Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2024.79207

Early warning scale for identifying patients at risk of clinical deterioration

Escala de alerta precoce na identificação de pacientes com risco de deterioração clínica

Escala de alerta temprana en la identificación de pacientes con riesgo de deterioro clínico

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ABSTRACT

Objective: to evaluate the National Early Warning Score (NEWS) in relation to the type of outcome and profile of patients in the medical clinical ward of a hospital in Teresina, Piauí, Brazil. **Method:** a quantitative study conducted in a public hospital in Teresina, with 150 medical records of patients admitted to the medical clinic sector from February 2022 to December 2022, based on demographic and clinical records and scale values at admission and outcome. **Results:** there was an association between the scale values and the age group (p=0.029), length of stay (p=0.023) and type of outcome (p < 0.001). High clinical risk prevailed among male patients (13%), aged between 60 and 94 years (13%), with a stay of 21 to 57 days (19.2%), and death as an outcome (100%). **Conclusion:** implementation of the aforementioned scale proved to be fundamental for predicting clinical problems and improving care quality.
Descriptors: Nursing Care; Patient Care Team; Hospital Rapid Response Team; Clinical Deterioration; Vital Signs.

RESUMO

Objetivo: avaliar pontuação da *National Early Warning Score (NEWS*) em relação ao tipo de desfecho e perfil dos pacientes da enfermaria clínica médica de um hospital em Teresina, Piauí, Brasil. **Método:** estudo quantitativo realizado num hospital público, em Teresina, com 150 prontuários de pacientes internados no setor clínica médica de fevereiro de 2022 a dezembro de 2022, a partir de registros demográficos, clínicos e valores da escala na admissão e desfecho. **Resultados:** houve associação dos valores da escala com a faixa etária (p=0,029), tempo de internação (p=0,023) e tipo de desfecho (p < 0,001). Alto risco clínico prevaleceu entre pacientes do sexo masculino (13%), na faixa etária de 60 a 94 anos (13%), com permanência de 21 a 57 dias (19,2%) e óbito como desfecho (100%). **Conclusão:** implementação da referida escala evidenciou ser fundamental para prever agravos clínicos e melhorar qualidade da assistência.
Descritores: Cuidados de Enfermagem; Equipe de Assistência ao Paciente; Equipe de Respostas Rápidas de Hospitais; Deterioração Clínica; Sinais Vitais.

RESUMEN

Objetivo: evaluar el puntaje de la National Early Warning Score (NEWS) con respecto al tipo de desenlace y el perfil de los pacientes de la enfermería clínica médica de un hospital en Teresina, Piauí, Brasil. **Método:** estudio cuantitativo realizado en un hospital público en Teresina, con 150 historiales médicos de pacientes internados en el sector de clínica médica desde febrero de 2022 hasta diciembre de 2022, a partir de registros demográficos, clínicos y valores de la escala en la admisión y desenlace. **Resultados:** hubo asociación de los valores de la escala con la edad (p=0,029), tiempo de internación (p=0,023) y tipo de desenlace (p < 0,001). El alto riesgo clínico prevaleció entre los pacientes del sexo masculino (13%), en la franja de edad entre 60 y 94 años (13%), con una estancia de 21 a 57 días (19,2%) y fallecimiento como desenlace (100%). **Conclusión:** la implementación de dicha escala demostró ser fundamental para prever agravios clínicos y mejorar la calidad de la asistencia.
Descriptores: Cuidado de Enfermería; Grupo de Atención al Paciente; Equipo Hospitalario de Respuesta Rápida; Deterioro Clínico; Signos Vitales.

INTRODUCTION

Early identification of warning signs of clinical deterioration and the consequent reduction in mortality is a fundamental role of the multidisciplinary team. Approximately 80% of signs of clinical deterioration in hospitalized patients can be identified 24 hours before the event worsens[1].

These situations are commonly preceded by changes in vital parameters and a lack of assessment tools and documentation can hinder the ability to recognize this. Therefore, late identification can enable the appearance of irreversible changes in the respiratory, cardiovascular and neurological systems, increasing the risks of morbidity and mortality[2].

