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The Auditing Process in Intensive Care Unit: A Systematic Review

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Authors' contributions

This work was carried out in collaboration between all authors. Authors LPB, GPB and HMTB designed the study. Authors GPB and LPB managed the literature searches. Authors RFA, WRP and LPB searched literature and reviewed the paper. All authors read and approved the final version of the manuscript.

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ABSTRACT

Introduction: The audit process consists of analyzing and verifying errors in a systematic way so that they can be prevented in the future.
Objectives: The objective of the present study was to perform a systematic review of articles that involve the audit process in an intensive care unit.
Methods: A systematic review of the literature in the PubMed database in search of articles published from January 1, 2002, to August 31, 2016. The research was carried out with the descriptors "medical audit" and "intensive care unit".
Results: The audit showed that it is possible to compare the rates of different units, even if they often present large variations in the data.
Conclusion: The study showed evidence of the need to perform audits in an intensive care unit, thus optimizing the results and improvements for the patients and the work team.

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1. INTRODUCTION

Auditing emerged as an accounting activity between the fifteenth and sixteenth centuries in Italy and consists of a process in which errors are systematically identified and verified, so that proper control measures can be put in place to prevent deficiencies in the future [1-3]. This tool acts on the assumption that failures are moments for learning and should be used for this purpose [4].

Concerning the form of intervention, audit can be classified as internal or external. Internal audit entails a more detailed evaluation because the process is carried out by someone employed by the institution who is familiar with the administrative structure, the organizational culture, the technologies, and the goals of the evaluated service. External audit is performed by people from outside of the institution, those who have no administrative link or intrinsic relationship with the individuals of the institution. The latter may be more effective because it allows for more critical and detailed final recommendations about the results observed [5,6].

Medical auditing emerged very incipiently in Brazil in the 1970s, since then, the practice of health auditing has been expanded [7].

Regarding the types of audit in the field of medicine or health, it may be retrospective or operational. The retrospective audit is performed through a systematic review and includes the evaluation of data coming from the patient, after being discharged from the unit. The operational audit is done through direct observation, interviews, and document analysis [8].

In the field of intensive therapy, where small mistakes can have serious consequences for the patients and the staff, adopting the practice of auditing is of great importance because it can prevent or quickly correct the failures present in a given health service. Such preventive measures and controls tend to improve the quality of care received by the patient in an intensive care unit [9].

Therefore, this study sought to analyze, through a systematic review, the audits carried out in the Intensive Therapies Unit (ICU) from 2002 to 2016.

2. MATERIALS AND METHODS

A systematic qualitative review was carried out on the articles on the audit process in Intensive Care Units (ICU), published in a previously selected electronic database.

A literature search was conducted through the online databases of the PUBMED portal in August 2016. The limits consisted of the articles published between January 1, 2002, and August 31, 2016. The reason for limiting the search from 2002 was that new laws were created from this period to establish legitimacy and reliability of the auditing system, both nationally and internationally.

Initially, the following descriptors were used in English for searching in the PUBMED:

1. "Medical audit" (Medical Subject Headings [MeSH]);
2. "Intensive care unit" (MeSH term).

The analysis of the articles followed the predetermined eligibility criteria. The research was performed in one phase: 1 "AND" 2. A search for this combination was performed using the "MeSH terms" filter.

The following inclusion criteria were used: (1) publications written in English, Spanish, or Portuguese; (2) studies correlating the themes of audit and intensive care units; (3) original articles with full text and are freely accessible; (4) prospective or retrospective observational studies (descriptive or analytical, excluding case studies), experimental or almost experimental studies, and (5) studies published from 2002 to the current year.

The exclusion criteria were as follows: (1) other study designs, e.g. case reports, case series, and literature reviews and comments; (2) non-original studies, including editorials, reviews, prefaces, brief communications, and letters to the editor, and (3) articles that did not discuss some of the inclusion criteria.

Each article was read in its entirety and the information was logged onto a spreadsheet that included authors, year of publication, and key data.

The data were compiled in the Microsoft Office Excel computer program, along with the information analyzed that correlated the parameters of interest in the area of ICU audit. The data synthesis process was performed through a descriptive analysis of the selected studies, and the final product of the analysis being presented in a narrative form.

