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Effects of multidisciplinary rounds and checklist in an Intensive Care Unit: a mixed methods study

Efeitos de rounds multidisciplinares e checklist em Unidade de Terapia Intensiva: estudo de método misto

Efectos de las rondas multidisciplinarias y la lista de verificación en la Unidad de Cuidados Intensivos: un estudio de método mixto

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ABSTRACT

Objectives: to analyze the implementation of multidisciplinary checklist-directed rounds before health indicators and multidisciplinary team perception of an Intensive Care Unit. **Methods:** a mixed methods study, with an explanatory sequential design, carried out at a hospital in southern Brazil, from September 2020 to August 2021. The integration of quantitative and qualitative data was combined by connection. **Results:** after the implementation of checklist-directed rounds, there was a significant reduction in hospital stay from ventilator-associated pneumonia, urinary tract infection and daily invasive device use. The investigated practice is essential for comprehensive care, harm reduction, effective work and critical patient safety. **Conclusions:** the multidisciplinary rounds with checklist use reduced data on health indicators of critically ill patients and was considered a vital practice in the intensive care setting.

Descriptors: Teaching Rounds; Checklist; Intensive Care Units; Patient Safety; Patient Care Team.

RESUMO

Objetivos: analisar a implementação de *rounds* multidisciplinares direcionados por *checklist* frente aos indicadores de saúde e a percepção da equipe multiprofissional de uma Unidade de Terapia Intensiva. **Métodos:** estudo de método misto, com desenho sequencial explanatório, realizado em um hospital do sul do Brasil, no período de setembro de 2020 a agosto de 2021. A integração dos dados quantitativos e qualitativos foi combinada por conexão. **Resultados:** após a implementação dos *rounds* direcionados por *checklist*, constatou-se redução significativa no tempo de internação por pneumonias associadas à ventilação mecânica, infecção do trato urinário e nos dias de uso de dispositivos invasivos. A prática investigada é essencial para o cuidado integral, a redução de danos, o trabalho eficaz e a segurança do paciente crítico. **Conclusões:** os *rounds* multidisciplinares com uso de *checklist* reduziram os dados dos indicadores de saúde de pacientes críticos e foi considerado como prática vital no cenário de cuidados intensivos.

Descritores: Visitas com Preceptor; Lista de Checagem; Unidades de Terapia Intensiva; Segurança do Paciente; Equipe de Assistência ao Paciente.

RESUMEN

Objetivos: analizar la implementación de rondas multidisciplinarias guiadas por checklist frente a indicadores de salud y la percepción del equipo multidisciplinario de una Unidad de Cuidados Intensivos. **Métodos:** estudio de método mixto, con diseño secuencial explicativo, realizado en un hospital del sur de Brasil, de septiembre de 2020 a agosto de 2021. La integración de datos cuantitativos y cualitativos se combinó por conexión. **Resultados:** después de la implementación de las rondas dirigidas por listas de verificación, hubo una reducción significativa en la estancia hospitalaria por neumonía asociada a ventilación mecánica, infección del tracto urinario y en los días de uso de dispositivos invasivos. La práctica investigada es fundamental para la atención integral, la reducción de daños, el trabajo eficaz y la seguridad del paciente crítico. **Conclusiones:** las rondas multidisciplinarias con el uso de listas de verificación redujeron los datos sobre los indicadores de salud de los pacientes críticos y se consideró una práctica vital en el entorno de cuidados intensivos.

Descriptores: Rondas de Enseñanza; Lista de Verificación; Unidades de Cuidados Intensivos; Seguridad del Paciente; Grupo de Atención al Paciente.

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INTRODUCTION

Rounds in Intensive Care Units (ICUs) are systematized meetings between health professionals that strengthen comprehensive care in intensive care delivery, because it provides the health team with the opportunity to examine patients' condition and clinical progress, in addition to discussing diagnostic/therapeutic options and making important decisions about critical care to patients[1-2]. Moreover, bedside rounds provide accurate, adequate communication with details of patient information, supporting clinical decision-making[1].

