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Emergency Medical Dispatch - The First Medical Response for Life Threatening Conditions

Assessment and intervention of patients with chest pain and/ or suspected cardiac arrest

Angela Bång

Göteborg 2002

EMERGENCY MEDICAL DISPATCH – THE FIRST MEDICAL RESPONSE FOR LIFE-THREATENING CONDITIONS

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Professor Rudy Koster, University of Amsterdam,
The Netherlands

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ABSTRACT

Aims: To describe the Emergency Medical Dispatcher's (EMDs) possibility of assessment and intervention of patients reported having chest pain and/or cardiac arrest, with regard to identification of the problem, priority-decision, provision of instructions in dispatcher-assisted bystander cardiopulmonary resuscitation (CPR), and the subsequent outcome in terms of final diagnosis and survival.

Methods: Prospective and retrospective observational studies based on registrations made by EMDs in case record forms (during two months, 1993), and in the dispatch protocol (27 months, 1994-1996) and subsequent follow-up in ambulance and hospital files. Evaluations of tape recordings of emergency calls to the EMS dispatch centre, concerning patients treated for out-of-hospital cardiac arrest (99 calls/1986, 100 calls/2000-2001).

A qualitative study was used to describe the EMDs perceptions of identifying cardiac arrest, offer and provide instructions in CPR to callers. Ten EMDs were approached for face-to-face interviews in 1997.

Results: Among 503 patients reporting chest pain, 68% were judged as having severe chest pain, of which 26% developed acute myocardial infarction (AMI) as compared with 13% among patients judged as having only vague chest pain ($p = 0.0004$). The EMDs had a strong suspicion of AMI in 36%, a moderate suspicion of AMI in 34%, and a vague or no suspicion in 30%. Among patients with a strong suspicion of AMI, 29% subsequently developed AMI compared with 18% among patients with a moderate suspicion, and 15% among patients with only a vague or no suspicion of AMI ($p< 0.001$). The study sample size was too small to evaluate the predictive value of various associated symptoms accompanying chest pain. The priority level was similar in patients with and without a life-threatening condition (81% vs. 73% receiving the highest priority). In patients with cardiac arrest outside hospital, more attention should be paid to the detection of these patients by the EMDs, however, when the EMDs had a suspicion, their accuracy was high. Half of witnesses accepted an offer of instructions in CPR, and one-third completed dispatcher-assisted bystander CPR.

The comparison between no performance and performance of dispatcher-assisted bystander CPR, suggests an increase in survival from 6% to 9%. Among suspected cardiac arrest cases, EMDs offer CPR instruction to only a small fraction of callers, with an accomplishment in all, of ~8%. However, 30-50% of suspected cardiac arrest cases seemed eligible to be approached with such an offer. A major obstacle was the presentation of suspected agonal breathing, which was estimated to occur in about 30%, and was described as: difficulties breathing, poorly, gasping, wheezing, impaired and occasional breathing.

The EMDs have a belief that they are being an empathic authority that relieves the caller of the burden of responsibility, and by meeting the witness mentally, this may enable the caller to act at the scene. The EMDs are dependent on the callers knowledge and trustworthiness, and convincing answers from the caller prompt a more secure feeling in the EMDs, just as caller's lack of knowledge having a negative effect on the EMDs efforts.

Conclusion: There was a strong relationship between the EMDs suspicion of AMI and subsequent development of AMI. One-third, however, developed AMI among those where the EMD had had a moderate, vague or no suspicion of AMI. Patients judged to have severe chest pain, developed AMI twice as often as patients judged to have vague pain. Caller's reporting patients with a combination of unconsciousness and agonal breathing or respiratory arrest should be offered dispatcher-assisted CPR instruction. This may improve survival in out-of hospital cardiac arrest.

Key words: cardiac arrest, cardiopulmonary resuscitation, dispatcher-assisted CPR, agonal breathing

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Dedication: To my son Alexander

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ABBREVIATIONS AND GLOSSARY TERMS

AED Automated external defibrillator. Small, portable device capable of automatically detecting and treating ventricular fibrillation, a major cause of sudden cardiac arrest.

Agonal respirations. See part: Cardiac arrest.

AMI Acute myocardial infarction. Heart attack, the necrosis or death of heart tissue due to the blockage of coronary arteries in the heart, resulting in inadequate oxygenation to the heart muscle itself.

Acute coronary syndromes. Including patients with AMI (non-Q-wave and Q-wave), unstable angina and sudden cardiac arrest.

ALS Advanced life support. Attempts at restoration of spontaneous circulation using basic CPR plus advanced airway management, endotracheal intubation, defibrillation, and intravenous medications.

BLS Basic life support. Includes recognition of cardiac arrest, access to the EMS system, and basic CPR.

Basic CPR. An attempt to restore spontaneous circulation by using chest wall compressions and pulmonary ventilation.

Bystander. A lay person citizen who witnesses or comes across a patient in cardiac arrest.

Bystander CPR. An attempt to provide basic CPR by a person not at the moment part of the organised emergency response system.

Cardiac arrest. The cessation of cardiac mechanical activity, confirmed by the absence of a detectable pulse, unresponsiveness, and apnea or agonal respirations.

CPR Cardiopulmonary resuscitation. A series of external chest compressions and rescue breaths to provide life-saving cerebral and coronary blood flow during cardiac arrest.

Congetive heart failure. A complex clinical syndrome that results from the hearts inability to increase cardiac output sufficiently to meet the body's metabolic demands.

EMS Emergency medical services. Aid delivered by a person who responds to medical emergencies in an official capacity as an EMS provider or EMS dispatcher.

EMS dispatchers (EMD)Emergency medical dispatcher. EMS personnel responsible for dispatching EMS responders to the scene of medical emergencies and providing telephone instructions to bystanders at the scene while professionals are en route.

EMS responders. EMS personnel who responds to medical emergencies by going to the scene in an emergency vehicle. They may be first-, second-, or third-tier responders, depending on the EMS system. They may be trained in ALS or BLS. All should be capable of performing defibrillation.

EMT Emergency medical technician. Emergency personnel trained in BLS.

ERC European Resuscitation Council

Paramedic or EMT-P. Emergency medical personnel trained in ALS.

PEA Pulseless electrical activity.

ROSC Return of spontaneous circulation

Stable angina pectoris. Angina characterised by effort-induced chest discomfort, with or without radiation. Lasting from a few seconds to 15 minutes. It is generally relieved by rest, removal of provoking factors, or sublingual vasodilators.

Sudden cardiac arrest. The sudden cessation of circulation, usually due to irregular ventricular rhythms, most notably ventricular fibrillation.

Unstable angina pectoris. Angina charcterised by pain lasts longer than stable angina, occurs more frequently, and may be precipitated by factors other than effort or activities.

VF Ventricular fibrillation. Severe derangement of the heartbeat that usually terminates fatally within 3-5 minutes if it is not promptly stopped.

CONTENTS

INTRODUCTION

HISTORY OF ALARM SYSTEMS (Part I)
Since the beginning of time there has been a great need to use an alarm system in a dangerous situation. The early people called or whistled to attract attention in their need for help. Soon thereafter our early ancestors started to use fire and smoke for to send messages longer distances than the voice carried.

When Persia was grounded by Kyros in the year 500 BC, a system was used with callers that were placed in a so called "signal line". They stood in voice reach of each other, thereafter each of them repeated the message that was called to them. The guards could send a message as far as 30 days march in one day.

The Chinese wall that was built approx. 200 BC is another example of an antique signalling system. The distance between the towers was often no further than at a call could be sent between them. From the signal towers that stood along the sailing lines into Peking, smoke and fire signals were sent with information on incoming ships. "It is said that in 24 hours can one known what has happened in Canton, that is the same as a distance of 250 German miles" (1750).

The guard and signal towers have probably been used as a warning system since 1500's. Messengers on foot or horse have been found around the world for a very long time. In the Middle Ages and into the 1900's messages were sent to the population to call together the villagers to prepare themselves to defend their village. The person that received the message was compelled, without delay, to go with it to the next village. The ringing of church bells was the most usual way to warn inhabitants of a fire in the village or forest fire between the 1100-1900's in Sweden.

In the year 1792 a new discovery was presented in France, an optical telegraph. This method of signalling spread to other countries in Europe and was developed further by the American, Samuel Morse, mostly known as being the inventor of the Morse code that is still being used today.

The first usable telephone was patented by Alexander Graham Bell in the year 1876.

Today the telephone is our most important way for making emergency calls, allowing us to send an alarm in no time at all.

The weak link in the chain is, however, still people, that in their way of dealing with situations are maybe still in the Middle Ages!

Alarm number
To use an alarm number there must be an automatic switchboard. When the switchboard was still manually operated, the caller simply lifted the telephone and requested to be connected to, for example, the police. However, if all the lines were busy, the consequences could be devastating. This was the reason as to why the first alarm number "999" was implemented and inaugurated in London 1937. The number should be easy to remember, easy to contact police, fire and the ambulance service.

Emergency medical dispatch in Sweden
A special alarm number was incorporated in Sweden in 1951 to improve the possibility for citizens to contact various emergency services. In 1973 an organisation was started in Sweden for independent county alarm centres. It was intended that the local county councils should be able to co-ordinate fire and ambulance dispatch. The alarm number was also moved to these centres, instead of at the local telephone exchange who had previously taken these emergency calls. In the new organisation, the operators who accepted the call would be interviewing the distress calls and dispatching them to the appropriate instance. They should also be available to give advice and improve the situation of the distress caller.

Many of the employed dispatchers came from the fire department dispatch centres. The applicants were tested for their simultaneous ability, and in this test the housewife with small children, showed good results. They were capable of doing several tasks at once and under pressure. Together with the start of county alarm centres, the dispatchers received three weeks training, including organisational and alarm planning, a small amount of medical training and some technical training at the switchboard. The need for an interview technique was soon realised to enable rapid assimilating of correct information from people in stressful situations.

During the 1980's a shift in the technique was started. The old fashioned type of switchboards and maps were changed to the computer system Coord Com, the automatic number presenter and geographical co-ordinators, that give the exact position of the caller's telephone.

This system allows for the rapid dispatch of help. All ambulances today are equipped with a satellite navigation system, GPS, which allows the dispatchers to immediately and exactly locate the units.

Each dispatch centre is in charge of all available emergency units, which enables quick decision-making. If necessary, the police, fire service and ambulance can be dispatched simultaneously (Alarm! 1998).

Emergency medical dispatch in the USA

In the beginning of the 1970s, dispatchers were seen as little more than public safety clerks. Early functions essentially consisted of identifying the emergency's location, determining which unit should respond, then notifying the units of the call and tracking their progress. Since there had been an extremely rapid evolution and implementation of emergency medical technician (EMT) and paramedic programmes throughout the United States, discussions started regarding the process of EMS dispatching.

In 1978, the first comprehensive emergency medical protocol tool was developed. The first formal training programme for dispatchers began and they were given the title Emergency Medical Dispatcher (EMDs) (Clawson 1981). The use of written prearrival instructions was started for the major problems such as cardiopulmonary resuscitation (CPR), choking, and childbirth.

In 1989, the National Association of EMS Physicians published a position paper, which stated that prearrival instructions were a mandatory component of every medical dispatch centre. (National Association of EMS Physicians, 1989). The number of emergency medical service (EMS) dispatch systems currently using prearrival instructions, is estimated to be 94% of the dispatch centres in the USA, and dispatch centres run by the police or fire departments only use such instructions in 70% percent of their centres (Cady et al. 1993).

The practice standards of emergency medical dispatch training, certification and curriculum, EMD management and quality assurance were approved by the American Society for Testing and Materials in 1990 (American Society for Testing and Materials, 1990).

The American system is highly protocol-driven and the requirements for formal medical competence are low. The emphasis is on internal training and feedback after performance evaluation.

A detailed description is presented as follows from an organisation pioneering the area of EMD (American Society for Testing and Materials, 1990).

- Entry level selection criteria for hiring EMDs; high school graduation, perform verbal skills in a clear and understandable manner in the required language, perform alpha-numeric transcription skills necessary to correctly

record addresses, locations and telephone numbers, demonstrate competency in basic telecommunication skills as required by the training agency, show a clear attribute of helpfulness and compassion toward the sick or injured patient or the caller, have the ability to clearly guide callers in crisis through application of necessary interrogation procedures, and the provision of pre-arrival instructions, have the ability to efficiently and effectively organise multiple tasks and complicated situations, have the ability to handle the levels of emotional stress present in caller/patient intervention, death and/or dying situations, call prioritisation and triage, having the ability to function within the team framework of public safety and EMS systems, also having the ability to elicit and assimilate caller information and then to prioritise and appropriately consolidate and summarise this information in a format used to inform and direct the EMS responders.

- Performance evaluation; compliance with medically approved protocols, performance evaluation through case review. The selection of cases to be reviewed should provide a perspective of the individual's performance over the entire spectrum of call-types received. The review process should, as a minimum, review 7-10% of calls received by the emergency medical dispatch agency. Participants in the case-review process should represent a cross-section of those within the system affected by the emergency medical dispatch program. Regular feedback must be provided to the EMD based on the findings of their performance appraisal. This should include both recognition of exemplary performance as well as behaviour requiring remediation. Field-to-dispatch feedback should be established to monitor.

- Quality assurance (QA) and risk management; QA includes initial hiring, orientation, training and certification, continuing dispatch education, recertification and performance evaluation through case review activities. Risk management consists of identification of problematic situations to assist medical directors, supervisors and EMDs in modifying practice behaviours found to be deficient by the quality assessment procedures.
- Development and provision of continuing dispatch education; in telecommunication, improve skills in the use and application of all parts of the scripted protocols, including interrogation, prioritisation and pre-arrival instructions, seek opportunities for discussion, skill practice and critique of skill performance. Maintain a current under-standing of EMD science. Use scenario drills/role playing, case review practice, EMS field experience and conference participation.
- Requirements for initial certification and recertification of EMD; successful completion of an EMD course and written examination that evaluates knowledge, comprehension and application of information required to function as an EMD. Initial certification period for a new EMD should be two years. Recertification demands the EMD to provide evidence of successful completion of a minimum of 12h of approved continuing medical dispatch education per year.