Some studies found, although addressing the theme, were excluded. These involved more than one hospital unit, in addition to the ICU, extending the work theme to other issues that are not the focus of this study, such as the correlation between the ICU audit process and other hospital sectors like the emergency and the surgical centers. Other studies have also reported on external audit procedures, involving the audit theme in internal or external transfers.

3. RESULTS AND DISCUSSION

Initially, the above-mentioned search strategies resulted in 98 references. After going through the titles and summary of citations retrieved based on the study inclusion criteria, 79 articles were excluded, and 19 articles were retrieved and included in the final sample (Fig. 1).

The 19 studies were previously distributed in ten categories as follows: Audits and Neonatal ICU (five studies: Aluvaala et al., 2015, Bergon-Sendin et al., 2015, Ursprung et al., 2005; Cust et al., 2003, and Wilkinson et al., 2006); Audit in ICU and the Implications of the Airways (five studies: Elliott et al., 2015; Astin et al., 2012; Hughes et al., 2003; Surridge, Segedin E Grant, 2007; Rao, Mansor E Inbasegaran, 2003); Audit in ICU and Insulin Therapy (two studies: Bone, Young and Chantler, 2006 and Laver et al., 2004); Audit in ICU and the use of technologies (a study: Armellino et al., 2012); Audit and Dermatological Conditions in ICUs (one study:. George et al, 2005); Audit and Recyclable Waste in ICU (one study: Mcgain, Story And Hendel, 2009); Audit in ICU and the Use of Evidence-based Protocols (one study: PLOST and NELSON, 2007); Audit and Echocardiography in ICU (one study: Orme, Oram and Mckinstry, 2009); Audit and Costs of Medications in ICUs (one study: Al-Haddad, Hayward and Walsh, 2004); and Audit and Patient Safety in ICU (one study: Thomas and Taylor, 2012).

The categorization of the studies aims at a systematic review of better organizational quality, and it is not mandatory that each article should be referenced only in its respective category. Table 1 provides an overview of all the studies included in the final sample and of all data elements used during the data analysis process.

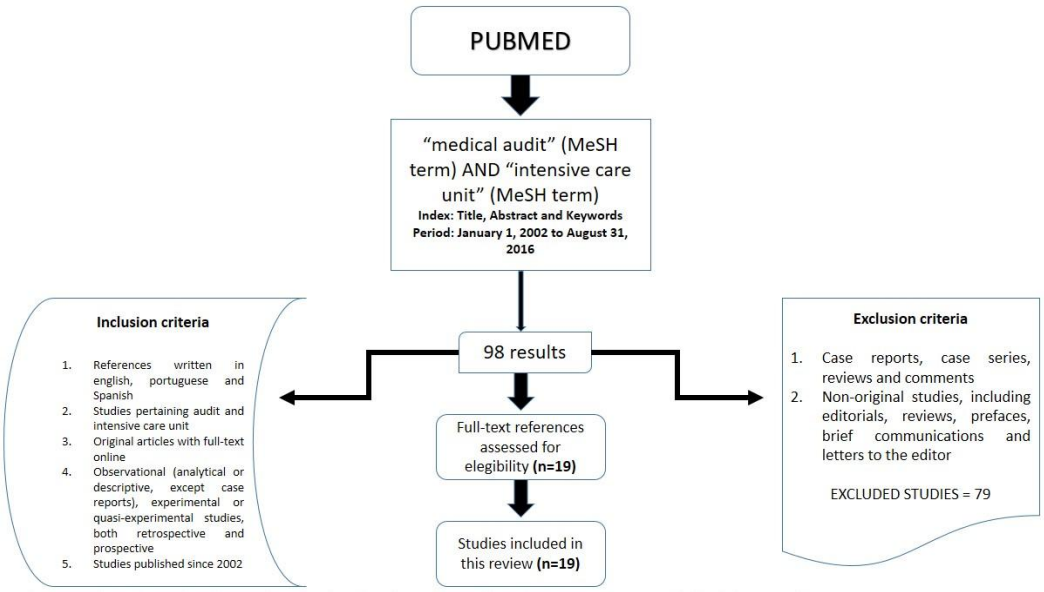

Fig. 1. Flow showing study selection for the review
Abbreviations: MeSH, Medical Subject Headings