The association between multidisciplinary rounds and the best quality of care was presented in studies[3-5] that found clinical benefits for patients, such as decreased hospitalization time and mortality due to improvement in the scope, efficacy, efficiency and focus of multidisciplinary visits by health professionals.

In order to further strengthen the benefits of rounds to patients, checklist use during the daily multidisciplinary visit is a care strategy that favors better therapeutic results of critically ill patients, such as a reduction in morbidity rates on the total days of mechanical ventilation use, in the occurrence of adverse events (AE) and in healthcare-associated infections (HAI)[4-7]. Thus, checklists are care tools for patient safety and have been increasingly implemented in ICU[6], since their applicability in high complexity services contributes to increased adhering to evidence-based practices[8].

Brazilian researchers[7] and Indians,[9] in order to elucidate the effects of checklist use in critically ill patients during the rounds, did not observe a reduction in the mortality rate. In turn, the Indian researcher[9] reports that, despite the existence of practice/intervention parameters listed in the ICU checklist, based on scientific guidelines, it is disappointing that there is no strong evidence in improving clinical outcomes so far.

In order to clarify controversial results on improvements in the clinical conditions of critically ill patients, studies of robust methods are necessary to identify reliable information from the implementation of health records tools during ICU rounds[10]. Thus, this study on multidisciplinary rounds using checklist is justified, because there is lack of national and international research using the mixed approach to elucidation and understanding of the effects of this intervention on health indicators.

Based on the above, the question that permeates this research is: does the round, using checklist to organize and integrate patient care actions, have effects on health indicators?

OBJECTIVES

To analyze the implementation of multidisciplinary checklist-directed rounds before health indicators and multidisciplinary team perception of an ICU.

METHODS

Ethical aspects

The ethical and legal precepts regarding research with human beings were met in accordance with Resolutions 466/2012 and 510/2016 of the Brazilian National Health Council. The record of this study is found in the Standing Committee on Ethics in Research Involving Human Beings (COPEP) of the *Universidade Estadual de Maringá* (UEM). All participants signed the Informed Consent Form. In order to guarantee anonymity, the representation of participants' names was expressed by the letters "MT", indicative of a multidisciplinary team, followed by an Arabic numeral referring to the order in which the interview was carried out.

Study design, place and period

This is a mixed methods study, delineated in the sequential explanatory approach, according to the Creswell and Creswell[11] methodological framework, with greater emphasis on quantitative data (QUAN) of step 1 on qualitative (QUAL) of step 2. The mixed approach was led by the Mixed Methods Appraisal Tool (MMAT).

The study was conducted at an Adult ICU of a medium-sized philanthropic hospital in southern Brazil, between September 2020 and August 2021. The ICU provides high complexity care for all specialties and has ten beds.

Study population: inclusion and exclusion criteria

In step 1, all medical records of patients admitted to the ICU aged 16 years or older, hospitalized for a time equal to or greater than 48 hours in the three investigation periods were selected: period 1: February and March 2018 (36 medical records analyzed); period 2: February and March 2019 (45 medical records analyzed); period 3: February and March 2021 (53 medical records analyzed). Medical records of patients who died within 48 hours of ICU stay and/or diagnosed with brain death were excluded. The standardized choice of February and March in different years occurred because the interventions assessed in this study started in February 2019 and February 2021 for periods 2 and 3, respectively. The initial two months of the intervention periods and two months of the period without intervention were selected, since, in this period of time, it was possible to include a sample considered sufficient for statistical analysis.

In step 2, seven ICU health professionals participated in the study, who were intentionally selected. All members of the multidisciplinary team who participated in the rounds of step 1 period 3 were invited to participate in this step. Professionals absent (vacation, leave and/or absence) from work in the period determined for data collection were excluded, but this did not occur.

Study protocol

Regarding the phases/steps of this study, step 1 consists of a quasi-experimental study, of the 'posttest only non-equivalent control group' type. In this study design, there is no participant randomization, but the pre-intervention group is assumed to be comparable with the post-intervention groups, even if they are not the same. Moreover, there was no pre-test assessment for each group, i.e., assessment took place in the group that did not receive the intervention and in the groups that received the intervention only once/period.

