REUFSM
REVISTA DE ENFERMAGEM DA UFSM

UFSM
Rev. Enferm. UFSM - REUFSM
Santa Maria, RS, v. 10, e5, p. 1-14, 2020
DOI: 10.5902/2179769238300
ISSN 2179-7692

Original Article Submission: 28/05/2019 Acceptancel: 14/10/2019 Publication: 08/01/2020

Predictive power of the early warning scale for clinical deterioration of critically ill patients

Poder preditivo de uma escala de alerta precoce para deterioração clínica de pacientes críticos

Poder predictivo de una escala de alerta precoz para el deterioro clínico de pacientes críticos

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Abstract: Aim: to evaluate the predictive power of the modified early warning scale to identify clinical deterioration in critically ill patients. **Method:** a descriptive, quantitative study in a teaching hospital with 214 individuals in the intensive care unit, through review of medical records, from March to December 2018. **Results:** the average length of stay was 10.42 days and respiratory diseases were the main cause of admission. Among the population studied, 136 (63.6%) were discharged and 78 (36.4%) died. Of the 78 patients (36.4%) who died, the mean early warning scale score at the moment of admission was 3.410 and the mean before death was 5.000. **Conclusion**: the early warning scale used in this study was considered a reliable instrument to identify clinical deterioration in patients and it is therefore recommended for the prevention of cardiorespiratory arrest in adults in the hospital environment.

Descriptors: Disease severity index; Intensive care units; Patient's severity; Patient Care Team

Resumo: Objetivo: avaliar o poder preditivo de uma escala de alerta precoce modificada para identificação de deterioração clínica em pacientes críticos. **Método:** estudo descritivo, quantitativo, em hospital de ensino, com 214 indivíduos na unidade de terapia intensiva, por meio de revisão dos prontuários, de março a dezembro de 2018.

Resultados: o tempo médio de permanência foi de 10,42 dias e as doenças respiratórias consideradas a principal causa de admissão. Dentre a população estudada, 136 (63,6%) obtiveram alta e 78 (36,4%) foram a óbito. Dos 78 pacientes (36,4%), a média do escore da escala de alerta precoce para deterioração na admissão foi de 3,410 e a média que antecedeu o óbito foi de 5,000. **Conclusão:** considerou-se a escala de alerta precoce utilizada neste estudo, um instrumento fidedigno para identificação da deterioração clínica, recomendando-a para prevenção de parada cardiorrespiratória em adultos no ambiente hospitalar.

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Descritores: Índice de gravidade de doença; Unidades de terapia intensiva; Gravidade do paciente; Equipe de assistência ao paciente

Resumen: **Objetivo:** evaluar el poder predictivo de una escala de alerta temprana modificada para identificar el deterioro clínico en pacientes críticos. **Método:** estudio descriptivo y cuantitativo en un hospital universitario con 214 personas en la unidad de cuidados intensivos, por revisión de registros médicos, de marzo a diciembre de 2018. **Resultados:** la duración promedio de la estadía fue de 10.42 días y el enfermedades respiratorias consideradas principal causa de ingreso. Entre la población estudiada, 136 (63.6%) fueron dados de alta y 78 (36.4%) murieron. De los 78 pacientes (36,4%), la puntuación media de la escala de advertencia temprana para el deterioro de la admisión fue de 3.410 y la media antes de la muerte fue de 5.000. **Conclusión:** la escala de alerta utilizada en este estudio se consideró un instrumento confiable para identificar el deterioro clínico, recomendándolo para la prevención del paro cardiorrespiratorio en adultos en el entorno hospitalario.
Descriptores: Índice de gravedad de la enfermedad; Unidades de cuidados intensivos; Severidad del paciente; Equipo de atención al paciente

Introduction

Patients considered serious or potentially serious are referred for hospitalization in hospital units and require specific and accurate care, often in Intensive Care Units (ICU).[1] In these units, they may undergo physiological deterioration during hospitalization, usually characterized by change in heart rate, respiratory rate, blood pressure, temperature, and level of consciousness. If identified early, physiological deterioration can be prevented and, in turn, decrease hospital mortality.[2]

In order to measure the quality and effectiveness of the care provided to critically ill patients during the period of hospitalization, scales were created by the end of the 20th century to meet these objective.[3] Severity scales or scores aim to provide resources that establish a parameter to identify the clinical evolution of patients and indicate signs of instability.[2]

