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OPEN PEER REVIEW

# Evaluating the Efficacy of the National Early Warning Score in Predicting the Mortality of Stroke Patients Admitted to Intensive Care Units

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## About this report

This open peer review (OPR) report shows the public comments made on this article during peer review, by the reviewers, the associate editor and the editor-in-chief, for every revision round, together with the authors' replies. Comments appear only with the consent of the people who wrote them. Reviewers who chose to sign their report are named; the others are shown as "Referee". Comments are edited for language only, and confidential remarks to the editors are not included.

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## 1 Original submission

5 comments · 29 Jan 2022 – 5 Feb 2022

### Referee 1 Reviewer

REJECT 29 Jan 2022

Dear AE,
Thank you for invitation of me as a reviewer of manuscript (ID: 116358) entitled “Evaluation of the efficacy of the National Early Warning Score (NEWS) in predicting the mortality of stroke patients admitted to intensive care units (ICU)”. Following are my comments and reviews on certain points of the study:
Title & Abstract:
1. Abbreviations such as (NEWS) or (ICU) are not usually used in the title of the article.
2. The type of study should be mentioned in the title or abstract of the article.
3. The main purpose of the study is not discussed in the results section of the article summary.
4. In line 18, severity of what??
Introduction:
1. Line 57: It is better to use the term "Predicting the value of" instead of the word "the effect of".
Materials & Methods:
1. How to calculate the sample size is not explained.
2. There is no mention of interfering and confounding factors and how to control their effect.
3. The description of the statistical tests and the method of data analysis are incomplete.
Results:
1. The way the results are expressed is very confusing and unsystematic.
2. In expressing the results, it is better to first present the values of the main variable, which is also the main purpose (means and ± SD of NEWS score) of the study. After that, the results of each variable and its relationship with the study outcome were investigated.
3. There are several inconsistencies in the presentation of the results: For example in the method section it was mentioned that, If the score of each variable alone is 3, the patient is in the moderate risk group and In the results section, it was reported that 78.9% of patients received a score of 3 in terms of level of consciousness, But in Table 3, only 26.7% of patients with moderate risk are reported.
4. Line 113 states that 30.98% of patients with a score of 3 have died, While in line 116, 100% mortality has been reported for them.
5. There are several typographical errors in the numbers mentioned in the results section. Like the body temperature in line 101 and the percentage of female patients who died in line 110.
6. What does mean "The study of the relationship between variables and chi2" in line 133?
7. T-test and chi-square are not suitable for correlating a variable with an outcome.
8. The table titles are not complete and correct.
9. In the method part, the assessing tool for the level of consciousness is not GCS, but mentioned in Table 6.
Discussion:
1. Due to the small sample size, the evaluation of the relationship between individual NEWS variables and specific outcomes cannot be valuable. And in fact, this score is valuable when it is fully evaluated and scored.
2. Some of the contents of this section are not available in the reference list. (line 196) And in general, the number of study references is very small.
3. The numbering of references in the text is not the same as the list of references. For example Lee et al
4. The books used are not referenced correctly. (Number 2, 3 & 6)
The article needs general editing in terms of English writing.
Thanks.

**Referee 2** Reviewer

MAJOR REVISION 31 Jan 2022

Dear AE,
Thanks for this research, but I thought it necessary to explain a few points as follows:
1- Abbreviations should be explained in the first part used. ( APACHE, CVA, CPR, AVPU)
2- Keywords were different in the abstract (required) and abstract in part 2.
3- In the introduction part, at the beginning of the first paragraph, the word stroke is acronyms with CVA ?,! while in the methods part, CVA is acronyms with (visceral hemorrhagic ischemic). Which one of them is correct and we know that CVA is an abbreviation for cerebrovascular accident.
4- In table 6, according to the logistic regression test, the GCS factor should be significant, but according to P-value (0/39) , it does not seem to be significant and LOS is significant.
5- The relationship between sex and mortality is meaningless, while according to the percentage of mortality mentioned in the text(43/5 vs. 5/56- men vs. women), this relationship should be significant.
6- Reference NO. 3 is not written correctly. Also, the references section needs up-date.
THANKS

**Referee 3** Reviewer

MAJOR REVISION 3 Feb 2022

Dear AE,
The manuscript" Evaluation of the efficacy of the National Early Warning Score
(NEWS) in predicting the mortality of stroke patients admitted to intensive care units (ICU)" was reviewed. Thanks to the researchers who did apply research in the ICU and wrote a useful article, I came up with some tips that will be sent to the authors for correction and response.
- In my opinion, the expression of information in the results section is vague.
- Table 4 is vague. The column headings are not specified correctly. Please be corrected.
- Although the text of the article refers to the relationship between loss of consciousness and patient mortality in Table 6, there is no information about loss of consciousness in the table. If the meaning of the loss of consciousness is the same as GCS, there is no significant relationship according to P. Value 0.39 in Table 6.
- In the same section of the results, vague and perhaps contradictory information is provided regarding the relationship between the length of hospital stay and mortality. In one place it is written that there is no significant relationship between the length of hospitalization and the NEWS criterion, and in the lower place it is written that the length of hospitalization was shorter in deceased patients, and in another place in the lower, it is written that the duration of hospitalization has a significant relationship with mortality. This should be further explained and clarified.
Respectfully,

