Ain Shams Journal of Forensic Medicine and Clinical Toxicology
July 2025, 45: 40-52

Effectiveness of Different Scoring Systems in Predicting Severity and Outcome of Acute Poisoning in Adults: A Prospective Study in Sohag University Hospitals, Egypt

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Abstract

Introduction: Prompt and precise evaluation of acutely poisoned patients attending the Emergency Department (ED) is crucial as it can help in the early identification of patients who may require Intensive Care Unit (ICU) admission or are at risk of mortality. **Objectives:** Evaluating the effectiveness of five scoring systems (Rapid Emergency Medicine Score (REMS), Modified Early Warning Score (MEWS), Rapid Acute Physiology Score (RAPS), Worthing Physiological Score (WPS), and National early warning score2 (NEWS2) in predicting severity and outcome of acute adult poisoning. **Methods:** A prospective study was conducted on 159 acutely poisoned adult patients who were presented to ED at Sohag University hospitals from December 2023 to November 2024. The receiver operating characteristic curve was utilized for evaluating the discrimination power of the scoring systems. **Results:** On-admission evaluation of all patients by using the five scoring systems revealed that all scores were significantly higher in ICU-needed patients, mechanically ventilated, and non-survivors. NEWS2 had the best accuracy for predicting ICU admission and mortality (97.4% and 97.1% respectively). REMS showed the best accuracy for Mechanical Ventilation (MV) requirement prediction. **Conclusion:** NEWS2, REMS, RAPS, WPS, and MEWS are simple, rapid, and effective tools to predict the patient's need for ICU admission, MV, and death in acutely poisoned adult patients.

Received in original form: 15 April 2025
Accepted in a final form: 15 July 2025

Key words Acute poisoning, Scoring Systems, Intensive Care Unit admission, Mortality

Introduction

The Emergency Department (ED) plays a crucial role in the management of patients presented with acute, complicated, and variable conditions. Rapid and accurate evaluation of the patients is essential as it can advocate early relevant interventions and enhance the ED patients' outcomes (Wilson et al., 2014 & Hung et al., 2017).

Acute poisoning usually embraces 1–3% of all ED visits and the cases that may need admission in the intensive care unit (ICU) about 4–40% with a death rate of 3–6% (Torky et al., 2023). The World Health Organization (WHO) reports that 220,000 fatalities and more than three million instances of acute poisoning occur each year. Due to a lack of hospital services and a rise in pesticide poisoning, the majority of these deaths take place in developing countries (Balaraju et al., 2020 & Boedeker et al., 2020).

In Egypt, poisoning significantly contributes to illness and death. The common use of pesticides, easy access to street drugs and cleaning agents, lack of awareness regarding the dangers of household cleaners, and the prevalence of venomous animals are the key factors contributing to the poisoning issue (Seif et al., 2016).

Scoring systems facilitate clinical decision-making and help healthcare providers anticipate patient outcomes. Numerous prognostic scoring systems have been created for the objective assessment of clinical status to prevent potential inaccuracies in evaluations made by physicians, ultimately leading to improved outcomes and determining the necessity for ICU admission (Eizadi-Mood et al., 2007 & Oprita et al., 2014).

Aim of the Work

The study aimed to evaluate the effectiveness of five physiological scoring systems in predicting the need for admission to ICU, mechanical ventilation, and mortality among acutely poisoned adult patients presented to ED at Sohag University Hospitals from December 2023 to November 2024. The used scoring systems in the study were the Rapid emergency medicine score (REMS), Modified early warning score (MEWS), Rapid acute physiology score (RAPS), Worthening physiological score (WPS), and National early warning score2 (NEWS2).

Subjects and Methods

Study design and setting

This is a cross sectional, hospital based prospective observational study carried out on acutely intoxicated adult patients both males and females, aged 18 years old and above presented to ED at Sohag University Hospitals from December 2023 to November 2024.

Data collection: Socio-demographic data including (age, gender, occupation, marital status and residence) and toxicological data including (toxic agent type,

mode of poisoning, route of exposure, delay time, duration of hospital stay and outcome) were recorded. Vital signs (blood pressure, heart rate, temperature and respiratory rate), consciousness level and oxygen saturation were evaluated and recorded upon presentation to the ED.

Inclusion criteria: All patients with acute poisoning aged 18 years old and above presented to ED at Sohag University Hospitals, from December 2023 to November 2024 were included in this study.

Exclusion criteria: Patients less than 18 years old, chronic poisoning patients, and Patients with neurological, cardiovascular, respiratory, renal, and hepatic diseases or condition that may alter vital signs condition.

Scoring systems

Five scoring systems were used initially upon presentation to the ED to evaluate the severity and outcome in the acutely intoxicated patients as follows:

1. The Rapid Emergency Medicine Score (REMS) consists of six components: pulse rate, respiratory rate, mean arterial pressure, peripheral oxygen saturation, Glasgow Coma Scale (GCS), and age. Age is rated on a scale from 0 to 6, while the other five components are scored from 0 to 4, resulting in a total daily score that ranges from 0 to 26 (Olsson et al., 2004).
2. The Rapid acute physiology score (RAPS) was created based on the APACHE II score by focusing solely on factors that can be readily measured in a hospital environment, specifically the mean arterial pressure, pulse rate, respiratory rate, and GCS (Rhee et al., 1987). Each variable is assigned scoring points that range from 0 to 4. The lowest possible RAPS score is zero, and the highest is 16.
3. The Modified Early Warning Score (MEWS) composed of five variables including, the systolic blood pressure, pulse rate, respiratory rate, oxygen saturations, temperature, and degree of consciousness using AVPU scale. It has a minimum score of 0 and a maximum score of 14 (Kelly et al., 2004).
4. The Worthing Physiological Score (WPS includes, systolic blood pressure, heart rate, oxygen saturation, AVPU score, and temperature with a total score range from 0 to 14 (Duckitt et al., 2007).
5. The National Early Warning Score 2 (NEWS2) is the latest version of the National Early Warning Score (NEWS), first produced in 2012 and updated by the Royal College of Physicians in 2017. It measures six physiological variables including heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation, level of consciousness plus the score for need of oxygen supplement (Royal College of Physicians, 2017).

