, Zacharioudakis IM, Zervou FN, Mylonakis E. Methicillin-resistant Staphylococcus aureus prevention strategies in the ICU: a clinical decision analysis*. Crit Care Med. 2015<br>. Feb;43(2):382-93<br>. Gidengil CA, Gay C, Huang SS, Platt R, Yokoe D, Lee GM. Cost-effectiveness of strategies to prevent methicillin-resistant Staphylococcus aureus transmission and infection in an intensive care unit. Infect Control Hosp Epidemiol. 2015 Jan;36(1):17-27<br>. Simor AE, Williams V, McGeer A, Raboud J, Larios O, Weiss K, Hirji Z, Laing F, Moore C, Gravel D; Community and Hospital Infection Control Association–Canada. Prevalence of colonization and infection with methicillin-resistant Staphylococcus aureus and vancomycin-resistant Enterococcus and of Clostridium difficile infection in Canadian hospitals. Infect Control Hosp Epidemiol. 2013 Jul;34(7):687-93 |

## INDICATOR Nº 49

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|---|---|
| **Indicator** | **MULTIRESISTANT PSEUDOMONAS AERUGINOSA (MRPA) INFECTIONS** |
| **Dimension** | Safety and effectiveness |
| **Justification** | The problem of antibiotic resistance is growing every year. The incidence of multiresistant microorganisms is increasing in both the community and hospital environment. *Pseudomonas aeruginosa* is one of the microorganisms most frequently isolated in clinical practice in critical patients. *Pseudomonas aeruginosa* infections are associated with high morbidity and mortality (18% – 61%, depending on the series). The appearance of multiresistance increases the length of hospital stays and mortality. |
| **Formula** | nº of episodes of MRPA infection<br>---------- x 100<br>total nº of infections* |
| **Explanation of terms** | **MRPA infection**: criteria used in the ENVIN-UCI study. Infection with *Pseudomonas aeruginosa*<br>Resistant to 3 or more families of antimicrobials.<br>The following infections* are included: ventilator-associated pneumonia, urethral catheter-related UTI, primary bacteremia, and catheter-related blood stream infections: |
| **Population** | All patients who spend more than 24 h in the ICU discharged during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation |
| **Standard** | < 15% |
| **Commentaries** | References:<br>. Estudio ENVIN-UCI. Informe del año 2014 http://hws.vhebron.net/envin-helics/<br>. Fariñas MC, Martínez-Martínez L. Multiresistant Gram-negative bacterial infections: Enterobacteria, Pseudomonas aeruginosa, Acinetobacter baumannii and other non-fermenting Gram-negative<br>. bacilli. Enferm Infecc Microbiol Clin. 2013;31:402-9<br>. López-Pueyo MJ, Barcenilla-Gaite F, Amaya-Villar R, Garnacho-Montero J. Antibiotic multiresistance in critical care units. Med Intensiva. 2011;35:41-53<br>. Strateva T, Yordanov D. Pseudomonas aeruginosa - a phenomenon of bacterial resistance. J Med Microbiol. 2009;58:1133-48<br>. Garner JS, Jarvis WR, Emori TG, Horan TC, Hughes JM. CDC definitions for nosocomial infections,1988. Am J Infect Control. 1988;16:128-40 |

## INDICATOR Nº 50

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|---|---|
| **Indicator** | **INDICATIONS FOR ISOLATION** |
| **Dimension** | Safety, appropriateness |
| **Justification** | To prevent cross-transmission of infections / colonization by microorganisms considered of epidemiological risk. |
| **Formula** | nº of patients w/ indication of isolation who are isolated<br>---------- x 100<br>nº of patients w/ indication of isolation |
| **Explanation of terms** | **Isolation:** Application of contact isolation measures<br>**Indications for isolation:**<br>1. Preventive isolation:<br>Patients transferred to the ICU from other centers<br>Patients transferred from the hospital's own wards or wards in other hospitals who have risk factors (prolonged hospitalization, decubitus ulcers, surgical wound infections, etc.)<br>Patients from nursing homes<br>Patients with a history of cultures positive for microorganisms with epidemiological risk (M. Tuberculosis, Meningococcus, MRSA, ESL-producing GNB (according to each center's protocol), multiresistant Pseudomonas / Acinetobacter, vancomycin-resistant enterococci, severe influenza.)<br>2. Documented isolation<br>Patients with any positive culture for microorganisms that represent an epidemiological risk |
| **Population** | All patients with indication for isolation discharged during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation/ Clinical information system /Microbiology department |
| **Standard** | 100% |
| **Commentaries** | References:<br>. *Always consider keeping the number of days of isolation to the minimum necessary.<br>. Bassetti M, De Waele JJ, Eggimann P, Garnacho-Montero J, Kahlmeter G, Menichetti F, Nicolau DP, Paiva JA, Tumbarello M, Welte T, Wilcox M, Zahar JR, Poulakou G. Preventive and therapeutic strategies in critically ill patients with highly resistant bacteria. Intensive Care Med. 2015 May;41(5):776-95<br>. Loveday HP, Pellowe CM, Jones SR, Pratt RJ. A systematic review of the evidence for interventions for the prevention and control of methicillin-resistant Staphylococcus aureus (1996-2004): report to the Joint MRSA Working Party (Subgroup A). Hosp Infect. 2006 May;63 Suppl 1:S45-70<br>. Coia JE, Duckworth GJ, Edwards DI, Farrington M, Fry C, Humphreys H, Mallaghan C, Tucker DR; Joint Working Party of the British Society of Antimicrobial Chemotherapy; Hospital Infection Society; Infection Control Nurses Association. Guidelines for the control and prevention of methicillin-resistant Staphylococcus aureus (MRSA) in healthcare facilities. J Hosp Infect. 2006 May;63 Suppl 1:S1-44<br>. Cooper BS, Stone SP, Kibbler CC, Cookson BD, Roberts JA, Medley GF, Duckworth G, Lai R, Ebrahim S. Isolation measures in the hospital management of methicillin-resistant Staphylococcus aureus (MRSA): systematic review of the literature. BMJ. 2004 Sep 4;329(7465):533 |

## INDICATOR Nº 51

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|---|---|
| **Indicator** | **BLOOD CULTURE CONTAMINATION** |
| **Dimension** | Safety, efficiency |
| **Justification** | False-positive blood cultures due to contamination of the sample are associated with increased costs and generate confusion in clinicians that can lead to inappropriate antibiotic administration, additional tests, and prolonged hospital stays. |
| **Formula** | nº of contaminated blood cultures<br>---------- x 100 nº of blood cultures |
| **Explanation of terms** | Blood cultures are considered contaminated when the following organisms are isolated in a single set: coagulase-negative Staphylococcus, Bacillus sp., Propionibacterium acne, or Corynebacterium sp. |
| **Population** | All blood cultures obtained by direct puncture |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Microbiology department |
| **Standard** | < 3% |
| **Commentaries** | References:<br>. Loza E, Planes A, Rodriguez M. Hemocultivos 2003. In: Cercenado E, Cantón R, editors. Procedimientos en Microbiologıía Clínica. Recomendaciones de la Sociedad Española de Enfer- medades Infecciosas y Microbiología Clínica. [updated 2003, 2.a edición, protocolo nº 3a, accessed 28/7/2016]. Available at: http://www.seimc.org/documentos/protocolos/microbiologia/)<br>. Dawson S. Blood culture contaminants. J Hosp Infect. 2014 May;87(1):1-10<br>. Isenberg H.D. Clinical Microbiology Procedures Handbook. American Society for Microbiology. 3rd ed. Washington 2010<br>. Arias S, Frutos F, Parra ML, Ramos B, Cerdá E, Sánchez-Cocheiro M, de la Cal M, García- Hierro P. [Utilization and utility of blood cultures in a medical-surgical intensive care unit.] Med Intensiva 2003;27(10):647-52<br>. Waltzman ML, Harper M. Financial and clinical impact of false-positive blood culture results. Clin Infect Dis. 2001 Aug 1;33(3):296-9<br>. Dunne WM, Nolte FS, Wilson ML, Hindler JA. Cumitech 1B, Blood Cultures III. Washington, D.C. ASM Press;1997<br>. Schifman RB, Pindur A. The effect of skin disinfection materials on reducing blood culture contamination. Am J Clin Pathol. 1993 May;99(5):536-8<br>. Bates DW, Goldman L, Lee TH. Contaminant blood cultures and resource utilization. The true consequences of false-positive results. JAMA. 1991 Jan 16;265(3):365-9 |

## INDICATOR Nº 52 (FUNDAMENTAL INDICATOR)

| Indicator | COMPLIANCE WITH HAND HYGIENE MEASURES |
|---|---|
| **Dimension** | Safety, effectiveness |
| **Justification** | Hand washing is the most important measure for reducing nosocomial infections. These infections increase morbidity, mortality, and the costs of care. Using alcohol-based solutions reduces the incidence of nosocomial infections by 40%. |
| **Formula** | nº of hand hygiene procedures<br>---------- x 100<br>nº of opportunities for hand hygiene observed |
| **Explanation of terms** | **Hand hygiene**: any measure to clean the hands (rubbing with an alcohol-based solution or washing with soap and water) with the aim of reducing or inhibiting the growth of microorganisms on the hands.<br>**Opportunity for hand hygiene**: moments in care activity when it is necessary to clean hands to interrupt the manual transmission of microorganisms (the WHO's 5 moments)<br>**Hand hygiene procedures**: those done in the 5 moments<br>**Observed**: hand hygiene procedures observed by trained professionals following the methods described by the WHO. At least 200 opportunities should be observed |
| **Population** | All healthcare staff during the period reviewed |
| **Type** | Process |
| **Source of data** | Direct observation |
| **Standard** | >90% |
| **Commentaries** | References:<br>A recommended indirect measure consists of measuring the volume of alcohol-based hand hygiene solution used in the ICU in a 1000-day period (mean 55 liters in the ICUs participating in the VINCAT study).<br>. WHO Guidelines on Hand Hygiene in Health Care http://apps.who.int/iris/bitstream/10665/44102/1/9789241597906_eng.pdf<br>. Reference manual for hand hygiene:<br>. http://apps.who.int/iris/bitstream/10665/102537/1/WHO_IER_PSP_2009.02_spa.pdf<br>. Chang NC, Reisinger HS, Jesson AR, Schweizer ML, Morgan DJ, Forrest GN, Perencevich EN. Feasibility of monitoring compliance to the My 5 Moments and Entry/Exit hand hygiene methods in US hospitals. Am J Infect Control. 2016 Aug 1;44(8):938-40<br>. Kingston L, O'Connell NH, Dunne CP. Hand hygiene-related clinical trials reported since 2010: a systematic review. J Hosp Infect. 2016 Apr;92(4):309-20 |

## METABOLISM AND NUTRITION

### INDICATOR Nº 53

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|---|---|
| **Indicator** | **COMPLICATIONS OF TOTAL PARENTERAL NUTRITION (PN): HYPERGLYCEMIA** |
| **Dimension** | Safety |
| **Justification** | PN has been associated with different complications in critical patients, most commonly hyperglycemia. Glycemic control is an integral part of nutritional support and can reduce morbidlity and hospital stays.<br>It is recommended to initiate insulin when blood glucose is ≥ 150 mg/dL to maintain levels < 150 mg/dL |
| **Formula** | $\frac{\text{nº of days with hyperglycemia in patients receiving PN}}{\text{total nº of days of PN}} \times 100$ |
| **Explanation of terms** | **Hyperglycemia**: plasma glucose ≥ 150 mg/dl in any determination |
| **Population** | All days of PN in patients in the ICU during the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | ≤ 10% |
| **Commentaries** | The method of measuring glucose levels should be standardized. Gold standard: from arterial or central blood by dry chemistry or laboratory methods, avoiding the use of test strips.<br>References:<br>. Finfer S, Wernerman J, Preiser JC, Cass T, Desaive T, Hovorka R, Joseph JI, Kosiborod M, Krinsley J, Mackenzie I, Mesotten D, Schultz MJ, Scott MG, Slingerland R, Van den Berghe G, Van Herpe T. Clinical review: Consensus recommendations on measurement of blood glucose and reporting glycemic control in critically ill adults. Crit Care. 2013 Jun 14;17(3):229<br>. NICE-SUGAR Study Investigators, Finfer S, Chittock DR, Su SY, Blair D, Foster D, et al. Intensive versus conventional glucose control in critically ill patients. N Engl J Med. 2009; 360:1283-97<br>. Preiser JC, Devos P, Ruiz-Santana S, Mélot C, Annane D, Groeneveld J, Iapichino G, Leverve X, Nitenberg G, Singer P, Wernerman J, Joannidis M, Stecher A, Chioléro R. A prospective randomised multi-centre controlled trial on tight glucose control by intensive insulin therapy in adult intensive care units: the Glucontrol study. Intensive Care Med. 2009 Oct;35(10):1738-48 |

## INDICATOR Nº 54

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|---|---|
| **Indicator** | **COMPLICATIONS OF TOTAL PARENTERAL NUTRITION (PN): LIVER DYSFUNCTION** |
| **Dimension** | Safety |
| **Justification** | PN has been associated with different complications in critical patients, commonly liver dysfunction, where other factors such as sepsis can be involved. Controlling this complication can reduce morbidity and hospital stays. |
| **Formula** | nº of days with liver dysfunction in patients receiving PN<br>---------- x 100<br>total nº of days of PN |
| **Explanation of terms** | **Liver dysfunction**:<br>Liver function should be determined at least once a week.<br>Bilirubin > 2 mg/dl or GOT, GPT, or alkaline phosphatase ≥ 2 times the normal value or INR ≥ 2 times the normal value (in patients without anticoagulant treatment or prior liver disease). |
| **Population** | All days of PN in patients in critical care during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 25% |
| **Commentaries** | References:<br>. Arabi YM, Aldawood AS, Haddad SH, Al-Dorzi HM, Tamim HM, Jones G, Mehta S, McIntyre L, Solaiman O, Sakkijha MH, Sadat M, Afesh L; PermiT Trial Group. Permissive Underfeeding or Standard Enteral Feeding in Critically Ill Adults. N Engl J Med. 2015 Jun 18;372(25):2398-408<br>. Harvey SE, Parrott F, Harrison DA, Bear DE, Segaran E, Beale R, Bellingan G, Leonard R,<br>. Mythen MG, Rowan KM; CALORIES Trial Investigators. Trial of the route of early nutritional support in critically ill adults. N Engl J Med. 2014 Oct 30;371(18):1673-84<br>. Grau T, Bonet A. Caloric intake and liver dysfunction in critically ill patients.Curr Opin Clin Nutr Metab Care. 2009;12:175-9<br>. Grau T, Bonet A, Rubio M, Mateo D, Farré M, Acosta JA, Blesa A, Montejo JC, de Lorenzo AG, Mesejo A; Working Group on Nutrition and Metabolism of the Spanish Society of Critical Care.<br>. Liver dysfunction associated with artificial nutrition in critically ill patients. Crit Care. 2007;11(1):R10. Crit Care. 2007;11(1):R10<br>. Dhaliwal R, Jurewitsch B, Harrietha D, Heyland DK. Combination enteral and parenteral nutrition in critically ill patients: harmful or beneficial? A systematic review of the evidence. Intensive Care Med. 2004 Aug;30(8):1666-71 |

## INDICATOR Nº 55 (FUNDAMENTAL INDICATOR)

| Indicator | MAINTAINING APPROPRIATE BLOOD GLUCOSE LEVELS |
|---|---|
| **Dimension** | Effectiveness, safety |
| **Justification** | Hyperglycemia in critical patients has been associated with increased infectious complications, morbidity, and mortality. However, strict glucose control with perfused insulin to maintain levels between 80 and 110 mg/dL has had a contradictory effect on mortality due to a high incidence of severe hypoglycemia. Current guidelines recommend aiming to maintain glucose below 150 mg/dl with insulin, avoiding strict glucose- control protocols aiming for (80-110 mg/dL). Continuous insulin perfusion protocols should avoid variability in glucose levels. |
| **Formula** | nº of patients with glucose > 150 mg/dL treated with insulin<br>---------- x 100<br>nº of patients with glucose > 150 mg/dL |
| **Explanation of terms** | **Indication for insulin treatment**: all critical patients with glucose > 150 mg/dl in 2 consecutive determinations. |
| **Population** | All patients admitted to the intensive care unit during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information systems. |
| **Standard** | 80% |
| **Commentaries** | References:<br>. Godinjak A, Iglica A, Burekovic A, Jusufovic S, Ajanovic A, Tancica I, Kukuljac A. Hyperglycemia in Critically Ill Patients: Management and Prognosis. Med Arch. 2015 Jun;69(3):157-60· Dawson S. Blood culture contaminants. J Hosp Infect. 2014 May;87(1):1-10<br>. Raurell Torredà M, del Llano Serrano C, Almirall Solsona D, Catalan Ibars RM, Nicolás Arfelis JM. [The optimal blood glucose target in critically ill patient: comparison of two intensive insulin therapy protocols]. Med Clin (Barc). 2014 Mar 4;142(5):192-9<br>. Vaquerizo Alonso C, Grau Carmona T, Juan Díaz M; Spanish Society of Intensive Care Medicine and Coronary Units-Spanish Society of Parenteral and Enteral Nutrition (SEMICYUC- SENPE). [Guidelines for specialized nutritional and metabolic support in the critically-ill patient. Update. Consensus of the Spanish Society of Intensive Care Medicine and Coronary Units- Spanish Society of Parenteral and Enteral Nutrition (SEMICYUC-SENPE): hyperglycemia and diabetes mellitus]. Med Intensiva. 2011 Nov;35 Suppl 1:48-52<br>. Preiser JC, Devos P, Ruiz-Santana S, Mélot C, Annane D, Groeneveld J, Iapichino G, Leverve X, Nitenberg G, Singer P, Wernerman J, Joannidis M, Stecher A, Chioléro R. A prospective randomised multi-centre controlled trial on tight glucose control by intensive insulin therapy in adult intensive care units: the Glucontrol study. Intensive Care Med. 2009 Oct;35(10):1738-48<br>. NICE-SUGAR Study Investigators., Finfer S, Chittock DR, Su SY, Blair D, Foster D, Dhingra V, Bellomo R, Cook D, Dodek P, Henderson WR, Hébert PC, Heritier S, Heyland DK, McArthur C, McDonald E, Mitchell I, Myburgh JA, Norton R, Potter J, Robinson BG, Ronco JJ. Intensive versus conventional glucose control in critically ill patients. N Engl J Med. 2009 Mar 26;360(13):1283-97 |

## INDICATOR Nº 56

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|---|---|
| **Indicator** | **SEVERE HYPOGLYCEMIA** |
| **Dimension** | Safety |
| **Justification** | There is no universal device that can infuse IV insulin effectively without compromising patients' safety. Therefore, it is necessary to measure the percentage of cases of severe hypoglycemia to establish adequate measures to help to limit them as far as possible. Protocols for continuous insulin perfusion should be designed to avoid severe hypoglycemia (< 40 mg/dl). Some studies found increased mortality even with moderate hypoglycemia (< 60 mg/dl).<br>Standardization of protocols for perfusion of insulin, disseminated so that all personnel are familiar with them, improves the efficiency and safety of glucose control in critical patients |
| **Formula** | total nº of glucose determinations with values < 40mg/dl<br>---------- x 100<br>total nº of glucose determinations |
| **Explanation of terms** | All glucose determinations in patients treated with insulin for glucose control.<br>Determinations should be done on arterial blood if possible and with appropriate glucose meters. |
| **Population** | All glucose determinations in patients treated with insulin for glucose control during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 0.5% |
| **Commentaries** | References:<br>. Van Hooijdonk RT, Binnekade JM, Abu-Hanna A, van Braam Houckgeest F, Hofstra LS, Horn J, Kuiper MA, Juffermans NP, van den Oever HL, van der Sluijs JP, Spronk PE, Schultz MJ. Associations between dynamics of the blood glucose level after hypoglycemia and intensive car e unit mortality: a retrospective multicenter study. Intensive Care Med. 2015 Oct;41(10):1864-5<br>. NICE-SUGAR Study Investigators., Finfer S, Liu B, Chittock DR, Norton R, Myburgh JA, McArthur<br>. C, Mitchell I, Foster D, Dhingra V, Henderson WR, Ronco JJ, Bellomo R, Cook D, McDonald E, Dodek P, Hébert PC, Heyland DK, Robinson BG. Hypoglycemia and risk of death in critically ill patients. N Engl J Med. 2012 Sep 20;367(12):1108-18<br>. Egi M, , Bellomo R, Stachowski E, French CJ, Hart GK, Taori G, Hegarty C, Bailey M. Hypoglycemia and outcome in critically ill patients. Mayo Clin Proc. 2010 Mar;85(3):217-24<br>. Arabi YM, Tamim HM, Rishu AH. Hypoglycemia with intensive insulin therapy in critically ill patients: predisposing factors and association with mortality. Crit Care Med. 2009 Sep;37(9):2536-44<br>. Raurell-Torredà M, Del Llano-Serrano C, Almirall-Solsona D, Nicolás-Arfelis JM. Arterial catheter setup for glucose control in critically ill patients: a randomized controlled trial. Am J Crit Care.2014 Mar;23(2):150-9<br>. Raurell Torredà M, Chirveches Pérez E, Domingo Aragón M, Martínez Ribe R, Puigoriol Juvanteny E, Foguet Boreu Q. Hypoglycemic events in intensive care patients: analysis by insulin administration method and sample type. Am J Crit Care. 2011 Sep;20(5):e115-21 |

## INDICATOR Nº 57

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|---|---|
| **Indicator** | **IDENTIFICATION OF PATIENTS WITH NUTRITIONAL RISK (NR)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Nutritional screening is a process to identify patients with nutritional problems or at risk of developing them. In the critical care department, screening is very important because it makes it possible to select patients who can benefit from nutritional intervention and thus to prevent the secondary effects of malnutrition. |
| **Formula** | nº of with an initial assessment of NR<br>---------- x 100<br>nº of patients discharged from critical care |
| **Explanation of terms** | Most screening methods have been developed and validated in noncritical patients. There is no consensus about the most appropriate method to identify NR in critical patients, although all critical patients are considered high risk. The method validated by Heyland et al. (NUTRIC) (1) can be used.<br>If no screening method is used, the workgroup recommends that adults who meet any of the following criteria be considered to have NR:<br>BMI <18.5 kg/m2<br>Involuntary weight loss (>5% in 3 months or >10% in 6 months)<br>Changes in habitual ingestion in the last month (inadequate ingestion in patients with adequate swallowing and absorption during at least 7 days)<br>**Initial assessment**: screening on admission to critical care. |
| **Population** | All patients admitted to critical care during the period reviewed.<br>**Exclusion criterion**: ICU stay < 48 h |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. (1)Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. CritCare. 2011;15(6):R268. doi: 10.1186/cc10546<br>. Coltman A, Peterson S, Roehl K, Roosevelt H, Sowa D. Use of 3 tools to assess nutrition risk in the intensive care unit. JPEN J Parenter Enteral Nutr. 2015 Jan;39(1):28-33<br>. Preiser JC. Do we need an assessment of the nutrition risk in the critically ill patient? Crit Care.<br>. 2012 Jan 9;16(1):101. doi: 10.1186/cc10572<br>. García de Lorenzo A, Álvarez Hernández J, Planas M, Burgos R, Araujo K; multidisciplinary consensus work-team on the approach to hospital malnutrition in Spain. Multidisciplinary consensus on the approach to hospital malnutrition in Spain. Nutr Hosp. 2011 Jul-Aug;26(4):701-10 |

## INDICATOR Nº 58

| | |
|---|---|
| **Indicator** | **ASSESSMENT OF NUTRITIONAL STATUS** |
| **Dimension** | Effectiveness |
| **Justification** | The limited value of most traditional methods for assessing nutritional status (NS) makes it difficult for us to recommend a method for assessing NS in the ICU. Patients' nutritional history and reliable anthropomorphic parameters are not always available; moreover, weight on admission can be misleading after fluid replacement. Visceral proteins are influenced by non-nutritional parameters, so they should not be used as a marker of NS. |
| **Formula** | $\frac{\text{nº of patients with nutritional risk (NR) and NS assessment}}{\text{nº of patients admitted with NR}} \times 100$ |
| **Explanation of terms** | In patients with NR assessed with scales designed for this purpose or detected through the presence of the factors listed in indicator nº 57, the type of malnutrition should be identified and NS should be assessed by:<br>1. Subjective Global Assessment (SGA)<br>2. If SGA is not used, the following are required:<br>Nutritional history and physical examination<br>Anthropometric determinations: weight, height, BMI<br>Determination of biochemical parameters related with the metabolism of proteins, sugars, and fats, and with the status of certain vitamins and minerals, taking into account parameters influenced by non- nutritional factors related to inflammation status. |
| **Population** | All patients with NR admitted to critical care during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | References:<br>. White JV, Guenter P, Jensen G, Malone A, Schofield M; Academy of Nutrition and Dietetics Malnutrition Work Group.; A.S.P.E.N. Malnutrition Task Force.; A.S.P.E.N. Board of Directors. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: characteristics recommended for the identification and documentation of adult malnutrition (undernutrition). J Acad Nutr Diet. 2012 May;112(5):730-8<br>. Ruiz-Santana S, Arboleda Sánchez JA, Abilés J; Spanish Society of Intensive Care Medicine and Coronary Units-Spanish Society of Parenteral and Enteral Nutrition (SEMICYUC SENPE). [Guidelines for specialized nutritional and metabolic support in the critically ill patient. Update. Con- sensus of the Spanish Society of Intensive Care Medicine and Coronary Units-Spanish Society of Parenteral and Enteral Nutrition (SEMICYUC-SENPE): nutritional assessment]. Med Intensiva. 2011 Nov;35 Suppl 1:12-6 |

## INDICATOR Nº 59

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|---|---|
| **Indicator** | **CALORIE AND PROTEIN REQUIREMENTS IN CRITICAL PATIENTS** |
| **Dimension** | Appropriateness, safety |
| **Justification** | Critical patients are in a hypermetabolic state with increased consumption of different substrates. Their calorie requirements depend on anthropometric factors and on the type and severity of disease, as well as on whether or not malnutrition was present before illness. There is sufficient clinical evidence that both providing too many and providing too few calories increase the risk of infection, liver dysfunction, and prolonged hospital stays. It is recommended to calculate these patients' requirements for artificial nutrition (AN). |
| **Formula** | nº of patients receiving AN whose requirements are calculated correctly<br>---------- x 100 total<br>nº of patients receiving AN |
| **Explanation of terms** | **Correct calculation of requirements**:<br>1. **Calorie intake**:<br>A.- Measured by indirect calorimetry or<br>B.- Formulas for estimating intake<br>1.- Non-ventilated patients: Mifflin's formula:<br>Men: (10) x weight + (6.25) x height in cm – (5) x age + 5<br>Women: (10) x weight + (6.25) x height in cm – (5) x age – 161<br>2.- Ventilated patients: Penn State criteria (modified Mifflin):<br>Calories = Mifflin x (0.71) + max temperature x (85) + minute V x 64) - 3085<br>3.- Range in intake in acute phase: 20-25 Kcal/kg/day<br>4.- Range in intake in stable phase: 25-30 Kcal/kg/day<br>2**. Protein intake**: depending on severity: Mild : 1.2 g/proteins/kg ideal weight/day;<br>Moderate 1.2-1.4 g/proteins/kg ideal weight/day; Severe 1.4- 1.8 g/proteins/kg ideal weight/day |
| **Population** | All patients with AN discharged from critical care in the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 85% |
| **Commentaries** | References:<br>. Singer P, Anbar R, Cohen J, Shapiro H, Shalita-Chesner M, Lev S, Grozovski E, Theilla M, Frishman S, Madar Z. The tight calorie control study (TICACOS): a prospective, randomized, controlled pilot study of nutritional support in critically ill patients. Intensive Care Med. 2011 Apr;37(4):601-9<br>. Rice TW, Mogan S, Hays MA, Bernard GR, Jensen GL, Wheeler AP. Randomized trial of initial trophic versus full-energy enteral nutrition in mechanically ventilated patients with acute respiratory failure. Crit Care Med. 2011 May;39(5):967-74<br>. Arabi YM, Tamim HM, Dhar GS, Al-Dawood A, Al-Sultan M, Sakkijha MH, Kahoul SH, Brits R. Permissive underfeeding and intensive insulin therapy in critically ill patients: a randomized con- trolled trial. Am J Clin Nutr. 2011 Mar;93(3):569-77<br>. Alberda C, Gramlich L, Jones N, Jeejeebhoy K, Day AG, Dhaliwal R, Heyland DK. The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicenter observational study. Intensive Care Med. 2009;35:1728-37 |

## INDICATOR Nº 60 (FUNDAMENTAL INDICATOR)

| Indicator | EARLY ENTERAL NUTRITION |
|---|---|
| **Dimension** | Effectiveness, Safety |
| **Justification** | Early (within 24 h–48 h of admission) initiation of enteral nutrition (EN) is associated with a reduction in infectious complications and in mortality in critical patients. |
| **Formula** | nº of patients with early initiation of EN<br>---------- x 100<br>nº of patients with EN |
| **Explanation of terms** | **Early initiation**: within the first 24–48 h after admission to the ICU.<br>**Indication for EN**: all patients in whom a complete oral diet is not possible who do not have contraindications for EN. |
| **Population** | All patients discharged from critical care during the period reviewed who have received EN during the ICU stay. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Canadian Clinical Practice Guidelines 2015. http://www.criticalcarenutrition.com/docs/CPGs2015/2.0 202015.pdf (Accessed Sept 2015)<br>. Martindale RG, Warren M. Should enteral nutrition be started in the first week of critical illness? Curr Opin Clin Nutr Metab Care. 2015;18:202-6<br>. Fernández Ortega JF, Herrero Meseguer JI, Martínez García P. [Guidelines for specialized nutritional and metabolic support in the critically ill patient. Update. Consensus of the SEMICYUC- SENPE: Indications, timing and routes of delivery]. Med Intensiva 2011;35(Supl 1):7-11<br>. McClave SA, Taylor BE, Martindale RG, Warren MM, Johnson DR, Braunschweig C, McCarthy MS, Davanos E, Rice TW, Cresci GA, Gervasio JM, Sacks GS, Roberts PR, Compher C; Society of Critical Care Medicine; American Society for Parenteral and Enteral Nutrition. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2016 Feb;40(2):159-211<br>. Kreymann KG, Berger MM, Deutz NE, Hiesmayr M, Jolliet P, Kazandjiev G, Nitenberg G, van den Berghe G, Wernerman J; DGEM (German Society for Nutritional Medicine), Ebner C, Hartl W, Heymann C, Spies C; ESPEN (European Society for Parenteral and Enteral Nutrition).ESPEN Guidelines on Enteral Nutrition: Intensive care. Clin Nutr. 2006;25:210-23 |

