

# Quality of care using a multidisciplinary team in the emergency room

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## ABSTRACT

**INTRODUCTION:** Bispebjerg Hospital has implemented a multidisciplinary team reception of critically ill and severely injured patients at the Emergency Department (ED), termed emergency call (EC) and trauma call (TC). The aim of this study was to describe the course, medical treatment and outcome for patients received by this multidisciplinary team and to evaluate the quality of acute medical treatment of these patients.

**MATERIAL AND METHODS:** A retrospective evaluation was made of all ECs and TCs registered during a six-month period. Information on sex, age, interventions at the ED, time spent at the ED and outcome measures (admission, Intensive Care Unit (ICU) admission and death) were obtained. The quality of the acute medical treatment during the ED stay and the first 48 hours of admission were evaluated by senior consultants from the departments receiving the patients.

**RESULTS:** A total of 150 ECs and 47 TCs were included. The median time spent at the ED was 65 minutes for ECs and 95 minutes for TCs. In EC patients a median of eight interventions were performed at the ED, while a median of five interventions were performed in TC patients. A total of 137 EC patients were admitted to hospital including 32 patients admitted to the ICU. In all, 49 EC patients died during admission. Forty percent of TC patients were discharged to their homes. Only one trauma patient died and none were admitted to the ICU. The acute medical treatment was found to be satisfactory in 87% of EC patients and 96% of TC patients.

**CONCLUSION:** A multidisciplinary team reception ensures early initiation of diagnostic procedures and treatment, short ED stays and admission to relevant departments in critically ill and severely injured patients.

Denmark is currently reorganizing emergency medical services in an effort to improve the quality of care. At present, emergency departments (ED) are often manned by younger and less experienced physicians [1] and only few departments have reception guidelines and triage systems for acute, critically ill medical patients [2].

In a recent rapport, the Danish National Health Service recommended centralisation of emergency services with fewer EDs manned by on-call specialist phys-

icians [3]. However, given the limited availability of resources and specialists, it is equally important to secure an appropriate use of the available resources.

To improve the quality of ED management of presumed critically ill and severely injured patients, Bispebjerg Hospital has implemented a multidisciplinary emergency team reception – termed emergency call (EC) and trauma call (TC) [4, 5].

This paper aims to describe the course, medical treatment and outcome for patients managed by the team, and to evaluate the quality of the acute medical care afforded to patients managed by the team.

## MATERIAL AND METHODS

Bispebjerg Hospital (BBH) is a 600-bed urban university hospital with a catchment area of 400,000 (surgical) and 270,000 (medical) citizens. The hospital has a number of internal medical wards including a pulmonary unit, a cardiac unit and a neurological unit. The hospital also performs orthopaedic and abdominal surgery and has a six-bed Intensive Care Unit (ICU). Each year, 38,000 patients are treated at the ED.

Since 2000 the BBH has had a multidisciplinary trauma team. In 2006 we introduced a multidisciplinary team at the ED for the management of presumed critically ill medical patients, termed medical emergency call. On 1 April 2009, we simplified our organization and introduced a new joint organization for the ED management of all presumed critically ill patients, medical as well as surgical, including trauma patients. The organization was renamed emergency call (EC) and trauma call (TC).

On arrival, ED patients are evaluated by trained triage nurses who allocate the patients into one of three categories (red, blue and white) based on the perceived severity of their injuries or illnesses according to common regional guidelines [6] and clinical judgment. The most severely ill and injured patients are marked as “red”. These patients need immediate or acute treatment. Our “red” patients undergo further evaluation to assess whether an EC or TC is warranted. This is a two-step process as illustrated in **Figure 1**. When the criteria for EC or TC are fulfilled, a multidisciplinary team (Figure 1) is sent for to make an initial assessment and to resus-

