# Low compliance with a validated system for emergency department triage

Dorthea Christensen[1], Nanna Martin Jensen[2], Rikke Maaløe[1], Søren Steemann Rudolph[1], Bo Belhage[1] & Hans Perrild[2]

**ABSTRACT**

**INTRODUCTION:** Bispebjerg Hospital has introduced a triage system at the Emergency Department (ED) based on "primary criteria" and a physiological scoring system named the Bispebjerg Early Warning Score (BEWS). A BEWS is calculated on the basis of five vital signs which are accessible bedside. Patients who have a "primary criterion" or a BEWS ≥ 5 are presumed to be critically ill or severely injured and should be received by a multidisciplinary team, termed the Emergency Call (EC) and Trauma Call (TC), respectively. The aim of this study was to examine compliance with this triage system at Bispebjerg Hospital.

**MATERIAL AND METHODS:** Retrospective evaluation of the triage of a random sample of 300 ED patients. ED medical charts were searched for "primary criteria", documentation of vital signs and a BEWS score. If a BEWS score had not been calculated, this was done retrospectively by the author. An evaluation was made to determine whether ECs or TCs had been correctly activated.

**RESULTS:** In 47 patients, all five vital signs for calculation of a BEWS had been documented. A BEWS had been calculated in 22 patients. Nine patients had a TC activation criterion, and in all these cases a TC was activated. A total of 48 patients had an EC activation criterion, but an EC had only been activated in 24 patients. Among the 24 patients for whom an EC had not been activated, eight had a "primary criterion" and 16 patients had a retrospective BEWS ≥ 5.

**CONCLUSION:** The triage system is not being used systematically and documentation of vital signs is insufficient at Bispebjerg Hospital. As a consequence, many patients who are presumed to be critically ill are not allocated to an EC. Initiatives have been taken to raise compliance with the system.

Patients arrive at the Emergency Department (ED) with varying severity of illness. To optimize patient care and resources at the ED, triage systems have been developed. Triage can be based on clinical assessment or validated methods, e.g. the Manchester Triage System and the Emergency Severity Index [1-4]. A recent Danish study showed that no Danish ED currently uses a validated triage system and, furthermore, that triage is primarily based on clinical assessment [5].

Bispebjerg University Hospital has been using triage systems for medical emergencies since 2006 and for trauma patients since 2000. The currently used triage system was introduced in October 2007. It comprises a physiological scoring system, named the Bispebjerg Early Warning Score (BEWS) and a number of "primary criteria". If patients are identified as critically ill or severely injured, a multidisciplinary team is activated. These teams are termed Emergency Call and Trauma Call, respectively. In another study, we have shown that the BEWS is valid for ED triage and can reliably identify critically ill patients [6].

The aim of this study was to examine whether the BEWS triage system is used systematically and correctly in a mixed ED population.

## MATERIAL AND METHODS

Setting: Bispebjerg University Hospital is a 600-bed urban teaching hospital located in the Northwestern District of Copenhagen. The hospital serves a population of 400,000 citizens with approximately 38,000 ED visits per year. In the hospital catchment area, a mobile emergency care unit (MECU) manned by anaesthesiologists performs pre-hospital triage for patients requiring special emergency treatment. Patients arrive at our ED by self-transportation, by ambulance or by the MECU.

The Emergency Call (EC) and Trauma Call (TC) are activated approximately 340 and 80 times per year, respectively.

Upon arrival, ED patients are met by a triage nurse. The triage nurses have received additional training and have at least two years of ED experience. The triage nurse allocates the patients to one of three waiting cat-


The Emergency Department Reception at Bispebjerg Hospital. When patients arrive, they are met by a triage nurse who allocates them into different waiting categories.

