ORIGINALES

Improving the quality of care for patients with sepsis in the context of an emergency service

Melhoria da qualidade do atendimento a pacientes com sepse no contexto de um serviço de emergencia

Mejora de la calidad de la atención a pacientes con sepsis en el contexto de un servicio de emergencia

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ABSTRACT:
Objective: To describe the process of implementing a participatory and multifaceted intervention to improve sepsis care and its effects on improving the quality of care.
Materials and methods: This is a before-after quasi-experimental study conducted in 2017/2018 in the emergency service of a hospital in Northeast Brazil. The quality of care of 564 patients diagnosed with sepsis was assessed using nine process criteria and one result criterion. The intervention was participatory and multifaceted, being applied for 10 months.
Results: After the intervention, the number of non-conformities decreased by 67% (843 vs 506), and all 10 criteria improved, with a significant improvement ($p<0.05$) in eight of them. Lethality decreased by 10% ($p=0.005$).
Conclusion: The intervention model presented was effective in improving the quality of care for sepsis in the emergency service, with the possibility of scaling up its use in Brazilian hospitals.

Keywords: Sepsis; Quality Improvement; Emergency Medical Services; Risk Management; Safety Management.

RESUMO:
Objetivo: Descrever o processo de implementação de uma intervenção participativa e multifacetada para melhorar o atendimento à sepse e seus efeitos na melhoria da qualidade do atendimento.

Materiais e métodos: Trata-se de um estudo quase-experimental do tipo antes-depois realizado em 2017/2018 no serviço de emergência de um hospital do Nordeste do Brasil. A qualidade do atendimento de 564 pacientes com diagnóstico de sepse foi avaliada por meio de nove critérios de processo e um critério de resultado. A intervenção foi participativa e multifacetada, com duração de 10 meses.

Resultados: Após a intervenção, o número de não conformidades diminuiu 67% (843 vs 506), e todos os 10 critérios melhoraram, com uma melhoria significativa (p <0,05) em oito deles. A letalidade diminuiu 10% (p = 0,005).

Conclusão: O modelo de intervenção apresentado foi eficaz na melhoria da qualidade do atendimento à sepse no serviço de emergência, com possibilidade de ampliar sua utilização nos hospitais brasileiros.

Palavras-chave: Sepse; Melhoria de Qualidade; Serviços Médicos de Emergência; Gestão de Riscos; Gestão da Segurança.

RESUMEN:

Objetivo: Describir el proceso de implementación de una intervención participativa y multifacética para mejorar la atención de la sepsis y sus efectos en la mejora de la calidad de la atención.

Materiales y métodos: Se trata de un estudio cuasi-experimental del tipo antes-después realizado en 2017/2018 en el servicio de urgencias de un hospital del noreste de Brasil. La calidad de la atención de 564 pacientes diagnosticados con sepsis se evaluó utilizando nueve criterios de proceso y un criterio de resultado. La intervención fue participativa y multifacética, con una duración de 10 meses.

Resultados: Después de la intervención, el número de incumplimientos disminuyó en un 67% (843 vs 506), y los 10 criterios mejoraron, con una mejora significativa (p <0,05) en ocho de ellos. La letalidad disminuyó en un 10% (p = 0,005).

Conclusión: El modelo de intervención presentado fue eficaz para mejorar la calidad de la atención de la sepsis en el servicio de urgencias, con la posibilidad de ampliar su uso en los hospitales brasileños.

Palabras clave: Sepsis; Mejoramiento de la Calidad; Servicios Médicos de Urgencia; Gestión de Riesgos; Administración de la Seguridad.

INTRODUCTION

Despite advances in the medical field, sepsis remains a serious public health problem. Epidemiological studies have shown that this disease causes countless deaths around the world and places a heavy burden on public and private health systems [1,2]. Although global figures on sepsis are scarce, and sometimes controversial, it is estimated that about 30 million new cases of the disease may be diagnosed each year, with the potential to cause more than 5 million deaths [3].

