

Large discrepancy between prehospital visitation to mobile emergency care unit and discharge diagnosis

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ABSTRACT

INTRODUCTION: In Copenhagen, Denmark, patients in need of prehospital emergency assistance dial 112 and may then receive evaluation and treatment by physicians (from the Mobile Emergency Care Unit (MECU)). ST-elevation myocardial infarction (STEMI) is a severe condition leaving only a limited time frame to deliver optimal care in the form of percutaneous transluminal coronary angioplasty. In theory, all patients with chest pain could have STEMI. The aim of this study was to study which of the patients suspected of having acute cardiac disease based on the 112 calls and met by the MECU were given a cardiac diagnosis on the scene and, furthermore, to compare these on-scene diagnoses with the primary discharge diagnoses from hospital.

MATERIAL AND METHODS: This was a retrospective study based on medical records from the MECU and the National Patient Registry. The study period covered six months in 2008 during which all 112-alarms to acute cardiac disease cases were met by the MECU were included. The study population comprised 1,219 patients.

RESULTS: A total of 780 (66.3%) of the dispatches resulted in a cardiac diagnosis by the MECU physician. 77% of the admitted patients were diagnosed with a primary cardiac disease on discharge. These were categorized into three groups: acute coronary syndrome (314 patients, 57%), cardiac arrhythmias (58 patients, 10%), and other cardiac disorders (183 patients, 33%). Only 46% of the study population was discharged from hospital with a cardiac diagnosis.

CONCLUSION: Only half of the included patients were discharged from hospital with a cardiac diagnosis, which leaves room for improvement.

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The Mobile Emergency Care Unit (MECU) in Copenhagen covers an area of approx. 675 km², inhabited by approximately 1.2 million citizens [1]. The MECU is staffed with a physician specialized in anaesthesiology and a specially trained assistant. The MECU is activated if a person calls the national emergency number 112. The Emergency Dispatch Centre was operated by non-health trained personnel.

Since 2007, the area covered by the MECU has been multiplied by seven and the number of citizens it serves has doubled. Consequently, the number of emergency calls has increased dramatically. As the MECU was not

upgraded to the same extent as the area it served, it was necessary to implement a change in the alarms to which the MECU was sent. Patients with suspected heart disease were given a higher priority than patients with other conditions such as asthma, convulsions and diabetes, among others. In 2008, the MECU was alarmed 10,173 times resulting in 7,775 runs [2].

In 2000, heart disease resulted in 100,000 hospitalisations in Denmark which amounts to 9% of all admissions nationwide. Of this group, 50% had ischaemic heart disease [3]. This number is increasing due to changes in the population's age composition and improved treatment [4].

ST-elevation myocardial infarction (STEMI) represents a severe cardiac condition leaving only a limited time frame to deliver optimal care in the form of percutaneous transluminal coronary angioplasty (PTCA). Furthermore, such treatment is provided at only one hospital in Copenhagen, why an accurate on-scene diagnosis is crucial so that patients may be transported to the appropriate facilities without delay.

The aim of this study was to reveal which patients the MECU met when responding to an alarm concerning suspected acute cardiac disease, and to compare the provisional MECU diagnosis with the subsequent primary discharge diagnosis from the hospital. We also wanted to evaluate the accuracy of the 112 emergency call system with respect to optimal use of the MECU.

