Original Article

Early Clinical Deterioration Risk Assessment in Inpatient Units of a Public University Hospital

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Abstract

Background: Clinical deterioration occurs due to changes in vital signs, which can be identified early to prevent negative outcomes. We used the NEWS2 system to assess the potential for early clinical deterioration in adult inpatient units at a public university hospital in southeastern Brazil. **Materials and Methods:** This was an exploratory study conducted at a public hospital in southeastern Brazil, following the guidelines of the Reporting of Strengthening Observational Studies in Epidemiology (STROBE) initiative. Data was collected from January to April 2021, involving 251 inpatients. A questionnaire was used to gather sociodemographic and clinical data, and the Brazilian version of NEWS2 was used to assess the risk of clinical deterioration. Data analysis included descriptive analyses, linear correlation tests, and comparative tests. **Results:** The average NEWS2 score was 2.9 points among 251 patients, indicating a moderate level of care complexity and recommending assessment by a registered nurse every 4–6 hours. There was no significant correlation between age and NEWS2 score, but the NEWS2 score was significantly higher for men. **Conclusions:** This study highlights the necessity of using robust assessment tools to evaluate the risk of early clinical deterioration, enabling clinicians to manage patient conditions effectively.

Keywords: *Clinical deterioration, hospitalization, nursing, patient safety*

Introduction

The clinical assessment of patients often relies on the monitoring of Vital Signs (VS), which serve as early indicators of actual or potential critical conditions requiring increased attention in inpatient units.[1,2] Alterations in these vital signs can significantly elevate the risks of Cardiopulmonary Arrest (CPA), unplanned admissions to Intensive Care Units (ICU),[3] and hospital mortality. Prompt identification of these alterations is crucial, as delays in intervention can exacerbate hospital mortality rates, while early recognition can enhance survival rates and improve patient outcomes.[1,4]

In the United States, over 200,000 adults experience in-hospital cardiac arrests each year, many of which could be prevented through the timely identification of VS deviations and the rapid implementation of intensive therapies. CPA often manifests abruptly, leading to the cessation of vital functions and immediate loss of consciousness, underscoring the critical importance of swift intervention to prevent irreversible brain damage and death.[4]

Nurses typically play a frontline role in detecting clinical changes, with routine vital sign assessments being a crucial indicator of an individual's evolving clinical status.[4] Given the link between nursing observations and patient outcomes, early recognition of warning signs by nursing staff is essential to prevent adverse events, such as in-hospital CPA, and to promote patient safety. However, early recognition must be complemented by effective intervention strategies to optimize patient outcomes.[5,6] The study utilized the National Early Warning System 2 (NEWS2), a globally used tool, to assess the potential for early clinical deterioration in adult inpatient units at a public university hospital in southeastern Brazil.

Materials and Methods

Data were collected over a four-month period, beginning in January and ending in April 2021. This was a cross-sectional and exploratory study that adhered to the principles of the STROBE initiative,[7] aiming to estimate the risk of early clinical

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deterioration in inpatient units of a university hospital in southeastern Brazil. Given the scarcity of data on clinical deterioration in this region, it was necessary to conduct an exploratory study to initiate investigations and explore the topic.

The sample size was based on the number of beds available in the study setting, totaling 302 beds. However, only 251 patients were included in this phase, as some beds were temporarily unavailable due to isolation measures. A convenience sampling approach was employed, considering all hospital beds in each unit for assessment. Data[8] were collected from medical records within the inpatient unit, focusing on information relevant to NEWS2.[9,10] Vital signs were recorded upon admission, and each bed was evaluated once to provide a comprehensive overview of the institution's situation.

Inclusion criteria encompassed patients admitted to the clinical and surgical inpatient units, provided they could give consent or had guardians sign consent forms on their behalf. This study excluded participants under 18 years of age and pregnant women. Patients were informed about the study's purpose, benefits, risks, compensation, and reimbursement. They were included upon expressing agreement and signing or initialing the informed consent form. There were no refusals, but hospital beds were sometimes vacant or blocked, requiring revisits until the necessary information could be obtained. Data were analyzed using the Statistical Package for the Social Sciences (SPSS), IBM SPSS Statistics (developed by BM, International Business Machines Corporation), version 24.0.[11] Descriptive statistics, linear correlation tests, and comparative tests were conducted to assess associations between sociodemographic and clinical variables.

Ethical considerations

The research received approval from the local Institutional Review Board (Approval Document nº37499220.9.0000.5404). Written consent was obtained from all participants, and confidentiality of data was ensured. Participants were assigned anonymous identification numbers.

Results

The sample was characterized by most females (64.5%), with a mean age of 55 [Table 1]. The NEWS2 score averaged 2.9 points, classifying patients as medium or moderate complexity [Table 2]. Correlation analysis using Spearman's coefficient did not show a significant correlation between age and the NEWS2 score (r = 0.11; p = 0.09; n = 251) [Table 3].