The study was subdivided into three investigation periods: period 1: round pre-implementation, in which the ICU did not perform rounds using checklist; period 2: round post-implementation

using the "Suspicion for good" - version 1 checklist[12]. The ICU multidisciplinary team performed daily rounds, but checklist 1 was completed on alternate days. This multidisciplinary team intervention with the clinical/therapeutic discussion of patients directed by checklist 1 in only a few days of the week lasted two years; period 3: round post-implementation using the "Multidisciplinary Checklist for ICU Rounds" - version 2[13], validated by one of the authors. During this period, the ICU performed the rounds daily and completed checklist 2. This daily intervention of the round directed by checklist 2 was maintained in the ICU, even after the end of data collection for this study.

Checklists 1 and 2 include 16 and 12 items of intervention/care to critically ill patients, respectively, based on best practices in health: prophylaxis for gastric ulcer; prophylaxis for venous thromboembolism (VTE); headboard elevation 30º; adequate analgesia; adequate sedation; adequate nutrition; removal of indwelling urinary catheter (IUC); removal of central venous catheter (CVC); extubation/spontaneous breathing test (SBT); airway pressure/protective mechanical ventilation; suspension/adjustment of antimicrobial doses; glycemic control; prophylaxis for pressure injury; removal from the bed; (oro)tracheal cannula cuff pressure; and ophthalmoprotection[12-13]. It is noteworthy that the first 12 intervention items were common between checklists 1 and 2.

Data collection in step 1 was performed between September 2020 and April 2021. From September to December 2020, retrospective data concerning were collected for periods 1 and 2 of investigation. From February to April 2021, prospective data collection was performed, which represents the 3rd period of investigation. It is worth mentioning that prospective data collection lasted until April 2021, to monitor the clinical outcome (discharge, death, transfer) of eligible patients in this period.

Data were collected with the aid of an instrument developed by the corresponding author, based on data from patients' medical records, checklists used in the ICU (versions 1 and 2) and on the data collection instrument model used in a randomized clinical trial study in Brazil[7].

The health indicators analyzed in the three investigation periods consisted of primary outcome (ICU mortality) and secondary outcomes (hospital mortality, ventilator-associated pneumonia (VAP), catheter-related bloodstream infection (CRBSI), urinary tract infection (UTI), days of mechanical ventilation (MV) use, days of CVC use, days of IUC use and length of stay). The analysis of primary and secondary outcomes in all periods investigated was based on the calculation of mortality rates, AE and length of stay, as recommended by scientific literature[7].

After preliminary analysis of predominant quantitative step data (QUAN), step 2 (QUAL) was performed in July and August 2021, with seven ICU health professionals under study.

In data collection, a semi-structured questionnaire was applied, elaborated, containing questions related to professional sociodemographic data. The main question was: tell me about the multidisciplinary visit and checklist in your clinical practice and five support questions that were used, when necessary, to further elucidate the phenomena "rounds and checklists", "reduction of health indicator rates" and "patient safety". A field diary was also used to record relevant information that was observed by the researcher during the interviews.

The interview was scheduled according to the availability of each professional, preferably after the ICU rounds, and was carried out individually, in a private environment, at the institution, with an average duration of 35 minutes. In this process, before the interview, the researcher presented to the participants the objectives of this study and the ethical aspects that involve research with human beings.

At the time of the interview, the narratives were recorded in audio. After that, they were transcribed in full through a word processor (Microsoft Word). Transcription was preferably performed on the same day that the interviews took place.

To give more fluidity to the texts/statements, the excerpts/extracts presented were edited, in order to align them with the grammatical language, however without changing the meaning, and, in order to facilitate the reader's understanding, words or terms were inserted in parentheses.