The Early Warning Scales are based on assessing vital signs and allocating points according to the changes found. Its purpose is to measure the risk of physiological deterioration of the patient, enabling early detection and action by the team in order to avoid complications[1].

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Editor in chief: Cristiane Helena Gallasch; Associate Editor: Sergio Corrêa Marques

Received: Sep 10th 2023 – Accepted: Jun 4th 2024

DOI: https://doi.org/10.12957/reuerj.2024.79207

Among the scales that measure the physiological deterioration of patients admitted to hospital units, the National Early Warning Score (NEWS) aims to identify adult patients at risk of clinical worsening in wards. The NEWS scale uses physiological parameters to obtain a score. Each parameter receives a specific score, which when added to the others, determines the condition severity[3].

The score is defined by the sum of the scores measured in assessing the consciousness level, temperature, heart rate, systolic blood pressure, respiratory rate, peripheral oxygen saturation and O_2 supplementation. The higher the score achieved in the physiological parameters, the higher the score achieved on the scale, and the greater the indication of clinical instability[4].

The NEWS Scale has four levels of clinical alertness as an assessment parameter, each with a corresponding response. Its null score (0) indicates the frequency of patient monitoring every 12 hours; scores of 1 to 4 indicate low clinical risk and monitoring every 4-6 hours; a score of 5 to 6, or a score of 3 in a single physiological parameter indicates average clinical risk and there must be monitoring at least every hour; finally, a score of 7 or more indicates high clinical risk and the need for continuous monitoring[3,5].

Early interventions conducted by rapid response teams can be activated with the implementation of warning scales, aiming to improve the evolutionary outcome and reduce the risk of injury, also contributing to lower treatment and care costs[6]. It is noteworthy that as the nursing team assists patients 24 hours a day and are responsible for the routine measurement of vital signs, they are often the first to identify possible manifestations of clinical worsening. Thus, nurses play an essential role in early recognition of signs and symptoms of a patient's clinical deterioration.

The NEWS Scale is a tool with the objective to also facilitate communication between healthcare teams, and between nursing and medical staff when deterioration of the patient's condition becomes apparent regarding their clinical parameters and recording observations. In this situation, there is the possibility of early intervention when necessary in order to avoid transferring the patient to intensive care units; and if the transfer is unavoidable, to ensure it occurs without delay. Therefore, it is essential for nurses to evaluate warning signs using the NEWS scale and take the necessary actions[7].

Consequently, the identification of clinical deterioration depends on pertinent observations by the healthcare team with the function of recognizing, communicating, intervening and documenting observations that may be reasons for immediate or future concerns in patient care in order to ensure effective and early intervention[8].

It is noteworthy that few national studies have addressed the application and performance of early warning scales in classifying hospital patients and monitoring vital signs, as well as the practice and effectiveness of systematized instruments to recognize patients in clinical deterioration[1,7,9].

Following this theme, the following research questions were defined: What are the National Early Warning Score (NEWS) values attributed to patients upon hospital admission and prior to their outcome? Is there an association between the clinical characteristics of patients and the NEWS scale score?

Given the context presented, the objective of this study was to evaluate the National Early Warning Score (NEWS) in relation to the type of outcome and profile of patients in the medical clinical ward of a hospital in Teresina, Piauí, Brazil.

METHOD

This is a descriptive, exploratory study with a quantitative approach conducted in the medical clinical sector of a public reference hospital in Teresina, Piauí, Brazil. This sector has a total of 32 beds distributed across 10 wards, two of which are for contact and respiratory isolation. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed to report the study.

Data collection took place from November 2022 to January 2023 based on information recorded in physical records. A form was used as a collection instrument that included variables on the sociodemographic and clinical profile, such as sex, age, main organic system affected, length of hospital stay, type of outcome in the medical clinic (discharge, transfer to the ICU or death) and the NEWS scale score values obtained at admission and prior to the patient's outcome.

