ORIGINAL

Analysis of quality indicators in an adult Intensive Care Unit: a descriptive study

Análise dos indicadores de qualidade em uma Unidade de Terapia Intensiva adulto: um estudo descritivo

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ABSTRACT

Objective: To analyze the results of quality indicators in healthcare assistance monitored in an adult intensive care unit. **Method:** A descriptive study with a retrospective analysis of the indicator reports from an adult intensive care unit. **Results:** Of the 33 indicators, nine are related to the overall functioning of the unit, with a low readmission rate within 24 hours (0.8%). Fourteen indicators are related to invasive devices, with a predominance of use for indwelling urinary catheters (63.2%), peripheral venous catheters (59.8%), and nasogastric/nasoenteric tubes (50.0%). Six indicators pertain to non-infectious incidents, highlighting pressure ulcer incidence (5.2%), obstruction (2.7%), and removal of nasogastric/nasoenteric tubes (2.3%). Additionally, four indicators address infectious incidents, with a significant incidence density of ventilator-associated pneumonia (37.8 per 1000 patient days). **Conclusion:** Positive aspects were observed, such as a predominance of hospital discharges and low readmission rates, while negative aspects included incidents. **Descriptors:** Nursing; Healthcare Quality Indicators; Intensive Care Units.

RESUMO

Objetivo: Analisar os resultados obtidos pelos indicadores de qualidade em assistência à saúde monitorados em uma unidade de terapia intensiva adulto. **Método:** Estudo descritivo com análise retrospectiva dos relatórios de indicadores de uma unidade de terapia intensiva adulto. **Resultados:** Dos 33 indicadores, nove referem-se ao funcionamento global do setor, destacando-se a baixa taxa de reinternação em 24 horas (0,8%); 14 referem-se aos dispositivos invasivos, com predomínio da utilização de cateteres vesicais de demora (63,2%), venosos periféricos (59,8%) e nasogástricos/nasoentéricos (50,0%); seis referem-se a incidentes não infecciosos, destacando-se a incidência de lesão por pressão (5,2%), obstrução (2,7%) e remoção de cateter nasogástrico/nasoentérico (2,3%); e quatro abordam os incidentes infecciosos, com destaque para a densidade de incidência de pneumonia associada à ventilação mecânica (37,8 por 1000 pacientes-dia). **Conclusão**: Foram observados aspectos positivos, como o predomínio de altas hospitalares e baixa taxa de reinternação, e aspectos negativos, como a ocorrência de incidentes. **Descritores:** Enfermagem; Indicadores de Qualidade em Assistência à Saúde; Unidades de Terapia Intensiva.

INTRODUCTION

The Intensive Care Unit (ICU) is considered a department where patients present higher severity, leading to a high number of invasive and complex procedures carried out by qualified professionals using advanced techno-logy[1]. To provide specialized, quality care, professionals need to possess theoretical and practical knowledge and be engaged in continuous education activities[1-2]. However, assessing the quality of care provided is a challenge, especially in ICUs, as the profile of critically ill patients is subject to conti-nuous hemodynamic variations that can contribute to an increased risk of immediate death, regardless of the care offered[3].

Assessment indicators of healthcare quality have been used in various heal-thcare services, especially in ICUs, to evaluate technical performance and

intervention methodology in the department[3]. Applying these indicators in practice requires great caution so they can be comprehensive, practical, concise, and valid. This allows for a more focused approach in areas that require further investigation[4].

By the Normative Instruction No. 4 developed by the Brazilian Health Regulatory Agency (*Agência Nacional de Vigilância Sanitária*, ANVISA), which addresses indicators for ICU evaluation, there is a requirement for monthly surveillance of certain indicators. Among the mandatory indicators are those that reflect avoidable adverse events, such as Incidence Density (ID) of Ventilator-Associated Pneumonia (VAP), ID of Central Venous Catheter (CVC)-related Primary Bloodstream Infections (BSI), and ID of Catheter-Associated Urinary Tract Infections (CAUTI). However, the legal obligation to obtain these indicators does not guarantee an analysis of the work process or proposals for improving the quality of care provided[5].