Emergency medical dispatch in Europe

Emergency medical dispatch centres are organised in different ways in European countries. There are centres hospital-based, fire-department-based and centres organised as independent structures. There is a broad variation of the educational level among the dispatchers. It ranges from trained laymen, paramedically trained, nurses or physicians, the latter mostly as consultants. In centres where each dispatcher is assigned response to several parts of the EMS (police, fire, medical and industrial assignments), the quality level on each is lower and decisions

primarily based on protocols. The medical quality is most probably impacted by the level of integration with emergency medicine. In Norway, the EMS dispatch centre is organised as a department within the emergency dept (ED), but has its own personnel, medical dispatchers (nurses) and ambulance dispatchers (ambulance personnel). The medical dispatchers, to be able to maintain there competence, occasional work days at the ED, intensive care or anaesthesiology department. As a backup, a few nurses from these departments, work temporary in the dispatch centre (Steen-Hansen 1995).

Protocols

Different protocols have been developed as a decision-making support for EMDs. The first Medical Priority Dispatch System (MPDS) development was started in Salt Lake City in 1977 (Clawson 1998). Another is the criteria-based dispatch protocol (CBD) system implemented in King County, Washington in 1990 (Culley et al 1993, Culley et al 1994). These systems are constructed to suit a formally medically untrained person, to make assessment, prioritise, give advice and instructions in medically acute conditions.

In Norway, a further development of the King County CBD was made in 1994 and put into use in 1995 (Norwegian Index to Emergency Medical Assistance, 1994). The Norwegian Index has been the basis for the current Swedish Index.

According to the ERC Guidelines (Resuscitation, Part 3, 2000), dispatchers should use medical dispatch protocols, including pre-arrival instructions for airway control, CPR, relief of foreign body airway obstruction and use of an automated external defibrillator (Becker et al 1993, Curka et al 1993).

Emergency medical dispatch in Sweden - current organisation

Function of the EMS dispatch centre

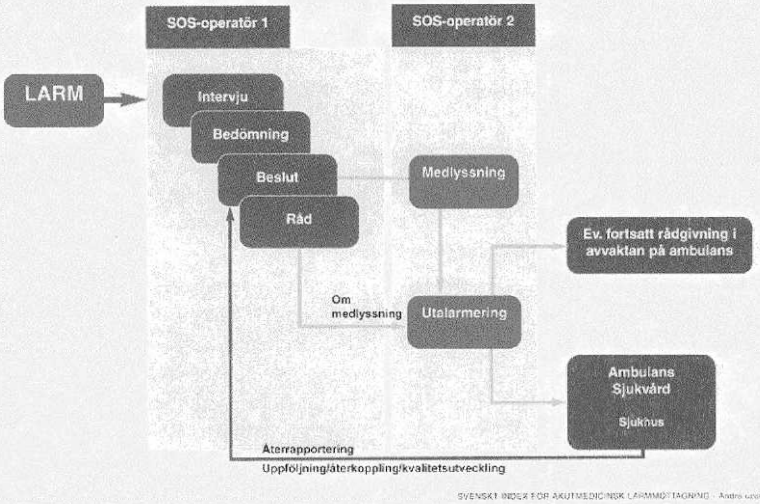
The function of the EMS dispatcher centre is to be the first medical response for calls to the national emergency number, 112. There are 20 dispatch centres distributed in Sweden, who are responsible in their catchment area for emergency medical dispatch of the following:

- Ambulance
- Fire service
- Police
- Poison info central
- Sea rescue
- Air rescue
- Mountain rescue
- On-call doctor

It is however, only emergency calls relevant to ambulance and fire services that are processed by the emergency medical dispatchers (EMD's). The remaining emergency calls, police and poison information centres, etc, are connected to the relevant departments.

The EMD's assignment

Phase 1: Identification phase; the identification phase where the dispatchers are required to define the need for assistance or not. When the emergency number 112 is answered, the caller describes the situation or requests, for example, a specific resource, i.e. ambulance, fire service or police. The caller that requests specific resource does not automatically receive the help requested, but must first describe the occurring events, following which the caller receives the desired help, either by being connected to the appropriate instance, directed or rejected. The automatic number-address presenter for the main line connected telephone, identifies the place from which the caller is ringing. This enables correct information regarding the address and place.



Phase 2: Priority phase; when the need for an ambulance has been determined, the urgency is defined based on the description of the event or symptoms.

Phase 3: Activation phase; dispatching of appropriate resources with regard to the urgency and type of event.

In a suspected life-threatening situation the receiving EMD connects the ambulance dispatcher to listen into the call. During this time the EMD who received the call continues the interview with the caller, and certifies the correct address and gives advice and instructions depending on the type of problem. The relevant information is forwarded to the selected EMS responders (Fig. 1).

The demands on this system are that the EMS responders are dispatched at the latest 45sec. after the emergency call has arrived at the EMS dispatch centre. During this time, the EMD must both interview the caller on **what** has happened and **where** the help is needed. The EMD is also required to obtain the relevant emergency plans and available resources.

Usually two EMDs co-operate were the tasks can be summarised as follows:

- interview caller
- determine level of priority
- dispatch and direct rescue units
- give advice and instructions were possible.

At the highest priority, acute life-threatening symptoms and accidents, the guide-lines in the EMS dispatch protocol say that the EMD should maintain contact with the caller until the situation is resolved or help has arrived (ambulance/physician). The EMD's should also maintain contact with the caller if the patient's condition deteriorates, i.e. in a suspicion of AMI or impaired consciousness.

Phases of EMS dispatch

The protocol for emergency medical dispatch is the EMD's standardised support. Emergency medical dispatch were medical decisions are made and measures taken, place very high demands on the EMD as a health-care provider. These assessments, advice, instructions and measures are made within the whole medical area. In addition the callers are often in a stressful situation, are mostly lay-people, and often not capable of communicating information correctly.

The Swedish protocol for emergency medical dispatch was implemented in 1997. It was based on guidelines developed and provided by the King County EMS, Seattle, USA, called "criteria-based dispatch" (Culley et al 1993; Culley et al 1994).

The protocol is organised as a systematic survey of queries placed to the caller, and based on the answeres received, the EMD decides the criteria for priority. The protocol contains 34 chapters dealing with diverse main complaints. Examples of the

complaints are; allergic reactions, breathing difficulties, unconsciousness, chest pain, diabetes, seizures, stroke, ophthalmic, traffic accidents or possible death (see appendix 1).

By using the first page in the protocol, all emergency calls start with:

- 1. What has happened?
- 2. Where is the patient/accident?
- 3. From where are you calling? (telephone number, address)

EMDs must as early as possible under the call determine:

- Is the patient awake and able to talk?
- Is the patient breathing normally?

For every main medical complaint there are questions one can place to the caller, enabling a criteria for being able to give the case priority, were advice and background facts help the EMD with medical information and facts.

A central part of the protocol are the guidelines for telephone instructions in CPR for adults and children.

When the patient is reported unresponsive, the EMD is guided by the protocol to the highest priority, and to any of the following instructions: "unconscious over the age of 8", "unconscious under the age of 8", "foreign body airway obstruction", or "possible death".

Instructions are formulated as a flowchart with a combination of questions and instructions to the caller that are formed after the answers the EMD receives.

With the support given by the EMD to the caller, he or she can be guided to start CPR awaiting the arrival of EMS responders.

Priority

Highest priority (1). *Acute life threatening conditions or accidents*
The nearest available EMS responders are dispatched. When the case is judged as an emergency by the EMDs, the EMS responders are dispatched with alacrity with lights and sirens to the scene.

Priority 2. *Acute but not life-threatening symptoms*
The nearest available EMS responders are dispatched. Not considered life threatening but includes clinical conditions and situations that require the immediate attention of a doctor (time indicative: EMS responders should be with the patients within 30 min.).

Priority 3. *Transportation*
Assignments were a reasonable time delay is not considered influential to the patient's medical condition. In this group are patients that are transported between respective health-care institutes and home.

For highest priority, acute life threatening situations, alarm ambulance, EMS responders and helicopter, the information should be forwarded by the EMD as soon as possible.

This information should include:

- Level of priority (1,2 or 3)
- Symptoms / events
- Address

The EMDs should also give information on:

- Condition of patient (conscious, somnolence, unconscious)
- Breathing (breathing normally, difficulties breathing)
- Patients age, gender, name
- Advice or instructions given by EMD
- Other EMS responders that were dispatched
- Security risk (i.e. dangerous goods, inflammable and explosion danger, chemicals etc)
- Helicopter landing plate, map co-ordinates
- Assigned meeting place
- Other information of importance for decision-making

The structure of the EMS dispatch centre
EMS dispatch centre in Göteborg serves 1.2 million inhabitants for emergency medical dispatch in a target area of Göteborgs community and two adjacent counties (16,536 square km) (Swedish Bureau of Statistics. 2002). Göteborg's EMS dispatch centre is staffed by 45 EMDs, of which 7 are on day duty and five during the night. The centre responds to the emergency number

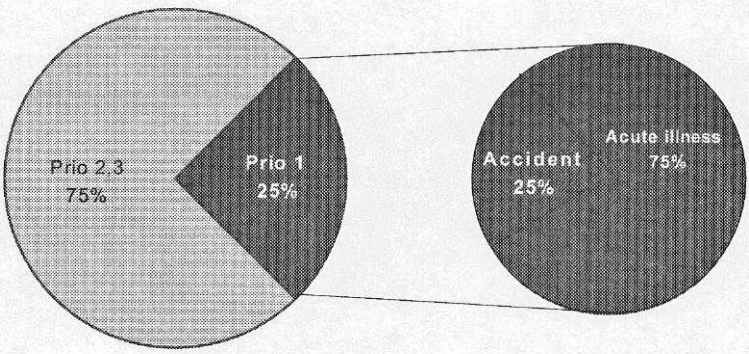
with 1500 in-coming calls/day, of which 7% constitutes medical emergency calls of the highest priority. The EMS dispatch centre in Göteborg is one of the countries 20, all of which are organised in an umbrella organisation (SOS Alarm), which is independent and self-controlling, separated from hospital and ambulance organisations. It is however, medically controlled by a national medical council, were the National Swedish Board of Health and Welfare is represented. Internationally, the EMS dispatch centres are organised in different ways, with varying degrees of integration with health services. For example, in Norway the EMS dispatch centres are integrated into the hospitals emergency departments and are manned by nurses (Steen-Hansen, 1995).

Distribution of levels of priority

The Swedish EMS dispatch centres receive annually 800 000 emergency medical calls of which 25% are seriously sick or injured (highest priority). In 20% of the assignments, the patient should be transported as soon as possible to the hospital (priority 2). The remaining 50% of assignments (priority 3) are classified as non-acute and need no extra care or supervision during transport.

Accidents are responsible for 20-25 percent of the highest priority assignments (priority 1), whilst acute illness is responsible for the remaining 75-80 percent. The most common cause of illness is acute chest pain, dyspnoea, impaired consciousness and/or seizures (Fig. 2).

Figure 2 Distribution of levels of priority.



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Experience in the handling of acute chest pain at the EMS dispatch centre

Patients having chest discomfort and calling the emergency medical number, constitute about 15% in one EMS system (Sramek et al. 1994) and only 2-7% in EMS systems where police assignments constitute a large proportion of all emergency calls (Palumbo et al 1996).

From a random sample of medical calls placed by citizens to the EMS dispatch centre in Amsterdam, calls with a cardiac origin occurred in approx. 21% among patients transported by ambulance and who could be evaluated (Koster 1995).

In the Follow-up Chest Pain study (FCP) in Göteborg, the aetiology among patients who called the EMS dispatch centre due to acute chest pain and were transported by ambulance to hospital (n=1445), was distributed as follows:
confirmed AMI (28%); confirmed or possible AMI or myocardial ischemia (69%); pulmonary embolism (1.3%); pericarditis (0.3%); pleuropneumonia (3.1%); gastritis (3.4%); hepatobiliary disease (1.0%); musculoskeletal symptoms (5.0%); psychogenic disorder (5.0%); other (3.1%), and uncertain (8.4%) (Herlitz et al. 2000).

The handling of acute chest pain/discomfort by the EMS dispatch centres is not, to a large extent, scientifically documented. However, a study by Sramek et al. evaluated the handling of potential cardiac emergency calls by dispatchers, and determined the final diagnosis and urgency and the ability of dispatchers to recognise non-urgent conditions. The possibility to retrospectively predict the seriousness with the main complaint: "chest discomfort" and "unconsciousness" was also assessed. Patients assessed and registered with these main complaint were judged to be urgent in 40% of all cases. Among 1071 patients, the majority of cases, the final diagnosis were cardiac 34% (including AMI and unstable angina of 15%), and in size order, neurological 10%, internal disorder 9%, pulmonary 5%, gastroenterological 5%, intoxication 3% and psychiatric 1%. The evaluation showed that cases identified by the EMDs as non-urgent were correct in 90%, whilst cases the EMD identified as urgent, were correct in 45% of cases. The accuracy was thus good in urgent cases, however, an over prioritisation occurred among non-urgent cases. The results may be seen as representative for those EMS dispatch centres manned by nurses, with no formal protocols (Sramek et al. 1994).

Aetiology

The aetiology of acute chest pain is varying. The different causes may be divided in life threatening and non life-threatening conditions.

Non life threatening conditions

Included in the non life-threatening conditions may be: musceloskeletal pain, psychiatric disorders/anxiety, oesophagitis, gastritis, peptic ulcers, pancreatitis, cholecystitis, pneumonia, pleuritis, cervical slipped disk and herpes zoster may be included in conditions non life threatening (Braunwald 2001).

Presentations of non life-threatening conditions

Patients with musculoskeletal pain often have a previous medical history with similar problems, especially back pain. The musculoskeletal pain is often varying with body movement and localised tenderness, often of cutaneous type. Patients with psychiatric disorders such as anxiety, depression and panic disorders may present with chest symptoms that can be difficult to assess. There is often a psychiatric medical history and alcohol abuse may be present. Somatic causes to the symptoms should however always be excluded. Pain from gastrointestinal disorders such as oesophagitis, gastritis, peptic ulcers, may cause chest pain or chest discomfort. A previous medical history including this is

often present. Other types of gastrointestinal disorders are pancreatitis, cholecystitis and liver disease, which also may give chest pain similar as in cardiac disease. Pneumonia may cause chest pain and if pleura is involved, pleuritis pain may be correlating to respiration (Task Force Report, 2002). Herpes zoster is often very painful, localised around the chest and initially without rash on the skin, which may lead to suspicion of a serious disease.

Life threatening conditions

Included in the life-threatening conditions may be: acute coronary syndrome (including unstable angina, non-Q wave AMI and Q-wave AMI), and other potential life-threatening conditions such as myocarditis, pericarditis, cardiomyopathy, pulmonary embolism, dissecting aortic aneurysm, aortic valvular disease and pneumothorax. The incidence of these diseases and conditions are varying and the Table 1 shows the distribution among Swedish citizens in terms of hospitalisation and death.