Analysis of results, and statistics

In the quantitative stage, to calculate health indicator rates assessed in the three investigation periods, the respective formulas were used[7]: ICU mortality = nº ICU deaths/nº total patients x 100; hospital mortality = nº hospital deaths/nº total patients x 100; VAP = nº VAP/nº MV patient days x 1,000; CRBSI = nº CRBSI/nº CVC patient days x 1,000; UTI = nº UTI/nº patient days IUC x 1,000; days of MV use = nº MV patient days/nº ICU patient days x 100; CVC use days = nº CVC patient days/ nº ICU patient days x 100; IUC use days = nº IUC patient days/nº ICU patient days x 100; and mean length of stay = nº days ICU patients/nº ICU patients.

Patient sociodemographic data and health indicators were organized in a Microsoft Excel spreadsheet® and, later, analyzed in the computational packages: Statistical Single User, version 13.2, and R version 4.0.2. Data will be presented in the form of double-entry/contingency frequency tables, with percentages for qualitative variables, and tables with descriptive measures, with comparison of groups, presentation of absolute numbers, mean and standard deviation for quantitative variables.

The estimate the round effect associated with checklist use on mortality, length of stay, HAI (VAP, CRBSI, UTI) and invasive device use was obtained using Poisson and Linear logistic regression models. The effect on the indicators was estimated, with adjustments for the Disease Severity Classification System Score (APACHE II). For the regression models, we used relative risk (RR), mean difference (MD) and their respective Confidence Intervals (CI), considering significance level of 5% ($\alpha = 0.05$).

In the qualitative analysis, through the acquired corpus, the content analysis technique was applied, thematic modality, following[14] pre-analysis, material exploration, and treatment of the obtained results and interpretation.

The integrated analysis of mixed research data occurred through the assessment of quantitative and qualitative results, combined by connection. Quantitative data were deepened and explained through convergences/similarities, complementarities and possible divergences revealed in the qualitative data, as recommended by the adopted reference[11], and the authors' inferences on data joint density were incorporated. To display the data integration, the Pillar Integration Process (PIP) was built, which is a joint display matrix, through an integrated conceptual scheme[15].

RESULTS

In step 1 (QUAN), 134 medical records of ICU patients were included, with similar characteristics in the three investigation periods, given the predominance of men, married, white and who used the Unified Health System (SUS - *Sistema Único de Saúde*). There was a gradual decline in the mean age from period 1 to 3, as well as a decline in the mean score of APACHE II, at the time of patient ICU admission, from period 2 to 3, as shown in Table 1.

The type of admission that prevailed in the ICU was clinical hospitalization and the main reason was impairment of the neurological system, followed by respiratory failure, in the three periods investigated. Among the comorbidities presented by patients, heart failure prevailed in period 1, and renal failure in periods 2 and 3.

ICU mortality in period 1 was 38.9%, while the predicted risk by APACHE II was 24.0%. In periods 2 and 3, mortality was 35.6% and 20.8%, with predicted risks of 40.0% and 24.0%, respectively. There was a significant reduction in ICU mortality and hospital mortality in periods 2 and 3, but there was no significance in estimating patient severity-adjusted effect size (APACHE II), as shown in Table 2.

When comparing the effect estimates with APACHE II adjustments of variables/outcomes between the period without intervention (period 1) with the intervention periods (periods 2 and 3), there was a significant reduction in the mean ICU stay in period 3 (p=0.0354); significant reduction in VAP (p=0.0374) and UTI (p=0.0306) rates in periods 2 and 3, respectively; and significant decrease in the percentage of days of MV use (p=0.0001; p=0.0023) and IUC (p=0.0426; p=0.0001), both in the 2nd and the 3rd periods investigated (Table 2).

Step 2 (QUAL) had the participation of all members (07) of the ICU multidisciplinary team who performed the rounds in the afternoon (03 nurses, 02 doctors, 01 physical therapist and 01 nutritionist). The mean age of professionals was 38 years. Six were specialists and had three years or more experience in the ICU, five were women and five were married.

From the statements, the following categories emerged: *Round with checklist use: vital practice for comprehensive care and harm reduction*; *Round and daily checklist: effective multidisciplinary team work for patient safety*. These categories are presented with the PIP of quantitative and qualitative data in Chart 1.