**Associate Editor**

REJECT 4 Feb 2022

Dear EIC,
Thank you for invitation of me as AE of manuscript (ID: 116358) entitled "Evaluation of the efficacy of the National Early Warning Score (NEWS) in predicting the mortality of stroke patients admitted to intensive care units (ICU)". The above manuscript was evaluated by me and 2 experienced judges, and I hope that all of these points of view will help the respected authors to correct the article.
Thanks.

**Editor-in-Chief** MAJOR REVISION 5 Feb 2022

Dear Author,
The reviewers' comments are mentioned. Please correct the details as mentioned above carefully according to reviewers' request.
Thanks.

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# Revision 1

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Dear Editor,

Thank you for your useful comments and suggestions on the **Evaluation of the efficacy of the National Early Warning Score in predicting the mortality of stroke patients admitted to intensive care units** of our manuscript.
We have modified the manuscript accordingly, and detailed corrections are listed below point by point:
Reviewer 1:
**1) - In my opinion, the expression of information in the results section is vague.**
The results were reviewed
2) - Table 4 is vague. The column headings are not specified correctly. Please be corrected.

Table 4 has been modified

**3) - Although the text of the article refers to the relationship between loss of consciousness and patient mortality in Table 6, there is no information about loss of consciousness in the table. If the meaning of loss of consciousness is the same as GCS, there is no significant relationship according to P. Value 0.39 in Table 6.**

Table 6 has been modified

**4) - In the same section of the results, vague and perhaps contradictory information is provided regarding the relationship between length of hospital stay and mortality. In one place it is written that there is no significant relationship between the length of hospitalization and the NEWS criterion, and in the lower place it is written that the length of hospitalization was shorter in deceased patients, and in another place in the lower, it is written that the duration of hospitalization has a significant relationship with mortality. This should be further explained and clarified.**

The results were reviewed in general and the ambiguous results were corrected.

**Reviewer 2:**

**1) 1- Abbreviations should be explained in the first part used. ( APACH, CVA, CPR, AVPU)**

Abbreviations corrected

**2) Key words were different in abstract (required) and abstract in part 2.**

The keywords in the text and the second part were corrected

**3) In introduction part, at the beginning of the first paragraph, the word of stroke is acronyms with CVA ?,! while in methods part, CVA is acronyms with (visceral hemorrhagic ischemic). Which one of them are correct and we know that CVA is abbreviation for cerebrovascular accident.**

Word CVA corrected

**4) The relationship between sex and mortality is meaningless, while according to the percentage of mortality mentioned in the text(43/5 vs. 5/56- men vs. women), this relationship should be significant**.

Among the patients who died, 56.5% were female and 43.5% were male. There was no significant relationship between sex and age with patient mortality.

**5) Reference NO. 3 is not written correctly. Also, references section need up-date.**

References corrected

**Reviewer 3:**

**1) Abbreviations such as (NEWS) or (ICU) are not usually used in the title of the article.**

Title corrected

**2) The type of study should be mentioned in the title or abstract of the article**.

The type of study was written in the abstract of the article

**3) The main purpose of the study is not discussed in the results section of the article summary.**

The main purpose of the study was discussed in the results

**4. In line 18, severity of what??**

Was corrected

**5. Line 57: It is better to use the term "Predicting value of" instead of the word "the effect of".**

Was corrected

**6. How to calculate the sample size is not explained.**

With regard to number of patients in similar articles and cases admitted to ICU in six months and approve of statistical consultants

**7) There is no mention of interfering and confounding factors and how to control their effect**.

Interfering factors controlled with include and exclude criterias. Include criterias were all patients with cerebral ischemia whom need ICU care Exclude criterias were any patients die in first 24h after admission and any patients who admitted to ICU for other diseases.IF patient had any pulmonary or cardiac disease excluded from research.

**Results:**

The results section was reviewed in general and writing errors were corrected

**Discussion:**

References in the discussion section were modified and the number of references was increased

We believe that the paper is now acceptable for the review process.

The manuscript has been resubmitted to your journal. We look forward to your positive response.

Sincerely,

## 2 Revision 1

2 comments · 19 Feb 2022 – 19 Feb 2022

### Associate Editor

MINOR REVISION 19 Feb 2022

Dear EIC,
This revised manuscript needs consideration and up-date in the references section.
Regards

### Editor-in-Chief

MINOR REVISION 19 Feb 2022

Dear Author,
Your article is reviewed by the reviewers carefully. According to their comments, this document needs minor revision. Please follow their comments as requested.
Thanks.

