REVISTA DE ENFERMAGEM REFERÊNCIA
homepage: https://rr.esenfc.pt/rr/
ISSNe: 2182.2883

RESEARCH ARTICLE (ORIGINAL)

Immediate life support to critical patients: Nursing care contributions

Suporte imediato de vida na pessoa em situação crítica: Contributos da intervenção do enfermeiro

Soporte vital inmediato en situaciones críticas: Contribuciones de la intervención de enfermería

José Paulo Passos de Miranda [1]
https://orcid.org/0009-0007-2035-0103

Márcio Daniel Dias de Almeida e Silva [2]
https://orcid.org/0000-0002-7410-9573

Clementina Sousa [3, 4]
https://orcid.org/0000-0002-7536-3557

José Magalhães [2]
https://orcid.org/0000-0002-0471-6394

Luís Carlos Carvalho Graça [3,4]
https://orcid.org/0000-0001-7510-2202

[1] National Medical Emergency Institute, Immediate Life Support of Ponte de Lima, Ponte de Lima, Portugal

[2] National Medical Emergency Institute, Northern Region Delegation, Porto, Portugal

[3] School of Health, Polytechnic Institute of Viana do Castelo, Viana do Castelo, Portugal

[4] Health Sciences Research Unit: Nursing (UICISA: E), Nursing School of Coimbra, Coimbra, Portugal

Corresponding author
Márcio Daniel Dias de Almeida e Silva
E-mail: marciodanielsilva@gmail.com

Received: 31.08.23
Accepted: 21.02.24

Abstract
Background: Immediate life support (ILS) ambulances allow nurses to intervene in pre-hospital settings, supported by their technical-scientific knowledge and complex protocols of action and regulation through telemedicine.
Objective: To analyze the contributions of nursing interventions in the evolution of the clinical state of critical patients.
Methodology: Quantitative, descriptive-correlational, retrospective, and observational study conducted in ILS settings in northern Portugal. A total of 574 electronic clinical records were analyzed between 1 November and 31 December 2019, corresponding to the same number of people evaluated. The National Early Warning Score (NEWS) was used to assess the clinical evolution of critical patients.
Results: There was a positive evolution of the NEWS score of critical patients after the intervention of ILS nurses (M = 4.43 ± 3.901 vs. 3.34 ± 3.329; sig < 0.001). Similarly, the clinical risk of critical patients decreased after the nurse's intervention.
Conclusion: This study demonstrated the importance of nurses in prehospital care, as a guarantee of safety, quality, and continuous improvement of care for critical patients.

Keywords: nurses; prehospital care; nursing care; critical care nursing

Resumo
Enquadramento: As ambulâncias de suporte imediato de vida (SIV) possibilitam ao enfermeiro capacidade de intervenção em contexto pré-hospitalar, suportada pelo seu conhecimento técnico-científico, protocolos complexos de atuação e regulação médica por telemedicina.
Objetivo: Analisar os contributos da intervenção dos enfermeiros SIV, na evolução do estado clínico da pessoa em situação crítica (PSC).
Metodologia: Estudo quantitativo, descritivo-correlacional, retrospetivo, realizado em meios SIV, na região norte de Portugal. Analisados 574 registos clínicos eletrónicos, entre 01 de novembro e 31 de dezembro de 2019, que correspondem ao mesmo número de pessoas avaliadas. Utilizada a escala National Early Warning Score (NEWS) para avaliar a evolução clínica da PSC.
Resultados: Observou-se uma evolução positiva do *score* NEWS da PSC, após a intervenção do enfermeiro SIV (M = 4,43 ± 3,901 vs 3,34 ± 3,329; sig < 0,001). Em sentido inverso, o risco clínico diminuiu significativamente após a intervenção do enfermeiro.
Conclusão: Demonstrou-se a relevância da intervenção do enfermeiro SIV no contexto pré-hospitalar, enquanto garantia de segurança, qualidade e melhoria contínua dos cuidados à PSC.