ORIGINAL ARTICLE

1) Department of Anaesthesiology, Bispebjerg Hospital, and
2) Department of Endocrinology and Gatroenterology, Bispebjerg Hospital

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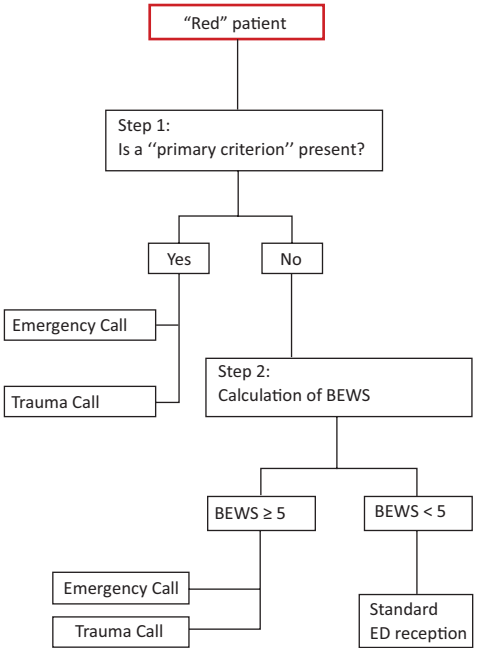
## FIGURE 1

Flowchart used by the triage nurses to identify critically ill and severely injured patients who should be received by an Emergency or Trauma Call. ''Red'' patients are patients who according to common regional guidelines need immediate treatment. ''Primary criteria'' are signs, symptoms or mechanisms presumed to be immediately life-threatening.




**"Primary criteria"**

| Emergency Call | Trauma Call |
|---|---|
| ☐ Cardiac or respiratory arrest | ☐ Mechanism of trauma – specified in separate guideline |
| ☐ Airway obstruction | ☐ Anatomical criteria – specified in separate guideline |
| ☐ Intubated patient | |
| ☐ Unconsciousness – GCS < 9 | |
| ☐ Ongoing, uncontrolled bleeding | |
| ☐ Ongoing convulsions | |
| ☐ Life-threatening intoxication/poisoning | |
| ☐ Meningitis obs. | |

Chart for calculation of the BEWS.

| | Points | | | | | | |
|---|---|---|---|---|---|---|---|
| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| Respiratory rate | | ≤ 8 | | 9-14 | 15-20 | 21-30 | > 30 |
| Pulse | | ≤ 40 | 41-50 | 51-100 | 101-110 | 111-130 | > 130 |
| Systolic BP | ≤ 70 | 71-80 | 81-100 | 101-199 | | > 199 | |
| Temperature | | ≤ 35 | 35.1-36 | 36.1-38 | 38.1-39 | > 39 | |
| Level of consciousness | | | | Awake | Respond to voice | Respond to pain | Unresponsive |

BEWS = Bispebjerg Early Warning Score; BP = blood pressure; ED = Emergency Department; GCS = Glascow Coma Score.

## FIGURE 2

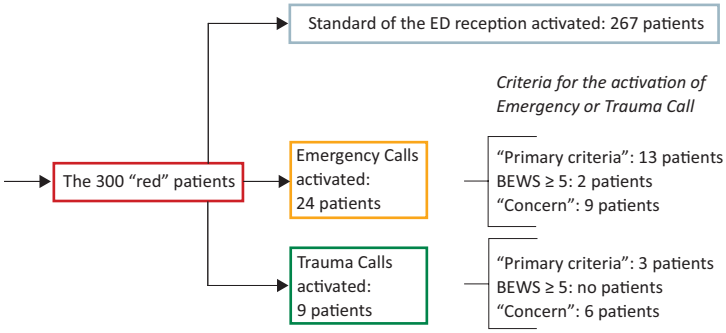
Results of the triage performed by the triage nurses on the 300 ''red'' patients.

**Criteria and vital signs documented by the ED triage nurses**

| | Random sample of "red" patients, n (N = 300) |
|---|---|
| "Primary criteria" identified | 16 |
| BEWS calculated and documented | 22 |
| BEWS ≥ 5 | 5 |
| BEWS < 5 | 17 |
| All five vital signs for calculation of BEWS documented in ED charts | 47 |
| Respiratory rated documented | 55 |
| Pulse documented | 270 |
| Systolic blood pressure documented | 274 |
| Temperature documented | 195 |
| Level of consciousness documented | 284 |
| Concern for patient | 15 |

BEWS = Bispebjerg Early Warning Score; ED = Emergency Department.