The NEWS score result is recorded in a specific form in the patient's physical record in the medical clinic of this hospital to monitor this score. The values obtained from measuring vital signs are noted and then evaluated according to the parameters assigned by the scale. According to the score found, the frequency of reevaluation control is

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adjusted according to the patient's criticality and the professionals involved are notified for evaluation and determination of the conduct.

The NEWS scale uses an assessment of physiological parameters (systolic blood pressure, heart rate, respiratory rate, body temperature, consciousness level, peripheral oxygen saturation and use of O_2 supplementation) to obtain a score that increases according to the distance in relation to the normal range. According to the score achieved on the scale, the nurse classifies the patient as low, medium or high risk for clinical deterioration. Scores for medium to high clinical risk trigger several actions to be taken, such as: activating the rapid response team for assessment and determination of conduct, greater monitoring frequency or transfer to the ICU[7].

Considering an average of 20 monthly hospitalizations in the aforementioned research sector, the population corresponded to 220 medical records analyzed. Inclusion criteria were the records of patients admitted to the medical clinic sector from February 2022 (when the NEWS scale was implemented) to December 2022. The exclusion criteria were erased records, or those with incomplete data, which indicated transfer to another sector other than the ICU (Intensive Care Unit), and the medical records of patients who died before applying the scale. This resulted in a sample of 150 medical records.

The data were analyzed using SPSS® version 20.0, presented in tables with absolute, relative frequencies, mean and standard deviation. The Chi-squared test and likelihood ratio were used to verify the association between the scale and sociodemographic and clinical variables, with analyzes with $p<0.05$ being considered statistically significant.

The research protocol was approved by the Research Ethics Committee of the institution involved, with no need to obtain an Informed Consent Form (ICF), assuming the commitment to ensure confidentiality and privacy regarding the accessed information.

RESULTS

The demographic and clinical characteristics of the 150 participants patients are shown in Table 1.

Table 1: Demographic and clinical characterization of patients (n=150). Teresina, PI, Brazil, 2023.

Variables		n	f(%)
Sex	Female	73	48.7
	Male	77	51.3
Age range (years)	16 - 30	21	14.0
	31 - 45	40	27.6
	46 - 59	43	28.7
	60 - 94	46	30.7
Length of stay (days)	1 - 5	34	22.7
	6 - 10	34	22.7
	11 - 15	32	21.3
	16 - 20	24	16.0
	21 - 57	26	17.3
Affected system	Neurological	06	4.0
	Respiratory	25	16.7
	Cardiological	01	0.7
	Gastrointestinal	26	17.3
	Hepatic	50	33.3
	Renal	04	2.7
	Hematological	20	13.3
	Immunological	09	6.0
	Orthopedic	07	4.7
	Rheumatological	02	1.3
Outcome	Discharge	138	92.0
	Deatch	05	3.3
	ICU	07	4.7

The average age was 51.16, ranging from 16 to 94 years old, with a predominance of males (51.3%). The shortest length of stay regarding hospitalization was one day, and the longest was 57 days, with the average stay in the medical clinic being 13.43 days. The clinical diagnoses were the most varied, with involvement of the hepatic system (33.3%)

DOI: https://doi.org/10.12957/reuerj.2024.79207

being the main reason for admission to the sector, followed by gastrointestinal (17.3%) and respiratory (16.7%) involvement. Of the total, 138 (92%) were discharged from the medical clinic and the rest were transferred to the ICU (4.7%), or death (3.3%) was the outcome.

Table 2 shows the comparison of the mean and standard deviation values of the NEWS scale between arrival (admission) and the outcomes of discharge, death or transfer to ICU.

Table 2: Comparison of the mean and standard deviation values of the National Early Warning Score (NEWS) between arrival (admission) and the outcomes of discharge, death and transfer to ICU (n= 150). Teresina, PI, Brazil, 2023.

National Early Warning Score (NEWS) scale values		Mean	Standard deviation
NEWS - Patients who were discharged as an outcome (n=138)	Admission	2.09	1.875
	Discharge	1.94	1.574
NEWS - Patients who presented death as an outcome (n=5)	AdmissionD	2.20	0.447
	eath	8.80	2.168
NEWS - Patients who were transferred to the ICU as an outcome (n=7)	Admission	1.43	1.512
	ICU	9.71	2.138

Patients who were discharged from the medical clinic unit as an outcome had an average of less than 3.0 on the NEWS scale both at admission and at the discharge time, showing a low clinical risk for physiological deterioration.

