

Original Article

Validating The National Early Warning Score (NEWS) in Emergency Department of a tertiary care hospital in Pakistan

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ABSTRACT

BACKGROUND

National Early Warning Score has been studied well in indoor settings of developed countries but hasn't been tested before in the Emergency Department of developing countries with fewer resources.

OBJECTIVE

Our objective was to determine whether the emergency department (ED) NEWS can be associated with Triage, admission, disposition, length of emergency/hospital stay, reappearance and mortality.

METHODOLOGY

A random sample of 1000 patients' first encounter in the ED was extracted in the study period (between November 2018 and April 2019). Statistical analysis was done to analyze whether ED NEWS severity category can be associated with Triage, admission, disposition, length of emergency stay, length of hospital stay, reappearance in two weeks and mortality.

RESULTS

ED NEWS Score is associated with triage as shown by mean 2.68 (SD ± 0.6, p=0.01). Also, a

high NEWS score also had impact on admission including 75 (66.4%) patients in severe and 55(74.3%) in moderate NEWS severity category respectively. NEWS score is also associated with Critical care admission and length of Emergency stay likely hood ratio of 26.0(p=0.038). Reappearance in emergency within next two weeks of discharge had no relation to NEWS severity. On the other hand both ED mortality and Hospital mortality were related to High NEWS. It correlates weakly with Length of Stay in emergency or with Length of Stay in Hospital.

CONCLUSION

NEWS Score can be used in the emergency department to identify and predict adverse outcome of patients presenting to ED. NEWS can be used as a triage tool when deciding whether and where patients should be admitted.

KEYWORDS

National Early Warning Score, Triage, Inpatient Mortality, Length of stay, Admission, Disposition

INTRODUCTION

Physiological parameters, such as pulse, blood pressure, temperature, saturation, respiratory rate, and sensorium provide vital information about acutely ill patients presenting to emergency. ⁽¹⁾ Serious adverse events (SAEs) and mortality may be prevented if these changes in the patient's vital parameters are recognized early and responded promptly. ⁽²⁾ Initially the Early Warning Scores were derived from expert opinion or mere observations and allocated scores to them without any validation. Therefore, several modifications of EWS have been proposed with better predictive accuracy. The Modified Early Warning Score (MEWS) is one of the most famous

modification which was first reported and validated. ⁽³⁾

In 2012, Members of the Royal College of Physicians National Early Warning Score Design and Implementation Group (NEWS-DIG) made adjustments to this system, based on clinical opinion, to develop the NEWS. ⁽⁴⁾ Although the validity of The NEWS score has been widely tested across the world, but mostly in developed countries, ⁽⁵⁾ thus its implementation in our settings require proper validation.

The availability of limited resources and critical care beds remains a problem in

healthcare provision in low-income and middle-income countries. ⁽⁶⁾ Emergency departments are usually overcrowded, poorly equipped and understaffed, hindering the accurate monitoring of physiological parameters required for NEWS implementation. Although data is limited, studies evaluating NEWS in these settings show wide variation in performance. ⁽⁷⁾ Few studies have explored the association between emergency department (ED) NEWS with hospital admission and inpatient mortality; as higher NEWS is associated with higher probability of being admitted to the critical area and higher inpatient mortality. ⁽⁸⁾ These findings suggested that NEWS could be used as a tool to identify patients requiring admission to the hospital and at an increased risk of death.

NEWS score is part of our nursing triage document since 2014 and is being recorded in each patient by default, but patients are mainly prioritized according to Emergency Severity Index (ESI) which depends upon understanding of nurses and sometimes results in undertriage of over triage. ⁽⁹⁾

Thus, we have evaluated NEWS performance in our population, with respect to its association with triage, admission, disposition, length of Stay, reappearance, and mortality prior to advocating its implementation in our settings.