## INDICATOR Nº 61

| | |
|---|---|
| **Indicator** | **MONITORING ENTERAL NUTRITION** |
| **Dimension** | Effectiveness |
| **Justification** | Tolerance to enteral nutrition (EN) enables the goals for caloric intake to be reached effectively. It is important to identify the presence of factors that can act as potential barriers to the tolerance of EN so that they can be corrected. The appropriate knowledge, definition, and management of the complications that can occur during EN are also important. |
| **Formula** | nº of patients with EN correctly monitored<br>---------- x 100<br>nº of patients admitted with EN |
| **Explanation of terms** | **Monitoring EN must include all of the following:**<br>Checking the amount of diet and formula administered in 24 h<br>Relating the real intake with the prescribed calorie and protein goals<br>Checking the position, type, and caliber of the feeding tube<br>Checking the patient's position: ≥ 20º<br>Identification and management of the gastrointestinal complications of EN: increased volume of gastric residue, constipation, EN-associated diarrhea, vomiting, regurgitation, abdominal distension, bronchoaspiration of the diet<br>Blood glucose control according to the critical care department's protocol<br>Serum electrolytes / 24 h<br>Triglicerides, cholesterol, albumin, retinol-bound protein / 7 days |
| **Population** | All patients with EN admitted to critical care during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Canadian Clinical Practice Guidelines 2015. Nutritional prescription of enteral nutrition. http://www.criticalcarenutrition.com/docs/CPGs 2015/3.2 2015.pdf (Accessed September 2015)<br>. Mesejo A, Vaquerizo C, Acosta J, Ortiz Leyba C, Montejo JC. [Recommendations for specialized nutritional and metabolic support in the critically ill patient. Update. Consensus of SEMICYUC- SENPE: Introduction and methodology]. Med Intensiva 2011;35(Supl 1):1-7<br>. Montejo JC. (Coordinator). SEMICYUC's Metabolism and Nutrition Workgroup. [Algorithms for nutritional intervention in the critical patient]. 2010. ISBN: 9788469326145<br>. McClave SA, Taylor BE, Martindale RG, Warren MM, Johnson DR, Braunschweig C, McCarthy MS, Davanos E, Rice TW, Cresci GA, Gervasio JM, Sacks GS, Roberts PR, Compher C; Society of Critical Care Medicine.; American Society for Parenteral and Enteral Nutrition. Guidelines for the Provision and<br>. Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2016 Feb;40(2):159-211<br>. Kreymann KG, Berger MM, Deutz NE, Hiesmayr M, Jolliet P, Kazandjiev G, Nitenberg G, van den Berghe G, Wernerman J; DGEM (German Society for Nutritional Medicine), Ebner C, Hartl W, Hey mann C, Spies C; ESPEN (European Society for Parenteral and Enteral Nutrition).ESPEN Guidelines on Enteral Nutrition:Intensive care. Clin Nutr. 2006;25:210-23 |

## INDICATOR Nº 62

| | |
|---|---|
| **Indicator** | **WITHDRAWING OBSTRUCTED FEEDING TUBES** |
| **Dimension** | Safety |
| **Justification** | Obstruction of feeding tubes (FT) can lead to failure to comply with standards for the administration of drugs and enteral nutrition with clinical consequences that range from the risk of bronchoaspiration to the interruption of treatment, which increase morbidity and costs. |
| **Formula** | $\frac{\text{nº FT removed due to obstruction}}{\text{total nº of FT removed}} \times 100$ |
| **Explanation of terms** | **FT obstruction**: loss of FT patency requiring its removal.<br>**Measures to prevent FT obstruction**: washing the FT with sterile water (every 6 h and after the administration of medication through the tube). |
| **Population** | All feeding tubes in patients in the critical care department during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 4% |
| **Commentaries** | References:<br>. Blumenstein I, Shastri YM, Stein J. Gastroenteric tube feeding: techniques, problems and solutions. World J Gastroenterol. Review.2014; 20(26):8505-24. Doi: 10.3748/wjg.v20.i26.8505<br>. Fletcher J. Nutrition: safe practice in adult enteral tube feeding. Br J Nurs.2011; 20 (19): 1234,1236-9<br>. Yardley IE, Donaldson LJ. Patient safety matters: reducing the risks of nasogastric tubes. Clin Med. 2010 Jun;10(3):228-30<br>. Phillips NM, Nay R. A systematic review of nursing administration of medication via enteral tubes in adults. J Clin Nurs. 2008 Sep;17(17):2257-65<br>. Williams NT. Medication administration through enteral feeding tubes. Am J Health Syst Pharm. 2008 Dec 15;65(24):2347-5<br>. Magnuson BL, Clifford TM, Hoskins LA, Bernard AC. Enteral nutrition and drug administration, interactions, and complications. Nutr Clin Pract. 2005 Dec;20(6):618-2<br>. Marcos M, Ayuso D, González B, Carrión MI, Robles P, Muñoz F, de la Cal MA. Análisis de la retirada accidental de tubos, sondas y catéteres como parte del programa de control de calidad. Enferm Intensiva 1994;5:115-20 |

## INDICATOR Nº 63

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|---|---|
| **Indicator** | **APPROPRIATE USE OF PARENTERAL NUTRITION** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Nutritional support is essential in critical patients to avoid rapid undernourishment due to metabolic stress. Parenteral nutrition (PN) is the alternative when a feeding tube cannot be used partly or completely for any reason. The objective of PN is to supply the macronutrients or micronutrients to meet the nutritional needs of the critical patient. PN can provide 100% of the calories required or it can be administered as a complement to enteral nutrition (EN). |
| **Formula** | nº of patients with indications for PN<br>---------- x 100<br>total nº of patients that need artificial nutrition |
| **Explanation of terms** | **Indications for PN:**<br>All patients admitted to the ICU without prospects of obtaining nutrition from oral or enteral feeding in 5–7 days<br>Complementary PN: If on the fourth day, at least 60% of the total calorie requirements are not met by EN.<br>Intestinal insufficiency: short bowel (<1.5 m), high flow fistula >2 l, radiation enteritis, acute inflammatory bowel disease.<br>Active GI bleeding<br>Mesenteric ischemia<br>Bowel obstruction |
| **Population** | All patients admitted to critical care who need artificial nutrition |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 16% with PN, and 25% with complementary PN |
| **Commentaries** | References:<br>. Preiser JC, van Zanten AR, Berger MM, Biolo G, Casaer MP, Doig GS, Griffiths RD, Heyland DK, Hiesmayr M, Iapichino G, Laviano A, Pichard C, Singer P, Van den Berghe G, Wernerman J, Wisch- meyer P, Vincent JL. Metabolic and nutritional support of critically ill patients: consensus and controversies. Crit Care. 2015 Jan 29;19:35<br>. Heidegger CP, Berger MM, Graf S, Zingg W, Darmon P, Costanza MC, Thibault R, Pichard C.<br>. Optimisation of energy provision with supplemental parenteral nutrition in critically ill patients: a randomised controlled clinical trial. Lancet. 2013 Feb 2;381(9864):385-93<br>. Vaquerizo Alonso, C., Mesejo, A., Acosta Escribano, J., Ruiz Santana, S. PARENTTE Workgroup. [Management of parenteral nutrition in intensive care units in Spain]. Nutr Hospitalaria, 2013,28(5), 1498-1507 |

## INDICATOR Nº 64

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|---|---|
| **Indicator** | **REFEEDING SYNDROME** |
| **Dimension** | Effectiveness, Safety |
| **Justification** | Refeeding syndrome (RFS) refers to metabolic alterations of fluids and electrolytes (phosphorus, magnesium, and potassium) caused by intense nutritional support in severely malnourished or starved patients.<br>Intake of carbohydrates stimulates the secretion of insulin, which causes alterations in the intracellular concentrations of electrolytes, resulting in hypophosphatemia (most specific alteration), hypomagnesemia, and severe hypokalemia. The most severe clinical manifestations of this syndrome include heart failure, arrhythmias, sudden death, hemolytic anemia, thrombocytopenia, flaccid paralysis, ataxia, coma, Guillain- Barré syndrome, rhabdomyolysis, seizures, acute respiratory failure, and acute tubular necrosis.<br>It is essential to identify patients at risk and provide them with progressive nutritional support. |
| **Formula** | $\frac{\text{nº of patients with artificial nutrition assessed for risk of RFS}}{\text{nº of patients with artificial nutrition}} \times 100$ |
| **Explanation of terms** | **Risk of RFS**: fasting for 7-10 days associated with severe stress, anorexia nervosa, chronic alcoholism, marasmus or kwashiorkor especially if weight loss > 10% in 2 months, prolonged intravenous fluid therapy, or cancer.<br>Electrolytes (sodium, potassium, phosphorus, and magnesium) must be checked daily in these patients, and ion deficits must be corrected prior to artificial nutrition. Intravenous thiamine should be administered during the first 3 days, and nutritional support should be started at 50% of calculated needs and increased progressively. |
| **Population** | All patients receiving artificial nutrition discharged from critical care during the period |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Rohre S, Dietrich JW, Refeeding syndrome: a review of the literature. Z Gastroenterol. 2014; 52;593-600<br>. Vignaud M, Constantin JM, Ruivard M, Villemeyre-Plane M, Futier E, Bazin JE, Annane D, Azuera group (AnorexieRea Study Group). Refeeding syndrome influences outcome of anorexia nervosa patients in intensive care unit: an observational study. Crit Care. 2010: 14 (5):R172<br>. Hartl WH, Jauch KW, Parhofer K, Rittler P, Working group for developing the guidelines for parenteral nutrition of The German Association for Nutritional Medicine. Complications and monitoring. Guidelines on Parenteral Nutrition. Chapter 11. Ger Med Sci. 2009; 18:17<br>. Mehanna HM, Moledina J, Travis J. Refeeding syndrome: what it is, and how to prevent and treat it. BMJ. 2008;336:1495-8 |

## INDICATOR Nº 65

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|---|---|
| **Indicator** | **PROPHYLAXIS AGAINST STRESS ULCERS IN CRITICAL PATIENTS RECEIVING ENTERAL NUTRITION** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Critical patients often develop gastrointestinal lesions due to altered perfusion of the gastric mucosa and increased gastric acid.<br>Different strategies have proven effective in preventing gastrointestinal bleeding (GIB) in critical patients with risk factors such as mechanical ventilation > 48 h. The appearance of GIB seems to increase the risk of death and prolong hospital stays, but drug prophylaxis does not reduce mortality and increases the risk of nosocomial pneumonia and diarrhea due to Clostridium difficile without efficacy superior to enteral nutrition (EN). |
| **Formula** | nº of patients with risk of GIB with EN who do not receive drug prophylaxis<br>---------- x 100<br>total nº of critical patients with risk of GIB who receive EN |
| **Explanation of terms** | **Population at risk of GIB:**<br>Mechanical ventilation > 48 h<br>Coagulopathies: INR > 1.5 or Platelets < 50/nL or PTT > 2 × ULN<br>Other risk situations: upper gastrointestinal bleeding <12 months; multiple organ failure, sepsis; cardiogenic shock; burns; TBI; acute kidney injury; known peptic disease; kidney or liver transplant; high-dose corticoids.<br>**Drug prophylaxis against GIB**: Protein pump inhibitors or H2-receptor antagonists |
| **Population** | All critical patients at risk of GIB who receive EN during the period reviewed.<br>**Exclusion criteria:** Patients with acid hypersecretory states (acute phase TBI, spinal cord lesions, burns) and those with a history of GIB in the last year. These patients should receive drug prophylaxis even if they are receiving EN. Consider suspending drug prophylaxis when complete doses of EN are tolerated and<br>they have overcome the hypersecretion phase (acute phase). |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 80% |
| **Commentaries** | References:<br>. Buendegens L, BueKoch A, Tacke F. Prevention of stress-related ulcer bleeding at the intensive care unit: Risks and benefits ofstress ulcer prophylaxis. World L Crit Care Med. 2016 Feb 4,5(1):57-64<br>. Krag M, Perner A, Wetterslev J, Wise MP, Hylander Møller M. Stress ulcer prophylaxis versus placebo or no prophylaxis in critically ill patients. A systematic review of randomised clinical trials with meta- analysis and trial sequential analysis. Intensive Care Med. 2014 Jan;40(1):11-22<br>. Krag M, Perner A, Wetterslev J, Wise MP, Borthwick M, Bendel S, McArthur C, Cook D, Nielsen N, Pelosi P, Keus F, Guttormsen AB, Moller AD, Møller MH. Prevalence and outcome of gastrointesti- nal bleeding and use of acid suppressants in acutely ill adult intensive care patients. Intensive Care Med. 2014 May;41(5):833-45<br>. Hurt RT, Frazier TH, McClave SA, Crittenden NE,Kulisec C, Saad M, Franklin GA. Stress prophylaxis in intensive care unit patients and the role of enteral nutrition. JPEN J Parenteral Enteral Nutr. 2012 Nov;36(6):721-31<br>. Alhazzani W, Alenezi F, Jaeschke RZ, Moayyedi P, Cook DJ. Proton pump inhibitors versus histamine 2 receptor antagonists for stress ulcer prophylaxisin critically ill patients: a systematic review and meta-analysis. Crit Care Med. 2013 Mar;41(3):693-705<br>. Marik PE, Vasu T, Hirani A, Pachinburavan M. Stress ulcer prophylaxis in the new millennium: a systematic review and meta-analysis. Crit Care Med. 2010 Nov;38(11):2222-8<br>. Ali T, Harty RF. Stress-induced ulcer bleeding in critically ill patients. Gastroenterol Clin North Am. 2009 Jun;38(2):245-65 |

## NEPHROLOGIC CARE

### INDICATOR Nº 66 (FUNDAMENTAL INDICATOR)

<table>
<tr><th>Indicator</th><th colspan="3">STRATIFICATION OF ACUTE KIDNEY INJURY (AKI) IN CRITICAL PATIENTS</th></tr>
<tr><td>Dimension</td><td colspan="3">Appropriateness</td></tr>
<tr><td>Justification</td><td colspan="3">Correct stratification of AKI requires accurate diagnostic tools that are easy to use at the bedside. The AKIN scale enables the severity of AKI to be stratified in critical patients.</td></tr>
<tr><td>Formula</td><td colspan="3">nº of patients diagnosed with AKI stratified by AKIN scale<br>---------- x<br>100 nº of patients with AKI discharged from critical care</td></tr>
<tr><td rowspan="7">Explanation of terms</td><td colspan="3">AKI: sudden decrease (in the last 48 h) in renal function, defined as:</td></tr>
<tr><td>Sta</td><td>Serum creatinine criteria</td><td>Urine output criteria</td></tr>
<tr><td>1</td><td>Increase in Crs ≥ 0.3mg/dl (26.4 µmol/L)<br>or increase to 1.5-fold to 2-fold over baseline</td><td><0.5 ml/kg/h in 6 hours</td></tr>
<tr><td>2</td><td>Increase in Crs to more than 2-fold to 3-fold over</td><td><0.5 ml/kg/h in 12 hours</td></tr>
<tr><td>3</td><td>Increase in Crs to >3-fold over baseline or Crs ≥0.4 mg/dl<br>(>354 µmol/L) with an acute increase of at least</td><td><0.3 ml/kg/h in 24 hours<br>or anuria for 12 hours</td></tr>
<tr><td colspan="3">Crs: serum creatinine</td></tr>
<tr><td colspan="3">3 also includes: initiation of replacement therapy or renal failure lasting > 4 weeks<br>AKIN: Acute Kidney Injury Network</td></tr>
<tr><td>Population</td><td colspan="3">All patients with AKI discharged from critical care during the period reviewed. Exclusion criterion: ICU stay < 48 h</td></tr>
<tr><td>Type</td><td colspan="3">Process</td></tr>
<tr><td>Source of data</td><td colspan="3">Clinical documentation. Clinical information system.</td></tr>
<tr><td>Standard</td><td colspan="3">95%</td></tr>
<tr><td>Commentaries</td><td colspan="3">References:<br>. Mehta RL, Kellum JA, Shah SW, Molitoris BA, Ronco C, Warnock DG, Levin A; Acute Kidney Injury Network. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. Critical Care 2007, 11: R31 (doi:10.1186/cc5713)<br>. Kellum JA, Bellomo R, Ronco C. Definition and Classification of Acute Kidney Injury. NephronClin Pract 2008;109: c182–c187. DOI: 10.1159/000142926</td></tr>
</table>

## INDICATOR Nº 67

| | |
|---|---|
| **Indicator** | **PREVENTION OF CONTRAST-INDUCED NEPHROPATH** |
| **Dimension** | Safety |
| **Justification** | Contrast-induced nephrotoxicity is a common cause of acute renal dysfunction. The use of contrast media is associated with increased morbidity, mortality, and stays.<br>The main risk factor for the development of nephrotoxicity is previously existing renal failure (RF). Appropriate hydration before and after the procedure reduces the risk of nephrotoxicity. |
| **Formula** | nº of procedures done in correctly hydrated high risk patients administered contrast material<br>---------- x 100<br>nº of procedures done in high risk patients administered contrast material |
| **Explanation of terms** | **High risk patients**: Mehran index > 10 points<br>**Contrast material:** intravenous administration of iodinated contrast material for diagnostic or therapeutic procedures.<br>**Correct hydration:** administration of 0.45% saline solution (1 ml/kg/h from 12 h before to 12 h after the procedure) (1B). Isotonic bicarbonate of soda can be used in emergencies (2B) |
| **Population** | All procedures done in high risk patients (Mehran > 10 points) who receive iodinated contrast material during the period reviewed.<br>**Exclusion criteria**: procedures in patients who need renal clearance techniques before the procedure. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Solomon R, Werner C, Mann D, D'Elia J, Silva P. Effects of saline, mannitol, and furosemide to prevent acute decreases in renal function induced by radiocontrast agents. N Engl J Med. 1994;331:1416-20<br>. Levine GN, Kern MJ, Berger PB, Brown DL, Klein LW, Kereiakes DJ, Sanborn TA, Jacobs AK; American Heart Association Diagnostic and Interventional Catheterization Committee and Council on Clinical Cardiology. Management of Patients Undergoing Percutaneous Coronary Revascularization. Ann Intern Med 2003;139:123-136<br>. Gleson TG, Bulugahapitiya. Contrast-induced nephropathy. Am J Roetgenol 2004; 183(6):16731689<br>. Mehran R, Aymong ED, Nikolsky E, et al. A Simple Risk Score for Prediction of Contrast-Induced Nephropathy After Percutaneous Coronary Intervention. Development and Initial Validation. J Am Coll Cardiol 2004; 44: 1393–1399<br>. Goldenberg I, Matetzky S. Nephropathy induced by contrast media: pathogenesis, risk factors and preventive strategies. CMAJ 2005; 172: 1461-1471 |

## INDICATOR Nº 68

| | |
|---|---|
| **Indicator** | **IDENTIFICATION OF PATIENTS WITH RISK FACTORS FOR DEVELOPING ACUTE KIDNEY INJURY (AKI)** |
| **Dimension** | Safety |
| **Justification** | Early detection of patients with risk factors for developing AKI during the ICU stay makes it possible to implement a series of measures to reduce the incidence of AKI. An estimated 30% of episodes of AKI can be prevented. |
| **Formula** | nº of patients in whom the risk of AKI is assessed<br>---------- x 100<br>nº of patients discharged after > 48 h in the ICU |
| **Explanation of terms** | **The risk factors for AKI** are age >75 years, at least one documented prior episode of AKI, chronic kidney disease with an estimated glomerular filtration rate < 60ml/min, chronic heart failure, use of nephrotoxic drugs and suspected prerenal state based on the use of diuretics and/or cognitive disturbances that could limit access to normal oral hydration.<br>**Risk assessment for AKI**: by determining whether risk factors are present and establishing a register of patients assessed. |
| **Population** | All patients discharged from the ICU during the period reviewed.<br>**Exclusion criterion**: ICU stay <48 hours. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO clinical practice guideline for acute kidney injury. KIDNEY INT SUPPL. 2012; 2: 1–138<br>. Stevens PE, Tamimi NA, Al-Hasani MK, Mikhail AI, Kearney E, Lapworth R, et al. Non-specialist management of acute renal failure. QJM [Internet]. 2001 Oct 1;94(10):533–40 |

## INDICATOR Nº 69

<table>
<tr><td>Indicator</td><td colspan="3">INDICATION OF RENAL REPLACEMENT THERAPY IN PATIENTS WITH AKIN STAGE 3 ACUTE KIDNEY INJURY</td></tr>
<tr><td>Dimension</td><td colspan="3">Effectiveness, safety</td></tr>
<tr><td>Justification</td><td colspan="3">There is a consensus that continuous renal replacement techniques (CRRT) should be started in critical patients when they meet the criteria for AKIN stage 3, especially in patients with sepsis and multiple organ failure.</td></tr>
<tr><td>Formula</td><td colspan="3">nº of AKIN stage 3 patients with sepsis and multiple organ failure undergoing CRRT<br>---------- x 100<br>total nº of AKIN stage 3 patients with sepsis and multiple organ failure discharged from the ICU</td></tr>
<tr><td rowspan="5">Explanation of terms</td><td>Stage</td><td>Serum creatinine criteria</td><td>Urine output</td></tr>
<tr><td>1</td><td>Increase in Crs ≥ 0.3mg/dl (26.4 µmol/L) or increase to 1.5-fold to 2-fold over baseline</td><td><0.5 ml/kg/h in 6 hours</td></tr>
<tr><td>2</td><td>Increase in Crs to more than 2-fold to 3-fold over baseline</td><td><0.5 ml/kg/h in 12 hours</td></tr>
<tr><td>3</td><td>Increase in Crs to >3-fold over baseline or Crs ≥0.4 mg/dl (>354 µmol/L) with an acute increase of at least 0.5 mg/dl (44 µmol/L)</td><td><0.3 ml/kg/h in 24 hours or anuria 12 hours</td></tr>
<tr><td colspan="3">Crs: serum creatinine</td></tr>
<tr><td colspan="3">Patients undergoing CRRT are considered to fulfill AKIN 3 criteria regardless of their stage when CRRT was initiated.<br>Sepsis and multiple organ failure.</td></tr>
<tr><td>Population</td><td colspan="3">All patients with AKIN 3 discharged from critical care during the period reviewed.<br>Exclusion criteria: previous renal replacement therapy, orders to limit life support, dehydration, or obstructive uropathy.</td></tr>
<tr><td>Type</td><td colspan="3">Process</td></tr>
<tr><td>Source of data</td><td colspan="3">Clinical documentation. Clinical information system</td></tr>
<tr><td>Standard</td><td colspan="3">> 90%</td></tr>
<tr><td>Commentaries</td><td colspan="3">References:<br>. Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO Clinical Practice Guideline for Acute Kidney Injury. Kidney Intern 2012; Suppl. 2: 1-138<br>. Standards and Recommendations for the Provision of Renal replacement Therapy on Intensive Care Units in the United Kingdom. Intensive Care Society Standards and Safety, January 2009, review date January 2012<br>. Karvellas CJ, Farhat MR, Sajjad I, et al. A comparison of early versus late initiation of renal replacement therapy in critically ill patients with acute kidney injury: a systematic review and meta- analysis. Crit Care 2011; 15: R72<br>. Bagshaw SM, Uchino S, Bellomo R, et al. and Beginning and Ending Supportive Therapy for the Kidney BEST Kidney Investigators. Timing of renal replacement therapy and clinical outcomes in critically ill patients with severe acute kidney injury. J Crit Care 2009; 24: 129-140</td></tr>
</table>

## INDICATOR Nº 70

| | |
|---|---|
| **Indicator** | **DYNAMIC DOSING DURING RENAL REPLACEMENT THERAPY** |
| **Dimension** | Effectiveness, safety |
| **Justification** | The dose of CRRT 20-35 mL/kg/h recognized as "best practice" is as efficacious as a higher or "intensive" dose (40 mL/kg/h). Higher doses do not result in benefits in terms of recovery of renal function, but they do result in a higher proportion of adverse events such dyselectrolytemia, "dialytrauma", or increased down time due to greater circuit clotting. Dosing should be reassessed daily based on patients' clinical condition and laboratory test results. |
| **Formula** | nº of CRRT treatments with appropriate dose and dynamic approach<br>---------- x 100<br>total nº of CRRT treatments |
| **Explanation of terms** | **Appropriate dose and dynamic approach**: the dose of effluent obtained should be 20-35 mL/kg/h and should be reassessed daily based on the patient's clinical condition and laboratory test results.<br>**CRRT treatment**: day in which CRRT is prescribed |
| **Population** | All CRRT treatments during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | > 95% |
| **Commentaries** | References:<br>. Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO Clinical Practice Guideline for Acute Kidney Injury. Kidney Intern 2012; Suppl. 2: 1-138<br>. Maynar Moliner J, Honore PM, Sánchez-Izquierdo Riera JA, et al. Handling continuous renal replacement therapy-related adverse effects in intensive care unit patients: the dialytrauma concept. Blood Purif 2012; 34: 177-85<br>. RENAL Replacement Therapy Study Investigators. Bellomo R, Cass A, Cole L, et al. Intensity of continuous renal-replacement therapy in critically ill patients. N Engl J Med 2009; 361: 1627-38<br>. Mehta RL, Kellum JA, Shah SV, et al. and de Acute Kidney Injury Network. Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. Critical Care 2007; 11: R31 |

## INDICATOR Nº 71

| | |
|---|---|
| **Indicator** | **ESTIMATION OF THE GLOMERULAR FILTRATION RATE THROUGH CREATININE CLEARANCE IN CRITICAL PATIENTS WITH ACUTE KIDNEY INJURY** |
| **Dimension** | Appropriateness |
| **Justification** | Calculating the glomerular filtration rate (GFR) based on mean creatine clearance during a time period has been validated in critical patients in a Spanish study and is more accurate than estimations based on regression formulas. This measure should be used to adjust drug dosage. Other, indirect formulas for estimating renal function (e.g., Cockcroft-Gault, MDRD, or CKD-EPI) have been validated for chronic patients but are not recommended for acute critical patients. |
| **Formula** | nº of patients with AKI and indication for estimation of GFR by creatine clearance in urine / nº of patients with AKI and indication for estimation of GFR x 100 |
| **Explanation of terms** | **AKI**: AKIN ≥1<br>**Indication for estimation of GFR**: drug adjustment or criteria for withdrawal of continuous renal replacement techniques when diuresis is recovered<br>**Mean creatine clearance** in urine collected during a period of time (2, 6, 12, or 24 hours) |
| **Population** | All patients discharged from critical care with the diagnosis of AKI in the discharge report during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | > 80% |
| **Commentaries** | References:<br>. Carlier M, Dumoulin A, Janssen A, Picavet S, Vanthuyne S, Van Eynde R, Vanholder R, Delanghe J, De Schoenmakere G, De Waele JJ, Hoste EA. Comparison of different equations to assess glo- merular filtration in critically ill patients. Intensive Care Med. 2015 Mar;41(3):427-35<br>. Seller-Pérez G, Herrera-Gutiérrez ME, Banderas-Bravo E, Olalla-Sánchez R, Lozano-Sáez R, Quesada- García G. [Concordance in critical patients between the equations designed for the calculation of glomerular filtration rate and 24-hour creatinine clearance]. Med Intensiva. 2010 Jun- Jul;34(5):294-302<br>. Bouchard J, Macedo E, Soroko S, Chertow GM, Himmelfarb J, Ikizler TA, Paganini EP, Mehta RL; Program to Improve Care in Acute Renal Disease. Comparison of methods for estimating glomerular filtration rate in critically ill patients with acute kidney injury. Nephrol Dial Transplant. 2010 Jan;25(1):102-7<br>. Herrera-Gutiérrez ME, Seller-Pérez G, Banderas-Bravo E, Muñoz-Bono J, Lebrón-Gallardo M, Fernandez-Ortega JF. Replacement of 24-h creatinine clearance by 2-h creatinine clearance in intensive care unit patients: a single-center study. Intensive Care Med. 2007 Nov;33(11):1900-6 |

## INDICATOR Nº 72

| | |
|---|---|
| **Indicator** | **USE OF DOPAMINE IN ACUTE KIDNEY INJURY (AKI)** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Dopamine at renal doses (< 5 ug/kg/min) has not proven effective for prophylaxis or treatment of AKI. (Level of evidence: IA ). Moreover, its possible adverse effects are well known and more unpredictable in AKI due to the lower rate of clearing of this molecule in this condition. Dopamine can be used as a compassionate measure in patients who need a negative balance who will not undergo CRRT because there is evidence that it increases clearance of free water. |
| **Formula** | nº of patients with AKI treated with dopamine<br>---------- x 100<br>total nº of patients with AKI |
| **Explanation of terms** | **Treated with dopamine:** dopamine perfusion < 5 mg/kg/min indicated as prophylaxis against AKI and/or as a treatment against AKI |
| **Population** | All patients with AKI discharged from critical care during the period reviewed.<br>**Exclusion criteria**: Use of dopamine for indications other than AKI or compassionate use to maintain a negative balance in patients in whom CRRT is not indicated. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 0 |
| **Commentaries** | References:<br>. Friedrich JO, Adhikari N, Herridge MS, Beyene J. Meta-analysis: low-dose dopamine increases urine output but does not prevent renal dysfunction or death. Ann Intern Med. 2005 Apr 5;142(7):510-24<br>. Holmes ChL, Walley KR. Bad medicine: low-dose dopamine in the ICU. Chest 2003; 123:1266-1275<br>. Kellum JA, Decker JM. Use of dopamine in acute renal failure: A meta-analysis. Crit Care Medicine 2001; 29:1526-1531<br>. Bellomo R, Chapman M, Finfer S, Hickling K, Myburgh J. Low-dose dopamine in patients with early renal dysfunction: A placebo-controlled randomised trial. Australian and new Zealand Intensive Care Society (ANZICS) Clinical Trial Group. Lancet 2000;356:2139-2143<br>. Abay MC, Reyes JD, Everts K, Wisser J. Current literature questions the routine use of low-dose dopamine. AANA J. 2007 Feb;75(1):57-63<br>. Joannidis M, Druml W, Forni LG, Groeneveld AB, Honore P, Oudemans-van Straaten HM, Ronco C, Schetz MR, Woittiez AJ. Prevention of acute kidney injury and protection of renal function in the intensive care unit Expert opinion of the working group for nephrology, ESICM. Intensive Care Med. 2010 Mar;36(3):392-411 |

