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Alteration in vital signs and clinical outcome of patients admitted to an emergency unit

Alteração de sinais vitais e desfecho clínico de pacientes admitidos em unidade de emergência

Alteraciones de los signos vitales y resultado clínico de pacientes admitidos en una unidad de emergencias

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Abstract: Objective: to describe the characteristics of the nursing records, including the vital signs, and to compare the patient's clinical outcome according to the presence of alterations in the vital signs in the emergency setting. **Method:** a cross-sectional study, with retrospective analysis of patient records of adult individuals admitted in May 2018 in an Emergency Room of São Paulo. The data collected from the nursing records were inserted in the REDCap® system and descriptive and inferential analyses were carried out. **Results**: of the 194 patient records (54.1% male, mean age of 59.7 years old), the complaints at admission, comorbidities and first care measures carried out in the emergency room were the most written down records. Heart and respiratory rates and blood pressure were the most altered and death-associated vital signs. **Conclusion:** the clarity and frequency of the nursing records, as well as the correct interpretation of the vital signs, are essential components for the safety of the care provided to the emergency patient.

Descriptors: Nursing records; Nursing care; Vital signs; Emergency service, hospital; Emergencies

Resumo: Objetivo: descrever as características dos registros de enfermagem, incluindo os sinais vitais, e comparar o desfecho clínico dos pacientes segundo a presença de alteração dos sinais vitais no ambiente de emergência. **Método:** estudo transversal, com análise retrospectiva de prontuários de pacientes adultos admitidos em maio/2018 em um Pronto-Socorro de São Paulo. Os dados dos registros de enfermagem coletados foram inseridos no sistema REDCap® e análises descritivas e inferenciais foram realizadas. **Resultados**: dos 194 prontuários (54,1% masculino, idade média 59,7 anos) a queixa de entrada, comorbidades e primeiras condutas realizadas na emergência foram os registros de enfermagem mais anotados. Frequências cardíaca e respiratória e

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pressão arterial foram os sinais vitais mais alterados e associados ao óbito. **Conclusão:** a clareza e a frequência dos registros de enfermagem, assim como a correta interpretação dos sinais vitais, são componentes essenciais para a segurança do cuidado prestado ao paciente na emergência.
Descritores: Registros de enfermagem; Cuidados de enfermagem; Sinais vitais; Serviço hospitalar de emergência; Emergências

Resumen: **Objetivo:** describir las características de los registros de Enfermería, incluidos los signos vitales, y comparar el resultado clínico de los pacientes según la presencia de alteraciones de los signos vitales en el entorno del servicio de emergencia. **Método:** estudio transversal, con análisis retrospectivo de historias clínicas de pacientes adultos admitidos en mayo de 2018 en una Unidad de Emergencias de San Pablo. Los datos de los registros recolectados se cargaron al sistema REDCap® y se realizaron análisis descriptivos e inferenciales. **Resultados**: en 194 historias clínicas (54,1% de pacientes masculinos con media de 59,7 años), el motivo de consulta inicial, las comorbilidades y las primeras acciones realizadas en el área de emergencias fueron los registros de enfermería más anotados. La frecuencia cardíaca, el ritmo respiratorio y la presión arterial fueron los signos vitales que presentaron mayores alteraciones y estuvieron más relacionados con un resultado final de fallecimiento. **Conclusión:** la claridad y la frecuencia de los registros de Enfermería, al igual que la correcta interpretación de los signos vitales, son componentes esenciales para la seguridad en la atención que se brinda a los pacientes en el área de Emergencias.
Descriptores: Registros de enfermería; Atención de enfermería; Signos vitales; Servicio de urgencia en hospital; Urgencias médicas

Introduction

Clinical records are one of the written communication types among the team to promote the continuity of care and must reflect the nursing process, indicating the fundamental decisions to the care provided (diagnosis, outcomes, and interventions).[1-3] These records bear important information on the care provided to the patient and should be made tidily in the medical record.[3-4] In the context of care, data on the patient's condition, the change in their clinical status, the procedures performed and the medical and nursing conducts taken must be recorded.[1,3] However, the literature points out that there are flaws in these annotations and that, often, they do not reflect the reality of care.[1-2] Given this context and the importance of the quality of the records, in 2016, the Federal Nursing Council (*Conselho Federal de Enfermagem*, COFEN) approved Resolution No. 0514 that guides the professionals on the essential information that should be recorded by means of the "Guide on recommendations for

nursing records in patient's medical records" handbook.[3] Recently a national survey in the intensive care setting verified that the quality of records is often observed as inadequate in the legal determinations according to the COFEN guidelines and that there is no clarity in the evaluation of the patient's condition.[5]