Nursing care can directly impact patients' clinical condition; hence, nurses need objective parameters to evaluate the quality of their work, such as the use of indicators. It is worth noting that a high number of indicators and the lack of standardization in their collection can lead to operational difficulties that compromise the final result. Furthermore, the absence of analysis and practical application of the results obtained turns the collection of indicators into a merely bureaucratic activity, deviating from its real purpose, which is to achieve effective changes in work processes.

In this context, conducting studies that aim to analyze healthcare quality indicators measured by the multidisciplinary team is justified, to support the planning and reorientation of the work process.

Thus, this study aimed to analyze the results obtained from quality indicators in healthcare assistance monitored in an Adult ICU.

METHOD

This is a descriptive study with a retrospective documentary analysis developed through the reading and analysis of secondary data from reports of care indicators in an Adult ICU.

The Adult Intensive Care Unit (ICU) in question is attached to a medium-sized hospital institution in the Zona da Mata region of Minas Gerais, Brazil. It has six beds and cares for critically ill patients who require continuous specialized professional attention, specific materials, and the necessary diagnostic, monitoring, and therapeutic technologies. The ICU team comprises nurses, physicians, nursing technicians, support staff, one nutritionist, and one physical therapist. The ICU has a coordinating nurse responsible for the monthly analysis of care indicators that help plan and evaluate the work process.

Data were collected between July and November 2021. The study included data available in electronic reports on nursing indicators for all patients admitted to the ICU between January and December 2020, a total of 444 admissions. ICU nurses collected daily information to calculate monthly indicators based on patient's clinical conditions, such as the presence of invasive devices and the occurrence of infectious or non-infectious events. At the end of each month, the data were consolidated by the coordinating nurse, discussed with the multidisciplinary team, and converted into electronic reports of the monthly indicators. It is important to note that although the data are from the COVID-19 pandemic, the ICU evaluated was not designated to treat SARS-CoV-2 infected patients. Therefore, its patient care dynamics remained unchanged and the indicators were not influenced by the pandemic.

In this study, the principal investigator also collected information on critical patient characteristics, such as age and reason for admission (clinical or surgical conditions). Concerning quality indicators, the data were grouped into four categories: global ICU functioning indicators, indicators related to the use of invasive devices, indicators related to the occurrence of non-infectious events, and indicators related to the occurrence of infectious events.

Global ICU functioning indicators include number of patient days per year and month; number of admissions through the *Sistema Único de Saúde* (SUS) and private insurance/private pay; bed occupancy rate per month; length of stay in the ICU in days; 24-hour readmission rate; absolute mortality rate; and estimated mortality rate using the Simplified Acute Physiology Score III (SAPS III).

The invasive device use indicators include annual data on patients in the following categories: Mechanical Ventilation (MV) Day; Central Venous Catheter (CVC) Day; Indwelling Urinary Catheter (IUC) Day; Peripheral Venous Catheter (PVC) Day; Orotracheal Tube (OTT) Day; Tracheostomy Tube (TTT) Day; Nasogastric Tube (NGT)/Nasoenteric Tube (NET) Day; and Utilization Rates

of these devices: MV, CVC, IUC, PVC, NGT/NET, OTT, and TTT.

Among the indicators related to the occurrence of non-infectious events, data were collected on the annual occurrence of pressure ulcers (PU), falls, medical device-related injuries, accidental extubations, accidental removals, and NGT/NET occlusions.

Finally, indicators related to the occurrence of infectious events included ventilator-associated pneumonia (VAP), catheter-associated urinary tract infections (CAUTI), central venous catheter-associated bloodstream infections (CRBSI), and peripheral vein catheter-associated phlebitis (PVC).

Data from the monthly health indicator reports were collected by the principal investigator and entered into a Microsoft Excel spreadsheet by two independent investigators.

SPSS version 23 software was used for data analysis. The Kolmogorov-Smirnov test was used to assess the normality of continuous variable distributions. Descriptive statistics were performed, presenting data in tables with relative and absolute frequencies, measures of central tendency (mean or median), and variability (standard deviation or interquartile range), depending on the data normality.

The research was conducted under the ethical aspects outlined in Resolution 466/2012 of the National Health Council (NHC). The project was approved by the Human Research Ethics Committee (REC) of the proposing institution, under protocol no. 4.214.221.