## SEDATION AND ANALGESIA

### INDICATOR Nº 73

| | |
|---|---|
| **Indicator** | **MONITORING SEDATION** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Sedation is necessary to guarantee comfort and safety of patients on mechanical ventilation (MV). However, its use is not exempt from adverse events (mostly derived from overuse or underuse) that can prolong MV, worsen critical patients' outcomes and prognoses, and increase healthcare costs. Validated sedation scales are useful in the management of MV patients, and their use is recommended in clinical guidelines. |
| **Formula** | nº of 8-hour periods in which sedation is monitored<br>---------- x 100<br>nº of 8-hour periods with MV and continuous sedation (days MV and continuous sedation x 3) |
| **Explanation of terms** | **Monitoring**: evaluation of the level of sedation with a validated scale every 8 hours or when the clinical situation changes<br>**Inclusion criteria:** MV > 12 hours and continuous sedation |
| **Population** | All 8-hour periods (or days x 3) in patients undergoing MV and continuous sedation during the period reviewed.<br>**Exclusion criteria:** neuromuscular blockade |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information systems. |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Validated scales: Ramsay Sedation Scale, Sedation Agitation Scale (SAS), Motor Activity Assessment Scale (MAAS), Richmond Agitation-Sedation Scale (RASS), Adaptation to the Intensive Care Environment (ATICE) instrument, and the Minnesota Sedation Assessment Tool (MSAT). Others may also be available. References:<br>. Reade MC, Finfer S. Sedation and delirium in the intensive care unit. N Engl J Med. 2014 Jan 30;370(5):444-54<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, Davidson JE, Devlin JW, Kress JP, Joffe AM, Coursin DB, Herr DL, Tung A, Robinson BR, Fontaine DK, Ramsay MA, Riker RR, Sessler CN, Pun B, Skrobik Y, Jaeschke R; American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Sessler CN, Pedram S. Protocolized and target-based sedation and analgesia in the ICU. Crit Care Clin. 2009 Jul;25(3):489-513<br>. Estébanez-Montiel MB, Alonso-Fernández MA, Sandiumenge A, Jiménez-Martín MJ; Grupo de Trabajo de Analgesia y Sedación de la SEMICYUC. [Prolonged sedation in Intensive Care Units] Med Intensiva. 2008 Feb;32 Spec No. 1:19-30<br>. Chamorro C, Martínez-Melgar JL, Barrientos R; SEMICYUC'S Sedation& Analgesia Workgroup. [Monitoring of sedation] Med Intensiva. 2008 Feb;32 Spec No. 1:45-52 |

## INDICATOR Nº 74 (FUNDAMENTAL INDICATOR)

| Indicator | APPROPRIATE SEDATION |
|---|---|
| **Dimension** | Safety, effectiveness |
| **Justification** | Inappropriate sedation (both oversedation and undersedation) increases morbidity, mortality, stays, and costs. For these reasons, both conscious (or cooperative) and unconscious sedation must be appropriately monitored and adapted to the patient's evolving condition. The type and dose of drug(s) must be tailored to the patient's characteristics and the indication for sedation. |
| **Formula** | $\frac{\text{nº of patients with appropriate continuous sedation}}{\text{nº of patients with appropriate sedation}} \times 100$ |
| **Explanation of terms** | **Appropriate sedation:** maintaining at least 80% of the results on the sedation scales within the range prescribed for each patient.<br>**Continuous sedation**: delivery of any sedative through an intravenous infusion pump. |
| **Population** | All patients with continuous sedation in the ICU during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 85% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence- based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, Davidson JE, Devlin JW, Kress JP, Joffe AM, Coursin DB, Herr DL, Tung A, Robinson BR, Fontaine DK, Ramsay MA, Riker RR, Sessler CN, Pun B, Skrobik Y, Jaeschke R; American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Sessler CN, Pedram S. Protocolized and target-based sedation and analgesia in the ICU. Crit Care Clin. 2009 Jul;25(3):489-513<br>. Estébanez-Montiel MB, Alonso-Fernández MA, Sandiumenge A, Jiménez-Martín MJ; SEMICYUC's Sedation& Analgesia Workgroup. [Prolonged sedation in Intensive Care Units] Med Intensiva. 2008 Feb;32 Spec No. 1:19-30 |

## INDICATOR Nº 75

| | |
|---|---|
| **Indicator** | **CONSIDERING INTERRUPTION OF SEDATION DAILY** |
| **Dimension** | Effectiveness, efficiency |
| **Justification** | Given the potential accumulation of sedatives, strategies to avoid oversedation are necessary. Studies comparing daily interruption of sedation with strict control of the level of sedation through a nursing algorithm have yielded heterogeneous, inconclusive results. Therefore, the Society's work group in sedation and analgesia considers it important to point out that:<br>• The two approaches are not exclusive<br>• Some drugs used for sedation and analgesia have long half-lives (e.g., midazolam, fentanyl, morphine) and higher potential for accumulation.<br>• This technique is easy to implement and very appropriate to rescue patients managed with drugs that have long half-lives in which we quantify a greater-than-expected depth of sedation. |
| **Formula** | nº days of mechanical ventilation (MV) with sedation level > objective in which sedation is interrupted / nº days of MV with sedation level > objective x 100 |
| **Explanation of terms** | **Interruption of sedation**: temporary suspension of infusion of sedative until the patient is conscious, obeys orders, or appears agitated.<br>**Sedation > objective**: prescribed or established by protocol |
| **Population** | All days of MV under continuous sedation during the period reviewed.<br>**Exclusion criteria:** neuromuscular blockade, intracranial hypertension, asthma, severe ARDS, acute myocardial ischemia. Drugs with very short half-life (e.g., remifentanil) |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 80% |
| **Commentaries** | References:<br>. Nassar AP, Park M. Daily sedative interruption versus intermittent sedation in mechanically ventilated critically ill patients: a randomized trial. Ann Intensive Care 2014;4:14<br>. Mehta S, Burry L, Cook D, Fergusson D, Steinberg M, Granton J et al. Daily sedation interruption in mechanically ventilated critically ill patients cared for with a sedation protocol: a randomized con- trolled trial. JAMA 2012; 308: 1985-1992<br>. Augustes R, Ho KM. Meta-analysis of randomised controlled trials on daily sedation interruption for critically ill adult patients. Anaesth Intensive Care. 2011; 39: 401-9<br>. Kress JP, Pohlman AS, O'Connor MF, Hall JB. Daily interruption of sedative infusions in critically ill patients undergoing mechanical ventilation. N Engl J Med. 2000 May 18;342(20):1471-7 |

## INDICATOR Nº 76

| | |
|---|---|
| **Indicator** | **MONITORING PAIN IN PATIENTS WHO CAN COMMUNICATE** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Critical patients are exposed to multiple pain-causing stimuli. Inadequate pain control causes stress and increases morbidity and probably mortality. Freedom from pain should be a quality-of-care objective in the ICU. Pain should be measured on a validated scale and monitored to ensure the desired level of analgesia is achieved and maintained. |
| **Formula** | nº who can communicate who are monitored according to protocol<br>---------- x 100<br>nº of patients in the ICU who can communicate |
| **Explanation of terms** | **Patient who can communicate**: patient capable of expressing or manifesting the presence of pain using a validated scale: VAS: visual analogue scale; VNRS: verbal numeric rating scale<br>**Monitoring according to protocol:**<br>**Measured at least one every** 8-hour shift (or more often if pain is reported). Sleep should not be interrupted if a validated measure of pain (e.g., VAS, VNRS) shows pain control is adequate.<br>VAS or VNRS should not be >3 more than once every 24 h period.<br>Compliance with indicator requires completing at least two-thirds of the planned measurements during the<br>ICU stay. |
| **Population** | All patients who can communicate discharged from critical care during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence- based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, Davidson JE, Devlin JW, Kress JP, Joffe AM, Coursin DB, Herr DL, Tung A, Robinson BR, Fontaine DK, Ramsay MA, Riker RR, Sessler CN, Pun B, Skrobik Y, Jaeschke R; American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Barr J, Kishman CPJ, Jaeschke R. The methodological approach used to develop the 2013<br>. Pain, Agitation, and Delirium Clinical Practice Guidelines for adult ICU patients. Crit Care Med 2013; 41: S1-S15<br>. Martin J, Heymann A, Basell K, et al. Evidence and consensus-based German guidelines for the management of analgesia, sedation and delirium in intensive care -short version. Ger Med Sci 2010; 8: Doc02<br>. Pardo C, Muñoz T, Chamorro C; Analgesia and Sedation Work Group of SEMICYUC. [Monitoring of pain. Recommendations of the Analgesia and Sedation Work Group of SEMICYUC] Med Intensiva. 2008 Feb;32 Spec No. 1:38-44 |

## INDICATOR Nº 77

| | |
|---|---|
| **Indicator** | **MONITORING PAIN IN PATIENTS WHO CANNOT COMMUNICATE** |
| **Dimension** | Effectiveness y safety |
| **Justification** | Pain is prevalent in critical patients, affecting up to 70%. Pain should be monitored and treated appropriately. In patients who cannot communicate, pain can be overlooked, and this can lead to inadequate pain management. Behavioral observation pain scales can be useful in these scenarios.<br>Physiological indicators are not recommended for monitoring pain because they are not specific. Monitoring pain in the ICU is associated with shorter duration of mechanical ventilation and shorter ICU stays. |
| **Formula** | nº of patients who cannot communicate monitored with behavioral observation pain scales / nº of patients who cannot communicate x 100 |
| **Explanation of terms** | **Behavioral observation pain scales:** validated scales that consider, amongst others, facial expression, muscle tone, and movements, and that are correlated with the presence of pain (e.g., Behavioral Pain Scale (BPS), Critical Care Observation Tool (CPOT), Scale of Behavior Indicators of Pain (ESCID)).<br>**Patient who cannot communicate:** patient incapable of expressing or manifesting the presence of pain using a validated scale (e.g., VAS, VNRS) because of low level of consciousness, deep sedation, or any other reason.<br>Compliance with pain monitoring requires evaluation with a behavioral observation **scale at least once during every 8-hour shift** or more often if necessary.<br>Compliance requires less than one measure above the following scores every 24 h : ESCID > 3, BPS > 5 , CPOT > 2 |
| **Population** | All patients in the ICU who cannot communicate in the period reviewed.<br>**Exclusion criteria**: neuromuscular blockade; barbiturate coma; brain death |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Latorre-Marco I, Acevedo-Nuevo M, Solís-Muñoz M, Hernández-Sánchez L, López-López C,<br>. Sánchez-Sánchez MM, Wojtysiak-Wojcicka M, de Las Pozas-Abril J, Robleda-Font G, Frade-Mera MJ, De Blas-García R, Górgolas-Ortiz C, De la Figuera-Bayón J, Cavia-García C. Psychometric validation of the behavioral indicators of pain scale for the assessment of pain in mechanically ventilated and unable to self-report critical care patients. Med Intensiva. 2016 Nov;40(8):463-473<br>. Celis-Rodríguez E, Birchenall C, Muñoz T, et al. Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients. Med Intensiva 2013; 37: 519-574<br>. Payen JF, Bosson JL, Chanques G, et al. Pain assessment is associated with decreased duration of mechanical ventilation in the Intensive Care Unit. DOLOREA study. Anesthesiology 2009; 111: 1308-1316<br>. Pardo C, Muñoz T, Chamorro C, Analgesia and Sedation Work Group of SEMICYUC. [Monitoring of pain. Recommendations of the Analgesia and Sedation Work Group of SEMICYUC]. Med Intensiva 2008; 32 Supl 1: 38-44<br>. Payen JF, Bru O, Bosson JL, et al. Assessing pain in critically ill sedated patients by using a behavioral pain scale. Crit Care Med 2001; 29: 2258-2263 |

## INDICATOR Nº 78

| | |
|---|---|
| **Indicator** | **INAPPROPRIATE USE OF NEUROMUSCULAR BLOCKERS** |
| **Dimension** | Safety |
| **Justification** | The incorrect use of drugs that cause neuromuscular blockade (NMB) can be associated with severe complications. Clinical guidelines recommend using muscle relaxants only in specific clinical situations (e.g., difficulties in mechanical ventilation (MV), tetanus, increased intracranial pressure, and decreased oxygen consumption), and only after other measures have failed. |
| **Formula** | $\frac{\text{nº of patients on MV with PO2/FiO2 > 200 and continuous NMB}}{\text{nº of patients on MV with PO2/FiO2 > 200}} \times 100$ |
| **Explanation of terms** | **Continuous NMB:** includes bolus administration at intervals ≤ 2 h and/or continuous perfusion of neuromuscular-blocking drugs |
| **Population** | All patients on MV with PO2/FiO2 > 200 during the period reviewed<br>**Exclusion criteria:**<br>1.- ARDS during the first 48 hours of MV<br>2.- Tetanus<br>3.- Intracranial hypertension<br>4.- Intracranial hypertension |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | <2% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence- based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Papazian L, Forel JM, Gacouin A, Penot-Ragon C, Perrin G, Loundou A, Jaber S, Arnal JM, Perez D, Seghboyan JM, Constantin JM, Courant P, Lefrant JY, Guérin C, Prat G, Morange S, Roch A; ACURASYS Study Investigators. Neuromuscular blockers in early acute respiratory distress syn- drome. N Engl J Med. 2010 Sep 16;363(12):1107-16<br>. Sandiumenge A, Anglés R, Martínez-Melgar JL, Torrado H; SEMICYUC's Anagelsia and Sedation<br>. Workgroup. [Use of neuromuscular blockers in the critical patient] Med Intensiva.2008 Feb;32 Spec No. 1:69-76<br>. Mehta S, Burry L, Fischer S, et al. Canadian survey of the use of sedatives, analgesics, and neuromuscular blocking agents in critically ill patients. Crit Care Med. 2006 Feb;34(2):374-80 |

## INDICATOR Nº 79

| | |
|---|---|
| **Indicator** | **MONITORING THE USE OF NEUROMUSCULAR BLOCKERS** |
| **Dimension** | Effectiveness, safety |
| **Justification** | The use of drugs that cause neuromuscular blockade (NMB) is associated with severe complications, Guidelines recommend monitoring NMB to assess the appropriateness of the dose administered and the presence of undesired effects. |
| **Formula** | $\frac{\text{nº of patients with continuous NMB monitored}}{\text{nº of patients with continuous NMB}} \times 100$ |
| **Explanation of terms** | **Monitoring NMB:** periodic clinical assessment and train-of-four measurements at least once during every 8-hour shift or more often if necessary<br>**Continuous NMB:** bolus administration at intervals ≤ 2 h and/or continuous perfusion of neuromuscular- blocking drugs |
| **Population** | All patients with continuous NMB during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence- based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Ariño-Irujo JJ, Calbet-Mañueco A, De la Calle-Elguezabal PA, Velasco-Barrio JM, López-Timoneda F, Ortiz-Gómez JR, Fabregat-López J, Palacio-Abizanda FJ, Fornet-Ruiz I, Pérez- Cajaraville J. [Neuromuscular blockade monitoring. Part 1] Rev Esp Anestesiol Reanim. 2010 Mar;57(3):153-60<br>. Chamorro C, Silva JA; Grupo de Trabajo de Analgesia y Sedación de la SEMICYUC. [Monitoring of neuromuscular blocking] Med Intensiva. 2008 Feb;32 Spec No. 1:53-8<br>. Sandiumenge A, Anglés R, Martínez-Melgar JL, Torrado H; SEMICYUC's Sedation and Analgesia<br>. Workgroup.[Use of neuromuscular blockers in the critical patient] Med Intensiva. 2008 Feb;32 Spec No. 1:69-76 |

## INDICATOR Nº 80

| | |
|---|---|
| **Indicator** | **MONITORING SEDATION DURING THE USE OF NEUROMUSCULAR BLOCKERS** |
| **Dimension** | Effectiveness, safety |
| **Justification** | It is essential to maintain appropriate levels of sedation in patients with neuromuscular blockade (NMB). The usual sedation scales are not appropriate for assessing sedation in these patients. In these cases, it is best to use objective monitoring systems (e.g., Bispectral Index (BIS), SedLine, Narcotrend). The BIS is the most widely used in critical care; it enables objective measurement of the level of sedation that facilitates the obtainment of the desired levels, avoiding both oversedation and undersedation that would be undesirable in these patients. |
| **Formula** | nº of patients with NMB monitored with objective systems / nº of patients with NMB x 100 |
| **Explanation of terms** | **Objective monitoring of sedation**: using BIS (monitoring the electrical activity in the frontal cortex and applying a dynamic algorithms to obtain a numeric value that correlates with the level of sedation); BIS scores range from 100 (awake patient) to 0 (patient with no electoral activity in the frontal cortex). During NMB values between 40 and 60 (without artifacts) are considered adequate. |
| **Population** | All patients in the ICU who receive NMB. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Yaman F, Ozcan N, Ozcan A, Kaymak C, Basar H. Assessment of correlation between bispectral index and four common sedation scales used in mechanically ventilated patients in ICU. Eur Rev Med Pharmacol Sci. 2012<br>. Bigham C, Bigham S, Jones C. Does the bispectral index monitor have a role in intensive care? JICS 2012; 13: 314-319<br>. Weatherburn C, Endacott R, Tynan P, Bailey M. The impact of bispectral index monitoring on sedation administration in mechanically ventilated patients. Anaesth Intensive Care. 2007 Apr;35(2):204-8 |

## INDICATOR Nº 81 (FUNDAMENTAL INDICATOR)

| Indicator | IDENTIFICATION OF DELIRIUM |
|---|---|
| **Dimension** | Effectiveness, safety |
| **Justification** | Delirium is associated with high morbidity and mortality, as well as with increased hospital costs. Delirium occurs in up to 80% of severe patients admitted to ICUs and is undetected in up to three-quarters of cases. Therefore, it is recommended to use systemic scales to identify delirium so it can be treated early. Both the "Confusion Assessment Method for the ICU" (CAM-ICU) and the "Intensive Care Delirium Screening Checklist" (ICDSC) have proven their usefulness in diagnosing delirium in critical patients. |
| **Formula** | $\frac{\text{nº of adults admitted to the ICU for > 24 h screened for delirium}}{\text{nº of adults admitted to the ICU for > 24 h}} \times 100$ |
| **Explanation of terms** | **Screening for delirium**: measuring delirium with the CAM-ICU or ICDSC<br>At least once a day and when the patient's mental status changes. |
| **Population** | All patients admitted to the ICU for more than 24 hours in the period reviewed.<br>**Exclusion criteria**: Richmond Agitation Sedation Scale < -3 or equivalent finding on another validated scale |
| **Type** | Process |
| **Source of data** | Clinical records. Clinical information system |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Salluh JI, Wang H, Schneider EB, Nagaraja N, Yenokyan G, Damluji A, Serafim RB, Stevens RD. Outcome of delirium in critically ill patients: systematic review and meta-analysis. BMJ. 2015 Jun 3;350:h2538<br>. Reade MC, Finfer S. Sedation and delirium in the intensive care unit. N Engl J Med. 2014 Jan 30;370(5):444-54<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, et al. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Palencia Herrejón E. [Diagnosis of delirium in the critical ill] Med Intensiva. 2010 Jan-Feb;34(1):1-3<br>. Toro AC, Escobar LM, Franco JG, Díaz-Gómez JL, Muñoz JF, Molina F, Bejarano J, Yepes D, Navarro E, García A, Wesley Ely E, Esteban A. [Spanish version of the CAM-ICU (Confusion Assessment Method for the Intensive Care Unit). Pilot study of validation] Med Intensiva. 2010 Jan- Feb;34(1):14-21<br>. Celis-Rodríguez E, Besso J, Birchenall C, de la Cal MA, Carrillo R, Castorena G, et al; Federación Panamericana e Ibérica de Sociedades de Medicina Crítica y Cuidados Intensivos. [Clinical practice guideline based on the evidence for the management of sedoanalgesia in the critically ill adult patient] Med Intensiva. 2007 Nov;31(8):428-71<br>. Ely EW, Margolin R, Francis J, May L, Truman B, Dittus R, Speroff T, Gautam S, Bernard GR, Inouye SK. Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). Crit Care Med. 2001; 29:1370-9 |

## INDICATOR Nº 82

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|---|---|
| **Indicator** | **NONPHARMACOLOGICAL PREVENTION OF DELIRIUM** |
| **Dimension** | Safety, effectiveness |
| **Justification** | Delirium is a preventable complication of acute disease; specific interventions aiming to affect certain risk factors can reduce the incidence of delirium. |
| **Formula** | nº of patients with preventive measure against delirium<br>---------- x 100<br>nº of patients discharged from the ICU |
| **Explanation of terms** | **Preventive measures against delirium**:<br>**Cognitive functions**: stimulating the patient's orientation and relations with the environment (flexible) visiting hours, visible clock, identification of professionals, informing the patient, allowing distractions, occupational therapy, personalizing the decoration, etc.).<br>**Preventing sleep deprivation:** strategies to control light and noise, grouping night nursing procedures, and favoring the sleep-wake cycle.<br>**Early mobilization:** passive and active exercises, early sitting up and walking, avoiding physical restraints.<br>**Enabling vision and hearing:** use of glasses and hearing aids in patients that used them before admission.<br>Appropriate pain control using specific protocols. |
| **Population** | All patients staying in the ICU for > 24 h during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information systems. Unit policies. |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Reade MC, Finfer S. Sedation and delirium in the intensive care unit. N Engl J Med. 2014 Jan 30;370(5):444-54<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74<br>. Barr J, Fraser GL, Puntillo K, Ely EW, Gélinas C, Dasta JF, Davidson JE, Devlin JW, Kress JP, Joffe AM, Coursin DB, Herr DL, Tung A, Robinson BR, Fontaine DK, Ramsay MA, Riker RR, Sessler CN, Pun B, Skrobik Y, Jaeschke R; American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the Intensive Care Unit: executive summary. Crit Care Med. 2013 Jan;41(1):263-306<br>. Palencia Herrejón E. [Diagnosis of delirium in the critical ill] Med Intensiva. 2010 Jan-Feb;34(1):1-3<br>. Celis-Rodríguez E, Besso J, Birchenall C, de la Cal MA, Carrillo R, Castorena G, et al; Federación Panamericana e Ibérica de Sociedades de Medicina Crítica y Cuidados Intensivos. [Clinical practice guideline based on the evidence for the management of sedoanalgesia in the critically ill adult pa- tient] Med Intensiva. 2007 Nov;31(8):428-71<br>. Palencia-Herrejón E, Romera MA, Silva JA; SEMICYUC's Workgroup on Analgesia and Sedation. [Delusion in the critical patient] Med Intensiva. 2008 Feb;32 Spec No. 1:77-9 |

## INDICATOR Nº 83

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|---|---|
| **Indicator** | **MAXIMUM DOSES OF OPIOIDS AND SEDATIVES** |
| **Dimension** | Effectiveness and efficiency |
| **Justification** | Excessive sedation can increase morbidity and mortality in critical patients. Oversedation causes delays in wakening, prolongs mechanical ventilation and increases the risk of associated complications, and prolongs ICU and hospital stays. Oversedation results from administering higher-than-necessary doses of sedatives with the risk of undesirable and toxic secondary effects, such as withdrawal syndrome, delirium, midazolam infusion syndrome, and propofol infusion syndrome. |
| **Formula** | $\frac{\text{nº of days on the maximum dose of analgesic-sedative drugs}}{\text{nº of days of perfusion of analgesic-sedative drugs}} \times 100$ |
| **Explanation of terms** | Maximum dose of midazolam: ≥ 0.25 mg/kg/h<br>Maximum dose of propofol: ≥ 4.5 mg/kg/h<br>Maximum dose of morphine hydrochloride: ≥ 0.07 mg/kg/h<br>Maximum dose of fentanyl: ≥ 1.5 µg/kg/h<br>If higher doses of these drugs are detected, other strategies for sedoanalgesia should be adopted (combined therapy, rotating drugs, using other drugs, inhalation sedation, etc.) |
| **Population** | All patients who receive continuous infusion of the above-listed drugs during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 10% |
| **Commentaries** | References:<br>. Celis-Rodríguez E, Birchenall C, de la Cal MÁ et al. Clinical practice guidelines for evidence-based management of sedoanalgesia in critically ill adult patients. Med Intensiva. 2013 Nov;37(8):519-74· Reade MC, Finfer S. Sedation and delirium in the intensive care unit. N Engl J Med. 2014 Jan 30;370(5):444-54<br>. Chamorro C, Romera MA and SEMICYUC's Workgroup on Analgesia and Sedation. [Control strategies for difficult sedation]. Med Intensiva 2008; 32 Supl 1: 31-37<br>. Estébanez-Montiel MB, Alonso Fernández MA, Sandiumenge A, Jiménez Martín MJ and SEMICYUC's Workgroup on Analgesia and Sedation. [Prolonged sedation in Intensive Care Units]. Med Intensiva 2008; 32 Supl 1: 19-30<br>. Riker RR, Fraser GL. Adverse events associated with sedatives, analgesics, and other drugs that provide patient comfort in the intensive care unit. Pharmacotherapy 2005; 25: S8-18<br>. Chamorro C, Romera MA, Pardo C. [Analgesia and sedation in the critical patient. Present and future]. Med Intensiva 2004; 28 Supl 3: 1-4 |

## BLOOD PRODUCTS

### INDICATOR Nº 84

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|---|---|
| **Indicator** | **INFORMED CONSENT FOR THE TRANSFUSION OF BLOOD PRODUCTS** |
| **Dimension** | Satisfaction, appropriateness |
| **Justification** | The administration of blood components is a therapeutic procedure that involves a risk to the patient's health. Current legislation requires written informed consent before this procedure. Failure to ask for written consent violates the patient's or family's right to decide. |
| **Formula** | nº of patients with blood products transfused in the ICU with written informed consent<br>---------- x 100<br>nº of patients with blood products transfused in the ICU |
| **Explanation of terms** | **Blood products:** packed red blood cells, plasma, and platelets<br>**Written informed consent:** stating the need for transfusion, its benefits, risks, and alternatives. Patients or legal representatives must understand and sign the document. It can be recorded directly in the clinical history.<br>**Life-threatening emergency:** clinical situations that require immediate transfusion of blood products without the possibility of obtaining written informed consent from patients or representatives. |
| **Population** | All patients administered blood products in the ICU for the first time during the period reviewed.<br>**Population excluded:** patients in life-threatening situations (this does not eliminate the requirement of informing patients and their families as soon as possible) |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Blood bank. |
| **Standard** | 95% |
| **Commentaries** | References:<br>Informed consent should be sought for each of the indications for transfusion (each form can include the transfusion of various units of blood components).<br>. Spanish Law 41/2002, regulating patients' autonomy and rights, and obligations regarding information and clinical documentation. Updated 22 September 2015 https://www.boe.es/buscar/pdf/2002/BOE-A-2002-22188-consolidado.pdf<br>. Royal decree 1854/1993. BOE 20 November1993;num 278 (page 32630)<br>. http://www.boe.es/boe/dias/1993/11/20/pdfs/A32630-32636.pdf<br>. Solsona JF, Cabré L, Abizanda R, Campos JM, Sainz A, Martín MC, Sánchez JM, Bouza C, Quintana M, Saralegui I, Monzón JL. [Recommendations of the Bioethics Group of the Spanish Society of Intensive Care Medicine and Coronary Units regarding informed consent in the intensive care unit]. Med. Intensiva 2002; 26 (5):254-255 |

## INDICATOR Nº 85

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|---|---|
| **Indicator** | **INAPPROPRIATE TRANSFUSION OF FRESH-FROZEN PLASMA (FFP)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | FFP is thought to be the blood component that is most often transfused erroneously. Transfusion of FFP can have the same adverse effects as transfusion of packed red blood cells. Transfusion of FFP is rarely if ever indicated in patients without blood loss and without prolonged coagulation times. |
| **Formula** | nº of patients with normal coagulation times who receive FFP transfusions<br>---------- x 100<br>nº of patients who receive FFP transfusions |
| **Explanation of terms** | **Normal coagulation times**: Prothrombin time (PT) > 70% and/or partial thromboplastin time (PTT) ≤1.5 times the control. |
| **Population** | All patients transfused with FFP during the period reviewed.<br>**Exclusion criteria:** patients without bleeding needing to undergo surgery or invasive procedures in whom FFP aims to reverse the effects of oral anticoagulants (dicoumarol/wardarin) or the deficit of congenital factors for which no purified or inactivated concentrate is available. Thrombotic thrombocytopenia purpura. (TTP). |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Blood bank. |
| **Standard** | 0% |
| **Commentaries** | References:<br>. Karam O, Tucci M, Combescure C, Lacroix J, Rimensberger PC. Plasma transfusion strategies for critically ill patients. Cochrane Database Syst Rev. 2013 Dec 28;12:CD010654<br>. Liumbruno GM, Bennardello F, Lattanzio A, Piccoli P, Rossetti G; Italian Society of Transfusion Medicine and Immunohaematology Working Party. Recommendations for the transfusion management of patients in the peri-operative period. III. The post-operative period. Blood Transfus. 2011 Jul;9(3):320-35<br>. The Blood Observational Study Investigators on behalf of the ANZICS-Clinical Trials Group. Transfusion practice and guidelines in Australian and New Zealand intensive care units. Intensive Care Med. 2010 Jul;36(7):1138-46 |