Palavras-chave: enfermeiras e enfermeiros; assistência pré-hospitalar; cuidados de enfermagem; enfermagem de cuidados críticos

Resumen
Marco contextual: Las ambulancias de soporte vital inmediato (SVI) permiten al personal de enfermería intervenir en un contexto prehospitalario, con el apoyo de sus conocimientos técnico-científicos y de complejos protocolos de actuación y regulación médica a través de la telemedicina.
Objetivo: Analizar las aportaciones de la intervención del personal de enfermería del SVI en la evolución del estado clínico de la persona en situación crítica (PSC).
Metodología: Estudio cuantitativo, descriptivo-correlacional, retrospectivo, realizado en centros de SVI del norte de Portugal. Se analizaron 574 historias clínicas electrónicas entre el 1 de noviembre y el 31 de diciembre de 2019, correspondientes al mismo número de personas evaluadas. Se utilizó la escala National Early Warning Score (NEWS) para evaluar la evolución clínica de la PSC.
Resultados: Se observó una evolución positiva en el *score* NEWS de la PSC, tras la intervención del personal de enfermería del SVI (M = 4,43 ± 3,901 vs 3,34 ± 3,329; sig < 0,001). Por el contrario, el riesgo clínico disminuyó significativamente tras la intervención del personal de enfermería.
Conclusión: Se demostró la relevancia de la intervención del personal de enfermería del SVI en el contexto prehospitalario, como garantía de seguridad, calidad y mejora continua en la atención a la PSC.

Palabras clave: enfermeras y enfermeros; cuidados prehospitalarios; cuidados de enfermería; enfermería de cuidados críticos

How to cite this article: Silva, M., Miranda, J., Sousa, C., Magalhães, J., & Graça, L. (2024). *Immediate life support to critical patients: Nursing care contributions. Revista de Enfermagem Referência, 6*(3), e32703. https://doi.org/10.12707/RVI23.104.32703

Introduction

In pre-hospital settings, nurses provide comprehensive support for individuals, families, and communities during sudden illness, trauma, crisis, or catastrophe. This support extends from the emergency scene to the reference health unit, ensuring continuity of care (Regulamento nº. 361/2015, 2015). The intervention of nurses contributes significantly to health gains, including reduced morbidity and mortality rates. Nurses repeatedly analyze, interpret, and evaluate vital parameters and clinically observe patients to quickly identify critical situations and implement procedures that promote the improvement of the patient's clinical state. The absence of specialized nursing care for critical patients in pre-hospital settings can increase the risk of deterioration in individuals affected by accidents or sudden illnesses. This highlights the importance of immediate life support (ILS) ambulances. In pre-hospital emergencies, nurses can manage the clinical risk and deteriorating condition of critical patients by routinely assessing basic physiological parameters recorded in their daily assessments using early warning scoring systems (EWS; Williams et al., 2016). Although nurses recognize their importance in identifying, assessing, treating, stabilizing, and transporting critical patients in pre-hospital settings, there is limited scientific evidence on the direct impact of their intervention due to the near absence of studies (Williams et al., 2016; Patel et al., 2018).

This study's objective was to analyze the impact of nurse interventions in ILS settings on the clinical state of critical patients, using the National Early Warning Score (NEWS). We based our analysis on existing literature and avoided including personal perceptions or subjective evaluations. The study aimed to describe the sociodemographic characteristics of critical patients assisted by ILS ambulance nurses, assess the evolution of their clinical status between initial and final assessments, and analyze their progress by gender and age group.