Outcomes: The primary outcomes are to measure patient's need for ICU admission and MV. The secondary outcome is to measure mortality among the patients.

Ethical Considerations

Approval was taken from the Medical Research Ethics Committee of Faculty of Medicine - Sohag University (approval number: Soh-Med-23-10-07PD). An informed consent was taken from the patients or their legal guardians and the personal information was kept unnamed for data secrecy.

Statistical analysis

The gathered data was coded, tabulated, and analyzed using Statistical Package for the Social Science (SPSS) software version 25. The Shapiro-Wilk test for normality was used for quantitative data. The Chi-square test was utilized for nominal data, while the independent t-test was used for numerical parametric data. For numerical non-parametric data, the Mann-Whitney test was used. The receiver operating characteristic (ROC) curve analysis was applied to compare the accuracy of the different scoring systems in predicting the need for ICU admission, MV, and mortality in adult patients with acute poisoning. Rates of accuracy, sensitivity, and specificity, were calculated. Areas under the ROC curves from 0.9-1 were regarded as excellent discrimination, 0.8-0.9 good discrimination, 0.7-0.8 fair discrimination, and 0.7-0.5 poor discrimination, according to Carter et al. (2016). P value <0.05 was adopted significant.

Results

The total number of patients enrolled in this study was 159 cases, 88 (55.35%) were females, while 71(44.65%) were males. The majority of patients were in the age group 18-29 years (58.49%), then those with the age group >29-40 years (23.90%), and lastly patients aged more than 40 years (17.61%). About 91 (57.23%) were single and 60 (37.74%) were married. Regarding the patients' occupation, 58 (36.48%) of them were workers, while others were not working 38 (23.90%), students 37 (23.27%), and housewife 26 (16.35%). Patients from rural areas were 55.97%, while urban ones were 44.03% (Table 1). Considering the toxicological history, the majority of poisoning was suicidal (69.81%), whereas accidental toxicity was (30.19%). About (81.76%) of cases were exposed to the poison by ingestion, followed by inhalational (12.58%), injection (3.14 %), and dermal exposure (2.52%). The ranges of delay time and hospital stay among the patients were 1-24 hours and 4-192 hours respectively.

Assessment of the patient's conscious level using the GCS and vital signs including, pulse, systolic and diastolic blood pressure, oxygen saturation, mean arterial pressure, respiratory rate, and temperature, were illustrated in table 1. Comparison between survived and non-survived patients regarding the socio-demographic characteristics, toxicological history, vital signs, and conscious level revealed significant differences in residence, delay time, systolic and diastolic blood pressure, oxygen saturation, mean arterial pressure, temperature, and GCS (Table1).

Table 2 shows the frequency distribution of toxic agents among the studied acutely poisoned patients. There were 27 types of toxic agents included

in this study. The commonest four of these poisons were aluminum phosphide 33 cases (20.75%) (13 survived and 20 died), antipsychotics 16 cases (10.06%) (15 survived and only one died), organophosphorus 15 cases (9.43%) (9 survived while 6 died), and carbamate 12 cases (7.55%) (All of them survived).

Regarding the clinical outcomes among the studied patients, approximately 41.5% of the patients required admission to ICU (n = 66), 23.27% of them needed Mechanical ventilation (MV) (n = 37), and the mortality rate was 25.79% (n = 41). There was a significant statistical difference between survived and dead patients regarding the need for ICU admission and MV ($p < 0.001$) (Table 3).

As shown in tables 4 and 5, the assessment of patients using the five studied scoring systems (REMS, RAPS, MEWS, WPS, and NEWS2) showed that ICU-admitted and mechanically ventilated patients had significantly higher Mean ± SD of the studied scores than other patients who were not ICU-admitted and were not needed MV ($p < 0.001$). Considering mortality, a comparison between survivors and non survivors regarding the five studied scoring systems revealed significant statistical differences ($p < 0.001$) (Table 6).

Using the ROC curve for evaluating the accuracy of the studied scores in predicting severity and outcomes showed that REMS, RAPS, WPS, and NEWS2 had excellent discrimination power in predicting the need for admission to ICU, while MEWS showed good discrimination power (Figure1. A & Table 7). At a cut-off >10, NEWS2 had the highest accuracy value (97.4%), followed by WPS (accuracy of 95.7% and cut-off >6), REMS (accuracy of 95.2% and cut-off >4), and RAPS (accuracy of 94.1% and cut-off >3). Likewise, fig. 1. B and table 8 reveal that REMS (accuracy of 96.1% and cut-off >5), NEWS2 (accuracy of 93.6% and cut-off >10), and RAPS (accuracy of 92.8% and cut-off >5) had excellent discrimination power regarding the need for MV, while MEWS and WPS show good discrimination power. In terms of mortality prediction, NEWS2 (accuracy of 97.1% and cut off ≥10), REMS (accuracy of 96.8% and cut-off ≥5), RAPS (accuracy of 95.7% and cut-off ≥5), and WPS (accuracy of 94.4% and cut-off ≥6) had excellent discrimination, while MEWS (accuracy of 89.5% and cut-off ≥5) had good discrimination (Figure 1.C & Table 9).