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# Revision 2

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

# Evaluation of the efficacy of the National Early Warning Score in predicting the mortality of stroke patients admitted to intensive care units


## Abstract

**Background**: NEWS is a tool used to identify patients at risk. Scores are based on initial clinical observations, including: heart rate, respiration rate, and systolic blood pressure, and oxygen saturation, level of consciousness, body temperature, and oxygen support. Few studies on NEWS evaluation have been conducted to date and no study has been conducted in Iran. This study aims to Evaluation of the efficacy of the National Early Warning Score (NEWS) in predicting the mortality of stroke patients admitted to intensive care units (ICU)

**Methods:** The present cross-sectional Ninety patients for whom a definitive diagnosis of CVA was presented based on the set of symptoms and para-clinics were included in the study. For patients with a definitive diagnosis of CVA at the beginning of admission to the ICU and up to the first 24 hours of admission of all parameters in NEWS measured and evaluated and for each patient according to this measurement completed.

**Results:** There was a significant relationship between systolic blood pressure, Respiratory support, heart rate and level of consciousness with patients' discharge status. Also, there was no significant relationship between age, sex, respiratory rate, SPO2 and fever with discharge status. There is a significant relationship between clinical risk based on NEWS scoring system and patients' status.

**Conclusion**: There is a significant relationship between clinical risk based on NEWS scoring and patients' discharge status, which indicates a significant increase in mortality in patients with higher NEWS.



**Keywords:** National Early Warning Score, Stroke, Intensive Care Unit

## Introduction

Cerebrovascular accident (CVA) is the most common disabling neurological disorder(1) and is the fourth leading cause of death in the United States after heart disease, cancer, and chronic lung disease(2). CVA is a vascular lesion that causes a neurological deficit and begins acutely and lasts over 24 hours(3). To diagnose CVA and find its causes and rule out other disorders similar to stroke, a number of evaluations such as ECG, CT scan, MRI, Echocardiography, Angiography, Doppler sonography must be performed(4). In addition to causing death, strokes cause disability of the patient throughout life, which can be in the form of various movement, sensory, verbal, memory, visual, etc. disorders that depend on the anatomical location of the affected arteries. These side effects can severely affect a person's future(5). Many patients can experience unexpected clinical deterioration during hospitalization, which is associated with in-hospital mortality(6).The primary goal in predicting hospital mortality is to improve patient prognosis. Several scoring systems are currently used to predict mortality in hospitals(7). Acute Physiology and Chronic Health Evaluation(APACHE) and Simplified Acute Physiology Score(SAPS) are examples of disease prognosis models. However, these scales are relatively complex and include several items that cannot be used as rapid and accessible clinical tools(8). Another of these systems is Modified Early Warning Score(NEWS), provided by doctors at Royal College London, which is a good development and may be good news for patients(9,10). NEWS is a tool used to identify at-risk patients. Scores are based on initial clinical observations, including heart rate, respiration rate, systolic blood pressure, oxygen saturation, level of consciousness, body temperature, ventilator respiratory support. High scores likely indicate that the patient is progressing to a critical condition. This system is currently used in several countries(11-13). Studies on NEWS evaluation have been conducted to date, but no study has been conducted in Iran, and in fact, it is a new prognostic model that seems to need to be evaluated for its effectiveness because it can be really useful as it's fast and accessible. In the present study, information about the parameters are recorded in the ICU at the time of patient admission, which increases the accuracy of data collection and this study also examines the ability of NEWS in predicting mortality in patients who are admitted to the ICU and are in fact in a more critical condition, which is different from other studies. The aim of this study was to evaluate Predicting

value of National Early Warning Score (NEWS) on predicting mortality of stroke patients admitted to the intensive care unit.

**Materials and Methods:**

The present cross-sectional was conducted in Alavi Hospital of Ardabil for six months in 2016-2017 on 90 patients who had a definite diagnosis of CVA (Cerebrovascular accident) based on clinical criteria of loss of consciousness, paresis, and palsy, Speech disorders, etc. and para-clinical criteria such as CT scan and MRI which were evaluated and diagnosed by a neurologist. The number of patients was determined With regard to the number of patients in similar articles and cases admitted to ICU in six months and approved by statistical consultants. For all patients in any age group and with any underlying disease (it should be noted that underlying diseases do not interfere with NEWS scoring and were not among our exclusion criteria) with a definitive diagnosis of CVA at the beginning of ICU admission and up to the first 24 hours, all of the required parameters for NEWS was measured and evaluated.respiratory rate, heart rate, and oxygen saturation, detected by Saadat B5 ICU monitoring device, respiratory support managed by observation, body temperature measured by Beaver digital thermometer model FT09, systolic blood pressure measured with Rosemax GB102 hand barometer, level of consciousness assessed by The AVPU scale(Alert,Voice, Pain,Unresponsive scale) and checklists designed based on NEWS for each patient and completed according to these measurements.