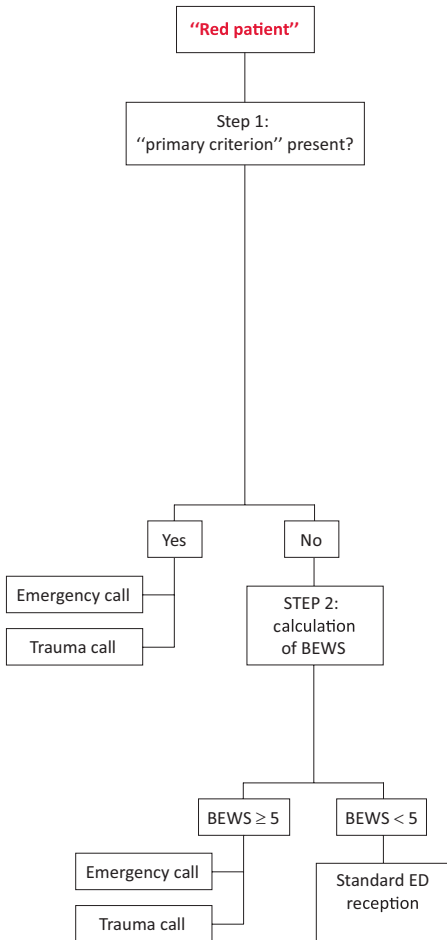
## ORIGINAL ARTICLE

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**FIGURE 1**

Flow chart used by the Emergency Department's triage nurses to identify presumed critically ill and severely injured patients, who should be received by a multidisciplinary team (emergency or trauma call). "Red" patients are patients, who according to common regional guidelines need immediate or acute treatment. "Primary criteria" are signs, symptoms or mechanisms presumed to be immediately life-threatening.



BEWS = Bispebjerg early warning score  
ED = Emergency Department  
GCS = Glasgow Coma Scale

#### "Primary criteria"

##### Emergency call

- Cardiac or respiratory arrest
- Airway obstruction
- Intubated patient
- Unconsciousness – GCS < 9
- Ongoing, uncontrolled bleeding
- Ongoing convulsions
- Life-threatening intoxication/poisoning
- Meningitis obs.
- Concern for the patient

##### Trauma call

- Mechanism of trauma – specified in separate guideline
- Anatomical criteria – specified in separate guideline
- Concern for the patient

#### BEWS calculation chart

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

#### Emergency call

Emergency call	Trauma call
ED nurse(s)	Two ED nurses
Anaesthesiologist	Anaesthesiologist
Anaesthesiologist trainee	Anaesthesiologist trainee
Nurse anaesthetist	Nurse anaesthetist
Medical doctor(s)	The on-call orthopedic surgeon
Secretary	Secretary
Hospital porter	Hospital porter
Two persons from radiology	Two persons from radiology

citate the patient. When necessary, the team can send for the on-call specialists in cardiology, neurology and abdominal surgery. Once the patient is stabilized, further treatment and patient responsibility are transferred to the attending physician from the ward at which the patient is admitted.

A retrospective evaluation of the ED management and the medical care provided during the first 48 hours of admission was conducted for all consecutive EC and TC patients from 1 April 2009 to 30 September 2009 to evaluate the implementation of our new organization. Patients were identified using the hospital's administrative system where EC and TC patients are registered with a special code. Data were obtained on sex, age, presenting problem, interventions performed at the ED, time spent at the ED and patient outcome measure-

ments (admission to hospital, ICU admission, length of stay and death during admission). No follow-up was made on patients transferred to other hospitals.

A senior consultant from the departments receiving the patients from the ED evaluated the quality of the acute medical care provided during the first 48 hours of admission including the ED stay. The evaluation was made based on two questions: 1) Did the patient – based on your professional assessment – have a satisfactory course of admission? 2) Can you point out any specifics which under the given circumstances could have been done in a better way? For patients transferred to other hospitals, this evaluation only included the time spent at the BBH.

The aim of this article is to present an evaluation of an organization which to our knowledge exists nowhere

else in Denmark. We have not previously performed such extensive evaluation of our organization. As we have not been able to find a comparable control group, data are presented descriptively. Age, time parameters and number of interventions are reported as medians and ranges.

## RESULTS

### The study population

A total of 155 EC and 48 TC patients were registered during the six-month study period. Five EC patients and one TC patient were excluded due to lack of data or erroneous coding. A total of 150 EC and 47 TC patients were thus included in the study. **Table 1** shows basic demographic study population data.

The median age for patients in whom an EC was activated was 66 years, and 54% were men. 68% of the patients managed by the trauma team were men with a median age of 26 years. Eighteen trauma patients (38%) were children under the age of fifteen.

The most frequent reasons for activation of an EC were a low level of consciousness (35%) and respiratory failure (32%). Head trauma was the most frequent reason for a TC. The mechanisms of injury were falls (64%), motor vehicle accidents (21%) and violent assaults (15%).

### Emergency department reception

Table 1 shows information on interventions and treatments performed during the ED stay. The median time spent at the ED was 65 min for EC patients and 95 min for TC patients.