Table (1): Socio-demographics data, toxicological history, and vital signs among patients with acute poisoning presented to ED at Sohag University Hospitals from December 2023 to November 2024.

Characteristic variables		Outcome						T-Test	
		Survived (N=118)		Non-survived (N=41)		Total (N=159)		t	P-value
Age	Range	18-65		18-67		18-67		-0.617	0.538
	Mean ±SD	29.873±10.658		31.146±13.277		30.201±11.360			
Chi-Square		N	%	N	%	N	%	X^2	P-value
Age group	18-29 Years	69	58.47	24	58.54	93	58.49	1.036	0.596
	>29-40 Years	30	25.42	8	19.51	38	23.90		
	>40 Years	19	16.10	9	21.95	28	17.61		
Sex	Male	50	42.37	21	51.22	71	44.65	0.964	0.326
	Female	68	57.63	20	48.78	88	55.35		
Marital status	Single	68	57.63	23	56.10	91	57.23	0.649	0.885
	Married	45	38.14	15	36.59	60	37.74		
	Divorced	2	1.69	1	2.44	3	1.89		
	Widow			2	4.88	5	3.14		
Occupation	No work	30	25.42	8	19.51	38	23.90	0.944	0.815
	House wife	20	16.95	6	14.63	26	16.35		
	Student	26	22.03	11	26.83	37	23.27		
	Worker	42	35.59	16	39.02	58	36.48		
Residence	Urban	58	49.15	12	29.27	70	44.03	4.882	0.027*
	Rural	60	50.85	29	70.73	89	55.97		
Mood of poisoning	Suicidal	81	68.64	30	73.17	111	69.81	0.296	0.587
	Accidental	37	31.36	11	26.83	48	30.19		
Route of exposure	Oral	99	83.90	31	75.61	130	81.76	3.501	0.321
	I.V Injection	2	1.69	3	7.32	5	3.14		
	Inhalation	14	11.86	6	14.63	20	12.58		
	Dermal	3	2.54	1	2.44	4	2.52		

Table (1): Continued.

Characteristic variables		Outcome			T-Test	
		Survived (N=118)	Non-survived (N=41)	Total (N=159)		
T-Test					t	P-value
Delay time (Hours)	Range	1-24	2-24	1-24	-4.754	<0.001**
	Mean ±SD	3.674±2.768	6.512±4.490	4.406±3.511		
Hospital stay (Hours)	Range	4-192	12-168	4-192	-0.743	0.458
	Mean ±SD	48.525±31.936	53.073±38.585	49.698±33.707		
Pulse	Range	40-160	50-150	40-160	-1.349	0.179
	Mean ±SD	103.220±20.914	108.951±29.585	104.698±23.491		
Systolic blood pressure	Range	70-160	40-190	40-190	5.146	<0.001**
	Mean ±SD	105.847±17.654	85.610±30.582	100.629±23.376		
Diastolic blood pressure	Range	30-100	20-100	20-100	6.140	<0.001**
	Mean ±SD	69.542±12.380	53.049±20.337	65.289±16.450		
Mean arterial pressure	Range	43-120	27-117	27-120	5.944	<0.001**
	Mean ±SD	81.703±13.452	63.976±23.088	77.132±18.151		
Respiratory rate	Range	8-36	8-36	8-36	1.255	0.211
	Mean ±SD	24.034±5.732	22.317±11.281	23.591±7.558		
Temperature	Range	36-39	36-39.5	36-39.5	2.608	0.010*
	Mean ±SD	37.093±0.535	36.805±0.790	37.019±0.621		
Oxygen Saturation	Range	46-100	40-92	40-100	9.655	<0.001**
	Mean ±SD	94.441±6.077	82.415±8.789	91.340±8.646		
Glasgow Coma Scale	Range	8-15	3-14	3-15	10.626	<0.001**
	Mean ±SD	13.432±1.795	9.024±3.335	12.296±2.991		

*SD: Standard deviation, χ 2: Chi square test, *: Statistically significant (p < 0.05), **: Statistically highly significant (p < 0.001),*

Table (2): Frequency distribution of toxic agents among the studied acutely intoxicated adult patients presented to ED at Sohag university hospitals.

Toxic agent	Outcome					
	Survived (N=118)		Non-survived (N=41)		Total (N=159)	
	N	%	N	%	N	%
Aluminum phosphide	13	11.02	20	48.78	33	20.75
Organophosphorus	9	7.63	6	14.63	15	9.43
Carbamate	12	10.17	0	0.00	12	7.55
Zinc phosphide	2	1.69	0	0.00	2	1.26
Corrosives	5	4.24	0	0.00	5	3.14
Hydrocarbons	6	5.08	0	0.00	6	3.77
Paraphenyldiamine dye	5	4.24	0	0.00	5	3.14
Carbon monoxide gas	4	3.39	2	4.88	6	3.77
Chlorine gas	4	3.39	0	0.00	4	2.52
Antipsychotics	15	12.71	1	2.44	16	10.06
Antiepileptics	5	4.24	2	4.88	7	4.40
Antidepressants	5	4.24	0	0.00	5	3.14
Benzodiazepine	5	4.24	0	0.00	5	3.14
Muscle relaxants	1	0.85	1	2.44	2	1.26
Theophylline	3	2.54	0	0.00	3	1.89
Digoxin	2	1.69	1	2.44	3	1.89
Methotrexate	1	0.85	0	0.00	1	0.63
Paracetamol	3	2.54	0	0.00	3	1.89
Salicylates	1	0.85	0	0.00	1	0.63
Iron	1	0.85	0	0.00	1	0.63
Morphine	1	0.85	3	7.32	4	2.52
Tramadol	4	3.39	0	0.00	4	2.52
Cannabis	3	2.54	2	4.88	5	3.14
Methamphetamine	3	2.54	2	4.88	5	3.14
Ethanol	2	1.69	0	0.00	2	1.26
Snake bite	1	0.85	1	2.44	2	1.26
Scorpion sting	2	1.69	0	0.00	2	1.26

Table (3): Clinical outcomes among acutely intoxicated adult patients presented to ED at Sohag University Hospitals from December 2023 to November 2024.