Presentation of life threatening conditions other than acute coronary syndrome

Pain from the myocardium is of a visceral type, which is the reason why conditions other than ischemic heart disease may shown a resemblance in presentation. These diseases are cardiomyopathy and myo-carditis, the pain, however, does not respond to nitrates and is posture and respiration correlated. Pulmonary embolism may also present with chest pain/discomfort, also being of visceral type. Patients with pulmonary embolism often have severe dyspnoea, a symptom that should lead to the highest priority at the EMS dispatch centre. Pneumothorax is most commonly seen in younger men, accompanied with chest pain of sudden onset and dyspnoea. Dissecting aortic aneurysm often shows with a severe "crushing" pain, diffusely localised over the chest or back (Task Force Report, 2002).

Table 1

Disease	Cause of death /100.000 inhabitants	Diagnosis among discharged alive /100.000 inhabitants
Acute myocardial infarction I21, I22	137	219
Acute myocardial ischemia I24, I20.0	1	83
Myocarditis I40, I41, I51.4	1	4
Pericarditis I30, I31, I32	0.23	10
Cardiomyopathy I25.0, I42, I43	4	15
Pulmonary embolism I26	9	39
Dissecting aortic aneurysm I71	14	17
Aortic valvular disease I35	6	24
Pneumothorax J93, S27.0	0.07	16

Patients in Sweden per 100.000 inhabitants that during 1999 either died (first column) or were discharged alive from hospital (second column) (The National Swedish Board of Health and Welfare, 1999) due to potential life-threatening disease that may present with acute chest pain (Herlitz et al. 2000).

Acute coronary syndrome

Efforts have been made to evaluate whether an accurate evaluation of the patient's symptoms would differentiate patients with AMI from patients with benign causes. If this was possible, it would be of help for the EMD in prioritising. Various aspects of the experience of symptoms have been studied; chest pain intensity, localisation, duration, verbal description, and presence of associated symptoms. These efforts have, to a large extent, been disappointing, with no clear distinctions being given. However, some of the results can serve as a frame of reference, where there is no other information, for example in the setting of an EMS dispatch centre.

Pathophysiology and medical therapy
The development of an AMI is a dynamic process whereby an imbalance between the supply and demand of oxygen and nutrition is the one of the main factors in the development of infarction. This development may proceed rapidly and minutes of time-delay to treatment may be fatal. It is often an occluding thrombus that stops the blood flow to an area in the myocardium. The main goals in the treatment of this condition is to dissolve the present thrombus, prevent the return or additional building of a new thrombus and to improve the imbalance between supply and demand on oxygen and nutrition. Medication that relieves the work of the heart and pain-relieving treatments are used for this purpose. The fact that studies have shown the importance of the time factor for a successful treatment, have resulted in the concepts: "time is saved heart muscle" and "the golden hour", which aims at optimal treatment. In summary, the EMDs initial assessment and priority is crucial for treatment to be optimal. A misjudgement of the EMD could, in the worst case-scenario, result in patient's death or in a disabling congestive heart failure due to major myocardial damage, that could otherwise have been prevented with treatment started earlier.

The treatment alternatives based on prior studies which are currently in use prior to arrival at the hospital, are: aspirin as thrombolytic therapy, betablockers which decreases the hearts metabolic rate, and morphine that relieve pain and decreases anxiety. Above all, thrombolytic therapy has, in large randomised studies, been shown to decrease mortality (ISIS-2).

In addition to the possibility of starting early treatment of the patient at the scene, the EMDs assessment is a critical link included in the delicate time frame for treatment started in hospital, such as percutaneous coronary intervention (PCI). A time-delay of more than 30 minutes means a higher risk for less successful treatment results for the patient.

Presentation of acute coronary syndrome
Acute coronary syndrome has a varying presentation, chest pain is however the most dominating symptom (80-90%) (Grijseels et al. 1995, Herlitz et al. 1992).

Pain characteristics and intensity
The ischemic chest pain is often described as an "oppression" or "uncomfortable feeling in the chest" (50%-60%) (Hartford et al. 1993; Lee et al. 1991), squeezing, burning or as a heavy weight over the chest (Logan et al. 1986, Hofgren et al. 1994). Among women (Peberdy et al. 1992) and elderly patients (Solomon et al.1989) and among patients with diabetes mellitus, the intensity of chest pain has been reported to be less intense and to have a shorter duration (Akyrou et al. 1995).

Patients interviewed after a cardiac event (AMI), have described their symptoms as being intermittent and varying, where the symptoms in many cases made the informants realise that they were not experiencing an episode from an acute illness but an evolving and cumulative event (Ruston et al. 1998).

In a selected group of patients admitted to the coronary care unit (CCU), patients self-assessed initial intensity of chest pain at home was registered and the difference between patients developing an AMI and those who did not, was surprisingly low (Herlitz et al. 1986).

Many patients with acute coronary syndrome have atypical symptoms, where as many as 25% do not have chest pain. On the other hand, among those who are admitted to hospital with a suspicion of AMI, the final diagnosis confirms that in 60% the patient did not have AMI or unstable angina (Pope et al. 1998).

Verbal description: The sensory and emotional components

In another study from Göteborg with a selected group of patients admitted to the CCU (n=94) with suspected AMI, a comparison of the patient's description of chest pain was made between those who did or did not develop AMI using a Pain-O-Meter (POM) and the Visual Analogue Scale (VAS). AMI patients reported more intense sensory and affective pain than non-AMI patients. It was observed that the AMI patients used the word "squeezing" (sensory component) and "troublesome", "tiring", "frightening" and "worried" (emotional component), significantly more frequently than did non-AMI patients. The AMI patients seemed to differ by having a higher emotional component in their pain, which was explained in terms of the fact that anxiety has been shown to be associated with an intense pain experience (Gaston-Johansson et al. 1991).

A larger study of similar design with 889 consecutive patients admitted to the CCU for suspected AMI, showed that intensity of pain varies from very vague to unbearable both among patients with and without AMI. The use of specific word descriptors to separate these two groups was not supported by this study. However, patients with AMI more frequently used stronger words to describe their pain such as "tearing" (sensory), terrifying and intolerable (affective) (Hofgren et al. 1994).

Localisation and radiation

The ischemic pain is usually localised substernal in the chest (Lee et al. 1991). Patients often localise the pain as over the whole chest area rather than at one point (Everts et al. 1996). The pain can also be localised in the upper abdomen and, more seldom as an isolated pain in the neck, jaw or arm and shoulder. It has been observed that AMI patients have reported pain on the right side of the chest and to the right arm significantly more often than the non-cardiac patients. Such differences were not found in other parts of the chest wall (Baunderman et al. 1990, Everts et al. 1996).

Radiation of pain to the right or left arm, to the neck, jaw and back is common in AMI, but also in stable and unstable angina (Hartford et al. 1993, Everts et al. 1996). However, a study of 903 consecutive patients admitted to CCU, showed that patients with a confirmed AMI reported pain in both arms more frequently than patients without AMI (Everts et al. 1996). Another study including 268 chest pain patients concluded that chest pain with a wide radiation involving the right arm strongly suggests that AMI is ongoing (among the 51 patients with right arm involvement, 41 had AMI) (Berger et al. 1990).

Women with AMI have reported pain in the back and neck (Everts et al. 1996, Mieschke et al. 1998) and in the jaws (Goldberg et al. 1998) more often than men.

Duration and frequency

Stable angina pectoris is often started after physical effort or psychological stress, chill factor, wind, or after meal. However, the symptoms mostly disappeare after a few minutes rest, and have a duration seldom longer than 5-15 minutes. With a longer duration, AMI or other causes should be suspected. Nitro-glycerine relieves pain in stable coronary heart disease, whilst in the unstable, acute coronary syndrome, there is only partial or temporary relief.

Unstable angina is defined as a newly appeared and severe angina, possibly with pain in rest or rapidly increased intensity and frequency of pain in a patient previously having a stable angina.

In the acute coronary syndrome, symptoms are similar to those in stable angina pectoris with regards to character, localisation and radiation of pain. However, the symptoms in the acute coronary syndrome are more intense and have a longer duration, usually more than 30 minutes. It is also more often

accompanied by nausea and sweating (Grijseels et al. 1995, Lee 1991).

In continuous chest pain/discomfort of more than 15 minutes, AMI should be suspected. In a study of patients admitted to the emergency ward with, among other indications, chest pain, a sudden onset of pain, and a duration of pain for more than 60 minutes, were events that were more sensitive for distinguishing AMI from other conditions (Berger et al. 1990).

Associated symptoms

Symptoms from the autonomic nervous system such as cold sweat, anxiety, nausea and vomiting are common in the acute coronary syndrome (Grijseels et al. 1995; Hartford et al. 1993; Hofgren et al. 1994). The associated symptoms of nausea, vomiting and dyspnoea are more frequent in woman with AMI and cold sweat is more common in men (Mieschke et al. 1998, Goldberg et al. 1998).

Previous medical history

Among patients transported by ambulance due to chest pain, 30% have been reported as having a previous history of AMI, and nearly half angina pectoris, 1 out of 5 heart failure and 1 out of 10 diabetes mellitus (Herlitz et al. 2000).

A previous history of angina pectoris, AMI and coronary artery bypass surgery or PCI and diabetes should be taken seriously as there is a likelihood for these patients that chest pain is being caused by an acute coronary syndrome (Pope et al. 1998, Grijseels, 1995).

Patients calling the EMS dispatch centre for chest pain compared to patients arriving by own transportation

Only 1/3 of patients with suspected AMI in the ED calls the EMS dispatch centre and are transported by ambulance (Herlitz et al. 2000).

Patients who call the EMS dispatch centre due to chest pain and subsequently are transported by ambulance, have in studies been shown to be older, and having a higher prevalence of previous AMI, angina pectoris, hypertension, diabetes mellitus and congestive heart failure, larger infarct sizes and higher mortality than those patients self-transporting to hospital. Patients transported by ambulance have been reported to more frequently develop AMI (28% vs. 11%) and an acute coronary syndrome (68% vs. 38%) as compared with patients transported by other means (Herlitz et al. 1987; Herlitz et al. 2000; Becker et al. 1996).

Based on the high risk pattern for patients with chest pain who calls the EMS dispatch centre, it is an alarming sign per se when patients or their relatives decide to call for an ambulance, a situation of which the EMD should be made aware.

In Göteborg, among patients being hospitalised due to suspected AMI, 2/3 are transported by ambulance but only 43% by an ALS response and a subsequent 57% with BLS response (Herlitz et al. 1992) .

Subsequently, it is of great interest to evaluate how EMDs handle these cases with regard to assessment and priority.

Patient delay and denial

The delay time for patients with AMI from symptom onset to admission to hospital represents the larger part of the delay time to treatment (GISSI 1995, Schmidt et al. 1990). Slow symptom progression, low income, female gender and advanced age are shown as predictors of pre-hospital delay time >6 hours (Schmidt et al. 1990). Other psychological factors such as interpretation, perception, denial, clinical status, self-treatment and knowledge are possibly associated with delay time as well.

Denial is a common reaction among AMI patients (Hartford et al. 1993, Schmidt et al. 1990, Hacket et al. 1969), and it is of significance for the EMD to be aware of the patient's denial in their interviews. This is also due to the fact that the majority of

patients with AMI are experiencing their first AMI (approx. 2/3) (Herlitz et al. 2000), and thus may have greater difficulties interpreting their symptoms (Hackett et al 1969; Schmidt et al 1990).

Ruston et al. divided patients according to delay in seeking medical help for a cardiac event into non-delayers, delayers and extended delayers. Non-delayers had knowledge of a wider range of symptoms before their heart attack and twice as many considered themselves to be potentially at risk for a heart attack compared with the other two groups. Patients with a previous history of AMI, and strong intensity of symptoms were influenced to seek health care earlier (Ruston et al. 1998).

Priority of chest pain by the EMS dispatch centre (Sweden)
At the time of the studies presented in papers I and II, the following criteria for priority was used:

Highest priority (1): Dispatch of ALS and BLS response

- Ongoing severe chest pain with or without associated symptoms (cold sweat, nausea, vertigo, dyspnoea, syncope)
- Ongoing vague chest pain with associated symptom
- Chest pain that yielded <15 minutes before the call but the patients still having associated symptom

Highest priority (1): Dispatch of BLS response

- Ongoing vague chest pain without associated symptoms

Urgent, but no suspicion of life threatening condition (2): Dispatch of BLS response

- Acute but not life-threatening symptoms
- Vague chest pain without associated symptom in another health care setting such as general practitioners clinic

From the year 2002 there are new criteria for EMS dispatch (See appendix).

Priority of chest pain by the EMS dispatch centre *(internationally)*
The Task Force on the Management of Chest Pain, and the European Society of Cardiology recommend directly sending an ambulance when the following conditions are present:

- Severe discomfort (either pain, heavy feeling, difficulty breathing) lasting more than 15 minutes and still present while the call is made.
- Pain location anywhere in the chest, possibly including neck, arms, back, high abdomen.
- Symptoms may or may not be associated with sweating, nausea and vomiting.

Factors favouring a fast track decision:

- Age over 30, either gender
- Discomfort similar to previously known angina or previous heart attack
- Discomfort, including in the right arm
- Intermittent loss of consciousness (Task Force Report,. 2002).

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Epidemiology and aetiology

In cardiac arrest, circulation ceases and vital organs are deprived of oxygen. The following cardiac rhythms could be the cause: ventricular fibrillation (VF), ventricular tachycardia (VT), asystole or pulseless electrical activity (PEA). The aetiology behind cardiac arrest composes of a variety of causes such as AMI, acute myocardial ischemia, primary arrhythmia, respiratory disease, trauma, intoxication, drowning etc. Of these, the most common is cardiac disease (Holmberg et al. 1998, Kuisma et al. 1997).

The reported incidence of cardiac arrest outside hospital in two large population-based studies ranged from 33 (Scotland) to 107 (Chicago) per 100.000 inhabitants (Sedgewick et al. 1993, Becker et al. 1991). In Sweden, the incidence of out-of-hospital cardiac arrests in which resuscitation is started is estimated to be 57/100,000, where 70% are witnessed and 30% receive bystander CPR. The incidence of VF/VT is 40% and the survival rate in all patients is approximately 5%, and 10% among those presenting VF/VT as first recorded arrhythmia (Holmberg et al. 1998).