For those who died as an outcome, the mean NEWS upon admission was 2.20 and the average that preceded death was 8.80, showing an increase in the scale parameter scores and consequently evolution in the severity of these patients and the high clinical risk for physiological deterioration.

The mean NEWS upon admission for patients who were transferred to the ICU as an outcome of the medical clinical unit was 1.43, and the mean prior to the outcome was 9.71. The worsening of the clinical picture is noted, with evolution from low risk to high clinical risk of physiological deterioration in these patients.

Tables 3 and 4 shows a significant association between the NEWS scale and the variables: age group (p=0.029), length of hospital stay (p=0.023) and type of outcome (p < 0.001).

Table 3: Distribution of the number of patients according to sex, age range, length of stay and clinical risk classification (National Early Warning Score Scale - NEWS) and sociodemographic and clinical characteristics (n=150). Teresina, PI, Brazil, 2023.

	NEWS Scale Classification at Outcome Clinical risk			
Sociodemographic and clinical variables	**Low n (%)**	**Medium n (%)**	**High n (%)**	***p-value**
Sex				0.207[1]
Male	56 (72.7)	11 (14.3)	10 (13.0)	
Female	61 (83.6)	8 (11.0)	4 (5.5)	
Age range (years)				**0.029**[2]
16 - 30	21 (100.0)	-	-	
31 - 45	30 (75.0)	5 (12.5)	5 (12.5)	
46 - 59	31 (72.1)	9 (20.9)	3 (7.0)	
60 - 94	35 (76.1)	5 (10.9)	6 (13.0)	
Length of stay (days)				**0.023**[2]
01 - 05	32 (94.1)	1 (2.9)	1 (2.9)	
06 - 10	29 (85.3)	4 (11.8)	1 (2.9)	
11 - 15	23 (71.9)	4 (12.5)	5 (15.6)	
16 - 20	19 (79.2)	3 (12.5)	2 (8.3)	
21 – 57	14 (53.8)	7 (26.9)	5 (19.2)	

Notes: 1: Chi-squared test; 2: Likelihood ratio test.

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Table 4: Distribution of the number of patients according to sex, age range, length of stay and clinical risk classification (National Early Warning Score Scale - NEWS) and sociodemographic and clinical characteristics (n=150). Teresina, PI, Brazil, 2023.

	NEWS Scale Classification at Outcome Clinical risk			
Sociodemographic and clinical variables	**Low n (%)**	**Medium n (%)**	**High n (%)**	***p-value**
Affected system				0.080[2]
Neurological	5 (83.3)	1 (16.7)	-	
Respiratory	16 (64.0)	5 (20.0)	4 (16.0)	
Cardiological	1 (100.0)	-	-	
Gastrointestinal	24 (92.3)	2 (7.7)	-	
Hepatic	35 (70.0)	6 (12.0)	9 (18.0)	
Renal	4 (100.0)	-	-	
Hematological	17 (85.0)	2 (10.0)	1 (5.0)	
Endocrine	-	-	-	
Immunological	9 (100.0)	-	-	
Orthopedic	4 (57.1)	3 (42.9)	-	
Rheumatological	2 (100.0)	-	-	
Outcome				**< 0.001**[2]
Discharge	117 (84.8)	18 (13.0)	3 (2.2)	
Death	-	-	5 (100.0)	
ICU	-	1 (14.3)	6 (85.7)	

Legend: 1- Chi-squared test; 2- Likelihood ratio test

High clinical risk prevailed among male patients (13%), aged 46 to 94 years (20%), with length of stay of 16 to 57 days (27.5%), and with death as the clinical outcome (100%). In relation to the affected system, patients with affected hepatic (18%) and respiratory (16%) systems were at greater risk for clinical deterioration.