Patients who underwent cardiopulmonary Resuscitation(CPR) during hospitalization and before admission to the ICU were excluded from the study due to increased risk of mortality and disruption of outcome. NEWS score was calculated for each patient BASED ON Table 1.

Table 1. Scores related to the physiological parameters of the news

| Physiological parameters | score | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| Respiratory rate | ≤8 | | 9-11 | 12-20 | | 21-24 | ≥25 |
| oxygensaturation | ≤91 | 92-93 | 94-95 | 96-100 | | | |
| Supplemental oxygen | | yes | | no | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Temperature(c) | ≤35 | | 35.1-36 | 36.1-38 | 38.1-39 | ≥39.1 | |
| Systolic BP | ≤90 | 91-100 | 101 | 110 | 111-219 | | ≥220 |
| Pulse rate | ≤40 | | 41-50 | 51-90 | 91-110 | 110-130 | ≥131 |
| | | | | A | | | V, P or U |

(A=Alert, V=Response to Voice, P= Response to pain and U=Unresponsive): additional score of 2 be added if the patient is on supplemental oxygen.

According to the NEWS scores patients classified into three groups of high risk (total scores greater than or equal to 7), moderate risk (total scores of 5-6 or 3 scores from only one parameter), and low risk (total scores of zero or 1- 4).

Table 2. The national early warning score thresholds and triggers

| Clinical risk | New scores |
|---|---|
| low | 0 |
| | Aggregate 1-4 |
| medium | Red score<br>(Individual parameter scoring 3) |
| | Aggregate 5-6 |
| high | Aggregate 7<br>Or more |

Patients were then followed up during their stay in the ICU, and in those who died while in the ICU, the relationship between NEWS scores and mortality was assessed.Also, in the deceased ones, each of the NEWS parameters was statistically examined separately to determine which of them was more disturbed.This study has been registered in the ethics committee of Ardabil University of Medical Sciences under the code number of ethics: IR.ARUMS.REC.1398.652. The collected data were entered into 24SPSS V software and presented in the form of frequency tables and graphs. Chi2 and T-test and logistic regression test were used to examine the relationship between variables.In this study, p-value less than 0.05 is considered significant.

## Results

This study conducted on 90 patients and 23 of them(25.6%) died during the study. In this study, out of 90 patients, 50 (55.6%) were female and 40 (44.4%) were male. The mean age of patients was 53/90±12/68 years with a range of 24 to 92 years. In the assessment of the level of

consciousness with AVPU, 71 patients (78.9%) had a score of 3, i.e. in the first 24 hours of entering the ICU, had a response to sound or pain or did not respond to the painful stimulus. Among the 90 patients studied, 54(60%) were low risk, 24(26.7%) were med risk and 12(13.3%) were high risk.

Among all the subjects, 60 patients (66.7%) had a heart rate of 51-90 beats per minute which gets a zero score. 83 patients (92.3%) had systolic blood pressure of 111-219 mmHg which gets a zero score in terms of systolic blood pressure. 88 patients (97.8%) had a body temperature of 38.0-36.1 degrees Celsius which gets a score of zero. 64 patients (71.2%) had oxygen saturation ≥ 96% which gets a score of zero.79 patients (87.8%) had a respiratory rate of 12-20 breaths per minute which gets a score of zero.

69 patients (67.7%) had not respiratory support which gets a score of zero. According to the data in Table 3, out of 90 patients studied in this study, 54 were low risk, 24 were Med Risk and 12 were High Risk(Table 3).

**Table 3. Distribution of clinical risk in CVD patients**

| Level of risk Scores | n | % |
|---|---|---|
| Low (4-0) | 54 | 60 |
| Med (6-5) ((Red Score | 24 | 26.7 |
| High (≥7) | 12 | 13.3 |
| Total | 90 | 100 |

Red score: Take 3 score from one parameters in NEWS

Among the patients who died, 56.5% were female and 43.5% were male. There was no significant relationship between sex and age with patient mortality. Among the patients who received a score of zero from the level of consciousness parameter, 5.3% of them died, while in patients with a score of 3, 30. 98 % of them died. There was a significant relationship between the level of consciousness at the onset and mortality of CVA patients. there was a significant relationship between heart rate at the onset and mortality rate of CVA patients.

There was a significant relationship between systolic blood pressure at the onset and the mortality rate of CVA patients in this study. The body temperature of 97% of living patients was between

38.0-36.1 which gets a score of zero and also100% of the deceased patients had a score of zero in terms of body temperature. There was no significant relationship between body temperature at the onset and mortality of CVA patients in this study. Among the patients who survived, most of them (71.6%), had a score of zero, and among the patients who died, the highest number (69.6%), had a score of zero and oxygen saturation≥96.There was no significant relationship between oxygen saturation and mortality rate in CVA patients.Among the patients who survived, the highest number (92.5%), had a score of zero, and among the patients who died, the highest number (73.9%), had a score of zero (12-20 breaths per minute).