## INDICATOR Nº 86

| | |
|---|---|
| **Indicator** | **INAPPROPRIATE TRANSFUSION OF PLATELET-RICH PLASMA (PRP)** |
| **Dimension** | Effectiveness and safety |
| **Justification** | Transfusion of platelet-rich plasma (PRP) is common in critical patients. The indications for this procedure are limited to bleeding patients with platelet deficiency and or platelet dysfunction. Transfusion of PRP has the same risks as transfusion of packed red blood cells or plasma, with the additional risks that the patient is exposed to multiple donors and that this product is not frozen (greater possibility of bacterial contamination). |
| **Formula** | $\frac{\text{nº of nonbleeding patients without thrombocytopenia and/or platelet dysfunction transfused with PRP}}{\text{nº of patients transfused with PRP}} \times 100$ |
| **Explanation of terms** | Thrombocytopenia: 50,000/µl.<br>Platelet dysfunction: meeting one of the following criteria:<br>- Ingestion of antiplatelet drugs within the last 10 days<br>- Having undergone treatment with extracorporeal circuits |
| **Population** | All patients transfused with PRP during the period reviewed.<br>**Exclusion criteria**: patients without bleeding requiring surgery or invasive procedures who have platelet dysfunction or thrombocytopenia (<50,000/µl. or < 100,000/ml for CNS or eyeball surgery). |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Blood bank. |
| **Standard** | 0% |
| **Commentaries** | References:<br>. Lieberman L, Bercovitz RS, Sholapur NS, Heddle NM, Stanworth SJ, Arnold DM. Platelet transfusions for critically ill patients with thrombocytopenia. Blood. 2014 Feb 20;123(8):1146-51<br>. McIntyre L, Tinmouth AT, Fergusson D. Blood component transfusion in critically ill patients. Curr Opin Crit Care. 2013 Aug;19(4):326-33<br>. Liumbruno GM, Bennardello F, Lattanzio A, Piccoli P, Rossetti G; Italian Society of Transfusion Medicine and operative period. III. The post-operative period. Blood Transfus. 2011 Jul;9(3):320-35<br>. Slichter SJ, Kaufman RM, Assmann SF, McCullough J, Triulzi DJ, Strauss RG, Gernsheimer TB, Ness PM, Brecher ME, Josephson CD, Konkle BA, Woodson RD, Ortel TL, Hillyer CD, Skerrett DL, McCrae KR, Sloan SR, Uhl L, George JN, Aquino VM, Manno CS, McFarland JG, Hess JR, Leissinger C, Granger S. Dose of prophylactic platelet transfusions and prevention of hemorrhage. N Engl J Med. 2010 Feb 18;362(7):600-13<br>. The Blood Observational Study Investigators on behalf of the ANZICS-Clinical Trials Group. Transfusion practice and guidelines in Australian and New Zealand intensive care units. Intensive Care Med. 2010 Jul;36(7):1138-46 |

## INDICATOR Nº 87 (FUNDAMENTAL INDICATOR)

| Indicator | INAPPROPRIATE TRANSFUSION OF PACKED RED BLOOD CELLS |
|---|---|
| **Dimension** | Effectiveness, safety |
| **Justification** | Transfusion with a hemoglobin threshold > 9 gm/dL has not been proven efficacious in reducing morbidity and mortality. Restrictive transfusion policies (Hb < 7 gm/dL) reduce morbidity and mortality at 30 and 60 days in young patients (< 55 yrs) of moderate severity (APACHE < 20). |
| **Formula** | $\frac{\text{nº of patients with hemoglobin > 7 g/dL before being transfused}}{\text{nº of patients transfused}} \times 100$ |
| **Explanation of terms** | The maximum period between hemoglobin determination prior to transfusion and transfusion of the first PRBC unit is 24h. |
| **Population** | All patients transfused in the ICU in the period reviewed<br>**Exclusion criteria:**<br>• Massive bleeding; acute coronary syndrome; sepsis /septic shock in the resuscitation phase; severe hypoxemia<br>• Brain death or imminent brain death<br>• Pregnancy<br>• Pediatric patients (< 16 y): hemodynamic instability, acute bleeding, or cardiovascular disease<br>• Neurocritical patients |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Blood bank. |
| **Standard** | 3% |
| **Commentaries** | References:<br>. Retter A, Wyncoll D, Pearse R, Carson D, McKechnie S, Stanworth S, Allard S, Thomas D, Walsh T; British Committee for Standards in Haematology. Guidelines on the management of anaemia and red cell transfusion in adult critically ill patients. Br J Haematol. 2013 Feb;160(4):445-64<br>. The Blood Observational Study Investigators on behalf of the ANZICS-Clinical Trials Group. Transfusion practice and guidelines in Australian and New Zealand intensive care units. Intensive Care Med. 2010 Jul;36(7):1138-46<br>. Hajjar LA, Vincent JL, Galas FR, Nakamura RE, Silva CM, Santos MH, Fukushima J, Kalil Filho R, Sierra DB, Lopes NH, Mauad T, Roquim AC, Sundin MR, Leão WC, Almeida JP, Pomerantzeff PM, Dallan LO, Jatene FB, Stolf NA, Auler JO Jr. Transfusion requirements after cardiac surgery: the TRACS randomized controlled trial. JAMA. 2010 Oct 13;304(14):1559-67<br>. Marik PE, Corwin HL.Efficacy of red blood cell transfusion in the critically ill: a systematic review of the literature. Crit Care Med. 2008 Sep;36(9):2667-74 |

## INDICATOR Nº 88

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|---|---|
| **Indicator** | **OVERTRANSFUSION OF PACKED RED BLOOD CELLS (PRBC)** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Historically, 2 units of PRBC were normally used for transfusion, although there was no evidence that a single unit would not be enough to correct anemia. A growing body of evidence suggests that transfusion is associated with increased morbidity, mortality and hospital stays. Using a single unit of PRBC in each transfusion procedure in critical patients without active bleeding would support a change toward a more restrictive policy. Randomized controlled trials have shown that restrictive transfusion policies do not yield worse outcomes than liberal strategies. |
| **Formula** | nº of transfusions in patients without active bleeding in which > 1 unit is transfused / nº of transfusions in patients without active bleeding x 100 |
| **Explanation of terms** | **Transfusion**: every medical decision that results in a request to the hospital's blood bank |
| **Population** | All patients transfused in the ICU during the period reviewed.<br>**Exclusion criteria**: Active bleeding. Pregnancy. Pediatric patients (<16 years old) |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Blood bank. |
| **Standard** | 5% |
| **Commentaries** | References:<br>. Shander A, Gross I, Hill S, Javidroozi M, Sledge S; College of American Pathologists; American Society of Anesthesiologists; Society of Thoracic Surgeons and Society of Cardiovascular Anes- thesiologists; Society of Critical Care Medicine; Italian Society of Transfusion Medicine and Immu- nohaematology; American Association of Blood Banks. A new perspective on best transfusion practices. Blood Transfus. 2013 Apr;11(2):193-202<br>. Carson JL, Grossman BJ, Kleinman S, Tinmouth AT, Marques MB, Fung MK, Holcomb JB, Illoh O, Kaplan LJ, Katz LM, Rao SV, Roback JD, Shander A, Tobian AA, Weinstein R, Swinton McLaughlin LG, Djulbegovic B; Clinical Transfusion Medicine Committee of the AABB. Red blood cell transfusion: a clinical practice guideline from the AABB*. Ann Intern Med. 2012 Jul 3;157(1):49-58<br>. Hofmann A, Farmer S, Towler SC. Strategies to preempt and reduce the use of blood products: an Australian perspective. Curr Opin Anaesthesiol. 2012 Feb;25(1):66-73<br>. Berger MD, Gerber B, Arn K, Senn O, Schanz U, Stussi G. Significant reduction of red blood cell transfusion requirements by changing from a double-unit to a single-unit transfusion policy in patients receiving intensive chemotherapy or stem cell transplantation. Haematologica. 2012 Jan;97(1):116-22<br>. Ma M, Eckert K, Ralley F, Chin-Yee I. A retrospective study evaluating single-unit red blood cell transfusions in reducing allogeneic blood exposure. Transfus Med. 2005 Aug;15(4):307-12 |

## TOXICOLOGY

### INDICATOR Nº 89

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|---|---|
| **Indicator** | **CORRECT INDICATIONS AND METHODS OF DIGESTIVE DECONTAMINATION IN ACUTE TOXICATION** |
| **Dimension** | Effectiveness, appropriateness |
| **Justification** | Digestive decontamination (DD) is one of the preferred techniques in the arsenal of treatments for intoxication.<br>Appropriate DD reduces toxicity in intoxications brought about by oral ingestion. Delay reduces the efficacy of the measure. However, its use in patients without indications can increase morbidity and mortality. The appropriate indication and use of DD will depend on the type and dose of medication, the time elapsed since its ingestion, and the patient's clinical condition |
| **Formula** | nº of appropriate DD in drug intoxications<br>---------- x 100<br>total nº of drug intoxications discharged from critical care |
| **Explanation of terms** | **Digestive decontamination**: any substance administered or procedure performed with the aim of preventing the digestive absorption of a toxic substance: syrup of ipecac, activated charcoal, polyethylene glycol, gastric lavage / aspiration, or cathartic.<br>**Appropriate application of the algorithm of indications and methods**: following established criteria (1). Appropriate means that DD was not performed when not indicated and was performed when indicated using the right method as specified in the algorithm. |
| **Population** | Patients intoxicated by oral ingestion discharged from the critical care department during the period reviewed.<br>Exclusion criteria: Ingestion of caustic substances, whether acids or bases, or other corrosive substances. Clinical presentation suggestive of acute abdomen. Mild intoxication. Excessive delay between ingestion and medical attention |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | >90% |
| **Commentaries** | The respiratory tract must be protected and adequate ventilation must be ensured.<br>References:<br>. (1) Amigó M, Nogué S, Sanjurjo E, Faro J, Ferró I, Miró O. [Efficacy and safety of gut decontamination in patients with acute therapeutic drug overdose]. Med Clin (Barc). 2004 Apr 10;122(13):487-92<br>. Vale JA, Kulig K; American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists. Position paper: gastric lavage. J Toxicol Clin Toxicol. 2004;42(7):933-43<br>. Zimmerman JL. Poisonings and overdoses in the intensive care unit: general and specific management issues. Crit Care Med. 2003 Dec;31(12):2794-801 |

## INDICATOR Nº 90

| | |
|---|---|
| **Indicator** | **MINIMUM STOCK OF ANTIDOTES IN THE CRITICAL CARE DEPARTMENT AND/OR HOSPITAL PHARMACY** |
| **Dimension** | Safety |
| **Justification** | It is necessary to define and protocolize the minimum stock of antidotes in accordance with the level of care provided at each center. The absence of essential antidotes can increase morbidity and mortality in intoxicated patients. |
| **Formula** | nº of recommended antidotes in stock (adequately accessible) / nº of recommended antidotes according to the level of care x 100 |
| **Explanation of terms** | **Antidote:** drug used to counteract the effects of a toxic substance or that is used for the specific treatment of an intoxicated patient.<br>**In stock**: readily available for healthcare staff 24 h/day, 365 days/year. Sufficient amount: to treat one patient for 24 hours<br>**Recommended antidotes:** List elaborated by the expert committee, adjusted to the level of care provided by the center (1) (See Annex I). Expired antidotes should be considered unavailable. |
| **Population** | All departments providing urgent care that might attend an intoxicated patient: Primary Care Centers; Level I, II, or III hospitals, 061, emergency ambulances. |
| **Type** | Structure |
| **Source of data** | Hospital pharmacy registry or person in charge of antidote stocks<br>Data from the Intoxication Surveillance Commission or similar |
| **Standard** | 95% |
| **Commentaries** | References:<br>. (1)Lloret J, Nogue S, Jiménez X. Protocols, Codis d'Activació i Circuits d'atenció urgent a Barcelona Ciutat. Malalt amb intoxicacions agudes greus. Consorci Sanitari de Barcelona. Bar- celona 2004<br>. Nogué S, Munné P, Soy D, Millá J.[Availability, use and cost of antidotes in Catalonia].Med Clin (Barc). 1998 May 9;110(16):609-13<br>. Ries NL, Dart RC. New developments in antidotes. Med Clin North Am. 2005 Nov;89(6):1379-97<br>. Nogué S, Puiguriguer J, Amigó M. [Quality indicators for urgent care of patients with acute intoxications.] (Calitox-2006). Rev Calid Asist. 2008 Jul; 23:173–91 |

## Annex I. Minimum provision of antidotes

| Primary Care Center | Non-hospital Emergency Clinic | Company Clinic | Penitentiary Clinic |
|---|---|---|---|
| Atropine<br>Biperiden<br>Activated charcoal<br>Diazepam<br>Flumazenil<br>Glucagon<br>Hypertonic glucose<br>Naloxone<br>Normobaric<br>oxygen Vitamin K<br>Ipecac syrup | Folinic acid<br>Apomorphine<br>Methylene blue<br>1M sodium<br>bicarbonate IV<br>absolute ethanol<br>Calcium gluconate<br>Hydroxocobalamin<br>Pyridoxine<br>Protamine<br>Magnesium sulfate | Ascorbic acid<br>in addition to all those listed for non-hospital emergency clinics | All those listed for non-hospital emergency clinics |

| Level I Hospital | Level II Hospital | Level III Hospital |
|---|---|---|
| N-<br>acetylcysteine<br>Ascorbic acid<br>Physostigmine<br>Penicillin<br>Fresh plasma<br>Long-chain polyethylene glycol<br>in addition to all those listed for non-hospital emergency clinics | Bromocriptine<br>Dantrolene<br>Dimercaprol<br>(BAL)<br>Calcium disodium<br>EDTA Phentolamine<br>Glucagon<br>Oximes<br>Penicillamin<br>e Silibinin<br>in addition to all those listed for Level I hospitals | Anti-digoxin antibodies<br>Prothrombin complex<br>Hyperbaric oxygen<br>(1) Snake anti-<br>venom<br>Antibotulinum<br>Sodium thiosulfate<br>in addition to all those listed for Level II hospitals.<br>(1) in specialized centers |

## INDICATOR Nº 91

| | |
|---|---|
| **Indicator** | **EARLY APPROPRIATE RENAL REPLACEMENT THERAPY IN ACUTE INTOXICATION** |
| **Dimension** | Safety |
| **Justification** | Renal replacement therapy (RRT) aims to extract toxins that have already been absorbed. RRT is indicated in few intoxicated patients, but it is sometimes a very useful treatment option (Annex II). It requires specific tools, qualified staff, and frequent controls; it is always a risk for the patient. |
| **Formula** | nº of correctly indicated RRT procedures (appropriate and early) / total nº of RRT procedures x 100 |
| **Explanation of terms** | **RRT:** hemodialysis, hemoperfusion, hemofiltration, hemodiafiltration, plasmapheresis, and blood replacement (exchange transfusion), and exceptionally peritoneal dialysis,<br>**Correctly indicated:** Based on the criteria elaborated by Lloret et al. and the Extrip group (Annex III)<br>**Appropriate:** Indicated and correct. Catheters that allow blood flow >100 mL/min placed in large caliber veins (femoral, jugular, or subclavian). Dedicated area (ICU or dialysis unit) with the necessary equipment and qualified staff. Optimal clinical control of the patient when the technique is being performed.<br>**Early**: the interval between the time when the patient meets the criteria for RRT to eliminate the toxin and the start of RRT should be <3 hours |
| **Population** | Renal replacement techniques carried out in the ICU to treat acute intoxications during the period reviewed |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Lavergne V, Nolin TD, Hoffman RS, Roberts D, Gosselin S, Goldfarb DS, Kielstein JT, Mactier R, Maclaren R, Mowry JB, Bunchman TE, Juurlink D, Megarbane B, Anseeuw K, Winchester JF, Dargan PI, Liu KD, Hoegberg LC, Li Y, Calello DP, Burdmann EA, Yates C, Laliberté M, Decker BS, Mello-Da-Silva CA, Lavonas E, Ghannoum M. The EXTRIP (EXtracorporeal TReatments In Poisoning) workgroup: guideline methodology. Clin Toxicol (Phila). 2012 Jun;50(5):403-13<br>. Nogué S, Marruecos L, Lloret J. Indicaciones de la depuración extrarrenal en el tratamiento de las intoxicaciones agudas. En: Morán I, Baldirà J, Marruecos L, Nogué S. Toxicología Clínica. Grupo difusión. Barcelona 2011 Pg: 109-119<br>. Garlich FM, Goldfarb DS .Have advances in extracorporeal removal techniques changed the indications for their use in poisonings? Adv Chronic Kidney Dis. 2011 May;18(3):172-9<br>. De Pont AC. Extracorporeal treatment of intoxications. Curr Opin Crit Care. 2007 Dec;13(6):668-73 |

## Annex II.- Clinical criteria to indicate renal replacement therapy

- Intoxication with clinical signs of severity (coma, seizures, respiratory failure, cardiorespiratory failure, multiple organ failure).
- Failure of the organ that clears the toxin (liver or kidney).
- Expected development of structural lesions (neurologic, hepatic, renal) or life-threatening risk (malignant arrhythmias), whether due to the dose absorbed or to the concentrations of the toxic substance in the blood.
- No response to general supportive treatment.
- No response to the antidote or no antidote available.

## Annex III.- Orientative plasma levels for the indication of different RRT techniques

| Type of technique | Toxic substance | Orientative plasma level |
|---|---|---|
| HEMODIALYSIS | Carbamazepine*<br>2,4 dichlorophenoxyacetic acid<br>Phenobarbital*<br>Ethylene glycol<br>Lithium<br>Methanol<br>Procainamide<br>Salicylates<br>Thallium<br>Theophyllin e<br>Valproate* | > 60 µg/mL<br>> 10 mg/dL<br>> 100 mg/dL<br>> 0.5 g/L<br>> 3.5 mEq/L<br>> 0.5 g/L<br>> 20 µg/mL<br>> 80 mg/dL<br>> 0.5 mg/L<br>> 60 mg/L<br>> 1 g/L |
| PLASMAPHERESIS | Thyroxin | Not established |
| EXCHANGE TRANSFUSION | Agents increasing methemoglobin production | Methemoglobin > 40% |

* In the absence of hemodialysis, hemoperfusion can be used. Continuous renal replacement techniques can extract any toxin that can be removed from blood, albeit less efficiently.

** It is essential to take into account the patient's clinical severity, the chronicity of lithium treatment, and the patient's spontaneous renal clearance and to increase or decrease these orientative values accordingly. Patients who have severe signs and symptoms should undergo RRT regardless of the levels of toxin in plasma.

## INDICATOR Nº 92

| | |
|---|---|
| **Indicator** | **PSYCHIATRIC ASSESSMENT IN VOLUNTARY ACUTE INTOXICATIONS IN SUICIDE ATTEMPTS** |
| **Dimension** | Effectiveness, appropriateness, safety |
| **Justification** | In all suicide attempts, the risk of reattempting in the immediate future must be assessed. All patients that have attempted suicide are more likely to attempt suicide than other patients. A psychiatrist must evaluate patients who have attempted suicide once the systemic effects of the intoxication have resolved.<br>Suicide is the third cause of death in subjects aged 15 to 20 years. Even for a psychiatrist, it is difficult to determine the degree of intentionality. The risk of successful suicide in the year after an unsuccessful attempt is 100 times greater than in the general population and suicides in this period account for 50% of all successful suicides. |
| **Formula** | nº of patients intoxicated in suicide attempts with psychiatric assessment before discharge<br>---------- x 100<br>total nº of patients intoxicated in suicide attempts discharged from critical care |
| **Explanation of terms** | **Psychiatric assessment:** report elaborated by a psychiatrist assessing the suicide attempt. This assessment must be registered and signed in the general report or clinical history. Telephone assessment or consultation is not considered valid. Centers without a psychiatrist on call must arrange for urgent transfer to a center where psychiatric assessment is available. |
| **Population** | All patients intoxicated in suicide attempts discharged from critical care during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation (general ICU and/or Psychiatry Department report) |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Muñoz R, Borobia AM, Quintana M, Martínez A, Ramírez E, Muñoz M, Frías J, Carcas AJ. Outcomes and Costs of Poisoned Patients Admitted to an Adult Emergency Department of a Spanish Tertiary Hospital: Evaluation through a Toxicovigilance Program. PLoS One. 2016 Apr 21;11(4):e0152876<br>. Goldfrank's Manual of Toxicologic Emergencies. New York: McGraw-Hill; 2015<br>. Nogué S, Amigó M, Sánchez M, et al. [Evaluation and follow-up of quality of care offered to intoxicated patients in the emergency department]. Rev. Toxicol. 2007; 24: 23-30 |

## INDICATOR Nº 93

| | |
|---|---|
| **Indicator** | **BRONCHOASPIRATION OF ACTIVATED CHARCOAL** |
| **Dimension** | Safety |
| **Justification** | Digestive decontamination is the most commonly used technique in the care of patients with acute intoxications. Its indications, techniques, and application must be protocolized to avoid placing the patient at risk; bronchoaspiration is the main risk. When activated charcoal is indicated, it is essential to guarantee the integrity of the airway, whether spontaneously (conscious patient) or through tracheal intubation (comatose patient) If there is a risk of bronchoaspiration on administering activated charcoal, the administration is not indicated unless the airway is protected. |
| **Formula** | nº of patients with bronchoaspiration after the administration of activated charcoal / nº of patients receiving activated charcoal x 100 |
| **Explanation of terms** | Administration of activated charcoal: whether via oral or gastric tube, in a single or in repeated doses. Also to be considered are whether it is the only treatment used to decontaminate the digestive tract or it is a complement to inducing vomiting or to gastric aspiration or lavage.<br>Bronchoaspiration of activated charcoal: when charcoal is detected in sputum (conscious patients) or in bronchial aspirate (intubated patients) or bronchoscopy (if done) within 24 hours of the procedure. |
| **Population** | All patients administered activated charcoal who are discharged from critical care during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 0% |
| **Commentaries** | References:<br>. Amigó, M., Nogué, S., Miró, O. [Use of activated charcoal in acute poisonings: clinical safety and factors associated with adverse reactions in 575 cases]. Medicina Clínica, 2010; 135: 243–249<br>. Lloret J, Nogué S, Amigó M. [Digestive decontamination of toxics. Techniques and indications. Severe acute intoxications]. A Net, L. Marruecos. Ars Médica. Barcelona (2006); 65-80<br>. Toxicology, A. A. O. C., Centres, E. A. O. P., & Toxicologists, C. (2005). Position Paper: Single- Dose Activated Charcoal. Clinical Toxicology. 2005; 43: 61-87 |

## TRANSPLANTS

### INDICATOR Nº 94 (FUNDAMENTAL INDICATOR)

| Indicator | BRAIN DEAD DONORS |
|---|---|
| **Dimension** | Effectiveness |
| **Justification** | Critical care departments are the first step in ensuring the acquisition of as many organs as possible. |
| **Formula** | nº of brain-dead actual donors<br>---------- x 100<br>nº of brain-dead patients in the ICU |
| **Explanation of terms** | **Actual donor:** Donor taken to the operating room for the removal of organs (even if none of the organs removed are subsequently transplanted).<br>**Brain death:** clinical situation in which the function of both the cerebral hemispheres and the brainstem has ceased completely and irreversible<br>This indicator takes into account losses due to:<br>Clinical contraindications<br>Family and/or judicial refusal<br>Problems during donor maintenance |
| **Population** | All brain-dead patients during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Death certificate reports. Transplant coordination records. |
| **Standard** | 60% |
| **Commentaries** | References:<br>. Guide of recommendations for Quality Assurance Programmes in the Deceased Donation Process Developed by: Dopki project Funded by the European Commission. 2009 http://www.ont.es/publicaciones/Documents/DOPKI%20GUIA.pdf<br>. Escudero D, Matesanz R, Soratti CA, Flores JI; on behalf of the Iberoamerican Donation and Transplant Network/Council. [General considerations on brain death and recommendations on the clinical decisions after its diagnosis.] Med Intensiva. 2009 Dec;33(9):450-4<br>. Escudero D. [Brain death diagnosis] Med Intensiva. 2009 May;33(4):185-95<br>. Seller Pérez G, Herrera-Gutiérrez ME, Lebrón-Gallardo M, Quesada-García G. [General planning for the maintenance of the organ donor] Med Intensiva. 2009 Jun-Jul;33(5):235-42<br>. Seller Pérez G, Hinojosa Pérez R. [Maintenance of the organ donor] Med Intensiva. 2009 Jun- Jul;33(5):233-4<br>. Programa de calidad en la donación de órganos. El Modelo español de Coordinación y Trasplantes<br>. Editorial Grupo Aula Médica S.L. ISBN: 978-84-7885-456-1 / Legal Deposit: M-22.757-2008.http://www.ont.es/publicaciones/Documents/modeloespanol.pdf<br>. Quality Criteria and Quality Indicators in Organ Donation http://www.odequs.eu/pdf/ODEQUS_Quality_Criteria-Indicators.pdf |

## INDICATOR Nº 95

| | |
|---|---|
| **Indicator** | **EVALUATION OF POTENTIAL ORGAN DONORS AFTER CIRCULATORY DEATH (DCD) WITH LIMITING LIFE SUPPORT** |
| **Dimension** | Appropriateness |
| **Justification** | In recent years, donation after circulatory death (DCD) has expanded the pool of organs available for transplants. Considering donation from patients expected to die (according to cardiorespiratory criteria) after limitations on life support (LLS) is good practice in end-of-life care for critical patients. |
| **Formula** | total nº of patients dying of cardiac arrest after LLS (withdrawal) evaluated for DCD<br>---------- x 100<br>total nº of patients dying of cardiac arrest after LLS (withdrawal) |
| **Explanation of terms** | **Evaluation for potential DCD:** patients with LLS in whom the possibility of DCD is assessed according to protocol, including evaluation of viability criteria and clinical contraindications, possibility of dying of cardiac arrest in the time period that allows organ extraction for transplantation. |
| **Population** | All patients with LLS dying of cardiac arrest in the ICU during the period reviewed.<br>**Exclusion criteria**: patients with prior instructions refusing donation; LLS only to withhold new treatments. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Death certificate reports. Transplant coordination records. |
| **Standard** | 95 % |
| **Commentaries** | References:<br>. Bodí MA, Pont T, Sandiumenge A, Oliver E, Gener J, Badía M, Mestre J, Muñoz E, Esquirol X, Llauradó M, Twose J, Quintana S. Brain death organ donation potential and life support therapy limitation in neurocritical patients. Med Intensiva. 2015 Aug-Sep;39(6):337-44<br>. Lesieur O, Leloup M, Gonzalez F, Mamzer MF; EPILAT Study Group. Eligibility for organ donation following end-of-life decisions: a study performed in 43 French intensive care units. Intensive Care Med. 2014 Sep;40(9):1323-31. doi: 10.1007/s00134-014-3409-2<br>. Donación en asistolia en España: Situación actual y recomendaciones. National Consensus Document 2012. En: http://www.ont.es/infesp/Paginas/Documentaciion.aspx<br>. Royal Decree 1723/2012, (28 December), regulating obtainment, clinical use, and territorial coordination of human organs for transplantation and establishing quality and safety requirements. https://www.boe.es/boe/dias/2012/12/29/pdfs/ BOE- A-2012-15715.pdf<br>. Frutos MA, Guerrero F, Daga D, Cabello M, Lebrón M, Quesada García G, et al. [Kidney transplantation with grafts from type III Maastricht death cardiac donors]. Nefrología 2012;32:760-6<br>. Quality Criteria and Quality Indicators in Organ Donation http://www.odequs.eu/pdf/ODEQUS_Quality_Criteria-Indicators.pdf |

## INDICATOR Nº 96

| | |
|---|---|
| **Indicator** | **MONITORING POTENTIAL ORGAN DONORS** |
| **Dimension** | Appropriateness |
| **Justification** | Potential donors should be maintained to achieve the greatest possible number of organs and to optimize their viability. This requires an ICU "maintenance protocol" for multiple organ donors. The significant and frequent alterations in hemodynamics, metabolism, and temperature regulation in these patients can threaten the viability of the organs to be transplanted. |
| **Formula** | $\frac{\text{total nº of brain-dead potential donors monitored appropriately}}{\text{total nº of brain-dead potential donors}} \times 100$ |
| **Explanation of terms** | **Brain death:** clinical situation in which the function of both the cerebral hemispheres and the brainstem has ceased completely and irreversibly.<br>**Potential donor:** patients diagnosed with brain death without absolute contraindications for donation.<br>Appropriate monitoring: Minimal requirements:<br>Invasive arterial blood pressure<br>Central venous pressure/possibility of transpulmonary monitoring in cardiopulmonary donors and early and periodic ultrasonography n heart donors<br>Heart rate<br>Central temperature<br>Diuresis<br>Blood gases<br>Hemogram and coagulation<br>Biochemical parameters: electrolytes, glucose, systematic liver and renal function tests, and urinary sediment |
| **Population** | All brain-dead potential donors discharged from the ICU during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Seller Pérez G, Herrera-Gutiérrez ME, Lebrón-Gallardo M, Quesada-García G. [General planning for the maintenance of the organ donor] Med Intensiva. 2009 Jun-Jul;33(5):235-42<br>. Hinojosa R, Herruzo A, Escoresca Ortega AM, Jiménez PI. [Evaluation and maintenance of heart donors]. Med Intensiva. 2009 Nov;33(8):377-84<br>. Del Río F, Escudero D, De La Calle B, Vidal FG, Paredes MV, Núñez JR. [Evaluation and maintenance of the lung donor]. Med Intensiva. 2009 Jan-Feb;33(1):40-9<br>. Salim A, Martin M, Brown C, Rhee P, Demetriades D, Belzberg H. The effect of a protocol of aggressive donor management: Implications for the national organ donor shortage. J Trauma. 2006 Aug;61(2):429-33<br>. Salim A, Velmahos GC, Brown C, Belzberg H, Demetriades D. Aggressive organ donor management significantly increases the number of organs available for transplantation. J Trauma. 2005 May; 58(5):991-4<br>. Wood KE, Becker BN, McCartney JG, D'Alessandro AM, Coursin DB. Care of the potential organ donor. N Engl J Med. 2004 Dec 23;351(26):2730-9 |

## INDICATOR Nº 97

| | |
|---|---|
| **Indicator** | **DIAGNOSING BRAIN DEATH** |
| **Dimension** | Effectiveness |
| **Justification** | A high percentage of the organs transplanted in Spain come from brain-dead donors, so broad, correct clinical information about diagnosing this condition is fundamental for donation. In Spain, about 15% of patients who die in ICUs are in this condition; in ICUs in neurosurgery reference centers, the percentage can be as high as 30%. |
| **Formula** | $\frac{\text{total nº of cases of brain death diagnosed}}{\text{total nº of deaths in the ICU}} \times 100$ |
| **Explanation of terms** | **Brain death:** clinical situation in which the function of both the cerebral hemispheres and the brainstem has ceased completely and irreversibly.<br>The diagnosis requires clinical neurologic examination or instrumental diagnostic tests listed in the regulations in force: Royal Decree 1723/2012, (28 December). Brain death should be recorded in the clinical history. |
| **Population** | All deaths in the ICU in the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation and Transplant Coordination records. |
| **Standard** | 5%-30%<br>< 5% represents a low level of diagnosis |
| **Commentaries** | References:<br>. Real Royal Decree 1723/2012, (28 December) regulating and establishing the quality and safety requirements for the obtainment, clinical use, and territorial coordination of human organs for transplantation. https://www.boe.es/boe/dias/2012/12/29/pdfs/ BOE-A-2012-15715.pdf<br>. Escudero D, Matesanz R, Soratti CA, Flores JI; on behalf of the Iberoamerican Donation and Transplant Network/Council. [General considerations on brain death and recommendations on the clinical decisions after its diagnosis.] Med Intensiva. 2009 Dec;33(9):450-4<br>. Escudero D. [Brain death diagnosis] Med Intensiva. 2009 May;33(4):185-95<br>. Wijdicks EFM. The diagnosis of brain death. N Engl J Med 2001; 344: 1215-21 |