ORIGINAL ARTICLE

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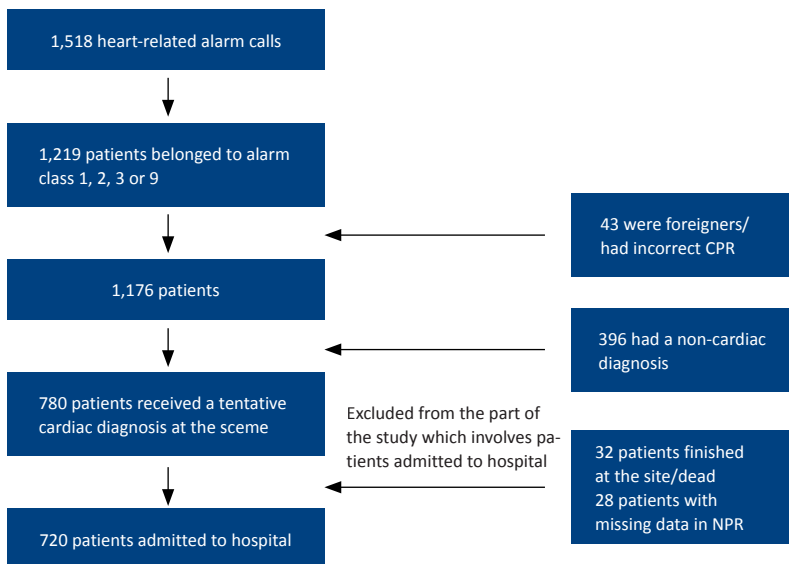
TABLE 1

Alarm classes used by the Mobile Emergency Care Unit.

Alarm class	Description
1	Finalized at the site of injury
2	Admitted without medical escort
3	Admitted with medical escort
4	Alarm withdrawn
5	Alarm reprioritized
6	Standby
7	Patient not found
8	Death – sure signs of death
9	Patient pronounced dead
10	Other causes
11	Telephone contact
12	Transfer

FIGURE 1

Inclusion and exclusion of patients.



CPR = personal identification number. All Danish citizens receive this at birth.

NPR = National Patient Registry, a national database consisting of health-related information.

MATERIAL AND METHODS

This was a retrospective study based on medical records from the MECU and the National Patient Registry (NPR). The inclusion period was from 1 July to 31 December 2008. The study was reviewed and approved by the Danish Data Protection Agency.

Inclusion criteria: The MECU deploys 12 alarm classes. The physician in the MECU classifies each call (Table 1). All MECU dispatches categorized as heart-related disease by the Emergency Dispatch Centre and allocated to alarm classes 1, 2, 3 or 9 by the MECU were included. Dispatches to cardiac arrest were not included as cardiac arrest is considered a completely different nosologic entity in terms of dispatch. Previous reports have evaluated the dispatches to cardiac arrest by the MECU [2, 5]. For all admitted patients, the primary discharge diagnosis from hospital, discharge dates and procedure codes were extracted from the NPR.

During the period from 1 July to 31 December 2008 there were 1,518 alarm calls to 112 categorized as heart-related illness. A total of 1,219 dispatches resulted in contact with a patient and were allocated to alarm classes 1, 2, 3 or 9.

Exclusion criteria: A total of 43 patients were foreigners or had an incorrectly listed personal identification number (CPR number). This resulted in 1,176 included dispatches. A total of 396 patients were excluded as the physician on the scene did not assign a provisional

cardiac diagnosis. In all, 29 patients were allocated to alarm class 1. This group was treated on the scene and not admitted to a hospital. Since one of the aims was to compare the tentative diagnosis by the MECU with the primary discharge diagnosis, these cases were excluded from the study. A review of the data from the NPR showed that six patients from alarm class 1 were taken to a hospital and admitted. We assume that there was an error in the registration of the alarm classification for these six patients and they were therefore included in the study. Nine patients were categorized into alarm class nine and pronounced dead on the scene. These patients were excluded because they were not admitted and treated.

Data were missing on 28 patients in the NPR. This group was probably treated in the emergency room and not admitted which may be the reason why no data were found. These patients were also excluded.

With the exclusions above, the total population of patients admitted with a prehospital provisional cardiac diagnosis was 720, Figure 1.

Trial registration: not relevant.

RESULTS

A total of 1,518 alarm calls categorized as heart-related illness were received at the Emergency Dispatch Centre during the study period. The MECU was dispatched 1,219 times and 1,176 trips were included. In all, 780 patients received a tentative cardiac diagnosis on the scene, and 720 patients were admitted to hospital. A total of 555 of these patients were diagnosed with a primary cardiac condition at discharge from hospital, corresponding to 77% of the 720 admitted patients and 46% of the total number of included dispatches.