The Mann-Whitney test compared genders regarding the NEWS 2 score. Data distribution was evaluated using the Shapiro-Wilk test. Comparative analysis suggests that the risk score for early clinical deterioration is significantly higher for males than for females (3.3 × 2.6, respectively; p = 0.05) [Table 4].

Discussion

We identified a population with an average age of 55 years. This data is similar to other epidemiological, descriptive,

Table 1: Sample characterization (*n*=251). Campinas, 2021

Variable	*n* (%)	Mean (SD*)	Median (IQR**)	Min-Max
Gender (*n*=248)				
Male	100 (40.34)			
Female	148 (59.66)			
Age		54.69 (17.76)	58.00 (12.00)	15–95
Age Group				
15–29 years	32 (13.28)			
30–59 years	100 (41.49)			
≥60 years	109 (45.23)			
Hospitalization Condition (*n*=250)				
Genitourinary	25 (10.42)			
Cardiovascular	48 (20.00)			
Gastrointestinal	23 (9.58)			
Infections Disease	16 (6.67)			
Other Chronic Noncommunicable Diseases	18 (7.50)			
Neuromuscular/Bones	33 (13.75)			
Covid	29 (12.08)			
Respiratory	4 (1.67)			
Hematological	17 (7.08)			
Others	12 (5.00)			
Psychiatric	15 (6.25)			

*Standard deviation. **Interquartile range

Table 2: Total risk score for early clinical deterioration (*n*=251). Campinas, 2021

Variable	*n*	Mean (SD*)	Median (IQR**)	Min–Max
NEWS2 – Total score	251	2.88 (2.41)	2,00 (3)	0–11

*Standard deviation. **Interquartile range

Table 3: Spearman Correlation of the total risk score for early clinical deterioration and age. Campinas, 2021

Variable	NEWS2 – Total score *r* (*p*)
Age	0.11 (0.09)

Table 4: Comparison of the total risk score for early clinical deterioration between genders and age. Campinas, 2021

News2 Score	Variables	*n*	Mean (SD*)	Median (IQR**)	Min–Max	*p****
	Gender					
NEWS2	Male	100	3.29 (2.65)	3.00 (4)	0–11	0.05*
	Female	148	2.58 (2.16)	2.00 (3)	0–9	
	Unknown	3	-	-	-	
	Age (years)					
	15–29	32	2.09 (1.25)	2.00	0–5	
NEWS2	30–59	100	2.96 (2.60)	2.00	0–10	0.32****
	≥60	109	3.05 (2.47)	3.00	0–11	

*Standard deviation. **Interquartile range. ****p* for the Mann–Whitney test. *****p* for the Kruskal–Wallis test

and retrospective studies that showed that more than half of hospitalizations were associated with individuals aged between 40 and 69 years.[12-14]

In terms of assigned sex at birth, the majority of the subjects were female (64.5%), which contrasts with existing literature where a higher prevalence of male patients has been reported.[15] This discrepancy may be attributed to prevention strategies specifically targeting the male population, thereby mitigating complications and injuries, and subsequently reducing the duration of hospital stays for men in certain units.[16,17] It is important to note that in Brazil, such data predominantly emerge from studies examining the profile of patients admitted to intensive care units. Research focusing on the profiles of patients in general hospitalization units remains limited. Studies that highlight sociodemographic and epidemiological attributes of hospitalized individuals contribute to the solidification of changes in care approaches. Additionally, they result in improved unit administration and provide insights into the costs associated with care, whether from a human, structural, procedural perspective, or even treatment management.[12]

The average NEWS2 score obtained in our study was 2.9 points. This score suggests medium or moderate complexity of required care, as it recommends that the patient's assessment be repeated for at least 4 to 6 hours, monitored, increased parameters recorded, and the necessary care offered. For the score range of 1–4, the appropriate care comprises informing a registered nurse, who must assess the patient and decide whether an increased frequency of monitoring and/or escalation of care is required.[18]

A similar study conducted in the same setting during the COVID-19 pandemic, with 399 patients, found similar sociodemographic and clinical characteristics.[7] The average age of the patients was 55.5 years; however, the patients were predominantly male (68.9%). The NEWS2 score at admission was 2. The NEWS2 sensitivity and specificity for scores of 5 or greater were 93.3% and 70.7%, respectively.

Some studies that evaluated the employability of NEWS2 in patients with coronavirus, for example, demonstrated that the score has better specificity than sensitivity.[19] However, it was mentioned by most of them as a usable score for analyzing the risk of clinical deterioration in patients affected by the coronavirus. Some studies analyzed suggest complementing the score with clinical/physiological parameters for better risk stratification among patients diagnosed with coronavirus infection.[20]

Spearman's correlations showed no significant correlation between age and the risk score for early clinical deterioration. This finding corroborates the need for NEWS to be adapted to older adults. One of the initiatives undertaken by the group responsible for the NEWS to enhance the tool's accuracy for the older population was to incorporate updates, including adding "new confusion" as a category for assessing the level of consciousness in NEWS2. However, the literature suggests that NEWS2 may still require further adaptations for older adults in future iterations and should be used in conjunction with other clinical assessments.[21]