## SAFETY

### INDICATOR Nº 98

| | |
|---|---|
| **Indicator** | **ADVERSE EVENTS DURING INTRAHOSPITAL TRANSPORT** |
| **Dimension** | Safety, appropriateness, continuity of care |
| **Justification** | Intrahospital transport and movement of critical patients for diagnostic or therapeutic procedures increases the risk of complications due to the discontinuity in care. Transport should be carried out using the right equipment (including life support and monitoring devices in accordance with the criteria for clinical safety and quality) and with enough trained personnel to immediately resolve unforeseen problems that might threaten the patient's life. It is essential to register the most serious adverse events that occur during intrahospital transport. |
| **Formula** | nº of intrahospital transfers with adverse events / total nº of intrahospital transfers x 100 |
| **Explanation of terms** | **Severe adverse events**: including at least death; cardiac arrest; accidental extubation; accidental removal of catheters, drainage tubes, and lines; interruption of oxygen supply; and falls.<br>**Intrahospital transfer:** transport for diagnostic or therapeutic interventions |
| **Population** | All intrahospital transfers of critical patients. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation and adverse event notification systems |
| **Standard** | < 10% |
| **Commentaries** | References:<br>. Parmentier-Decrucq E1, Poissy J, Favory R, Nseir S, Onimus T, Guerry MJ, Durocher A, Mathieu D. Adverse events during intrahospital transport of critically ill patients: incidence and risk factors. Ann Intensive Care. 2013; 3(1):10. doi: 10.1186 /2110-5820-3-10<br>. Schwebel C, Clec'h C, Magne S, Minet C, Garrouste-Orgeas M, Bonadona A, Dumenil AS, Jamali S, Kallel H, Goldgran-Toledano D, Marcotte G, Azoulay E, Darmon M, Ruckly S, Souweine B, Timsit JF; OUTCOMEREA Study Group Safety of intrahospital transport in ventilated critically ill patients: a multicenter cohort study. Crit Care Med. 2013; 41(8):1919-28. doi 10.1097/CCM.0b013e31828a3bbd<br>. Quenot JP1, Milési C, Cravoisy A, Capellier G, Mimoz O, Fourcade O, Gueugniaud PY. Intrahospital transport of critically ill patients (excluding newborns) recommendations of the Société de Réanimation de Langue Française (SRLF), the Société Française d'Anesthésie et de Réanimation (SFAR), and the Société Française de Médecine d'Urgence (SFMU). Ann Intensive Care. 2012; 2(1):1. doi:10.1186/2110-5820-2-1<br>. Fanara B, Manzon C, Barbot O, Desmettre T, Capellie G. Recommendations for the intra-hospital transport of critically ill patients. Crit Care. 2010;14(3):R87<br>. Warren J, Fromm RE Jr, Orr RA, Rotello LC, Horst HM. Guidelines for the inter- and intrahospital transport of critically ill patients. Crit Care Med. 2004;32(1):256-62<br>. Horst HM. Guidelines for the inter- and intrahospital transport of critically ill patients. Crit Care Med. 2004;32(1): 256-62 |

## INDICATOR Nº 99

| | |
|---|---|
| **Indicator** | **CHECKLIST IN INTRAHOSPITAL TRANSPORT** |
| **Dimension** | Safety, appropriateness, and continuity of care |
| **Justification** | Critical patients often need to be transported to other departments within the hospital for diagnostic and/or therapeutic interventions, thus increasing the risk of adverse events. Despite current guidelines and the incorporation of protocols into clinical practice, the incidence of adverse events remains high. Checklists are a tool that helps minimize complications during transport, improving patient safety and ensuring the continuity of care. |
| **Formula** | $\frac{\text{nº of transport checklists completed}}{\text{total nº of intrahospital transfers}} \times 100$ |
| **Explanation of terms** | **The checklists** should include the procedures and the equipment that must be checked during the different phases of transport.<br>Before: assess the need for transport and patient stability. Verify the preparation of the material, fluids, and medication; establish communication with the personnel in the department that will receive the patient to ensure everything will be ready.<br>During: maintain surveillance during transport and during diagnostic and/or therapeutic interventions: check vital signs and need for medication every 15 minutes. Check continuity of oxygen delivery and electrical supply as well as medication and infusion pumps.<br>After: reconnect devices in the ICU (ventilator, monitor, and infusion pumps), document all actions in the clinical history and register all possible adverse events. |
| **Population** | All transfers of critical patients for diagnostic and/or therapeutic interventions. |
| **Type** | Process |
| **Source of data** | Clinical documentation and checklist sheet |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Brunsveld-Reinders AH, Arbous MS, Kuiper SG, de Jonge E. A comprehensive method to develop a checklist to increase safety of intra-hospital transport of critically ill patients. Crit Care. 2015;19:214. doi: 10.1186 / s13054-015-0938-1<br>. Melgarejo Urendez A, Bernat Adell MD , Lorente García P. [Analysis of adverse events associated with interhospital transfer of critically ill patients. Safety checklist.] Enferm Intensiva. 2014;25(2):58-64<br>. Fanara B, Manzon C, Barbot O, Desmettre T, Capellie G. Recommendations for the intra-hospital transport of critically ill patients. Crit Care. 2010;14(3):R87<br>. Jarden RJ, Quirke S. Improving safety and documentation in intrahospital transport: development of an intrahospital transport tool for critically ill patients. Intensive Crit Care Nurs. 2010;26(2):101-7. doi: 10.1016/j.iccn.2009.12.007 |

## INDICATOR Nº 100

| | |
|---|---|
| **Indicator** | **MANAGEMENT OF MONITORING ALARMS** |
| **Dimension** | Safety, appropriateness |
| **Justification** | Inappropriate alarm management increases morbidity and mortality due to delayed response, thus reducing the quality of care and patient safety.<br>Appropriate alarm management requires specific training. |
| **Formula** | nº of monitored patients who present an adverse event due to inappropriate alarm management<br>---------- x 100<br>nº of patients monitored |
| **Explanation of terms** | **Adverse event:** any undesired event attributable to inappropriate alarm management that harms a critical patient.<br>Inappropriate alarm management:<br>• - Unattended alarm<br>• - Alarm not adapted to each patient<br>• - Alarm canceled without appropriate attention<br>• - Inaudible alarm<br>• - Excessive alarm volume during the patient's sleep period |
| **Population** | All patients admitted to the ICU who are monitored during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system. Adverse event notification systems |
| **Standard** | 5% |
| **Commentaries** | Period reviewed: we recommend working with samples of days<br>References:<br>. Sendelbach S, Wahl S, Anthony A, Shotts P. Stop the Noise: A quality improvement project to decrease electrocardiographic nuisance alarms. Crit Care Nurse. 2015;35(4):15-22<br>. Bridi AC, Louro TQ, da Silva RC. Clinical Alarms in intensive care: implications of alarm fatigue for the safety of patients. Rev Lat Am Enfermagem. 2014 Nov-Dec;22(6):1034-40<br>. Joint Commission. The Joint Commission sentinel event alert: medical device alarm safety in hospitals. http://www.jointcommission.org/sea _issue_50/. April, 2013 |

## INDICATOR Nº 101

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|---|---|
| **Indicator** | **ACCIDENTAL FALLS** |
| **Dimension** | Safety, satisfaction |
| **Justification** | Falls can injure patients and lower perceived quality. This is a sentinel indicator. Falls increase hospital stays and healthcare costs. They reduce mobility and the quality of life and thus increase dependency. Falls can be avoided. The use of protocols and restraining measures can reduce the incidence of falls.<br>Analyzing falls enables their causes to be determined so the corresponding preventive measures can be implemented and weak points can be improved. |
| **Formula** | $\frac{\text{nº of falls occurring}}{\text{nº of stays}} \times 1000$ |
| **Explanation of terms** | All falls should be counted, whether the patient was in bed, sitting, or walking without the support necessary. Falls registered during movement/transport of patients should be included. |
| **Population** | All stays of patients discharged from critical care in the period reviewed |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system. Specific registry for falls. |
| **Standard** | 0% |
| **Commentaries** | We recommend using validated scales to evaluate the risk of falls at admission and periodically. References:<br>. Breimaier HE, Halfens RJ, Lohrmann C. Effectiveness of multifaceted and tailored strategies to implement a fall-prevention guideline into acute care nursing practice: a before-and-after, mixed- method study using a participatory action research approach. BMC Nurs. 2015; 31:14-18<br>. Richardson A, Carter R. Falls in critical care: a local review to identify incidence and risk. Nurs Crit Care. 2015;18:1-6<br>. U.S Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. 2010 International Conference on Fall Prevention and Protection. 2011. Cincinnati Available at: http://www.cdc.gov/niosh/docs/2012-103/pdfs/2012-103.pdf<br>. Stevens JA. A CDC Compendium of Effective Fall Interventions: What Works for Community- Dwelling Older Adults. 2010. 2nd Edition. Georgia |

## INDICATOR Nº 102

| | |
|---|---|
| **Indicator** | **MEDICATION ERRORS IN THE ICU** |
| **Dimension** | Safety |
| **Justification** | Errors in the administration of medication are the most common incidents in the ICU; these errors increase morbidity, mortality, stays, and costs. Communicating these errors enables action to be taken to prevent them |
| **Formula** | $\frac{\text{total nº of medication errors reported}}{\text{total nº of administrations of medication}} \times 100$ |
| **Explanation of terms** | **Total nº of administrations**: derived by calculating the mean number of patients in the ICU in one year and the mean number of administrations of medication per patient (approximately 15 administrations per day).<br>**Medication error**: errors occurring in any of the phases involved in the use of the medication. At least the following 5 must be correct: medication, dose, patient, time, and route of administration. |
| **Population** | All administrations of medications to patients in the ICU during the period reviewed.<br>**Exclusion criteria**: adverse reactions to medications |
| **Type** | Outcome |
| **Source of data** | Clinical documentation and direct observation. Incident notification system. |
| **Standard** | 5% |
| **Commentaries** | References:<br>. Toffoletto MC, Canales J, Moreira Arce MA, Ordenes Guerra D,A, Vergara Rodriguez CA Errors in the preparation and administration of medications: a integrative review of the Latin American literature. Enferm global 2015, 37:350-60. (accessed 18-12-15). Available at: http://revistas.um.es/eglobal/article/viewFile/185381/169201<br>. Salazar N, Rojas L, Jirón M, Romero C. [Medication errors in the intensive care unit]. Rev Hosp Clín Univ Chile 2012; 23: 114 – 22<br>. Chico Fernández M, García Fuentes C, Alonso Fernández MA, Toral Vázquez D, Bermejo Aznárez S, Sánchez-Izquierdo Riera JA, Alted López E. [Development of communication tool for patient safety ("Briefing"). Experience in a trauma and emergency intensive care unit.] Med Intensiva. 2012;36(7):481-487<br>. Valentin A, Capuzzo M, Guidet B, Moreno R, Metnitz B, Bauer P, Metnitz P; Research Group on Quality Improvement of the European Society of Intensive Care Medicine (ESICM); Sentinel Events Evaluation (SEE) Study Investigators. Errors in administration of parenteral drugs in intensive care units: multinational prospective study. BMJ. 2009 Mar 12;338:b814<br>. SEMICYUC. [Incidents and adverse events in intensive medicine. Safety and risk in critical patients]. SYREC 2007. Madrid: Ministry of Health and Social Policy; 2009. http://www.safetydelpaciente.es/contenidos/castellano/SYREC.pdf |

## INDICATOR Nº 103

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|---|---|
| **Indicator** | **ACCIDENTAL REMOVAL OF VASCULAR CATHETERS** |
| **Dimension** | Safety, effectiveness |
| **Justification** | The accidental removal of catheters directly affects the patient's safety; it increases the risk of event adverse, the staff's workload, and the length of stay (and thus costs for material and human resources). |
| **Formula** | $\frac{\text{nº of vascular catheters removed accidentally}}{\text{nº of vascular catheter days}} \times 1000$ |
| **Explanation of terms** | **Accidental catheter removal includes:**<br>• - Voluntary or involuntary removal by the patient<br>• - Removal by staff in performing a maneuver<br>• - Obstruction or extravasation of the catheter<br>**Inclusion criteria:**<br>• - Central venous or arterial catheters (central and/or peripheral insertion)<br>• - Catheters inserted in ICU and out of ICU |
| **Population** | All vascular catheter days in patients discharged during the period reviewed who have spent more than<br>24 h in the ICU.<br>• · Exclusion criterion:<br>• - Patients in the ICU for less than 24 h |
| **Type** | Outcome |
| **Source of data** | Clinical documentation |
| **Standard** | Arterial catheter: 15 catheters per 1000 days<br>Central venous catheter: 6 catheters per 1000 days |
| **Commentaries** | References:<br>. Amo MD, Carmona FJ, Gómez I, Bonilla G, Gordo F. [Assessment of the efficacy of the implementation of an arterial cannulation protocol as quality assurance method.] Enferm Intensiva 2004;15:159-164<br>. Carrion MI, Ayuso D, Marcos M, Robles MP, de la Cal MA, Alía I, Esteban A. Accidental removal of endotracheal and nasogastric tubes and intravascular catheters. Critical Care Med 2000;28:63-66<br>. Lorente L, Huidobro MS, Martin MM, Jiménez A, Mora ML. Accidental catheter removal in critically ill patients: a prospective and observational study. Critical Care 2004;8 (4): 229-33<br>. Arias-Rivera S, Sánchez-Sánchez MM, Sánchez-Izquierdo R, Gallardo-Murillo MJ, Santos-Díaz RI, Frutos-Vivar F. Establishment of a nursingdriven sedation protocol: effect on the sedation level and accidental withdrawal of tubes and catheters. Enferm Intensiva.2008;19(2):71-77<br>. Mayol Pérez ML, Peñalver Pérez E, López Fernández-Delgado D, Ortuño Esparza D, Sierra Sánchez M. Incidencia de retirada de catéteres venosos centrales en unidades de hospitalización de cuidados intensivos. Una revisión bibliográfica. PARANINFO DIGITAL 2013;19:5 pantallas, Available at: http://www.index-f.com/para/n19/106d.php |

## INDICATOR Nº 104

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|---|---|
| **Indicator** | **CRASH CART REVIEW** |
| **Dimension** | Safety, appropriateness |
| **Justification** | The correct maintenance of crash carts ensures that material is available when needed. This indicator measures the level of prevention for the potential response to an emergency. |
| **Formula** | $\frac{\text{nº of reviews performed according to protocol}}{\text{nº of reviews indicated (days x 3)}} \times 100$ |
| **Explanation of terms** | **Crash cart review "according to protocol" includes**:<br>Time: 3 times /day (8 h nursing shift) or every shift<br>Contents:<br>Check the cart's seal<br>• If sealed, sign and record the date of review<br>• If not sealed, use the quantitative checklist to review the medications and material for airways and circulatory support<br>• Check that the monitor and defibrillator are working (according to the manufacturer's instructions and specifications). |
| **Population** | All expected reviews (3 or 2 per day, depending on shifts) in the period reviewed<br>**Excluded**: reviewing the cart after using it |
| **Type** | Process |
| **Source of data** | Specific crash cart review checklist |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Fierro Rosón J, Ruiz Bailén M, Peinado Rodríguez J, Ramos Cuadra J A, Cárdenas Cruza A, Díaz Castellanos MA. [Inspection and maintenance of crash cart in primary health care emergencies]. Ciber Revista 2011; 22:8. Available at: http://www.enfermeriadeurgencias.com/ciber/noviembre2011/pagina8.html<br>. Rodríguez-Borrajo S. et al. Hospital nurses' knowledge of the patient care plan for immediate life threatening situations. Enferm Clin. 2008;18:190-6<br>. Calvo Macías C et al. [Material for the pediatric resuscitation trolley]. An Pediatr (Barc). 2007;66:51-4<br>. Fierro Rosón J, Ruiz Bailén M, Peinado Rodríguez J, Ramos Cuadra J A, Cárdenas Cruza A, Díaz Castellanos MA. [Evaluation of the content and functioning of cardiopulmonary resuscitation trolleys in a hospital.] Med Intensiva.2003;27(6):399-403 |

## INDICATOR Nº 105

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|---|---|
| **Indicator** | **USING A VALIDATED SCALE TO ASSESS THE RISK OF DEVELOPING PRESSURE ULCERS (PU)** |
| **Dimension** | Safety |
| **Justification** | A scale to assess the risk of developing PU (PUS) is an instrument that enables the early identification of patients that can develop PU by considering risk factors. Using such a scale aims to: 1. Ensure efficient and effective assignment of limited preventive resources. 2. Support clinical decision making.<br>3. Allow case adjustment according to epidemiologic studies.4. Facilitate the development of risk assessment protocols. 5. Provide evidence in lawsuits. |
| **Formula** | nº of patients admitted to the ICU assessed with PUS<br>---------- x 100<br>total nº of patients admitted to the ICU |
| **Explanation of terms** | **PUS:** assessment within 7-10 hours of ICU admission and every 24 h thereafter. Assign preventive measures according to the level of risk detected. Patients who present PU should be considered high risk. |
| **Population** | All patients in the ICU during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | References:<br>. National Institute for Health and Care Excellence (2014) Pressure ulcers: prevention and management of pressure ulcers. Available at: http:// www.nice.org.uk/guidance/cg179(accessed07.01.2016)<br>. Cox J. Predictors of pressure ulcers in adult critical care patients. Am J Crit Care 2011; 20(5):364 –75<br>. Pancorbo Hidalgo PL, García Fernández FP, Soldevilla Agreda JJ, Martínez Cuervo F. [Pressure ulcers risk assessment: Clinical practice in Spain and a meta-analysis of scales effectiveness]. Gerokomos 2008; 19 (2): 135-139<br>. Papanikolaou P, Lyne P, Anthony D. Risk assessment scales for pressure ulcers: a methodological review. Int J Nurs Stud 2007; 44 (2): 285-96<br>. Pancorbo Hidalgo PL, García Fernández FP, López Medina IM, Álvarez Nieto C. Risk assessment scales for pressure ulcer prevention: a systematic review. J Adv. Nurs 2006; 54 (1):94-110<br>. Fuentelsaz Gallego C. Validation of the EMINA© scale: tool for the evaluation of risk of developingm pressure ulcers in hospitalized patients. Enfermería Clínica 2001; 11 (3):97-103 |

## INDICATOR Nº 106

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|---|---|
| **Indicator** | **INCIDENCE OF PRESSURE ULCERS** |
| **Dimension** | Safety |
| **Justification** | Pressure ulcers represent an important health problem at all levels of care. Up to 95% of PU are preventable with appropriate care and resources. Pressure ulcers increase mortality in elderly and critical patients, and if complications in healing occur, the rate increases sixfold.<br>The main risk factors for the development of pressure ulcers in critical patients are essentially the same as for the general population of patients (reduced mobility, dampness, nutritional deficiency, etc.), although they present with greater intensity in critical patients. Critical patients have the added risk factors of decreased ability to change position, loss of sensory perception, altered metabolism, poor nutritional status, the infusion of vasoactive drugs, etc. |
| **Formula** | nº of patients admitted to the ICU who develop pressure ulcers<br>---------- x 100<br>total nº of patients admitted to the ICU |
| **Explanation of terms** | **Pressure ulcer**: occurring in any area of the body that is exposed to pressure for prolonged periods when the patient remains in the same position. They are defined and graded according to protocol. |
| **Population** | All patients in the ICU during the period reviewed.<br>**Exclusion criteria**: patients with pressure ulcers on admission to the ICU. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system. Specific registries. |
| **Standard** | 5% |
| **Commentaries** | References:<br>. García-Fernández FP, Soldevilla-Ágreda JJ, Pancorbo-Hidalgo PL, Verdú-Soriano J, López- Casanova P, Rodríguez-Palma M. Clasificación-categorización de las lesiones relacionadas con la dependencia. Serie Documentos Técnicos GNEAUPP . Grupo Nacional para el Estudio y Asesoramiento en Úlceras por Presión y Heridas Crónicas. Logroño. 2014. Available at: http://www.gneaupp.es/app/adm/docu- mentos-guias/archivos/4_pdf<br>. National Institute of Clinical Excellence. Pressure ulcers: prevention and management of pressure ulcers. NICE guidelines 2014<br>. Black JM, Cuddigan JE, Walko MA, Didier LA, Lander MJ, Kelpe MR. Medical device related pressure ulcers in hospitalized patients. Int Wound J. 2010;7(5):358-65<br>. National Institute for Health and Care Excellence (2014) Pressure ulcers: prevention and management of pressure ulcers. Available at: http:// www.nice.org.uk/guidance/cg179(accessed07.01.2016)<br>. Pedro L. Pancorbo-Hidalgo, Francisco P. García-Fernández, Joan-Enric Torra i Bou, José Verdú Soriano, J. Javier Soldevilla-Agreda. Pressure ulcers epidemiology in Spain in 2013: results from the 4th National Prevalence Survey. 2013. Gerokomos. 2014;25 (4):162-170<br>. Keller BP, Wille J, van Ramshorst B, van der Werken C. Pressure ulcers in intensive care patients: a review of risks and prevention. Intensive Care Med. 2002;28:1379–1388 |

## INDICATOR Nº 107 (FUNDAMENTAL INDICATOR)

| Indicator | PREVENTION OF VENOUS THROMBOEMBOLISM |
|---|---|
| **Dimension** | Safety |
| **Justification** | The use of prophylactic measures against deep vein thromboembolism (DVTE) during the ICU stay is associated with a decrease in morbidity and mortality due to thromboembolism. |
| **Formula** | nº of patients receiving prophylaxis against DVTE<br>---------- x 100<br>nº of patients admitted |
| **Explanation of terms** | **Prophylaxis against DVTE**: any of the following throughout the ICU stay:<br>• Fractionated heparin<br>• Unfractionated heparin<br>• Fondaparinux<br>• Complete anticoagulation<br>• Devices (pneumatic or other) for lower limb compression |
| **Population** | All patients discharged from critical care in the period reviewed<br>**Exclusion criteria**:<br>• Patients admitted for procedures requiring hospitalization for < 24 h<br>• For the use of pharmacological prophylaxis: contraindications for anticoagulation<br>• For the use of mechanical measures: lower limb lesions |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 90%<br>In the SEMICYUC's 2007 study, compliance was 77.4% |
| **Commentaries** | The authors recommend measuring this indicator by periods. References:<br>. Minet C, Potton L, Bonadona A, Hamidfar-Roy R, Somohano CA, Lugosi M, Cartier JC, Ferretti G,<br>. Schwebel C, Timsit JF. Venous thromboembolism in the ICU: main characteristics, diagnosis and thromboprophylaxis. Crit Care. 2015 Aug 18;19:287. doi: 10.1186/s13054-015-1003-9<br>. Alhazzani W, Lim W, Jaeschke RZ, Murad MH, Cade J, Cook DJ. Heparin thromboprophylaxis in medical-surgical critically ill patients: a systematic review and meta-analysis of randomized trials. Crit Care Med. 2013 Sep;41(9):2088-98<br>. García-Olivares P, Guerrero JE, Galdos P, Carriedo D, Murillo F, Rivera A. PROF-ETEV study: prophylaxis of venous thromboembolic disease in critical care units in Spain. Intensive Care Med. 2014 Nov;40(11):1698-708<br>. García-Olivares P, Guerrero JE, Tomey MJ, Hernangómez AM, Stanescu DO. [Prevention of venous thromboembolic disease in the critical patient: an assessment of clinical practice in the Community of Madrid]. Med Intensiva. 2014 Aug-Sep;38(6):347-55 |

## INDICATOR Nº 108

| | |
|---|---|
| **Indicator** | **UNEQUIVOCAL IDENTIFICATION** |
| **Dimension** | Safety |
| **Justification** | Inadequate patient identification is a significant cause of adverse incidents in healthcare. Identification problems are often associated with errors in the administration of medication, surgical interventions, diagnostic tests, transfusion of blood products, etc. Using identification bracelets and correct application of active identification protocols reduce the risk of these incidents. |
| **Formula** | nº of patients with appropriate identification bracelets<br>---------- x 100<br>nº of patients discharged from critical care |
| **Explanation of terms** | **Appropriate identification bracelet**: identification bracelet from the center that meets the criteria for comfort, safety, adaptability, and resistance and includes the information for unequivocal identification (first and family names, date of birth, personal identification code). The bracelet should be placed around one of the patient's limbs; placement on the bars of the bed is not considered adequate. |
| **Population** | All patients discharged from critical care during the period reviewed.<br>**Exclusion criteria**:<br>• Patients who refuse to wear the identification bracelet; they must be informed of the risks involved and their refusal must be documented in the clinical history.<br>• In life-threatening emergencies; urgent care is the priority but the identification bracelet should be placed as soon as possible. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Direct observation. |
| **Standard** | 10 |
| **Commentaries** | References:<br>. Martinez-Ochoa EM, Cestafe-Martinez A, Martinez-Saenz MS, Belio-Blasco C, Caro-Berguilla Y, Rivera-Sanz F. [Assessment of the implementation of an unambiguous patient identification system in an acute care hospital.] Med Clin (Barc) 2010;135:61-66<br>. Cousins DH, Gerrett D, Warner B. A review of medication incidents reported to the National Reporting and Learning System in England and Wales over 6 years (2005–2010). Br J Clin Phar- macol 2012;74(4):597–604 |

## INDICATOR Nº 109

| | |
|---|---|
| **Indicator** | **WALKROUNDS WITH MANAGEMENT** |
| **Dimension** | Safety |
| **Justification** | Walkrounds (WR) with management favor supervisors' involvement in promoting the culture of safety and have proven effective in improving and reinforcing compliance with good practice. WR improve professionals' attitudes toward patient safety and facilitate the interdisciplinary communication necessary for an integrated view of patient safety. WR should not be considered an isolated procedure but rather part of a continuous cycle of improvement. To be really effective, WR should be a formal, rigorous, organized process. There are guidelines that explain the phases of the process and how it should be carried out. |
| **Formula** | $\frac{\text{nº of WR with management done}}{4} \times 100$ |
| **Explanation of terms** | **WR with management**: WR with the management team, physicians, nurses, and other ICU professionals:department head, supervisor, medical staff, and nursing staff.<br><br>The management team can vary depending on the size and characteristics of the hospital (manager, medical director, nursing director, systems director, maintenance chief, chief financial officer) |
| **Population** | The quarters of the year |
| **Type** | Process |
| **Source of data** | Critical Care Department's Functional Plan |
| **Standard** | 75% |
| **Commentaries** | References:<br>. Suárez Mier MB, Martínez Ortega MC, Vegas Pardavila E, Fernández Prada M, Cofiño Castañeda LA, Díaz Alonso Y, Salamanca Corteguera MS. [Patient safety walkrounds with hospital managers: a tool for improving the care of critical patients]. Actualidad Médica, 99(791): 18-21 (2014).<br>. Morello RT, Lowthian JA, Barker AL, McGinnes R, Dunt D, Brand C. Strategies for improving patient safety culture in hospitals: a systematic review. BMJ Qual Saf 2013 Jan;22(1):11-18<br>. Menendez MD, Martinez AB, Fernandez M, Ortega N, Diaz JM, Vazquez F. [Walkrounds and briefings in the improvement of patient safety]. Rev Calid Asist 2010 May-Jun;25(3):153-160<br>. Frankel A. WalkRounds improve patient safety. Gaining feedback to provide exceptional patient care. Healthc Exec. 2008 Mar-Apr;23(2):22-4, 26, 2<br>. Frankel A, Graydon-Baker E, Neppl C, Simmonds T, Gustafson M, Gandhi TK. Patient Safety Leadership WalkRounds. Jt Comm J Qual Saf. 2003;29:16-26 |

## BIOETHICS

### INDICATOR Nº 110

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|---|---|
| **Indicator** | **APPROPRIATE END-OF-LIFE CARE** |
| **Dimension** | Effectiveness, satisfaction |
| **Justification** | The appropriateness of end-of-life care should be considered in all patients who die in the ICU, where a significant percentage of deaths occur after the decision to withhold or withdraw life support (WLS).<br>End-of-life care practices vary widely. Protocols based on recommendations of the scientific societies can reduce variability and improve quality. |
| **Formula** | nº of patients who die in the ICU with WLS in whom the protocol was applied<br>---------- x 100<br>total nº of patients who die in the ICU with WLS |
| **Explanation of terms** | The minimum aspects that must be included in the protocol for end-of-life care:<br>• Decision making centered on patients and their families<br>• Communication within the team and with patients and their families<br>• Appropriateness of treatment for the new objectives<br>• Treatment to alleviate symptoms and to increase wellbeing<br>• Emotional and practical support for patients and their families<br>• Spiritual support for patients and their families<br>• Emotional and organizational support for ICU professionals<br>• Inclusion of organ and tissue donation in end-of-life care |
| **Population** | All patients who die with WLS in the ICU during the period reviewed. |
| **Type** | Proce |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | The measurement of this indicator implies the existence of a specific protocol for end-of-life care and its application in patients who die with orders to WLS.<br>References:<br>. Blinderman CD, Billings JA. Comfort Care for Patients Dying in the Hospital. N Engl J Med 2015;373:2549-2561<br>. Australian and New Zealand Intensive Care Society. ANZICS Statement on Care and Decision- Making at the End of Life for the Critically Ill (Edition 1.0). Melbourne, ANZICS, 2014<br>. Truog RD, Campbell ML, Curtis JR, Haas CE, Luce JM, Rubenfeld GD, Rushton CH, Kaufman DC; American Academy of Critical Care Medicine. Recommendations for end-of-life care in the intensive care unit: a consensus statement by the American College [corrected] of Critical Care Medicine.Crit Care Med. 2008 Mar;36(3):953-63<br>. Cabré LI, Abizanda R, Baigorri F, Blanch L, Campos JM, Irribaren S, Mancebo J, Martín MC, Martínez K, Monzón JL, Nolla M, Rodriguez A, Sánchez JM, Saralegui I, Solsona JF and the SEMICYUC work group. Code of ethics of the Spanish Society of Intensive Care, Critical and Coronary Units (SEMICYUC). Med Intensiva 2006; 30: 1-5<br>. Monzón Marín JL, Saralegui Reta I, Abizanda i Campos R, Cabré Pericas L, Iribarren Diarasarri S, Martín Delgado MC, Martínez Urionabarrenetxea K; SEMICYUC Bioethics group.[Treatment recommendations at the end of the life of the critical patient].Med Intensiva. 2008 Apr;32(3):121-33<br>. Clarke EB, Curtis JR, Luce JM, Levy M, Danis M, Nelson J, Solomon MZ; Robert Wood Johnson Foundation Critical Care End-Of-Life Peer Workgroup Members. Quality indicators for end-of-life care in the intensive care unit. Crit Care Med. 2003 Sep;31(9):2255-62 |