The 1,176 trips made by the MECU were distributed on following eight groups according to provisional medical diagnosis: cardiac, neurological, respiratory, gastrointestinal, musculoskeletal, psychiatric/poisoning, endocrinological, and others, Table 2.

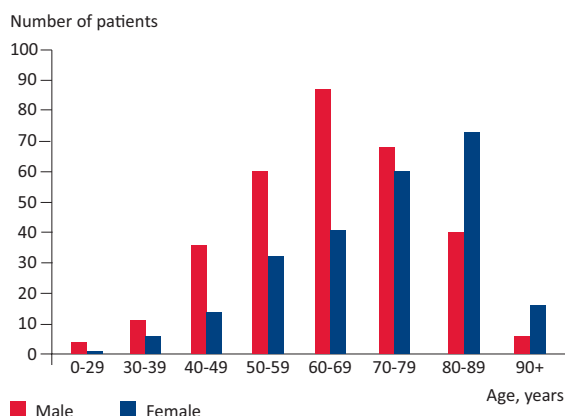
TABLE 2

Distribution of diagnosis made on scene.

Physician's provisional diagnosis	Number of patients (%)
Cardiac	780 (66.3)
Neurological	120 (10.2)
Respiratory	61 (5.2)
Gastrointestinal	52 (4.4)
Musculoskeletal	46 (3.9)
Psychiatric/poisoning	30 (2.6)
Endocrinological	2 (0.2)
Other	85 (7.2)


FIGURE 2

Distribution by age and sex.



The distribution by sex among the 720 patients was 56% men and 44% women. In the age group 0-80 years, more men than women were hospitalized, and in the age group above 80 years, the majority were women, **Figure 2**.

The 555 patients were discharged with 58 different cardiac diagnoses classified according to the International Classification of Diseases-10. Due to the large number of diagnoses, they were divided into three main groups:

- Acute coronary syndrome (ACS): 314 patients (57%).
- Cardiac arrhythmias: 58 patients (10%).
- Other cardiac disorders: 183 patients (33%).

The ACS group included patients with STEMI, non-ST-elevation myocardial infarction (NSTEMI), and unstable angina pectoris. The cardiac arrhythmia group included bradycardia, tachycardia, Wolf Parkinson White, atrial fibrillation and flutter, and atrioventricular nodal re-entry tachycardia. The group with other cardiac conditions included chest pain (without evidence of ACS), cardiac failure, cardiogenic shock, pericarditis, aortic valve disease and cardiogenic pulmonary oedema.

A total of 72 patients underwent PTCA. This represents 23% of all ACS patients and 13% of the 555 patients with a cardiac discharge diagnosis.

Twenty-three patients were treated and finalized at the site of injury, and nine patients died in the prehospital setting.

Discharge diagnoses for the remaining 165 patients with a non-cardiac diagnosis were distributed on the following groups: musculoskeletal disorders: 30 patients; gastrointestinal disorders: 29 patients; infections: 23 patients; neurological disorders: 21 patients; respiratory

disorders: 16 patients; endocrinological disorders: five patients and other causes: 41 patients.

DISCUSSION

Our study showed that 780 (66.3%) of the included patients were assigned a provisional cardiac diagnosis on the scene, and approximately half of the included dispatches resulted in admittance and a primary cardiac discharge diagnosis from hospital.

A limitation of this study design is that data were collected retrospectively. During the study period, there was no standardized way to question or collect information from the person who called 112. This makes the categorisation of the calls more individualized.

The strength of this study is that it provides an accurate picture of the clinical practice during the study period.

Two other Danish studies have evaluated the accuracy of the Danish emergency call system. They concluded that alarms only corresponded moderately with the provisional diagnoses made by the physician on the scene (32% and 45%) [5, 6]. We found a higher accuracy of 66%, which may be explained by the fact that we looked at heart-related illness in general, whereas Mathisen et al and Andersen et al only looked at cardiac arrest and ACS, respectively [5, 6].