RESULTS

During the study period, 444 patients were admitted to the ICU with a mean age of 64.4 (±3.5) years. Among the reasons for admission, 315 (70.9%) were due to clinical conditions, and 129 (29.1%) were related to surgical conditions. Of the 33 indicators collected in the ICU, 9 (27.3%) are related to the overall functioning of the ICU. Notable findings include the predominance of admissions financed by the public health system (SUS) (77.0%), a low 24-hour readmission rate (0.8%), and a lower absolute mortality rate (25.4%) compared to expected mortality (26.5%) (Table 1).

Table 1 - Global indicators of ICU functioning, collected in 2020 (n=444). Viçosa, MG, Brazil, 2020

Overall indicators for the functioning of the ICU	Parameters (n=444)
Number of patient-days in the year n (%)	1.988 (100,0%)
Number of patient-days in month m (dp)	165,7 (±14,7)
Number of hospitalizations through the public health system (SUS) n (%)	342 (77,0%)
Number of hospitalizations through private health insurance/plans n (%)	102 (23,0%)
Occupancy rate of ICU beds in month m (dp)	90,5 (±3,0)
Length of stay in the ICU, in days* m (dp)	5,4 (±1,7)
Rate of readmission within 24h* %	0,8%
Absolute mortality rate* %	25,4%
Estimated mortality rate by SAPS III* %	26,5%

Source: Prepared by the authors, 2021.
Note: m - mean; SD - standard deviation; n - absolute frequency; % - relative frequency (percentage). *Indicators of mandatory monthly monitoring according to ANVISA/DC Normative Instruction No. 4, of February 24, 2010.

The indicators related to the use of invasive devices accounted for 42.4% (14 indicators) of the total analyzed. It was observed that IUC (indwelling urinary catheter) was used in 63.2% of cases, PVC (peripheral venous catheter) in 59.8% of cases, and NGT/NET (nasogastric tube/nasoenteric tube) in 50.0% of cases in adult ICU in the year 2020 (Table 2).

Table 2 - Indicators related to the use of invasive devices, collected in 2020 (n=444). Viçosa, MG, Brazil, 2020

Indicators related to the use of invasive devices	Parameters (n=444)
Patient on MV-day in the year n(%)	873 (43,9%)
Patient on CVC-day in the year n(%)	957 (48,1%)
Patient on IUC-day in the year n(%)	1.257 (63,2%)
Patient on PVC-day in the year n(%)	1.189 (59,8%)
Patient on OTT-day in the year n(%)	615 (30,9%)
Patient on TTT-day in the year n(%)	258 (13,0%)
Patient on NGT/NET-day in the year n(%)	994 (50,0%)
MV Utilization Rate (%)	43,9%
CVC Utilization Rate (%)	48,1%
IUC Utilization Rate (%)	63,2%
PVC Utilization Rate (%)	59,8%
NGT/NET Utilization Rate (%)	50,0%
OTT Utilization Rate (%)	30,9%
TTT Utilization Rate (%)	13,0%

Source: Prepared by the authors, 2021.
Note: n - absolute frequency; % - relative frequency (percentage).
*Indicators of mandatory monthly monitoring according to ANVISA/DC Normative Instruction No. 4, of February 24, 2010.

Of the six (18.2%) indicators related to the occurrence of non-infectious incidents, pressure injury (PI) was found to have the highest incidence (5.2%), followed by CNG/CNE obstruction and accidental removal (2.7% and 2.3%, respectively) (Table 3).

Tabela 3 – Indicators related to the occurrence of non-infectious events, collected in 2020 (n=444). Viçosa, MG, Brazil, 2020

Indicators related to the occurrence of noninfectious events	Parameters (n=444)
Incidence of pressure injury in the year %	5,2%
Incidence of falls in the year %	0,2%
Incidence of medical device injury %	-
Incidence of accidental extubation %	0,12%
Incidence of accidental removal of CNG/CNE %	2,3%
Incidence of CNG/CNE obstruction %	2,7%

Source: Prepared by the authors, 2021.
Note: % - relative frequency (percentage).

Among the four (9.5%) indicators related to the occurrence of infectious incidents, VAP was the infection with the highest ID (37.8 × 1000 patient-days in MV) (Table 4).