In Brazil, the incidence of hospitalizations for sepsis increased by more than 50% between 2006 and 2015, with a lethality rate of around 46%, being higher in public hospitals (55%) than in private hospitals (37%) [4]. According to the SPREAD study [5], which assessed 229 Intensive Care Units (ICUs) in the country in 2014, almost 30% of this type of bed was occupied by patients with sepsis or septic shock, and the associated mortality was 55.4%. This high lethality is even more evident when comparing national data with those from other countries, as did the PROGRESS study [6], which found that hospital mortality from sepsis in Brazil was 67.4%, higher than countries like Argentina (56.6%), India (39.0%), the United States (42.9%) and Australia (32.6%).

Some factors related to the quality of health care may be associated with this high mortality. In part, it can be attributed to the lack of knowledge on the part of health professionals about the signs of severity associated with the disease and the lack of standardization of conducts on the part of many organizations, which leads to a late

diagnosis and a consequent delay in starting therapeutic measures [7,8]. Additionally, problems related to safety culture, unavailability of resources, as well as barriers to access health services, can also influence these numbers.

In recent decades, the recognition of sepsis as one of the main preventable causes of morbidity and mortality in the world [9] has led to the emergence of quality improvement initiatives based on managed protocols, focused on early diagnosis and appropriate and timely treatment of the disease. A meta-analysis identified that quality improvement programs increase compliance with treatment packages and decrease mortality [10]. In the meantime, the *Campanha de Sobrevivência à Sepse* (CSS, as per its Portuguese acronym, being translated into Sepsis Survival Campaign), together with the *Institute for Healthcare Improvement* (IHI), has developed educational programs and sepsis treatment packages every four years, that is, evidence-based measures that, when carried out together, produce good results [7,11].

In South American countries, the Latin American Sepsis Institute (LASI) has been proposing to assist organizations that intend to improve the quality of care for septic patients, through the implementation of educational programs and the generation and dissemination of knowledge, based on the protocols of the CSS [5,11]. Despite this knowledge, there is a lack of publications on initiatives to improve the quality of sepsis in emerging and low-income countries [3], especially in emergency departments, which are the gateway for most septic patients.

In this context, the present study aimed to describe the process of implementing a participatory and multifaceted intervention to improve sepsis care and its effects on improving the quality of care.

MATERIALS AND METHODS

In order to carry out this study, the SQUIRE guidelines (*Standards for Quality Improvement Reporting Excellence*) [12] were followed, which provide a model for reporting new knowledge on how to improve the quality of health care.

Context and identification of the opportunity for improvement

This study was carried out in the 2017/2018 biennium in the Emergency Sector of the Cariri Regional Hospital (CRH), located in Juazeiro do Norte, Ceará, in Northeast Brazil. The hospital has a tertiary, public and state character and has 219 hospital beds and 90 emergency beds, with monthly care of about 2,500 patients. CRH is part of the network of hospitals managed by the Institute of Health and Hospital Management, a private non-profit institution qualified as a Social Health Organization (SHO). Inaugurated in 2011, it has a level three accreditation certificate from the National Accreditation Organization and its strategic lines are the care of patients with acute ischemic stroke, multiple traumas and sepsis.

With a view to favoring an organizational climate of change, a multidisciplinary leadership team was created with professionals with relevant knowledge, credibility and authority to drive process improvements. This group was formed by a physician and three nurses (coordinators of the emergency sector), a business administrator, a quality advisor, in addition to the risk manager, the general coordinator of nursing and

the general director of the hospital (n=9). After performing a nominal group technique [13], the septic patient care was participatively selected as an improvement target to be implemented in the Emergency Department of CRH.