The comparative analysis between assigned sex at birth and NEWS2, in our study, shows that the score is significantly higher for males than for females. Several factors could potentially explain this. Biological differences play a role, as males and females have different physiological responses to illness and injury, with men potentially presenting more severe symptoms for certain conditions. The prevalence of comorbidities, such as cardiovascular diseases which are more common and severe in males, may also contribute to higher NEWS2 scores. Health-seeking behavior differences are another factor; men may delay seeking medical attention until their conditions are more severe, resulting in higher scores upon admission, whereas women might seek medical care earlier. Additionally, certain diseases present differently in males and females, with symptoms often being more subtle in females, potentially leading to lower NEWS2 scores. Lifestyle factors such as higher rates of smoking, alcohol consumption, and occupational hazards among males can lead to more severe illnesses and higher NEWS2 scores. Lastly, social and environmental

factors, including different stressors experienced by men and women, can influence health and the severity of conditions.

Regular assessment of early clinical deterioration risk involves vigilant monitoring of vital signs, symptoms, and relevant indicators. Detecting even subtle changes in these parameters can serve as an early warning sign for the emergence of complications. This early detection allows healthcare providers to intervene quickly, preventing the progression of conditions that could compromise patient safety.[22] Such interventions may include adjustments to medication regimens, targeted treatment initiation, care plan modification, or even timely transfers to specialized units.

An assessment using an appropriate tool can effectively mitigate disease severity and reduce the likelihood of adverse outcomes.[23] A study that evaluated 214 ICU patients confirmed the predictive value of NEWS2 in seriously ill adults—more than 70% of the population with a score above 3 points, with an average above 5 points, came from an inpatient unit with high morbidity at the time of admission in the ICU.[14]

The literature supports that most patients admitted to Intensive Care Units or with a cardiopulmonary complication present clinical deterioration hours before the event. More than 80% of these patients could be identified approximately 24 hours before these serious adverse events if there were some systems to assess clinical deterioration in inpatient units.[24] Therefore, identifying patients in inpatient units who can benefit from Intensive Care Units becomes crucial.[25]

Nursing activities play a fundamental role in meeting the needs of patients in the hospital environment. Every nursing task must be supported by critical thinking and producing clear and precise documentation. This documentation, like the NEWS2 scoring systems, is essential for effective interprofessional communication and the evaluation of nursing care. High-quality nursing practices improve patient and family satisfaction, safety, and cost-effectiveness.[26]

Regular clinical assessment, such as using NEWS2, also promotes better communication between healthcare teams. When doctors openly share observations and concerns regarding a patient's deteriorating condition, collaborative decision-making ensues, leading to more effective treatment strategies and better patient outcomes.[27]

The study encountered several limitations attributable to the COVID-19 pandemic. Throughout the study period, hospital beds within the inpatient units were predominantly allocated to patients either suspected of or confirmed with a diagnosis of COVID-19. This shift in patient demographics not only altered the population under observation but also constrained the ability of researchers to collect data effectively during this period. Initially, the study intended to administer the NEWS 2 protocol within 24 hours of patient admission to the unit. However, given the constraints of limited resources and the hospital's structural and procedural adaptations, an alternative approach was deemed necessary for data collection. Consequently, data retrieval relied on an active review of patient medical records, focusing on vital signs documented upon admission and nursing notes, without directly interacting with the patients.

It is, therefore, necessary to foster the use of the NEWS2 in hospital units. Its ability to anticipate the physiological deterioration of patients and prevent undesirable and irreversible results, in addition to being simple to handle and interpret by health professionals, makes it a unique tool. This practice is a cornerstone of patient safety, promoting timely interventions, personalized care, and, ultimately, better outcomes.

This study has limitations that should be considered when interpreting the results. Firstly, the lack of robust scientific evidence regarding the application of the NEWS2 score in clinical patient monitoring in Brazil underscores the need for research conducted across multiple centers.[28] The research was conducted in a single university hospital in southeastern Brazil, which may limit the generalizability of the findings to other institutions and regions. The absence of data from various centers could reduce the representativeness and applicability of the study's conclusions in different contexts within the country.

Conclusion

This exploratory analysis of inpatient units' data of a large Brazilian public university hospital focused on a pioneer utilization of the NEWS2 in this setting. The findings effectively characterized the studied sample regarding NEWS2 scores and showcased its potential as a robust instrument for ensuring safe, high-quality patient care in public health. In alignment with existing literature, this study underscores the imperative for public healthcare services to adopt robust tools for gauging the likelihood of early clinical decline.

As a result, the assessment of patient complexity holds promise as a future management tool, with far-reaching implications for enhancing multidisciplinary care quality and optimizing bed allocation, patient classification, and nursing dimensioning, particularly within intensive care settings, ultimately contributing to reducing hospital mortality rates. Prospective research avenues might explore additional correlations, particularly about critical clinical outcomes, such as the frequency of admissions to intensive care units, overall hospital mortality rates, patient classification tools, and nursing dimensioning.

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Conflicts of interest

Nothing to declare.

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