DISCUSSION

The characteristics of patients in the three periods investigated present groups of fifty-year-old adults, primarily male, of clinical hospitalization and neurological impairment, followed by respiratory failure. Characteristics similarity of compared groups is a criterion that points to greater validity of the research design and ensures methodological rigor.

There was a reduction in ICU mortality, hospital mortality and the mean number of days of hospitalization during intervention periods (periods 2 and 3). The decrease in ICU mortality and significant decrease in length of stay (p=0.0354) from period 1 to 3 was noticed by health professionals, especially MT1 and MT7, as a result of the implementation of a solid strategy for the best care of critically ill patients, which is the round associated with checklist use. Although the decrease in ICU mortality was not significant (p<0.05), the hypothesis that this clinical outcome is related to lower disease severity in the cohort of participants in the third period investigated cannot be rejected because the mean APACHE score was lower in this period.

Table 1 - Characteristics of Intensive Care Unit patients in the three investigation periods (N=134), Brazil, 2021

Characteristics	Period 1 (n=36)	Period 2 (n=45)	Period 3 (n=53)
Personal data - n (%)			
Male	20 (55.6)	27 (60.0)	31 (58.5)
Married marital status	21 (58.3)	21 (46.7)	25 (47.2)
White race	30 (83.3)	29 (64.4)	31 (58.5)
SUS use	32 (88.9)	44 (97.8)	48 (90.6)
Patient age and APACHE II on admission - mean (SD)			
Age	58.7 (21.5)	55.3 (19.2)	52.1 (19.9)
APACHE II	19.5 (6.3)	20.2 (7.7)	16.9 (6.8)
Type of admission - n (%)			
Clinical	30 (83.3)	40 (88.9)	42 (79.2)
Surgical	16 (16.7)	5 (11.1)	11 (20.8)
Reason for ICU admission - n (%)			
Neurological	16 (44.4)	11 (24.4)	18 (34.0)
Respiratory insufficiency	8 (22.2)	8 (17.8)	12 (22.5)
Postoperative care	6 (16.7)	5 (11.1)	11 (20.8)
Sepsis	3 (8.3)	7 (15.6)	2 (3.8)
Cardiovascular	2 (5.6)	1 (2.2)	3 (5.7)
Others	1 (2.8)	13 (28.9)	7 (13.2)
Comorbidity - n (%)			
Heart failure	8 (22.2)	1 (2.2)	2 (3.8)
Renal failure	-	7 (15.6)	7 (13.2)
Cancer treatment	4 (11.1)	2 (4.4)	3 (5.7)
HIV	2 (5.6)	1(2.2)	2 (3.8)
Gastrointestinal diseases	2 (5.6)	-	4 (7.5)
Others	3 (8.4)	8 (17.8)	6 (11.3)

ICU – Intensive Care Unit; SUS – Sistema Único de Saúde.

Table 2 - Effects of rounds using checklist on patient health indicators in the Intensive Care Unit (N=134), Brazil, 2021