Intervention

The planning of the intervention followed three main guidelines: 1) participatory design, which was ensured by involving a multidisciplinary team directly related to the problem; 2) based on data, because the intervention actions were directed to the quality criteria of the worst conformity in the first assessment of the quality level after analysis using a Pareto diagram; 3) and multifaceted, considering that a sum of interventions is more effective for improvement [14].

Considering a structured qualitative analysis with a cause-and-effect diagram and an initial assessment based on quality criteria, an affinity diagram was elaborated (**Table 1**), aimed to order and systematize the interventions proposed by the group in four strategic lines: managerial actions, educational actions, information systems and work reorganization.

Table 1: Affinity diagram guiding quality improvement interventions. Juazeiro do Norte, CE, 2017

MANAGERIAL ACTIONS
● To create the Local Sepsis Committee responsible for monitoring results and developing action plans aimed to optimize processes;
● To identify a process manager, responsible for monitoring the protocols opened in the emergency, managing data, and collecting results;
● To carry out a monthly quality audit on adherence and conduct of the sepsis protocol;
● To establish a monthly indicator monitoring calendar to be presented to the management, the Hospital Infection Control Commission and the Patient Safety and Management Center, with the responsibility of the Sepsis Committee for the results achieved;
● To establish performance goals for the health care team.
EDUCATIONAL ACTIONS
● To carry out, together with the Teaching and Research Center and the Hospital Infection Control Commission, training of the emergency sector's health care team regarding the updating of the sepsis protocol, creating a schedule of permanent activities;
● To train the emergency health care team on the correct measurement of vital signs;
● To sensitize the health care team regarding the importance of early diagnosis and correct management of the patient with sepsis;
● To carry out on-site visits to actively search for septic patients, auditing protocols and discussing doubts with collaborators.
● To disclose the new instruments (protocol, screening form and antimicrobial guide), as well as the importance of early recognition and rapid treatment of sepsis, in the greatest possible number of media.
INFORMATION SYSTEMS
● Presentation of the indicators of the first assessment to the team.

● To carry out individual and collective performance feedback to the health care team;
● To signalize septic patients in physical and electronic media.
WORK REORGANIZATION
● To update the institutional protocol for septic patient care, based on the latest CSS and LASI guidelines;
● To update the sepsis protocol screening form;
● To update the institutional empirical antimicrobial guide;
● To agree with the support sectors on the ideal time for the performance of their actions;
● To restructure the line of care for septic patients.

From then on, an action plan for the implementation of the proposed actions was elaborated, presented in a Gantt diagram. Change initiatives were socialized within the institution based on training, discussions of clinical cases, on-site visits and individual approaches to collaborators, following the CSS and LASI guidelines.

Until the implementation of quality improvement measures, there was no risk classification, i.e., the indication that the patient could be a carrier of sepsis. Considering that this is the first contact of the user with a health professional, the nurse acting in risk classification became responsible for signaling a possible sepsis, based on the alteration of vital signs or the presence of organic dysfunction. As soon as this occurred, the patient should undergo immediate medical care and, if the suspicion was confirmed, the sepsis protocol would be opened.

Consequently, the patient's name would be marked with red color in the electronic medical record, indicating the priority of care, and the patient would follow with a sign indicating that he/she had sepsis, containing the time limits for reassessment. The pharmacy performed the release of the antimicrobial as soon as possible and the laboratory streamlined the collection of blood and the release of test results.

Performance data were assessed monthly by the sepsis committee, which used the quality criteria built to assess compliance; and, from these data, indicators were generated. The results were presented monthly at the meetings with the teams.

Intervention study

In order to study the effect of the intervention, this improvement project included a before-after type quasi-experimental design.

The population of this study included all medical records of patients diagnosed with sepsis in the emergency sector of CRH. Sepsis is considered to be a potentially fatal condition caused by a dysregulated response of the human organism to infection [15]. All patients who met this criterion, during the period in question, were analyzed in this study. The study units were the daily census spreadsheets of the patients who had the sepsis protocol opened. Medical records of patients who did not show signs of infection, patients with unavailable or non-existent data, those who died within 3 hours of sepsis diagnosis and those in end-of-life care were excluded.