Table 2

Cause	Holmberg et al. 1998 n	Holmberg et al. 1998 %	Kuisma et al. 1997 n	Kuisma et al. 1997 %
Suffocation	108	**1.0**	14	**5.1**
SIDS	89	**0.8**	5	**1.8**
Drowning	109	**1.0**	22	**7.8**
Suicide	120	**1.1**		
Lung disease	325	**2.9**		
Trauma	190	**1.7**	62	**22.5**
Drug overdose	169	**1.5**	31	**11.2**
Heart disease	7382	**67.1**	533	**65.9**
Non-traumatic bleeding			36	**13.0**
Asthma			8	**3.0**
Pulmonary embolism			18	**6.5**
Malignancy			16	**5.8**
Intracranial processes			14	**5.1**
Pneumonia			12	**4.4**
Hanging			11	**4.0**
Convulsions			5	**1.8**
Carbon monoxide intoxication			5	**1.8**
Haemorrhagic pancreatitis			4	**1.5**
Sepsis			2	**0.7**
Other	2515	**22.9**	11	**4.0**

Heart disease is causative for about 2/3 of all sudden cardiac deaths outside hospital (Kuisma et al. 1997, Holmberg et al. 1998).

A detailed description of the aetiology of out-of-hospital cardiac arrest is presented above in Table 2. As described by the Swedish National Cardiac Arrest Registry, where 10,966 patients were analysed during the time period from 1990 to 1995 (Holmberg et al. 1998), and from the middle-sized urban city of Helsinki which included 809 patients during a two-year period, 1994-1995 (Kuisma et al. 1997).

Agonal respirations in cardiac arrest

Spontaneous inadequate breathing (agonal respirations) may occur early in the cardiac arrest and should not be confused with effective respirations (Clark et al 1991). Presence of agonal breathing presents a difficulty for the identification of a suspected cardiac arrest and, in one report of EMD-processed cardiac arrest calls, caller failed in 25% to recognise cardiac arrest due to agonal respirations (Overton et al. 1997).

In sudden cardiac arrest, blood flow to the brain will stop, the person collapses and become unresponsive. The respiratory centres of the brain can, however, still be active for several minutes. These centres in the brain stimulate respiratory movements, so called agonal respirations. These are: abnormal gasping, jerking respirations that produces movement of the thoracic, neck and mouth. Several studies clearly suggest that presence of agonal respirations in patients with cardiac arrest may have an increased potential of survival than those without (Mullie et al. 1989, Clark et al. 1991, Martens et al. 1995). The type of respiration in cardiac arrest has not been frequently reported, although this parameter seems significantly related to outcome.

The term "agonal" is defined in the medical dictionary as "pertaining to, or occurring at the time just before death" (Dorland's Illustrated Medical Dictionary, 2000) or "relating to the process of dying or the moment of death, so called because of the erroneous notion that dying is a painful process" (Stedmans Medical Dictionary, 2000). Thus, they do not define agonal in conjunction with respirations.

According to Braunwalds textbook of cardiovascular medicine, it mentions agonal breathing as follows; "absence of respiratory efforts, or the presence of agonal respiratory efforts, in conjunction with an absent pulse, is diagnostic of cardiac arrest; however, respiratory efforts can persist for a minute or more after the onset of the arrest" (Braunwald, 2001).

Clark et al. reviewed 445 emergency calls concerning patients with non-traumatic, out-of-hospital cardiac arrest in King County, Washington, aimed at discovering the frequency of agonal respirations in cardiac arrest calls, the way callers described them and discharge rates associated with agonal breathing. The study revealed that agonal respirations occurred among 55% of the witnessed cases, and among 40% of the whole population. More important was the observation that agonal respiration was associated with a significantly higher survival rate (27%), when compared with patients without agonal activity (9%) (Clark et al. 1991). Descriptions of agonal activity were: the patient was said to be barely breathing, heavy or laboured breathing, problematic breathing, noisy, gasping, snorting, gurgling, moaning and groaning breathing.

Mullie et al. reported gasping for 46% of in-hospital cardiac arrest patients and only 17% for out-of-hospital cardiac arrest patients. In the out-of-hospital setting, gasping was significantly related to outcome where the gasping patients survived in 20% and the patients in respiratory arrest, in 5% (Mullie et al. 1989).

Martens et al. analytically produced and validated a simple clinical algorithm for acute decision-making during CPR based on over 2000 consecutive patients of out-of-

hospital cardiac arrest. They concluded that simultaneous and persistent absence of VF, gasping and light-reactive pupils after arrival of the second tier, was strongly associated with a poor outcome (Martens et al. 1995).

Experimental animal models have shown a high incidence of agonal breathing in cardiac arrest. Menegazzi et al. included 12 porcine models where ventricular fibrillation (VF) was induced and left untreated for 8 minutes. All 12 had agonal respirations through the first two minutes, 11 even at 3 min., five at 4 minutes and two at 7 minutes. Many of the animals had supranormal tidal volumes and near-normal minute ventilations (Menegazzi et al. 1995). Berg et al. also used a swine model inducing VF for five minutes. Swine were randomly assigned to 8 minutes of ventilation plus chest compressions (CC+V) or chest compressions only (CC) or no CPR (controls). Fifteen of the 26 animals had active gasping or agonal respirations during CPR, but none gasped before CC was given. Eight of the 10 CC+V animals, 7 of the 10 CC animals and none of the controls gasped (Berg et al. 1997).

EMDs have to be trained to differentiate between adequate versus inadequate breathing and to proceed without delay in offering the dispatcher-assisted CPR instruction to patients reported unconscious with inadequate breathing.

The problem of agonal respirations in delaying recognition of cardiac arrest and the subsequent onset of chest compressions, should be taught in CPR-courses for lay rescuers.

Respiratory arrest

Absence of respiratory efforts with persistence of a pulse suggests a primary respiratory arrest that will lead to cardiac arrest in a short time. There are a variety of causes of respiratory arrest, including near-drowning, stroke, obstructive lung disease, foreign-body airway obstruction, inhalation of gas, epiglottis, drug overdose, electrocution, suffocation, injuries, lightning strike and coma from any cause. In the case of primary respiratory arrest, the heart and the lungs can continue to provide oxygen to blood for several minutes, and oxygenation of brain and other vital organs can occur. During respiratory arrest or inadequate spontaneous respirations, the establishment of a patent airway and rescue breathing can maintain oxygenation and prevent a cardiac arrest (Braunwald, 2001).

The chain of survival

A series of components are recognised as the "consensus model" and give the strongest recommendation for saving more people from out-of hospital cardiac arrest, called the "Chain of Survival" (Cummins et al. 1991, Cummins et al. 1997). The critical links included are: 1) early access, 2) early CPR, 3) early defibrillation and 4) early advanced care. It has been revealed in studies that an interval from collapse to CPR of 5 minutes combined with an interval from collapse to defibrillation of 10 minutes, are interventions making the most difference in survival (Cummins et al. 1985, Larsen et al 1993, Valenzuela et al. 1997). The first link, early access, encompasses the events from collapse to the EMS-arrival and their preparation for provision of care. Included in the first link are: (International Guidelines, Part 12, 2000)

- Recognition of early warning signs (chest pain, shortness of breath)
- Early identification of patient's collapse by someone who activates the EMS system
- Rapid determination of the nature of problem by the EMDs
- Rapid identification of the nearest appropriate EMS responder unit
- Rapid dispatch of the unit to the scene, <1 minute on average
- Rapid recognition by EMDs of a potential cardiac arrest
- Rapid provision of critical information to EMS responders about the type of the emergency and location

- Rapid arrival of the EMS responders with all necessary equipment to the patients side
- Rapid identification of a cardiac arrest by the EMS responders

The second link, early CPR, is shown to double the probability of survival when initiated by bystander before EMS arrival (Larsen et al. 1993, Holmberg et al. 2000).

Bystander CPR and Community-wide programs for CPR training

To achieve the goal of an early start of CPR (within five minutes), community-wide programmes are recommended for citizens (1992 ERC Conference), including schools, military bases, work sites and public buildings, among others.

In Sweden, educational programmes in CPR for laypersons were started in 1983, based on the American Heart Associations guidelines. The programme was revised in 1987 and again in 1993, according to guidelines from the European Resuscitation Council (Anon. 1992). This educational programme has emerged through the principle of cascade and 1.5 million Swedish citizens have been trained in BLS-rescue. Based on monitoring of CPR training, it is estimated that, during a period of 12 years (1983-1995), 15-20% of the Swedish population had been trained in CPR (Holmberg 2000). In Göteborg specifically, approx. 111.000 inhabitants (24% of the entire population) have been trained in basic life support during the past five years (1997-2001) (CPR Working Group of the Swedish Society of Cardiology, 2002), The Swedish Red Cross, 2002.) A continuous community effort is, however, needed to increase the spread of this knowledge and make it a mandatory basic skill for citizens.

It has, however, been acknowledged in studies that skill-retention is poor among participants in the traditional CPR-training courses (Brennan et al. 1995). Skill acquisition and skill retention are issues for further development and research. There have been reports describing a simplified curriculum and "practice-while-watching" videos have shown good results (Braslow et al. 2000, Batcheller et al. 2000).

Studies of staged teaching for basic life support training are currently being developed and evaluated (Assar et al. 1998, Assar et al. 2000). Three stages specifically have been designated, the first, bronze; including alarming, opening of the airway, look for signs of life (breathing, coughing, movements) and 50 chest compressions and controlling of open airway. The second, silver stage, adding ventilation in a ratio of compressions to breaths of 50:5, and the third stage is a conversion to conventional CPR. In a randomised-controlled trial of 495 trainees, performance was compared in tests immediately after instruction of those who had received a conventional course and of those who had had the simple bronze level tuition. The biggest difference related to the mean delay to first compression being 63 sec. for the gold group and 34 sec. for the bronze group, and the number of chest compressions where the gold group performed 39 chest compressions/minute, compared to 84 compressions/minute in the bronze group. This was regarded by the authors as having implications on circulation since blood flow in the vessels is built up during several compressions and reaches a plateau of pressure relatively slowly. The bronze stage resulting in longer chest compression sequences, might produce more effective compressions (Assar et al. 2000).

Adult Basic Life Support

Adult Basic Life Support includes:

- Prompt recognition and action for myocardial infarction and stroke to prevent respiratory and cardiac arrest
- Rescue breathing for victims of respiratory arrest
- Chest compressions and rescue breathing for victims of cardio-pulmonary arrest (International Guidelines, Part 3, 2000).

Major International Guideline's changes from the year 2000 are among others:

- Pulse check; lay rescuers should no longer be taught or expected to perform a pulse check.
- The absences of signs of circulation (normal breathing, coughing or movement) are the signal for lay rescuers to begin chest compressions.
- Chest compressions; the rate for adult CPR is approx. 100 per minute and the compression-ventilation ratio for 1-and 2 rescuer-CPR is 15 compressions to 2 ventilations.
- Chest compressions-only CPR is recommended for use in dispatcher-assisted CPR or when the bystander is unwilling or unable to perform mouth-to-mouth rescue breathing.

EMD life support

A critical measure of effective, emergency medical dispatch, is a short time interval from the incoming emergency call until the time the ambulance response are dispatched, which are recommended to be no more than one minute (Becker et al. 1993). When the medical dispatchers have collected information that leads to a suspicion of cardiac arrest, the EMD should offer and give pre-arrival instructions to the caller on how to perform bystander CPR until the EMS responders arrive. This method of dispatcher-assisted bystander CPR has been shown to be feasible and effective (Rea et al. 2001, Clark et al. 1994). EMD life support has rapidly become the standard of care in many EMS systems (Becker et al. 1993, Zachariah et al. 1995). EMDs provide the first link between the patient and bystanders and EMS personnel. Trained EMDs may provide pre-arrival instructions to bystanders using standard, medically approved telephone instructions (Curka et al. 1993). This dispatcher-directed program can thus complement the community CPR training efforts.

EMDs identification and accuracy in determining cardiac arrest

In an EMS system with a high frequency of EMD life support, cases in which the EMDs initially suspected cardiac arrest in the absence of a true cardiac arrest, is reported to be 20% (260/1296) (Hallstrom et al. 2000). Most of these were attributed to stroke or transient ischemic attack (24%), seizures (21%) or syncope (21%). However, in only 14 (of 260) patients were CPR instructions started, and completed in 7. The remaining suspected cases were discovered during the process of getting the patient down onto the floor which resulted in additional information that allowed the dispatcher to realise the mistake. Inadequacy of the protocol was responsible for 91% of the non-arrests being judged as cardiac arrests, whereas dispatcher-error was responsible for 70% of all cardiac arrests that were judged as non-arrests. In the same study, a relatively large proportion of patients, 21% (266/1296), received no advanced cardiac life support on ambulance arrival, mostly because it was considered futile.

Chest compressions-only CPR

International Guidelines 2000 for CPR and Emergency Cardiovascular Care recommend chest-compression-only for use in dispatcher-assisted CPR instructions to untrained bystanders (International Guidelines, Part 3, 2000). However, this should only be applied on adult patients and is recommended for EMS systems with rapid response times (Pepe et al. 2001).

The background to this decision is the disadvantages and possible adverse effects of mouth-to-mouth ventilation. The disadvantages consists of reluctancy and difficulties in performing mouth-to-mouth ventilation (Locke et al. 1995), since it is a complex psychomotor skill (Brennan et al. 1995). Furthermore, the mouth-to-mouth component of CPR may have adverse effects, such as promoting gastric insufflation (Ruben et al. 1961) and decreasing the percentages of time allocated

to effective chest compressions (Wenzel et al. 1994).

Experimental studies on animals have shown that assisted ventilation may not be crucial during the first minutes after cardiac arrest with VF, if adequate chest compressions are given. In a comparison of simulated mouth-to-mouth ventilation plus chest compressions (CC+V), chest compressions only (CC) or no CPR (controls), no difference was seen between the groups with or without ventilation when chest compressions were given. Both these groups tended to have better survival than do those receiving no CPR (Berg et al. 1997).
In another study, swine underwent 6 minutes of untreated VF, followed by 10 minutes of chest compressions plus assisted ventilation with 85% oxygen versus chest compressions without assisted ventilation. The non-ventilated animals were paralysed to prevent gasping and its effect on total ventilation. Return of spontaneous circulation was achieved in 9 of 12 (75%) ventilated animals versus only 1 of 12 (8%) non-ventilated animals (Idris et al. 1994). The investigators suggest that ventilation can be withheld when chest compressions are initiated promptly after cardiac arrest, but with prolonged arrest intervals beyond 6 minutes, supplemental oxygenation and assisted ventilation is probably a critical determinant of CPR success.