**Results of the ED nurses' triage**




egories (red, blue or white) based on the perceived severity of their injuries or illnesses. This is done in accordance with regional guidelines [7] and it is based on the patient's symptoms/diagnoses and the nurse's clinical judgement. The most severely ill and injured patients are allocated to the "red" category. These patients presumably need immediate treatment. According to the regional guidelines, treatment must be initiated within one hour.

Patients in the "red" category ("red" patients) immediately undergo further evaluation to assess whether an EC or TC is warranted. This is a two-step process

(**Figure 1**). The first step is to determine whether an EC or TC should be activated based on a "primary criterion". ''Primary criteria'' are signs, symptoms and mechanisms presumed to be immediately life-threatening, e.g. upper airway obstruction or high-energy trauma.

If no "primary criteria" are present, the evaluation continues to step two, where the BEWS is calculated. This calculation is based on five vital signs each assigned a score of 0-3 points. The total score gives the BEWS. A BEWS ≥ 5 will activate an EC or TC. For patients with a BEWS < 5, the EC or TC *can* be activated if the nurse or physician has concerns for the patient's clinical condition. In "red" patients where no EC or TC is activated, standard ED care is given.

Most cases of EC and TC are activated after the patients have arrived at the ED as described above. In a few cases, an EC or TC is activated prior to the arrival of the patient, e.g. when a call is requested by the MECU or when the triage nurse is concerned for the patient due to information telephoned in by the ambulance.

We performed a retrospective analytical cross-sectional study. A sample of 300 randomly selected "red" patients treated over a six-month period in 2009 were included. This sample size corresponded to one ninths of the total population of »red« patients seen in the ED during this six-month period.

Demographic data, presenting problem, vital signs on arrival or within the first 15 minutes of arrival, a BEWS and the presence of "primary criteria" were obtained from nursing admission charts.

Based on information documented in the ED medical charts and ambulance records, a retrospective evaluation was made to determine whether the ED triage had been performed according to the defined criteria for "red" patients. Patients with insufficient data were excluded. The charts and records were searched for the presence of »primary criteria« and a BEWS was calculated. Patients were then subdivided into two groups: BEWS ≥ 5 and BEWS < 5.

If an EC or TC was activated in the absence of a "primary criterion" or a BEWS ≥ 5, "concern for the patient" was listed as a criterion according to our triage system.

We considered an "activated EC/TC" a call that was activated by the ED triage nurses and a "potential EC/TC" as a call *not* activated although a criterion was present.

### Statistical method

Data are primarily presented descriptively. Age is reported as median and range.

## RESULTS

Triage is performed by the ED triage nurses as described in Figure 1. In 89% (267/300) of the cases, the patients had been allocated to a standard ED reception. An EC had been activated in 24 patients, and a TC in nine patients. Demographic data on the study population are presented in **Table 1**.

**TABLE 1**

Demographic data of the study population (n = 300).

| | |
|---|---|
| Men, n | 149 |
| Median age, years (range) | 53 (0-98) |
| *Transportation to hospital, n* | |
| Self-transportation | 122 |
| Ambulance | 158 |
| MECU | 15 |
| Unknown | 5 |
| *Presenting problem, n* | |
| Chest pain | 67 |
| Respiratory problems | 51 |
| Neurological deficit incl. LOC | 49 |
| Intoxication/poisioning | 35 |
| Gastrointestional problems | 27 |
| Other cardiological problems | 23 |
| Trauma | 14 |
| Allergic reaction | 8 |
| Psychiatric problem | 3 |
| Other problems | 23 |

LOC = loss of consciousness; MECU = mobile emergency care unit.

Men and women were equally represented in our study population. Their median age was 53 years. The most common presenting problems were chest pain (22%), respiratory problems (17%) and neurological problems (16%). A total of 58% of the patients had been transported to the ED by ambulance or by the MECU. In these patients, monitoring and some level of treatment had been initiated before their arrival at the ED.

The criteria for activation of EC and TC are shown in **Figure 2**.

In 16 patients, the ED triage nurses identified a "primary criterion" and activated an EC or TC. These 16 cases counted eight cases of unconsciousness, three cases of ongoing convulsions, one case of airway obstruction, one case of respiratory arrest, one case of potentially life-threatening intoxication, one motorcyclist injured at > 50 km/hour and one case of fall trauma > 4 m.