Variables		Outcome						Chi-Square Test	
		Survived (N=118) 74.21%		Non-survived (N=41) 25.79%		Total (N=159) 100%		X^2	P-value
Need for ICU admission	Yes	25	21.19	41	100.00	66	41.51	77.846	<0.001**
	No	93	78.81	0	0.00	93	58.49		
Need for Mechanical Ventilation	Yes	4	3.39	33	80.49	37	23.27	101.295	<0.001**
	No	114	96.61	8	19.51	122	76.73		

*χ 2: Chi square test, **: Statistically highly significant (p <0.001), ICU: Intensive Care Unit.*

Table (4): Comparison between ICU-admission needed patients and others who didn't need regarding the studied scoring systems.

Score		Need for ICU admission			T-Test	
		Yes (N=66)	No (N=93)	Total (N=159)	t	P-value
Rapid Emergency Medicine Score (REMS)	Range	1-14	0-9	0-14	15.606	<0.001**
	Mean ±SD	8.424±3.177	2.247±1.786	4.811±3.916		
Rapid Acute Physiology Score (RAPS)	Range	1-11	0-6	0-11	14.697	<0.001**
	Mean ±SD	6.394±2.286	2.000±1.482	3.824±2.854		
Modified Early Warning Score (MEWS)	Range	3-11	0-9	0-11	11.734	<0.001**
	Mean ±SD	7.000±2.075	3.581±1.597	5.000±2.473		
Worthing Physiological Score (WPS)	Range	4-11	0-8	0-11	15.896	<0.001**
	Mean ±SD	8.348±1.819	3.710±1.809	5.635±2.920		
National Early Warning Score2 (NEWS2)	Range	5-18	0-11	0-18	18.881	<0.001**
	Mean ±SD	13.242±2.695	5.538±2.416	8.736±4.571		

*SD: Standard deviation, **: Statistically highly significant (p <0.001), ICU: Intensive Care Unit.*

Table (5): Comparison between patients who needed mechanical ventilation and those who didn't need it regarding the studied scoring systems.

Score		Need for Mechanical Ventilation			T-Test	
		Yes (N=37)	No (N=122)	Total (N=159)	t	P-value
Rapid Emergency Medicine Score (REMS)	Range	5-14	0-13	0-14	14.425	<0.001**
	Mean ±SD	10.162±2.291	3.189±2.655	4.811±3.916		
Rapid Acute Physiology Score (RAPS)	Range	3-11	0-10	0-11	11.380	<0.001**
	Mean ±SD	7.297±1.970	2.770±2.162	3.824±2.854		
Modified Early Warning Score (MEWS)	Range	3-11	0-10	0-11	7.141	<0.001**
	Mean ±SD	7.216±1.931	4.328±2.217	5.000±2.473		
Worthing Physiological Score (WPS)	Range	6-11	0-11	0-11	8.813	<0.001**
	Mean ±SD	8.676±1.355	4.713±2.627	5.635±2.920		
National Early Warning Score2 (NEWS2)	Range	10-18	0-17	0-18	11.376	<0.001**
	Mean ±SD	14.297±1.839	7.049±3.735	8.736±4.571		

*SD: Standard deviation, **: Statistically highly significant (p <0.001).*

Table (6): Comparison between survivors and non-survivors regarding the studied scoring systems

Score		Mortality			T-Test	
		Survived(N=118)	Non-survived(N=41)	Total(N=159)	t	P-value
Rapid Emergency Medicine Score (REMS)	Range	0-11	5-14	0-14	-15.803	<0.001**
	Mean ±SD	3.008±2.434	10.000±2.460	4.811±3.916		
Rapid Acute Physiology Score (RAPS)	Range	0-8	3-11	0-11	-14.384	<0.001**
	Mean ±SD	2.559±1.870	7.463±1.912	3.824±2.854		
Modified Early Warning Score (MEWS)	Range	0-10	3-11	0-11	-10.163	<0.001**
	Mean ±SD	4.085±1.929	7.634±1.920	5.000±2.473		
Worthing Physiological Score (WPS)	Range	0-11	6-11	0-11	-11.827	<0.001**
	Mean ±SD	4.458±2.319	9.024±1.440	5.635±2.920		
National Early Warning Score 2 (NEWS2)	Range	0-15	10-18	0-18	-14.227	<0.001**
	Mean ±SD	6.720±3.351	14.537±1.790	8.736±4.571		

SD: Standard deviation, **: Statistically highly significant (p <0.001).