Background

The National Medical Emergency Institute (INEM) coordinates the Integrated Medical Emergency System (SIEM) in mainland Portugal. SIEM is composed of various emergency services with different levels of differentiation. ILS is an intermediate level of differentiated care and its activity is based on complex intervention protocols. The nurse assumes the role of team leader (INEM, 2013). The ILS project started in 2007 due to the restructuring of emergency services in mainland Portugal and the consequent need to strengthen the SIEM, which provides coverage for urgent and emergency situations in mainland Portugal (Oliveira & Martins, 2013). At the time of this restructuring, it was understood that nurses, due to their technical and scientific skills, derived from their training and clinical practice, were the professionals of excellence to respond to the health needs of critical patients in pre-hospital settings. Nurses work 24 hours a day and, among other activities, they are responsible for recognizing patients who need urgent intervention due to the increased likelihood of their clinical condition deteriorating (Regulamento 367/2015, 2015). In this process, there is a subjective component that is influenced by the nurse's experience and critical judgment, which influences the assessment of changes in vital parameters and the signs and symptoms identified. Despite this subjective component, EWS make a decisive contribution to objectifying the assessments made, with a high accuracy rate (Martín-Rodríguez et al., 2019). To date, around 100 EWS have been created to help identify the person's severity and make clinical decisions (Martín-Rodríguez et al., 2019), by objectively measuring the physiological deterioration of critical patients (Tavares, 2014). One priority for health systems is to identify high-risk individuals early, particularly those whose clinical situation is time-sensitive (Martín-Rodríguez et al., 2019). Therefore, pre-hospital emergency services need to utilize EWS. Kauppi's (2020) study found that the patient's previous medical history and deviations from normal vital parameters were independently associated with both a time-sensitive final diagnosis and the risk of death within 30 days. Early detection of acute changes in physiological parameters can trigger a prioritized clinical response, potentially avoiding unfavorable outcomes for the patient (Patel et al., 2018). The ILS ambulance is staffed by a nurse and an emergency technician who are responsible for evaluating, stabilizing, and transporting victims of accidents or sudden illnesses (Despacho n.º 5561/2014, 2014). According to Ivic et al. (2022), nurses who work in pre-hospital emergencies are valuable assets in assisting SCA patients. Experience based on a systematic and in-depth approach is essential, particularly in assessing elderly people with non-specific complaints, to improve the clinical safety of patients. Recognizing critical patients in pre-hospital settings can improve hospital referral and anticipate treatment before arrival at the emergency department (ER). Successful ERs have high rates of identifying critical patients, assessing clinical risk, and considering factors that influence survival (Hoikka et al., 2016). These assumptions benefit critical patients with intensive care needs and time-sensitive clinical conditions, such as severe traumatic injuries, acute cardiovascular diseases, and cardiorespiratory arrest (Kievlan et al., 2016). The use of the Rapid Emergency Triage and Treatment System (RETT-A) and the NEWS by nurses in pre-hospital settings has shown high specificity and sensitivity regardless of age and gender (Magnusson et al., 2020). The NEWS scale was initially developed by Williams and Wright in 1997. It has since been validated internationally for use in pre-hospital emergency settings, demonstrating high predictive performance for both mortality and hospitalization in intensive care settings (Williams et al., 2016). The NEWS scale is a scoring system ranging from 0 to 20. It assigns a value to the corresponding NEWS Clinical Risk category by adding up the scores for various physiological parameters and/or the extreme score for an individual parameter. The NEWS Clinical Risk assesses severity across four levels ('low score 0', 'low', 'medium', and 'high'), while the NEWS score

has a wider range of values (0-20), resulting in greater sensitivity in the obtained results. The use of this scale enables identification of critical situations, prediction of adverse events, and aids in the decision to refer patients to the most suitable hospital (Arévalo-Buitrago et al., 2022; Magnusson et al., 2020).

Research questions/Hypotheses

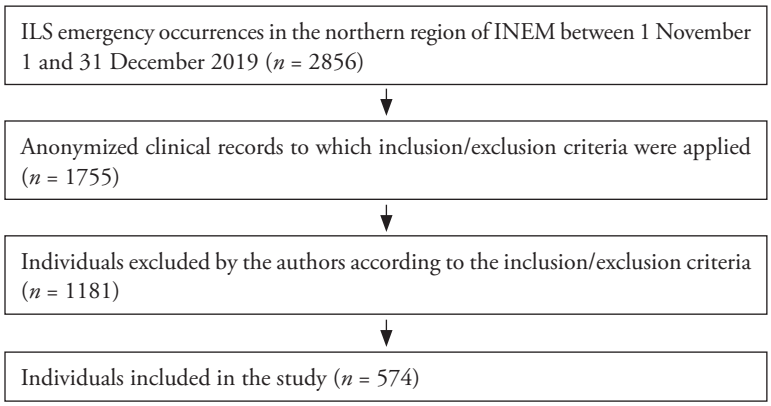
Do ILS nurses' interventions affect the clinical status of critical patients? Does the change in clinical status vary by gender or age group?
Hypothesis 1: ILS nurses' interventions have a positive effect on the clinical status of critical patients, regardless of gender.
Hypothesis 2: ILS nurses' interventions have a positive effect on the clinical status of critical patients, regardless of age group.