Pulse, blood pressure and level of consciousness were documented in 90-95% of the "red" patients, while temperature and respiratory rate were documented in only 65% and 18% of cases, respectively. All five vital signs needed to calculate the BEWS had only been documented in 16% (47/300) of the cases.

A BEWS had both been calculated and documented in the nursing charts in 7% (22/300) of the cases. Among these, 17 patients had a BEWS < 5 and five patients had

a BEWS ≥ 5. An EC or TC, however, had only been activated in two of the five patients with a BEWS ≥ 5.

The results of the retrospective triage are presented in **Figure 3**.

Step 1: A *"primary criterion"* was present in 24 cases. In three of these patients, a TC was correctly activated. An EC was activated in 13 cases. In the remaining eight cases of potential EC, four patients were unconscious, three patients had ongoing convulsions and one patient had a potentially life-threatening intoxication.

Step 2: A *BEWS* was calculated retrospectively in 54% (148/276) of the cases in which a "primary criterion" was not present. Twenty-two patients had a BEWS ≥ 5 and 126 patients had a BEWS < 5. An EC was activated in six of the 22 patients with a BEWS ≥ 5 leaving 16 potential ECs. A BEWS had been calculated by the triage nurses in only two of the six activated ECs.

The 16 potential ECs were 12 patients with respiratory problems/insufficiency, three patients with infection/sepsis and one patient with a possible cerebral apoplexy.

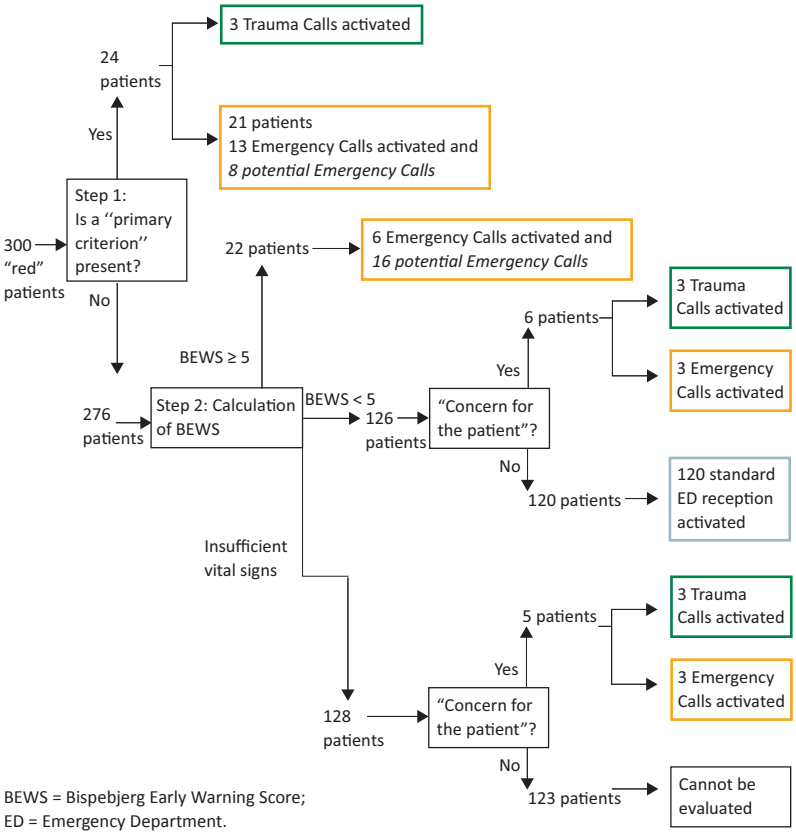
In 126 patients, the BEWS was below five. In six of these patients, an EC or TC had been activated without a documented reason, presumably because of "concern for the patient". The remaining 120 patients had been allocated to a standard ED reception.

In 42% (128/300) of the patients, it was impossible to calculate a retrospective BEWS because of insufficient documentation of vital signs. In five of these patients, an EC or TC had been activated presumably because of ''concern for the patient". For the remaining 123 patients, a retrospective evaluation on whether the triage had been performed correctly according to the triage system could not be made.