## INDICATOR Nº 111

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|---|---|
| **Indicator** | **INFORMATION TO FAMILIES OF ICU PATIENS** |
| **Dimension** | Satisfaction |
| **Justification** | Patients' rights to information are regulated by current legislation. A significant percentage of critical patients are incapacitated, which means that this information must be given to family members or other persons to whom the patient has a close relation. In critical patients, given the severity and variability in the clinical situation, this information should fulfill a set of criteria. |
| **Formula** | nº of patients/families informed according to the criteria<br>---------- x 100<br>nº of patients admitted to critical care |
| **Explanation of terms** | **Families**: immediate family members or those designated or authorized by the patient<br>**Criteria for information to families:**<br>• Competent patients must be informed.<br>• Information should be provided on a daily basis (including on weekends and holidays), and ample time should be taken to explain the most important changes occurring and to respond to the families' queries. This also applies to the information provided on admission.<br>• Information should be given in a comfortable place, ensuring privacy.<br>• The information should be provided by the patient's attending physician. The physician attending the patient or supervising the patient's care when the patient's attending physician is not present should be explicitly specified. In the absence of the patient's attending physician, the physician on duty will assume this responsibility.<br>• It is recommended that physicians and nurses should provide the information together, at least during the first contact with the family, during daily reports, in cases of unexpected death, and when reporting decisions to withhold life support.<br>• The entire staff must know the information provided to avoid contradictions and inconsistencies.<br>• It is recommended to include the information provided in the clinical documentation. |
| **Population** | All patients admitted to the ICU during the period reviewed.<br>**Exclusion criteria:**<br>Patients with no family or legal representatives<br>Patients who express their desire that their families not be informed |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Davidson JE, Aslakson RA, Long AC, Puntillo KA, Kross EK, Hart J, Cox CE, Wunsch H, Wickline MA, Nunnally ME, Netzer G, Kentish-Barnes N, Sprung CL, Hartog CS, Coombs M, Gerritsen RT, Hopkins RO, Franck LS, Skrobik Y, Kon AA, Scruth EA, Harvey MA, Lewis-Newby M, White DB, Swoboda SM, Cooke CR, Levy MM, Azoulay E, Curtis JR. Guidelines for Family-Centered Care in the Neonatal, Pediatric, and Adult ICU. Crit Care Med. 2017 Jan;45(1):103-128<br>. Davidson JE, Aslakson RA, Long AC, Puntillo KA, Kross EK, Hart J, Cox CE, Wunsch H, Wickline MA, Nunnally ME, Netzer G, Kentish-Barnes N, Sprung CL, Hartog CS, Coombs M, Gerritsen RT, Hopkins RO, Franck LS, Skrobik Y, Kon AA, Scruth EA, Harvey MA, Lewis-Newby M, White DB, Swoboda SM, Cooke CR, Levy MM, Azoulay E, Curtis JR. Guidelines for Family-Centered Care in the Neonatal, Pediatric, and Adult ICU. Crit Care Med. 2017 Jan;45(1):103-128<br>. Alonso-Ovies A, Álvarez J, Velayos C, García MM, Luengo MJ. [Expectations of relatives ofcritically ill patients regarding medical information. Qualitative research study]. Rev Calid Asist. 014Nov- Dec;29(6):325-33<br>. Scheunemann LP, McDevitt M, Carson SS, Hanson LC. Randomized, controlled trials of interventions to improve communication in intensive care: a systematic review. Chest. 2011 Mar;139(3):543-54<br>. Spanish law 41 /2002 Basic regulations about patient autonomy and patients' rights regarding information and clinical documentation (November 2002). BOE 15 November 2002, updated 22 September 2015 https://www.boe.es/buscar/pdf/2002/BOE-A-2002-22188-consolidado.pdf |

## INDICATOR Nº 112

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|---|---|
| **Indicator** | **INFORMATION FROM NURSING STAFF TO PATIENTS' FAMILIES** |
| **Dimension** | Satisfaction, appropriateness |
| **Justification** | It is a priority for families to receive information from the multidisciplinary team. Nurses have the most and closest contact with patients' families. Protocolized transmission of information from nursing staff to patients' families helps to reduce family members' stress and anxiety and can help achieve greater cooperation from the family in the critical patients' healthcare process and facilitate decision making. |
| **Formula** | nº of families informed by nursing staff<br>---------- x 100<br>nº of patients discharged from critical care |
| **Explanation of terms** | **The information should:**<br>• Use jargon-free language adapted to the family's sociocultural characteristics; family's understanding of the information provided should be checked<br>• Include information about nursing care of the patients and possible involvement of the family in care<br>• Include information about the patient's mood and comfort, integrating physical, emotional, and spiritual aspects as well as physical aspects of the unit<br>• Aim to establish an environment of empathic trust and emotional support for family members<br>• Be delivered at least daily and be individualized according to explicit or implicit demands<br>• Be given in an appropriate space (office or at the bedside, depending on the patient's and family's<br>• situation)<br>• Be documented in the clinical history; family's understanding of the information given should also be documented.<br>Note: do not provide information about prognosis, diagnosis, or treatment, as providing this information is the responsibility of the physicians. |
| **Population** | Families of all patients admitted to critical care during the period reviewed.<br>**Exclusion criteria:** Patients with no family or legal representatives. Patients who express their desire that their families not be informed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 95% |
| **Commentaries** | References:<br>. Gaeeni M, Farahani MA, Seyedfatemi N, Mohammadi N. Informational support to family members of intensive care unit patients: the perspectives of families and nurses. Glob J Health Sci. 2014 Sep 25;7(2):8-19<br>. Nolen KB, Warren NA. Meeting the needs of family members of ICU patients. Crit Care Nurs Q. 2014 Oct-Dec;37(4):393-406<br>. Al-Mutair AS, Plummer V, O'Brien A, Clerehan R. Family needs and involvement in the intensive care unit: a literature review. J Clin Nurs. 2013 Jul;22(13-14):1805-17<br>. Pardavila Belio MI, García Vivar C. Needs of the family in the intensive care units, a review of the literature. Enferm Intensiva. 2012;23(2):51-67<br>. Peigne V, Chaize M, Falissard B, Kentish-Barnes N, Rusinova K, Megarbane B et al. Important questions asked by family members of intensive care unit patients. Crit Care Med. 2011;39(6):1365-71<br>. Nelson DP, Plost G. Registered nurses as family care specialists in the intensive care unit. Crit Care Nurse. 2009;29(3):46-52<br>. Olsen KD, Dysvik E, Hansen BS. The meaning of family members' presence during intensive care stay: a qualitative study. Intensive Crit Care Nurs. 2009;25(4):190-8 |

## INDICATOR Nº 113 (FUNDAMENTAL INDICATOR)

| Indicator | INCORPORATION OF ADVANCED LIFE DIRECTIVES IN DECISION MAKING |
|---|---|
| **Dimension** | Appropriateness, satisfaction |
| **Justification** | Advance health directives (AHD) facilitate respect for the incapacitated patient's wishes. Current legislation establishes and regulates the obligation to incorporate AHD into the decision-making process.<br>It is the staff's responsibility to explore the existence of AHD in the decision-making process for those patients that cannot express their preferences; this is especially important in patients with orders to withhold life support and for organ donation. |
| **Formula** | nº of incapacitated patients for whom the existence of AHD was explored<br>---------- x 100<br>nº of incapacitated patients |
| **Explanation of terms** | **Incapacitated patient**: patients whose conditions preclude them from making decisions<br>**AHD**: involves the exploration of AHD that meet the legal requirements for validity<br>Other instructions that are not legally regulated should also be taken into consideration (oral instructions, written documents, etc.). |
| **Population** | All incapacitated patients in the critical care department during the period reviewed. |
| **Type** | Process |
| **Source of data** | **Clinical records**: should include an explicit statement by the attending physician about whether the existence of AHD has been explored before making decisions regarding incapacitated patients. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Velasco-Sanz TR, Rayón-Valpuesta E. Advance directives in intensive care: Health professional competences. Med Intensiva. 2016 Apr;40(3):154-162<br>. Spanish law 41 /2002 Basic regulations about patient autonomy and patients' rights regarding information and clinical documentation (November 2002). BOE 15 November 2002, updated 22 September 2015<br>. https://www.boe.es/buscar/pdf/2002/BOE-A-2002-22188-consolidado.pdf<br>. Silveira MJ, Kim SY, Langa KM Advance directives and outcomes of surrogate decision making before death. N Engl J Med. 2010 Apr 1;362(13):1211-8<br>. Arauzo V, Trenado J, Busqueta G, Quintana S. [Degree of knowledge on the law of advance directives among the relatives of the patients admitted to ICU]. Med Clin (Barc). 2010 Apr 10;134(10):448-5<br>. Saralegui Reta I, Monzón Marín JL, Martín MC. [Advanced directives in intensive care medicine]. Med Intensiva 2004;28:256-261 |

## INDICATOR Nº 114 (FUNDAMENTAL INDICATOR)

| Indicator | COMPLIANCE WITH WRITTEN INFORMED CONSENT |
|---|---|
| **Dimension** | Satisfaction |
| **Justification** | In general, every act in a healthcare environment requires the patient's or legal representative's prior consent. Failure to obtain consent violates the patient's right to autonomy. Although, as a general rule, consent will be verbal, the legislation requires written consent in certain circumstances (surgery, invasive procedures and procedures that suppose significant risks or drawbacks). |
| **Formula** | nº of informed consent forms correctly completed<br>---------- x 100<br>nº of procedures requiring informed written consent |
| **Explanation of terms** | **Correctly completed informed consent forms**: Document including the identification and signature of the physician and the patient/authorized legal representative, together with a brief description of the procedure and the possible risks involved, as well as alternatives if they exist.<br>**Procedures requiring written informed consent**: The SEMICYUC Bioethics workgroup recommends the following:<br>• Tracheostomy:<br>• Transfusion of blood products<br>• Surgical intervention<br>• Renal replacement techniques<br>• Pacemaker implantation<br>• Plasmapheresis<br>• Endovascular procedures<br>• Other new procedures or those whose efficacy has not been demonstrated<br>• Therapeutic immobilization > 24 h<br>There are specific legal regulations for transfusion of blood products, organ donation, and research studies.<br>**Exclusion criteria**: incapacitated patients whose family or legal representatives cannot be contacted. |
| **Population** | All of the procedures listed above during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | Compliance with this indicator will be considered fulfilled only if all the requirements mentioned in the"explanation of terms" are met.<br>References:<br>. Spanish law 41 /2002 Basic regulations about patient autonomy and patients' rights regarding information and clinical documentation (November 2002). BOE 15 November 2002, updated 22<br>. September 2015 https://www.boe.es/buscar/pdf/2002/BOE-A-2002-22188-consolidado.pdf<br>. Solsona JF, Cabré L, Abizanda R, Campos JM, Sainz A, Martín MC, Sánchez JM, Bouza C, Quintana M, Saralegui I, Monzón JL and SEMICYUC's Bioethics work group. [Recommendations of the Bioethics Group of the Spanish Society of Intensive Care Medicine and Coronary Units regarding informed consent in the intensive care unit]. Med. Intensiva 2002;26 (5):254-255<br>. Davis N, Pohlman A, Gehlbach B, Kress JP, McAtee J, Herlitz J, Hall J. Improving the process of informed consent in the critically ill. JAMA. 2003 Apr 16;289(15):1963-8<br>. Clark PA. Intensive care patients' evaluations of the informed consent process. Dimens Crit Care Nurs. 2007 Sep-Oct;26(5):207-26<br>. Fan E, Shahid S, Kondreddi VP, Bienvenu OJ, Mendez-Tellez PA, Pronovost PJ, Needham DM. Informed consent in the critically ill: a two-step approach incorporating delirium screening. Crit Care Med. 2008 Jan;36(1):94-9 |

## INDICATOR Nº 115

| | |
|---|---|
| **Indicator** | **LIMITING LIFE SUPPORT** |
| **Dimension** | Appropriateness, satisfaction |
| **Justification** | The aim of limiting life support is to adapt the level of treatment to the patient's clinical situation and prognosis, not only to avoid suffering caused by futile treatment. Life support is limited in a large percentage of ICU patients. The decision to limit life support should never be taken individually, rather certain essential scientific and consensual criteria must be met. |
| **Formula** | nº of limitations on life support that fulfill the criteria<br>---------- x 100<br>total nº of limitations on life support |
| **Explanation of terms** | Both withdrawing and withholding therapeutic measures are considered limitation of life support<br>**The following are considered essential for limitations on life support**:<br>• Based on the best scientific evidence available<br>• Taking the patient's wishes into consideration as well as advance health directives<br>• Consensus among the healthcare team<br>• Informing and consulting with the family<br>All of the above must be stated in the clinical records (the decision to limit life support, its clinical basis, whether reached by consensus, whether the family was informed, and whether the patient's previous instructions were taken into consideration). |
| **Population** | All patients admitted to the ICU in whom life support is limited during the period reviewed.<br>**Exclusion criteria**:<br>Decision not to admit a patients to the ICU, because this does not generally allow the team to deliberate the decision.<br>In exceptional cases, the decision to limit life support can be taken individually. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | 100% |
| **Commentaries** | When the healthcare team's decision is not unanimous or is not supported by the family, it is advisable to consult the institution's Ethics Committee.<br>References:<br>. Hernández-Tejedor A, Martín Delgado MC, Cabré Pericas L, Algora Weber A; Members of the study group EPIPUSE. Limitation of life-sustaining treatment in patients with prolonged admission to the ICU. Current situation in Spain as seen from the EPIPUSE Study. Med Intensiva. 2015 Oct;39(7):395-404<br>. Rubio O, Sánchez JM, Fernández R. [Life-sustaining treatment limitation criteria upon admission to the intensive care unit: results of a Spanish national multicenter survey]. Med Intensiva. 2013 Jun- Jul;37(5):333-8<br>. Poyo-Guerrero R, Cruz A, Laguna M, Mata J; Comité de Ética del Hospital Son Llatzer de Palma de Mallorca (España). [Preliminary experience with the introduction of life-sustaining treatment limitation in the electronic clinical record]. Med Intensiva. 2012 Jan-Feb;36(1):32-6<br>. Cabré L, Solsona JF and SEMICYUC's Bioethics work group. Limitation of therapeutic activity in intensive care medicine. Med Intensiva. 2002;26: 304-311<br>. Cabré L, Mancebo J, Solsona J, Saura P, Gich I, Blanch L, et al. Multicenter study of the multiple organ dysfunction syndrome in intensive care units: the usefulness of Sequential Organ Failure Assessment scores in decision making. Intensive Care Med. 2005 Jul;31(7):927-33. Intensive Care Med. 2005;31:927-33 |

## INDICATOR Nº 116

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|---|---|
| **Indicator** | **USE OF RESTRAINTS** |
| **Dimension** | Safety, appropriateness |
| **Justification** | Physical restraints should only be considered as a last resort, after all other alternatives have failed.<br>Given the ethical issues involved (use in incapacitated patients, impossibility of obtaining family approval; systematic, routine use without individualizing application, etc.) and the potential undesirable physical and psychological consequences, the use of restraints should be regulated by protocol. |
| **Formula** | $\frac{\text{nº of applications of restraints according to protocol}}{\text{nº of applications of restraints}} \times 100$ |
| **Explanation of terms** | **Restraint:** any action or procedure that impedes the free movement of a person to a position of their choosing and /or normal access to their body through the use of any method that subjects a person's body that they cannot control or remove easily. It is recommended that the use of mechanical restraints be as close to null as possible. Restraints should be prescribed by physicians, although in emergencies, nurses can apply restraints. Restraints always require multidisciplinary management. Prescriptions should be reviewed every 24 hours.<br>**The protocol must include at least:**<br>• Definition of restraint and types of restraints<br>• Indication of situations in which restraints should be applied<br>• Correct procedure for applying restraints<br>• Follow-up of restrained patients: type, reason, duration, adverse effects, frequency of monitoring, measures to prevent complications.<br>• Information to the patient and/or family when the patient cannot decide. Informed consent is required if > 24 h<br>• Documentation in the clinical history: start, follow-up, and removal<br>• Prescriptions for restraints must be written in both medical and nursing logs. |
| **Population** | All applications of restraints in the period reviewed.<br>**Exclusion criteria:** restraints imposed by court order. |
| **Type** | Process |
| **Source of data** | Clinical documentation |
| **Standard** | 100% |
| **Commentaries** | The measurement of this indicator implies the existence of a specific protocol for the indication and management of restraints.<br>References:<br>. Bleijlevens MH, Wagner LM, Capezuti E, Hamers JP and the International Physical Restraint Workgroup. Physical Restraints: Consensus of a Research Definition Using a Modified Delphi Technique. J Am Geriatr Soc. 2016. doi: 10.1111/jgs.14435<br>. Luk E, Sneyers B, Rose L, Perreault MM, Williamson DR, Mehta S, Cook DJ, Lapinsky SC, Burry L. Predictors of physical restraint use in Canadian intensive care units. Crit Care. 2014 Mar 24;18(2):R46. doi: 10.1186/cc13789<br>. Maccioli GA, Dorman T, Brown BR, Mazuski JE, McLean BA, Kuszaj JM, Rosenbaum SH, Frankel LR, Devlin JW, Govert JA, Smith B, Peruzzi WT; American College of Critical Care Medicine, Society of Critical Care Medicine. Clinical practice guidelines for the maintenance of patient physical safety in the intensive care unit: use of restraining therapies--American College of Critical Care Medicine Task Force 2001-2002. Crit Care Med. 2003 Nov;31(11):2665-76<br>. Martín Iglesias V, Pontón Soriano C, Quintián Guerra MT, Velasco Sanz TR, Merino Martínez MR, Simón García MJ, González Sánchez JA: Mechanical restraint: its use in intensive cares. Enferm Intensiva 2012, 23:164–170 |

## PLANNING, ORGANIZATION, AND MANAGEMENT

### INDICATOR Nº 117 (FUNDAMENTAL INDICATOR)

| Indicator | DAILY ROUNDS FOR MULTIDISCIPLINARY TEAMS |
|---|---|
| **Dimension** | Safety |
| **Justification** | Teamwork is essential for patient safety. Daily multidisciplinary clinical rounds reduce the risk of adverse events, facilitate teamwork, and improve communication among professionals. |
| **Formula** | nº of days in which multidisciplinary rounds are done / 365 x 100 |
| **Explanation of terms** | **Multidisciplinary rounds**: joint clinical sessions including physicians and nurses discussing the main problems and clinical decisions (daily goals, diagnostic and therapeutic plans) in ICU patients. Other professionals (e.g., clinical pharmacologist, physical therapists) should be included when relevant. |
| **Population** | All days of the year |
| **Type** | Process |
| **Source of data** | The critical care department's functional plan |
| **Standard** | 80% |
| **Commentaries** | Joint clinical sessions can take multiple forms, ranging from bedside rounds to classic handovers in which different professionals take part. We recommend using tools such as daily objectives or checklists and documenting them in the clinical information system.<br>References:<br>. Mosher HJ, Lose DT, Leslie R, Pennathur P, Kaboli PJ. Aligning complex processes and electronic health record templates: a quality improvement intervention on inpatient interdisciplinary rounds. BMC Health Serv Res. 2015 Jul 13;15:26<br>. Ten Have EC, Nap RE, Tulleken JE. Measurement properties and implementation of a checklist to assess leadership skills during interdisciplinary rounds in the intensive care unit. Scientific World- Journal. 2015;2015:951924<br>. Ten Have EC, Nap RE, Tulleken JE. Quality improvement of interdisciplinary rounds by leadership training based on essential quality indicators of the Interdisciplinary Rounds Assessment Scale. Intensive Care Med. 2013 Oct;39(10):1800-7.<br>. Rhodes A, Moreno RP, Azoulay E, Capuzzo M, Chiche JD, Eddleston J, Endacott R, Ferdinande P, Flaatten H, Guidet B, Kuhlen R, León-Gil C, Martin Delgado MC, Metnitz PG, Soares M, Sprung CL, Timsit JF, Valentin A; Task Force on Safety and Quality of European Society of Intensive Care Medicine (ESICM). Prospectively defined indicators to improve the safety and quality of care for critically ill patients: a report from the Task Force on Safety and Quality of the European Society of Intensive Care Medicine (ESICM). Intensive Care Med. 2012 Apr;38(4):598-605<br>. Kim MM, Barnato AE, Angus DC, Fleisher LA, Kahn JM. The effect of multidisciplinary care teams on intensive care unit mortality. Arch Intern Med. 2010 Feb 22;170(4):369-7 |

## INDICATOR Nº 118

| | |
|---|---|
| **Indicator** | **PATIENT HANDOFFS** |
| **Dimension** | Safety |
| **Justification** | The interdisciplinary exchange of information about the patient is an essential component of patient safety; it helps to improve the effectiveness of the measures applied and to ensure patient-centered care. The high frequency of information exchange, the severity of critical patients, and the large quantity of information to exchange make this process more difficult in critical care. Verbal communications can suffer from interruptions and time limitations; thus, there is a risk of losing information that is very important for the continuity of care. |
| **Formula** | $\frac{\text{nº of regulated handoffs}}{\text{nº of routine handoffs}} \times 100$ |
| **Explanation of terms** | **Regulated handoffs**: exchange of information among professionals (physician-physician, nurse-nurse) in routine transfers of responsibility (change of call/ change of turn/discharge to the ward).<br>This term involves:<br>• Identification of the professional responsible for the care of the patient<br>• A pre-established time and place for the transfer of information.<br>• Fundamental clinical information, including the patient's current condition<br>• Information about decision making<br>• Procedures and complementary tests pending completion or evaluation<br>• The most important points should be recorded in the clinical history and be readily accessible. |
| **Population** | All routine handoffs during the period reviewed.<br>**Exclusion criteria**: exchanges of information with other professionals involved in the care of the patient. |
| **Type** | Process |
| **Source of data** | Critical care department's functional plan. Direct observation. |
| **Standard** | 90% |
| **Commentaries** | References:<br>. Colvin MO, Eisen LA, Gong MN. Improving the Patient Handoff Process in the Intensive Care Unit: Keys to Reducing Errors and Improving Outcomes. Semin Respir Crit Care Med. 2016 Feb;37(1):96-106<br>. Lane-Fall MB, Collard ML, Turnbull AE, Halpern SD, Shea JA. ICU Attending Handoff Practices: Results From a National Survey of Academic Intensivists. Crit Care Med. 2016 Apr;44(4):690-8<br>. Van Sluisveld N, Hesselink G, van der Hoeven JG, Westert G, Wollersheim H, Zegers M. Improving clinical handover between intensive care unit and general ward professionals at intensive care unit discharge. Intensive Care Med. 2015 Apr;41(4):589-604<br>. Abraham J, Kannampallil TG, Almoosa KF, Patel B, Patel VL. Comparative evaluation of the content and structure of communication using two handoff tools: implications for patient safety. J Crit Care. 2014 Apr;29(2):311.e1-7<br>. Benham-Hutchins MM, Effken JA. Multi-professional patterns and methods of communication during patient handoffs. Int J Med Inform. 2010 Apr;79(4):252-67 |

## INDICATOR Nº 119

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|---|---|
| **Indicator** | **SUSPENSION OF SCHEDULED SURGERY** |
| **Dimension** | Safety, efficiency |
| **Justification** | The suspension of scheduled surgical interventions (SI) due to unavailability of ICU beds can involve a risk to the patient, diminish satisfaction, and increase stays and costs |
| **Formula** | $\frac{\text{nº of scheduled SI suspended due to unavailability of previously ICU reserved beds}}{\text{nº of scheduled SI with ICU bed reserved}} \times 100$ |
| **Explanation of terms** | **Scheduled and suspended SI due to unavailability of ICU bed**: SI not on the day planned because the ICU bed reserved was unavailable |
| **Population** | All scheduled SI with a bed previously reserved in the ICU during the period reviewed.<br>**Exclusion criteria**: SI with ICU bed reserved that are suspended for other reasons. |
| **Type** | Outcome |
| **Source of data** | ICU management registry<br>Surgical registries |
| **Standard** | < 3% |
| **Commentaries** | References:<br>. Wiyartanti L, Park MW, Chung D, Kim JK, Sohn YT, Kwon GH .Managing uncertainties in the surgical scheduling. Stud Health Technol Inform. 2015;210:384-8<br>. Colmenero M. [The ritual of the lack of beds]. Med Intensiva. 2011 Apr;35(3):139-42<br>. Sahraoui A, Elarref M. Bed crisis and elective surgery late cancellations: An approach using the theory of constraints. Qatar Med J. 2014 Jun 16;2014(1):1-11<br>. González-Arévalo A, Gómez-Arnau JI, delaCruz FJ, Marzal JM, Ramírez S, Corral EM, García-del- Valle S.Causes for cancellation of elective surgical procedures in a Spanish general hospital. Anaesthesia. 2009 May;64(5):487-93 |

## INDICATOR Nº 120

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|---|---|
| **Indicator** | **PREMATURE OR UNPLANNED ICU DISCHARGE** |
| **Dimension** | Safety, appropriateness |
| **Justification** | The limited number of beds in the ICU and the increase in the number of critical patients increase the likelihood that some patients will be discharged early or without previous planning.<br>Early or unplanned discharge is associated with an increase in the number of adverse events, readmissions, stays, costs, and hospital mortality. |
| **Formula** | $\frac{\text{nº of patients with early or unplanned discharge from critical care}}{\text{nº of patients discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Early or unplanned discharge**:<br>Discharge that was not scheduled or agreed upon in a clinical session or that took place only to allow another patient to be admitted, regardless of the time of day<br>Discharge of patients who do not fulfill standard criteria(1) |
| **Population** | All patients discharged from critical care during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | < 5% |
| **Commentaries** | Dedicated teams for ward medical emergencies or ward follow-up by critical care specialists can reduce the negative impact of early discharge.<br>References:<br>. (1) Nates JL, Nunnally M, Kleinpell R, Blosser S, Goldner J, Birriel B, Fowler CS, Byrum D, Miles WS, Bailey H, Sprung CL. ICU Admission, Discharge, and Triage Guidelines: A Framework to Enhance Clinical Operations, Development of Institutional Policies, and Further Research. Crit Care Med. 2016 Aug;44(8):1553-602<br>. Blanch L, Abillama FF, Amin P, Christian M, Joynt GM, Myburgh J, Nates JL, Pelosi P, Sprung C, Topeli A, Vincent JL, Yeager S, Zimmerman J; Council of the World Federation of Societies of Intensive and Critical Care Medicine. Triage decisions for ICU admission: Report from the Task Force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2016 Jun 22. pii: S0883-9441(16)30136-8<br>. Vollam SA, Dutton SJ, Young D, Watkinson PJ. Out-of-hours discharge from intensive care, in- hospital mortality and intensive care readmission rates: a systematic review protocol. Syst Rev. 2015 Jul 16;4:93<br>. Wagner J, Gabler NB, Ratcliffe SJ, Brown SE, Strom BL, Halpern SD. Outcomes among patients discharged from busy intensive care units. Ann Intern Med. 2013 Oct 1;159(7):447-55<br>. Rodríguez-Carvajal M, Mora D, Doblas A, García M, Domínguez P, Tristancho A, Herrera M. [Impact of the premature discharge on hospital mortality after a stay in an intensive care unit]. Med Intensiva. 2011 Apr;35(3):143-9<br>. Boots RJ. When is it time to go? The difficulty of intensive care unit discharge decisions at times of high census or admission demand. Crit Care Med. 2009 Nov;37(11):2982-3<br>. Daly K, Beale R, Chang RWS. Reduction in mortality after inappropriate early discharge from intensive care unit: logistic regression triage model.BMJ. 2001;322:1274-1276 |

## INDICATOR Nº 121

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|---|---|
| **Indicator** | **DELAYED DISCHARGE FROM THE ICU** |
| **Dimension** | Efficiency, accessibility, appropriateness |
| **Justification** | Delays in the discharge of critical patients are associated with inappropriate increases in cost and reduce the number of beds available for new admissions.<br>Delays could increase morbidity and hamper relations with patients' families.<br>Appropriate management of ICU beds and prior scheduling of discharges reduces delays at discharge. |
| **Formula** | nº of ICU stays with delays at discharge<br>---------- x 100<br>total nº of ICU stays |
| **Explanation of terms** | **Delay at discharge**: more than 12 h from indication for discharge to exit from the ICU |
| **Population** | All stays of patients discharged from the ICU in the period reviewed<br>**Exclusion criteria**: stays of patients in which a previously planned discharge was delayed for medical reasons |
| **Type** | Outcome |
| **Source of data** | Clinical documentation. Clinical information system |
| **Standard** | <5 % |
| **Commentaries** | References:<br>. Blanch L, Abillama FF, Amin P, Christian M, Joynt GM, Myburgh J, Nates JL, Pelosi P, Sprung C, Topeli A, Vincent JL, Yeager S, Zimmerman J; Council of the World Federation of Societies of Intensive and Critical Care Medicine. Triage decisions for ICU admission: Report from the Task Force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2016 Jun 22. pii: S0883-9441(16)30136-8<br>. Nates JL, Nunnally M, Kleinpell R, Blosser S, Goldner J, Birriel B, Fowler CS, Byrum D, Miles WS, Bailey H, Sprung CL. ICU Admission, Discharge, and Triage Guidelines: A Framework to Enhance Clinical Operations, Development of Institutional Policies, and Further Research. Crit Care Med 2016 Aug;44(8):1553-602<br>. Chrusch CA, Olafson KP, McMillan PM, Roberts DE, Gray PR. High occupancy increases the risk of early death or readmission after transfer from intensive care. Crit Care Med. 2009 Oct;37(10):2753-8<br>. Garland A, Connors AF Jr. Optimal timing of transfer out of the intensive care unit. Am J Crit Care 2013 Sep;22(5):390-7<br>. Johnson DW, Schmidt UH, Bittner EA, Christensen B, Levi R, Pino RM. Delay of transfer from the intensive care unit: a prospective observational study of incidence, causes, and financial impact. Crit Care. 2013 Jul 4;17(4):R128. doi: 10.1186/cc12807 |

