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Factors impacting upon timely and adequate allocation of prehospital medical assistance and resources to cardiac arrest patients

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ABSTRACT

Aim: Explore, understand and address issues that impact upon timely and adequate allocation of prehospital medical assistance and resources to out-of-hospital cardiac arrest (OHCA) patients.
Methods: Mixed-methods design obtaining data for one year in three emergency medical communication centres (EMCC); Oslo-Akershus (OA), Vestfold-Telemark (VT) and Østfold (Ø). Data collection included quantitative data from analysis of dispatch logs, ambulance records and audio files. Qualitative data were collected through in-depth interviews and non-participant observations.
Results: OA-, VT- and Ø-EMCC responded to 1095 OHCAs and 579 of these calls were included for further analysis (333, 143 and 103, respectively). There were significant site differences in their recognition of OHCA (89, 94 and 78%, respectively, $p < 0.001$), provision of CPR instructions (83, 83 and 61%, respectively, $p < 0.001$), time from call answered to initial CPR instructions (1.4 min (1.2, 1.6), 1.1 min (0,9, 1.2) and 1.3 (1.2, 1.7) respectively, $p = 0.002$). The most frequent reason for delayed or failed recognition of OHCA was misinterpretation of agonal breathing. Interviews and observations revealed individual differences in protocol use, interrogation strategy and assessment of breathing. Use of protocol was only part of decision making, dispatchers trusted their own clinical experience and intuition, and used assumptions about the patient and the situation as part of decision making.
Conclusion: Agonal breathing continues to be the main barrier to recognition of cardiac arrest. Individual differences among dispatchers' strategies can directly impact on performance, mainly due to the wide definition of cardiac arrest and lack of uniform tools for assessment of breathing.

Introduction

Patient outcomes depend on emergency medical dispatchers' ability to rapidly recognise out-of-hospital cardiac arrest (OHCA) and offer cardiopulmonary resuscitation (CPR) instructions to bystanders. If a dispatcher recognise cardiac arrest, victims are more likely to receive bystander CPR improving their chance of survival.[1–4] While current guidelines emphasise the importance of emergency medical communication centres (EMCC) with the dispatcher as an essential link in the chain of survival,[5,6] the International Liaison Committee (ILCOR) consensus on science highlights substantial knowledge gaps about dispatcher training and EMC centre configuration.[5]

The American Heart Association (AHA) published a scientific statement advocating quality assurance and monitoring of key quality indicators like recognition of OHCA, provision of CPR

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instructions and important time intervals.[7] However, large variations in quality among published studies exist, with recognition of arrest between 56-98% and time to first chest compression between 2,9 and 4,8 minutes.[3,8–12] There is limited insight into reasons for this variation.

During the 90s, lay rescuer education and training gradually removed the use of carotid pulse check to identify cardiac arrest, and assessment of breathing became increasingly emphasised.[13–16] Experience from EMC centres suggested untrained bystanders could identify cardiac arrest by assessing whether a person was unresponsive and in respiratory arrest.[17] Widespread implementation of new CPR training courses following 2000 AHA and 2001 European Resuscitation Council (ERC) guidelines abandoned pulse checks for lay rescuers, and cardiac arrest was defined as an unresponsive person with no or abnormal breathing.[18,19] Due to these guideline changes, many efforts have been made to describe and address the issue of abnormal or agonal breathing during cardiac arrest.[20,21] Nonetheless, agonal breathing remains the single most challenging barrier to recognise cardiac arrest.[10,21–24] Better clinical support tools are needed to ensure optimal handling of all cardiac arrest calls.

The aim of this study was to explore, understand and address issues that impact upon timely and adequate allocation of prehospital medical assistance and resources to OHCA patients.

Methods

This is a descriptive and exploratory study with mixed-method design using both quantitative and qualitative research methods: The study explores factors and issues impacting on emergency medical dispatchers behaviour and response in cardiac arrest situations.

We evaluated dispatcher performance at three representative Norwegian EMC centres; Oslo-Akershus, Vestfold-Telemark, and Østfold. All norwegian EMC centres are staffed by registered nurses and emergency medical technicians/paramedics. They use the same decision support tool; Norwegian Index for Emergency Medical Assistance,[25] with some local variations. This “Norwegian Index” is criteria based and uses guidelines with prompts based on caller descriptions of signs and symptoms to provide direction and assistance in defining appropriate levels of care. The cardiac arrest protocol recommended during the study period prescribed in the presence of a presumed cardiac cause, chest compression only CPR the first 10 minutes moving to standard CPR with compression: ventilation (30:2). If presumed respiratory or traumatic cause, standard CPR was recommended from the beginning.