Variables/ Outcomes	Period 1 Without round and checklist (n=36)	Period 2 Round and checklist 1 (n=45)	Period 3 Round and checklist (n=53)	Adjusted effect estimate Period 2 x 1 RR (95% CI)	*p* value*	Adjusted effect estimate Period 3 x 1 RR (95% CI)	*p* value*
Mortality and adverse events							
ICU death	14/36 (38.9)	16/45 (35.6)	11/53 (20.8)	0.62 (0.23;1.61)	0.3328	0.65 (0.40;1.04)	0.0748
Hospital death	19/36 (52.8)	20/45 (44.4)	15/53 (28.3)	0.77 (0.29;2.03)	0.6016	0.71 (0.43;1.19)	0.1968
VAP†	6/344 (17.4)	1/274 (3.6)	2/240 (8.3)	0.09 (0.01;0.61)	0.0374	0.47 (0.17;1.03)	0.0811
CRBSI‡	4/415 (9.6)	2/400 (5.0)	1/335 (3.0)	0.37 (0.05;2.00)	0.2640	0.40 (0.09;1.10)	0.1200
UTI§	7/465 (15.1)	6/392 (15.3)	1/260 (3.8)	0.61 (0.96;1.14)	0.4200	0.30 (0.07;0.75)	0.0306
Days of device use/total ICU days (%)							
MV‖	344/472 (72.9)	274/455 (60.2)	240/454 (52.9)	0.85 (0.78;0.92)	**0.0001**	0.87 (0.81;0.95)	0.0023
CVC¶	415/472 (87.9)	400/455 (87.9)	335/454 (73.8)	0.96 (0.84;1.11)	0.6298	0.93 (0.86;1.00)	0.0585
IUC**	465/472 (98.5)	392/455 (86.2)	260/454 (57.3)	0.86 (0.75;0.99)	0.0426	0.75 (0.70;0.81)	0.0001
Mean inpatient time (SD)							
ICU time	13.1 (10.3)	10.1 (8.8)	8.6 (6.8)	0.04 (0.00;2.69)	0.1327	0.01 (0.00;0.06)	0.0142

**Significant p-value <0.05 considering 95% confidence level;† VAP - ventilator-associated pneumonia;‡ CRBSI - catheter-related bloodstream infection;§ UTI - urinary tract infection;‖ MV - mechanical ventilation;¶ CVC - central venous catheter; ** IUC - indwelling urinary catheter.*

Chart 1 - Pillar Integration Process: synthesis of statements based on mortality, hospitalization time, invasive devices and adverse events, Brazil, 2021

QUAN data	**QUAN** Categories Period **(P)**	**Pillar integration themes**	**QUAL** categories	**QUAL -** codes Similarity **(S)** Complementarity **(C)**
ICU and hospital death	Mortality rate: P1 = 38.9% P2 = 35.6% P3 = 20.8% Hospital mortality rate: P1 = 52.8% P2 = 44.4% P3 = 28.3%	Mortality reduction	Round with checklist use: vital practice for comprehensive care and harm reduction	**S** - *The round/checklist is the framework for the best patient care. You have good practices scientifically proven by the literature that, through a simple checklist prepared and executed by a multidisciplinary team, the benefit of the patient with what we call the 'major hard outcome', which is death, is significant.* (MT7) **S** - *Avoiding harm to the patient was the reason to implement the round and checklist in the hospital, decreasing hospital stay, mortality* [...] *we think about holistic full care.* (MT1) **S** - *Assessment of bedside exams and discussion of the clinical case by all professionals was very important* [...]. (MT3); [...] *we thought about what could be done to reduce hospitalization time and prevent injuries.* (MT6) **S** - [...] *the fact of 'un-invading' patients as soon as possible, as soon as possible, seems to have impacted on the reduction of mortality rates, infection and length of stay.* (MT4) **S** - *Before, the checklist was filled out every other day and now, with the daily completion in multidisciplinary visits, we observe* [the instrument items] *every day and this contributes to the reduction of these indicators* [mortality, infection and hospitalization time]. (MT6) **S** - *The reasons for the reduction of adverse events are greater vigilance and execution of goals* [established by the multidisciplinary team in the round], *and mainly the removal of invasive devices.* (MT7) **S** - *The reason for the reduction in adverse events is simple, it's because you predicted what was going to happen. If I reduce the invasive device, I reduce adverse events.* (MT5) **C** - [...] *when this practice* [round with checklist use] *fails, indicators tend to get worse. Any slip page and the patient 'pays the price'.* (MT7) **C** - [...] *often a patient comes in with a heart attack and has sepsis due to a bloodstream infection or pneumonia that prolongs the length of hospital stay. Death will occur not because of the underlying cause that they hospitalized, but because of the complications they had.* (MS5)
ICU stay	Mean time (days) of hospitalization: P1 = 13.1 P2 = 10.1 P3 = 8.6	Reduction of mean hospital stay		
VAP, CRBSI, and UTI*	HAI. Number of HAI per 1,000 patient-days: **- VAP** P1 = 17.4 P2 = 3.6 P3 = 8.3 **- CRBSI** P1 = 9.6 P2 = 5.0 P3 = 3.0 **- UTI** P1 = 15.1 P2 = 15.3 P3 = 3.8	Reduction of AE		