There was no significant relationship between the number of breaths per minute at onset and mortality rate in CVA patients.79.8% of patients who did not have respiratory support at onset survived, but 42.8% of patients who had respiratory support at onset, died and 57.2% of them survived. There was a significant relationship between respiratory support and mortality of CVA patients in this study. Based on the data in Table 4, individuals with Medium clinical risk, without considering the mortality or discharge status, compared to Low and High clinical levels had a relatively longer stay in the ICU. Evaluation of the relationship between NEWS and length of stay with T-Test showed that there was no significant relationship between them.

**Table 4**. Relation NEWS with LOS in ICU in studied CVA patients

| Level of clinical risk | Length of stay | p-value |
|---|---|---|
| | Mean±SD | |
| Low | 12.7±2.5 | 0.5 |
| Med | 17.3±3 | |
| High | 12.3±8.3 | |

The mean length of stay of patients who survived was 15.4 ± 1.2 days and was significantly longer than deceased patients' which was 9.2 ± 5 days. Based on Table 5, 16.7% of low-risk, 25% of Med Risk and 66.6%of High-Risk patients according to NEWS at the time of admission died.

**Table 5**. Relation clinical risk level at admission time and mortality of patients

| Level of risk Scores | live | | dead | | Total | | p-value |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | |
| Low | 45 | 83.3 | 9 | 16.7 | 54 | 100 | 0.002 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (4-0) | | | | | | | |
| Med (6-5) or ((Red Score | 18 | 75 | 9 | 25 | 24 | 100 | |
| (red Score) High (7≤) | 4 | 33.3 | 8 | 66.6 | 12 | 100 | |

The results showed that there was a significant relationship between clinical risk at the onset and mortality rate of CVA (P = 0.002). According to the data in Table 6, which is based on logistic regression test, among the above variables, only AVPU and length of stay had a significant relationship to mortality rate and other variables did not have such an effect on mortality prediction.

**Table 6**. Results of logistic regression for detection effective factors on mortality prediction in hospitalized patients in ICU

| Variables | ODDs | CI 95% | | p-value |
|---|---|---|---|---|
| | | upper | lower | |
| Sex | 1.51 | 5.19 | 0.44 | 0.51 |
| Age | 1.04 | 4.09 | 0.99 | 0.09 |
| AVPU | 0.44 | 0.97 | 0.2 | 0.039 |
| HR | 0.43 | 1.09 | 0.17 | 0.074 |
| SBP | 0.27 | 1.2 | 0.06 | 0.084 |
| SO2 | 1.23 | 2.6 | 0.58 | 0.59 |
| RR | 0.78 | 1.71 | 0.36 | 0.54 |
| Respiratory support | 0.6 | 1.2 | 0.3 | 0.15 |

| | | | | |
|---|---|---|---|---|
| LOS | 1.074 | 1.14 | 1.009 | 0.024 |

Based on the ROC curve, the area under the rock curve is 72%, which at the cut-off point 3, the sensitivity and specificity of this indicator for detecting and predicting mortality is about 96% and 76%.

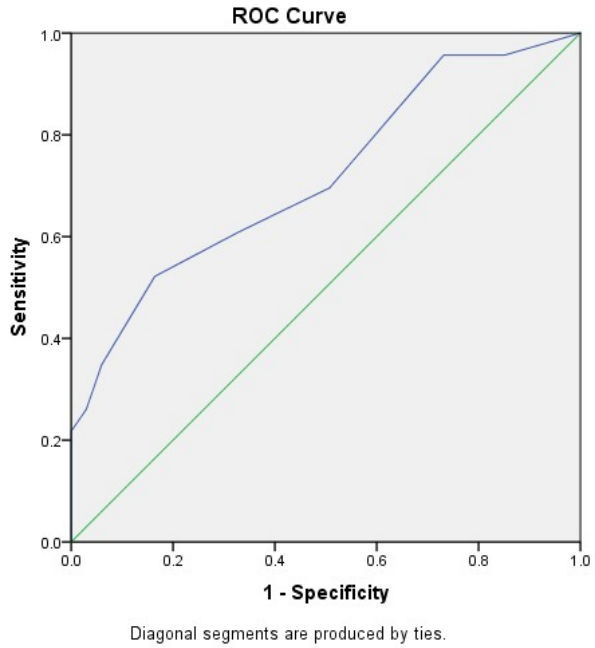



**Figure 1**. The ROC for detection relation NEWS with mortality of patients in ICU

## Discussion

The intensive care unit has been provided for management of critically ill patients(13). Since there are always limitations in the services that can be provided in the intensive care unit, achieving appropriate criteria to predict the mortality of patients admitted to these centers is doubly important for prioritizing patients to provide services(14-16). So far, several scoring systems such as SAPSΠ and APACHEΠ have been used to quantify patient status and predict mortality.However, these scales are relatively complex and include several items that cannot be used as rapid and accessible clinical tools (4). NEWS is a scoring system used to identify at-risk patients.Scores are based on initial clinical observations, including heart rate, respiratory rate, systolic blood pressure, oxygen saturation, level of consciousness, body temperature, oxygen respiratory support (5).Studies to date have assessed the ability of the NEWS scoring system in