In the urgency and emergency settings, national studies on the quality of nursing records are still scarce.[2,5] The context of the emergency room should be the reason for the investigation of these notes because it is a complex and heterogeneous environment due to the different levels of severity and length of stay of clinical, surgical, and trauma patients.[6-7] Many patients stay in this sector for more than twenty-four hours and the nursing staff is the one that provides direct care to these patients and, therefore, the documentation of this care should be accurate and complete.[6-7]

Recording the clinical condition, including the vital signs, in the emergency setting allows the care plan to be best suited to the complexity of each patient.[6] In addition, the vital signs have been treated as early indicators of deterioration in the condition of the hospitalized patients, requiring adequate interpretation of their values so that the use of such information can be reflected in the decision-making processes of nurses.[6-7]

Early management of patients who show signs of clinical worsening through the examination of the vital signs can prevent the occurrence of adverse events such as cardiac arrest (CA), intra-hospital death, and unplanned Intensive Care Unit (ICU) admission.[6,8] An Australian study observed that, in the emergency setting, the most frequently recorded vital signs were blood pressure, heart rate, and peripheral oxygen saturation. Respiratory rate, temperature, and evaluation of the level of consciousness were the least recorded.[7]

It is well known that the assessment of the vital parameters is still flawed, incomplete, and without proper registration in wards and emergency settings.[7,9] The systematic evaluation of the vital signs through early detection scales is applied internationally and has assisted the health care team in identifying signs of clinical deterioration and in making more complete

records.[7,9] These data can also be used to verify the severity and mortality levels of the patients in the emergency room by the Rapid Emergency Medicine Score (REMS) scale.[8,10-11] Therefore, the international literature has been signaling the importance of monitoring vital signs in the early identification of the patient's deterioration and severity. Nursing is fundamental in this process because it is the team that monitors the vital parameters and must be able to recognize and act upon the identification of any change in them.[6-7]

Assessing and accurately recording the physiological parameters of the patients in emergency units are important measures to ensure quality care focused on the needs of each patient.[1,6,9] In this sense, the objective of this study was to describe the characteristics of the nursing records, including the vital signs, and to compare the clinical outcome of the patients according to the presence of altered vital signs in the emergency setting.

Method

This is a cross-sectional and retrospective study. Its population consisted of medical and nursing records of patients cared for between 05/01/2018 and 05/31/2018 in a public secondary level Adult Emergency (*Pronto-Socorro Adulto*, PSA) unit in the city of São Paulo. The PSA unit provides medical clinic, general surgery, and orthopedics care, with a mean of 300 patients admitted per month.

The observation sector has ten beds with a multi-parametric monitor and oxygen network, and capacity for ten extra stretchers. In the PSA unit, the nursing process is documented manually in a physical record for all the patients under clinical observation. The nurse admits the patient, defines the nursing diagnoses, the expected outcomes, and the nursing interventions. Every 24 hours the patient's progress is followed-up in relation to these diagnoses and outcomes.

The records of the care procedures, including the vital signs, are made by the nursing team in their own printed manual forms called “nursing annotations” and “vital signs monitoring”.

The routine in the observation sector is monitoring the vital signs (body temperature, heart rate, blood pressure, respiratory rate, and pain) at the beginning of the shift and every six hours, compatible with the nursing team's work shift. In this study, all the parameters recorded every six hours were considered, and the absence of notes for any vital sign in the analyzed shift was considered as not recorded. For the purpose of this study, a nursing record was defined as the set of all the notes made in the patient's records every six hours; therefore, each night shift included two “nursing records”, corresponding to two periods of six hours each.

In the PSA unit, pulse oximetry is assessed in the patients under observation who were admitted to beds with multi-parametric monitors. For the patients in extra stretchers, this parameter is obtained by portable oximeters; therefore, the evaluation of this parameter in those patients is not routine. Pain is assessed by means of a numeric scale. There is no pattern as to the frequency of the evaluation of the level of consciousness, and the Glasgow Coma Scale is commonly applied to the traumatized patients.