Tabela 4 – Indicators related to the occurrence of infectious events, collected in 2020 (n=444). Viçosa, MG, Brazil, 2020

Indicators related to the occurrence of infectious events	Parameters (n=444)
Incidence Density of VAP* (x1000 patients-day on MV)	37,8
Incidence Density of Catheter-Associated UTI* (×1000 patients-day with a urinary catheter)	3,2
Incidence Density of Catheter-Related Bloodstream Infections associated with Central Venous Catheters (×1000 patients-day with CVC)	8,4
Incidence Density of Phlebitis related to Peripheral Venous Catheters (×1000 patients-day with PVC)	0,8

Source: Elaborated by the authors, 2021.
*Indicators for mandatory monthly monitoring according to ANVISA/DC Normative Instruction No. 4, dated February 24, 2010.

DISCUSSION

Based on the results analyzed, among the admissions, regardless of the source of funding, there was a predominance of older patients admitted for clinical conditions, which confirms the results of other studies[6-8]. This scenario may be the result of both the demographic transition process and the increase in life expectancy in countries such as Brazil. The physiological changes that occur with age make older people more susceptible to the development of diseases and complications that require intensive and specialized care, leading to higher hospitalization rates among the elderly compared to other age groups[8].

Overall, when analyzing the global indicators of ICU functioning, it was evident that the SUS stood out as the most used source of financing for patient admissions to adult ICUs. This situation could be related to the guarantee of universal and free access to different health services provided by the SUS, which allows a wide population coverage[9].

Regarding the length of stay, which is considered an important indicator to evaluate the performance and quality of care[7], significant heterogeneity is observed in the national scientific literature, ranging from one to 23 days and being related to inherent patient characteristics and the care provided[6-8,10]. In this study, patients stayed in the hospital for an average of 5.4 days, a duration considered within the expected variation for the Brazilian reality. Conversely, a multicenter study conducted in 57 countries showed an average ICU stay of 27.7 days, with a directly proportional relationship between longer stays and higher patient-to-nurse ratios[11]. It is important to emphasize that, regardless of location, it is the responsibility of the healthcare team to efficiently manage the patient's length of stay to minimize inappropriate ICU utilization and the associated risks[7].

In terms of hospital outcomes, the majority of patients had positive outcomes and were discharged from the ICU. This result was higher than that found in a study conducted in an adult ICU of a public hospital in the Federal District[8]. It is believed that the predominance of ICU discharges is related to the quality of care provided, which is also evidenced by the low 24-hour readmission rate (0.8%), compared to other units where the rates were 2.4%[12] and 9.5%[13]. It is understood that high readmission rates have a direct impact on the increased risk of infection for patients and, consequently, on the deterioration of their clinical condition, a condition that quadruples the risk of death according to the length of hospital stay[14]. Furthermore, it is believed that the higher occurrence of discharges from the ICU may also be due to the ICU's location within a medium-sized hospital, which lacks a semi-intensive care unit, thus serving patients with lower severity and lower risk of death, who could benefit from units with less complex care. In this study, the lower severity of patients is evidenced by the low mortality rate estimated by the SAPS III, compared to other studies conducted with critically ill patients (7-8). However, despite the low estimated mortality rate, the exceptional performance of the ICU professionals should not be overlooked, as the observed actual mortality was even lower than the mortality predicted by the severity score.

Regarding the use of invasive devices, it is worth noting that the rates of MV utilization and CVC utilization, which are mandatory monthly monitoring indicators, were present in less than half of the patients (43.9% and 48.1%, respectively), which could also be associated with the lower severity of the patients. Although the data were collected during the COVID-19 pandemic, patients with respiratory symptoms were directed to another unit, and therefore, the research setting was not influenced by this context.

In this study, it was observed that the three most commonly used devices were IUC, PVC, and NGT/NET. The predominance of these three devices was also evidenced in other studies[15-17]. The frequent use of IUC in the ICU is due to its importance in obtaining parameters to evaluate hemodynamic balance, especially for assessing diuresis control and urinary retention, as well as for diagnostic exams, surgical interventions, and postoperative care[16]. However, it should be emphasized that the duration of IUC use is associated with the development of CAUTI, and therefore, preventive actions should be incorporated into the work process of the healthcare team[16].