DISCUSSION

It is necessary to apply scales in the hospital environment and especially for critical patients to recognize clinical deterioration. The use of NEWS was verified in this study with patients hospitalized in the medical clinical ward, the results of which showed that this scale is an important predictive tool for early warning signs.

The progressive increase in the scale value was related to worsening of the patient's clinical status and the outcome of transfer to the ICU or death. A higher prevalence of high clinical risk was observed among male patients, older, with an affected liver system, mainly due to cirrhosis and alcoholic hepatitis and with a longer hospital stay.

Research shows that NEWS is a good indicator of increased severity and mortality in patients with different clinical profiles, for example, in patients with sepsis, surgical patients and respiratory diseases[9].

A study which analyzed scientific publications on the use of early warning scores in tertiary services as tools for identifying clinical deterioration in patients with suspected or diagnosed sepsis showed that NEWS was the most used and most accurate score for predicting hospital mortality and admission to the Intensive Care Unit (ICU)[10].

Regarding its use in the ward, studies indicate that NEWS provides early detection of instabilities most of the time, leading to rapid intervention and possible transfer from this less complex environment to a more complex one[11]. This corroborates the present study, in which an increase in the average NEWS score was observed during the hospitalization period from 1.43 to 9.71 in those patients who were transferred to the ICU as an outcome, highlighting clinical worsening.

Conversely, it can also occur when patients are transferred from the ICU to the clinical ward. The results of a study conducted in a tertiary hospital in Norway showed that deterioration of surgical ward patients previously treated in the ICU was preceded by an increase in the NEWS value, which ranged from medium to high risk. Thus, it suggests that monitoring with NEWS in the surgical ward is important after ICU discharge[12].

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Another application of early warning scores is in the risk stratification of patients infected by SARS-CoV-2, with complications such as Respiratory Distress Syndrome. A study which aimed to evaluate the prognostic accuracy of NEWS2 (updated version of NEWS) in predicting clinical deterioration in patients with COVID-19 showed that a threshold of 5 resulted in high sensitivity (0.83), moderate specificity (0.65) and good discrimination (0.82). This means that early interventions should be implemented for patients with COVID-19 with more than five NEWS2 points, as the clinical situation of these patients is expected to deteriorate rapidly[13]. In another study conducted in a hospital in Rio Grande do Sul, the cut-off point for predicting mortality in patients with COVID-19 was greater than or equal to 6 points[14]. Similarly, the original NEWS scale used in the present study assesses that a score of 5 to 6 points constitutes medium clinical risk and greater than 7 as high clinical risk, and that professionals should be called in for rapid intervention and continuous monitoring. It was possible to observe an association between NEWS and the type of outcome, in which lower score values upon admission were associated with hospital discharge, while higher values were associated with death or transfer to the ICU.

One of the challenges of applying early warning scales is professionals' adherence to the recommended intervals for monitoring vital signs. The conformity or otherwise of the interval between measurements of vital parameters with that recommended by NEWS has been analyzed in studies which show that as the scoring categories in NEWS progress (indicating recommendations for increasingly shorter vital sign measurement intervals), the lower the compliance[15,16].

A study conducted in an emergency room at a university hospital in São Paulo found that the use of NEWS enabled monitoring vital signs on an individual basis and increased compliance with the recommended intervals for monitoring vital signs. However, this compliance decreased as the NEWS score recommended a shorter vital signs' monitoring interval[9].

The high demand of patients, the scarcity of human resources and the limited time to perform activities were considered barriers to non-adherence to the monitoring frequency recommended by early detection systems for clinical deterioration[17].

The literature points to other early warning scales with similar parameters which were based on the original version of the Early Warning Score (EWS), and which are based on assessing vital signs and attributing points according to the changes found.

The Modified Early Warning Score (MEWS) is one of the tools used, especially upon emergency admission and during hospitalization in the ward. Research with patients admitted to the ICU of a university hospital in Minas Gerais showed that the mean MEWS value lower than 3 was related to patients who were discharged from the ICU (63.6%), and a mean of 5 was an assessment which preceded the death (36.4%). There was an association between MEWS and death in the ICU, which highlighted the predictive power of this scale for irreversible and unwanted outcomes. There is a certain consensus that a MEWS value of 5 or more is generally associated with imminent clinical instability[4].