To be continued

Chart 1 (concluded)

QUAN data	**QUAN** Categories Period **(P)**	**Pillar integration themes**	**QUAL** categories	**QUAL -** codes Similarity **(S)** Complementarity **(C)**
MV, CVC, and IUC*	Invasive device use rate: **- MV** P1 = 72.9% P2 = 60.2% P3 = 52.9% **- CVC** P1 = 87.9% P2 = 87.9% P3 = 73.8% **- IUC** P1 = 98.5% P2 = 86.2% P3 = 57.3%	Reduced days of invasive device use	Round and daily checklist: effective multidisciplinary team work for patient safety	**S** - *Daily surveillance of the round* [...], *multidisciplinary observation at the bedside was important in reducing the days of invasive devices*. (MT2); *The checklist daily completion makes a difference. I believe that*. (MT3) **S** - *I believe that the decrease in invasive devices is related to discussion at the time of the round and also by the organization of checklist 2 that has become better, clearer and objective. Before, the item* [checklist 1] *was not so clear and we went unnoticed*. (MT6) **S** - *It is important for everyone on the team to be present daily* [in the round] *to interact and discuss what is best for patient safety*. (MT2) **S** - *The checklist is extremely important for an effective team work. With its use, the risk of forgetfulness in checking something is minimal because it occurs in real time*. (MT5) **S** - *The multidisciplinary visit with the use of a checklist is very important, especially for the team's work together, because the possibility of extubating patients is discussed in the round. So, I pause the diet and if I establish the brain death protocol* [in another patient], *I know I can lower the caloric goal. This contributes to patient quality and safety*. (MT3)

**VAP - ventilator-associated pneumonia; CRBSI - catheter-related bloodstream infection; UTI - urinary tract infection; MV - mechanical ventilation; CVC - central venous catheter; IUC - indwelling urinary catheter; HAI – healthcare-associated infections; AE – adverse events.*

The decrease in ICU mortality and length of stay observed in this study were also observed in a multicenter[4] study carried out in 34 ICUs from 15 countries with the objective of determining whether the support tool "Checklist for early recognition and treatment of acute illnesses and injuries" during admission and round in the ICU was associated with improvements in adherence to processes and in evidence-based daily care. In this study, after the implementation of this resource, in all ICUs, a reduction in mortality and length of stay of patients was observed.

Regarding patient clinical conditions and care processes, researchers[3] state that interprofessional team communication based on patient safety during the rounds reduces patient hospitalization time, AE and delays in starting adequate therapy, which result in lower mortality rates. Other morbidity markers, which include total MV days, readmission, and infection prevention also show significant improvement with the interprofessional approach[3].

The present study showed a significant decrease in VAP (p=0.0374) rates in period 2, and of UTI (p=0.0306) in period 3. Although CRBSI did not show significance between the periods investigated, there was a considerable reduction in this morbidity marker in the period in which they performed rounds with daily use of the multidisciplinary checklist and achievement of daily goals. When establishing connections and explaining the reduction of VAP, UTI and CRBSI in period 3, professionals' statements reinforce the importance of preventable damage prevention, since the monitoring of invasive devices daily, at the time of the round, in order to schedule the removal, was one of the main factors mentioned for reducing infections/AE.

A study conducted in 16 ICUs of teaching hospitals in Iran[16] also found that VAP, UTI and sepsis were the most frequent infections that threatened patient safety. To reverse this situation, researchers point to the need to promote discussions about the work process, the joint planning of actions, preventive care and interprofessional collaboration[16-18]. In the present study, participants reported that teamwork and compliance with prevention methods are essential for reducing of harm to patients. Thus, the multidisciplinary team's systemic view on work dynamics in scenarios with complex demands increases safe care practice.