Patients in whom an EC was activated underwent a median of eight "interventions" at the ED. Venous blood samples, arterial blood samples and a 12-lead electrocardiography (ECG) were obtained in more than 70% of the EC patients, and one third of the patients had a chest X-ray performed at the ED. Medical treatment was initiated in 101 patients (67%). In most cases, supplementary oxygen, nebulizer treatment, diuretics, antibiotics and analgesics were given to patients with chronic obstructive pulmonary disease (COPD), pneumonia and pulmonary oedema. Advanced airway management (e.g. endotracheal intubation) was necessary in 33 patients (22%). Cardiopulmonary resuscitation was provided in 5% of EC patients.

A median of five "interventions" were provided for patients managed by the trauma team. Conventional X-ray studies of the chest, cervical spine and pelvis were performed in 50% of the patients while at the ED, 43% had various computed tomography (CT) exams and in 17% of cases, a bedside ultrasound examination was performed. Medicine - primarily tetanus vaccinations and analgesics - was administered to 20 trauma patients.



TABLE 1

Demographic data and information about the emergency department's management of patients in whom an emergency call or a trauma call was activated.

	Emergency call (n = 150)	Trauma call (n = 47)
Men, n	82	32
Median age, years (range)	66 (0-103)	26 (1-82)
Age < 15 years, n	5	18
<i>Presenting problems</i>		
Loss of consciousness <sup>a</sup> , n	52	2
Respiratory insufficiency, n	48	0
Convulsions, n	14	0
Cardiac arrest, n	9	0
Intoxication/poisoning, n	6	0
Hypotension, n	6	0
Arrhythmia, n	4	0
Head trauma, n	0	20
Trauma to the truncus, n	0	12
Trauma to the extremities, n	0	8
Different bruises, n	0	7
Others reasons, n	10	0
Median time spent at ED, min (range)	65 (4-302)	95 (15-345)
Median number of interventions (range)	8 (0-16)	5 (0-14)
<i>Most frequent "interventions" performed</i>		
<i>Diagnostic "interventions"</i>		
Electrocardiography, n	113	5
Venous blood samples, n	105	16
Arterial blood samples, n	110	4
Microbiological samples <sup>b</sup> , n	29	0
X-ray in the ED, n	50	24
Ultrasound in the ED, n	19	8
Computed tomography, n	22	20
<i>Treatment</i>		
Medicine, n	101	20
Fluids, n	90	14
Anaesthesiological interventions <sup>c</sup> , n	33	0
Cardio-pulmonary resuscitation, n	7	0
Stiff collar for the neck and/or spineboard, n	0	11
Calling in physicians from specialties not represented in the multidisciplinary team, n	73	9

ED = Emergency Department.

a) Loss of consciousness is defined as Glasgow Coma Score < 9 and/or cases in which the patient is unresponsive or only responds to pain; b) microbiological samples include sampling of blood, urine, spinal fluid and respiratory secretion for culture; c) anaesthesiological interventions include ventilation by mask, endotracheal intubation and continued positive airway pressure by mask.

In 49% of the EC and 19% of the TC patients, the team requested medical or surgical attendance in the diagnostic process and treatment at the ED.

### Outcome

**Table 2** shows outcome data of emergency calls and trauma calls.

A total of 137 EC patients (91%) were admitted. Twelve of these patients were transferred to other hospitals: Five children were transferred to a department of paediatrics, three patients were transferred to the Cardiac Catheterization Lab, two patients were transferred



TABLE 2

Patient outcome measurements for patients in whom an emergency call or a trauma call were activated.

	Emergency Call (n = 150)	Trauma Call (n = 47)
<i>Patients discharged from the ED</i>		
Discharged to home, n	3	19
Admitted to an internal medical ward, total, n	92	7
Endocrinological-gastroenterological unit, n	22	1
Pulmonary unit, n	30	1
Cardiac unit, n	19	0
Neurological unit, n	21	5
Admitted to a surgical ward, total, n	4	13
Abdominal, n	3	1
Orthopaedic, n	1	12
Admitted to the recovery room, n	4	0
Admitted to the ICU, n	25	0
Died in the ED, n	10	0
Transferred to another hospital, n	12	8
<i>Outcome for patients admitted to a ward at Bispebjerg Hospital</i>		
Admissions, n	125	20
Median length of stay at hospital, days (range)	2 (1-147)	1 (1-48)
Deaths during admission, n	39	1
Median time to death, days (range)	2 (0-28)	0
Admissions to the ICU from hospital wards, n	7	0
Median time to ICU admission from a hospital ward, hours (range)	21 (3-29)	–

ED = Emergency Department; ICU = Intensive Care Unit.

to a neurosurgical department, one patient was transferred to a hospital with vascular surgery capabilities and one patient was transferred to a medical ward closer to her home.