In 1997, the first clinical severity assessment scale was developed in the United Kingdom, called the Early Warning Score (EWS) and consisting of scores that measured the level of physiological deterioration of patients.[4]

Based on the original version of the EWS, the Modified Early Warning Scoring (MEWS), an easy-to-manage bedside instrument, was designed for fast identification of patients at an

alarming state and at risk of catastrophic physiological deterioration.[4] The instrument has values ranging from zero to 14 points that indicate the patient's level of consciousness, blood pressure, heart rate, respiratory rate and body temperature.[5-7]

The literature indicates that 79% of patients with cardiopulmonary arrest presented significant change in vital signs before the arrest, and that 54% of these patients died, indicating that this clinical outcome could have been avoided in most patients, in the in-hospital environment, especially if health professionals used the MEWS, a fundamental tool for identifying physiological deterioration in patients allowing the implementation of preventive actions.[7-8] The use of MEWS by nurses, doctors, physiotherapists and nursing technicians to identify the physiological deterioration of patients as early as in the first day in the ICU results in a remarkable survival rate and significant improvement in hospital discharge, as these professionals have the chance to plan and anticipate the care.[9-11]

Despite the importance of adopting scales such as MEWS for early detection of physiological deterioration, and the fact that the prognosis of patients admitted to the ICU is directly related to the severity of their condition, the use of this scale is little explored by health care team and studies about its efficacy are incipient.[9-12] Given the above, the aim of the present study was to evaluate the predictive power of a modified early warning scale to identify clinical deterioration in critically ill patients.

Method

This is a descriptive, prospective study with quantitative approach conducted through observational analysis in a university hospital in the state of Minas Gerais that assists the municipal and regional population, with availability of 220 beds. Specifically, the adult ICU has a specialized care structure, consisting of 20 beds, all with multiparametric monitors for accurate real-time assessment of the patient's clinical condition.[13]

The study population consisted of 214 critically ill ICU patients, according to the sample calculation duly performed by a statistician, which considered the average monthly hospitalizations of this population, with a sampling power of 80% and a significance level of 5%.

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We included clinical patients aged 18 years or older and coming from the urgency and emergency unit and nursing wards. Patients who were sedated, who had undergone surgery, and who had no family members or guardians present at visiting hours to agree by signing the Informed Consent Form were excluded.

Data collection took place from March to November 2018. The clinical data used to apply the MEWS were obtained from electronic medical records of ICU patients, prioritizing two moments: admission to the ICU, to identify the MEWS value at the entry into the sector, and the last note of the desired clinical parameters, before the patient's outcome, discharge or death.

Although the MEWS is not yet validated for the national context, the similarity with the context of the original validation study[14] and its use in other Brazilian studies[4,8] were considered as reasons for its adoption in the present study.

The researchers were present five days a week in the ICU during the collection period, taking turns, and establishing 2 hours of evaluation per day. This resulted in an average of 5 to 6 patients between clinical diagnoses admitted to the ICU and evaluations of their outcomes.

Because the use of the MEWS is not usual in the reality of the ICU analyzed in this research, to meet the objective of evaluating the predictive power of this tool regarding physiological deterioration of patients, the researchers created an instrument and had its face and content validated by three professionals who held a PhD in the area of urgency and emergency, with due expertise in the proposed theme.

The instrument had two parts; the first addressed the characterization of individuals, including sex, age, main body system affected, date of admission to the ICU and length of stay

in this sector. The second indicated the registration of clinical characteristics such as level of consciousness, systolic blood pressure, heart rate, respiratory rate and body temperature.

MEWS value of zero indicates that the patient has no physiological deterioration and should continue to be monitored and observed. Score 14 indicates that physiological deterioration is installed and determines the referral to ICU.[5-7] However, score 3 or above 3 is considered an important indicator of physiological deterioration.[5-6] As the MEWS score increases, the need for urgent care also increases, with a proportionality between these variables.[6]

The values corresponding to each variable present in the MEWS were summed for further evaluation of its predictive power of clinical deterioration of critically ill patients.