Table 1. Audit in intensive care unit, studies and main conclusions

Authors and Year	Title	Main findings
Bergon-Sendin E, Perez-Grande C, Lora-Pablos D, Moral-Pumarega MT, Melgar-Bonis A, Peña-Peloche C, Diezma-Rodino M, García-San Jose L, Cabañes-Alonso E, Pallas-Alonso CR. Bergon-Sendin E, Perez-Grande C, Lora-Pablos D, Moral-Pumarega MT, Melgar-Bonis A, Peña-Peloche C, Diezma-Rodino M, García-San Jose L, Cabañes-Alonso E, Pallas-Alonso CR. (2015).	Smart pumps and random safety audits in a Neonatal Intensive Care Unit: a new challenge for patient safety.	Random Safety Audits were a very useful tool for detecting inappropriate use of pumps in the NICU.
Elliott D, Elliott R, Burrell A, Harrigan P, Murgo M, Rolls K, Sibbritt D. (2015).	Incidence of ventilator-associated pneumonia in Australasian intensive care units: use of a consensus-developed clinical surveillance checklist in a multisite prospective audit	The checklist used helps to identify patients at risk of developing ventilator-associated pneumonia (VAP).
Aluvaala J, Nyamai R, Were F, Wasunna A, Kosgei R, Karumbi J, Gathara D, English M; SIRCLE/Ministry of Health Hospital Survey Group. (2015).	Assessment of neonatal care in clinical training facilities in Kenya	Poor documentation limits the use of routine data for quality improvement.
Astin J, King EC, Bradley T, Bellchambers E, Cook TM. (2012).	Survey of airway management strategies and experience of non-consultant doctors in intensive care units in the UK.	There remains room for improvement in airway management strategies and resources in ICUs.
Thomas AN, Taylor RJ. (2012).	Review of patient safety incidents reported from critical care units in North-West England in 2009 and 2010	The wide range of reported pressure sore rates suggests that their incidence could be reduced.
Armellino D, Hussain E, Schilling ME, Senicola W, Eichorn A, Dlugacz Y, Farber BF. (2012).	Using high-technology to enforce low-technology safety measures: the use of third-party remote video auditing and real-time feedback in healthcare	The data suggest that remote video auditing combined with feedback produced a significant and sustained improvement in hand hygiene.
McGain F, Story D, Hendel S. (2009)[50].	An audit of intensive care unit recyclable waste.	An adequate logistical and financial environment, repeated education sessions and an enthusiastic waste contractor and ICU team are factors which may improve ICU recycling rates.
Orme RM, Oram MP, McKinstry CE. (2009).	Impact of echocardiography on patient management in the intensive care unit: an audit of district general hospital practice	It is recommended that adequate training in echocardiography be incorporated into the intensive care curriculum.
George SM, Harrison DA, Welch CA, Nolan KM, Friedmann PS. (2008).	Dermatological conditions in intensive care: a secondary analysis of the Intensive Care	Failure of the skin is a distinct entity comparable to other failures in the organ system due to its