patients in different wards. In the present study, the effect of NEWS at entering the ICU in predicting the mortality of 90 CVA patients admitted to the ICU of Alavi Hospital in Ardabil during their stay was investigated and also the relationship between each of the NEWS parameters with mortality was investigated separately. Our study showed that there is a significant relationship between the parameters of level of consciousness, heart rate per minute, systolic blood pressure, and respiratory support independently with patient mortality so that the higher the score of these parameters, the Mortality will likely be higher during hospitalization.However, the parameters of sex, age, body temperature, oxygen saturation, the respiratory rate in our study could not predict the mortality of CVA patients. The length of stay of patients was not predictable based on NEWS at the onset.Our study also showed that when the relationship between each of the NEWS parameters (independently and not as a total score) is measured in conjunction with the variables of age, sex, and length of stay by logistic regression test, this relationship is only significant at the level of consciousness and length of stay.In other studies, the parameters of NEWS have not been studied separately so far.Our study also showed that in CVA patients admitted to the ICU, the higher the calculated score at the time of admission, the higher the risk of mortality during ICU hospitalization. However, in this study, due to time limitation, patients' mortality after discharge did not be followed-up.

However, the aim of our study was to prioritize critically ill CVA patients to provide them intensively and specialist care due to limited hospital facilities and not to predict overall mortality, as it seems that due to differences in post-discharge care, different factors after discharge can influence the condition of patients.

A study conducted by Liljehult et al(5) in 2015 Entitled Predicting mortality of stroke patients with NEWS Vital signs were measured immediately after admission and continuously during the hospitalization period.A total of 24 patients (8.8%) died within 30 days.The mortality rate was lowest for the 0-1 score at admission (2%) and highest for the score ≥ 5 (63%). In our study like the liljehult study, the statistical population was only stroke patients. NEWS was able to predict the mortality of stroke patients, and patients with a NEWS score less than 3 at the onset of admission were estimated to have a 96 percent chance of survival.

A study by YounngSeoklee et al entitled, Assessing the Effectiveness of NEWS in Predicting Hospital Mortality, showed that NEWS's performance was effective in predicting in-hospital mortality.According to Kaplan Meyer survival curves, the survival time of patients who are at

high risk according to NEWS is significantly shorter than the patients at low risk. In addition, Lee et al. Showed that the combined model, which includes other factors such as age and diagnosis, is more effective in predicting in-hospital mortality than NEWS alone (4). In our study, the need for the NEWS scoring system was able to predict the mortality of CVA patients admitted to the ICU during their stay, but in an independent study, there was no significant relationship between age and mortality.

A study by Uppanisakorn et al. Entitled NEWS's ability to predict early clinical deterioration after discharging of ICU showed that NEWS could be an independent predictor of early clinical deterioration in ICU discharge. In fact, NEWS Showed 93.6%sensitivity and 82.2% specificity in predicting clinical deterioration in the first 24 hours after discharging of ICU (7). In our study, like the study of Uppanisakorn et al. NEWS was very effective in predicting the mortality of ICU patients, and the sensitivity and specificity of this index for predicting mortality was about 96% and 76%.

Gray B.Smith et al.'s study, entitled NEWS ability to diagnose patients at risk of premature heart failure, unexpected admission to the intensive care unit, and death, showed that NEWS has a great ability to diagnose patients at risk of premature cardiac arrest, unexpected hospitalization in the ICU or death within 24 hours after the calculation of NEWS (8). In our study, it was shown that this scoring system can predict the patient's clinical condition even in more than 24 hours and even until the discharging of ICU. However, continuous monitoring of patients during ICU admission with NEWS may be able to predict patients' condition accurately until discharge. But F. Hamilton et al.'s study of NEWS's ability to predict sepsis-induced mortality was a meta-analysis of a systematic review of six studies involving 4,298 patients with sepsis, which showed that NEWS could not predict mortality of patients with sepsis (9).Comparison of this study with our study showed that the predictive power of the NEWS scoring system in patients with stroke is greater and better than the predictive power of this system in patients with sepsis.However, various factors such as accuracy in data collection and even the feature of disease due to its unpredictable and critical nature due to the possibility of multisystem involvement can affect the outcome of the study.