Even though physiological studies are informative, it is the long-term survival for patients that needs to be evaluated.

"The Belgian Resuscitation Group" evaluated prospectively 3053 patients with cardiac arrest outside hospital. Ambulance physicians assessed quality of bystander CPR and whether chest compressions and ventilation were performed. The long-term survival among the good quality chest compressions only CPR, and the patient group receiving traditional CPR of good quality, did not differ (15% and 16%, respectively). Conclusions drawn from these observations should be limited to adult patients with witnessed VF (Van Hoeyveghen et al. 1993).

Other sources of ventilation during CPR include compression-induced ventilation and spontaneous gasping (or agonal breathing) (Berg RA et al 1995, Berg et al. 1997), where several investigations have established that spontaneous gasping occurs frequently, early and during CPR and is associated with a better outcome (Berg et al. 1997, Clark et al. 1991).

Several studies have shown that survival is correlated with coronary perfusion pressure, but no studies of cardiac arrest with VF have shown a better outcome with early ventilation (Kern et al. 1992).

In a randomised trial of dispatcher-assisted CPR, there was one intervention arm where callers received instructions for chest compressions only, and the control arm where callers received standard instructions for CPR with mouth-to-mouth ventilation and chest compression. Of the 241 patients in the chest compression-only group, 14.6% survived compared with 10.4% of the 279 patients in the control arm (Hallstrom et al. 2000).

In this single study of dispatcher-assisted bystander CPR from Seattle, chest compression-only CPR was thus associated with the survival equivalent of chest compression plus ventilation. For witnesses untrained in CPR or unwilling to perform mouth-to-mouth ventilation, current guidelines for dispatcher-assisted bystander CPR endorses the importance of starting chest compressions alone. To provide chest compressions is much better than not starting any resuscitation at all (International Guidelines, Part 3, 2000).

The time interval from collapse to arrival of first EMS response is crucial if instructions for chest compressions only are given to the witness. In this Seattle study, the median response time is extremely short, 4 minutes (Hallstrom et al. 2000). In Sweden this

interval is 2-3 times longer, 6-13 minutes (Herlitz J, et al 2000, Holmberg et al. 1998), which is an unfavourable factor for the omission of mouth-to-mouth ventilation.

Caller's reactions, emotional content and ability to co-operate

A layperson witnessing a cardiac arrest, has most certainly no previous experience of medical emergencies, does not know what to observe and has a limited vocabulary for describing the situation accurately. Some witnesses are probably eager to see signs of life, and in cases of agonal breathing, the witness will report that the patient is breathing. It is a challenge for the EMDs to meet the actual needs of patients reported unconscious, not breathing normally.

Studies showing witnesses that are psychologically susceptible towards interviews, instructions and performing, compared the emotional content of callers in both cardiac arrest and non-cardiac arrest calls (n=516), where 65% were calm in the cardiac arrest calls, compared to 90% in non-cardiac arrest cases (Eisenberg et al. 1986).

Culley et al. (1991) described a delay of CPR-instruction in relatively few cases of cardiac arrest as being caused by a distraught (11%) or hysterical (9%) witness. Meron et al. (1996) described, after reviewing 114 tape recordings of out-of-hospital cardiac arrest, that 77% of witnesses were calm which the authors considered a necessary condition for attempting dispatcher-assisted bystander CPR.

Clawson et al. (2001) reported on a study of 6000 cases from two communication centres, where they measured emergency callers content and co-operation. The mean score of emergency callers was extremely low, regardless of the caller party, type of call, the time of day or the geographical location using the Emotional Content and Co-operation Score (ECCS, see: Methods). A significant difference was, however, shown between suspected cardiac arrest calls and non-arrest calls. In a prospective study of emergency medical calls with main complaints of chest pain or unconsciousness, the degree of panic in the callers voice was evaluated among 800 included cases, whereby in most calls (82%), the callers voice was normal and conversational (Sramek et al. 1994).

Altogether, this seems to show that the vast majority of cardiac arrest witnesses are calm, which can be crucial for co-operation between caller and EMD.

History of Dispatcher-assisted cardio-pulmonary resuscitation

In 1974, in Phoenix, Arizona, a paramedic, who just happened to be in dispatch at the time, gave unplanned and unscripted instructions to the mother of a non-breathing baby. The child survived and the dispatch centre began routinely to offer such pre-arrival instructions. This programme was known as "medical self help" and used no formal dispatch protocols. This event was widespread, and in the early 1980s, a number of places throughout the United States, including Aurora, Colorado, King County, Washington, and Salt Lake City, Utah, began using pre-scripted instructions for major problems such as cardiac arrest, choking and childbirth (Zachariah et al. 1995).

Overview of significant studies of dispatcher-assisted CPR

The following selection of studies have influenced the development of dispatcher-assisted bystander CPR from the start of the late seventies until today.

1984

An early description of experiences from dispatcher-assisted bystander CPR, was made by King County, Washington, USA. Having the objective of implementing a short, safe and effective CPR instruction, expert's opinions from cardiologists, anaesthesiologists, paramedics and dispatchers were gathered in the preparations.

A study of mock rescue scenarios was performed and the participants in the study were laymen, both with and without previous life support training, who were confronted with the situation of having encountered a collapsed person (manikin), and were asked to call a special emergency number. When calling, they received telephone instructions in CPR. CPR performance of volunteers without formal CPR training was comparable to the performance of individuals who have received formal training. The specific words in the scripted instruction directly determined adequacy of performance and resulted in a significantly better CPR performance than did impromptu_instruction by the EMD. The volunteers receiving instructions according to the fixed protocol, performed more CPR-cycles, received higher quality scores, asked fewer questions and came back unnecessarily more seldom and seemed less distraught than in the impromptu-instruction group. A clear and thorough standard for telephone instruction in CPR was therefore considered necessary. These study results led to an implementation of the concept of dispatcher-assisted bystander CPR in all dispatch centres in USA (Carter et al. 1984).

1985

To evaluate the written telephone CPR instruction in King County, a follow up of patients with cardiac arrest outside hospital due to underlying cardiac disease was performed. The twenty months before and after the implementation were studied and bystander-CPR increased from 45% to 56% after the introduction of the programme. Among all cardiac arrests, the dispatchers offered instruction in 38%. The reasons for not offering were communication errors (19%), which usually were caused by inability of the caller or dispatcher to differentiate normal breathing from agonal breathing. Dispatcher errors (13%), included misunderstanding or misinterpretation of the caller's responses or lack of compliance to the protocol. Other reasons (30%) included that the patient was too far from the telephone or that the dispatcher was newly employed and not trained in the programme. Of callers who were offered telephone CPR instruction, 59% accepted such an offer. Those who did not accept, consisted of those who already knew CPR (10%), refused (22%), or declined due to the fact that they heard the ambulance coming (6%). Refusal was associated with advanced age or poor health. Among those that accepted the offer, a high proportion performed the complete CPR instruction (71%). In the before period with spontaneous, impromptu CPR instructions, 1/17 patients survived (6%). In the after period where there was a standardised message and training program, there were 12 survivors among 58 cases (21%).

The program appeared to be safe since there were a low proportion of subjects with broken ribs, flail chest and pneumothorax. Fifty-five of 58 callers that had performed dispatcher-assisted CPR, were interviewed and they all stated that they were glad to have been able to perform CPR, 89% thought the instruction was very understandable and 84% thought the program was an excellent idea (Eisenberg et al. 1985).

1986

The King County group wanted to identify features of probable cardiac arrest calls. A review was performed of the content of cardiac arrest and non-cardiac arrest calls, to identify the factors that hinder, respectively increase rapid identification of a probable cardiac arrest. The most usual place of arrest was at home (79%) and the caller was mostly a close relative (73%). The results point out that it is a mistake to rely on the caller's ability to identify the problem. Instead, it is important to help the dispatcher determine whether or not to suspect a cardiac arrest. The data suggested that when the patient is over 50 years old and the caller is emotionally upset, there is a high possibility of a cardiac arrest. This scenario should therefore directly lead the dispatcher to ask questions of responsiveness and

breathing, after address, age and telephone number (Eisenberg et al. 1986).

1989

In a study report from Memphis, USA, using a recording manikin in a simulated cardiac arrest scenario, volunteers were divided into three groups; persons without any CPR experience that were given CPR instructions (A, n=65), persons that had CPR experience and that were given CPR instructions (B, n=43), and persons with previous CPR experience but who did not receive CPR instruction (C, n=43). It was found that the previously untrained volunteers of group A performed CPR of an overall quality comparable to that performed by previously trained members of group C. Group A performed chest compressions significantly better than group C, but had greater problems performing effective ventilations. The group B that previously were trained when they received the instruction, showed a CPR performance superior to that achieved by both groups A and C (Kellermann et al. 1989).

1991

King County reports on a study aiming at determine the frequency of bystander CPR before and after implementation of a telephone CPR programme, determine the reasons for delays of identification of cardiac arrest by the dispatchers, and to deliver CPR instruction over the telephone, and to suggest a time standard for delivery of the instruction. The rate of bystander-HLR increased from 32% in the before period, to 54% in the after-period. The survival remained, however, unchanged during both periods, 32% respective 33%. For 267 cases of cardiac arrest outside hospital, the median time for dispatchers to identify the problem was 75 seconds and the total time for the entire message was 2-3 minutes. This was considered reasonable as a time standard. Dispatcher-caused delay occurred when unnecessary questions were raised (57%), the question "breathing normally" was omitted (21%), and deviation from the protocol (22%). Delay due to the caller not being near the patient (29%), left the telephone (14%), being distraught (11%) or hysterical (9%). Time delay to identification and intervention by the dispatchers was mainly due to unnecessary questions. Examples of these were: "How old is the patient?" (more than once), "Any history of medical problems?", "What is the patient experiencing?", "Has the patient been ill recently?", "Is patient taking any medication?", "Does the patient have a pulse?" or "Do you think patient is having a heart attack?". These questions were judged as "fillers", used when the dispatcher was indecisive. According to the review, these questions often occurred when the dispatcher reached a decision point and was hesitant to move forward with instructions (Culley et al. 1991).

1991

During regular review of cardiac arrest calls in King County, cases were encountered where callers described that the patient was breathing. The presence of some kind of breathing caused confusion for the dispatchers in their attempts to identify cardiac arrest. A study was therefore initiated to determine the frequency of agonal breathing among 445 non-traumatic cardiac arrests and the ways callers described them. The study showed a high incidence of agonal breathing among cardiac arrest patients outside hospital. Any attempt of breathing was described by the caller in 40%, it could be heard over the telephone in 13% and it was noted in the ambulance chart in 1/3 of all cases. Among witnessed arrests, 55% had agonal breathing and the descriptions were: barely breathing (18%), heavy or laboured breathing (10%), problems breathing (9%), noisy breathing (8%), gasping breathing (7%). The remaining were described as snorting, gurgling, moaning and groaning. Agonal activity was strongly associated with being discharged alive, 27% survival with agonal activity and 9% survival without agonal activity. The phenomenon is time-limited with estimated duration for the agonal breathing of up to 6 minutes, and a

determinator for early access to the patient (Clark et al. 1991).

1994

King County reported again, this time concerning data where the purpose was to evaluate the accuracy of determining cardiac arrests. This was made by identifying and determining the rates of performance of telephone CPR instruction in non-cardiac arrest cases. Confirmed cases of cardiac arrest (n=185) were collected from an ongoing cardiac arrest surveillance system. Potential cases of cardiac arrest (n= 154) were collected from ambulance charts, including cases of hypotension or shock, respiratory difficulty, adult- and febrile seizures, syncope, cerebral vascular accident, coma or decreased level of consciousness. The confirmed cases of cardiac arrest (excluding trauma cases), were classified according to whether it was possible or appropriate to provide CPR instruction. Among the confirmed cases of cardiac arrest, it was possible, according to the assessment of tape recordings, to provide CPR instruction in 1/3 of all cases. The reasons why CPR instructions was not provided were: that the patients was reported as awake and/or breathing normally (23%), ongoing bystander-CPR (16%), 2nd or 3rd person involved in the call (11%), caller could not or did not want to (10%), witness not at the scene of the emergency (10%) or left the telephone (14%), the patient was described as being cold (3%), hysterical callers, language difficulties or rapid arrival of ambulance (10%). Regarding the accuracy, ventilation instructions were performed inappropriately in 1.9% of cases where it was not needed, and chest compressions in 1.2% where the patient had a pulse. The telephone CPR instruction was considered safe enough based on these results, with built-in screening questions regarding the assessment of responsiveness and breathing and by the various interventions that occurs before reaching the stage of chest compressions (positioning, breathing control, breathing, breathing control again) (Clark et al. 1994).

1995

To investigate the quality of telephone-assisted CPR in Norway, included in the Norwegian Index, study of a mock rescue scenarios was performed. Forty-two randomly selected women, 45-65 years old, with no prior experience or training in CPR, were confronted with an unprepared, simulated cardiac arrest (manikin), where they were able to call the emergency dispatch centre. They were then given guidance in CPR. The majority of participants managed the breathing and chest compressions adequately when each part was judged separately, 1/3 managed to perform both with satisfaction. Regarding the question if a real situation occurred, there were only 14% of the women that said that they would try CPR in reality without instructions, while 71% could imagine doing it with guidance (Rikardsen and Wikran 1995).

1995

Another centre reporting, was the Emergency Medical Communication Centre of Vestfold county, Norway, which serves 200,000 inhabitants. During one year, attempts of telephone instruction in CPR were made 628 times. These represented 5% of all calls, which led to ambulance response (26% of the "red" calls; i.e. suspected life-threatening conditions). The telephone instruction was considered time-demanding and required considerable concentration by the dispatcher. The assignment was also considered very difficult if the same medical dispatcher was also responsible for dispatching the EMS units (Steen-Hansen 1995).

2000

A simplification of the CPR instruction for callers reporting a suspected cardiac arrest might be beneficial for increasing the number of cardiac arrest patients receiving early chest compressions. Based on results from experimental studies showing no

difference in survival with early initiated chest compressions alone compared to chest compressions plus mouth-to-mouth ventilation, a randomised study was conducted in Seattle. The study compared CPR by chest compressions alone (n=241) with CPR by chest compressions plus mouth-to-mouth ventilation (n=279). Dispatcher-assisted bystander chest compression-only CPR was shown to have a survival rate comparable to that of patients receiving traditional CPR instruction, in witnessed cases. In conclusion the authors stated that chest compressions alone may be the preferred approach for bystanders inexperienced in CPR (Hallstrom et al. 2000).