Authors and Year	Title	Main findings
	National Audit & Research Centre (ICNARC) Case Mix Programme Database	high ICU mortality.
Surridge J, Segedin ER, Grant CC. (2007).	Pertussis requiring intensive care.	Early discharge from the pediatric intensive care unit (PICU) of children with pertussis is associated with an increased risk of readmission and poor outcomes.
Plost G, Nelson DP. (2007).	Empowering critical care nurses to improve compliance with protocols in the intensive care unit.	Extrinsic rewards improved compliance with protocols and resulted in a change in the culture in the intensive care unit that had a cumulative outcome.
Bone EG, Young D, Chantler J. (2006).	Target ranges and the apparent compliance with tight glycaemic control.	The audit showed a sustained reduction in the median blood glucose.
Wilkinson DJ, Fitzsimons JJ, Dargaville PA, Campbell NT, Loughnan PM, McDougall PN, Mills JF. (2006).	Death in the neonatal intensive care unit: changing patterns of end of life care over two decades.	There have been substantial changes in the diseases that led to death in the neonatal intensive care unit due to prenatal diagnosis and changes in the community and medical attitudes.
Ursprung R, Gray JE, Edwards WH, Horbar JD, Nickerson J, Plsek P, Shiono PH, Suresh GK, Goldmann DA. (2005).	Real-time patient safety audits: improving safety every day.	Real-time security audits performed during routine work can detect a wide range of errors.
Al-Haddad M, Hayward I, Walsh TS. (2004).	A prospective audit of the cost of sedation, analgesia and neuromuscular blockade in a large British ICU.	The bottom-up cost of sedation in a large ICU in the UK represented 81% of top-down cost obtained from the pharmacy.
Laver S, Preston S, Turner D, McKinstry C, Padkin A. (2004).	Implementing intensive insulin therapy: development and audit of the Bath insulin protocol.	This study provides initial effectiveness and safety data for the Bath Insulin Protocol.
Rao AS, Mansor L, Inbasegaran K. (2003).	Audit on tracheostomies performed at the General Intensive Care Unit, Kuala Lumpur Hospital.	The overall complication rate of performing a percutaneous tracheostomy is comparable with that of an open tracheostomy.
Hughes, M., MacKirdy, F.N., Ross, J., Norrie J, Grant IS; Scottish Intensive Care Society. (2003).	Acute respiratory distress syndrome: an audit of incidence and outcome in Scottish intensive care units.	The incidence of Acute respiratory distress syndrome (ARDS) in the Scottish population is higher than in most other studied populations.
Cust, A.E., Darlow, BA, Donoghue DA; Australian and New Zealand Neonatal Network (ANZNN). (2003).	Outcomes for high-risk New Zealand newborn infants in 1998-1999: a population-based, national study.	These unique population-based national data provide contemporary information on the care and early morbidity and mortality outcomes for all high-risk infants.

Audits and Neonatal UTI

Some studies have addressed the auditing processes in neonatal intensive care units.

An audit was conducted in 22 neonatal intensive care units of public hospitals in Kenya, where they sought data on neonatal care, mainly regarding the availability of basic resources such as medications and equipment, and the quality of clinical and patient records [10].

In neonatal ICUs, primary care such as using hand rubbing with alcohol and the kangaroo method were not being performed in some units; in more than half of the cases, phototherapy was not performed and the routine for HIV was performed in only 54% of the cases, with no prescription of antiretroviral drugs [10].

It was evidenced that the highest number of neonatal ICU deaths occurred in newborns of normal birth weight, which reinforces the importance of the continuous education for the multi-professional team and the availability of financial resources to minimize health risks and increase the survival of this population [10].

Another study audited the infusion pump systems through Random Safety Audits (RSA) in neonatal ICUs [11].

The RSA is an audit tool which is not yet widespread in the hospital environment; it allows the identification of adverse reactions and errors at an early stage, thus allowing preventive actions [11].

In neonatal ICUs, the infusion pump system was being used inadequately and after some interventions by the auditors, only 73.13% of the pumps were properly used. Errors were also reported in relation to the infusion pressure limit and overdose errors of medications such as fentanyl and midazolam [11].

Overdose in neonatal intensive care units has also been documented, even allowing a 20% error rate, along with the use of antimicrobials such as penicillin and gentamicin, despite its nephrotoxic and ototoxic effects [10,12].

The use of RSA has been shown to be effective in minimizing the incidence of medication errors in children, which usually happens three times more to them than adults, since it analyzes the professionals' practice in real time, besides enabling the team to perform self-analysis [13-15].

The RSA system provides positive results, requiring simple training and low implementation cost, improving the work process of all health staff [11,16].

Another study aimed to determine the applicability of real-time audit in neonatal ICUs, with instant detection of errors and feedback for the team, aiming to improve health care [15].

The audit was carried out in thirteen days, addressing items such as delayed service, equipment failure, and diagnostic studies; thus, detecting 338 errors on all of the auditing days, among which are the ventilator alarms not set in the adequate safety levels, placement of transthoracic echocardiography without confirmation by radiography, and cardiovascular alarms with no definition of adequate safety levels. These corroborate with the fact that medical errors are a significant problem in health care, especially when it comes to neonatal intensive care [13,15,17].

The random audit process, through the checklist, seeks a better statistical control, lean production, analysis of root cause of the problems, and choosing the subsets of points prone to random errors. Such benefits demonstrate the great potential of the random audit to detect errors in the patient care system during the work shift, which are often detected and reversed quickly by the team itself [15,18].