Methodology

A quantitative, descriptive-correlational and retrospective study was conducted using computerized clinical records created by ILS nurses in the northern region of INEM (Portugal) between November 1st and December 31st, 2019. This time frame was chosen as it precedes the declaration of the COVID-19 pandemic and the subsequent changes it brought to the lives and health of citizens and healthcare professionals, as well as their care.
The study's inclusion criteria required a clinical record in electronic format (INEM's ITeams platform) for critical patients due to an accident or sudden illness, aged 16 or over, who were assisted by ILS nurses in pre-hospital settings. The records must include the NEWS score before and after the nurse's intervention. Records relating to pregnant women, situations in which a doctor was present at the scene, and inter-hospital transport were excluded. INEM provided 1,755 clinical records. Analysis of these records revealed that 574 critical patients were eligible for the study as both NEWS assessments were documented, while 1,181 were excluded due to incomplete NEWS records. Figure 1 displays the sample selection. The study employed the NEWS scale to gather data. This scale comprises of seven items, namely respiratory rate, peripheral oxygen saturation, supplementary oxygen, temperature, systolic blood pressure, heart rate, and assessment of state of consciousness. The scale ranges from 0 (no severity) to 20 (highest risk). Descriptive analysis techniques were used for statistical treatment, based on frequency distribution, measures of central tendency (mean, median), and dispersion (standard deviation, minimum and maximum). Parametric tests were employed to analyze relationships and differences between groups and moments, after verifying the assumptions for their use. To assess the normality of distribution for samples over 50, we used the Kolmogorov-Smirnov test, and for smaller samples, we used the Shapiro-Wilk test. We analyzed the homogeneity of variances based on the means using Levene's test. To compare groups and the two moments under analysis, we used Student's t-test for independent samples and paired samples, respectively. We analyzed the association between variables using the Pearson correlation coefficient. We used IBM SPSS Statistics, version 26.0, and accepted a significance level of 5%.

Figure 1

Sample selection flowchart



This empirical study followed ethical precepts and received approval from the UICISA: E Ethics Committee (no. P755/03-2021) and authorization from INEM (Minutes no. 22/2020, of 12 March, of the Board of Directors).

Results

The clinical records of 574 critical patients were analyzed in this study. 53% of the patients were male, and the age

range was 17 to 101 years, with a mean of 70.36 ± 18.30 years and a median of 75 years. Women had a statistically significant higher average age than men (73.48 ± 18.52 vs 67.59 ± 17.60, t = 3.907; gl = 572; sig < 0.001). The most represented age group was people aged 80 or over (40.2%). The average age of women was 73.48 ± 18.518 years with a median of 80 years. Men had an average age of 67.59 ± 17.598 years with a median of 71 years (refer to Table 1). The majority of cases had an elapsed time of 30 minutes or less between the initial and final assessments (52.8%), followed by 31 to 60 minutes (36.1%), and more than 90 minutes in 2.4% of cases.

Table 1

Socio-demographic characterization of the population (n = 574)

Gender	*n*	%
Male	304	53.0
Female	270	47.0
Age group		
24 years or less	13	2.3
25-64 years	165	28.7
65-79 years	165	28.7
80 years or more	231	40.2

Note. n = Total sample; % = Percentage.

The NEWS score was assessed twice and ranged from 0 to 20, with a median of 3. The average score at the initial assessment was 4.43 ± 3.901, and at the final assessment, it was 3.34 ± 3.329. After grouping (see Table 2), 16.4% had a low-risk score of 0 at the initial assessment, with the remainder evenly distributed between low, medium, and high risk. In the final assessment, low risk was predominant (36.4%), with high risk showing the lowest frequency (17.1%).

Table 2

NEWS score and NEWS clinical risk (n = 574)

NEWS clinical risk	Initial		Final	
	n	%	*n*	%
Low score 0	94	16.4	143	24.9
Low	164	28.6	209	36.4
Medium	160	27.9	124	21.6
High	156	27.2	98	17.1

Note. n = Total sample; % = Percentage; NEWS = National Early Warning Score.

Significant differences were found between genders when comparing the NEWS score in both the initial assessment (t = 2.180; df = 527; sig = 0.03) and the final assessment (t = 2.061; df = 527; sig = 0.04), with women having higher averages. The analysis of the NEWS score evolution between the first and second clinical assessments (Table 3) revealed statistically significant correlations (global: r = 0.822; male: r = 0.815; female: r = 0.831) and differences between the two moments. The initial assessment showed higher averages than the final assessment. In the final assessment, the average decrease was greater in women than in men.