Data collection from the first assessment was carried out between September and November 2017, the intervention took place between December 2017 and March 2018

and the reassessment between April and June 2018. To this end, a self-elaborated instrument was used based on the 10 developed criteria. The sources for data collection were the medical records and the screening forms of the sepsis protocol. The data were collected by a previously trained physician and a previously trained nurse, who assessed the level of compliance with the criteria. For this study, only one sepsis event was considered for each patient's hospitalization.

Measures

A list with 10 criteria was elaborated (**Table 2**), which defined the quality of the assessed service. Each criterion was detailed in terms of its definition, exceptions and clarifications so that they could be interpreted in the same way by different assessors.

Table 2: Criteria for assessing the quality of the care process for patients with sepsis. Juazeiro do Norte, CE, 2017.

Nº	CRITERION	EXCEPTION	CLARIFICATIONS
1	Early sepsis diagnosis	End-of-life care patients, with medical records.	Early diagnosis is one made within one hour from the time of the patient's first registration in the emergency sector, for patients who enter the hospital with signs of sepsis or within one hour from the evidence in the medical record of suspicion of the disease, for patients already admitted to the hospital. The time will be displayed on the sepsis protocol screening form.
2	Reassessment of the patient within 3 hours of the initial diagnosis	Patients who were discharged or died before 3 hours after the initial sepsis diagnosis.	It must be considered as compliant when there is a medical record showing the time the reassessment was performed.
3	Correct classification of disease severity	Not applicable.	It assesses whether the physician was able to correctly classify the patient as having sepsis, severe sepsis* or septic shock (before the intervention)[16] and infection, sepsis and septic shock (after the intervention)[11].
4	Correct reclassification of disease severity	Patients who were discharged or died before 3 hours after the initial sepsis diagnosis.	After the 3-hour reassessment, the physician must be able to correctly reclassify the patient, maintaining or changing the diagnosis. The patient can be reclassified as having sepsis, severe sepsis* or septic shock (before the intervention); and infection, sepsis,

			sepsis with lactate having changed 2 times the baseline value, septic shock and infection-free (after the intervention).
5	Assertiveness concerning the infectious focus	Patients who were discharged or died in less than 48 hours with no defined focus.	The infectious focus must be confirmed through examinations and/or clinical reassessment within 48 hours and will be considered compliant when, within the agreed time frame, this is recorded in the medical chart.
6	Correct antimicrobial administered within the first hour after the sepsis diagnosis	Not applicable.	The antibiotic will be considered correct when it complies with the institutional empirical antimicrobial guide and is administered within one hour of the sepsis diagnosis. Patients already using antimicrobials and who have not had their schedule changed, as it is understood that there was no indication of change, will be considered compliant.
7	Blood collection for blood cultures before antimicrobial administration	Not applicable.	It will be considered compliant when blood collection for blood cultures is performed before the administration of the antibiotic. Patients using antimicrobials will only be considered compliant if they have blood cultures collected within 72 hours before the sepsis diagnosis or if their antibiotic regimen has been changed with the previous collection of the examination.
8	Adequate volume replacement in patients with sepsis.	Not applicable.	For hypotensive patients or those with a lactate result greater than twice the reference value on average, adequate volume replacement means providing the volume corresponding to 30ml/kg of fluids within one hour after the hypotension or lactate result is found. For patients with contraindications to large volumes, it will be considered as compliant when there is a record in the medical record of the reason for not performing, or slower or smaller volume replacement. For the purposes of this criterion, the volume replacement record will be considered compliant when performed within the first 3 hours of the sepsis diagnosis. For patients who are not hypotensive or with lactate results

			twice below the reference value, the item will be considered as compliant.
9	Lactate access within 60 min of sepsis diagnosis	Not applicable.	Lactate should be collected and released within 60 minutes after the sepsis diagnosis.
10	Survival	End-of-life care patients.	It will be considered compliant when the patient survives the sepsis episode or when the death is not related to the sepsis.