A special circumstance in this study was that the mean first-unit response was 4 minutes. Thus, whether survival for the chest compression-only group can be expected to be similar to traditional CPR in settings with substantially longer response times is not known. International Guidelines now recommend chest compressions-only CPR, for use in dispatcher-assisted CPR instructions to untrained bystanders (International Guidelines, Part 3, 2000).

2001

In a population-based study conducted in King County, EMS-attended adult cardiac arrest patients (n= 7265) were evaluated to assess the association between survival to discharge and three distinct CPR groups: no bystander CPR (including 44% of patients), dispatcher-assisted bystander CPR (including 26% of patients) and bystander CPR without dispatcher assistance (including 30% of patients). Overall, survival was 15%.

By using "no bystander CPR" as a reference group, the adjusted odds ratio of survival was 1.45 for dispatcher-assisted bystander CPR, and 1.69 for bystander CPR without dispatcher assistance. This study indicates an improvement in survival with ~50% after out-of-hospital cardiac arrest when dispatcher-assisted bystander CPR is performed compared to no CPR. It was found that, dispatcher-assisted bystander CPR resulted in a 26% absolute increase in the proportion of arrest victims who received bystander CPR (30% to 56%) (Rea et al. 2000).

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THE EMS DISPATCH CENTRES ROLE IN EMERGENCY CARDIAC CARE (Part IV)

The EMS dispatch centre's main goal is to create optimal conditions for patients and their possibility to assimilate the next link in the chain of care. In many countries the EMS dispatch centre is the first contact with emergency care for citizens seeking emergency medical help. One condition for the adequate dispatching of ambulance units, is the need for competent receivers of the emergency call. With increased demands on the EMS response, there are also higher quality demands on the dispatch function. The EMS response units operative function of starting treatment immediately at the scene, is of utmost importance for patients suffering from life-threatening conditions (International Guidelines, Part 12,. 2000).

Based on International and European guidelines, the EMS dispatch centres medical role in emergency cardiac care can be described as follows:

A. Identification of symptoms

Identifying symptoms that describe a possible life-threatening condition with a rapid compilation of information:

- Is the patient awake?
- Is the patient breathing normally?

Complaints of chest pain (Task Force Report,. 2002):

- Does the patient have severe discomfort (either pain, heavy feeling, difficulty breathing) that has lasted more than 15 minutes and is still present whilst the call is being made?
- Is the pain localised anywhere in the chest, possibly including the neck, arms, back, high abdomen?
- Are there symptoms such as sweating, nausea and vomiting that may or may not be associated with cardiac disease?

Factors favouring a fast track decision:

- Over 30 years of age, either gender
- Discomfort similar to previous angina or previous heart attack
- General discomfort including pain in the right arm
- Intermittent loss of consciousness

B. Dispatch of EMS response units

Two-tier systems in which first responders are trained in early defibrillation are most effective in providing rapid ALS (Eisenberg et al. 1990). Two-tier systems are organised with a geographical closely positioned BLS first response, followed by a second ALS-tier. The EMDs must identify the nearest EMS responder unit to the scene in <1 minute on average, and provide critical information to EMS responders regarding the type of the emergency (International Guidelines, Part 12,. 2000).

C. Offer medical advise to the caller

Chest pain/chest discomfort

Pre-arrival instructions, in which the EMD offers to give the caller advise and instructions on what to do while waiting for the EMS responders to arrive is an internationally wide-spread concept (Nat. Assoc. of EMS Physicians, 1989).

Patients with new onset of chest discomfort should rest quietly. It is important that the EMD attempts to calm the calling witness or patient. Under acute coronary syndrome, the oxygen supply may be exhausted and an imbalance between supply and demand occurs which translates into ischemia (Ardehali, Ports, 1990). The oxygen demand among these patients can be decreased by less physical activity and psychological stress (McFetridge et al. 1997, Krantz et al. 1991).

The EMDs can, as a first medical response, tell the patient to sit or lie comfortable, not to attempt to get dressed or make any

unnecessary efforts. To try to obtain a calm response and to inspire a feeling of security is an important task for the EMD.

Another important factor is to make sure that someone stays by the patient's side as a support and help in the event that the patient's condition should worsen. The EMD may stay on the line to be a support and a source of security until the EMS responders arrive at scene.

If the patient has nitro-glycerine and has not taken any, the EMD can advise the patient to take according to his/hers physicians ordination to improve oxygenation to the heart (Held 1992).

- The EMD could also advise the patient to take a fast-acting aspirin tablet (250-500 mg) - which is also the message conveyed to the public when symptoms of chest pain or chest discomfort (Task Force Report,. 2002, Meischke, et al, 2000).

D. Offer instructions to the caller (See chapter: Cardiac arrest)

Unconscious, not breathing normally (worst case)
Protocols for CPR instructions by telephone have been developed and validated by Eisenberg et al., (1985) in Seattle-King County, Washington (Carter et al. 1984, Clark et al. 1994). These pre-arrival instructions and advise for various main complaints, are now "standard practice" for EMS dispatch centres all over the world and have been translated into more than ten languages.

E. Follow-up of accuracy in the single emergency calls

There are well-established examples of immediate quality control of the EMS dispatch after completed ambulance assignment. At the hospital-based Emergency Communication Centre in Norway, all documentation is entered into a PC programme, which is then sent to hospital records. The data programme is accessible from all working stations in the ED and anaesthesiology departments. The EMDs have also access to the hospital database and are able to estimate whether the patient received adequate help or not. When there were deviations where the patient was not correctly prioritised, the cause was registered in the dispatch protocol. The EMS dispatch-responsible physician can, by these means, follow the patients "on-line" in current events (Steen-Hansen 1995).

F. Follow-up of the total accuracy in various types of emergency calls

Statistical compilations of data regarding the interview and dispatch process and the resulting ambulance responses should be regularly presented for the EMDs (SOS-rapport 1997).

The accuracy in priority decision-making is dependent on the EMD's accuracy, protocol reliability and caller ability/accuracy. Based on the information available, mostly given by laymen, the EMD shall interpret medical symptoms and decide priority in a short period of time. For example, in cases of chest pain and dyspnoea, the basis for assessment must assume the most serious situation present, until proven otherwise. This causes a high sensitivity for detection of life-threatening conditions to the cost of increased utilisation of ALS resources. EMS systems must plan accordingly for some over-estimation. It is important, however, to perform evaluations of the organisation in order to be able to improve the accuracy in the EMD priorities.

Tiered ambulance systems require well-prepared dispatch protocols and the use of these must be purpose-evaluated in the EMS organisation.

EMD study endpoints
EMS dispatch, being one link in the chain of potentially life-saving efforts, has difficulties in accurately studying the established

endpoints of medicine, mortality and morbidity. Endpoints as surrogates to study in emergency medical dispatching, are suggested to be: (Calle et al. 1996)

- the appropriate use of ALS units (in two-tiered systems)
- the accuracy of pre-arrival instructions
- the information collection during the telephone interview
- the duration of the call handling
- the compliance to adopted protocols

Prehospital emergency care

The concept "prehospital emergency care" is defined in Sweden as: including the EMS (ambulance responders), acute efforts of general practitioners or health care providers, all emergency medical assessments made by EMS dispatch centres and emergency departments (National Swedish Board of Health and Welfare, 2002). During the last 5-10 years, the Swedish ambulance service has emerged largely from being a transport service to a pre-hospital emergency care. The demands on competence have increased from a seven-week education during the 80's to the nurse competence of today (Suserud 1998).

The EMS aims at starting treatment already in the home or at the scene of an emergency and during transport to hospital. Development in Sweden moves towards a differentiated EMS with well-equipped ALS units manned with nurses for all assignments regarded as emergency, and transport ambulances for other responses. The aim is to integrate the ALS teams with hospital emergency care in rotational duty, enabling a continuous competence development by accessing knowledge in caring science present in the established in-hospital care (Ambulance Service, 1997).

The EMDs competence

The EMS dispatch centres are served by EMDs that communicate both with the callers seeking acute medical help, and the providers of the emergency care (EMS responders). The level of medical formal training varies considerably in different countries, with physicians (France), nurses (Netherlands, Norway), firemen/EMTs (Denmark, Belgium). However, the majority do not have a formal training but have passed a medical dispatching course (USA, Finland, Sweden, Great Britain). The standards of formal education for those working in EMS dispatch centres have not been defined. There are suggestions of minimum requirements for dispatch centre personnel, such as full paramedic education, followed by at least two years experience in the field, a minimum of 40 hours training in emergency dispatching and an ongoing work rotation in the field and in the dispatch centre (Rossi R. 1994).

The subject of adult pedagogics describes that one condition for development of competence is the presence of pedagogic leadership. The pedagogic leader interacts with the co-workers, is open-minded for impulses from those around, and has a starting point from the people in the workplace (Their,1994). A pedagogic leadership would probably be of great help for the EMD's in their demanding work.

In some countries, including Sweden, all kinds of medical complaints, regardless of the emergency level, are reported to the dispatch centre. It has been suggestions that a broad variety of the cases urgently need highly trained EMDs as receivers and interpreters of calls (e.g. nurse or physician), (Calle et al. 1996), since they are the ones that are most able to make appropriate clinical judgements for selection from a broad spectrum of situations, and thus can give the most appropriate help. In other countries, patients turn first to their general practitioner, the dispatch centre being called mainly for patients in need of in-hospital assessment.

In Sweden, current recruitment demands on EMDs are: formal competence as nurse, assistant nurse or EMT (SOS Rapport, 1997). However, the majority of EMDs in Sweden lack formal medical competence

according to prior standards, having only the EMD training that includes:

- 3 weeks including interview and priority training and 10h medical training
- 1 week including co-listening to incoming calls
- 4 weeks including local training
- 5 weeks under supervision

The EMD then works independently, but since 1998 has the possibility of contacting a higher medical competence (physician or nurse). Accordingly the National Swedish Board of Health and Welfare, assessment and priority of ambulance response should be made by nurses who have received increased supervision of physicians.

Communication and caring

Emergency medical calls can be better understood by having nurses or paramedics as receivers, trained in, and having experience of emergency care and the ability to recognise the patient's condition both medically and psycho-logically. Additionally, nurses are trained to work according to evidence-based care. This could prove to be an incitement towards research and development of methods for improvement and quality control of emergency medical dispatch. A close leadership by physicians is, however, crucial for the quality of the medical work at the EMS dispatch centre. They should be an operative part of the EMS dispatch, having medical responsibility and supervisory evaluation and quality control.

To work as an EMD, formal and experience-based medical competence is not sufficient. Special competence in communication, in guidelines for level of priority, EMS resources, ability of stress management, independency and co-operation is needed.

EMDs have a crucial role in the handling of emergency calls, where they can stay on the call until the EMS arrives at scene. Care-related communication is a subject, which the author considers highly relevant in the interaction between caller and EMD in emergency medical calls to the dispatch centre.

Since the EMS dispatch is built on mediation, exchange of information and meaning between EMD and caller, communication is central. In the health care profession, the purpose of communication is to promote health and reduce suffering as far as possible.

The concept of communication comes from the Latin word "communicare" which means "to do something jointly", "make someone else part of ", "be in contact with" (Encyclopaedia Britannica.com). Erroneous interpretations, misunderstandings and emotional reactions are unavoidable parts of communication.

The relationship between the health care provider and patient is complex. Both parties are involved in a situation of emotional tension; the patient or caller due to illness or injury, and the health care provider owing to the situation and character of the work. The purpose of communication is double-sided, on one hand to have contact and create trust, on the other to receive crucial information.

The work at the EMS dispatch centre, with its high tempo and rapid flow-through, means large communicative challenges for the EMDs. The EMDs have subsequently much shorter time to establish contact and perceive the whole of the patient situation, than other health care professionals. Good communicative skills are needed to understand the caller and be able to provide appropriate care.

Communication in caring and in the EMDs professional role, have been characterised as follows (Eide & Eide, 1997):

- having knowledge and skills
- being knowledgeable in ethics; including autonomy, beneficence, non-maleficence and justice (Beauchamp and Childress, 1978).
- having empathy

- being goal-directed; the ability and intention of the EMD to fulfil the goal of the professional by using knowledge and skill, empathy and ethics for providing patients needs as efficiently as possible.

In order to promote positive conditions in the EMS dispatch, it is important to organise the work in such a way that parallel and simultaneous tasks are not needed. For example, when simultaneously dispatching ambulances and answering emergency calls, stress will influence negatively on the EMD choices, whether to act or not in providing advise and pre-arrival instructions, and being a support for the caller.

Listen actively

To listen actively means to focus attention on the other party and subsequently follow up the observations by various types of encouragement, support, questions and comments. By being relationship-directed, we can show interest, caring and attention in such a way that the other party feels well cared for. Active listening is a way of caring communication, to gain fast understanding for the patient's problem and needs. As with empathy, active listening is a part of health care provider's professional attitude towards the patient (Eide & Eide, 1997). There may be problems for the EMD to fulfil this in their assignments due to multiple tasks and/or the lack of specialisation.

Perception

How signs and signals from senders are perceived depends on how the receiver perceives these signals, and how they are interpreted. This is called perception.

The amount of information has to be limited, structured and organised into meaningful parts of the whole. Attention span has an important function in this context. When we look around, we focus on something at a cost for something else. The information is filtrated and much has been rejected before it reaches our consciousness. The selection of impressions and how to organise these, are influenced by our preferences, interests, needs, emotions, previous experiences, knowledge and expectations. Studies have shown that we have a tendency to see what we expect or want to see (Atkinson et al. 1993).

Stored in our memory are "cognitive maps", which influences our experiences of persons and events in the outer world and vice versa. This processing has a course: a) by per-ception processing information of the outer world, b) the perceptional inner "map" being put together with the incoming information and being adjusted by the new information, c) the revised "map" meets the new information and result in a some different comprehension.

For the process of communication, this is an important reminder of that which we see is not the complete reality, but an inter-pretation of it. Cognitive maps helps us to rapidly perceive and take a position on new information, but we have a tendency to pay attention to that information that conforms to the "map" we already have (Atkinson et al 1993).

The cognitive maps of the EMDs that non-visually interrogates for assessment and identification of emergent symptoms and injuries, are different. Learning and exper-ience influences these. Feedback of previously performed assessments is a method that most probably would help the EMDs in making more appropriate and accurate choices.