The following criteria for inclusion of the patient’s records were considered: being 15 years of age or older and being admitted to one of PSA beds with a multi-parametric monitor or on an extra stretcher. Records lacking information on age, gender, discharge type, and/or unreadable handwriting were excluded. The records of the patients who came into the PSA unit in CA and did not show the return of spontaneous circulation were not included in the sample, as these cases are not admitted to observation beds.

The hospital's Medical and Statistical Archive Service (*Serviço de Arquivo Médico e Estatística*, SAME) provided a list of 319 patient records that remained under observation in the PSA unit during the study period. Of these, 87 records were being kept at a location outside the SAME with no availability during the data collection period. Still from the same list, 15 records

were duplicated and nine were from patients who came into the unit in CA without return to spontaneous circulation. Of the 208 available records, 14 were excluded due to incomplete data, 194 medical records remaining for final analysis.

The following variables were collected from these medical records: sociodemographic (age, gender, and comorbidities), time of patient's observation in the PSA unit (medical specialty of care, length of stay in the unit, and discharge type: home, hospitalization, transfer or death), nursing records (admission by the nurse, report of the neurological, cardiovascular, and respiratory conditions of the patient, devices present - venous access, ventilatory support, bladder or enteral catheter, drain, and immobilizations - date, time, signature, stamp, and vital signs). Of the vital signs, the recording of frequencies of body temperature, heart rate, mean blood pressure, respiratory rate, peripheral oxygen saturation, and pain were collected.

Data from the record on the conducts performed when any of these signs presented changes were analyzed. The search for these records occurred when any altered vital sign was identified, according to the parameters considered normal (Chart 1) by the REMS scale.[11-12] The REMS scale estimates the severity and predicts the patient's mortality in the emergency setting by evaluating the vital signs and age of the patient. As body temperature is not included in the REMS parameters, the authors of this study defined altered temperature when the patient reaches >37.8ºC (>100ºF), according to the unit's routine. As mentioned, the Glasgow Coma Scale is not applied in all the patients in the unit, which is why this parameter was not analyzed.

Chart 1- Normal parameters of vital signs according to the REMS scale. São Paulo, SP, Brazil, 2018.

Heart Rate (BPM)*	Respiratory Rate (BIPM) †	Mean arterial pressure (mmHg) ‡	Peripheral oxygen saturation

			(%)§
70-109	12-24	70-109	>89

*BPM-Beats Per Minute; †BIPM-Breath Incursions Per Minute; ‡mmHg-millimeters of mercury; § %-Percentage.
Source: Parameters of the vital signs of the REMS scale,[11-12] adapted to the study.

For data collection, two of the researchers were first trained to use the Research Electronic Data Capture *(REDCa*p®) system.[13] The REDCap® tools used were electronic collection, dynamic management, and data export. Previously, a pilot test was carried out with ten medical records and, in the event of any divergence during the pilot test and data collection, a third researcher was consulted.

Descriptive and inferential statistics were performed during data analysis. For the analysis of the outcome, the patients were divided into two groups: survivors (patients who were discharged, transferred, or escaped from the PSA unit, in addition to those PSA patients who were hospitalized in the institution's units) or non-survivors (patients who died in the PSA unit). For the comparison of these groups according to altered vital signs, the Person's Chi-Square, Brunner-Munzel, and Fisher's Exact tests were used, with a significance level of 5%. The R program, version 3.6.1, was used for data analysis.

The study was approved by the Research Ethics Committee of the State Public Institution on July 6th, 2018, under Statement No. 2,759,136 according to Resolution 466/12 of the National Health Council. The free and informed consent form was waived for patients/families, since it was retrospective research of medical records analysis, without any damage and interference in the care and treatment of the patient in the institution. The researchers committed themselves to guaranteeing secrecy and reliability of the collected data, and the records were consulted carefully and responsibly in order to avoid deviations and breaches of secrecy.

Results

Of the 194 medical records analyzed, 105 (54.1%) were of male patients, with a mean age of 59.7 years old (SD±20.4) and a range between 17 and 99 years old. Regarding comorbidities, 89 (45.9%) had systemic arterial hypertension; 44 (22.7%) Diabetes *Mellitus*; 23 (11.9%) cardiopathy; 17 (8.8%) stroke, and 13 (6.7%) oncological disease.