Patients who were not assigned a provisional cardiac diagnosis on the scene were divided into seven subgroups where neurological disorders accounted for the majority, followed with respiratory and gastrointestinal disorders. Symptoms belonging to these common conditions/diseases can often mimic cardiac symptoms. It can be difficult to distinguish the specific conditions over the phone, especially for non-health educated personal such as those who answered the 112-calls.

One other Danish study compared the provisional diagnosis made by the physician and the subsequent primary discharge diagnosis from hospital. They found that the accuracy for prehospital identification of stroke was 30.1% [7]. In the present study, the accuracy was 77%. As mentioned previously, the difference in accuracy may be due to the fact that we included a broad spectrum of patients with cardiac disease, while Fischer et al only included patients with a more specific diagnosis (stroke).

We find an accuracy of 77% acceptable, but it can be improved. We only included the primary diagnosis. It is possible that some patients with a non-cardiac primary diagnosis have a secondary cardiac diagnosis and thereby also a cardiac condition, which may require treatment. Furthermore, there may be a change or a development in the patient's medical condition during hospitalization. This may reflect on the primary discharge diagnosis.

Another aspect that may explain why some of the



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provisional cardiac diagnoses made by the physician did not correlate with the discharge diagnoses is that some cardiac conditions require laboratory testing in addition to electrocardiography to be diagnosed. This can also explain why only 23 patients were finished on the scene, which is a small proportion of the total number of included patients. This may reflect over-triage by the physician or the lack of diagnostic tools in the prehospital setting.

The prognosis for patients with STEMI depends on the time to reperfusion, and several studies have demonstrated that mortality may be reduced by decreasing door-to-balloon time by early recognition of STEMI and by fast-tracking the patient directly to percutaneous coronary intervention centre [8-11]. A 30-minute delay reduces life expectancy by one year [12, 13]. Terkelsen et al found that system delay had the strongest association with mortality, and that prehospital and in-hospital triage were factors which could be optimized [14].

In our study, the "ACS group" represented 57%, i.e. a high proportion of the admitted population, and PTCA was performed on 23% of all ACS patients. In a larger randomized clinical study, Dracup et al showed that education of patients with ischaemic heart disease in symptoms of ACS did not make the patients call for medical assistance earlier than the control group in case of symptoms [15]. This underpins the importance of proper selection of cardiac patients so that the MECU can be dispatched to the intended patient population and may give the qualified treatment at the site of injury and then transport patients to a hospital with the appropriate facilities with minimal delay. The two other groups of cardiac conditions encompassed several potentially life-threatening diagnoses, not least various symptoms of acute heart failure, and they would also benefit from early intervention.

Nine patients were pronounced dead by the physician. This small number reflects that we did not include dispatches in which the MECU was sent to a cardiac arrest. It is possible that these patients died after the Emergency Centre was alarmed or on the scene while the MECU was there. Another possibility is that the Emergency Centre wrongly categorized these nine patients. This is supported by the findings of Mathiesen et al who found that the Emergency Centre failed to categorize 68% of all MECU dispatches to cardiac arrest as such in 2000-2006 [5].

The distribution on sex and age of the 555 cardiac patients shows an expected predominance of males aged 0-80 years. This is consistent with previous reports [16].

46% of all dispatches were given a cardiac discharge diagnosis, which leaves room for improvement in the Emergency Centre handling of MECU dispatches. Studies have supported further medical education of the dispatch staff [5, 6]. Since May 2011, health professionals, primarily nurses, have responded to the 112 calls and made the dispatch reports to the MECU. It will be interesting to see if this leads to more accurate reports to the MECU resulting in better triage. This will hopefully help to increase the quality of work of the MECU.

CONCLUSION

In two thirds of the dispatches, the MECU gave a provisional cardiac diagnosis. The accuracy of prehospital identification of cardiac disease was three fourths of the admitted patients. Half of the study population was discharged from hospital with a primary cardiac diagnosis and 57% of these had ACS. These results indicate some over-triage at the Emergency Centre. This leaves room for improvement. Another study performed after the implementation of health care personnel at the emergency dispatch centre would possibly reveal changes in accuracy of dispatches.

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