Based on appropriate qualitative research recommendations we used a purposive sampling method, selecting information rich cases for in-depth study.[26] Maximum variation purposive sampling aims to capture and describe central themes cutting across a great deal of variation. Common patterns emerging from great variation are of particular interest. Value is placed on capturing core experiences and central, shared dimensions of a setting or phenomenon.[26] Maximum variation was captured by: (1) Location: metropolitan vs. non-metropolitan/remote, (2) Size: large vs. smaller population served as well as large vs. smaller geographical area covered, and (3) Organisation of Emergency Medical Service (EMS) system – dispatchers working only with dispatch vs. dispatchers rotating through ambulance or emergency room shifts. This reflects a balance between obtaining in-depth rich data within centres as well as being able to compare centres. The study was conducted in accordance with the Declaration of Helsinki incorporating principles of informed consent, right to withdraw and anonymity.[27] Exception from confidentiality was approved by the regional research ethics committee (Reference no. 2012/1611 A).

EMC centres (Table 1)

Oslo and Akershus EMCC (OA-EMCC)

OA-EMCC is part of the Oslo University Hospital (OUH). OA-EMCC covers the regions of Oslo, Akershus and Rømskog consisting of both rural and urban areas and a population of 1,2 million people. In 2013 OA-EMCC received approximately 315 000 calls of which approximately 124 000 were emergency calls. The region has 45 regular ambulances at its disposal in addition to one single paramedic manned ambulance, one motorcycle unit, and one physician staffed rapid response vehicle. In addition, OA-EMCC is responsible for two physician staffed helicopters. OA-EMCC employs 25 emergency medical technicians (EMTs)/paramedics coordinating ambulance responses and 29 registered nurses answering emergency calls.

Vestfold-Telemark EMCC (VT-EMCC)

VT-EMCC serves a population of approximately 400,000, and deploys 31 ambulances at 15 stations. It is staffed by registered nurses with additional training in emergency medical dispatch answering emergency calls, and EMTs/paramedics coordinating ambulance responses. The VT-EMCC has on-site training in telephone triage and dispatch, and keeps the staff professionally updated with regular courses and training days. In 2013 they responded to 32,776 emergency calls and handled a total of 63,025 calls, resulting in 47,486 ambulance assignments. VT-EMCC uses a locally designed protocol with reduced opening lines and specific key words for OHCA suspicion. Instructions in CPR for adults recommend compression-only CPR for all OHCAs except those with hypoxia or trauma.

Østfold EMCC (Ø-EMCC)

Ø-EMCC is operated by Østfold Hospital Trust and covers a population of 287, 000 people. It deploys 23 ambulances, and delivers emergency and non-emergency services to the cities and nearby communities. Ø-EMCC is staffed by registered nurses with additional EMCC training answering emergency calls, and EMTs/paramedics coordinating ambulance responses. The nurses rotate between work in the dispatch centre and as clinical nurses in the emergency room. Ø-EMCC employs 21 dispatchers each responding to an average of eight OHCA calls annually. Ø-EMCC handles almost 110 000 calls per year, respond to approximately 42 000 calls of which approximately 28 000 are emergency calls.

Collection of quantitative data

All consecutive adult OHCA calls during a one-year period in the three different study sites were registered, from Jan 28th 2013 to Jan 31st 2014, from Jan 1st 2013 to Dec 31st 2013, and April 1st 2013 to Mar 30th 2014, at the OA-EMCC, VT-EMCC, and Ø-EMCC, respectively. OHCA cases were identified from respective cardiac arrest registries and digitalised recordings were audited. Key indicators included clarification of consciousness and normal breathing, recognition of OHCA and incidence of pre-arrival instructions with appropriate time intervals. Additional information was obtained from ambulance and dispatch records. The following cases were excluded:

- patients where ambulance personnel either witnessed the arrest or decided not to start CPR due to futility
- patients not in cardiac arrest at time of call
- caller not with patient
- cases without need for CPR instructions (health care facility or on-going CPR)
- calls interrupted before recognition of cardiac arrest was possible
- cases with missing/corrupted audio files.