There was a predominance of the medical clinic care specialty (n=93; 48.0%), followed by general surgery (n=79; 40.7%) and by orthopedics (n=22; 11.3%). The mean length of stay in the PSA unit was 1.3 days, with a maximum of seven days. Of the total, 72 (37.1%) patients were discharged from hospital, 67 (34.5%) were referred to the inpatient unit, seven (3.6%) to the ICU, 27 (14.0%) transferred to another hospital, 18 (9.3%) died in the PSA unit during the observation period and three (1.5%) escaped.

As for the nursing records at the patient's admission, it was verified that, in 140 (72.2%) records the transportation means by which the patient arrived at the service was reported, in 192 (99,0%) there was the admission complaint record, in 190 (97.9%) there was a description of the patient's physical condition when arriving at the service, in 172 (88.7%) there was the record of the patient's comorbidities, and in 145 (74,7%) it was possible to find the first care measures performed in the sector.

Table 1 - Description of the nursing record content categories. São Paulo, SP, Brazil, 2018.

Content categories	Nursing record			
	Yes		No	
	n	%	n	%
Description of the neurological condition	765	95.4	37	4.6
Description of the devices present	773	96.4	29	3.6
Description of the respiratory condition	216	26.9	586	73.1
Description of the cardiovascular condition	135	16.8	667	83.2

Date	714	89.0	88	11.0
Time	792	98.8	10	1.2
Signature of the professional	738	92.0	64	8.0
Stamp of the professional	726	90.5	76	9.5

n=Total of nursing records

The stay in emergency room of the 194 patients whose medical records were analyzed totaled 802 six-hour shifts, which corresponded, as described in the method, to 802 nursing records. Table 1 highlights that the patient's respiratory and cardiovascular conditions were the least recorded by the nursing team.

Table 2 - Vital signs' records. São Paulo, SP, Brazil, 2018.

Vital signs	**Nursing record**			
	Yes		No	
	n	%	n	%
Mean arterial pressure	797	99.4	5	0.6
Heart Rate	797	99.4	5	0.6
Respiratory Rate	794	99.0	8	1.0
Temperature	794	99.0	8	1.0
Pain	706	88.0	96	12.0
Peripheral oxygen saturation	400	49.9	402	50.1

n=Total of nursing records

The data in Table 2 show the vital signs annotation for all the 802 nursing records. It can be seen that peripheral oxygen saturation was the least recorded vital sign. The set of vital signs (mean arterial pressure, heart rate, respiratory rate, peripheral oxygen saturation, temperature, and pain) was verified only once in 616 (76.8%) of the 802 nursing records.

Table 3 - Vital signs according to the frequency of abnormal values. São Paulo, SP, Brazil, 2018.

Vital signs	**Altered**	
	Yes	No

	n	%	n	%
Mean arterial pressure	186	23.3	611	76.7
Heart Rate	172	21.6	625	78.4
Respiratory Rate	75	9.4	716	90.6
Temperature	35	4.4	759	95.6
Peripheral oxygen saturation	12	3.0	388	97.0

n=Total of the vital signs' records

From the total of 4,288 vital signs recorded, it was observed that, in 480 (11.2%) of them, some parameter was altered. Table 3 shows the frequencies of each altered vital sign. It is observed that mean arterial pressure, heart rate and respiratory rate were the vital parameters that had the most frequent changes.

In 108 (22.5%) of the 480 records of altered vital signs there were notes of the conducts performed. Ventilatory support, such as airway management, nasal catheter placement, ventilatory mask, and mechanical ventilation, was the most registered conduct (n=70; 64.8%), followed by medication administration, including vasoactive drug and volume replacement (n=26; 24.0%) and other conducts (n=12; 11.1%) such as fasting, chest drain passage, and communication to the medical team.

Table 4 - Clinical outcome of the patients in the PSA unit according to the presence of any altered vital sign. São Paulo, SP, Brazil, 2018.

