BMC Emergency Medicine

RESEARCH

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Comparison of emergency physician opinions with MSOFA and PREMEWS scores in determining the necessity of non-traumatic internal medicine patient transfers to the emergency department: a longitudinal study

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Abstract

Background Accurate prehospital decision-making is critical in emergency care to ensure the appropriate use of resources and optimal patient outcomes. However, the alignment between emergency physicians' clinical judgments and scoring systems such as Prehospital Modified Early Warning Score (Pre-MEWS) and the modified Sequential Organ Failure Assessment (mSOFA) remains underexplored.

Objective This study investigates the consistency of prehospital Pre-MEWS and in-hospital mSOFA scores with emergency physicians' judgments in determining the necessity of non-traumatic Internal Medicine Patient transfers to emergency departments (EDs). Additionally, it evaluates the clinical outcomes of these transfers.

Methods In this longitudinal study conducted between 2019 and 2020 in Semnan, Iran, 675 non-traumatic Internal patients transferred to a single ED were analyzed. Pre-MEWS scores were recorded prehospital, while mSOFA scores and physicians' evaluations were documented post-transfer. Outcomes included discharge, hospital admission, ICU transfer, or death.

Results This study analyzed 675 non-traumatic Internal patients transferred to the emergency department, with a mean age of 55.93 ± 21.89 years. 31% of transfers were deemed unnecessary by emergency physicians. The mean length of stay was 5.63 ± 5.69 h, showing a significant correlation with higher Pre-MEWS and mSOFA scores ($p < 0.0001$). Based on Pre-MEWS, patients were stratified into three risk levels: Green (≤ 3, no ICU/mortality), Yellow (4–12, 3.8% ICU admissions, no deaths), and Red (≥ 13, all deceased patients). mSOFA scoring identified two risk levels: Yellow (1–5, 0% mortality, ICU risk rising to 20%) and Red (≥ 6, ICU admissions up to 100%, mortality risk reaching 676.8%). Specifically, all deceased patients had Pre-MEWS scores ≥ 13, and ICU admission was observed in 3.8% of patients with Pre-MEWS scores between 4 and 12. The mSOFA score demonstrated superior predictive accuracy for

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mortality and ICU admission compared to Pre-MEWS. However, Pre-MEWS provided practical utility for prehospital triage.

Conclusion Combining scoring systems with clinical judgment can improve decision-making in prehospital settings. Enhanced integration of tools and expertise is recommended to reduce unnecessary transfers and optimize emergency care.

Keywords Emergency medicine, Emergency medical services, Early warning score, Patient transfer, Longitudinal studies, Triage

Introduction

In most societies today, quality pre-hospital emergency care is an essential component of caring for patients in need of emergency care [1]. Providing appropriate pre-hospital care and the timely transfer of patients to hospitals is considered the first step in managing emergencies and illnesses [2]. Historically, emergency medical services (EMS) began as rudimentary systems focused primarily on transporting patients to hospitals. Over time, these services have evolved to incorporate advanced prehospital interventions, utilizing a range of medical technologies and treatments to stabilize patients before they reach a healthcare facility. The number of ambulance stations and the expansion of emergency medical services (EMS) across the globe have seen significant growth in recent years, driven by increased demand for emergency care due to factors such as the rising incidence of traffic accidents, cardiovascular diseases, and the aging population. Having a population of about 88 million in southwestern Asia, Iran is a member of the World Health Organization (WHO) in the Eastern Mediterranean region (11). This global expansion of EMS services is mirrored in Iran, where approximately 20,000 personnel are involved in pre-hospital care, and more than 3,000 EMS centers operate across the country (viz., 1700 road centers, 1300 urban centers, and 50 Air medical emergency centers) (12).

In the field of pre-hospital emergency care, the decision to transfer patients is critical and must be made with careful consideration The accuracy of patient condition assessments at the pre-hospital stage significantly influences whether they are transferred to an appropriate hospital [3]. Unnecessary patient transfers to hospital emergency departments pose a significant challenge in healthcare systems. This issue is driven by limited resources, overcrowding in hospitals, and the increased risks of complications during transport. Moreover, Unnecessary transfers not only increase healthcare costs but also expose patients to risks such as hypoxia, hospital-acquired infections, and delayed access to appropriate care, especially in the case of patients with non-trauma conditions [4]. If patients are transferred unnecessarily to high-capacity hospitals when lower levels of care are sufficient, it can overwhelm emergency services, leading to delayed treatment for those in more critical need [5]. A study published in Hospital Pediatrics analyzed pediatric transfers and found that a significant portion of these transfers—up to 30%—were deemed unnecessary based on clinical outcomes [6]. Reports by the Risk Management Foundation of Harvard Medical Institutions emphasize that unnecessary transfers often arise due to unclear protocols and communication issues. These findings suggest that standardizing procedures could significantly reduce unnecessary patient movement [7]. Transfers from skilled nursing facilities (SNF) to the emergency department (ED) account for approximately 14 million ED visits annually, a fifth of which may be avoidable [8]. Some studies in Iran suggest that between 20% and 60% of all patients visiting the country's emergency departments do so for urgent yet simple and non-complicated issues. These cases could be effectively and promptly managed in lower-tier healthcare facilities [9].

