

Nurses' knowledge of prehospital and in-hospital management of traumatic hypovolemic shock: a national observational study

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ABSTRACT

Introduction: traumatic hypovolemic shock is one of the leading causes of preventable death following major trauma. Its management relies on evidence-based resuscitation strategies and requires a time-sensitive, integrated approach across the prehospital and in-hospital settings. Nurses play a pivotal role in the early recognition and initial management of these patients. The objective of the study was to assess nurses' knowledge of traumatic hypovolemic shock management and to explore the association between recent trauma training, the availability of clinical care algorithms, and performance in clinical scenarios.

Materials and Methods: a national cross-sectional observational study was conducted between July 1 and July 31, 2025, among 170 nurses affiliated with ANIARTI (Italian Association of Critical Care Nurses). Data were collected using a purpose-designed questionnaire that underwent content validation (S-CVI = 0.95). The questionnaire included socio-demographic and professional characteristics, information on trauma training and the availability of clinical care algorithms, and six clinical scenarios assessing knowledge of traumatic hypovolemic shock management. Descriptive statistics and bivariate comparisons using Welch's t-test were performed. Results. The mean total knowledge score was 3.12 out of 6 (52%). Correct response rates ranged from 49% to 83% across the six clinical scenarios. Participants who had attended recent trauma training achieved higher mean scores than those without recent training (3.60 vs 1.96). Higher mean scores were also observed in settings where integrated clinical care algorithms were available.

Conclusions: nurses' knowledge of traumatic hypovolemic shock management was overall moderate. This exploratory study suggests that recent trauma training and the availability of structured clinical care algorithms may be associated with better performance in clinical scenarios. Given the use of a purpose-designed questionnaire that underwent content validation only, these findings should be interpreted as an exploratory assessment rather than as a definitive measure of nurses' knowledge. Periodic trauma education programmes and the implementation of shared clinical care algorithms may contribute to improving consistency in trauma care and supporting patient safety across emergency settings.

Key words: hemorrhagic shock; wounds and injuries; permissive hypotension; nursing; emergency medical services.

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Introduction

Traumatic hypovolemic shock is characterized by a critical reduction in tissue perfusion resulting from acute blood loss and is recognized as one of the leading causes of preventable death following major trauma.^{1,2} Trauma is the third leading cause of death in Western countries and the leading cause of mortality among individuals younger than 40 years.² In the United States, approximately 40% of trauma-related deaths are attributable to hemorrhage, which remains the most common preventable cause of death following traumatic injury.¹ In Italy, according to the most recent data released by the Italian National Institute of Statistics (ISTAT), more than 166,000 road traffic accidents involving personal injuries occurred in 2023, resulting in over 3,000 deaths and more than 224,000 injured individuals.³ Over the past decade, trauma resuscitation has progressively shifted towards damage control resuscitation strategies, including permissive hypotension, with the aim of minimizing trauma-induced coagulopathy and facilitating early haemorrhage control.^{4,5} The management of major trauma is inherently time-sensitive and requires close integration between the prehospital and in-hospital settings, particularly during the so-called *golden hour*, when timely recognition and treatment are crucial for improving patient survival.⁶ Within this context, nurses play a pivotal role in the early recognition of shock, prioritization of life-saving interventions, continuous monitoring of physiological parameters, and coordination of multidisciplinary team activities during the initial phase of trauma management.^{7,8} Despite the importance of nursing practice in trauma care, national evidence regarding nurses' knowledge of traumatic hypovolemic shock management remains limited. In particular, little is known about the relationship between trauma-specific education, the availability of structured clinical care algorithms, and nurses' decision-making abilities in both the prehospital and hospital settings.^{9,10}

Materials and Methods

A national cross-sectional observational study was conducted between July 1 and July 31, 2025, in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies. The study population consisted of nurses affiliated with ANIARTI (Italian Association of Critical Care Nurses) working in prehospital emergency medical services and emergency departments. The questionnaire was distributed through the official ANIARTI mailing list and communication channels. Data were collected using a purpose-designed questionnaire consisting of 16 multiple-choice items organized into three sections: socio-demographic and professional characteristics; information regarding trauma education and the availability of regional clinical care algorithms; and six clinical scenarios focused on the management of traumatic hypovolemic shock in both the prehospital and in-hospital settings. The six clinical scenarios were specifically designed to assess participants' knowledge of the initial management of patients with traumatic hypovolemic shock. The scenarios addressed different stages of the clinical pathway, including early recognition of shock, primary assessment according to the ABCDE approach, prioritization of nursing interventions, initial resuscitation strategies, and the application of recommendations from international trauma guidelines. Each scenario included one predefined correct answer established *a priori* according to the available scientific evidence and the international guidelines used during questionnaire development. One point was assigned for each correct answer and zero points for