* The term severe sepsis has ceased to be used since 2016 and was therefore changed in the second assessment.

Regarding the type of data, the first nine criteria analyzed were related to process, and the last was related to result, being that all had assessed the validity of face, content and criterion (scientific evidence).

After that, reliability was analyzed through a pilot study with 30 patients and two assessors. The agreement of the indicators was considered strong or perfect in all cases, considering that they had a Kappa index greater than or equal to 0.8.

Data analysis

In order to assess quality, before and after the intervention, the point estimate and the confidence interval (CI: 95%) of the level of compliance with the 10 adopted quality criteria were calculated.

With a view to assessing the effect of the intervention, the absolute and relative improvement of each criterion was estimated. In order to check the statistical significance of the detected improvement, a unilateral hypothesis test was performed by calculating the z-value, considering the absence of improvement as a null hypothesis, which was rejected when the p-value was less than 0.05. The choice of the unilateral test was because the hypothesis is clearly unidirectional (in the sense of improvement), and therefore the bidirectional test would be more restrictive.

Additionally, a graphic representation of the main quality problems identified in the assessments was elaborated. Initially, from a table of absolute and relative frequencies of non-compliance, a before-after Pareto chart was later designed, where it was possible to assess the achieved absolute improvement and compare the level of quality between the assessments. In order to facilitate the visualization of this chart, the data from the second assessment were standardized for a sample compatible with the first.

Ethical aspects

The study was approved by the Ethics and Research Committee with human beings of the Onofre Lopes University Hospital under the consubstantiated opinion nº 2.366.555, dated 11/06/2017.

RESULTS

Process of implementing the intervention

The description of the intervention implementation process is recommended to understand the effects of a study aimed to improve health care [12]. The intervention process lasted approximately ten months, from its conception to the second data collection in June 2018. In the initial phases, a sepsis committee was created and a leadership was appointed to improve this process. The first actions involved updating the sepsis protocol according to the most current scientific evidence, followed by the review of documents used to care for these patients (screening form and antimicrobial guide) and the assessment of the level of quality of care between September and November 2017. After analyzing the data of the quality criteria, the assessment was presented to the responsible teams and the restructuring of the sepsis care line took place. Permanent awareness actions for adherence to the protocol, definition of goals, presentation of monthly indicators, among others, were included. The details of the chronological sequence of the implementation of the intervention can be seen in **Figure 1**.

Figure 1: Timeline of proposed actions to improve quality. Juazeiro do Norte, CE, 2018.
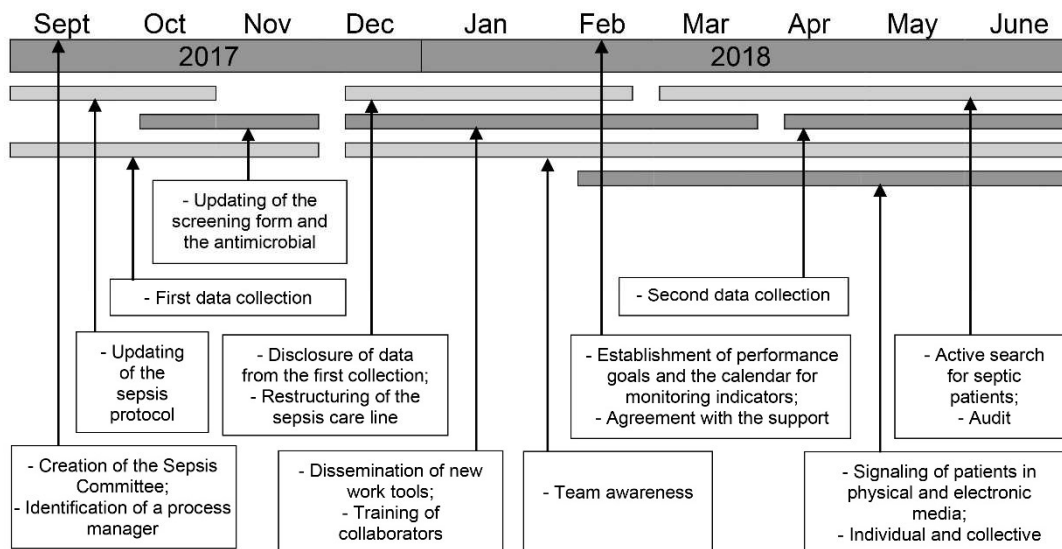
Improving the quality of care for patients with sepsis