Data were double-typed into Microsoft Excel® 2013 spreadsheets by two different researchers and analyzed in the Statistical Package for the Social Sciences (SPSS). For statistical analysis, mean, median, standard deviation, minimum and maximum values were calculated for quantitative variables, and the distribution of absolute and relative frequencies was calculated for qualitative variables. A paired t-test was used to compare the means of the MEWS scores of patients at the moment of admission and before the main outcome (death), considering a significance level of 5% (= 0.05).

This study was submitted to the Ethics Committee to comply with the requirements of Resolution 466/12 of the National Health Council, with protocol 2424.370. The consent form authorizing the access to the intensive care unit and research and manipulation of medical records was obtained from the hospital. To participate in the study, the family members were consulted about their interest and they signed two copies of the Informed Consent Form. Likewise, the patients, who were oriented at the time of the approach, also signed the Informed Consent Form, after being informed of all the peculiarities of the research.

Results

This research aimed to evaluate the predictive power of the MEWS regarding the occurrence of physiological deterioration in ICU patients. An average age of 69.23 years was found, ranging from 18 to 99 years. The shortest hospital stay of patients in this sector was 1 day and the longest was 78 days, and the average length of stay was 10.42 days. Table 1 shows the sociodemographic profile of the patients included in this study.

Table 1 - Characterization of patients according to sex, main body system affected, and patient outcome in the Intensive Care Unit. Uberaba (MG), Brazil, 2018.

Variables	n	%
Sex		
Male	96	44.9
Female	118	55.1
Main body system affected		
Neurological	35	16.4
Respiratory	59	27.6
Cardiovascular	42	19.6
Gastrointestinal	17	7.9
Renal	16	7.5
Hematological	6	2.8
Endocrine	1	0.5
Immunological	38	17.7
Outcome		
Discharge	136	63.6
Death	78	36.4

Most patients were female, representing 118 individuals (55.1%). Respiratory system involvement (27.6%) was the main reason for admission to the adult ICU, followed by cardiovascular (19.6%), immunological (17.7%), and neurological (16.4%) involvement.

Of the 214 patients, 136 (63.6%) were discharged from the ICU and 78 (36.4%) died in the same circumstance. Tables 2 and 3 below show, respectively, death as outcome, showing the

interpretation of the MEWS, and then discharge, and the respective mean of the MEWS for comparison.

Table 2 - Modified Early Warning Scoring (MEWS) values of the population that presented death as outcome in the Intensive Care Unit, n = 78. Uberaba (MG), Brazil, 2018

MEWS	Mean	Standard deviation	Standard error of the mean	p value
Admission	3.410	2.0667	0.2340	
Death	5.000	3.3342	0.3775	0.001
Difference between admission and death	-1.5897	3.7605	0.4258	

The mean MEWS score at admission of the 78 patients (36.4%) who had death as outcome in the ICU was 3.410, and the mean MEWS before their death was 5,000, with a statistically significant p value for physiological deterioration (0.001).

Table 3 - Modified Early Warning Scoring (MEWS) values of the population that presented discharge as outcome in the Intensive Care Unit, n = 136. Uberaba (MG), Brazil, 2018.

MEWS	Mean	Standard deviation	Standard error of the mean	p value
Admission	2.9635	1.80036	.15382	
Discharge	2.9781	2.51310	.21471	0.952
Difference between admission and discharge	-.0146	2.85169	.24364	

The mean MEWS value of patients who were discharged from the ICU as an outcome during the study period was lower than 3.

Discussion

Researches that show sociodemographic and epidemiological characteristics of ICU patients help to consolidate changes in care strategies. They result in improved unit

management, whether from a human, structural, process, or even care management perspective.[15]

The present research identified a mean age of 69.23 years in the studied population. This age is similar to an epidemiological, descriptive and retrospective study conducted with 695 patients in the adult ICU, where more than half of hospitalizations (51.2%) were of people aged between 40 and 69 years.[15]

When compared to the literature, the average length of stay of patients in this study, 10.42 days, was longer than in other intensive care units, which is usually ≤ 6 days. Significantly shorter stays than expected may indicate the presence of cost-reducing efforts through premature discharge of patients or greater severity of cases (high mortality in the first days/hours); on the other hand, significantly longer stay than expected may indicate deficiencies and difficulties in the care provided.[16]

Regarding sex, the result of the present study contradicts the findings of the literature, as the majority of the population was female (55.1%). Demographic characteristics in ICUs generally converge to male predominance, of more than 50%.[17]