incorrect answers, yielding a total knowledge score ranging from 0 to 6. This score was subsequently treated as a continuous measure of participants' knowledge. The complete questionnaire, including all six clinical scenarios, is provided as *Supplementary Material*. The questionnaire was developed with the support of two expert nurses working in prehospital and emergency care. Content validity was assessed by a panel of ten expert nurses with extensive experience in prehospital and hospital trauma management. Each expert independently evaluated all six clinical scenarios using a five-point Likert scale according to the following criteria: clarity and comprehensibility, clinical relevance, realism of the scenario, consistency of the response options, and the ability of each item to assess the intended knowledge domain. Experts were also invited to provide qualitative comments, which were reviewed by the authors and incorporated into the final version of the questionnaire before its administration. Quantitative content validation was performed by calculating the Item Content Validity Index (I-CVI) for each item and the overall Scale Content Validity Index (S-CVI), which was 0.95, indicating excellent content validity.¹¹ A separate pilot study was not conducted because the questionnaire was administered only after completion of both the qualitative and quantitative content validation processes and implementation of all modifications suggested by the expert panel. Additional psychometric properties, including internal consistency and test-retest reliability, were not evaluated because the instrument was specifically developed for this observational study. Data were collected anonymously and voluntarily using the online platform Jotform® (Jotform Inc., San Francisco, CA, USA) in accordance with the European Union General Data Protection Regulation (GDPR, Regulation EU 2016/679). The primary outcome was the total score obtained across the six clinical scenarios (range 0–6), expressed as the number of correct responses. Higher scores indicated greater knowledge regarding the initial management of traumatic hypovolemic shock. Statistical analyses were performed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Categorical variables were summarized using frequencies and percentages, whereas continuous variables were described using the mean, median, and standard deviation. The proportion of correct responses was also calculated for each clinical scenario. Exploratory comparisons were performed according to recent trauma education and the availability of clinical care algorithms. Specifically, differences between participants with and without recent trauma education were assessed using Welch's independent-samples t-test, assuming unequal variances. Statistical significance was established at $p < 0.05$. Given the observational and exploratory nature of the study, all observed associations were interpreted descriptively, and no causal inferences were made. Because the survey was anonymous, involved healthcare professionals only, and did not include the collection of patient data, formal approval by an Ethics Committee was not required according to current Italian regulations and local institutional practice.

Results

A total of 170 nurses were included in the study. The characteristics of the study population and the main findings are summarized in Table 1. Most participants were aged between 30 and 40 years and had more than five years of professional experience. Overall, 60.0% worked in the prehospital setting, while 70.0% reported having attended trauma-related training courses within the previous 24 months. The availability of clinical care algorithms varied across the different clinical settings. The mean total knowledge score across the six clinical scenarios was 3.12 ± 1.12 out of

a maximum of 6 (52%). The proportion of correct responses ranged from 83% for Clinical Scenario 1 to 49% for Clinical Scenario 6, indicating a progressive decline in performance as the decision-making complexity of the scenarios increased. Participants who had attended trauma training within the previous two years achieved significantly higher mean scores than those without recent trauma training (3.61 ± 0.91 vs. 1.96 ± 0.77 correct responses out of six). Comparison using Welch's independent-samples t-test demonstrated a statistically significant difference between the two groups ($t = 12.08$; $p < 0.001$), with a mean difference of 1.65 points (95% CI, 1.38–1.92) and a large effect size (Cohen's $d = 1.89$). Lower mean scores were observed in settings without structured clinical protocols than in those where clinical care algorithms were available. In contrast, the difference between settings with integrated clinical care algorithms and those with only a major trauma algorithm was comparatively small.

Discussion

The present study demonstrated an overall moderate level of nurses' knowledge regarding the management of traumatic hypovolemic shock. Recent trauma education emerged as the factor most strongly associated with higher knowledge scores, highlighting the pivotal role of continuing professional education in the management of time-sensitive and highly complex clinical conditions. These findings are consistent with the international literature,

which has shown that structured educational programmes based on Advanced Trauma Life Support (ATLS®), Prehospital Trauma Life Support (PHTLS®), and simulation-based training are associated with improvements in theoretical knowledge, clinical decision-making, and the initial management of trauma patients. In particular, Chowdhury *et al.*,¹² reported a significant improvement in nurses' performance following intensive ATLS®-based educational programmes, whereas Dehghannezhad *et al.*¹³ demonstrated sustained improvements in knowledge and clinical performance after integrated educational interventions combined with simulation-based training. Although the present study was observational and descriptive in nature, its findings are consistent with these previous reports. The absence of a clear association between years of professional experience and knowledge scores suggests that clinical experience alone may not be sufficient to maintain up-to-date knowledge of major trauma management unless supported by structured continuing education. This finding further emphasizes the importance of regular, multidisciplinary educational programmes based on realistic clinical scenarios. The use of standardized clinical scenarios in the present study allowed participants' applied knowledge to be assessed in realistic clinical situations, although it cannot replace the direct evaluation of clinical competence in everyday practice. Another relevant finding concerns the availability of structured clinical care protocols. Lower knowledge scores were observed among participants working in settings without structured protocols, whereas the difference between settings with integrated clinical care algorithms and those with only a

Table 1. Characteristics of the study population and study findings (N=170).