METHODS

The study protocol was reviewed and approved by Shifa International Hospital Institutional Review Board. Patients are seen in the ED between November 2018 and April 2019 (either discharged from the ED or admitted towards or Critical Care units) were 10138 in total. A random sample of 1000 patients was extracted using Simple random sampling technique including every 10th encounter in emergency department.

On a daily basis, Variables of interest were collected on a data collection Performa. These Variables included demographics (age, gender), date and time of clinical events (ED admission time, length of stay in ED), ED NEWS and Priority level as per ESI triage system, reappearance in ED in two weeks and ED Mortality. In addition, outcomes of interest including admission to a critical area, length of hospital stay and in-hospital mortality were extracted.

The analysis was performed using SPSS version 23.

The number and percentages of patients demographics (age and Gender) were reported. Also, patients who were either discharged or admitted to the hospital from emergency department were also documented.

Distribution of Comorbid conditions in different ED NEWS categories of patients sample included in the study

is also reported in frequency and percentages.

The NEWS was recorded as continuous data and then the distribution of patients in different well-established severity categories of NEWS (zero, mild, moderate and severe) was sorted respectively.

Priority Level according to ESI, which is our current triage tool were also recorded ranging from p1 to p5, and its comparison was done with NEWS score.

Disposition of patients from ED to the critical area (like ICU, CCU, stroke unit, HDU) or ward was compared in different NEWS categories using Pearson's chi-square.

Then the determination of the association of the NEWS with inpatient mortality in ED was done using Pearson's chi-square test analysis. To determine the association of the NEWS with inpatient mortality, the aforementioned analysis was repeated.

The association between length of hospital stay in days and NEWS severity category was determined using Pearson's chi-square test and Spearman's correlation coefficients.

Reappearance in the Emergency department in two weeks was also sorted in association with NEWS severity category.

Logistic regression was performed to determine whether ED NEWS is associated with admission disposition after adjusting for variables.

RESULTS

Patients are seen in the ED between November 2018 and April 2019 (either discharged from the ED or admitted towards or Critical Care) were 10138 in total. A random sample of 1000 patients was extracted using Simple random sampling technique. Out of these, 504(50.4%) patients were discharged from ED and 496 (49.6%) patients were admitted.

According to gender distribution, there were 510(51.0%) males and 490(49.0) females. Patients were also categorized according to their age groups including young (18-40), Middle-aged (41-60), Old (61-80) and very old (80 and above) respectively. Most of the patients belong to middle-aged (326, 32.6%) and old age groups (329, 32.9%). (Table 1)

Priority Level recorded according to ESI, which is our current triage tool. Priority was recorded ranging from p1 to p5, where P1 represents the sickest and P5 indicates the most stable patient. Most of the patients fall in the category of P3 597(57.9%) followed by P2 358(35.8%) and P4 49(4.9%). Both extremes, P1 9(0.9%) which indicates

collapsed patients and P5 5(0.5%) being the most stable patients, represent a very small proportion of the total sample. Patients who were brought in dead and their NEWS scoring was not possible were not included in the study.

The distribution of Comorbid conditions in different ED NEWS categories of patients sample included in the study is also reported. There have been a small number of patients who had no comorbid conditions 123(12.3%), yet diabetes 262(26.2%) and hypertension 319 (31.9 %) have been among the most common comorbidities. Renal disease 115 (11.5%) and Heart disease 100 (10.0%) have

| Variables | Values | Number | % |
|----------------|--------------------|--------|-----|
| Age | 18-40 years | 250 | 25 |
| | 41-60 years | 326 | 33 |
| | 61-80years | 329 | 33 |
| | 80 and above years | 95 | 9.5 |
| Gender | Male | 490 | 49 |
| | Female | 510 | 51 |
| Disposition | Admitted | 496 | 50 |
| | Discharged | 504 | 50 |
| Priority (ESI) | P1 | 9 | 0.9 |
| | P2 | 358 | 36 |
| | P3 | 579 | 58 |
| | P4 | 49 | 4.9 |
| | P5 | 5 | 0.5 |