Altered vital sign	**Category**	**Clinical outcome in the PSA unit**				**p**
		Survivors		**Non-survivors**		
		n	**%**	**n**	**%**	
Heart Rate	Yes	60	82.2	13	17.8	0.002*
	No	116	95.9	5	4.1	
Respiratory Rate	Yes	21	72.4	8	27.6	<0.001*
	No	155	93.9	10	6.1	
Peripheral oxygen saturation	Yes	5	62.5	3	37.5	0.028†
	No	171	91.9	15	8.1	
Mean arterial pressure	Yes	67	81.7	15	18.3	<0.001*
	No	109	97.3	3	2.7	

Temperature	Yes	6	60.0	4	40.0	0.008†
	No	170	92.4	14	7.6	

n=Total of patients;* Person's Chi-squared test; † Fisher's Exact test

Of the 194 patients, 122 (62.8%) had some altered vital signs, with a mean of 1.2 altered vital signs during their stay in the PSA unit. According to the *Brunner-Munzel* test, there was a significant difference ($p<0.001$) of the mean number of altered vital signs among the survivors (1.0±1.1), and the non-survivors (2.6±1.5). When comparing the groups (survivors and non-survivors), it was observed that there was a significant difference between them in relation to the presence of alteration of all the vital signs analyzed, with a greater probability of death among the patients who had some alteration during their stay in the PSA unit (Table 4).

Discussion

The results of this study show the main characteristics of the nursing documentation in the emergency setting, being possible to observe that the heart rate, blood pressure, respiratory rate, and temperature records were fully completed in most of the sample. The recording of altered vital signs was present in 62.8% of the sample, a fact that puts into discussion the importance of strictly monitoring the vital signs in the emergency setting. However, in the documentation of the nursing conducts in relation to the altered physiological parameters, it was verified that in only 22.8% of the medical records there was an adequate recording of the conducts performed.

In the nursing documentation at admission, most of the records were about the patient's physical conditions, as well as the means by which they arrived at the unit, their main complaints, the comorbidities present, and the initial conducts performed. For the emergency unit nurse, the evaluation with information on the patient's physical condition and initial complaint in the context of the nursing process provides the necessary data to draw up the care

plan according to the diagnostic priorities found, enabling the appropriate nursing interventions for each patient.[4,7]

As in other national studies,[1,4] there was a small percentage of lack of information (11.0%) and absence of the professional stamp (9.5%) in this research. The literature points out that the absence of a date, time, and stamp, items considered necessary for the adequate nursing record according to the COFEN, is still a constant behavior in the nursing daily routine that can compromise the evaluation process and the auditing of the records.[1,4,14] Electronic documentation in the emergency setting can help to reduce part of this problem, as well as supporting data collection and storage, clinical reasoning, and language standardization.[2]

The results of this study confirm that the vital signs' records are fundamental in the hospital setting, even in the Emergency Department. It is the nursing team's responsibility to measure the vital signs in constant surveillance to identify and interpret abnormalities of the physiological parameters that may signal worsening of the clinical condition.[6,15] In the English hospitals that compose the National Health Service (NHS), the maximum recommended interval for checking the vital signs is 12 hours; while in Australia, according to guidelines of The Australian National Consensus Statement on recognizing and responding to clinical deterioration, this interval is 8 hours and the controlled vital signs are blood pressure, heart rate, respiratory rate, peripheral oxygen saturation, temperature, and consciousness level.[9,15] In this study, it was observed that the interval for monitoring vital signs was 6 hours in most of the sample, according to the unit's routine. In Brazil, there is still no established consensus on the interval for monitoring vital signs in the hospital setting, and the level of consciousness is not yet routinely incorporated in the evaluation of vital signs control.[3]

When evaluating the vital sign's records, data on heart rate, temperature, respiratory rate, and mean arterial pressure were the most complete. A similar result was obtained in an

Australian study that evaluated the vital sign's records in the emergency setting and in the medical and surgical clinic ward.[7]

Documentation of peripheral oxygen saturation was observed only in 49.9% of the sample. In contrast, an Australian study verified that, in the emergency setting, oxygen saturation was one of the most evaluated and recorded parameters.[7] As previously mentioned, the evaluation of this parameter is carried out in the patients who remain under observation in beds with multi-parametric monitors of the PSA unit. It is possible to observe that, despite the few records of the respiratory condition in the sample of this study, the annotation of the respiratory rate was satisfactory, and it is important to highlight that this sign is considered an indicator of severity, hence the need for its adequate evaluation and recording in the hospital setting.[7-8]