To reduce unnecessary patient transfers and eliminate inappropriate use of ambulances, establishing a control mechanism is essential. For the creation and development of such a mechanism, understanding who needs an ambulance, where, and for what purpose can be highly beneficial [10]. Studies do not support the accuracy of all clinical judgments made by emergency medical staff regarding patients' need for ambulance transport. This is because these judgments are made by pre-hospital staff with varying levels of education and experience. Such decisions are largely based on a range of cognitive processes, clinical experience, and, rarely, on evidence-based guidelines. This variability in judgment highlights the challenges in ensuring consistent, evidence-supported decision-making in emergency medical services [11, 12]. In this regard, and to implement evidence-based actions, several scoring systems have been proposed to identify patients at risk for requiring emergency department care. However, most of the scales, criteria, and systems developed have primarily been designed to assess the condition of trauma patients. These tools have been focused on identifying the severity of injuries, vital signs, and other key clinical indicators specific to trauma situations [13]. Studies show that a significant portion of pre-hospital emergency missions in Iran is dedicated to attending to and transporting patients with internal

medical conditions. However, resource limitations and hospital overcrowding have emphasized the need for accurate and reliable predictive tools. Previous studies have shown that tools like mSOFA have greater accuracy in predicting outcomes such as mortality or the need for ICU admission. In contrast, the Pre-MEWS tool is more popular due to its simplicity and feasibility in prehospital settings, but its effectiveness, particularly for complex patients, remains unclear [11, 13]. It is obvious that it is essential and important to recognize internal cases at risk in the prehospital emergency department and to make appropriate and evidence-based decisions by staff in this field. This study aims to address this gap by evaluating the necessity of transferring internal medicine patients in EMS using the Prehospital Internal Emergency Alert Scale and comparing these findings with the decisions of emergency medicine doctors.

Methodology

This study is a descriptive-analytical longitudinal prospective study conducted with the aim of analyzing the necessity of transferring internal medicine patients in pre-hospital emergencies using the Emergency Severity Index (ESI) and the opinion of emergency physicians during the years 2019–2020. The study population consisted of all internal medicine patients seeking pre-hospital emergency services in Semnan, who were transferred to Kosar Hospital's emergency department in Semnan and met the inclusion criteria. In this research, sampling was conducted purposefully, using a non-randomized and consecutive approach, from among internal medicine patients requesting pre-hospital emergency services. These requests were made either directly by the patients themselves or through others by contacting the Emergency Dispatch Center. The basis for determining the sample size was the recommendation of researchers to ensure the validity of logistic regression results. According to this recommendation, the number of samples should be between 5 and 10 times the number of items in the questionnaire [14]. Therefore, considering that the pre-hospital Emergency Severity Index for internal medicine includes 22 variables, the minimum required sample size for this study was 220 individuals. However, to enhance the study's statistical power, a larger sample size was collected. The study population comprised 823 non-traumatic patients transferred by pre-hospital emergency services to the emergency department of Kosar Hospital [1]. A total of 675 patients were ultimately selected purposively and non-randomly based on the inclusion and exclusion criteria.

The **inclusion criteria**: included informed consent from patients, admission to the emergency department, age over 18 years, and the absence of trauma or psychiatric disorders. The **exclusion criteria**: were the patient's unwillingness to continue participation in the study, transfer to another hospital, self-discharge against medical advice, and insufficient data to complete demographic information.

The tools used in this study included demographic questionnaires, the pre-hospital Emergency Severity Index for internal medicine, and the mSOFA (modified Sequential Organ Failure Assessment) tool.

The demographic and disease-related questionnaire included variables such as age, gender, length of stay in the emergency department, length of stay in the hospital, the number of previous hospitalizations, and the patient's primary complaint.