Table 1: Demographic characteristics (n = 1000)

been the other important comorbid conditions. All those conditions which were rare presentations are reported under the heading of “others” 333(33.3%). (Table 2)

The maximum news score was “17” and minimum was (0), with a mean NEWS score of 2.4 (SD= ± 2.91). The distribution of patients among different well-established NEWS severity categories was also recorded. The NEWS severity categories included, zero 347(34.7%), mild 466(46.6), moderate 113(11.3%) and severe74 (7.4%) respectively. (Table 3)

Patient triage priority level categories as per Emergency Severity Index (ESI- triage tool) mean 2.68 (SD ± 0.6) were compared with different NEWS severity categories mean 0.96(SD ±0.86), using Pearson Correlation, which is significant (p=0.01 two-tailed). Most of the P1 and P2 patients fall in either the category of moderate (5-7) or severe (>7) NEWS score. (Table 4)

ED NEWS was also evaluated regarding its impact on admission to critical area versus ward, using Pearson’s

| | | Frequency | Percent |
|-------|---------------------|-----------|---------|
| Valid | None | 123 | 12.3 |
| | Diabetes | 262 | 26.2 |
| | Hypertension | 319 | 31.9 |
| | Stroke | 21 | 2.1 |
| | Cancer | 43 | 4.3 |
| | Renal disease | 115 | 11.5 |
| | Heart disease | 100 | 10 |
| | Respiratory disease | 46 | 4.6 |
| | Liver & GI disease | 29 | 2.9 |
| | others | 333 | 33.3 |
| Total | 1000 | 100 | |

Table 2: Comorbid conditions

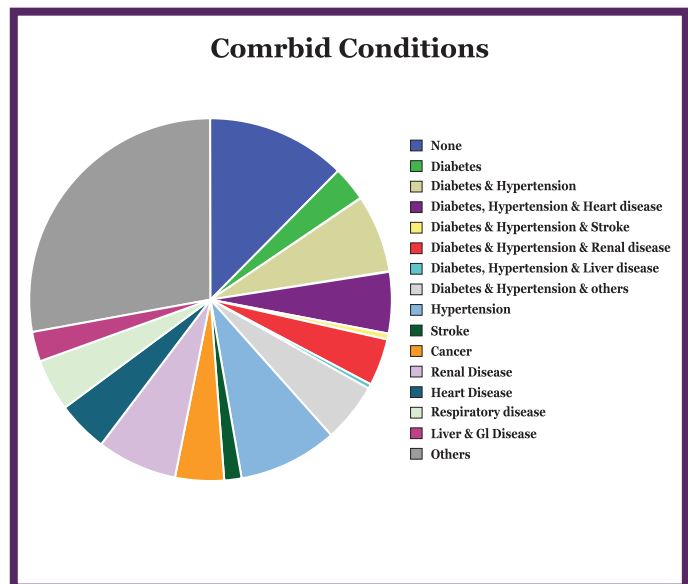


Figure 1: Comorbid Conditions

| | | Frequency | Percent |
|-------|-----------------------|-----------|---------|
| Valid | Zero | 347 | 34.7 |
| | Mild (1-4) | 466 | 46.6 |
| | Moderate (5-7) | 113 | 11.3 |
| | Severe (more than 7) | 74 | 7.4 |
| | Total | 1000 | 100 |