## Conclusion

In this study, we evaluated the effect of NEWS on predicting mortality of stroke patients in the intensive care unit and finally, it was concluded that there is a significant relationship between clinical risk based on NEWS scoring system and patients' status, which indicates a significant increase in mortality in patients with higher NEWS score.It is suggested that a study be performed in a larger statistical population and in other diseases and evaluate the ability of this criterion in predicting mortality and survival of discharged patients.It is suggested that this scoring system be studied in comparison with other scoring systems.

**Footnotes:**

**Authors' Contribution:** Study concept and design: Mahzad Yousefian and Ali Mohammadian-Erdi. Analysis and interpretation of data: Khatereh Isazadehfar. Manuscript preparation: Fatemeh Badamchi and Mahzad Yousefian. Collection of data: Fatemeh Badamchi. Critical revision: Mahzad Yousefian

**Acknowledgements**: None

**Conflict Of Interest:** The authors declare that they have no conflict of interest.

**Funding/Support:** None

**Ethical Approval:**

This study is approved under the ethical approval code of IR.ARUMS.REC.1398.652 (webpage of ethical approval code is: https://ethics.research.ac.ir/EthicsProposalView.php?id=125117)

**References**

**1.** Yousefian m, sadegi srgp, sakaki m. Vitamin d supplements' effect on expediting the weaning process in patients with the stroke. Electron j gen med. 2019;16(2):em133. Https://doi.org/10.29333/ejgm/94224

**2.** Yousefian m, ghazi a, amani f, movaffagh b. Mortality rate in patients admitted to the icu based on lods, apache iv, trios, saps ii. J adv pharm educ res. 2022;12(1):56- 62. Https://doi.org/10.51847/cghzosuz9x**.**

**3**. Smith hj, pasko dn, haygood clw, boone jd, harper lm, straughn jm jr.. Early warning score: an indicator of adverse outcomes in postoperative patients on a gynecologic oncology service. Gynecol oncol2016;143(2):105-8. Doi:10.1016/j.ygyno.2016.08.153 pmid:27507186

4. Lee ys,choi jw, park yh, chung c, park d, lee je, et al. Evaluation of the efficacy of the national early warning score in predicting in hospital mortality via the risk stratification. Journal of critical care.2018;47:222-226.

5.Liljehult J, Christensen T. Early warning score predicts acute mortality in stroke patients. Acta Neurologica Scandinavica.2016;133(4):261-267.

6. Walter G, Brodily-Robert B, Daroff Jerald M. 4nd ed Neurology in clincal practice- The neurological disorders;2006.p. 1197-287.

7.Uppanisakorn S, Bhurayanontachai R,Boonyarat J,Kaewpradit J. National EarlyWarning Score (NEWS) at ICU discharge can predict early clinical deterioration after ICU transfer. Journal of Critical Care.2018;43:225-229. DOI: 10.1016/j.jcrc.2017.09.008. PMID: 28926736

8. Smith GB, Prytherch DR, Meredith P, Schmidt PE, Featherstone PI. The ability of the National Early Warning Score (NEWS) to discriminate patients at risk of early cardiac arrest, unanticipated intensive care unit admission, and death. Resuscitation. 2013;84(4):465-470.

9. Hamilton F,Arnold D,Baird A,Albur M,Whiting P. EarlyWarning Scores do not accurately predict mortality in sepsis:A meta-analysis and systematic review of the literature. Journal of Infection.2018;76(3):241-248

10. Spagnolli W, Rigoni M, Torri E, Cozzio S, Vettorato E, Nollo G. Application of the National Early Warning Score (NEWS) as a stratification tool on admission in an Italian acute medical ward: A perspective study. Int J Clin Pract2017;71. doi:10.1111/ijcp.12934 pmid:28276182

11. Sbiti-Rohr D, Kutz A, Christ-Crain M, Thomann R, Zimmerli W, Hoess C, et al. The National Early Warning Score (NEWS) for outcome prediction in emergency department patients with community-acquired pneumonia: results from a 6-year prospective cohort study. BMJ Open. 2016; 6(9). 3-10

12. Hoikka M, Silfvast T, Ala-Kokko TI. Does the prehospital National Early Warning Score predict the short-term mortality of unselected emergency patients?. Scandinavian Journal of Trauma,resuscitation and emergency medicine.2018;26(1):48-57.

13. Yuan WC, Tao C, Dan ZD, Yi SC, Jing W, Jian Q. The significance of National Early Warning Score for predicting prognosis and evaluating conditions of patients in resuscitation room. Hong Kong Journal of Emergency Medicine. 2018; 25(6):324-330.