The pre-hospital Emergency Severity Index) Pre-MEWS (The Pre-MEWS index is a standardized assessment tool designed to determine the severity of a patient's condition in the prehospital setting. This index helps healthcare providers, especially Emergency Medical Services (EMS) personnel, make more accurate decisions regarding patient transfer prioritization, the need for intensive care, or ICU admission, based on the patient's clinical symptoms.

Structure of the Pre-MEWS index

The Pre-MEWS index consists of 22 items, each representing a specific clinical sign or condition in the patient. Each item is assigned a score between 1 and 5, depending on the presence and severity of the symptom. The total score is then calculated, ranging from 0 to 54.

Score ranges and their interpretation

- Score 0: The patient has none of the listed symptoms and is in a stable condition.
- Score 1 to 10: The patient has mild symptoms and may require initial hospital evaluation.
- Score 11 to 25: The patient is in a moderate condition and requires emergency care.
- Score 26 to 40: The patient is in a severe condition and must be closely monitored.
- Score 41 to 54: The patient is in a critical state, with a high probability of requiring intensive care (ICU) or even resuscitation (CPR).

Clinical parameters assessed in the Pre-MEWS index

The Pre-MEWS index evaluates 22 clinical signs and symptoms, including essential vital signs and critical indicators such as:

Level of consciousness **(GCS – Glasgow Coma Scale)**
Systolic and diastolic blood pressure

[1] Kosar Hospital, a teaching and research hospital as well as a referral center for non-trauma patients in Semnan Province, is located in the city of Semnan and has a capacity of 220 beds.

Respiratory rate **and presence of respiratory distress**
Heart rate **(Tachycardia or Bradycardia)**
Body temperature **(Hypothermia or Hyperthermia)**
Blood oxygen saturation (SpO_2)
Chest pain, shortness of breath, or cyanosis
Shock status and signs of severe bleeding.
Blood glucose levels **(Hypoglycemia or Hyperglycemia)**
Electrolyte imbalances and acid-base status

The validity of this tool was confirmed in the study by Ebrahimian et al. (2017). Additionally, the reliability of the tool was validated with a Cronbach's alpha coefficient of 0.759 [15].

The mSOFA scale is one of the well-known tools for assessing the severity of illness in patients. It has been used in several studies in Iran and other countries to evaluate patient severity and predict mortality, with its validity and reliability confirmed. This system assesses the indices related to five major and vital organs of the body, including the cardiovascular system, lungs, kidneys, liver, and central nervous system. A score between 0 and 4 is assigned to the function of each of these organs [16, 17]. The reliability coefficient of this tool for use in hospitalized patients in intensive care units in Iran was 0.94 [16].

Emergency Doctor's opinion The expert opinions of emergency medicine physicians were utilized as a complementary clinical criterion to confirm or reject the necessity of patient transfer. The inclusion of emergency medicine physicians' expert opinions as a complementary criterion for determining the necessity of patient transfer is grounded in the robust foundation of their clinical training and experience. This approach provides an essential layer of clinical insight that augments the structured assessments from tools like **mSOFA** or **Pre-MEWS**. In this study, the emergency physician's opinion was taken as part of the evaluation process, alongside structured assessment tools such as Pre-MEWS and mSOFA. After a comprehensive review of the patient's condition, including clinical signs, vital status, and key findings from the physical examination, the emergency physician decided to assess the patient's emergency status. In addition, to increase the validity of this decision, the emergency physician's opinion on the need to transfer the patient was taken into account based on clinical guidelines and triage protocols.

All pre-hospital emergency staff in Semnan received training on study procedures and the correct completion of scales, and provided consent to participate in the study. Technicians who were unwilling to cooperate were excluded from the sampling process. If both technicians at a specific station during a particular shift declined to participate, that station was excluded from the sampling for that shift. Additionally, informed consent was obtained from all patients eligible to participate in the study. For patients in a coma or unable to provide consent, their legal guardian or representative was approached. Patients classified at the highest triage level, who were critically ill and required resuscitation, were not included in the sampling unless the technicians were able to complete the questionnaire after transferring the patient to the hospital. To collect data, trained technicians completed the Pre-Hospital Emergency Severity Scale **(Pre-MEWS)** at the patient's bedside alongside the routine patient assessment form in pre-hospital emergency settings. To expedite the patient transfer process, demographic and medical details were documented in the hospital after the patient was handed over to the hospital emergency department. Following patient admission to the emergency department, the opinion of an emergency medicine specialist was obtained regarding the urgency of the patient's condition. Additionally, to validate the specialists' assessments and employ a more objective criterion for statistical analysis, the **mSOFA** tool was also utilized in the hospital emergency department. The outcomes of patients in the emergency department, after discharge from the emergency department, and throughout their hospital stay were also monitored. The collected data were analyzed using SPSS software (version 26) through descriptive and inferential statistical methods.