Table (7): Performance of the used scoring systems for prediction of Intensive Care Unit admission among the studied patients

Need for ICU admission						
Predictors	**Cutoff**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
Rapid Emergency Medicine Score (REMS)	>4	89.39	91.40	88.1	92.4	95.2%
Rapid Acute Physiology Score (RAPS)	>3	89.39	86.02	81.9	92.0	94.1%
Modified Early Warning Score (MEWS)	>5	77.27	92.47	87.9	85.1	89.8%
Worthing Physiological Score (WPS)	>6	81.82	96.77	94.7	88.2	95.7%
National Early Warning Score2 (NEWS2)	>10	84.85	98.92	98.2	90.2	97.4%

PPV: Positive Predictive Value, NPV: Negative Predictive Value, ICU: Intensive Care Unit.

Table (8): Performance of the used scoring systems for predicting the need for Mechanical Ventilation among the studied patients.

Need for Mechanical Ventilation						
Predictors	**Cutoff**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
Rapid Emergency Medicine Score (REMS)	>5	97.30	82.79	63.2	99.0	96.1%
Rapid Acute Physiology Score (RAPS)	>5	83.78	86.89	66.0	94.6	92.8%
Modified Early Warning Score (MEWS)	>5	86.49	78.69	55.2	95.0	83.8%
Worthing Physiological Score (WPS)	>6	94.59	81.97	61.4	98.0	89.5%
National Early Warning Score2 (NEWS2)	>10	97.30	82.79	63.2	99.0	93.6%

NPV: Negative Predictive Value, PPV: Positive Predictive Value.

Table (9): Performance of the used scoring systems for mortality prediction among the studied patients.

Mortality						
Predictors	**Cutoff**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
Rapid Emergency Medicine Score (REMS)	≥ 5	85.59	97.56	99.0	70.2	96.8%
Rapid Acute Physiology Score (RAPS)	≥ 5	90.68	87.80	95.5	76.6	95.7%
Modified Early Warning Score (MEWS)	≥ 5	82.20	90.24	96.0	63.8	89.5%
Worthing Physiological Score (WPS)	≥ 6	84.75	95.12	98.0	68.4	94.4%
National Early Warning Score2 (NEWS2)	≥ 10	85.59	97.56	99.0	70.2	97.1%

NPV: Negative Predictive Value, PPV: Positive Predictive Value.

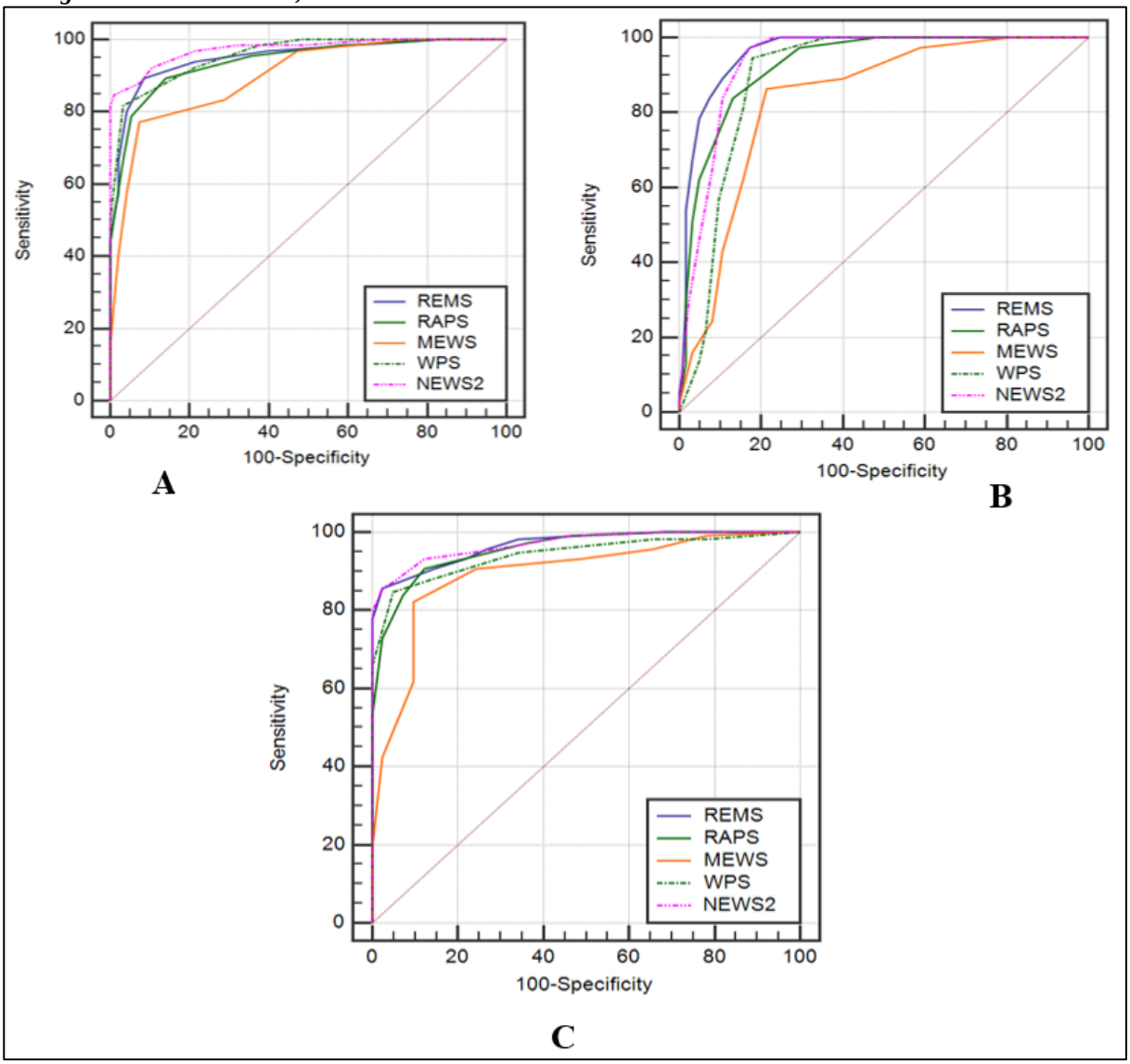

Figure (1): Accuracy of the studied scoring systems for predicting the need for ICU admission (A), Mechanical ventilation (B), and Mortality (C) among the studied patients by using ROC curve analysis.