There was an absolute improvement in all process criteria (criteria 1-9) and lethality (criterion 10), which decreased from 36% to 26% (p=0.005), according to **Table 3**. In the pre-intervention, seven criteria had compliance values of less than 75%, with

special emphasis on the reassessment within 3 hours (criterion 2) and correct reclassification (criterion 4), which had compliance percentages of 23% and 48%, respectively. After the intervention, the improvement was significant (p<0.05) in eight of the 10 criteria, and only two of them remained with a level of compliance below 75%. At this point, it is worth mentioning that the criteria "Reassessment within 3 hours" and "Collection of blood cultures before antimicrobials" obtained a relative improvement above 50%, achieving the highest rates observed. The total fulfillment of the criteria varied from 0 to 17.5%.

Table 3: Compliance with quality criteria and improvement estimates. Juazeiro do Norte, CE, 2018.

| Nº	Criterion	1st Assessment n=249 p1 (CI 95%)	2nd Assessment n=315 p2 (CI 95%)	Absolute Improvement p2 – p1	Relative Improvement p2-p1/1-p1	Statistical Significance* p
1	Early diagnosis	68 (62 – 74)	79 (75 – 83)	11	36	< 0.001
2	Reassessment within 3 hours	23 (18 – 27)	64 (59 – 69)	41	53	< 0.001
3	Correct classification	74 (67 – 77)	87 (83 – 91)	13	49	< 0.001
4	Correct reclassification	48 (42 – 54)	67 (62 – 72)	19	36	< 0.001
5	Assertiveness concerning the infectious focus	89 (85 – 93)	93 (90 – 96)	4	36	0.049
6	Correct antimicrobial administered within 1 hour	65 (59 – 71)	71 (66 – 76)	6	17	NS
7	Blood culture collection before antimicrobial	66 (60 – 72)	87(83 – 91)	21	63	< 0.001
8	Adequate volume replacement	83 (78 – 88)	91 (88 – 94)	8	47	0.002
9	Lactate within 60 min	80 (75 – 85)	82 (78 – 86)	2	10	NS
10	Survival	64 (58 – 70)	74 (69 – 79)	10	27	0.005

NS: Not significant, that is, p>0.05; * One-sided z-value test.
Source: Self-elaborated.

The initial assessment showed an absolute frequency of 843 non-conformities, which were reduced to 506 after the implementation of the proposed measures. In the chart

of the second assessment, it was possible to observe that the improvement achieved was 67% and that there was a reduction in the number of non-conformities of all criteria, which illustrates the effectiveness of the project (**Figure 2**).