Ethical considerations

This study was approved by the Research Ethics Committee of Semnan University of Medical Sciences (Approval Number: IR.SEMUMS.REC.1397.280). The study objectives were explained to each patient, and informed consent was obtained from all participants. It was emphasized that participation was voluntary and that patients could withdraw from the study at any time.

Results

In this study, 675 patients transferred to the emergency department were analyzed. The age groups were as follows: 12–17 years (Adolescent), 18–35 years (Young Adult), 36–45 years (Middle-Aged), 46–65 years (Adult), 66–75 years (Elderly), 76–85 years (Aged), and over 85 years (Very Old), with a mean age of 55.93 ± 21.89 years. Other demographic information is provided in Table 1.

The mean and standard deviation of the length of stay in the emergency department for the patients was 5.63 ± 5.69 h. Pearson correlation test showed a direct relationship between the length of stay in ED of nontraumatic patients and scores obtained from the two scales,

Table 1 Frequency distribution of study participants based on demographic and disease information

Variable		Frequency (Percentage)	Variable		Frequency (Percentage)
Gender	Male	363 (53.8)	Previous Hospitalization	Yes	398 (59)
	Female	312 (46.2)		No	277 (41)
Duration of Observation in the ED	0–3 h	247 (36.6)	Patient Status After Receiving Emergency Services	Transfer to Internal Medicine Department	113 (16.75)
	3–6 h	244 (36.1)		Transfer to (ICU)	111 (16.45)
	6–12 h	128 (19)		Discharge from the ED	433 (64.1)
	12<	56 (8.3)		Death in the ED	18 (2.7)
Final Outcome of Hospitalized Patients	Discharge from the Hospital	181 (80.8)	**Necessity of Transfer from the Emergency Medicine Perspective**	**Required**	**465 (68.9)**
	Death	43 (19.2)		**Not Required**	**210 (31.1)**
Main Complaint	Neurological	86 (12.7)	Main Complaint	Endocrine	16 (2.4)
	Cardiovascular	228 (33.8)		LOC	56 (8.3)
	Gastrointestinal	53 (7.9)		Poisoning	71 (10.5)
	Respiratory	56 (8.3)		Other Conditions	32 (4.7)
	Urinary System	2 (0.3)		Weakness and Fatigue	43 (19.20)

that is, the higher the patients' scores, the longer their stay ($p < 0.0001$).

Based on the Pre-MEWS score, completed by pre-hospital emergency personnel according to the patient's condition, and the patients' outcomes after transfer to the emergency department (including discharge, ICU admission, general ward admission, or death), three risk levels were determined To stratify the risk of transferring patients from pre-hospital emergency settings to hospital emergency departments, the relative frequency of mortality and transfer to intensive care units (ICUs) was initially determined based on scores obtained from the **Pre-MEWS** tool until the patients were discharged from the hospital emergency department. Subsequently, the relative frequency of mortality and ICU transfers was matched with the **Pre-MEWS** scores of the patients. Based on these two indicators, patients were stratified into three levels: Level 1 (red), Level 2 (yellow), and Level 3 (green). The results showed that none of the patients with **Pre-MEWS** scores of ≤ 3 experienced mortality or required ICU admission. These individuals were classified as Level 3 (green). Additionally, none of the patients with **Pre-MEWS** scores between 4 and 12 died; however, 28 patients (3.8%) were admitted to the ICU. These individuals were classified as Level 2 (yellow). All individuals who died had Pre-MEWS scores of ≥ 13 and were classified as Level 1 (red) (Table 2).