Motivation

There are many starting points for the understanding of motivation. Motivation is present as a concept in the theories of learning and pedagogic. Motivation is directed by the awareness of needs, knowledge of action possibilities and the goal (Hermansen, et al. 1992). One theory of motivation starts with a model for goal-directed action including purpose directed action, judgement of situation, goal formatting and goal performance. The goals a person sets up for his/her actions, i.e. to

use their abilities, is intimately connected with their reflections of what they consider realistic in current circumstances from the evaluations made in a situation, and in relation to themselves. Self-realisation is a fundamental motive for the human being. To be able to perform our abilities there has to be different kinds of evidence i.e. response and feedback in relation to ourselves and others, for us to successfully encounter a challenge (Pörn, 1981).

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AIMS OF THE STUDY

- To describe the EMDs assessment of the severity of chest pain and presence of associated symptoms in relation to definite diagnosis. (Paper I)
- To describe the EMDs initial suspicion of AMI and priority, in relation to the subsequent diagnosis and outcome. (Paper II)
- To describe survival after out-of-hospital cardiac arrest, in relation to whether or not bystanders were offered and subsequently performed dispatcher-assisted bystander CPR. (Paper III)
- To describe the impact of callers previous training in CPR on survival. (Paper III)
- To describe the EMDs ability to identify cases as suspected cardiac arrest and whether they were suitable for dispatcher-assisted bystander CPR. (Papers IV and VI)
- To describe how EMDs perceive their experience of identifying suspected CA, and offer and provide dispatcher-assisted bystander CPR. (Paper V)
- To describe the frequency of agonal respiration in cardiac arrest calls and the ways they are described by callers. (Paper VI)

Ethical considerations

Approval by the Committee for Ethics in Medical Investigations, Göteborg University, were made in the study presented in paper III. The studies presented in papers I, II and IV were initiated and performed as a quality assurance of EMD assessment and handling of chest pain and cardiac arrest cases. The study presented in paper V was presented to the Committee for Ethics, the committee, however, stated there was no need for their approval as they considered the study as being an internal quality assurance. The application to the Ethics Committee for the study presented in paper VI, was made when the study had already been started, and considered also as a quality assurance study. The committee left their approval during data collection.

DEFINITIONS

Suspected Cardiac Arrest (papers III-VI)
An unconscious person, not breathing or not breathing normally.

The Reaction Level Scale/85 (RLS/85) (paper III)
awake = RLS 1-3,
superficially unconscious = RLS 4-6,
deeply unconscious = RLS 7-8.

A Confirmed Myocardial Infarction (paper I-III)
Two of the following criteria had to be fulfilled: a) chest pain: b) elevation of myocardial specific enzymes in at least two samples: c) appearance of new Q-waves in a 12-lead standard electrocardiogram (ECG).

A Possible Acute Myocardial Infarction (paper III)
Was recorded if there was a strong clinical suspicion of AMI in combination with either: a) no certain chest pain, myocardial enzymes above the normal range and ST-elevation but no Q-waves on the ECG, b) no certain chest pain, increased myocardial enzymes but difficulty in interpreting the ECG (signs of a previous AMI or left bundle branch block [LBBB]), c) previous history of ischemic heart disease, ventricular fibrillation as initial arrhythmia or sudden onset of acute congestive heart failure together with LBBB (in cases where no further diagnostic information was available).

Myocardial Ischemia (paper III)
Was recorded if ST-changes on ECG indicating acute ischemia without elevation of myocardial specific enzymes.

Perception (paper V)
Perception often stands for the assumed (not stated), which is not necessarily said, since it has never been an object for reflection. The perception represents the reference frame in which we have collected our knowledge or the foundation on which we build our reasoning.

Agonal Breathing (paper VI)
A patient was considered as having agonal breathing if the witness acknowledges that the patient did not breathe normally. It was also noted whether agonal breathing could be heard through the telephone. This definition was adopted from an empirical study describing the incidence of agonal respirations in cases of cardiac arrest (Clark et al. 1991). Medical dictionaries defines agonal as: "pertaining to or occurring at the time just before death" (Dorland´s, 2000) or "relating to the process of dying or the moment of death, so called because of the erroneous notion that dying is a painful process" (Stedmans, 2000). Thus, they did not define agonal in conjunction with respirations.

Quality of Interview (paper VI)
The quality of interviews were graded from one to three, where one was an unapproved interrogation and three was an approved interview as described below:
1. Unapproved interviews where important questions regarding consciousness and breathing are omitted. The EMD terminates the call despite the need for guidance, advice and support. The EMD does not offer T-CPR with any obvious reasons.
2. Insufficient interview where the EMD raised questions regarding either consciousness or breathing, but not both. Raised unnecessary questions, repeats questions without reason and shows insecurity in his/her handling of the case. Does not offer T-CPR with any obvious reasons.
3. Approved interview where the EMD have asked about consciousness and breathing, adjust to new problems, having good ability to ask the right questions, to both listen and lead the caller, to give support and advise. The EMD stays with the call if needed until ambulance arrival and offers T-CPR in appropriate cases.

Callers Emotional Content and Co-operation Score (ECCS) (paper VI)
1. Normal conversational speech
2. Anxious but co-operative
3. Moderately upset but co-operative
4. Uncooperative, not listening, hysterical
5. Uncontrollable, hysterical

METHODS

Design
An exploratory, descriptive design was used in all studies. Papers I and II had also a correlation design. Both quantitative and qualitative research methods have been applied to cover different angles of the research problem.

A survey of the thesis
Six papers are included in this thesis. Paper I describes the correlation between EMDs assessment of the severity of chest pain together with presence of associated symptoms, and the development of AMI and risk of early death. In paper II, a description of the correlation between EMDs initial suspicion of AMI and the subsequent priority, is presented. In paper III, outcome after out-of-hospital cardiac arrest is described in relation to dispatcher-assisted bystander CPR and previous training in CPR. Papers IV and VI evaluates the quality of EMD interview in cases of cardiac arrest and the feasibility of performing dispatcher-assisted bystander CPR. Paper V describes how EMDs perceive their experiences of identifying CA, offer and perform T-CPR.

Target area and population
The target area and population in papers I, II, IV and VI, was the municipality of Göteborg, which has an area of 449 km^2 and approximately 430,000 inhabitants in the

years1986 and 1993 and 470,000 inhabitants in the year 2000.

The target area in paper III was the community of Göteborg and two adjacent counties in Sweden which have an area of 16,536 square kilometres and 1.220,000 inhabitants.

The target area in paper V, consisted of the EMS dispatch centre in Göteborg and the study population of forty-nine EMD's who staffed the EMS dispatch centre and were qualified for dispatcher-assisted bystander CPR. This dispatch centre covers a population of 1.2 million inhabitants being a part of the response system to the national three-digit emergency number 112. The incidence of cardiac arrest were resuscitation was attempted in this area constitutes 34 out of 100.000 inhabitants per year.

Description of organisation, CPR education and intervention

EMS- and dispatch organisation (papers I-VI)

One dispatch centre co-ordinated a two-tier response system for the Emergency Medical Services (EMS) in the municipality of Göteborg. For calls assessed as a life-threatening condition, an advanced life support responder (ALS) and the nearest basic life support team (BLS) were dispatched simultaneously.

In the study described in paper IV, the EMS was organised in six departments, there are two ALS responders and 11 BLS responders in service round the clock (during the summer, only one operating ALS responder). The staff at the ALS consisted of two paramedics who had received 39 weeks of medical training including intubation, defibrillation. They were not authorised to administer drugs other than sodium bicarbonate. During office hours, one ALS team was reinforced by a coronary care unit nurse. The BLS responders were staffed by two EMTs with seven weeks of medical training.

The BLS responders in the target area had not yet been equipped with automated external defibrillators (AEDs). The introduction of these devices started in 1986 and in 1988 they were included as standard equipment on all 11 BLS-responses.
By the times of the studies, which are presented in papers I, II, III and VI, the EMS organisation had changed and the number of BLS response units had increased to 20 in service 24-hours daily. The BLS response was staffed by two EMTs with 7-20 weeks of medical training.

The study presented in paper III included also the response system in the two counties outside the community of Gothenburg, which was organised according to both two-tier and single tiered systems, depending on locality. These ambulances were staffed by two paramedics with a requirement of training at assistant nurse level plus 20 weeks of paramedic training.

All BLS responders in the target area were equipped with automated external defibrillators (AED´s). Medication protocols followed the European Resuscitation Council guidelines. The ambulance crew could independently make decisions of terminating CPR efforts at the scene of emergency. The criteria for such decision were: asystole for more than 30 minutes without return of spontaneous circulation.

EMD CPR education

The EMDs qualification in dispatcher-assisted bystander CPR contains six months of dispatch training, training of interview technique, computer training, 2 weeks of basic medical training, 1-2 review courses on basic CPR training and a two-day course on delivering formal instructions by telephone to assist bystanders in performing CPR.

EMD intervention

EMDs were instructed to suspect cardiac arrest when the interview with the caller indicated that the patient was suffering from unconsciousness and respiratory arrest.

Specifically, the dispatchers were instructed to ask the caller whether the patient was awake, answered when addressed and if the caller saw signs of breathing. For all cases categorised as suspected CA, the dispatcher used a standardised instruction protocol for CPR (Appendix I). In 1997, the Swedish Index for Emergency Medical Dispatcher was implemented. In this Index, the dispatcher-assisted bystander CPR instructions were revised from the prior Göteborg CPR-instruction (Appendix I). The main change regarded the question on breathing, which was changes to: Is the patients breathing normally?, instead of just asking whether breathing was present or not.

MATERIAL AND SAMPLE

The Quantitative studies (Papers I-IV, VI)

Material, sample and performance

Material and performance (paper I and II)
All patients who dialled the emergency number in the community of Göteborg during two months (between 18th January and 20th March 1993) and were judged by the EMDs as having acute chest pain were included in the study. The EMD then filled in a specific prospectively designed case record form which included the estimated intensity of pain graded as severe or vague and whether the patient had any of the following symptoms; dyspnoea, cold sweat, nausea, vertigo or syncope. The record form also included the initial degree of suspicion of AMI according to a five-point scale, where 1 = no suspicion, 2 = vague suspicion, 3 = moderate suspicion, 4 = strong suspicion and 5 = convincing AMI. They also noted which priority level they choose. The patients were also retrospectively followed up via ambulance and hospital records in order to describe the clinical course and final diagnosis. This study has resulted in two published papers (I and II).

Material and performance (paper III)
All patients categorised by EMDs as suspected cardiac arrest during 27 months (between 1st January 1994 to 31st March 1996) were set to be offered dispatcher-assisted bystander CPR (T-CPR) and were included in one of the prospectively determined classes: 1) T-CPR completed (caller without previous CPR training), 2) T-CPR completed (caller with previous CPR training), 3) T-CPR started, but not completed, 4) T-CPR declined by caller due to previous CPR training, 5) T-CPR declined by caller due to other reasons or, 6) T-CPR not offered.
A retrospective follow-up was then performed among the included cases. Data were collected from ambulance and hospital records, autopsy reports and death certificates, of the subsequent clinical course with regard to patient status on ambulance arrival, cause of cardiac arrest, survival etc.

Sample and performance (papers IV and VI)
In papers IV and VI, the medically responsible physician (for the EMS in paper IV, and for the dispatch centre in paper VI), together with the operational leader at the dispatch centre listened to and evaluated tape recordings of emergency calls. Paper IV deals with 99 consecutive cases of cardiac arrest between 23rd February to 31st May and 4th to 16th October, 1986. Paper VI, deals with 100 non-consecutive cases evaluated between 1st September, 2000 and October 31, 2001. In both studies, patients were admitted to the two (paper IV) and three (paper VI) city hospitals in Göteborg after out-of-hospital cardiac arrest. The tapes were assessed from various prospectively, predetermined aspects regarding consciousness and breathing and other variables, which were recorded in a study protocol. In paper VI, ambulance records were also reviewed regarding patients described having an abnormal breathing in the call, for an evaluation of their breathing on ambulance arrival.

Statistical methods (papers I-III)

Descriptive statistics
In paper IV, 95% confidence interval was used with regard to the given percentages of interviews being of different quality. Distribution of variables are given as means in paper III and paper VI, medians in paper I-III and VI, and ranges in papers I-III and VI.

Statistical analysis
In paper I, Fisher´s exact test was used to test for differences. A two-tailed test was applied. No correlations for multiple testing was made. P- values were only denoted if $p < 0.02$. In paper II, Fisher´s permutation test was used to test the correlation between the dispatchers initial suspicion of AMI and the different variables. The Kruskal-Wallis test was used in assessing the overall p value regarding some variables (heart rhythm and diagnosis). All the p-values were two-sided and due to the large number of p-values calculated, no formal significance level was stated. However, p values were only denoted if $p<0.05$. In paper III, when evaluating proportions, Fischer´s exact test was used. A p-value less than 0.05 was regarded as significant.

Multivariate statistical analysis
In order to select independent predictors for infarct development in Paper I, a multivariate analysis was used, including age, sex, severity of pain and presence of associated symptoms.

The Qualitative study (paper V)

Description of the design and method
Qualitative methodology is a matter of how to characterise something, how to mould it. The goal is to find out the characteristics of a certain phenomenon, how it is constructed. Compared to quantitative methods which is measuring sizes and quantities, qualitative methods are used to reveal constitutions and characteristics by trying to find categories, descriptions or models which best can describe a phenomenon.

In paper V, a qualitative method inspired by the phenomenographic approach was used. Phenomenography is an empirically grounded research method, which has been developed at the Department of Education at Göteborg University, Sweden (Marton 1981). Marton describes phenomenography as a research approach for describing the limited number of qualitatively different ways in which a phenomenon is experienced, conceptualised, or understood, based on an analysis of accounts of experiences as they are formed in descriptions produced usually exclusively through interviews.

Fundamental for this method of qualitative analysis, is the distinction between how something is and how it is conceived to be. The method thereby follow the second-order perspective, i.e., how a person experience and conceive something. The benefit of phenomenographic studies can be summarised as giving an understanding of possible ideas about a phenomenon, foundation for reflection and most important, describe what conceptions there are present, not how many subjects who has that conception of a phenomenon.

The strategic sample
Initially we planned for that subjects would be selected strategically by gender and experience in time of t-CPR. The strata of experience in time of t-CPR revealed that five EMDs had 0.5-5 years, 16 had 6-9 years and 28 had 12 years experience. That is to say that 21 had 0.5-9 years experience and 28 had 12 years experience. The median time for the strata "experience" was 12 years, and for that reason this strata was not used. We used solely, the strata "distribution of gender" among the dispatcher-assisted bystander CPR educated EMD´s, distributed thus: 32 women (65%) and 17 men (35%). Six female and four male EMDs were draft for interview.