Figure 2: Before-after Pareto diagram. Juazeiro do Norte, CE, 2018.
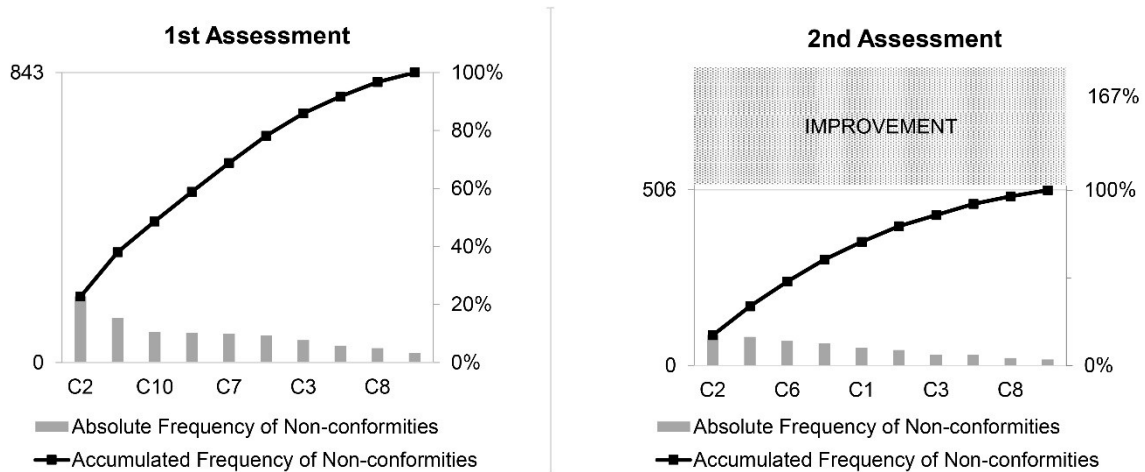
Despite the evident improvement, the results achieved by the criteria "Correct antimicrobial administered in the first hour" and "Adequate volume replacement" did not obtain statistical significance, represented by a p-value above 0.05.

Unintended consequences of the intervention

An unexpected beneficial result was the reduction in the rate of hospital stay of patients admitted with sepsis, which fell from an average of 16 to 13.7 days.

Although a constant improvement in the performance of care for septic patients has been observed, there has been great resistance on the part of surgeons and orthopedists to adhere to the proposed measures, despite the sensitization carried out. Another difficulty faced was the high degree of turnover of professionals.

DISCUSSION

Study contributions

This study contributed to improving the quality of care for patients with sepsis as it presented an intervention model capable of successfully increasing the compliance of the proposed quality indicators and decreasing the lethality in this group of patients considered a priority for hospital care. From the comparison with previous studies, this study stands out for having built indicators and specific intervention for patients cared for in the emergency department, a critical setting for the timely care of patients with sepsis, when most of the available studies address the ICU setting [5,14,17,18]. Moreover, the study included all patients in the analyzed period, without being affected by random errors in the sampling process.

There are few studies in low- and middle-income countries that assess the issue of quality improvement related to sepsis. In Brazil, these publications are practically restricted to those made by LASI, notably in the southeastern region of the country, in

such a way that this study, in addition to being part of a select and restricted group of national publications, is probably unprecedented in the northeast region, especially in emergency departments.

One of the particularities of this study was to describe the use of participatory and multifaceted improvement cycles as a management tool to change contexts. Improvement cycles are systematic and scientifically rigorous procedures to address quality objectives in the field of clinical governance and in the science of improving the quality of health care, where different models developed in the industry can be used, such as those proposed by Deming and Juran [13]. The participatory and multifaceted approach has been described and has shown excellent results [8,14,19,20].

Quality of care improvement

The improvement identified in this study can be explained by intrinsic components of the implemented multifaceted intervention, among which we can highlight the engagement of senior and middle management. Leadership is the central domain of quality improvement initiatives that underpin the development of all other actions, and it would be unlikely that any strategic intervention would be successful with no support of strong and consistent leadership [21]. This was the management model found in the CRH setting, which was involved in all phases of the project, including supporting intervention actions and collecting results.

In addition, the intervention setting was developed in a place where the health care team is used to working with a protocolized approach, and the organizational capacity is directed to the development of actions that facilitate the continuous improvement of quality. Within this context, collaborators received continuing education, aiming to bring the latest evidence on the management of septic patients, since staff training is among the main strategies associated with improvements in the outcome of these patients [8,19]. It is known that, in developing countries, there is a big gap between the provision of health care based on evidence and the treatment carried out at the bedside [22]. Concerning sepsis, this low awareness leads to late recognition of the disease and a consequent delay in therapeutic measures.