14. Stark AP, Maciel RC, Sheppard W, Sacks G, Hines OJ. An early warning score predicts risk of death after inhospital cardiopulmonary arrest in surgical patients. Am Surg2015;81:916-21.pmid:26463280

15.Forster S, Housley G, McKeever TM, Shaw DE. Investigating the discriminative value of Early Warning Scores in patients with respiratory disease using a retrospective cohort analysis of admissions to Nottingham University Hospitals Trust over a 2-year period. BMJ Open2018;8:e020269. doi:10.1136/bmjopen-2017-020269 pmid:30061434

16. Hodgson LE, Dimitrov BD, Congleton J, Venn R, Forni LG, Roderick PJ. A validation of the National Early Warning Score to predict outcome in patients with COPD exacerbation. Thorax2017;72:23-30. doi:10.1136/thoraxjnl-2016-208436 pmid:27553223

## 3 Revision 2

1 comment · 7 Mar 2022

### Editor-in-Chief

MINOR REVISION 7 Mar 2022

Dear Authors,
Please update the references section.
Thanks.

4

# Revision 3

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

Dear Editor,

Thank you for your useful comments and suggestions on the **Evaluation of the efficacy of the National Early Warning Score in predicting the mortality of stroke patients admitted to intensive care units** of our manuscript.
We have modified the manuscript accordingly, and detailed corrections are listed below point by point:
Reviewer 1:
**1) - In my opinion, the expression of information in the results section is vague.**
The results were reviewed
2) - Table 4 is vague. The column headings are not specified correctly. Please be corrected.

Table 4 has been modified

**3) - Although the text of the article refers to the relationship between loss of consciousness and patient mortality in Table 6, there is no information about loss of consciousness in the table. If the meaning of loss of consciousness is the same as GCS, there is no significant relationship according to P. Value 0.39 in Table 6.**

Table 6 has been modified

**4) - In the same section of the results, vague and perhaps contradictory information is provided regarding the relationship between length of hospital stay and mortality. In one place it is written that there is no significant relationship between the length of hospitalization and the NEWS criterion, and in the lower place it is written that the length of hospitalization was shorter in deceased patients, and in another place in the lower, it is written that the duration of hospitalization has a significant relationship with mortality. This should be further explained and clarified.**

The results were reviewed in general and the ambiguous results were corrected.

**Reviewer 2:**

**1) 1- Abbreviations should be explained in the first part used. ( APACH, CVA, CPR, AVPU)**

Abbreviations corrected

**2) Key words were different in abstract (required) and abstract in part 2.**

The keywords in the text and the second part were corrected

**3) In introduction part, at the beginning of the first paragraph, the word of stroke is acronyms with CVA ?,! while in methods part, CVA is acronyms with (visceral hemorrhagic ischemic). Which one of them are correct and we know that CVA is abbreviation for cerebrovascular accident.**

Word CVA corrected

**4) The relationship between sex and mortality is meaningless, while according to the percentage of mortality mentioned in the text(43/5 vs. 5/56- men vs. women), this relationship should be significant**.

Among the patients who died, 56.5% were female and 43.5% were male. There was no significant relationship between sex and age with patient mortality.

**5) Reference NO. 3 is not written correctly. Also, references section need up-date.**

References corrected

**Reviewer 3:**

**1) Abbreviations such as (NEWS) or (ICU) are not usually used in the title of the article.**

Title corrected

**2) The type of study should be mentioned in the title or abstract of the article**.

The type of study was written in the abstract of the article

**3) The main purpose of the study is not discussed in the results section of the article summary.**

The main purpose of the study was discussed in the results

**4. In line 18, severity of what??**

Was corrected

**5. Line 57: It is better to use the term "Predicting value of" instead of the word "the effect of".**

Was corrected

**6. How to calculate the sample size is not explained.**

With regard to number of patients in similar articles and cases admitted to ICU in six months and approve of statistical consultants

**7) There is no mention of interfering and confounding factors and how to control their effect**.

Interfering factors controlled with include and exclude criterias. Include criterias were all patients with cerebral ischemia whom need ICU care Exclude criterias were any patients die in first 24h after admission and any patients who admitted to ICU for other diseases.IF patient had any pulmonary or cardiac disease excluded from research.

**Results:**

The results section was reviewed in general and writing errors were corrected

**Discussion:**

References in the discussion section were modified and the number of references was increased

We believe that the paper is now acceptable for the review process.

The manuscript has been resubmitted to your journal. We look forward to your positive response.

Sincerely,

## 4 Revision 3

3 comments · 11 Mar 2022 – 11 Mar 2022

### Referee 4 Reviewer

ACCEPT 11 Mar 2022

Dear AE,
This revised manuscript was reviewed, and the majority of the necessary corrections were made
Sincerely

### Associate Editor

ACCEPT 11 Mar 2022

Dear EIC,
Fortunately, the author could correct the majority of the requested items, and based on reviewers' comments, this revised format is acceptable for publishing.
Regards

### Editor-in-Chief

ACCEPT 11 Mar 2022

Dear Author,
The document is reviewed carefully by the reviewers. According to their comments and your revisions as requested, this manuscript is accepted.
Thanks.