Table 3

NEWS score evolution between the two assessment moments by gender

	Initial mean	Final mean	*t*-test; df; sig
Global (*n* = 574)	4.43 ± 3.901	3.34 ± 3.329	*t* = 11.759; *df* = 573; *sig* < 0.001
Male (*n* = 304)	4.10 ± 3.98	3.07 ± 3.21	*t* = 7.763; *df* = 303; *sig* < 0.001
Female (*n* = 270)	4.81 ± 3.78	3.34 ± 3.47	*t* = 8.985; *df* = 269; *sig* < 0.001

Note. n = Total sample; *df* = Degrees of freedom; *t* = Student's *t*-test; *sig.* = Significance.

Table 4 shows that there are statistically positive and weak correlations between age and the NEWS score when broken down by gender, except for the first moment in women, where the correlation is moderate.

Table 4

Correlations between age and the NEWS score at the two assessment moments by gender

	Initial assessment (Pearson's correlation; sig)	Final assessment (Pearson's correlation; sig)
Global (*n* = 574)	*r* = 0.372; *sig* < 0.001	*r* = 0.349; *sig* < 0.001
Male (*n* = 304)	*r* = 0.327; *sig* < 0.001	*r* = 0.300; *sig* < 0.001
Female (*n* = 270)	*r* = 0.406; *sig* < 0.001	*r* = 0.381; *sig* < 0.001

Note. n = Total sample; *r* = Pearson's correlation; *sig.* = Significance.

The means were compared by age group between the two assessment moments (Table 5). Statistically significant differences were found in all age groups except for those aged 24 years or less. The group aged 80 years or more experienced the largest drop in means, followed by the group aged 65 to 79.

Table 5

Analysis of differences between the two assessment moments by age group

	Initial mean	Final mean	*t*-test; *df*; *sig*
≤ 24 years	0.69 ± 0.947	0.46 ± 0.660	*t* = 1.389; *df* = 12; *sig* = 0.190
25-64 years	2.87 ± 3.083	2.04 ± 2.529	*t* = 5.270; *df* = 164; *sig* < 0.001
65-79 years	4.26 ± 3.99	3.36 ± 3.45	*t* = 5.464; *df* = 164; *sig* < 0.001
≥ 80 years	5.88 ± 3.873	4.42 ± 3.419	*t* = 9.127; *df* = 230; *sig* < 0.001

Note. df = Degrees of freedom; *t* = Student's *t*-test; *sig.* = Significance.

Discussion

Early detection of clinical deterioration is crucial for timely treatment. This is especially important in pre-hospital settings, where time is of the essence, particularly for time-sensitive conditions that require rapid assessment and stabilization of critical patients. Due to the context's characteristics, there will be greater pressure, and time will be a fundamental and determining factor for the success of interventions (Oliveira & Martins, 2013; Martín-Rodríguez et al., 2019). Augusto (2015) emphasizes that nurses play a crucial role in identifying, treating, and monitoring victims of accidents or sudden illnesses in pre-hospital settings. The study population was mostly male (53%) and had an age range of 17 to 101 years. The mean age was higher in women than in men (73.48 ± 18.52 vs. 67.59 ± 17.60). The most representative age group was 80 years old or more (40.2%). These figures reflect the aging of the population and the consequent greater need for healthcare, including emergent and/or urgent care in out-of-hospital settings (Instituto Nacional de Estatística [INE], 2023). In 2021, there were more women than men aged 80 or more (448,636 vs. 263,837; INE, 2023). This could be the reason for the increase in critically ill patients and greater clinical complexity. Such complexity requires professionals with greater technical and scientific expertise. The results of the NEWS assessment showed that the initial score ranged from 0 to 20 points, with a