Although the evaluation of the level of consciousness is not yet considered routine for monitoring the vital signs in the Brazilian context, the systematic evaluation of the physiological parameters, including the level of consciousness and through an early warning system, can help in the identification of diseases with high mortality, such as sepsis.[3,16]

An international research study that sought to analyze the criteria of The quick Sequential Organ Failure Assessment (qSOFA) and the vital signs using the National Early Warning Score (NEWS) scale in emergency patients regarding the ability to predict admission in ICU beds showed that the NEWS score performed better than the qSOFA, since it covers the complete evaluation of these parameters, the assessment of the level of consciousness being one of the factors discussed in the study for the better performance of this score in relation to the qSOFA.[16]

The adoption of an early warning system that includes the assessment of the level of consciousness in the routine control of vital signs may be interesting in the Brazilian reality. In England, NHS hospitals already use NEWS, an early warning system, and report that this practice has enabled language standardization and systematic assessment with frequent measures of the vital signs.[17]

Blood pressure and heart and respiratory rates were the vital signs with the highest frequency of alterations. A similar finding was identified in an Australian study that observed the frequency of the early signs of clinical worsening through the assessment of the physiological parameters in an emergency context. It was verified that 1,071 (19.6%) were altered measures (31% of the systolic blood pressure and 20.8% of heart rate).[15] It is highlighted that altered heart and respiratory rates and blood pressure are related to the high chance of adverse events (intra-hospital deaths, CA, and unplanned intensive care admission),[8,15] being important to notice that there is already a change in the vital signs within 48 hours before an adverse event occurs.[8]

The patients who died in this study had more than twice as many altered vital signs compared to those who survived. Changes in heart rate, respiratory rate, blood pressure, temperature, and peripheral oxygen saturation were associated with the event of death. These findings converge to another study that evaluated the set of altered vital signs and the outcomes of patients in an emergency service and observed that, at admission, most of the men aged 60 and over had altered heart rate, respiratory rate, and temperature.[18] Also in this study, the patients who died had more than two altered signs during their stay in the emergency service.[18]

Therefore, a number of research studies reinforce the importance of rigorous surveillance of the set of physiological parameters in an emergency unit.[6,15,18-19] Although it was not the objective of this research to verify the conditions of the vital signs at hospital discharge, an American research study draws our attention which discusses the values of these signs at the time of discharge and at hospital readmission in seven days. Patients who were discharged with altered heart and respiratory rates had more chance of readmission in seven days (Odds Ratio = 1.87) when compared to the hospital discharge of patients with only one of these signs (Odds Ratio = 1.21).[19]

Another highlight of this research was the low frequency of the conduct annotations in relation to the alterations in the vital signs, with the ventilatory support and medication administration records (fundamental measures for the permeability of the airway and maintenance of circulation) being the most found. The findings from the results of this investigation seek to reflect the role of nursing in recognizing alterations in the vital signs and their proper recording, since it is the profession that spends the most time with the patient.[6,15] Omissions of records of changes in the vital signs associated with long working hours and sometimes insufficient numbers of nursing professionals may compromise the quality of care and influence on the occurrence of adverse events, even if there is no evidence that long working hours in nursing can bring along less safety to the patient.[20-21]

Finally, the fact that data was collected in a single institution by means of the retrospective analysis of medical records is a limitation of the study, and this must be considered in the generalization of the results.

Conclusion

Nursing records in the emergency setting had the following as their main characteristics: description of the initial complaint, physical condition, and comorbidities of the patients, in addition to the first care conducts performed. The annotation of the vital signs was complete in most of the medical records, with heart rate, blood pressure, and respiratory rate being the most documented and often altered parameters that were present in the patients who died. The surviving patients had fewer altered vital signs.

Despite the low frequency of records on the medical and nursing conducts taken in the face of the altered parameters, ventilatory support and medication administration were the ones most recorded.

The clarity of the nursing annotations, as well as the correct interpretation of the vital signs, can favor safe nursing care. In Brazil, there is still no consensus as regards the regular measurement of the physiological parameters of the patients in the emergency service. Therefore, the use of an early warning system can help in guiding the professionals as to the ideal frequency for measuring the vital signs and should be considered in the clinical practice of the emergency setting.

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