Discussion

Overcrowding and deficiency of resources are concerning problems in any ED setting especially in developing countries. Accurate evaluation and identification of patients who need critical care is a very challenging issue. Recently, a variety of scoring systems have been developed for illness measurement and stratification of ED patients (Olsson and Lind, 2003 & Rahmatinejad et al., 2021). The ideal risk

stratification score should be able to predict the severity and outcome of the patients, such as death and ICU admission by using rapid and easily measured clinical and laboratory parameters (Olsson et al., 2004 & Çelik and Karaca, 2023).

Physiological scoring systems can be used for identifying high-risk patients because they are rapidly calculated and need practicable factors such as pulse rate, respiratory rate, blood pressure, body temperature, and level of consciousness (Nakhjavan-Shahraki et al., 2017). So, the current study was designed to evaluate the effectiveness of five physiological scoring systems (REMS, RAPS, MEWS, WPS, NEWS2) in predicting the severity and outcome of acute poisoning among adult patients presented to ED at Sohag University Hospitals.

It is a prospective observational study that enrolled 159 patients. The present study showed that the mean age of patients was 30.20±11.36 years, with ages ranging from 18 to 67 years. Likewise, previous studies were conducted by Elbasha et al. (2023) in Egypt and Dogan et al. (2014) in Turkey where the mean ages were 26.56±9.24 years and 27.4±11.75 years respectively. The majority of patients in this study were in the age group 18-29 years which was consistent with other studies conducted in Egypt by Elbasha et al. (2023) and in India by Guntheti and Laxman; (2020) where most patients were aged between 21 to 30 years. This may be attributed to the higher rates of stress, failures, incapacity to manage new responsibilities, and poor family interaction in ages 20 to 40 (Ahmed et al., 2014). The highest percentage of the patients in this study were females (55.35%) as females are more liable to mood disturbances and stress. This finding is consistent with other studies conducted in Egypt by Elbasha et al. (2023) and Khayal et al. (2023) (females were 63.2 and 55.27% respectively), in Lebanon by Hitti et al. (2020) (females were 60.2%), in Congo by Mupendwa et al. (2023) (females were 52%), and in Spain by Llorens et al. (2024) (females were 62.1%). On the other side, a study conducted in France found that the percentage of male patients (57%) was more than females (Resiere et al., 2020).

In terms of residence, the highest percentage of patients came from rural areas (55.79%). This finding is in harmony with other studies done in Egypt (El Gendy et al., 2018 & Morsi et al., 2023), India (Batra et al., 2003), and Colombia (Benavides et al., 2023). In contrast, Halawa et al. (2013) and Elbasha et al. (2023) in Egypt, Tefera and Teferi, (2020) in Ethiopia, and Liu et al. (2023) in China found that patients from urban areas outnumbered those from rural ones. The results of this study revealed that the majority of patients were single 57.23%. Likewise, a previous study conducted by Mbarouk et al. (2017) in Tanzania (single patients were 51.9%), while Acharya et al. (2019) found that 60.1% of the patients were married.

The WHO estimates that each year, around 800,000 people die by suicide and that roughly 20 times as many individuals attempt suicide (WHO, 2019). In this study, the majority of poisoning intent was suicidal (69.81%) and the main route of exposure was oral. These results are in agreement with numerous studies conducted around the world, such as Egypt (Elbasha et al., 2023 & Hegazy and Elfiky, 2016), Ethiopia (Desalew et al., 2011), Nepal (Acharya et al. 2019), Tanzania (Mbarouk et al. 2017), China (Zhang et al., 2018), Colombia (Hurtado et al., 2024), India (Maheswari et al., 2016), and France (Resiere et al., 2020). The oral route may be indicative of the higher risk of suicide attempts or exposure in the home, as well as the lower risk of toxicities in the workplace and the environment in our study (Khayal et al., 2023).

The main etiological toxic agents in this study were aluminum phosphide (20.75%), followed by antipsychotics (10.06%), organophosphorus (9.43%), and carbamate (7.55%). This was consistent with studies from Morocco (Boukatta et al.; 2014), Egypt (Elbasha et al., 2023), and Southwestern Colombia (Hurtado et al., 2024) where pesticide toxicity was more prevalent (64.17%, 34%, and 34.2% respectively). The high prevalence of pesticide poisoning can be explained by their wide use, availability and the economic status of the region, which is mainly agricultural (Boukatta et al.; 2014). This finding is in contrast with a study in France where therapeutic drug poisoning was the most common (58%) among cases (Resiere et al., 2020). In Egypt, Abdelhamid et al. (2022) and Khayal et al. (2023) found that the main cause of poisoning was pharmaceutical drugs. While, Liu et al. (2023) found in a study conducted in China that drugs of abuse were the most common (53.2%), followed by pesticides (22.2%).