The high rate of PVC utilization, on the other hand, can be explained by its role as a rapid access route to the bloodstream, enabling the effective delivery of drugs and administration of blood products, as well as facilitating the collection of materials for laboratory tests. However, improper manipulation of this route can lead to infectious processes that may cause serious harm to the patient's health. Hence, the adoption of central line-associated bloodstream infection

prevention bundles is recommended among ICU healthcare professionals[15].

Regarding devices responsible for enteral nutrition, it is essential to highlight that their use is indicated for patients unable to orally ingest fluids and food, allowing the infusion of diets and medications into the gastrointestinal tract or directly into the initial portion of the small intestine[17]. However, like all invasive devices, NGT/NET can also cause infections by acquiring pathogens through the gastrointestinal tract, creating an appropriate environment for multidrug-resistant bacteria[16]. Furthermore, proper positioning of these devices is emphasized to prevent fluid administration into the respiratory tract[17].

NGT/NET were also the subject of interest in another category of indicators related to the occurrence of non-infectious incidents, particularly obstruction and accidental removal of these devices. Similar results have been reported in other studies[17-18]. Catheter obstruction can occur as a result of care errors, most often due to inadequate flushing of the system during diet and/or medication administration[17]. Therefore, to minimize the occurrence of this event, the importance of nursing care in adopting best practices related to enteral catheter use is emphasized. This extends beyond correct installation to include guidance to families and teams and, most importantly, adherence to institutional flushing protocols[19].

Furthermore, in terms of non-infectious events, pressure ulcers (PUs) stand out as the most common adverse event during the period studied, reflecting the fragility of care. PUs are preventable health problems that harm patients and require prolonged treatment, resulting in increased costs. Preventive measures, such as changing the patient's position, should be promoted by all professionals to reduce their occurrence[18].

Regarding indicators related to infectious events, ventilator-associated pneumonia (VAP) stands out as the primary infection developed during ICU admission, with a higher incidence density compared to other studies with a similar population[20-21]. The presence of the endotracheal tube (ETT) allows direct communication of pathogens from the oral cavity to the lower respiratory tract, especially when proper oral hygiene is not practiced[21-22]. In this context, the nursing team plays a fundamental role in reducing this important healthcare indicator, as adopting preventive practices such as oral hygiene, maintaining an elevated head of bed position, and cuff pressure control can be effective interventions to minimize the risk of VAP occurrence[21].

The limitation of this study is that it was conducted in a single ICU, which limits the generalizability of the results due to regional differences within the country. In addition, it relied on document analysis rather than direct patient observation. However, the information used to assess the indicators is collected daily by ICU nurses based on patient observation and subsequently analyzed by the coordinating nurse. It is also important to note that the one-year sample allows for a broader representation of patients and may be indicative of the reality within the ICU.

CONCLUSION

In conclusion, there are a variety of health indicators that are analyzed monthly by the ICU team, including aspects related to the overall functioning of the department, the use of invasive devices, and the occurrence of infectious and non-infectious events, all of which are in line with national and international standards.

Positive aspects of ICU care were observed, such as the predominance of discharged patients, a lower absolute mortality rate compared to the estimated severity of illness, and a low rate of readmission within 24 hours. A significant proportion of the indicators evaluated were related to the use of invasive devices, with CVD, CVP, and CNG/CNE being prominent, requiring specific nursing care for proper management and prevention of incidents and adverse events. Among non-infectious incidents, pressure ulcers, obstruction, and unintentional removal of CNG/CNE were the most common. Among infectious incidents, VAP had the highest incidence density. These findings underscore the need to re-evaluate adherence to interventions that can prevent their occurrence. In light of these results, it is clear that appropriate collection and analysis of health indicators in different healthcare settings, especially in ICUs caring for critically ill patients, is crucial. Through the analysis of these indicators, the institutional reality can be recognized and the necessary resources can be effectively allocated to improve the quality of care. In addition, the analysis of indicators can be useful in planning educational strategies aimed at changing workflows to ensure safer services with fewer adverse events for patients.

We hope that this research can contribute to expanding knowledge about the results obtained from indicator analysis and stimulate future

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research focused on implementing interventions that can trigger improvements in workflow and quality of care.

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CONFLICT OF INTERESTS
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