With regard to health team commitment, prevention and collaboration, the category *Round with checklist use: vital practice for comprehensive care and harm reduction* explains the quantitative data of this study because statements denote that the involvement of professionals in patient clinical discussion, checklist daily completion, disease prevention and execution of goals proposed by the multidisciplinary team had a positive impact on mortality rates, infection rates and length of stay. Thus, for comprehensive care and harm reduction to critically ill patients, researchers claim that knowledge about the best care guidelines and understanding of risks/problems in highly complex scenarios are essential for greater patient safety[18].

The present investigation found a significant decrease in the number of days of invasive device use (MV, IUC) in the intervention periods. These results are similar to a prospective study carried out in eight pediatric ICUs in five countries, with the objective of verifying the implementation of checklists during patient safety rounds. After implementing the checklist, it was found that using the checklist improved team support to various care recommendations such as lower use of MV, CVC and IUC[19].

As for days of patient exposure to invasive devices, in the category *Round and daily checklist: effective multidisciplinary team work for patient safety*, it was evident that round surveillance at the bedside by the multidisciplinary team, the checklist daily completion and the validated checklist application (used in period 3) influenced the reduction of days of invasive device use, HAI/AE occurrence and, consequently, greater patient safety.

Summing up, the positive effects of multidisciplinary rounds associated with checklist use in patients' health indicators was corroborated by ICU multidisciplinary team professionals, as they perceived this care strategy as a vital practice for comprehensive care and harm reduction. Participants also noticed that this practice supports the team's effective work, which results in greater safety

for patients. These perceptions correspond with literature[10] where it is reported that attention to clinical trends of critically ill patients and treatment plans based on the best care is a social need for greater success in health indicators.

This study of mixed methods allowed measuring the effects of the multidisciplinary rounds associated with checklist use in patients' health indicators and explain their effects (improvement of these indicators) through similarities and complementarities obtained from the multidisciplinary team's statements. It is noteworthy that there were no discrepancies/divergences between the quantitative and qualitative data, since the health professionals involved support the practice of multidisciplinary care in the ICU.

Study limitations

The limitation of this study is the small sample of patients analyzed in the three investigation periods in a single ICU. Thus, it is suggested the insertion of more patients, longer investigation time and a greater number of ICUs in future research of mixed methods.

Checking the isolated correlation of the round associated with the checklist on health indicator improvement in critically ill patients can be considered counterproductive, since the complexity of the work process in intensive care centers has different factors/variables that interfere in the outcomes of mortality, length of stay and AE. By assuming this fragility, the challenge of exclusively determining the positive effects of rounds with checklist use in the ICU permeates the national scenario and raises the need for new studies, especially mixed investigations.

Contributions to health

Implementing rounds with checklist use in the ICU contributes to improving multidisciplinary care for critically ill patients, by establishing a link between the service, the health team and users, as evidenced in the quantitative data and in the perception of professionals involved in qualitative data collection and analysis.

CONCLUSIONS

It is concluded that, in the periods in which the rounds multidisciplinary associated with checklist use occurred, there was a significant reduction in ICU stay, VAP, UTI, days of MV and IUC use.

Data integration through the mixed approach revealed that daily round with checklist use is a vital practice for comprehensive care, harm reduction, effective multidisciplinary team work, and greater critical patient safety.

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ERRATUM

In the article "Effects of multidisciplinary rounds and checklist in an Intensive Care Unit: a mixed methods study", with DOI number: https://doi.org/10.1590/0034-7167-2021-0934", published in Revista Brasileira de Enfermagem, 2022;75(3):e20210934, in the abstract:

Where it read:

Results: after the implementation of checklist-directed rounds, there was a significant reduction in hospital stay from ventilator-associated pneumonia, urinary tract infection and daily invasive device use.

It reads:

Results: after the implementation of checklist-directed rounds, there was a significant reduction in hospital stay, ventilator-associated pneumonia, urinary tract infection and daily invasive device use.

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