In summary, the retrospective triage showed 24 potential ECs – eight patients with a ''primary criterion" and 16 patients with a BEWS ≥ 5. All TCs had been correctly activated according to the triage system.

**FIGURE 3**

Results of the retrospective triage performed by the authors on the 300 ''red'' patients. Activated Emergency/Trauma Calls refers to calls that were activated by the ED triage nurses. Potential Emergency Calls refers to calls that were not activated although a criterion was present, BEWS.




BEWS = Bispebjerg Early Warning Score; ED = Emergency Department.

## DISCUSSION

The principle finding of this study was that compliance with the triage system was low. The triage system had not been used systematically and the documentation of vital signs was insufficient.

In this study, we found that many critically ill patients, especially patients with respiratory problems and a decreased level of consciousness, were not properly allocated to an EC even though they fulfilled a triage system criterion. The reasons for this could be that the triage nurses misinterpreted and/or disregarded the severity of their symptoms and sent for the on-call doctors from the specialist department (e.g. the neurological department) instead. Impaired consciousness is, however, often a non-specific symptom that warrants activation of an EC to ensure thorough clinical assessment. In another study [8], we showed that a multidisciplinary team ensures early identification of critically ill patients, rapid initiation of relevant diagnostic procedures and treatment and rapid admission to the relevant departments.

The overall documentation of vital signs was poor, the BEWS was rarely calculated even when all or some vital signs were documented and almost half of the ECs and TCs were activated based on "concern for the patient". In our opinion, this shows that ED triage is primarily based on intuition and clinical judgment by the triage nurses.

Several studies have confirmed poor documentation of vital signs to be a wide-spread problem [9, 10]. In line with such studies, we found that the respiratory rate is particularly poorly documented even though it has been shown to be a sensitive marker for critical illness and high mortality [11-14]. We are pleased to see that some vital signs like blood pressure, pulse rate and level of consciousness have been documented in the majority of our patients. The predictive value of a single

vital sign in identifying critically ill patients is, however, low [15]. The BEWS uses five vital signs in a weighed fashion. We have shown that this system has a high predictive value and that it is a sensitive tool for the detection of critically ill patients [6].

There are several reasons for the lack of compliance with the triage systems: Lack of sufficient training with the system, workload, an over-reliance on one's own experience and clinical judgment among the triage nurses and a lack of acceptance of the system.

The triage nurses might see the triage system as too complicated and time-consuming compared with triage that is based on clinical judgment and intuition. However, in order to ensure a uniform, high-quality ED triage, we believe that triage should be performed according to a validated system based on objective criteria. The results published in this article support the need to use objective criteria to avoid under-triage. On the other hand, we acknowledge the importance of intuition and clinical judgment by experienced ED nurses. In our opinion, triage nurses should therefore continue to have the opportunity to activate an EC or TC based on "concern for the patient" in cases in which a "primary criterion" or a BEWS ≥ 5 is not present.

Implementation of a new system for ED triage requires substantial changes in attitudes and routines and is therefore an ongoing process that takes time, resources and which requires constant attention by the ED management. As our results show, the triage system had not been fully implemented after two years. Implementation of the system has continued to play an important role in the ongoing process of securing quality ED triage. In parallel with this study, we have therefore introduced education in the concept of EC and TC for new staff and simulation-based training and further education of the ED nurses that focus on explaining how and why to use the triage system.

As a result of these initiatives, an audit performed in May 2010 showed a rise in the proportion of "red" patients for whom all five vital signs were documented upon arrival at the ED.

In conclusion, the implementation of a validated early warning score based triage system has proved to be a long process. Despite two years of education and training, we have shown that compliance with the triage system is low. The triage system is not being used systematically and overall documentation of vital signs remains poor. As a result, EC and TC are not activated in all patients who fulfill a valid criterion.

**CORRESPONDENCE:** *Dorthea Christensen,* Akacievej 18, st. th., 2830 Virum. Denmark. E-mail: dortheafc@gmail.com

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**CONFLICTS OF INTEREST:** none

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