Table 3: NEWS severity category

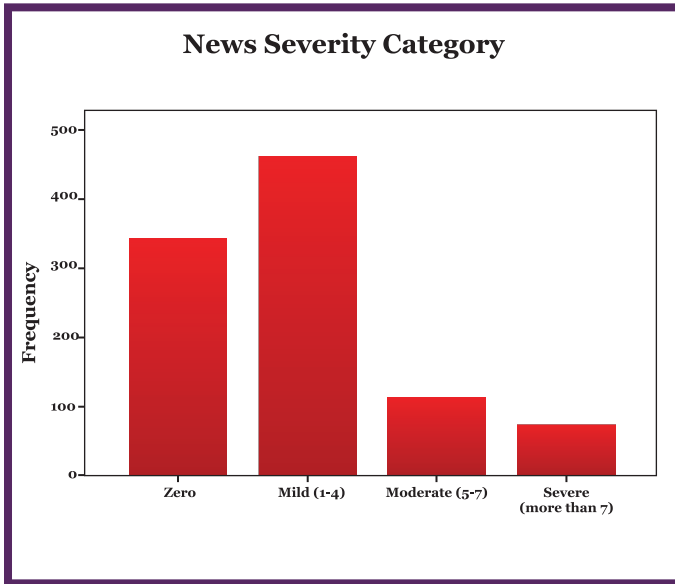


Figure 2: NEWS severity Category

chi-square test which showed a likelihood ratio of 59.6($p=0.01$). More patients admitted in groups with moderate 75(66.4%) and high 55 (74.3%) NEWS score.

Patients who expired in ED mostly belong to higher NEWS severity categories, Moderate (n-3, 2.70%) and Severe (n-3, 4.10%) respectively. Similarly, with regards to in-hospital mortality, high NEWS score is also associated with high mortality (mild n-7, 1.9%, moderate n-9, 8.0% and severe n-9, 12.2%). (Table 5)

There was no association of patients who reappeared in the emergency department two weeks after discharge with NEWS score severity. An almost similar number of patients reappeared in NEWS score Zero (5.8%) and Severe (4.1%). (Table 6)

DISCUSSION

The NEWS and NEWS2 are early warning score systems which are based on bedside physiological parameters to identify patients at risk of adverse event and prompt a quick response accordingly. Currently an overhead announcement to activate a Rapid Response Team (RRT) is made in our hospital indoors whenever attending nurse finds already defined alarming physiological parameters as per NEWS criteria. In emergency department however Emergency Severity Index is used to triage patients on

| NEWS severity Category | | | | | Total |
|---------------------------------|---------|------------|----------------|-------------|---------|
| | Zero | Mild (1-4) | Moderate (5-7) | Severe (>7) | |
| Count | 0 | 1 | 3 | 5 | 9 |
| % within NEWS severity Category | 0.00% | 0.20% | 2.70% | 6.80% | 0.90% |
| Count | 88 | 149 | 61 | 60 | 358 |
| % within NEWS severity Category | 25.40% | 32.00% | 54.00% | 81.10% | 35.80% |
| Count | 227 | 294 | 49 | 9 | 579 |
| % within NEWS severity Category | 65.40% | 63.10% | 43.40% | 12.20% | 57.90% |
| Count | 29 | 20 | 0 | 0 | 49 |
| % within NEWS severity Category | 8.40% | 4.30% | 0.00% | 0.00% | 4.90% |
| Count | 3 | 2 | 0 | 0 | 5 |
| % within NEWS severity Category | 0.90% | 0.40% | 0.00% | 0.00% | 0.50% |
| Count | 347 | 466 | 113 | 74 | 1000 |
| % within NEWS severity Category | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |

Table 4: TRIAGE comparison with NEWS severity Category

| NEWS Severity Category | Disposition | | Admission to Critical VS Ward (n, %) | | Mortality in ED (n, %) | | Mortality in Hospital (n, %) | |
|-----------------------------|-------------|------------|--------------------------------------|---------|------------------------|----------|------------------------------|----------|
| | Admitted | Discharged | ICU | Ward | Expired | Admitted | Expired | Improved |
| Zero | 136 | 211 | 24 | 112 | 0 | 347 | 2 | 134 |
| | -39.20% | -60.80% | -18.80% | -30.20% | 0.00% | -347% | -0.60% | -38.60% |
| Mild (1-4) | 230 | 136 | 56 | 178 | 0 | 466 | 7 | 227 |
| | -49.40% | -50.60% | (43.8%) | -48.00% | 0.00% | -100.00% | -1.50% | -48.70% |
| Moderate (5-7) | 75 | 38 | 26 | 48 | 3 | 110 | 9 | 65 |
| | -66.40% | -33.60% | (20.3%) | (12.9%) | -2.70% | -97.30% | -8.00% | -57.50% |
| Severe (more than 7) | 55 | 19 | 22 | 33 | 3 | 71 | 9 | 46 |
| | -74.30% | -25.70% | -17.60% | -8.90% | -4.10% | -95.60% | -12.20% | -62.20% |