Also, based on the **mSOFA** score and the outcome of patients after being transferred to the emergency department (which included discharge from the emergency department, admission to the intensive care unit, admission to the general ward, and death), two risk levels were determine. Patients with mSOFA scores of 1 to 5 generally have better outcomes, with most being discharged directly from the emergency department (ED) or requiring general ward admission. Mortality is rare in this group (0%), and ICU admissions are relatively low, though they increase gradually as the mSOFA score rises (e.g., from 1.4% at mSOFA 2 to 20% at mSOFA 5). These patients are stratified as Level 2 (yellow), indicating the need for close monitoring but no immediate high-risk interventions. Patients with mSOFA scores ≥ 6 show a substantial escalation in risk, characterized by higher mortality rates (e.g., 2.6% at mSOFA 6 rising to 20% at mSOFA 14). ICU admission rates dominate in this category, especially as scores increase (e.g., 26% at mSOFA 6 to 100% at mSOFA scores of 15 and 16). Mortality risk also aligns proportionally with mSOFA score progression, as seen with mortality risks exceeding 250% at scores ≥ 6 and reaching up to 676.8% at scores 16. These patients are categorized as Level 1 (red), requiring urgent and intensive care resources (Table 3).

The mean and standard deviation of the Pre-hospital Emergency Warning System (Pre-MEWS) scores for internal medicine patients at the time of transfer from pre-hospital environments, based on a study of 675 patients, were 11.95 ± 6.21. The minimum score obtained using this tool was zero, and the maximum score was 33. Patients who scored between zero and three on the **Pre-MEWS** tool were classified into risk level three (green), patients who scored between four and twelve were classified into risk level two (yellow), and those who scored above twelve were classified into risk level one (red). Additionally, the results showed that individuals who scored between zero and five on the **mSOFA** tool were classified into risk level two (yellow), and those who scored above five were classified into risk level one (red). It seems that the small sample size, the limited range between the lower and upper scores of this tool, and the fact that this tool was not originally designed to assess the severity of patients in pre-hospital settings, contributed to the **mSOFA** tool's inability to indicate the green

Table 2 Mortality risk stratification of transferred patients using the Pre-MEWS system

Risk Level	Outcome in Hospital Emergency Department (%)				Pre-MEWS Score	Mortality Risk (%)
	Death (%)	Transfer to ICU (%)	Transfer to Ward (%)	Discharge from ED (%)		
Level 3	0(0)	0(0)	0(0)	5 (100)	0	0
Level 3	0(0)	0(0)	1 (20)	4(80)	1	19.3
Level 3	0(0)	0(0)	1 (11.1)	8 (88.9)	2	38.6
Level 3	0(0)	0(0)	0(0)	30 (100)	3	57.9
Level 2	0(0)	1 (2.5)	1 (2.5)	38 (95)	4	77.2
Level 2	0(0)	1 (3.8)	3 (11.5)	22 (84.7)	5	96.5
Level 2	0(0)	2 (5)	4 (10)	34 (85)	6	115.8
Level 2	0(0)	0 (0)	4 (12.5)	28 (87.5)	7	135.1
Level 2	0(0)	3 (6.5)	3 (6.5)	40 (87)	8	154.4
Level 2	0(0)	4 (10.5)	10 (26.3)	24 (63.2)	9	173.7
Level 2	0(0)	3 (10.4)	5 (17.2)	21 (72.4)	10	193
Level 2	0(0)	3 (9.4)	10 (31.2)	19 (59.4)	11	212.3
Level 2	0(0)	10 (27.8)	7 (19.5)	19 (52.7)	12	231.6
Level 1	1 (2.5)	7 (17.9)	8 (20)	23 (59.6)	13	250.9
Level 1	1 (2.8)	5 (14)	10 (28)	19 (55.2)	14	270.2
Level 1	0 (0)	3 (10.7)	4 (14.3)	21 (75)	15	289.5
Level 1	2 (6.3)	8 (25)	8 (25)	14 (43.7)	16	308.8
Level 1	1 (3.6)	6 (21.4)	3 (10.7)	18 (64.3)	17	328.1
Level 1	1 (3.2)	12 (39.6)	7 (21.2)	10 (33)	18	347.4
Level 1	4 (16)	10 (40)	4 (16)	7 (28)	19	366.7
Level 1	2 (7.4)	10 (37.1)	5 (18.4)	10 (37.1)	20	386
Level 1	1 (5.9)	8 (47)	3 (17.6)	5 (29.5)	21	405.3
Level 1	4 (33.3)	4 (33.3)	0 (0)	4 (33.4)	22	424.6
Level 1	0 (0)	1 (11.1)	4 (44.4)	4 (44.5)	23	443.9
Level 1	0 (0)	5 (71.6)	1 (14.2)	1 (14.2)	24	463.2
Level 1	0 (0)	1 (14.2)	4 (57.2)	2 (28.6)	25	482.5
Level 1	0 (0)	0 (0)	1 (50)	1 (50)	26	501.8
Level 1	0 (0)	1 (25)	2(50)	1 (25)	27	521.1
Level 1	1 (33.3)	1 (33.3)	0 (0)	1 (33.4)	28	540.4
Level 1	0 (0)	0 (0)	0 (0)	0 (0)	29	559.7
Level 1	0 (0)	0 (0)	0 (0)	0 (0)	30	579
Level 1	0 (0)	0 (0)	0 (0)	0 (0)	31	598.3
Level 1	0 (0)	0 (0)	0 (0)	0 (0)	32	617.6
Level 1	0 (0)	0 (0)	1 (100)	0 (0)	33	636.9
Level 1	0 (0)	0 (0)	0 (0)	0 (0)	34-54	1042.2
Total	18 (2.7)	110 (16.3)	113 (16.7)	433 (64.2)		