Regarding the clinical outcomes among the studied acutely poisoned adult patients, the overall mortality rate was 25.79% which is high compared to other studies conducted in France (Resiere et al., 2020), Colombia (Hurtado et al., 2024), Ethiopia (Tefera and Teferi, 2020), China (Zhang et al., 2018), and Tanzania (Mbarouk et al.2017) where the mortality rates were 10.3%, 4.2%, 1.5%, 1.2%, and 0.9% respectively. The raised mortality rate may be due to the high percentage of the severe and fatal poisoning agents in our study as aluminum phosphide was the prominent cause of death, followed by organophosphorus. The mortality rate from aluminum phosphide poisoning can range from 37 to 100% even in the presence of well-equipped hospitals (Khayal et al., 2023). This is in agreement with Hegazy and Elfiky, (2016), who found that the mortality rate due to poisoning with aluminum and zinc phosphide was 60% of their non-survived patients. Likewise, Ahmed and Aref, (2024) found that aluminum phosphide poisoning was the main cause of death among acutely poisoned cases admitted to ICU. On the contrary, Abdelhamid, (2021) and Hurtado et al. (2024) illustrated that the most frequent specific toxic agents related to mortality were organophosphates (23.8%. and 23.5% respectively). Approximately 41.5% of patients in the current study needed ICU admission and 23.27% of them needed MV. These results are relatively similar to that detected by Hurtado et al. (2024) in Colombia where 45.8% of the patients

admitted to ICU and 24.6 % of them needed MV. The difference in incidence of ICU admission, need for MV, and mortality between studies might be attributed to the difference in severity of toxicity between cases included in each study.

Comparing the Mean ± SD of the five studied scores (REMS, RAPS, MEWS, WPS, and NEWS2) for all patients on admission, showed that ICU-admitted patients, mechanically ventilated patients, and non-survivors had significantly higher Mean ± SD than those who were not needed ICU admission, were not mechanically ventilated, and survivors. This indicates that these scores could have a possible role in predicting the need for ICU admission, MV, and mortality in acutely poisoned patients attending ED. According to (Ha et al., 2015), REMS could be effective in risk stratification for emergency patients. Likewise, numerous studies recorded that REMS significantly had higher values in non-survived compared to survived patients in cases of aluminum phosphide poisoning (Abd Elghany et al., 2018) and Carbon monoxide poisoning (El-Gharbawy and Khalifa, 2019 & Elhawary and Sagah, 2022). Cattermole et al. (2009) found a significant increase of REMS in critically ill patients presented to ED who needed ICU admission or died compared to those who didn't need ICU admission and survived. Wahdan and Helal, 2021, recorded that the median of REMS was significantly higher among acute tricyclic antidepressant poisoning patients who required both ICU admission and MV in comparison to those who didn't require it. Furthermore, two studies recorded that the values of REMS and MEWS were significantly higher among acute clozapine poisoning patients and acute theophylline poisoned patients who needed ICU admission and/or MV compared to others who didn't need (Lashin and Sharif, 2023 & Sagah and Elmansy, 2023). In addition, other studies conducted by Valiollahzadeh et al. (2022) and Lee et al. (2024) found that MEWS was significantly high in acute poisoning patients presented to ED who died compared to survivors. Shahin and Hafez. (2020) detected that the values of REMS and RAPS were significantly higher in cases of poisoning with cholinesterase inhibitors who required MV and died in comparison to others who didn't need MV and survivors. Another study was conducted to predict in-hospital mortality in ED and found a significant difference between survivors and non-survivors regarding RAPS, REMS, MEWS, and WPS (Rahmatinejad et al., 2021). Furthermore, Torky et al. (2023) found that REMS and NEWS2 were significantly low in survivors compared to non-survivors in a study conducted on acutely poisoned patients admitted to the ICU of the Poison Control Center at Ain Shams University Hospitals. The median values of WPS and MEWS were significantly different between mechanically ventilated and non-mechanically ventilated patients presented with acute organophosphorus poisoning (Helmy et al., 2022).

In the current study, ROC curve analysis was used to evaluate the five scores' accuracy for predicting the need for ICU admission, MV, and mortality in acute poisoning adult patients who attended ED. Concerning the condition for ICU admission, NEWS2, WPS, REMS, and RAPS had excellent discrimination for the need for ICU admission with accuracy levels of 97.4%, 95.7%, 95.2%, and 94.1% respectively at cut-off >10, >6, >4, and >3 respectively. While MEWS had good discrimination for ICU admission (accuracy was 89.8% at cut-off >10). Regarding the need for MV, the REMS had the highest discrimination power (accuracy of 96.1% at cut-off >5) followed by NEWS2 (accuracy of 93.6% at cut-off >10), and RAPS (accuracy of 92.8% at cut-off >5), while MEWS and WPS show good discrimination. Concerning mortality prediction, NEWS2 had the highest power of discrimination (accuracy of 97.1% at cut-off ≥10) followed by REMS (accuracy of 96.8% and cut-off ≥5), RAPS (accuracy of 95.7% at cut-off ≥5), and WPS (accuracy of 94.4% and cut-off ≥6), and MEWS (accuracy of 89.5% at cut-off ≥5). Likewise, Shahin and Hafez, (2020), reported that of REMS and RAPS had excellent prediction power regarding the need for MV (at cut-off >6) and mortality (at cut-off >4) among cholinesterase inhibitors poisoned patients. The REMS exhibited excellent discriminatory power (accuracy was 91.8%) in predicting acute paraphenylenediamine mortality (El-Sarnagawy et al., 2023). According to Abd Elghany et al. (2018), REMS had accuracy level of 0.970 at cut-off ≥4.5 in mortality prediction among cases of aluminum phosphide poisoning. It has been detected that REMS was a good predictor for MV requirement among carbon monoxide poisoned patients at a cut-off value >4 (Elhawary and Sagah, 2022). El-Sarnagawy and Hafez, (2017) found that REMS had a good accuracy level in predicting ICU admission and the need for MV in drug overdose patients. Furthermore, Sagah and Elmansy, (2023) reported that MEWS and REMS had good prediction power regarding ICU admission (at cut-off >4 and >3 respectively) and excellent prediction of MV need (at cut-off >8 and >6 respectively) in cases of acute theophylline poisoning.