The majority of the patients were admitted to our internal medical wards. However, a total of 32 (21%) patients were admitted to the ICU. A total of 25 patients (78%) were transferred directly to the ICU from the ED. The median time to ICU admission was 23 hours for the seven patients not admitted directly from the ED.

In ten EC patients, resuscitation was considered futile and these patients died at the ED shortly after treatment cessation. Another 39 patients died during admission within a median of two days. The team found 12 of these patients (31%) to be terminal and therefore admitted them for palliative care. In another eight patients (21%), the team found that there was no indication for intensive care or cardiopulmonary resuscitation. In 19 of the 39 patients who died during admission, no limitation of treatment was documented in the patient records.

Nineteen of the patients managed by the trauma team were discharged directly from the ED (40%). Another 20 patients were admitted to our hospital and eight patients (primarily children) were transferred to other hospitals for admission. No trauma patients were admitted to the ICU. In one patient with severe head

trauma, no surgical treatment was possible. He died as expected a few hours after admission.

### Evaluation of the course of the first 48 hours of admission

In 130 EC (87%) and 45 TC (96%) patients, the acute medical care given was rated as “satisfactory”. In seven EC and two TC patients, an evaluation could not be made because of insufficient documentation in the hospital records. The ED reception was rated “unsatisfactory” in only nine EC patients and in another four EC patients, the acute medical care during the first 48 hours of admission was rated “unsatisfactory”. **Table 3** summarizes the results of the evaluation within the relevant medical and surgical specialties and provides a short description of the problems identified by the reviewers in the cases rated as “unsatisfactory”.

### DISCUSSION

To improve the quality of ED care of critically ill and severely injured patients, the BBH has implemented a concept for multidisciplinary team management. The aim was to rapidly identify critically ill patients through the use of a validated triage system and to achieve the best available treatment through the immediate presence of relevant emergency care providers in a well-organized team structure.

The principal findings of this study are that a multidisciplinary team reception at the ED ensures early initiation of diagnostic procedures and treatment, leads to short ED stays, admission to relevant departments and an early identification of the need for intensive care admission in presumed critically ill and severely injured patients.

Patients for whom an EC or a TC was activated constitute two very different populations at our hospital with regard to demographic data, disease intensity and outcome. More than half of the ECs were admitted to intensive care or died during admission and thus form a group of severely ill patients. Conversely, the majority of patients managed by our trauma team were not severely injured, had a low mortality and were treated at and often discharged directly from the ED. This is primarily due to the fact that the BBH is a level-two trauma centre located near the regional level-1 trauma centre. However, the presence of a trauma team at our hospital ensures familiarity and experience with the trauma team structure. In our experience, this is crucial when we occasionally do receive a severely injured patient. As many of the team members are the same in EC and TC situations (Figure 1) and as the approach is similar in critically ill and injured patients (i.e. the ABCDE-principle), the experience and structure of the trauma team are transferred to the critically ill non-trauma patients.



TABLE 3

Results of the evaluation of the quality of the acute medical care during the first 48 hours of admission within the relevant medical and surgical specialties.