Another probable factor associated with the achieved result was the use of continuous auditing and feedback to professionals as instruments to boost adherence to the indicators. Setting standards, monitoring them, identifying and solving problems as they arise are strategies to increase compliance with indicators [7,23].

As an essential factor for the identified improvement, it is also possible to cite the restructuring of the clinical protocol for the care of septic patients in such a way that the screening tool started to be guided by nurses. The involvement of nursing in hospital processes is a known practice [7,20,24], where the initial screening performed by a nurse increased the compliance of criterion 1, which dealt with the early diagnosis of the disease, corroborating other publications [20,25], being this a key factor in reducing mortality [19].

The 10% reduction in lethality due to sepsis identified in this study is reinforced by other studies that aimed to increase adherence to treatment packages [17,18]. A study carried out on three continents showed that, for every 10% in the increase in compliance with good practices, there was a reduction in the lethality rate in the order

of 3 to 5% [17]. In Brazil, a study [26] that assessed 25 public institutions demonstrated an 8.3% increase in compliance with treatment packages and a 6.8% reduction in lethality. The greater reduction in lethality identified in the present study can be explained by the early identification of these patients, since the majority had the disease still recognized in the risk classification, the gateway of the emergency department, as well as by the lower severity of the patients and the initial level of compliance with good practices developed at the institution.

Although there is a divergence in the literature on the importance of using protocols for sepsis care, we believe that the protocolized approach was essential for the identified improvement. Some studies say that bedside treatment with timely use of fluids and antimicrobials is sufficient for the treatment of sepsis, with no need for guiding documents [27-29]. However, the trials were conducted with a more severe patient profile and in centers of excellence, where the usual treatment at the bedside can be comparable with the protocolized approach, a reality that is still far from many Brazilian hospitals and the target population of this study.

The intervention had a lesser effect for two quality criteria. Regarding the administration of the correct antibiotic, we believe that the high turnover of medical professionals in the emergency department, the lack of knowledge and lack of interest in seeking the institutional antimicrobial guide, as well as the low safety culture of some collaborators may have influenced this result. This may have limited the reduction in lethality, since the adequate choice of antibiotics in the first hour is associated with a survival rate of almost 80% [30]. The non-significant improvement in the release of the lactate result within 60 minutes may have occurred because the compliance of this criterion was high in the first assessment, due to the reduced number of collaborators in the laboratory sector, their non-involvement in the continuing education processes, as well as the distance of this sector to the emergency department. The increase in this parameter is considered the best marker of hypoperfusion available at the bedside and its result directly influences therapeutic measures [7]. It is suggested that these points are a priority in future improvement interventions.

Limitations

The study was conducted at a single center, as is the case with most quality improvement studies, so caution should be exercised when extrapolating the quality level estimates found to other centers. Another implication was the absence of a parallel control group, which does not allow us to say whether the mere availability of national recommendations had no effect on improving processes and results. The analysis of the lethality rate and length of hospital stay was crude, with no standardization for possible confounding variables that could have a different prevalence in the periods before and after the intervention. However, the result of the intervention is consistent with the reports of other studies, both for the health care concerning sepsis and for other clinical issues, suggesting that the improvement method was decisive in changing the local reality.

CONCLUSION

The intervention model presented was effective in improving the quality of care for sepsis in an emerging country, especially in the emergency department, and was associated with a reduction in the lethality rate. The presented findings have implications for researchers, health professionals and managers as an initiative to change realities, since the method is feasible and possibly sustainable in the long term. Future studies can identify the reasons for the lack of adherence by health professionals to some criteria, as well as appoint this model for emergency hospitals in the country, in an attempt to intervene in this important public health problem.

Acknowledgements

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