mean of 4.43 ± 3.901 points. The final NEWS score also ranged from 0 to 20 points, with a mean value of 3.34 ± 3.329 points. This indicates an overall improvement in the clinical state of the patients. The distribution of the NEWS score shows an increase in the number of people with a score of 0 points from the initial to the final assessment. This indicates an improvement in the clinical condition of a significant number of people in a critical situation. Initially, 94 critical patients had a NEWS score of 0 points, but in the final assessment, 143 people had the same score. However, higher NEWS scores correspond to a significant decrease in the number of individuals. Fifteen critical patients received ratings of more than 13 points in the initial assessment, and three received such ratings in the final assessment. These results demonstrate that the intervention of the ILS nurse is an asset in pre-hospital settings, as it can significantly improve the clinical conditions of those they care for. The clinical situation of critical individuals improved due to pre-hospital intervention by ILS nurses, regardless of gender. All age groups, except those aged 24 or less, showed a favorable evolution of their clinical situation. These results confirm the hypotheses of Maciver (2021) and Mota et al. (2021). Monitoring and interpreting vital parameters can help detect the acute deterioration of critical patients early, potentially preventing adverse events. Early detection of signs of clinical deterioration is crucial to initiate prompt treatment and reverse the clinical condition. This reinforces patient surveillance by the responsible health team (Patel et al., 2018; Némedi et al., 2023; Vasconcelos et al., 2019). This study shows that nurses effectively intervened in pre-hospital settings by detecting and assessing the clinical situation of critical patients early on and implemented appropriate actions to improve the clinical state and limit its deterioration, as evidenced by the progressive reduction in the NEWS score and clinical risk. Early detection and a timely, clinically competent response are crucial for patients' clinical outcomes (Olasveengen et al., 2020; Perkins et al. (2021); Némedi et al., 2023). The results align with Augusto's (2015) analysis of the implementation of the NEWS scale in three assessment moments to assess nurses' work in pre-hospital settings. In the initial assessment, a large number of critical patients were identified as high-risk. However, in the subsequent assessment that utilized NEWS, there was a significant decrease in the number of cases classified as high risk when compared to the first and second assessments. The majority of cases were classified as no risk, with women being the majority, followed by those classified as low risk, with men being the majority (Augusto, 2015). Significant differences were found between men and women in each of the assessment moments regarding the relationship between the gender variable and the NEWS score of people who required the intervention of ILS nurses. Women showed a greater deterioration in their clinical condition. Additionally, the number of women in the older age groups is substantially higher than men, which may affect the statistical significance of the difference in severity between men and women. The statistical significance of the differences in the NEWS score between genders decreased from very significant (sig = 0.004) to significant (sig = 0.032) between the initial and final assessments. This may indicate the ILS nurse's ability to stabilize the patient's clinical condition, as the differences between genders were attenuated after their intervention. These results suggest that older age and more complex clinical conditions may contribute to the variations and higher success rates of nurse interventions. However, further studies targeting these variables are needed to draw conclusions and analyze the impact of nurse intervention in pre-hospital settings. We analyzed the association between age and the NEWS score of critical patients. We found that the score increased with age, which was evident in both assessment moments and across all age groups. In the initial and final assessments, critical patients aged 80 or more had the highest mean NEWS score. Additionally, older people experience greater morbidity due to an increase in the prevalence of chronic degenerative diseases, leading to more disabilities (Tavares, 2014). As people age pathologically and physiologically, their clinical conditions tend to deteriorate, leading to an increase in disability and morbidity. ILS nurses observed greater clinical deterioration in older people upon arrival and after intervention. However, ILS nurses intervened and reduced the deterioration in clinical status across all age groups, including the oldest, between the first and second assessments. The clinical condition of younger people also improved, albeit with a smaller variation, as indicated by the NEWS score.

The study has limitations. This emergency service is relatively new, and there is little research to compare these results with other evidence in national and international literature. Additionally, incomplete records on the NEWS scale significantly reduced the sample size. It was not possible to identify the nursing care that was most effective in improving the clinical status of critical patients, nor to determine whether the positive evolution of their clinical status was due to autonomous interventions or to the protocol interventions of ILS nurses. The study's results and limitations indicate the necessity of a national-level multicenter study to assess the impact of nurses' intervention in ILS ambulances. The study also suggests that nurses should play a more significant role in enhancing the documentation of the care they provide.

Conclusion

The study emphasized the significance of emergency nurses' involvement in pre-hospital ILS settings. The main findings showed a gradual decrease in the NEWS score based on gender and age group, indicating an improvement in the clinical condition from the initial to the final assessment after the nurse's intervention.