Section	Variable	Category	N	Value % (SD)
Participant characteristics	Age group (years)	< 30	19	11.2
		30 – 40	62	36.5
		41 – 50	54	31.7
		> 50	35	20.6
		< 1	5	2.9
	Professional experience (years)	1– 4	30	17.6
		5 –10	63	37.0
		> 10	72	42.3
	Geographical area	Northern Italy	134	78.8
		Central Italy	23	13.5
		Southern Italy	13	7.6
	Clinical setting	Prehospital	102	60.0
		Hospital	68	40.0
	Trauma training within the previous 24 months	Yes	119	70.0
		No	51	30.0
	Availability of regional clinical care algorithms	Major trauma algorithm + nursing algorithm	61	35.9
		Major trauma algorithm only	81	47.6
		No structured protocols	28	16.5
Performance in clinical scenarios	Clinical Scenario 1	-	141/170	83
	Clinical Scenario 2	-	98/170	58
	Clinical Scenario 3	-	111/170	65
	Clinical Scenario 4	-	119/170	69
	Clinical Scenario 5	-	96/170	56
	Clinical Scenario 6	-	84/170	49
Section	Variable	Category	N	Value % (SD)
Comparative analysis	Recent trauma training	Yes	119	3.61 (0.91)
		No	51	1.96 (0.77)
	Clinical care algorithms	Major trauma algorithm + nursing algorithm	61	3.30 (NA)
		Major trauma algorithm only	81	3.21 (NA)
		No structured protocols	28	2.46 (NA)

Note. Data are presented as frequencies and percentages (%) or, where appropriate, as mean (SD). SD, standard deviation; NA, not applicable.

major trauma algorithm was more modest. Given the observational design of the study, these findings do not support causal inferences regarding the effect of clinical care algorithms. Nevertheless, they suggest that shared organizational tools may facilitate nurses' clinical decision-making and contribute to greater consistency in trauma care pathways, in agreement with the current Italian recommendations for the integrated management of major trauma.¹⁴ Several limitations should be acknowledged. First, the use of a convenience sample, the exclusive recruitment of nurses affiliated with ANIARTI, and the uneven geographical distribution of participants, with a predominance of respondents from Northern Italy, may have introduced selection bias and limit the generalizability of the findings. Second, the questionnaire was specifically developed for this study and underwent content validation only. Although the high S-CVI supports the clinical relevance of the questionnaire items, additional psychometric properties, including internal consistency and test-retest reliability, were not evaluated and should be addressed in future validation studies. Furthermore, the use of standardized clinical scenarios provides an assessment of applied knowledge but does not directly measure actual clinical performance. Finally, because of the cross-sectional observational design, no causal relationship can be established between trauma education, the availability of structured clinical care protocols, and participants' performance. Overall, the findings suggest that periodic multidisciplinary trauma education programmes, together with the implementation of shared clinical care protocols and algorithms across trauma systems, may contribute to improving the consistency of trauma care pathways and supporting nurses' clinical decision-making across emergency settings.^{15,16}

Conclusions

Overall, nurses' knowledge of traumatic hypovolemic shock management was moderate. Participants who had received recent trauma education achieved higher mean knowledge scores, whereas the availability of structured clinical care protocols and algorithms was associated with better performance. However, these findings should be interpreted with caution given the observational design of the study. Because the questionnaire was specifically developed for this study and underwent content validation only, the findings should be regarded as an exploratory assessment of nurses' knowledge within the study sample rather than as a definitive measure of nurses' knowledge. Despite these methodological limitations, the findings suggest that regular multidisciplinary trauma education programmes, combined with the implementation of shared clinical care protocols and algorithms across trauma systems, may contribute to improving the consistency of trauma care pathways and supporting nurses' clinical decision-making in emergency care settings.

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Online supplementary materials

Questionnaire used in the study

Contributions: the authors contributed equally to this paper.

Conflict of interest: the authors declare that they have no conflicts of interest.

Ethical approval and informed consent: anonymous survey of healthcare professionals; no clinical patient data collected; no review by the Ethics Committee was required according to local practice.

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