level. The risk levels of these tools indicate that patients marked with red are at high risk and should be immediately transferred to the emergency department. Risk level two suggests that these patients can be transferred to the hospital with a delay compared to those in level one. Risk level three indicates that most of these patients are outpatient and can be transferred to the hospital when appropriate or advised to visit a doctor on an outpatient basis.

Discussion

This study aimed to analyze the characteristics and outcomes of patients transferred to the emergency department (ED), focusing on the risk stratification provided by the Pre-MEWS and mSOFA scoring systems. The

Table 3 Risk stratification of mortality in patients transferred from pre-hospital emergency environments using the mSOFA system

Risk Level	Outcome in Hospital Emergency Department (%)				mSOFA Score	Mortality Risk (%)
	Death (%)	Transfer to ICU (%)	Transfer to Ward (%)	Discharge from ED (%)		
No data	0(0)	0(0)	0(0)	(0) 0	1	42.3
Level 2	0(0)	2(1.4)	19(13.1)	124(85.5)	2	84.6
Level 2	0(0)	10(6.4)	17(10.8)	130(82.8)	3	126.9
Level 2	0(0)	20(11.7)	32(18.7)	119(69.6)	4	169.2
Level 2	0(0)	10(20)	17(34)	32(46)	5	211.5
Level 1	1(2.6)	10(26)	12(31.6)	15(39.8)	6	253.8
Level 1	6(26)	9(39)	5(21)	3(13)	7	296.1
Level 1	1(4.5)	11(49.5)	4(18)	6(27)	8	338.4
Level 1	3(21.4)	7(50)	4(28.6)	0(0)	9	380.7
Level 1	2(10)	14(70)	0(0)	4(20)	10	423
Level 1	2(40)	2(40)	1(20)	0(0)	11	465.3
Level 1	1(12.5)	6(75)	1(12.5)	0(0)	12	507.6
Level 1	1(16.7)	4(66.6)	1(16.7)	0(0)	13	549.9
Level 1	1(20)	4(80)	0(0)	0(0)	14	592.2
Level 1	0(0)	1(100)	0(0)	0(0)	15	634.5
Level 1	0(0)	1(100)	0(0)	0(0)	16	676.8
Level 1	0(0)	0(0)	0(0)	0(0)	17-20	719.1-846
Total	18 (2.7)	111 (16.4)	113(16.7)	433 (64.2)		

findings highlight the effectiveness of these tools in predicting patient mortality and ICU admission needs, offering valuable insights for emergency medical services (EMS) decision-making. The study revealed that among the 675 patients analyzed, the mean age was 55.93 ± 21.89 years, and 53.8% were male. A significant proportion of patients (64.1%) were discharged from the ED, while 16.75% were transferred to the internal medicine department, 16.45% required ICU admission, and 2.7% succumbed to their condition in the ED. These findings align with previous studies that emphasize the critical role of pre-hospital triage systems in determining patient outcomes and resource allocation [18].

Currently, the evaluation of patients and the decision regarding their transfer to the hospital in Iran are carried out by EMS personnel. This decision is made based on the judgment of dispatch experts, standard protocols, or remote consultation with a dispatch physician via phone or radio. In addition to the patient's physical condition, other factors also influence this decision, including: Patient-related factors (physical condition, socioeconomic status, and cultural aspects), Mission-related conditions (such as hospital accessibility and traffic), Characteristics and conditions of EMS personnel [19]. Also, in Iran, EMS does not utilize prehospital triage tools to identify high-risk patients [20]. The decision regarding the transfer of patients to the hospital emergency department is directly influenced by pre-hospital triage. This system determines whether the patient needs to be transferred, to which hospital they should be taken, and with what priority they should be admitted. These decisions also affect the triage process in the hospital emergency department. The data collected by EMS during the transfer helps the emergency medical staff to make quicker decisions and place the patient in the appropriate category [21, 22].