## INDICATOR Nº 122

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|---|---|
| **Indicator** | **DELAYED ADMISSION TO THE ICU** |
| **Dimension** | Accessibility, efficiency, safety |
| **Justification** | Delays in the admission of critical patients to the ICU increase morbidity and mortality as well as costs. Delays are usually related to the unavailability of beds in the ICU. |
| **Formula** | $\frac{\text{nº of critical patients admitted after delays > 4 hours}}{\text{total nº of patients discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Delay**: Time interval from indication for admission by a critical care physician to actual admission to the ICU. Includes delays after scheduled surgery. |
| **Population** | All patients discharged from critical care during the period reviewed.<br>**Exclusion criteria**: transfers from other centers |
| **Type** | Outcome |
| **Source of data** | Clinical documentation |
| **Standard** | 5% |
| **Commentaries** | References:<br>When admission is delayed, the intensivist remains responsible for the care of the critical patient regardless of where the patient is located.<br>. Blanch L, Abillama FF, Amin P, Christian M, Joynt GM, Myburgh J, Nates JL, Pelosi P, Sprung C, Topeli A, Vincent JL, Yeager S, Zimmerman J; Council of the World Federation of Societies of Intensive and Critical Care Medicine. Triage decisions for ICU admission: Report from the Task Force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2016 Jun 22. pii: S0883-9441(16)30136-8<br>. Bing-Hua YU. Delayed admission to intensive care unit for critically surgical patients is associated with increased mortality. Am J Surg. 2014 Aug;208(2):268-74<br>. Hung SC, Kung CT,Hung CW, Liu BM, Liu JW, Chew G, Chuang HY, Lee WH, Lee TC Determining delayed admission to ICU for mechanically ventilated patients in the ED. Crit Care 2014; 18:485. doi: 10.1186/s13054-014-0485-1<br>. Cardoso LT, Grion CM, Matsuo T, Anami EH, Kauss IA, Seko L, Bonametti AM. Impact of delayed admission to intensive care units on mortality of critically ill patients: a cohort study. Crit Care. 2011 Jan 18;15(1):R28<br>. Restrepo MI, Mortensen EM, Rello J, Brody J, Anzueto A. Late admission to the ICU in patients with community-acquired pneumonia is associated with higher mortality. Chest. 2010 Mar;137(3):552-7<br>. Carter AW, Pilcher D, Bailey M, Cameron P, Duke GJ, Cooper J. Is ED length of stay before ICU admission related to patient mortality? Emerg Med Australas. 2010 Apr;22(2):145-50<br>. Vidal Tejedor B, Micó Gómez M, Abizanda Campos R, Alvaro Sánchez R, Belenguer Muncharaz A, Mateu Campos L, Andrés EB. [Bias in time delay in ICU admission as a mortality risk factor or “lead time bias”]. Med Intensiva. 2008 Aug-Sep;32(6):272-6<br>. Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP; DELAY-ED study group. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. Crit Care Med. 2007 Jun;35(6):1477-83 |

## INDICATOR Nº 123

| | |
|---|---|
| **Indicator** | **UNSCHEDULED READMISSION TO THE ICU** |
| **Dimension** | Safety, efficiency |
| **Justification** | A high rate of readmission could reflect premature discharges, incorrect use of ward care, or a poor response to treatment despite appropriate care. Low rates could reflect excessively long ICU stays (inappropriate discharge criteria).<br>Readmission is generally associated with increased hospital stays, increased consumption of resources, and greater morbidity and mortality |
| **Formula** | $\frac{\text{nº of patients with unscheduled readmissions < 48 hours}}{\text{nº of patients discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Unscheduled readmission**: Readmission due to unforeseen causes, whether related or not, and regardless of where the patient spent the last 48 hours |
| **Population** | All patients discharged from critical care in the period reviewed<br>**Exclusion criteria:**<br>• Death<br>• Patients discharged with orders to limit life support |
| **Type** | Outcome |
| **Source of data** | Admissions department<br>Critical care department |
| **Standard** | 4% |
| **Commentaries** | The readmission rate reported in the different studies published ranges from 4% to 14% (mean 7%).<br>References:<br>. Brown SE, Ratcliffe SJ, Halpern SD. Assessing the utility of ICU readmissions as a quality metric: an analysis of changes mediated by residency work-hour reforms. Chest. 2015 Mar;147(3):626-36<br>. Li P, Boyd JM, Ghali WA, Stelfox HT. Stakeholder views regarding patient discharge from intensive care: Suboptimal quality and opportunities for improvement. Can Respir J. 2015 Mar-Apr;22(2):109-18<br>. Hosein FS, Roberts DJ, Turin TC, Zygun D, Ghali WA, Stelfox HT. A meta-analysis to derive literature- based benchmarks for readmission and hospital mortality after patient discharge from intensive care. Crit Care. 2014 Dec 31;18(6):715<br>. Kramer AA, Higgins TL, Zimmerman JE. The association between ICU readmission rate and patient outcomes. Crit Care Med. 2013 Jan;41(1):24-33<br>. Brown SE, Ratcliffe SJ, Kahn JM, Halpern SD. The epidemiology of intensive care unit readmissions in the United States. Am J Respir Crit Care Med. 2012 May 1;185(9):955-6 |

## INDICATOR Nº 124

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|---|---|
| **Indicator** | **SURVEY ABOUT PERCEIVED QUALITY ON DISCHARGE FROM THE ICU** |
| **Dimension** | Satisfaction |
| **Justification** | Patient-centered care and family is one of the main goals of healthcare.<br>Satisfaction surveys are useful for knowing family members' perceptions of the quality of care. They can also be used to assess patients' satisfaction. |
| **Formula** | $\frac{\text{nº of surveys given out and completed}}{\text{nº of patients discharged from critical care}} \times 100$ |
| **Explanation of terms** | **Discharge includes**: discharge to the ward, to the patient's home, to another center, or death. Readmissions should be counted.<br>**Completed survey**: survey returned with > 70% of the questions answered by the patients or their families<br>We recommend using any version of the Family Satisfaction with Care in the Intensive Care Unit ( FS-ICU) questionnaire. |
| **Population** | All patients discharged from critical care during the period reviewed.<br>**Exclusion criteria:** ICU stay < 24 hours |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Specific registries |
| **Standard** | > 75% |
| **Commentaries** | At least one slice of four-weeks is recommended each year. The survey should include items about:<br>1. Environmental conditions; 2. Relations with physicians; 3. Relations with nursing staff; 4. Aspects related with visits; 5. Information received<br>References:<br>. Van den Broek JM, Brunsveld-Reinders AH, Zedlitz AM, Girbes AR, de Jonge E, Arbous MS. Questionnaires on Family Satisfaction in the Adult ICU: A Systematic Review Including Psychometric Properties. Crit Care Med. 2015 Aug;43(8):1731-44<br>. Holanda Peña MS, Ots Ruiz E, Domínguez Artiga MJ, García Miguelez A, Ruiz Ruiz A, Castellanos Ortega A, Wallmann R, Llorca Díaz J. [Measuring the satisfaction of patients admitted to the intensive care unit and of their families].Med Intensiva. 2015 Jan-Feb;39(1):4-12<br>. Schwarzkopf D, Behrend S, Skupin H, Westermann I, Riedemann NC, Pfeifer R, Günther A, Witte OW, Reinhart K, Hartog CS. Family satisfaction in the intensive care unit: a quantitative and qualitative analysis. Intensive Care Med. 2013 Jun;39(6):1071-9<br>. Hunziker S, McHugh W, Sarnoff-Lee B, Cannistraro S, Ngo L, Marcantonio E, Howell MD. Predictors and correlates of dissatisfaction with intensive care. Crit Care Med. 2012 May;40(5):1554-61<br>. Santana Cabrera L, Ramírez Rodríguez A, García Martul M, Sánchez Palacios M, Martín González JC, Hernández Medina E. [Satisfaction survey administered to the relatives of critical patients]. Med Intensiva. 2007 Mar;31(2):57-61<br>. Pérez MD, Rodríguez M, Fernández A; Calatán M, Montejo JC. [Evaluation of satisfaction among the relatives of patients admitted to an intensive care unit]. Med Intensiva 2004;28(5):234-49 |

## INDICATOR Nº 125

| | | |
|---|---|---|
| **Indicator** | **DATABASE FOR MINIMUM ICU DATASET** | |
| **Dimension** | Effectiveness | |
| **Justification** | The ICU minimum basic dataset (MBDS) registry makes it possible to unify criteria and data for classifying healthcare processes in intensive medicine. This registry helps in health system planning (care, clinical management, training and research, financing, and productivity evaluation) in critical care departments, avoiding the loss of information. | |
| **Formula** | nº of patients discharged from critical care included in the MBDS registry<br>---------- x 100<br>nº of patients discharged from critical care | |
| **Explanation of terms** | **ICU-MBDS**: database containing patient ID information and 20 items related to clinical and healthcare factors. Personal ID code (identification of the episode/file nº)<br>• Date of birth<br>• Sex<br>• Date of admission to hospital<br>• Date of admission to the ICU<br>• Time of admission to the ICU<br>• Readmission<br>• Type of patient<br>• Source | • Date of ICU discharge<br>• Time of ICU discharge<br>• Date of hospital discharge<br>• Destination at discharge<br>• Status at hospital discharge<br>• Reason for admission<br>• Main diagnosis causing ICU admission<br>• Secondary diagnoses<br>• Procedures<br>• Severity or risk-of-death scores |
| **Population** | All patients discharged from critical care in the period reviewed<br>Other activities that do not lead to ICU admission are not computed as units of the registry | |
| **Type** | Process | |
| **Source of data** | ICU-specific registry. Clinical information system. SEMICYUC CMBD-UCI | |
| **Standard** | 100% | |
| **Commentaries** | References:<br>. Wallace DJ1, Kahn JM. Florence Nightingale and the Conundrum of Counting ICU Beds. Crit Care Med. 2015 Nov;43(11):2517-8<br>. Royal Decree 69/2015, (Feb.6), regulating Registry of Specialized Healthcare Activity<br>. http://www.boe.es/diario_boe/txt.php?id=BOE-A-2015-7664<br>. Campillo-Artero C. [Clinical registries: practical recommendations for its creation]. Med Clin (Barc).2011;136:163-6<br>. Ministry of Health and Social Policy.[Intensive Care Units. Standards and Recommendations 2010]<br>. http://www.msssi.gob.es/organizacion/sns/planCalidadSNS/docs/UCI.pdf | |

## INDICATOR Nº 126

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|---|---|
| **Indicator** | **COMPLIANCE WITH ICU NURSING REGISTRIES** |
| **Dimension** | Continuity of care |
| **Justification** | Nursing registries are fundamental in healthcare. They are legal documents that form part of the patient's clinical history. They guarantee the quality and continuity of processes in nursing care. These registries record planned and executed actions by nurses as well as all the data from monitoring the critical patient. They improve multidisciplinary communication. |
| **Formula** | $\frac{\text{nº of duly completed registries}}{\text{nº of registries analyzed}} \times 100$ |
| **Explanation of terms** | **Nursing registrie**s: paper or computerized charts that record all the information about the patient and nursing processes carried out, as well as the documentation and annexes accepted by the hospital's clinical documentation committee.<br>**Duly completed**:<br>• With all the data specified in the regulations for the use of clinical records at each hospital<br>• Or each shift, a brief summary of the patient's condition and record of the nursing processes that were planned and executed. All entries must be signed by the nurse responsible for the patient. |
| **Population** | All registries for patients discharged from critical care during the period reviewed. |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. García Ramírez S, Navío Marco AM, Valentin Morganizo L.[Basic rules to fill the nursing registers]. Nure investigación 2007; 4(28). Accessed October 2015. Available at: http://www.nureinvestigacion.es/OJS/index.php/nure/article/view/335<br>. Donati A, Gabbanelli V, Pantanetti S, Carletti P, Principi T, Marini B, Nataloni S, Sambo G, Pelaia P. The impact of a clinical information system in an intensive care unit. J Clin Monit Comput. 2008 Feb;22(1):31-6<br>. Del Olmo-Núñez SM, Casas-De la Cal L, Mejías-Delgado A. The nursing register: a communication system. Enferm Clin. 2007; 17(3): 142-5<br>. Perpiñá Galvan J. Analysis of nursing registers of the General University Hospital of Alicante and recommendations for improvement. Enferm Clin. 2005;15:95-102<br>. González Sánchez JA, Cosgaya García O, Simón García MJ, Blesa Malpica AL. [Nursing records: conventional versus computerized. Critical care unit.] Enferm Intensiva. 2004;15(2):53-62 |

## INDICATOR Nº 127

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|---|---|
| **Indicator** | **NURSING REPORT AT DISCHARGE** |
| **Dimension** | Safety, Continuity of care |
| **Justification** | Discharging a patient from the ICU involves transferring information to the professionals that will continue to care for the patient in a different area of the hospital. The information must be complete, clear, and relevant to guarantee the continuity of care and the patient's safety. These handoffs are considered high-risk processes that generate many adverse events. A standardized process favors communication among professionals, minimizes variability, and strengthens the patient's participation in the context of safe care. |
| **Formula** | $\frac{\text{nº of patients with complete discharge reports}}{\text{total nº of patients discharged from critical care}} \times 100$ |
| **Explanation of terms** | A **discharge report** is a protocolized summary of the patient's stay in critical care, approved by the center. It should:<br>• Identify the professional responsible for caring for the patient<br>• Identify the patient<br>• State the reason for admission<br>• Summarize the stay, providing the relevant clinical information<br>• Report the patient's current condition<br>• List procedures and complementary tests pending execution/evaluation<br>• Report information necessary for the continuity of care (catheters, lines, wound care, pressure ulcers, etc.)<br>• Follow-up treatment<br>• Information provided to the patient/family<br>This applies to all patients administratively discharged from critical care. |
| **Population** | All patients discharged from critical care during the period reviewed.<br>**Exclusion criteria**: patients who die in the ICU, for whom an epicrisis should be done |
| **Type** | Process |
| **Source of data** | Clinical documentation. Clinical information system. Death registry. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Navarro Armedo JM, Orgiler Urangaa PE, de Haro Marín S. ICU Nursing discharge report is a useful record to guarantee the continuity of cares on the patient's discharge. Enferm Intensiva 2005; 16(2):62-72<br>. Ministry of Health and Social Policy.[Intensive Care Units. Standards and Recommendations 2010]<br>. http://www.msssi.gob.es/organizacion/sns/planCalidadSNS/docs/UCI.pdf |

## INDICATOR Nº 128

| | |
|---|---|
| **Indicator** | **STANDARDIZED MORTALITY RATE** |
| **Dimension** | Safety, effectiveness, efficiency |
| **Justification** | Raw mortality is not a good indicator of quality as it does not take into consideration differences in case mix or severity of illness.<br>Using standardized mortality rates enables comparative auditing |
| **Formula** | $\frac{\text{Observed hospital mortality}}{\text{Expected hospital mortality (mean value +/- confidence interval)}} \times 100$ |
| **Explanation of terms** | **Observed hospital mortality**: nº of patients admitted to critical care who die in the hospital / nº of patients admitted to critical care by unit of time<br>**Expected hospital mortality**: arithmetic sum of the individual probabilities of death for each patient admitted to critical care according to the severity score / nº of patients admitted to critical care<br>**Standardized mortality**: mortality adjusted for severity; different predictive models can be used (APACHE I-II-III, MPM I-II; SAPS I-II-3)<br>This indicator is based on the comparison of the results with those predicted by the model.<br>All predictive indices of risk of death refer to hospital mortality. |
| **Population** | All patients admitted to critical care during the period reviewed.<br>**Exclusion criteria**:<br>Patients who die within 24 h of ICU admission<br>Post-cardiac-surgery patients (because no validated system is available for this type of patients) |
| **Type** | Outcome |
| **Source of data** | Clinical history. Mortality commission. |
| **Standard** | 1 (+/- 0.10) |
| **Commentaries** | References:<br>The main selection criteria should be the exactitude (validation and reliability) of the model and the goodness of fit (calibration and discrimination).<br>. Lee J, Maslove DM. Customization of a Severity of Illness Score Using Local Electronic Medical Record Data. J Intensive Care Med. 2017 Jan;32(1):38-47<br>. Power GS, Harrison DA. Why try to predict ICU outcomes? Curr Opin Crit Care. 2014 Oct;20(5):544-9<br>. Liu V, Turk BJ, Ragins AI, Kipnis P, Escobar GJ. An electronic Simplified Acute Physiology Score- based risk adjustment score for critical illness in an integrated healthcare system. Crit Care Med. 2013 Jan;41(1):41-8<br>. Breslow MJ, Badawi O. Severity scoring in the critically ill: part 2: maximizing value from outcome prediction scoring systems. Chest. 2012 Feb;141(2):518-27 |

## INDICATOR Nº 129

| | |
|---|---|
| **Indicator** | **AUTOPSY RATE** |
| **Dimension** | Effectiveness, safety |
| **Justification** | Autopsies show the importance of correlating clinical and pathology findings and contribute scientific knowledge that can be used in future situations similar to the death under investigation. Autopsies are a tool for analyzing adverse events. |
| **Formula** | $\frac{\text{nº of patients autopsied}}{\text{nº of patients who die in critical care}} \times 100$ |
| **Explanation of terms** | |
| **Population** | All patients discharged from critical care during the period reviewed.<br>Exclusion criteria: autopsies performed to comply with court orders |
| **Type** | Process |
| **Source of data** | Clinical documentation<br>Pathology department |
| **Standard** | 10% |
| **Commentaries** | References:<br>. Fröhlich S, Ryan O, Murphy N, McCauley N, Crotty T, Ryan D. Are autopsy findings still relevant to the management of critically ill patients in the modern era?Crit Care Med. 2014 Feb;42(2):336-43<br>. Tejerina E, Esteban A, Fernández-Segoviano P, María Rodríguez-Barbero J, Gordo F, Frutos-Vivar F, Aramburu J, Algaba A, Gonzalo Salcedo García O, Lorente JA. Clinical diagnoses and autopsy findings: discrepancies in critically ill patients*. Crit Care Med. 2012 Mar;40(3):842-6<br>. Magret Iglesias M, Vidaur Tello L, Fernández Olsina S, García Fontgivell JF, Blázquez Vilàs S, Alonso Rubio S, Díaz Santos E, Sirvent Calvera JJ, Rello J. [Discrepancies between clinical and pathological diagnosis in a polyvalent intensive care service] Med Intensiva. 2006 Apr;30(3):95-100<br>. Esteban A, Alia I, Fernández P, Palomino R. [Evolution of the percentage of autopsies in an intensive care unit]. Med Intensiva 1991;15:127-130<br>. For accreditation as a teaching ICU, a rate >10% of patients who die is recommended. [Teaching accreditation for critical care departments. National Commission for the Specialty of Intensive Care Medicine]. Med Intensiva 1997; 21:392-39 |

## INDICATOR Nº 130

| | |
|---|---|
| **Indicator** | **ICU STAFF ORIENTATION PLAN** |
| **Dimension** | Appropriateness, safety, satisfaction |
| **Justification** | Orientation programs for new staff members facilitate their integration and adaptation to their new posts and thus contribute to patient safety by reducing new staff members' stress. |
| **Formula** | $\frac{\text{nº of professionals assigned to the ICU completing orientation programs}}{\text{nº of professionals assigned to the ICU}} \times 100$ |
| **Explanation of terms** | **Professional assigned to the ICU**: Any professional assigned to the ICU, whether working for the center or merely at the center (physician, nurse, nurse's aide, orderlies, and administrative staff), whether on a temporary or permanent basis.<br>**Staff orientation** plan: formalized procedure to welcome and integrate staff arriving in the ICU that facilitates their incorporation into the unit and invites them to participate in the organization's common goals. It should include training in protocols and procedures, procedures for cardiorespiratory arrest, prevention of occupational hazards, patient safety, infection control, and internal operating rules. |
| **Population** | All professionals assigned to the ICU during the period reviewed in the last year. |
| **Type** | Process |
| **Source of data** | Hospital Human Resources Department. Record of teaching/training activities. |
| **Standard** | 100% |
| **Commentaries** | The orientation plan will also include the mission, values, and philosophy of the ICU.<br>References:<br>. Alonso Ovies A, Alvarez Rodríguez J, García Gálvez MM, Velayos Amo C, Balugo Huertas S, Alvarez<br>. Morales A. Usefulness of failure mode and effects analysis to improve patient safety during the process of incorporating new nurses in an intensive care unit. Med Clínica 2010 135(Supl1):45-53<br>. Ministerio de Sanidad y política Social. Unidad de Cuidados Intensivos. Standardes y Recomendaciones 2010 http://www.msssi.gob.es/organizacion/sns/planCalidadSNS/docs/UCI.pdf<br>. Reader TW, Flin R, Mearns K,Cuthbertson BH. Developing a team performance framework for the intensive care unit. Crit Care Med 2009; 37:1787-93<br>. Morrison AL, Beckmann U, Durie M, Carless R, Gillies DM. The effects of nursing staff inexperience (NSI) on the occurrence of adverse patient experiences in ICUs. Aust Crit Care. 2001;14:116-21 |

## INDICATOR Nº 131 (FUNDAMENTAL INDICATOR)

| Indicator | PRESENCE OF AN INTENSIVIST IN THE ICU 24/7 |
|---|---|
| **Dimension** | Appropriateness, safety, efficiency |
| **Justification** | The presence of an intensivist in the ICU 24 h/day guarantees the quality of care, decreasing mortality and stay among critical patients. |
| **Formula** | nº of days in which an intensivist is present 24 h<br>---------- x 100<br>365 |
| **Explanation of terms** | "**Intensivist**": physician that is a certified intensive medicine specialist, excluding residents<br>Physical presence is considered necessary |
| **Population** | All days of the year in the period reviewed. |
| **Type** | Structure |
| **Source of data** | Department of human resources. Duty rosters. |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Amin P, Fox-Robichaud A, Divatia JV, Pelosi P, Altintas D, Eryüksel E, Mehta Y, Suh GY, Blanch<br>. L, Weiler N, Zimmerman J, Vincent JL; The Intensive care unit specialist: Report from the Task Force of World Federation of Societies of Intensive and Critical Care Medicine. Council of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2016 Oct;35:223-228<br>. Lilly CM.ICU physician staffing: what else do we need to know? Chest. 2015 Apr;147(4):867-8<br>. Kerlin MP, Harhay MO, Kahn JM, Halpern SD. Nighttime intensivist staffing, mortality, and limits on life support: a retrospective cohort study. Chest. 2015;147(4):951-958<br>. McLean AS.Is a Single Entry Training Scheme for Intensive Care Medicine Both Inevitable and Desirable? Crit Care Med. 2015 Sep;43(9):1816-22<br>. Board of directors of the Spanish Society of Intensive Care Medicine and Coronary Units (SEMICYUC). [Intensive medicine in Spain]. Med Intensiva. 2011 Mar;35(2):92-101 |

## INDICATOR Nº 132 (FUNDAMENTAL INDICATOR)

| Indicator | SYSTEM FOR NOTIFICATION OF ADVERSE EVENTS |
|---|---|
| **Dimension** | Safety |
| **Justification** | Adverse events (AE) are common in the field of medicine and are associated with significant mortality and morbidity, as well as increased stays and use of resources. Moreover, they diminish patients' and families' satisfaction. Designating a core safety group within the ICU to promote a culture of safety and the analysis of incidents/AE is an essential facet of healthcare safety and quality. |
| **Formula** | The presence of a system for the notification of AE in the ICU and a core safety group. |
| **Explanation of terms** | **Notification system**:<br>• Voluntary and anonymous<br>• Providing the possibility for all professionals to notify incidents/AE<br>• Must include at least sentinel events and the analysis of root causes<br>• Must provide feedback / each semester: bulletins, warnings, etc<br>• Can work simultaneously with other surveillance systems for specific types of AE: Infections, falls, restraints, etc.<br>**Core safety group**: at least 2 clinical safety leaders (physician and nurse) with the **capacity to analyze incidents** and AE in an ICU with a notification system, using the most appropriate methods for each case. |
| **Population** | Hospital records |
| **Type** | Structure |
| **Source of data** | ICU or hospital registries |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Wu AW, Pronovost P, Morlock L. ICU incident reporting systems. J Crit Care. 2002 Jun;17(2):86-94<br>. Needham DM, Thompson DA, Holtzmullller CG, Dorman T, Luboms LH, Morlock LL, Pronovost PJ. A system factors analysis of airway events from the Intensive Care Unit Safety Reporting System (ICUSRS). Crit Care Med 2004;32(11):2227-33<br>. Pronovost PJ, Thompson DA, Holzmueller CG, Lubomski LH, Dorman T, Dickman F, Fahey M, Steinwachs DM, Engineer L, Sexton JB, Wu AW, Morlock LL. Toward learning from patient safety reporting systems. J Crit Care. 2006 Dec;21(4):305-15<br>. Winters BD, Berenholtz SM, Pronovost P.Improving patient safety reporting systems. Crit Care Med. 2007 Apr;35(4):1206-7<br>. Kiekkas P, Aretha D, Stefanopoulos N, Baltopoulos GI.Knowledge is power: studying critical incidents in intensive care. Crit Care. 2012 Jan 9;16(1):102 |

## INDICATOR Nº 133 (FUNDAMENTAL INDICATOR)

| Indicator | FLEXIBLE VISITING HOURS |
|---|---|
| **Dimension** | Satisfaction |
| **Justification** | An "open ICU" with flexible visiting hours is beneficial for patients, patients' families, and professionals.<br>This policy promotes patient wellbeing, decreasing anxiety in patients and their families, and minimizing the traumatic experience of disease and hospitalization. It also favors contact between patients and their families, promotes the participation of the families in caring for the patient, and improves perceived quality. There is no clinical evidence that restricted visiting hours affect patient safety. Making visiting hours flexible is included in plans for humanizing ICUs. |
| **Formula** | The existence of flexible visiting hours in the ICU |
| **Explanation of terms** | **Flexible visiting hours**: specific protocols for visiting hours adapted to each patient's specific circumstances that go beyond the classical restricted visiting hours (<2 hours/ day). Assigning a principal caregiver (a specifically designated family member or friend) can make it easier to implement these flexible visiting hours. |
| **Population** | All intensive care units. |
| **Type** | Structure |
| **Source of data** | Critical cre functional plan |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Heras La Calle G, Oviés ÁA, Tello VG. A plan for improving the humanisation of intensive care units. Intensive Care Med. 2017 Apr;43(4):547-549<br>. Escudero D, Martín L, Viña L, Quindós B, Forcelledo L, del Busto C, Rodríguez-García R, Álvarez- García L; Grupo HU-CI. [It is time to change the visiting policy in intensive care units]. Med Intensiva. 2016 Apr;40(3):197-9<br>. Escudero D, Martín L, Viña L, Quindós B, Espina MJ, Forcelledo L, López-Amor L, García-Arias B, del Busto C, de Cima S, Fernández-Rey E. [Visitation policy, design and comfort in Spanish intensive care units]. Rev Calid Asist. 2015 Sep-Oct;30(5):243-50<br>. Escudero D, Martín L, Viña L, Forcelledo L, García-Arias B, López-Amor L. [Open the doors on the ICU. An unavoidable necessity] . Med Intensiva. 2015 Nov;39(8):522-3 |

## INDICATOR Nº 134

| | |
|---|---|
| **Indicator** | **BURNOUT SYNDROME** |
| **Dimension** | Satisfaction, safety |
| **Justification** | Burnout syndrome, defined as a response to chronic work-related stress and characterized by emotional exhaustion, depersonalization, and low self-realization is common in professionals working with the critically ill. Burnout syndrome has negative consequences not only for professionals, but also for patients, families, and organizations. Using validated scales to measure professional debilitation makes it easier to recognize the syndrome and take action against it. |
| **Formula** | Surveys to assess burnout in ICU professionals. |
| **Explanation of terms** | **Surveys done:** measuring burnout in all professionals working in the ICU with validated scales at least once every two years.<br>**Validated scales**: Maslach Burnout Inventory (MBI)(1) Copenhagen Burnout Inventory (CBI), "Oldenburg Burnout Inventory" (OLBI), "Cuestionario para la Evaluación del Síndrome de Quemarse en el Trabajo", "Cuestionario y Entrevista Semi-estructurada de Desgaste Profesional Médico" (CDPM) or the "Cuestionario de Desgaste Profesional en Enfermería" (CDPE) |
| **Population** | All ICUs |
| **Type** | Outcome |
| **Source of data** | Critical care department's functional plan |
| **Standard** | Do 1 survey every / 2 years |
| **Commentaries** | ICUs are recommended to have multimodal strategies to prevent and deal with burnout syndrome.<br>References:<br>. (1) Maslach C, Jackson SE. Maslach Burnout Inventory. Palo Alto, California: Consulting Psychologists Press; 1981.<br>. Moss M, Good VS, Gozal D, Kleinpell R, Sessler CN. An Official Critical Care Societies Collaborative Statement: Burnout Syndrome in Critical Care Healthcare Professionals: A Call for Action. Crit Care Med. 2016 Jul;44(7):1414-21<br>. Burghi G, Lambert J, Chaize M, Goinheix K, Quiroga C, Fariña G, Godino M, Pittini G, Pereda S , Fregossi C, Mareque S, Bagnulo H, Azoulay E. Prevalence, risk factors and consequences of severe burnout syndrome in ICU. Intensive Care Med. 2014 Nov;40(11):1785-6<br>. Frade Mera MJ, Vinagre Gaspar R, Zaragoza García I, Viñas Sánchez S, Antúnez Melero E, Alvarez González S, Malpartida Martín P. [Burnout syndrome in different intensive care units]. Enferm Intensiva. 2009 Oct-Dec;20(4):131-40<br>. Santana Cabrera L, Hernández Medina E, Eugenio Robaina P, Sánchez-Palacios M, Pérez Sánchez R, Falcón Moreno R. [Burnout syndrome among nurses and nurses' aides in an intensive care unit and admission wards]. Enferm Clin. 2009 Jan-Feb;19(1):31-4 |