Other studies should be conducted in broader contexts, such as at the national level. These studies should include other variables, such as the time of arrival of nurses to critical patients, the time of arrival at the hospital, pathological history, protocols, and interventions carried out. This will allow for comparison and correlation with the clinical state of people in critical situations.

This article is the result of a master's thesis.

Author contributions

Conceptualization: Silva, M., Miranda, J., Sousa, C.
Data curation: Silva, M., Miranda, J., Sousa, C., Graça, L.
Formal analysis: Miranda, J., Sousa, C., Graça, L.
Investigation: Silva, M., Miranda, J., Sousa, C.
Methodology: Miranda, J., Sousa, C., Graça, L.
Project administration: Sousa, C.
Resources: Sousa, C., Graça, L.
Software: Sousa, C., Graça, L.
Supervision: Silva, M., Sousa, C.
Validation: Silva, M., Miranda, J., Sousa, C., Magalhães, J., Graça, L.
Visualization: Miranda, J., Sousa, C.
Writing - original draft: Miranda, J., Sousa, C.
Writing - review & editing: Miranda, J., Sousa, C., Magalhães, J., Graça, L.

References

Arévalo-Buitrago, P., Morales-Cané, I., Luque, E. O., Godino-Rubio, M., Rodríguez-Borrego, M. A., & López-Soto, P. J. (2022). Early detection of risk for clinical deterioration in emergency department patients: Validation of a version of the national early warning score 2 for use in Spain. *Emergencias, 34*(6), 452-457.

Augusto, O. A. (2015). *Identificação do risco de deterioração fisiológica no pré-hospitalar* [Master's Dissertation]. Instituto Politécnico de Viseu.

Despacho n.º 5561/2014 do Ministério da Saúde. (2014). *Diário da República: 2.ª Série, nº 79*. https://static.sanchoeassociados.com/DireitoMedicina/Omlegissum/legislacao2014/Abril/Desp_5561_2014.pdf

Hoikka, M., Länkimäki, S., Silfvast, T., & Ala-Kokko, T. I. (2016). Medical priority dispatch codes-comparison with national early warning score. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 24*, 142. https://doi.org/10.1186/s13049-016-0336-y

Instituto Nacional de Estatística. (2023). *Taxa de variação da população residente (2011-2021) (%) e taxa de variação da população residente (2011-2021) (%).* https://censos.ine.pt/xportal/xmain?xpgid=censos21_populacao&xpid=CENSOS21

Instituto Nacional de Emergência Médica. (2013). *SIEM - Sistema Integrado de Emergência Médica*.

Ivic, R., Vicente, V., Kurland, L., Svensson, J., Klintemård, R. S., Castrén, M., & Bohm, K. (2022). Pre-hospital emergency nurse specialist's experiences in caring for patients with non-specific chief complaints in the ambulance - A qualitative interview study. *Internacional Emergency Nursing, 63*, 101178. https://doi.org/10.1016/j.ienj.2022.101178

Kauppi, W., Herlitz, J., Karlsson, T., Magnusson, C., Palmér, L., & Axelsson, C. (2020). Pre-hospital predictors of an adverse outcome among patients with dyspnoea as the main symptom assessed by pre-hospital emergency nurses: A retrospective observational study. *BMC Emergency Medicine*, *20*(89). https://doi.org/10.1186/s12873-020-00384-1

Kievlan, D. R., Martin-Gill, C., Kahn, J. M., Callaway, C. W., Yealy, D. M., Angus, D. C., & Seymour, C. W. (2016). External validation of a prehospital risk score for critical illness. *Critical Care, 20*(255). https://doi.org/10.1186/s13054-016-1408-0

Maciver, M. (2021). Pre-hospital use of early warning scores to improve detection and outcomes of sepsis. *British Journal of Community Nursing, 26*(3), 122-129. https://doi.org/10.12968/bjcn.2021.26.3.122

Magnusson, C., Herlitz, J., & Axelsson, C. (2020). Pre-hospital triage performance and emergency medical services nurse's field assessment in an unselected patient population attended to by the emergency medical services: A prospective observational study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine, 28*(81). https://doi.org/10.1186/s13049-020-00766-1