The **ESI model** is a five-level triage system designed for the rapid assessment of patients in hospital emergency departments, prioritizing them based on the severity of their condition and required medical resources. **Pre-hospital assessment** by EMS includes collecting patient history and monitoring vital signs, playing a crucial role in hospital decision-making. Consequently, effective coordination and communication between prehospital assessments and the ESI triage system in hospital emergency departments enhance the triage process, optimize resource allocation, and improve patient care quality [23].

A major finding of this study was the direct correlation between ED length of stay and scores obtained from both the Pre-MEWS and mSOFA tools ($p < 0.0001$). This suggests that higher-risk patients, as identified by these scoring systems, tend to remain in the ED longer, potentially due to the complexity of their medical conditions and the need for specialized interventions. This correlation highlights the necessity of efficient risk stratification to optimize patient flow and prevent ED overcrowding.

The review of early warning systems implemented in pre-hospital emergencies has shown that these systems can be useful in predicting clinical outcomes. However, there is significant heterogeneity among different early warning systems, making it challenging to generalize these tools across various environments. Studies suggest that future research is needed to identify a reliable early warning tool specifically suited for prehospital settings [24, 25].

The published literature on prehospital triage tools predominantly derive from high-income health systems and mostly focus on adult stroke and trauma populations [26]. There was significant heterogeneity of clinical end points in the articles reporting all-comer triage tools. Consequently, a single triage tool in this group with the best performance metrics could not be identified [26]. One of the tools that can be used for stratifying the risk of internal medicine patients is the National Early Warning Score (**NEWS**). While **NEWS** and its updated version, **NEWS2** provides valuable information, it may not always capture the complexity of internal medicine patients, especially those with chronic conditions where baseline vitals may differ from normal ranges [27–29]. In the study by Jafouri and colleagues, conducted to evaluate the impact of scales such as **PRESEP**, **MRST**, **qSOFA**, and **MEWS** on hospital triage for patients with infections, the results indicated that all the scales demonstrated poor performance [30]. Rita Patel and colleagues evaluated the effectiveness and predictive accuracy of the Early Warning Score (**EWS**) in predicting the deterioration of patients' conditions in the pre-hospital setting. They concluded that very low or very high scores had greater predictive power for the likelihood of patient condition worsening, while intermediate scores yielded ambiguous results [24].

The key distinction of our study compared to others is that we used a psychometrically validated tool specifically designed for prehospital environments. However, it is not possible to directly compare the mean and standard deviation obtained from this tool with other tools. This is because the scoring range of our tool spans from 0 to 54, whereas many of the other tools used have a score range between 0 and 20. This difference in scoring ranges makes direct comparison challenging and may limit the generalizability of the findings across different tools. We have categorized risk using two tools. Risk classification for patient transfer based on these two tools ensures that if more than two internal medicine patients are present at the scene, triage can be effectively performed. In this study, which examined the necessity of transferring internal patients in the pre-hospital emergency department, it was determined Based on the **Pre-MEWS** score, 49 patients had scores between 0 and 3, which constituted **7.25%** of the total patients. This could indicate that the **Pre-MEWS** tool is suitable for assessing patients with stable conditions, but may require more careful consideration if they have more complex conditions. This is while, from the perspective of the emergency medicine physician on duty, **31%** did not require transfer.

The findings indicate that the **mSOFA** tool has a higher ability to identify patients at risk of mortality and those requiring intensive care unit (ICU) services compared to **Pre-MEWS**. However, as observed, **Pre-MEWS** also proves to be valuable and beneficial in this regard. Considering that the necessary data to complete

the **Pre-MEWS** tool is more readily available in the prehospital environment compared to **mSOFA**, it is recommended that the use of **Pre-MEWS**, which was specifically designed for assessing the deterioration of internal medicine patients in prehospital settings, should be given more attention.

From the perspective of emergency medicine specialists, one of the primary challenges in using **Pre-MEWS** is that the tool may not be sensitive enough to detect subtle changes in a patient's condition, especially in those with chronic diseases, whose baseline vital signs might deviate from normal ranges. In these cases, emergency specialists emphasize that tools which rely on slight changes in vital signs should be used in conjunction with a more thorough clinical evaluation to prevent errors in decision-making. This combined approach ensures that decisions about patient transfers or interventions are based on a comprehensive understanding of the patient's condition, rather than solely on numerical scores [31, 32]. While **mSOFA** aids in identifying organ failure and predicting critical patient conditions, emergency medicine specialists often emphasize that it may not be the most practical tool in prehospital environments due to challenges in obtaining accurate data. For example, precise assessments of kidney function or coagulation status in prehospital settings may not be feasible. This limitation can result in difficulties in fully implementing the **mSOFA** scoring system in such environments, rather than reducing its accuracy as a predictive tool [32].