## TECHNOLOGY ASSESSMENT AND RESEARCH METHODS

### INDICATOR Nº 135

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|---|---|
| **Indicator** | **CLINICAL INFORMATION SYSTEM** |
| **Dimension** | Safety, effectiveness, efficiency |
| **Justification** | Clinical information systems (CIS) are necessary to manage the information generated by patients in critical care departments. They help improve patient safety, the quality of care, and clinical management; moreover, they are very useful for research and training.<br>A wide variety of CIS are available on the market. To be useful, a CIS should meet minimum standards and meet the needs of patients and professionals. |
| **Formula** | Presence of a CIS in the ICU. |
| **Explanation of terms** | **The CIS must:**<br>• Have good connectivity with all types of peripheral medical devices.<br>• Enable reliable transmission of information to and from the hospital clinical history. Connection with the pharmacy is optional.<br>• Be simple for clinical administrators to configure.<br>• Allow drug prescription through a library of drugs.<br>• Allow the configuration of a complete clinical sheet that manages entries and exits.<br>• Enable the management of nursing interventions, diagnostic procedures, and medical procedures, as well as the calculation of scales.<br>• Allow care plans and assessment plans to be configured.<br>• Facilitate the management of alarms and meta-alarms.<br>• Incorporate the registry of the MBDS, with codes and reports.<br>• Have a tool making it possible to search for information and extract data. |
| **Population** | Hospital information systems |
| **Type** | Structure |
| **Source of data** | ICU equipment |
| **Standard** | 100% |
| **Commentaries** | References:<br>. Carayon P, Wetterneck TB, Alyousef B, Brown RL, Cartmill RS, McGuire K, Hoonakker PL, Slagle J, Van Roy KS, Walker JM, Weinger MB, Xie A, Wood KE. Impact of electronic health record techno- logy on the work and workflow of physicians in the intensive care unit. Int J Med Inform. 2015 Aug;84(8):578-94<br>. Gómez Tello V, Alvarez Rodríguez J, Núñez Reiz A, González Sánchez JA, Hernández Abadía de Barbará A, Martínez Fresneda M, Morrondo Valdeolmillos P, Nicolás Arfelis JM, Pujol Varela I, Calvete Chicharro M; Sociedad Española de Medicina Intensiva Crítica y Unidades Coronarias (SEMICYUC). [Technical and functional standards and implementation of a clinical information system in inten- sive care units]. Med Intensiva. 2011 Nov;35(8):484-96 |

## INDICATOR Nº 136

| | |
|---|---|
| **Indicator** | **AVAILABILITY OF MULTIFUNCTION ULTRASONOGRAPHY** |
| **Dimension** | Effectiveness, efficiency, safety, accessibility |
| **Justification** | The availability of multifunction ultrasonography (US) in ICUs makes it possible to do US studies at the bedside 24 hours/day. Multifunction US can improve the diagnosis and management of different pathologies and allow invasive procedures to be done more safely. |
| **Formula** | Availability of a multifunction US scanner 24 hours/day. |
| **Explanation of terms** | **Multifunction US**: 24-hour availability of one or more US systems with specific probes for vascular, pleuropulmonary, and abdominal imaging as well as for echocardiography and transcranial Doppler imaging in the ICU. |
| **Population** | All intensive care units.<br>**Exclusion criteria**: transcranial Doppler imaging is essential in ICUs with neurocritical patients. |
| **Type** | Structure |
| **Source of data** | Register of ICU equipment. |
| **Standard** | 100% |
| **Commentaries** | Critical care professionals are recommended to undergo formal training in clinical US.<br>References:<br>. Ayuela Azcárate JM, Clau-Terré F, Vicho Pereira R, Guerrero de Mier M, Carrillo López A,<br>. Ochagavia A, López Pérez JM, Trenado Alvarez J, Pérez L, Llompart-Pou JA, González de Molina FJ, Fojón S, Rodríguez Salgado A, Martínez Díaz MC, Royo Villa C, Romero Bermejo FJ, Ruíz Bailén M, Arroyo Díez M, Argueso García M, Fernández Fernández JL; SEMICYUC's Cardiac Care and CPR Work Group. [Consensus document on ultrasound training in Intensive Care Medicine. Care process, use of the technique and acquisition of professional skills]. Med Intensiva. 2014 Jan- Feb;38(1):33-40<br>. Álvarez-Fernández JA, Núñez-Reiz A; on behalf of the Club de Ecografía UCI Madrid de la SOMIAMA. Clinical ultrasound in the ICU: changing a medical paradigm. Med Intensiva.2016 May;40(4):246-9<br>. Expert Round Table on Ultrasound in ICU. International expert statement on training standards for critical care ultrasonography. Intensive Care Med. 2011 Jul;37(7):1077-83<br>. Beaulieu Y, Marik PE. Bedside ultrasonography in the ICU: part 1. Chest. 2005 Aug;128(2):881-95<br>. Beaulieu Y, Marik PE. Bedside ultrasonography in the ICU: part 2. Chest. 2005 Sep;128(3):1766-81<br>. Chacko J, Brar G. Bedside ultrasonography-Applications in critical care: Part II. Indian J Crit Care Med. 2014 Jun;18(6):376-81<br>. Chacko J, Brar G. Bedside ultrasonography: Applications in critical care: Part I. Indian J Crit Care Med. 2014 May;18(5):301-9 |

## CONTINUING EDUCATION, TEACHING, AND RESEARCH

### INDICATOR Nº 137 (FUNDAMENTAL INDICATOR)

| Indicator | EXISTENCE OF BASIC PROTOCOLS |
|---|---|
| **Dimension** | Appropriateness |
| **Justification** | Good clinical practice is favored by the standardization of processes in agreement with current scientific evidence by means of periodically updated protocols. Protocols should adjust guidelines to the diagnostic and therapeutic possibilities of our working environments. Protocols should aim to homogenize the care provided in each center and serve as tool to facilitate and streamline decision making. |
| **Formula** | Existence of duly updated basic protocols |
| **Explanation of terms** | **Protocol**: at the very least, should include assessment, diagnosis, treatment, the responsibilities of the team members, and healthcare circuits used.<br>**Basic protocols**: all ICUs should have protocols for<br>• Criteria for admission to and discharge from the ICU<br>• Acute coronary syndrome<br>• Management of severe arrhythmias and heart block<br>• Life support<br>• Initial care for multiple trauma patients<br>• Traumatic brain injury<br>• Sedation, pain, and delirium<br>• Invasive and noninvasive mechanical ventilation; weaning from mechanical ventilation<br>• Acute respiratory distress syndrome (ARDS)<br>• Sepsis, septic shock, and treatment of infections in general<br>• Limitations on life support<br>• Appropriate end-of-life care<br>• Use of restraints<br>• Preventing falls<br>• Preventing and treating pressure ulcers<br>• Enteral and parenteral nutrition<br>• Management of hyperglycemia<br>• Renal replacement techniques<br>• Prophylaxis against upper gastrointestinal bleeding<br>• Prophylaxis against deep vein thrombosis<br>• Acute intoxications<br>• Transport within the hospital<br>• Brain death<br>• Donation after circulatory death<br>**Updated**: referring to the period of time established for their revision. A period of 3 to 5 years is generally recommended. |
| **Population** | Census of up-to-date protocols in the department. |
| **Type** | Structure |
| **Source of data** | Protocol registry |
| **Standard** | Yes or 100%. |
| **Commentaries** | The standard should be considered met when all 24 protocols listed above are available and meet the criteria for content and updating listed in the explanation of terms. Professionals must have access to the protocols.<br>Excluded from the list of basic protocols are those referring to conditions that do not form part of critical care departments domain.<br>In addition to these processes, the workgroup recommends that protocols should be available for all clinical situations for which ordinary medical practice varies. |

## INDICATOR Nº 138

| | |
|---|---|
| **Indicator** | **RESEARCH ACTIVITY** |
| **Dimension** | Appropriateness |
| **Justification** | Various approaches to biomedical and nursing research (promoting health, aging, and communication with patients and with other professionals) should be considered an indispensable investment for the success of any strategy that aims to improve outcomes for patients and their families. Research makes healthcare organizations more competitive and ultimately leads to better health for the general population.<br>Participating in competitively funded research projects identifies departments with consolidated research activity. |
| **Formula** | Number of active research projects carried out or underway in the department during the last 3 years. |
| **Explanation of terms** | **Research project:**<br>• Competitively funded research: projects financed through research programs from the European Union, National R&D Plan, FIS, FISPSE, regional programs, or foundations with committees or reviewers.<br>• Clinical trial: approved by the clinical research committee and fulfilling legal requirements.<br>All projects must be approved by the corresponding ethics committee (hospital, university) at the center(s) where they will be carried out. |
| **Population** | All research projects generated by the department during the period evaluated.<br>**Exclusion criteria:** post-authorization studies |
| **Type** | Outcome |
| **Source of data** | Accrediting document from the organ granting the research funds. Hospital or departmental record of research activity. |
| **Standard** | 1 research project / 3 years |
| **Commentaries** | This indicator is designed to assess participation in research projects, not to identify outstanding units. The authors consider this indicator to be highly recommendable for teaching hospitals and fundamental<br>for those accredited to train residents (physicians and nurses) |

## INDICATOR Nº 139

| | |
|---|---|
| **Indicator** | **SCIENTIFIC PUBLICATIONS** |
| **Dimension** | Appropriateness |
| **Justification** | Training and research are essential components of appropriate and effective professional development. Without these components, it would be difficult to set professional goals to resolve problems or satisfy needs or to improve quality.<br>Publications (presentations at congresses or articles in prestigious journals) are indicators of the results of the research done in the department. |
| **Formula** | Number of publications or presentations by the department in the last two years. |
| **Explanation of terms** | **Publication**: original article, editorial, systematic review, or meta-analysis published in indexed journals (national or international). Only publications authored by a professional from the department count. Letters to the editor do not count.<br>**Presentations at congresses**: presentations accepted at national or international congresses sponsored by scientific societies or referenced in Pubmed in which a professional from the department is an author. |
| **Population** | Publications by department professionals during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Departmental records |
| **Standard** | 1 publication or 4 presentations / 3 years for level I or level II (or non-teaching) hospitals<br>3 publications or 12 presentations / 3 years for level III (or teaching) hospitals |
| **Commentaries** | As this indicator is intended to measure research activity, publications that are considered secondary sources (apart from systematic reviews) are excluded.<br>The authors consider this indicator to be highly recommendable for teaching hospitals and fundamental for those accredited to train residents (physicians or nurses). |

## INDICATOR Nº 140

| | |
|---|---|
| **Indicator** | **CONTINUING MEDICAL EDUCATION (CME)** |
| **Dimension** | Appropriateness, satisfaction |
| **Justification** | Continuing education is essential for appropriate and effective professional development. It is especially important in areas where scientific evidence is quickly translated into modifications in clinical practice. Continuing education is a tool to improve professional satisfaction, contributing to the achievement of goals set for professional development. |
| **Formula** | $\frac{\text{nº of staff professionals obtaining CME credits in the last 36 months}}{\text{nº of staff professionals}} \times 100$ |
| **Explanation of terms** | **Staff professionals**: physicians and nurses whether working under a contract for normal working hours or only covering nights, weekends, and holidays<br>**Obtaining credits**: 5 credits / 3 years<br>**CME**: clinical sessions, courses, workshops, seminars, whose contents are related with the specialty, whether in the hospital or outside the hospital. |
| **Population** | Staff physicians and nurses during the period reviewed. |
| **Type** | Outcome |
| **Source of data** | Registry of teaching activities |
| **Standard** | > 75% |
| **Commentaries** | The obtainment of credits should be overseen by national or international accreditation organs (CME commissions from the national health system, regional health systems, or the European Accreditation Council for CME EACCME o ACCME)<br>Spanish law 44/2003, 21 November, organization of health professions. BOE nº 280, 22 November 2003. 41442-41458 |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| CARDIAC CARE AND CPR | 1. | Early administration of acetylsalicylic acid in acute coronary syndrome | Effectiveness & safety | Process | 100% |
| | 2. | Early administration of beta-blockers in acute myocardial infarction) | Effectiveness & safety | Process | 90% |
| | 3. | Risk stratification in acute coronary syndrome | Effectiveness & safety | Process | 100% |
| | 4. | Urgent invasive strategy in unstable on-ST-elevation myocardial infarction | Effectiveness & safety | Process | 95% |
| | 5. | Reperfusion techniques in ST-elevation myocardial infarction | Effectiveness, safety, & appropriateness | Process | 90% |
| | 6. | Door-needle (thrombolysis) time in ST-elevation myocardial infarction | Effectiveness, safety, & appropriateness | Process | 100% |
| | 7. | Door-balloon time in primary percutaneous coronary intervention | Safety & effectiveness | Process | 100% |
| | 8. | Hospital mortality in ST-elevation myocardial infarction | Safety | Outcome | < 7% (STEMI ) & < 5.5% (nonSTEMI ) Includes patients w/ cardiorespiratory arrest and Killip IV |
| | 9. | Temperature control after cardiac arrest | Effectiveness & safety | Process | 100% |
| | 10. | Use of the Utstein template | Appropriateness | Process | 100% |
| | 11. | Registry of quality indicators in heart surgery | Safety & effectiveness | Structure | YES (100%) |
| | 12. | Incidence of early complications in the implantation of devices to treat and/or prevent arrhythmias | Safety | Outcome | < 2 % |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| ACUTE RESPIRATORY FAILURE | 13. | Incidence of barotrauma | Safety | Outcome | ≤ 0.5 cases barotrauma x 1000 days MV |
| | 14. | Ventilator circuit change at 7 days | Safety & efficiency | Process | < 100% |
| | 15. | Indications for prone positioning in acute respiratory distress syndrome (ARDS) | Safety & effectiveness | Process | > 90% |
| | 16. | Pressure ulcers in patients in prone position | Safety | Process | < 15 cases per 1000 days MV |
| | 17. | Spontaneous breathing trial | Safety& efficiency | Process | > 90% |
| | 18. | Semirecumbent position in patients undergoing invasive mechanical ventilation | Safety & Effectiveness | Process | > 90% |
| | 19. | Changing heat-and-moisture exchangers | Safety & effectiveness | Process | 100% |
| | 20. | Self-extubation | Safety | Outcome | < 7 cases per 1000 days intubation |
| | 21. | Unplanned extubation during maneuvers | Safety | Outcome | < 3 extubations per 1000 days intubation |
| | 22. | Reintubation | Safety & effectiveness | Outcome | < 12% |
| | 23. | Indicating noninvasive ventilation in exacerbations of hypercapnic chronic respiratory failure | Effectiveness, safety, & efficiency | Process | > 95% |
| | 24. | Skin lesions related with facemasks for noninvasive mechanical ventilation | Safety | Outcome | < 7% |
| | 25. | Lung-protective ventilation in acute respiratory distress syndrome (ARDS) | Safety | Process | > 90% |
| | 26. | Appropriate endotracheal suctioning | Safety | Process | 100% |
| | 27. | Endotracheal tube cuff pressure | Safety | Process | 95% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| NEUR OCRITICAL CARE AND TRAUMATOLOGY | 28. | Severe trauma attended by the critical care department | Effectiveness& safety | Process | 95% |
| | 29. | Tracheal intubation in patients with severe traumatic brain injury and Glasgow Coma Score < 9 during the first 24 hours | Safety | Process | 95% |
| | 30. | Surgical intervention in traumatic brain injury with subdural hematoma and/or epidural hematoma | Safety & effectiveness | Process | 100% |
| | 31. | Monitoring intracranial pressure in patients with severe traumatic brain injury with pathological CT findings | Effectiveness & safety | Process | 95% |
| | 32. | Mortality in severe traumatic brain injury | Safety & effectiveness | Outcome | < 35% |
| | 33. | Early osteosynthesis in fractures of the femoral diaphysis | Safety, continuity of care & effectiveness | Process | 95% |
| | 34. | Early surgical fixation of open fractures | Safety, continuity of care & effectiveness | Process | 95% |
| | 35. | Early diagnosis of subarachnoid hemorrhage | Effectiveness & safety | Process | 90% |
| | 36. | Administration of nimodipine in subarachnoid hemorrhage | Effectiveness & safety | Process | 100% |
| | 37. | ICU-acquired weakness | Safety | Outcome | < 25-30% |
| | 38. | Intravenous fibrinolysis in acute ischemic stroke | Effectiveness | Process | 100% |
| | 39. | Door-to-needle time in acute ischemic stroke in candidates for thrombolytic treatment | Effectiveness & appropriateness | Process | 90% |
| | 40. | Use of somatosensory evoked potentials in post-anoxic encephalopathy | Appropriateness | Process | 90% |
| | 41. | Early control of systolic blood pressure in spontaneous intracerebral hemorrhage | Effectiveness | Process | 80% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| INFECTIOUS DISEASES | 42. | Catheter-related bloodstream infections | Safety & effectiveness | Outcome | < 3 episodes per 1000 catheter days |
| | 43. | Catheter-related urinary tract infections | Safety & effectiveness | Outcome | < 4 episodes per 1000 catheter days |
| | 44. | Ventilator-associated pneumonia | Safety & effectiveness | Outcome | < 7 episodes per 1000 days MV |
| | 45. | Early resuscitation in severe sepsis / septic shock | Effectiveness | Process | 95% |
| | 46. | Early antibiotic treatment in sepsis | Effectiveness & safety | Process | 100% |
| | 47. | Inappropriate empirical antibiotic treatment for infections treated in the ICU | Safety & effectiveness | Outcome | 90% |
| | 48. | Methicillin-resistant Staphylococcus aureus infections | Safety & effectiveness | Outcome | < 2.5% |
| | 49. | Multiresistant Pseudomonas aeruginosa infections | Safety & effectiveness | Outcome | < 15% |
| | 50. | Indications for isolation | Safety & appropriateness | Process | 100% |
| | 51. | Blood culture contamination | Safety & efficiency | Process | < 3% |
| | 52. | Compliance with hand hygiene measures | Effectiveness | Process | > 90% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| ME TABOLISM & NUTRITION | 53. | Complications of total parenteral nutrition: hyperglycemia | Safety | Outcome | ≤ 10% |
| | 54. | Complications of total parenteral nutrition: liver dysfunction | Safety | Outcome | <25% |
| | 55. | Maintaining appropriate blood glucose levels | Effectiveness & safety | Process | 80% |
| | 56. | Severe hypoglycemia | Safety | Outcome | 0.5% |
| | 57. | Identification of patients with nutritional risk | Effectiveness & safety | Process | 100% |
| | 58. | Assessment of nutritional status | Effectiveness | Process | 100% |
| | 59. | Calorie and protein requirements in critical patients | Appropriateness & safety | Process | 85% |
| | 60. | Early enteral nutrition | Effectiveness & safety | Process | 100% |
| | 61. | Monitoring enteral nutrition | Effectiveness | Process | 100% |
| | 62. | Withdrawing obstructed feeding tubes | Safety | Outcome | 4% |
| | 63. | Appropriate use of parenteral nutrition | Safety & effectiveness | Process | 16% with PN & 25% with complementary PN |
| | 64. | Refeeding syndrome | Effectiveness & safety | Process | 100% |
| | 65. | Prophylaxis against stress ulcers in critical patients receiving enteral nutrition | Safety & effectiveness | Process | 80% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| NEPHROLOGIC CARE | 66. | Stratification of acute kidney injury in critical patients | Appropriateness | Process | 95% |
| | 67. | Prevention of contrast-induced nephropathy | Safety | Process | 95% |
| | 68. | Identification of patients with risk factors for developing acute kidney injury | Safety | Process | 100% |
| | 69. | Indication of renal replacement therapy in patients with AKIN Stage 3 acute kidney injury | Effectiveness & safety | Process | > 90% |
| | 70. | Dynamic dosing during renal replacement therapy | Effectiveness & safety | Process | > 95% |
| | 71. | Estimation of the glomerular filtration rate through creatinine clearance in critical patients with acute kidney injury | Appropriateness | Process | > 80% |
| | 72. | Use of dopamine in acute kidney injury | Safety & effectiveness | Process | 0% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| SEDATION & ANALGESIA | 73. | Monitoring sedation | Safety & effectiveness | Process | 95% |
| | 74. | Appropriate sedation | Safety & effectiveness | Process | 85% |
| | 75. | Considering interruption of sedation daily | Effectiveness & efficiency | Process | 80% |
| | 76. | Monitoring pain in patients who can communicate | Effectiveness & efficiency | Process | 100% |
| | 77. | Monitoring pain in patients who cannot communicate | Effectiveness & efficiency | Process | 100% |
| | 78. | Inappropriate use of neuromuscular blockers | Safety | Process | <2% |
| | 79. | Monitoring the use of neuromuscular blockers | Effectiveness & safety | Process | 100% |
| | 80. | Monitoring sedation during the use of neuromuscular blockers | Effectiveness & safety | Process | 100% |
| | 81. | Identification of delirium | Effectiveness & safety | Process | 90% |
| | 82. | Nonpharmacological prevention of delirium | Safety & effectiveness | Process | 90% |
| | 83. | Maximum doses of opioids and sedatives | Effectiveness & efficiency | Process | <10% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| | 84. | Informed consent for the transfusion of blood components | Satisfaction & appropriateness | Process | 95% |
| | 85. | Inappropriate transfusion of fresh-frozen plasma | Effectiveness & safety | Process | 0% |
| | 86. | Inappropriate transfusion of platelet-rich plasma | Effectiveness & safety | Process | 0% |
| | 87. | Inappropriate transfusion of packed red blood cells | Effectiveness & safety | Process | 3% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| SAFETY BLOOD PRODUCTS | 99. | Checklist in intrahospital transport | Safety, appropriateness, & continuity of care | Process | 100% |
| | 100. | Management of monitoring alarms | Safety & appropriateness | Process | 5% |
| | 101. | Accidental falls | Safety & appropriateness | Outcome | 0% |
| | 102. | Medication errors in the ICU | Safety | Outcome | 5% |
| | 103. | Accidental removal of vascular catheters | Safety & effectiveness | Outcome | Arterial catheter: 15/1000 days Venous catheter: 6/1000 days |
| | 104. | Crash cart review | Safety & effectiveness | Process | 100% |
| | 105. | Using a valid scale to assess the risk of developing pressure ulcers | Safety | Process | 100% |
| | 106. | Incidence of pressure ulcers | Safety | Outcome | 5% |
| | 107. | Prevention of venous thromboembolism | Safety | Process | 90%; in SEMICYUC study (2007), the mean was 77.4% |
| | 108. | Unequivocal identification | Safety | Process | 100% |
| | 109. | Walkrounds with supervisors | Safety | Process | 75% |
| | 88. | Overtransfusion of packed red blood cells | Effectiveness & safety | Process | 5% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| TOXICOLOGY | 89. | Correct indications and methods of digestive decontamination in acute intoxication | Effectiveness & appropriateness | Process | >90% |
| | 90. | Minimum stock of antidotes in the critical care department and/o hospital pharmacy | Safety | Structure | 95% |
| | 91. | Early appropriate renal replacement therapy in acute intoxication | Safety | Process | 100% |
| | 92. | Psychiatric assessment in voluntary acute intoxications in suicide attempts | Effectiveness, appropriateness, & safety | Process | 100% |
| | 93. | Bronchoaspiration of activated charcoal | Effectiveness | Outcome | 0% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| TRASPLANTS | 94. | Brain dead donors | Effectiveness | Outcome | 60% |
| | 95. | Evaluation of potential organ donors after cardiac death after limiting life support | Appropriateness | Process | 95% |
| | 96. | Monitoring potential organ donors | Appropriateness | Process | 100% |
| | 97. | Diagnosing brain death | Effectiveness | Outcome | 5%-30% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| BIOETICA | 110. | Appropriate end-of-life care | Effectiveness & satisfaction | Process | 100% |
| | 111. | Information to families of ICU patients | Satisfaction | Process | 100% |
| | 112. | Information from nursing staff to patients' families | Appropriateness & satisfaction | Process | 95% |
| | 113. | Incorporation of advance directives in decision making | Appropriateness & satisfaction | Process | 100% |
| | 114. | Compliance with written informed consent | Satisfaction | Process | 100% |
| | 115. | Limiting life support | Appropriateness & satisfaction | Process | 100% |
| | 116. | Use of restraints | Safety & appropriateness | Process | 100% It is recommended that |
| | 114. | Compliance with written informed consent | Satisfaction | Process | 100% |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| PLANNING, OR GANIZATION, & MANAGEMENT | 117. | Daily rounds for multidisciplinary teams | Safety | Process | 80% |
| | 118. | Patient handoffs | Safety | Process | 90% |
| | 119. | Suspension of scheduled surgery | Safety & efficiency | Outcome | < 3% |
| | 120. | Premature or unplanned ICU discharge | Safety & appropriateness | Process | < 5% |
| | 121. | Delayed discharge from the ICU | Efficiency, accessibility, & appropriateness | Outcome | < 5% |
| | 122. | Delayed admission to the ICU | Accessibility, efficiency, & safety | Outcome | 5% |
| | 123. | Unscheduled readmission to the ICU | Safety & efficiency | Outcome | 4% |
| | 124. | Survey about perceived quality on discharge from the ICU | Satisfaction | Process | > 75% |
| | 125. | Database for minimum ICU dataset | Effectiveness | Process | 100% |
| | 126. | Compliance with ICU nursing registries | Continuity of care | Process | 100% |
| | 127. | Nursing report at discharge | Safety & continuity of care | Process | 100% |
| | 128. | Standardized mortality rate | Safety, effectiveness, & efficiency | Outcome | 1 (±0.10) |
| | 129. | Autopsy rate | Effectiveness & safety | Process | 10% |
| | 130. | ICU staff orientation plan | Appropriateness, safety, & satisfaction | Process | 100% |
| | 131. | Presence of an intensivist in the ICU 24/7 | Appropriateness, safety, & efficiency | Structure | 100% |
| | 132. | System for notification of adverse events | Safety | Structure | 100% |
| | 133. | Flexible visiting hours | Satisfaction | Structure | 100% |
| | 134. | Burnout syndrome | Satisfaction & safety | Outcome | Complete 1 survey every 2 years |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| CONTINUING MEDICAL EDUCATION, TEACHING, & RESEARCH | 135. | Clinical information system | Safety, effectiveness, & efficiency | Structure | 100% (yes) |
| | 136. | Availability of multifunction ultrasonography | Effectiveness, efficiency, Safety, & accessibility | Structure | 100% (yes) |

| | Number | Indicator | Dimension | Type | Standard |
|---|---|---|---|---|---|
| TECHNOLOGY ASSESSMENT AND RESEARCH METHODS | 137. | Existence of basic protocols | Appropriateness | Structure | Yes or 100% |
| | 138. | Research activity | Appropriateness | Outcome | 1 research project every 3 years |
| | 139. | Scientific publications | Appropriateness | Outcome | 1 publication or 4 communications / 3 years for level I or II (or non- teaching) hospitals<br><br>3 publications or 12 communications/ 3 years for level III (or teaching) hospitals |
| | 140. | Continuing medical education | Appropriateness & satisfaction | Outcome | 75% |

# ANNEXES

**ANNEX I**

## 1. PREFACE TO THE 2005 QUALITY INDICATORS

The strategic plan of the Spanish Society of Intensive and Critical Care and Coronary Units (SEMICYUC) provides for the development of instruments to aid in the continual improvement of the quality of care.

The Board of Directors designated the elaboration of the Quality Indicators for the Treatment of Critically Ill Patients to the Society's Work Group for Planning, Organization, and Management and to the Avedis Donabedian Foundation (ADF). I am pleased to present the result of two year's labor in this endeavor.

It should come as no surprise that these quality indicators are for the treatment of the critical patient, as the logo of our Society indicates we are after all "the Professionals for the Critical Patient". For this reason, we consider it our duty to provide physicians specializing in critical care medicine and nursing staff with the means to measure the quality of care in their daily practice, not only in hospital intensive care units, but wherever critical care patients are found. Our mission to ensure optimal care for these patients is intrinsic to our training as specialists, and society at large holds us accountable for this task.

These indicators are not intended to be tools to control our daily practice, rather they provide a system of self-assessment that will enable us to quantify and analyze what we do and how we do it in order to help us determine those aspects that can be improved. Obviously, this first version is not definitive; like protocols, quality indicators need to be revised and updated periodically in function of new developments in healthcare and the growing body of scientific evidence.

A large number of intensivists that belong to the SEMICYUC and nurses belonging to the Spanish Society for Intensive Care and Coronary Unit Nursing (SEEIUC) have participated in this project, perhaps a greater number than in any other of the Society's undertakings, and I believe that this attests to the cohesion and good health of our professional societies.

I would like to thank the ADF and especially Dr. Rosa Maria Saura for instructing us in the methodology used for the elaboration of the indicators and for their patience in responding to our doubts and questions. Without their help and dedication, this project could never have been realized with the rigor that characterizes each and every one of the indicators.
I would also like to express my gratitude to the Society's Work Group for Planning, Organization, and Management, who undertook this project with great enthusiasm from the time it was first suggested by the Board of Directors. Dr. Mari Cruz Martín, the scientific director throughout the project, is undoubtedly the person who has done the most work and who has done the most to make the rest of us work, too. For this reason, I would like to take this opportunity to recognize Dr. Martín as the true architect of these Quality Indicators for the Treatment of Critically Ill Patients.

In recent years, the SEMICYUC's work groups have acquired an essential role not only in the Society's annual congress but also in many other affairs. The participation of all of the work groups, each and every one of which has developed the specific indicators for their area (corrected and adapted methodologically by the directors and authors of the indicators), has been extremely helpful. I would like to acknowledge the efforts and of these work groups, with a special mention for all of those designated by their groups to be in charge of the project, and thank them for a job well done.

I would also like to thank the individual members of the SEMICYUC and of the SEEIUC for their contributions and willingness to help the scientific direction and authors of the project in the elaboration of the indicators.

Various members of the SEMICYUC took part in the final correction of the indicators and I would also like to thank them for their efforts and collaboration.

Last but not least, on behalf of the SEMICYUC, I would like to thank Boehringer Laboratories for their financial support, which has made this project possible.

Dr. Lluís Cabré
President of the SEMICYUC

**ANNEX II**

COLLABORATORS IN THE 2005 QUALITY INDICATORS

## STEERING COMMITTEE

- Lluís Cabré Pericas
- Juan Roca Guiseris
- Pedro Galdos Anuncibany
- José Luís Escalante Cobo
- Lluís Blanch Torra
- Jose María Domínguez Roldán
- Juan B. López Messa
- Gumersindo González Díaz
- Pedro Castillo Suero
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**ANNEX III**

## COLLABORATORS IN THE 2011 QUALITY INDICATORS

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- Cristóbal León Gil
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