Martín-Rodríguez, F., Castro-Villamor, M., Vegas, C. P., Martín-Conty, J. L., Mayo-Iscar, A., Benito, J. F., Ibañez, P. B., Arnillas-Gómez, P., Escudero-Cuadrillero, C., & López-Izquierdo, R. (2019). Analysis of the early warning score to detect critical or high-risk patients in the prehospital setting. *Internal and Emergency Medicine, 14*, 581-589. https://doi.org/10.1007/s11739-019-02026-2

Mota, M., Cunha, M., Santos, E., Figueiredo, Â., Silva, M., Campos, R., & Santos, R. M. (2021). Eficácia da intervenção da enfermagem pré-hospitalar na estabilização das vítimas de trauma. *Revista de Enfermagem Referência, 5*(6), e20114. https://doi.org/10.12707/RV20114

Olasveengen, T. M., Mancini, M. E., Perkins, G. D., Avis, S., Brooks, S., Castrén, M., Chung, S. P., Considine, J., Couper, K., Escalante, R., Hatanaka, T., Hung, K. K., Kudenchuk, P., Lim, S. H., Nishiyama, C., Ristagno, G., Semeraro, F., Smith, C. M., Smyth, M. A., … Morley, P. T. (2020). Adult basic life support: International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Resuscitation, 156*, A35-A79. https://doi.org/10.1016/j.resuscitation.2020.09.010

Oliveira, A., & Martins, J. (2013). Ser enfermeiro em suporte imediato de vida: Significado das experiências. *Revista de Enfermagem Referência, 3*(9), 115-124. https://doi.org/https://doi.org/10.12707/RIII1287

Patel, R., Nugawela, M. D., Edwards, H. B., Richards, A., Roux, H. L., Pullyblank, A., & Whiting, P. (2018). Can early warning scores identify deteriorating patients in pre-hospital settings? A systematic review. *Resuscitation, 132*, 101-111. https://doi.org/10.1016/j.resuscitation.2018.08.028

Perkins, G. D., Graesner, J. T., Semeraro, F., Olasveengen, T., Soar, J., Lott, C., Voorde, P. V., Madar, J., Zideman, D., Mentzelopoulos, S., Bossaert, L., Greif, R., Monsieurs, K., Svavarsdóttir, H., & Nolan, J. P. (2021). European resuscitation council guidelines 2021: Executive summary. *Resuscitation, 161*, 1-60. https://doi.org/10.1016/j.resuscitation.2021.02.003

Regulamento nº 361/2015 da Ordem dos Enfermeiros. (2015). *Diário da República: 2.ª Série,* nº 123. https://static.sanchoeassociados.com/DireitoMedicina/Omlegissum/legislacao2015/Junho/Regul_361_2015.pdf

Regulamento nº 367/2015 da Ordem dos Enfermeiros. (2015). *Diário da República: 2.ª Série,* nº 124. https://www.sep.org.pt/files/uploads/2016/10/sep_Regulamento_Padroes_Qualidade_Cuidados_Especializados_em_Enfermagem_Saude_Familiar.pdf

Némedi, N. S., Lóczi, G., Kovács, E., & Zima, E. (2023). A felnőtt emelt szintű újraélesztés és a postresuscitatiós ellátás újdonságai. *Orvosi Hetilap, 164*(12), 454-462. https://doi.org/10.1556/650.2023.32725

Tavares, T. C. (2014). *Scores de alerta precoce: Estado da arte e proposta de implementação* [Master's Dissertation, University of Beira Interior, Health Sciences]. https://ubibliorum.ubi.pt/bitstream/10400.6/4943/1/3357_6732.pdf

Vasconcelos, P., Oliveria, A., Augusto, T., Ladeira, L., Lourenço, J., Barros, F., & Ramos, R. (2019). National early warning score (News) evaluation in an ambulance-nurse: One-year experience in Portugal. *BMJ Open, 9*(2), A15-A16. https://doi.org/http://dx.doi.org/10.1136/bmjopen-2019-EMS.41

Williams, T. A., Tohira, H., Finn, J., Perkins, G. D., & Ho, K. M. (2016). The ability of early warning scores (EWS) to detect critical illness in the prehospital setting: A systematic review. *Resuscitation, 102*, 35-43. https://doi.org/10.1016/j.resuscitation.2016.02.011