This contradiction stems possibly from the modern massive incentive of preventive strategies directed at the male population for the control of specific diseases and the consequent awareness and adherence of men to health programs, which has minimized the health problems and reduced their stay in ICUs.[18-19]

Respiratory tract diseases were the main cause of hospitalization, followed by cardiovascular diseases. These findings are in line with the results of an epidemiological study conducted with 171 patients where cardiorespiratory diseases stood out as the main cause of ICU admission.[20]

The clinical demands of ICU patients stand out against the surgical ones, possibly due to the aggravation of chronic problems. Acute clinical conditions and age over 80 years are

associated with mortality in survival studies with follow-up of less than 30 days, and situations such as lowering of consciousness, use of mechanical ventilation and respiratory diseases are factors that worsen this outcome.[20]

As for the clinical outcome, most patients in this study were discharged from the sector with an average MEWS value of less than 3, which shows no physiological deterioration,[21] and yet, a considerable number of patient had death as outcome. Disease severity is generally used to predict mortality in ICU patients, with a high mortality rate in this setting, ranging from 5.4 to 33% in the international scenario.[21] In the national scenario, the mortality rate is above international rates, from 36.9 to 50.74%.[22-24]

Patients who presented death as clinical outcome in this study had a mean MEWS value at admission of 3,410, and 5,000 at the last assessment of clinical parameters before death. The results showed a statistically significant difference in the association between MEWS values and the outcome (mortality) of ICU patients, with a p value of 0.001.

Patients who scored ≥ 5 points on the MEWS were associated with a higher risk of death and ICU admission.[25] This fact reinforces the need for the use of the MEWS by health professionals in emergency wards to recognize early physiological deterioration before ICU admission, and to avoid it.[24]

This scale has the main goal of facilitating the communication between health teams about the physiological deterioration of the patient so as to prevent it. In this sense, the use of this tool may avoid the transference of the patient to the ICU, and when transference is inevitable, it may ensure that this occurs without delay.[4,25]

Patients admitted to the ICU have a variable morbidity and mortality and usually present warning signs a few days before hospitalization,[8] which is shown in the present study by the already high MEWS value at the moment of admission (MEWS = 3.410). This shows that physiological changes, which indicate the worsening of clinical status, may early indicate

potential critically ill patients, who will need special monitoring in nursing wards or emergency rooms.[8]

When patients come from the wards or emergency rooms, they usually have high morbidity at the moment of admission to the ICU, which is indicated by MEWS values greater than 3 points in more than 70% of the population, with an average of more than 5 points.[8] These data were confirmed in the present study. Despite the lower mortality rate than that identified in the national scenario,[23] there was a strong association between the presence of critical scores (≥ 3 points) at admission and physiological deterioration, with a significant increase of the MEWS average to 5,000 in the majority of patients in their outcome.

Therefore, the adoption of the MEWS in the in-hospital health care context must be encouraged. Given its potential to predict physiological deterioration in patients, MEWS may prevent undesirable and irreversible outcomes, besides being easy to handle and to be interpreted by health professionals.[8]

Conclusion

MEWS values greater than or equal to 3 were related to clinical deterioration of patients in the ICU; this scale constitutes therefore an important indicator at the moment of admission. There was significant statistical relevance in the association of MEWS and death in the ICU, which shows the predictive power of this scale for irreversible and unwanted outcomes.

The limitation of this study was the fact that data collection took place in only one ICU, which hinders the generalization of the findings. The main contribution and implication for the practice is that the efficacy of the MEWS was demonstrated, when the physiological deterioration of patients in the in-hospital environment was detected, thus indicating the importance of the MEWS for the early and effective decision making regarding patients, with

the main intention of enabling evidence-based practice to improve professional competence and patient safety.

The MEWS is considered a reliable and effective instrument to identify physiological deterioration in patients, and it is therefore recommended for the prevention of cardiorespiratory arrest in adults.

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How to cite this article

Nascimento JSG, Macedo GO, Borges GB. Predictive power of the early warning scale for clinical deterioration of critically ill patients. Rev. Enferm. UFSM. 2019 [Acesso em: Anos Mês Dia]; vol.10 e5: 1-14. DOI:https://doi.org/10.5902/2179769238300