Emergency medicine specialists emphasize that while tools like **Pre-MEWS** and **mSOFA** are valuable for assessing patient status and informing decisions about hospital transport, they should not be relied upon as the sole basis for decision-making. Particularly for patients with complex conditions or chronic illnesses, thorough clinical evaluation and consideration of the patient's medical history are crucial. In such cases, these scoring systems can serve as initial guides for assessing the patient's condition but must be complemented by the clinical judgment of the emergency physician. This integrative approach ensures a more accurate and holistic evaluation, reducing the risk of errors [33]. According to emergency medicine specialists, combining various assessment tools, such as **Pre-MEWS** and **mSOFA**, with a thorough evaluation of the patient's clinical condition, can lead to more effective decision-making. For instance, if a patient scores low on **Pre-MEWS** but exhibits other warning signs, such as altered levels of consciousness or seizure activity, immediate hospital transfer may still be necessary. This underscores the importance of not relying solely on scoring tools, especially when clinical symptoms suggest a potentially deteriorating condition, regardless of the calculated scores.

This approach aligns with findings from studies that stress the importance of integrating clinical judgment with scoring tools to avoid over-reliance on numerical scores, which may not capture the nuances of individual patient condition [31, 32] And Such an integrated approach is recommended in the literature, which highlights the value of these tools as guides rather than definitive indicators, emphasizing that clinical judgment remains central in complex cases.

Conclusion

This study examines the necessity of transferring internal medicine patients in prehospital emergency care. The findings indicate that **Pre-MEWS** can be effective in identifying stable patients; however, it has limitations in assessing patients with chronic or complex conditions. Among all evaluated patients, 7.25% had scores ranging from 0 to 3, suggesting stable conditions with a low need for urgent transfer. Nevertheless, 31% of emergency physicians deemed some transfers unnecessary, highlighting that **Pre-MEWS** scores alone may not be sufficient and should be used in conjunction with physicians' clinical assessments.

These findings underscore the importance of integrating scoring tools such as **Pre-MEWS** with clinical evaluations to optimize decision-making in prehospital emergency care. While **Pre-MEWS** enables emergency personnel to rapidly assess patients, it may not always accurately reflect actual clinical risks. Therefore, this tool should be complemented by thorough medical evaluations to ensure that patients with subtle or atypical symptoms receive appropriate care.

Future studies should focus on enhancing the accuracy of early warning tools by assessing their sensitivity and specificity. Additionally, continuous patient monitoring from the arrival of emergency medical technicians until hospital discharge or death could improve risk assessment and decision-making. Furthermore, conducting studies with larger sample sizes and employing a broader range of assessment tools is recommended to better evaluate mortality risk in internal medicine patients.

Research limitations

Data Collection Challenges: Prehospital settings inherently limit the ability to gather comprehensive patient data, which may affect the accuracy of scoring tools like **mSOFA** that require detailed physiological inputs. Disparity in Clinical Judgment: The differences observed between **Pre-MEWS** scores and the emergency physicians' clinical assessments highlight a potential gap in how the tools reflect real-world decision-making, suggesting the need for further refinement of these scoring systems.

Acknowledgements
The authors express their sincere gratitude to all individuals who contributed to the writing of this article. The researchers also wish to express their gratitude to the Research Deputy of Semnan University of Medical Sciences for their approval of the study proposal.

Author contributions
A.E, A.M, and H.S.H conceived and designed the study. H.S.H and M.T.S.H collected, and checked the data. H.S.H and AE analyzed the data. H.S.H and A.M draft the manuscript. A.E, and A.M revised the manuscript, and H.S.H submitted the manuscript. All authors reviewed and approved the final Manuscript.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
All methods were performed in accordance with the relevant guidelines and regulations. Under the guidance of principles of the World Medical Association Declaration of Helsinki, it was taken into the first consideration to respect participants' rights and to protect their health and rights. This study adheres to ethical principles. The research was approved by the Ethics Committee of Semnan University of Medical Sciences (Approval Number: IR.SEMUMS.REC.1397.280).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 10 December 2024 / Accepted: 2 April 2025
Published online: 12 April 2025

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