Table 5: NEWS Severity Category association with Critical area admission, Mortality in ED and Mortality in Hospital

| | | | NEWS severity Category | | | | Total |
|-----------------------------|-----------|---------------------------------|------------------------|------------|----------------|----------------------|--------|
| | | | Zero | Mild (1-4) | Moderate (5-7) | Severe (more than 7) | |
| Revisit in two weeks | No | Count | 327 | 434 | 102 | 71 | 934 |
| | | % within NEWS severity Category | 94.20% | 93.10% | 90.30% | 95.90% | 93.40% |
| | Revisited | Count | 20 | 32 | 11 | 3 | 66 |
| | | % within NEWS severity Category | 5.80% | 6.90% | 9.70% | 4.10% | 6.60% |

Table 6: Reappearance in two weeks in different NEWS severity Category

arrival. We had Incorporated NEWS in our Nursing triage form initially in 2014 to start documenting and to make our nursing staff familiarize with the NEWS score. Before starting one hour and two-hour NEWS scoring we want to assess NEWS score performance in Emergency department. The purpose of our study was to identify any relationship of NEWS recorded in emergency with mainly admission, triage, reappearance and disposition in primary analysis and then to establish any association of NEWS with Length of stay and Mortality in secondary analysis. We were also interested to evaluate that weather NEWS can be used as a triage tool in the ED In our settings? ⁽¹⁰⁾

Our study establishes a direct association of the high NEWS score with admission to the hospital. More patients were discharged in NEWS category Zero, while on the other hand most patients were admitted in NEWS severe category.

A recent study also found that the increase in the NEWS score is associated with 33% more chances of hospital admission. ⁽¹¹⁾

We also compared our current triage tool, with the NEWS severity category which goes along with ESI in separating sick from the stable patients. Most patients fall in the category of P3 597(57.9%) followed by P2 358(35.8%) and

P4 49(4.9%). Both extremes, like P1 9(0.9%) which indicates collapsed patients and P5 5(0.5%) being the most stable patients, represent very small proportion of the total sample.

The maximum news score was “17” and minimum was “0”, with a mean NEWS score of 2.4 (SD= ± 2.91). The distribution of patients among different well-established NEWS severity categories was also recorded. A large study has already proved that The NEWS together with the structured hospital triage system, effectively serves to predict early mortality and detect high-risk patients.⁽¹²⁾

ED NEWS was also evaluated regarding its impact on admission to critical area versus ward, using Pearson’s chi-square test which showed a likelihood ratio of 59.6(p=0.01). Patients who expired in ED mostly belong to NEWS severity category of Moderate (n-3, 2.70%) and Severe (n-3, 4.10%) respectively.

In another validation study, a maximum NEWS of 5 was associated with an increased risk of death (OR 5.4), ICU admission (OR 10.9), and HDU admission (OR 3.3).⁽¹¹⁾

Despite our limitations, we believe our study serves its basic purpose, which was to understand NEWS association with outcomes like disposition, mortality, and length of stay in our study population. This enabled us to familiarize our residents and staff with the recording and later analyzing early warning scores. As it is a single-center trial thus its results are not generalizable.

CONCLUSIONS

Our results support previously published data on the ED NEWS score association with clinically relevant events. There is convincing evidence that ED NEWS is associated with higher odds of admission, admission to ICU, increased length of stay and mortality.

Further studies are needed to explore NEWS performance in our settings using hourly NEWS scoring and defining NEWS alerts in the Emergency department.

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