Accordingly, the present study showed that patients who were discharged as an outcome from the medical clinical ward also had a mean NEWS value lower than 3.0, demonstrating a low clinical risk for physiological deterioration. On the other hand, the average NEWS value between 8 and 10 was related to the outcome of death or transfer to the ICU.

Studies which compared NEWS with other types of early warning scores, such as the quick Sequential Organ Failure Assessment Score (qSOFA) and Systemic Inflammatory Response Syndrome (SIRS), showed that NEWS obtained better results in predicting the early detection of critical clinical conditions, such as sepsis, cardiovascular emergencies and serious respiratory diseases. NEWS obtained equivalent or higher values for most scale characteristics in relation to SIRS and qSOFA[18,19].

Given the context presented, the importance of applying NEWS by the healthcare team as a tool to measure the patient's risk of clinical deterioration is highlighted, enabling early detection and action to minimize the risk of death, cardiorespiratory arrest, and other serious events. Applying a predictive scale offers greater autonomy to nurses by helping with decision-making when faced with acute events and improves communication between professionals in the units.

Although NEWS presents good evidence in various clinical settings, it is important to highlight that it should not be used as the only metric for risk stratification, but rather as a complement to clinical judgment, not as a replacement[20].

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The main limitations of NEWS are that measuring it requires trained professionals and can be prone to calculation errors. It is also worth remembering that the use of this score is aimed at assessing the risk of acute complications in adult clinical and surgical patients, and should not be performed on pediatric patients (in this case PEWS - Pediatric Early Warning Score, stands out), or pregnant women (in this case MEOWS - Modified Early Obstetric Warning Score, is suggested) because the physiological response to acute illness is different in these groups[20].

The need for training the health team to accurately measure parameters is reinforced in order to understand the meaning of NEWS and knowledge of clinical conduct according to risk classification. Such actions are important to generate reliable information which favors decision-making regarding the patient's situation.

Study limitations

The limitation of the study was characterized by the fact that data collection was concentrated in just one hospital clinic, which makes it difficult to generalize the findings. The use of the NEWS scale is still an experimental practice in the aforementioned hospital where the study was conducted, only so far being adopted in the routine of the medical clinical sector, with the opportunity to expand its application to other sectors. Another limitation was the scarcity of studies which have addressed applying early warning scales, such as NEWS.

It is suggested that studies with NEWS be expanded to other sectors of the hospital, as well as checking the adherence of health professionals in applying the scale and the effect of using it on the interval of vital signs monitoring records as per recommended by the system for patients.

CONCLUSION

This study observed an association between NEWS and the type of outcome, which highlights the importance of the scale as a predictive tool for early warning signs. Patients who needed to be transferred to the ICU or died had an average of greater than or equal to eight in the NEWS score at the moment before the outcome, indicative of a clinical condition as recommended by the scale.

The main contribution of the study and implications for practice is that it demonstrated the effectiveness and importance of NEWS in identifying signs of physiological deterioration in patients in the in-hospital environment. It is hoped that with this study good care practices can be disseminated and thus improve the care provided by nursing professionals and patient safety.

The data highlighted the importance of implementing the NEWS scale in healthcare in the in-hospital context, as it is a tool with the potential to predict clinical problems, favor early recognition of warning signs and thus reduce undesirable outcomes.

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Conceptualization, A.S.C.A.; methodology, A.S.C.A. and B.V.S.S.; software, A.S.C.A., B.V.S.S. and PC.A.; validation, A.S.C.A. and B.V.S.S.; formal analysis, A.S.C.A. and B.V.S.S.; investigation, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; resources, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; data curation, A.S.C.A. and B.V.S.S.; manuscript writing, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; writing – review and editing, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; visualization, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; supervision, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A.; project administration, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and P.C.A.; funding acquisition, A.S.C.A., B.V.S.S., E.S.B.R., S.M.G.B. and PC.A. All authors read and agreed with the published version of the manuscript.