Another audit determined morbidity and mortality in neonatal ICUs in New Zealand by studying "high-risk" children; those born at less than 32 weeks gestation (37%), the ones with birth weight of less than 1500 g (32%), those who received assisted ventilation for four hours or more (94%), or underwent major surgery (7%) [19].

The rate of intubation in resuscitation was 25% and 3% had an Apgar score of lower than 4 in five minutes. These proportions were higher for extreme preterm infants, reaching 74% and 6%, respectively, with the knowledge that preterm birth, premature rupture of the membranes (14%), and prepartum hemorrhage (11%) were the main causes that led to premature birth, and in 45% of the births no complications were detected during the prenatal period [19].

Audit in the neonatal ICU reinforced the importance of using surfactant for preterm infants with hyaline membrane disease and the use of corticosteroids in pregnancies of less than 34 weeks to reduce mortality and the incidence of respiratory distress syndrome and intraventricular hemorrhage. Studies based on gestational age are more useful than basing on birth weight [19-21] for clinical decision making.

The causes of deaths, their respective prognoses, and any decisions to withdraw or limit medical treatment in a neonatal ICU in two distinct periods were also audited. In the first period there was a mortality rate of 9.7%, while in the second period this rate was 6.2%, and three-quarters of the children died after some decision to withdraw from clinical treatment [22].

Significant changes have been documented in the diseases that lead to death in the neonatal ICU. The decrease in deaths due to chromosomal abnormalities and changes in the prognoses of children from whom treatment has been withdrawn can be explained in part by the better pre-natal follow-up and clinical changes in attitudes [22].

A growing reality in neonatal ICUs is the withdrawal of treatment support when the child no longer has a realistic survival rate; this decision being one agreed upon by the health team and the family. This is an issue that still constitutes an impasse in the context of neonatal intensive care, in view of its practical and ethical conditions [22,23].

It can be seen from the audits carried out in the neonatal ICU that, in recent years, there has been a great advance in neonatal care due to the great technological advances such as the improvement in ventilatory support and the appearance of new treatments as evidenced mainly by the mortality drop of this population [24].

ICU Audit and Airway Implications

Airway problems are recurrent in critically ill patients admitted in ICUs. This risk increases due to the greater probability of using mechanical ventilation, so the number of complications and deaths due to respiratory complications in ICUs occur in the ratio of 1:5 and 1:2, respectively [25-27].

An audit of ten ICUs in Australia and New Zealand for 30 days sought to formulate a clinical check form for ventilator-associated pneumonia (VAP) and to associate its sensitivity to measure the incidence of VAP in this population [27].

It was demonstrated by the audit that the numbers of patients diagnosed by both the medical record and the routine medical practice were similar, 29 and 30 patients, respectively. Of these people, only 17% were diagnosed by the two methods, mainly patients with more exuberant clinics [27].

Only seven ICUs practiced methods of prevention of VAP, knowing that once they were diagnosed with VAP they needed a longer period of hospitalization, around 1,357 days, and a higher mortality rate as evidenced by APACHE II with 12 to 23 points [27,28].

It is necessary to have a greater diagnostic standardization for VAP, and that the developed check form, with 4 main points (ratio PaO22 and FiO2, RX image, sputum change and inflammatory response), is a valid instrument for the improvement of the ICU working process in the diagnosis of VAP [27].

Through a national audit conducted in the United Kingdom, Astin et al. [26] sought to know if the ICUs used strategies for airways management as a clinical practice, to prove if they have adequate capabilities to intervene with and to manage complications referring to the airway.

Amongst some complications, such as tracheostomy displacement and unforeseen events with the endotracheal tube, only 10% and 7% of the ICUs, respectively, have been shown to have a management plan even though these two events are the main problems encountered in the context of airway complications [29].

It was demonstrated that only 38% of the sample used a plan of care and control of the airways for more severe patients, and only 19% of the patients were identified as being at greater risk and with the plan put into practice—signifying a lack of care, with improvement possibilities in both strategic management and professional training, as well as in the availability of equipment [26].

An audit of 23 ICUs in Scotland diagnosed 367 patients with acute respiratory distress syndrome according to criteria defined by the American-European Consensus Conference over a period of eight months, with a frequency of 8.1% and

Incidence of 16 cases per 100,000 inhabitants, with an ICU mortality rate of 53.1%, hospital mortality rate of 60.9% and main comorbidity associated, sepsis [30].