Valiollahzadeh et al. (2022), reported that MEWS had an accuracy level of 0.869% at cut-off 3.5 in mortality prediction among poisoning patients. Lashin and Sharif, (2023) stated that REMS had a comparable discrimination power with MEWS regarding ICU admission and both scores had excellent discrimination power toward the need for MV in patients with acute clozapine poisoning. According to Ha et al., 2015, WPS and REMS have good prognostic value regarding mortality prediction in ED patients. In contrast, Torky et al., (2023) found that REMS and NEWS2 and (AUC = 0.781 at 7 points and AUC = 0.628 at 10 points respectively) had poor discrimination power to predict mortality in cases of acute poisoning admitted to ICU. The severity of clinical conditions and the differences between types of poisoning could explain these contradictory findings.

Simple and quick scoring methods that call for little or no investigations are very important tools in an emergency setting (Brabrand et al., 2010). In this study, NEWS2, REMS, RAPS, MEWS, and WPS fit these criteria. To the best of our knowledge, few studies

evaluated the effectiveness of these five scoring systems as predictors of ICU admission, MV requirement, and mortality among acutely intoxicated patients in general. However, many studies proved the efficacy of some of them as outcome predictors in poisoning with specific poisons such as organophosphorus, aluminum phosphide, CO, PPD, theophylline, and clozapine. The five used scoring systems in this study are practical, depend on physiological parameters that allow optimum triage of the patient, utilization of resources, and facilitate making decision and outcome prognosis.

Conclusion

In conclusion, NEWS2, REMS, RAPS, WPS, and MEWS are simple, less time-consuming, lab-independent scoring systems and could rapidly be used in ED patients' assessment as they depend on routine clinical parameters that all emergency clinicians can apply. According to the results of this study, the on-admission NEWS2, REMS, RAPS, WPS, and MEWS were significant predictors for the need for ICU admission, MV, and mortality in acutely poisoned adult patients presenting to ED.

Recommendations

The NEWS2, REMS, RAPS, WPS, and MEWS are suggested to be used in the assessment of acutely intoxicated patients for early identification of patients who may need ICU admission, require MV, and are at risk of death. Studies with larger sample sizes are needed to identify the best cut-off values for severity and outcome prediction.

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فعالية الأنظمة القياسية المختلفة فى التنبؤ بشدة ونتائج التسمم الحاد لدى البالغين: دراسة مستقبلية بمستشفيات سوهاج الجامعية، مصر

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الملخص العربى

المقدمة:

يُعد التقييم السريع والدقيق لمرضى التسمم الحاد الذين يرتادون قسم الطوارئ أمرًا بالغ الأهمية، إذ يُمكن أن يُساعد ذلك في التحديد المبكر للمرضى الذين قد يحتاجون إلى دخول وحدة العناية المركزة أو المعرضين لخطر الوفاة. هدف الدراسة: تقييم فعالية خمسة أنظمة قياسية (مقياس طب الطوارئ السريع (REMS)، مقياس الفسيولوجيا الحادة السريع (RAPS)، مقياس الإنذار المبكر المعدل (MEWS)، مقياس الفسيولوجيا الجديرة (WPS)، و المقياس الوطني للإنذار المبكر ٢ (NEWS2) في التنبؤ بشدة ونتيجة التسمم الحاد.

طريقة البحث: أجريت هذه الدراسة المستقبلية على ١٥٩ مريضًا مصابًا بالتسمم الحاد الذين حضروا إلى قسم الطوارئ في مستشفيات سوهاج الجامعية فى الفترة من ديسمبر ٢٠٢٣ إلى نوفمبر ٢٠٢٤. تم استخدام منحنى خصائص تشغيل المستقبل لتقييم قوة التمييز لأنظمة القياس المستخدمة.

النتائج: أظهرت نتائج تقييم كل المرضى عند دخول المستشفى باستخدام الأنظمة القياسية الخمسة ارتفاعا كبيرا فى مجموع نقاط كل الأنظمة القياسية فى المرضى الذين تم حجزهم بوحدة العناية المركزة والحالات التى تم وضعها على أجهزة التنفس الصناعى وكذلك حالات الوفاة. كان المقياس الوطني للإنذار المبكر ٢ (NEWS2) الأفضل من حيث دقة التنبؤ بحاجة المريض لدخول وحدة العناية المركزة وإحتمالية حدوث الوفاة (٩٧.٤٪ و ٩٧.١٪). بينما كان مقياس طب الطوارئ السريع (REMS) هوالأفضل في التنبؤ بإحتياج المريض لإجهزة التنفس الصناعى.

الاستنتاج: تُعد أنظمة (مقياس طب الطوارئ السريع (REMS)، مقياس الفسيولوجيا الحادة السريع (RAPS)، مقياس الإنذار المبكر المعدل (MEWS)، مقياس الفسيولوجيا الجديرة (WPS)، و المقياس الوطني للإنذار المبكر ٢) أدوات بسيطة وسريعة وفعالة للتنبؤ بتطورات ونتائج مرضى التسمم الحاد الذين يرتادون قسم الطوارئ من حيث إحتياجهم لدخول وحدة العناية المركزة او الوضع على أجهزة التنفس الصناعى وكذلك إحتمالية حدوث الوفاة.

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