<i>Endocrinology-gastroenterology (n = 27 patients)</i>	<p><i>Satisfactory: 25 patients (93%)</i></p> <p><i>Unsatisfactory: 2 patients: 1 patient may have received less intensive treatment at the ward because "do not attempt resuscitation"-order was given at the ED. Another patient was over-hydrated during the first day of admission and probably should have received inotropic medicine instead</i></p> <p><i>Could not be evaluated due to insufficient documentation: 0 patients</i></p>
<i>Pulmonary medicine (n = 34 patients)</i>	<p><i>Satisfactory: 32 patients (94%)</i></p> <p><i>Unsatisfactory: 1 patient should have been admitted to the cardiac unit instead</i></p> <p><i>Could not be evaluated due to insufficient documentation: 1 patient</i></p>
<i>Cardiology (n = 29 patients)</i>	<p><i>Satisfactory: 23 patients (79%)</i></p> <p><i>Unsatisfactory: 5 patients: 1 patient with pneumonia and sepsis should probably have been admitted directly to the ICU from the ED, but was not admitted until 10 hours later (the patient died 20 days later in the ICU). 3 patients should have been admitted to other medical specialties. In an elderly senile patient, retrospective evaluation reached the conclusion that she should not have been admitted</i></p>
<i>Neurology (n = 45 patients)</i>	<p><i>Satisfactory: 42 patients (94%)</i></p> <p><i>Unsatisfactory: 1 patient was transferred between different wards 4 times within 32 hours and thus had an unsatisfactory course of admission</i></p> <p><i>Could not be evaluated due to insufficient documentation: 2 patients</i></p>
<i>Abdominal surgery (n = 9 patients)</i>	<p><i>Satisfactory: 7 patients (78%)</i></p> <p><i>Unsatisfactory: 2 patients: In 1 patient an Emergency Call should have been activated on arrival, but was not. This was a patient with severe gastro-intestinal haemorrhage in whom an Emergency Call was not activated until 65 min after arrival when the patient suffered cardiac arrest. In the other patient, a chest X-ray was not assessed until 11 hours later when the patient was moved to another ward. The X-ray was normal</i></p> <p><i>Could not be evaluated due to insufficient documentation: 0 patients.</i></p>
<i>Orthopaedic surgery (n = 27 patients)</i>	<p><i>Satisfactory: 27 patients (100%)</i></p> <p><i>Unsatisfactory: 0 patients</i></p> <p><i>Could not be evaluated due to insufficient documentation: 0 patients</i></p>
<i>Intensive care (n = 26 patients)</i>	<p><i>Satisfactory: 22 patients (85%)</i></p> <p><i>Unsatisfactory: 2 patients: In 1 patient an Emergency Call should have been activated on arrival, but was not activated until 40 min later. The patient presented with impaired consciousness and was transferred to the ICU with severe sepsis, but survived. In the other patient myocardial ischaemia was overlooked on a 12-lead electrocardiography taken during admission.</i></p> <p><i>Could not be evaluated due to insufficient documentation: 4 patients.</i></p>

ED = Emergency Department; ICU = Intensive Care Unit.

The medical patients received by the multidisciplinary team predominantly need standard medical treatment due, among others, to COPD, pulmonary oedema, infection/sepsis, i.e. conditions which all young medical interns are trained to handle before they go on call. However, the severity of illness implies that more than one fifth of the patients require advanced interventions, e.g. endotracheal intubation. Rapid and relevant treatment of these patients is therefore ensured by the presence of an internist, an anaesthesiologist or an anaesthesiologist trainee and a nurse anaesthetist who form part of the multidisciplinary team. For patients with obvious cardiac, neurological and abdominal emergencies, the on-call specialists are often sent for immediately so that they may participate in the initial stabilization at the ED.

Patients for whom an EC or TC is activated often present with non-specific symptoms, e.g. unconsciousness, and are hence transferred to one of several different medical and surgical departments. This supports previous experience [7]. The quality of our concept for

ED management of presumed critically ill and severely injured patients was evaluated by specialists from the departments whereto the patients were admitted. The result confirms that our concept provides a high treatment quality for a heterogeneous group of patients.

Studies have shown that mortality is significantly higher among patients admitted to an ICU from a general ward compared with patients admitted directly from the ED [8, 9]. In our study, 78% of the patients in need of intensive care were admitted directly from the ED. Our evaluation showed that only one in seven patients might have needed earlier transfer to the ICU. Compared with other studies [10], this is a very good result that supports our conclusion that multidisciplinary team reception provides early recognition and quality of care for patients in need of intensive care.

To rationally prioritize resources, it is important to identify the critically ill patients who have a chance of survival. Patients in whom an EC is activated have a high mortality. This is not due to inadequate treatment, but rather due to the severity of their illness when arriving



At Bispebjerg Hospital critically ill patients are managed by a multidisciplinary team in the Emergency Department.

at the ED. The presence of a multidisciplinary team helps identify patients in whom resuscitation is considered futile.

A limitation of this study is the lack of a control group. The effect of a multidisciplinary team on the length of hospitalization, the incidence of ICU admissions and mortality therefore cannot be estimated. We considered using both a historical control group and a control group from another hospital. However, poor documentation of the vital signs used to perform triage is a problem both at our hospital [7] and at other hospitals [11, 12]. We therefore have not succeeded in finding a comparable control group.

Due to insufficient documentation, it was impossible to evaluate the quality of care in some patients. However, this only concerned very few patients and does not affect the overall picture that a multidisciplinary team reception ensures good quality of the acute medical treatment.

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