41% of the individuals had a diagnosis of ARDS on admission, 20% were diagnosed within the first 24 hours and 16% were diagnosed on the second day. The audit revealed that ventilatory parameters on the first day of admission did not conform to the strict criteria accepted as the gold standard for ARDS management and that those with ARDS on admission or those who were transferred late to the ICU had a higher mortality rate, supporting the early referral of critically ill patients to ICUs, [31].

Another audit aimed at the incidence of children infected with pertussis, admitted to pediatric intensive care units from 1991 to 2003, resulting in a total of 72 children, 97% of whom were 12 months of age, which shows an increase in cases per year, quarantine patients (56%) had cough for less than 8 days before admission, apnea or paroxysmal cough was present in 33 (83%) of these children, 35 (49%) received mechanical ventilation, and 4 died [32].

The audit found that 28 children (39%) were affected within less than six weeks of age, of the remaining 44, only 13 (30%) were fully immunized according to their age and 23 (52%) of these 44 had not received any immunization, corroborating with the low vaccine coverage, the increase in cases can also be explained by the endemic nature of pertussis in adults, adolescents, and school children [32-34].

The tracheostomies in an ICU were also audited throughout a period of six months in order to evaluate the safety profile and complications between the surgical tracheostomy and the percutaneous tracheostomy by dilatation (PTD), the latter being the first choice procedure when tracheostomy was indicated [35].

During the audit period, 49 tracheostomies were performed, of which 30 (61% of cases) were PTD performed by experienced anesthesiologists using the Portex® kit, while 19 (39% of cases) were performed in the surgery room by surgeons [35].

The audit found that the complication rates between the two methods were comparable, and the main complication was hemorrhage which is easily reversed by compressive methods. In the long term, the main complications described were voice changes, with an incidence of 36-48% in 6 months post-tracheostomy [35-38].

It was concluded that with the choice of PDC there was a significant reduction in waiting time, in addition to cost reduction, since logistics for the surgical center is not necessary [35].

Audit in ICU and Insulin Therapy

Intensive insulin therapy to control glycemic rates reduces mortality among critically ill patients in an intensive care unit [39].

The implementation of a new insulin therapy protocol in an ICU in England was audited. Between 2001 and 2002, this protocol resulted in a modest reduction of blood glucose from 7.0 to 6.8 mmol / l, which was maintained in subsequent years, improving the clinical setting without increasing the incidence of hypoglycemia, a major concern in the control of blood glucose [40,41].

In the United Kingdom they also audited the development and implementation of the Bath protocol for insulin therapy in an ICU which achieved a blood glucose value around 6.2 mmol / l compared to 9.2 mmol / l prior to protocol implantation, facing the values that were specified before, of 4.4 to 6.1 mmol / l, capable of reducing mortality for the surgical intensive care unit, and that should be started if blood glucose reaches values above 7 mmol / l and being contraindicated for children, patients under oral diet and patients with diabetic ketoacidosis [39,42].

In general, the audited insulin protocols have resulted in good glucose control within the intensive therapy units, providing flexible guidelines over rigid rules for best clinical practice in these units [39,40,42].

Audit in ICU and the use of technologies

An audit on the hand washing habits of ICU professionals was performed through cameras installed in the unit for a 16-week period without feedback. A hand washing rate of less than 10% was obtained, and for 91 weeks with feedback through electronic plates and report delivery had a hand hygiene rate of 81.6%, which was maintained for 75 weeks [43].

The data suggest that the combined audit of video and feedback has produced a significant

improvement in the hand hygiene of ICU professionals, which is one of the units within the hospital where the hand washing rate is lower, even though it is a universally accepted practice for decreased infection control in the hospital [43,44].

Classically, the handwashing audit was done through direct observation by the auditor, or through reports, or by measurement of the products used in the procedure, however, this new concept of auditing involving videos and feedback presents itself to be consistent, proving that the use of technologies may assist the auditor in doing his work [43,45,46].

Audit and dermatological conditions in ICU

An audit was conducted in 178 intensive care units, focusing on dermatological pathologies that required intensive care, although dermatology is a specialty of low mortality and historically managed in outpatient clinics [47].

The main dermatological conditions were infectious diseases such as cutaneous cellulitis and necrotizing fasciitis, malignant diseases of the skin, bullous diseases, Stevens-Johnson Syndrome, and toxic epidermal necrolysis, making up 0.47% of all units' admissions, with a mortality rate of 28.1% which is comparable to pathologies such as pancreatitis and pneumonia, highlighting the importance of intensive therapeutic follow-up for certain skin morbidities [47-49].

The audit revealed that dermatological conditions sometimes require intensive treatment and reinforces the importance of a multidisciplinary approach, emphasizing the involvement of the dermatologist, together with the intensivist and the nursing team in the management of these pathologies [47].

Audit and Recyclable Waste in ICU

One study audited the residues of an intensive care unit in Australia for 7 days, where they collected a total of 540 kg, representing 5% of hospital waste, which 401 kg were uncontaminated general waste and 230 kg recyclable garbage, mainly containing plastics, paperboard and paper, with a total of 0.4 kg that were cross-contaminated [50].

It should be emphasized that the infectious waste flux is not suitable for recycling because of safety concerns, but the audit found that infectious risk, lack of data, financial concerns, resistance to change, apathy, and a difficulty in separating different types of plastic constitute barriers for the recycling of waste to the ICU [50-52].

Factors such as a suitable logistic and financial environment and continuing education sessions for the health team can reduce the incidence of infectious cross-contamination in ICU waste and make it an ideal site for hospital recycling [50].

Audit in ICU and the use of evidence-based protocols

Two authors audited the use of evidence-based protocols in the ICU during a trial period and a follow-up period of 3 years after the implantation period [53].

A major impasse for the use of protocols is the lack of compliance on the part of the medical professionals. Often times, there needs to be strategies to change the behavior of professionals—a management team that encourages compliance and rewards, achieving through the audit, an average compliance increase of 62% to 77% to 90% initially, and more than 90% at the end of 3 years. This confirms that the use of protocols simplifies and standardizes service, facilitates patients' safety, reduces costs, increases survival, and increases the number of patients treated in the ICU by 50%, even without increasing the number of beds or professionals [53].

Audit and echocardiography in ICU

The impact of transthoracic (TTE) and transesophageal echocardiography (TOE) on the management of critically ill patients in an ICU was also audited, using a total of 258 echocardiographies in 217 patients [54].

Both transthoracic and transesophageal echocardiography can identify the causes and guide therapy, predicting clinical response, and may significantly alter the management of critically ill patients by up to 46% [55-57].

The audit showed that transesophageal echocardiography was superior to transthoracic for critical patients due to the challenge of obtaining images. However, the two presented a high therapeutic impact, with the training of qualified professionals to perform them and their access in all ICUs being essential [54].

Audit and costs of medications in ICUs

One study audited the use of sedative, analgesic, and neuromuscular drugs and their respective costs in the budget of an intensive care unit with an average of 700 admissions per year [58].

Propofol and alfentanil were the most commonly used drugs, being given to 136 (88%) and 106 (68%) patients, respectively. The total cost was £ 14,070, representing 16% of pharmacy costs in the audit period and about 1% of total costs, however, the patients who stayed in the ICU for more than 2 days (representing 50% of the population studied) consumed 93.7% of the expenses of these drugs [58].

It is emphasized that patients with a prolonged stay in the ICU present higher expenses, but this value can be reduced through the introduction of protocols and changes in clinical practice [59-60].

Audit and patient safety in ICU

An audit that targeted patient safety incidents in intensive care units according to the criteria of the National Patient Safety Agency of the United Kingdom (NPSA) was also conducted, and the obtained data were from reports that detected a total of 4219 incidents [61].

The audit showed that it is possible to compare the rates of different units, even if they often present large variations in the data, verifying if these variations represent different clinical practices, with particular emphasis on pressure ulcers, which represented the highest percentage of incident numbers and mainly because it is an avoidable damage, thus reducing costs and suffering for the patient [61-63].

4. CONCLUSION

The study concluded that the main subjects that underwent audit procedures in intensive care units were: neonatal ICUs, respiratory airway implications, insulin use, use of technologies, dermatological conditions, recyclable waste, use of clinical protocols, the impact of echocardiography, drug costs, and patient safety. The importance of having audits in the work process of an ICU was evident, as doing so optimizes its results and benefits patients with better and more significant clinical practices and health care.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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