Inclusion procedure
An information letter was sent to all EMDs at the dispatch centre including the purpose of the study and that they could either sign the consent form indicating their willingness to participate or decline in participating. The

EMDs were informed that their responses in the interviews would be kept confidential. A randomly performed selection was made taking into account the gender proportion at the dispatch centre.

The qualitative interview

There were 10 EMDs approached for semi-structured, face to face interviews, using the phenomenographical approach, in which the preferred method of data collection is the individual interview (Marton, 1994). The interviews in paper V were based on questions focusing on the theoretical perspective scanning the following fields: EMDs perception in identifying suspected cardiac arrests, and EMDs perceptions of offer and perform instructions in cardiopulmonary resuscitation via telephone. However, the starting-point was direct questions to open the conversation.

The initial question about the phenomenon was: Can you describe what you do when you suspect a cardiac arrest? Based on the narrative, the following questions were asked: What do you feel when you realise that it is probably an unconscious patient not breathing?, can you describe a case where you provided instructions and felt satisfied?, what knowledge did you use?, are there any difficulties in identifying a cardiac arrest?, are there difficulties in assessing responsiveness?, are there any difficulties in assessing normal breathing?, can you describe difficulties providing an instruction?, what does it mean for you as an EMD to offer and sometimes provide T-CPR to a person who calls and were you suspect a CA?, Do you believe in T-CPR?

Data analysis

The interviews were tape recorded and transcribed verbatim by the interviewer. After transcription, the analysis evolved by seeking various characteristics in the data related to the theoretical perspective and was performed in four steps. It started with repeated reading of each interview to obtain the whole. On the basis of these readings, the next step was to select certain statements made by the informants. In the third step, the goal was to compare different answers by searching for similarities and differences. By contrast, the understanding that arose of the characteristics of perceptions was visualised and constituted the essence in the analysis. When various ideas were crystallised, they were grouped into patterns. The fourth step was to search for a final pattern.

The categories that appeared were presented with subclasses and quotations to certify the categories and 31 subcategories emerged which could be grouped into twelve main categories. The results appeared reasonable to all the authors and were concordant with the authors' previous experiences.

RESULTS

Paper I

Ambulance dispatchers estimation of intensity of pain and presence of associated symptoms in relation to outcome in patients who call for an ambulance due to acute chest pain.

In this paper the relation between a) the EMDs estimated severity of pain and presence of associated symptoms, in patients who call for an ambulance because of acute chest pain, and b) whether they develop acute myocardial infarction (AMI) and the risk of early death was presented.

503 patients with acute chest pain contacted the EMS dispatch centre in Göteborg over a 2-month period. These accounted for 25% of all emergency calls during the same period.

Table 3 shows that the EMDs were able to judge pain as severe or vague in 405 patients (81%). Of these 405 patients, 68% were judged to have severe pain with a similar frequency regardless of age and sex.

Dyspnoea was reported in one-third of the patients with a similar frequency regardless of age and sex. Nausea was reported in 20%, vertigo in 8%, cold sweat in 17 % and syncope in 5% of all patients.

Table 4 shows that patients judged as having severe chest pain (68%) developed AMI during the first 3 days in hospital on 26% of occasions as compared with 13% among patients judged as having only vague chest pain (P = 0.0004). The association between the estimated intensity of pain and infarct development appeared to be similar regardless of the presence of associated symptoms.

The presence of any of the following associated symptoms, dyspnoea, nausea, vertigo, cold sweat or syncope, tended to be associated with a higher infarction rate (24%) than if none of these symptoms was present (17%, P= 0.06) (Table 5). Mortality during the pre-hospital and the hospital phase was not associated with the estimated severity of pain or the presence of associated symptoms. In a multivariate analysis considering age, sex, severity of pain and presence of associated symptoms, only severity of pain appeared as an independent predictor of infarct development (P=0.004).

Table 3

	Severe pain	Not evaluated	Associated symptoms				
			Dyspnoea	Nausea	Vertigo	CS*	Syn**
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
All patients (405/503)***	68 (274)	19 (98	34 (173)	20 (103)	8 (38)	17 (87)	5 (23)
Age ≤ 73 years (199/251)	67 (133)	21 (52)	34 (85)	22 (54)	8 (20)	21 (53)	7 (18)
Age > 73 years (206/252)	68 (141)	18 (46)	35 (88)	19 (49)	7 (18)	13 (34)	2 (5)
Sex							
Men (205/260)	67 (137)	21 (55)	32 (83)	20 (53)	7 (18)	20 (52)	6 (16)
Women (200/243)	68 (137)	18 (43)	37 (90)	21 (50)	8 (20)	14 (35)	3 (7)

Table 4

	Severity of pain						
	Severe	Vague	*p***	Not evaluated	*p***	Sensitivity	Specificity
	% (n)	% (n)		% (n)		a (b)	a (b)
All patients (268/128)*	26 (70)	13 (17)	0.004	19 (18)	-	80 (67)	36 (49)
Age (years)							
≤ 73 (128/64)	25 (32)	9 (6)	0.012	10 (5)	0.14	84 (74)	38 (52)
> 73 (140/64)	27 (38)	17 (11)	0.16	29 (13)	-	78 (61)	34 (45)
Sex							
Men (132/66)	33 (44)	14 (9)	0.004	19 (10)	-	83 (70)	39 (53)
Women (136/62)	19 (26)	13 (8)	-	19 (8)	-	76 (62)	33 (44)
Presence of associated symptoms							
Yes (198/52)	27 (53)	15 (8)	0.10	24 (12)	-	87 (73)	23 (36)
No (70/76)	24 (17)	12 (9)	0.06	14 (6)	-	65 (53)	56 (66)

Table 5

	Development of AMI	*p***	Mortality	*p***	Sensitivity†	Specificity†
	% (n)		% (n)			
Associated symptoms						
Dyspnoea						
Yes (169/173)*	22 (38)	-	6 (11)	-	36	66
No (322/330)	21 (67)		7 (22)			
Cold sweat						
Yes (85/87)	29 (25)	0.06	10 (9)	0.15	24	84
No (322/330)	20 (80)		6 (24)			
Nausea						
Yes (100/103)	25 (25)	-	8 (8)	-	24	81
No (391/400)	20 (80)		6 (25)			
Vertigo						
Yes (38/38)	11 (4)	0.10	3 (1)	-	4	91
No (453/465)	22 (101)		7 (32)			
Syncope						
Yes (22/23)	18 (4)	-	13 (3)	0.19	4	95
No (469/480)	22 (101)		6 (30)			
Any of the above						
Yes (301/309)	24 (73)	0.06	7 (23)	-	70	41
No (190/194)	17 (32)		5 (10)			

Paper II

Outcome for patients who call for an ambulance for chest pain in relation to the dispatchers initial suspicion of acute myocardial infarction.

In this paper the relation between the EMDs initial suspicion of AMI, among patients who call for an ambulance due to chest pain, and the subsequent diagnosis and outcome are presented. In all, 503 patient called for an ambulance in Gothenburg due to acute chest pain during a 2-month period, and information on the dispatcher's initial suspicion of AMI was available in 484 patients. Of these patients, 174 (36%) were assessed as having at least a strong suspicion of AMI. In 167 patients (34%) there was a moderate suspicion of AMI, and in the remaining 143 patients (30%) there was only a vague or no suspicion of AMI.

In 493 of the 503 calls (98%), it was possible to classify the case as life threatening or not according to given criteria.

Table 6

	Life-threatening condition		
	Yes (n=220)	No (n=273)	p*
Age (years)			
Median	76	72	<0.001
Range	29-95	19-96	
Sex (%)			
Women	46	51	
Men	54	49	
Previous history (%)			
Cardiac arrest	2	1	
Myocardial infarction	52	33	<0.001
Angina pectoris	70	46	<0.001
Hypertension	32	29	
Diabetes mellitus	19	13	
Congestive heart failure	36	27	
Stroke (1)	15	15	
Smoking (56)	22	25	
Chronic alcoholism (1)	7	9	
Level of priority (%)			
1	81	73	
2	6	12	
3	13	15	

Out of the total number of calls (n=503), 76% were classified as a priority 1 call for an ALS-response, 10% were classified as a priority 1 with no need for ALS-response, and 15% were classified as priority 2, where a BLS-response should be at the patients side within 30 minutes. The BLS-response arrived with the patient a median of 3 minutes earlier than the ALS-response.

Patients with a life-threatening condition were older and more frequently had a history of myocardial infarction and angina pectoris (Table 6). The level of priority did not significantly differ between patients with and without a life-threatening condition; among patients with a life-threatening condition, 81% received the highest priority versus 73% of the patients without a life-threatening condition.

Patients in whom there was a lower initial suspicion of AMI more frequently displayed signs of alcohol overdose on admission to hospital. Patients in whom there was a stronger initial suspicion of AMI more frequently had hypotension, bradycardia, arrhythmias and ECG signs of acute ischemia, particularly ST-elevation and ST-depression on admission. Consequently, there was a clear association between the dispatcher's suspicion of AMI and the suspicion of AMI by the physician in the emergency department and also with the proportion of patients who were hospitalised (Table 7).

Table 7

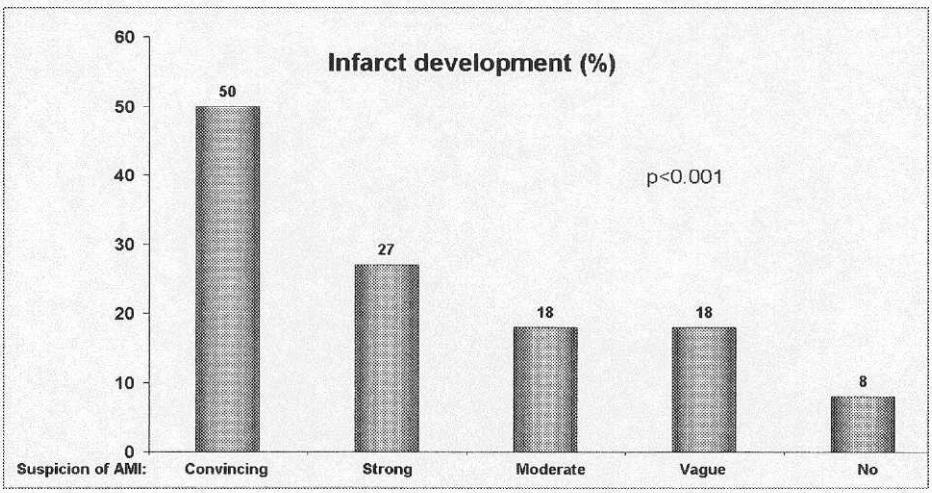
	Suspicion of AMI			
	No/Vague *(n=143)*	Moderate *(n=167)*	Strong *(n=174)*	*p**
Symptoms of (%)				
Pain	28	29	36	
Alcohol overdose (12)	9	2	2	<0.01
Heart failaure (15)	17	13	15	
Systolic blood pressure (mmHg) (33)				
Median	148	145	145	
Range	80-240	60-240	0-255	<0.01
<100 mmHg (%)	2	4	9	
Heart rate (beats/min) (28)				
Median	80	80	80	
Range	50-150	34-170	0-170	
<50 beats/min (%)	0	0.6	4	<0.01
Heart rhythm (%) (10)				
Pacemaker rhythm	5	3	0-6	
Sinus rhythm	80	81	79	
Supraventricular arrhythmia	15	15	16	
Nodal rhythm	0	0	1	<0.05[b]
Ventricular tachycardia	0	0	0.6	
Ventricular fibrillation	0	0	0.6	
Asystole	0	0	1	
Slow ventricular tachycardia	0	0.6	0.6	
ECG pattern (%) (13)				
Non-pathological	34	30	26	
Pathological but with no signs of acute ischaemia	44	44	44	<0.05[b]
Signs of acute ischaemia	22	26	30	
ST elevation	12	10	17	<0.05
ST depression	15	20	23	<0.05
T inversion	2	6	7	
Q wave	4	4	7	
Physician's initial suspicion of AMI (%)(14)				
Obvious AMI	6	5	13	
Strong suspicion of AMI	33	37	43	<0.001[b]
Vague suspicion of AMI	27	29	26	
No suspicion of AMI	34	29	19	
Hospitalized (%) (8)	73	83	90	<0.001

As can be seen in Table 8 and Fig. 3, there was a strong association between the dispatcher's suspicion of AMI and the diagnosis in hospital. Of those patients who were initially assessed as having at least a strong suspicion of AMI, 29% subsequently developed infarction, compared with 18% among patients with a moderate suspicion of AMI and 15% among patients with only a vague or no suspicion ($p < 0.001$).

Table 8

	Suspicion of AMI			
	No/Vague *(n=135)*	Moderate *(n=165)*	Strong *(n=172)*	*p**
Diagnosis (%)				
Myocardial infarction	15	18	29	
Possible myocardial infarction	0.7	0.6	2	
Myocardial ischaemia	19	22	22	
Possible myocardial ischaemia	17	22	20	
Musculoskeletal pain	10	4	4	
Psychogenic pain	5	7	2	<0.01[b]
Pulmonary embolism	0	1	0	
Pleuritis	0	1	0	
Pneumonia	3	4	3	
Gastrointestinal pain	7	5	5	
Aortic aneurysm	0	1	0.6	
Pneumothorax	0.7	0	0	
Other cause	22	13	12	
Uncertain cause	0	1	1	

Figure 3



No significant relationship between the initial suspicion of AMI and mortality was observed. The overall early mortality, including the pre-hospital and hospital phase was 6%.

Paper III

Evaluation of dispatcher-assisted cardio-pulmonary resuscitation.

In this paper an evaluation of outcome of 475 cases being categorised by EMDs as suspected cardiac arrest, and included in one of six categories pending on whether they were offered dispatcher-assisted bystander CPR, and the callers prior training in CPR.

In all, 473 could be followed up and of them 427 fulfilled the criteria for cardiac arrest on ambulance arrival. In 147 cases, dispatcher-assisted bystander CPR was not offered, although cardiac arrest was suspected. The reasons were: the caller described the patient as cold and stiff (60%), caller unable to participate in routine interview (15%), the caller not at scene of emergency (10%) and EMD uncertain in interpreting the case (5%).

Forty-six patients (10%) categorised by EMDs as suspected cardiac arrest, did not have cardiac arrest on arrival of ambulance (Table 9). Among half of these, dispatcher-assisted bystander CPR was not offered, mostly due to lack of information to interpret the case correctly. Among the 23 non-cardiac arrest cases that were offered dispatcher-assisted bystander CPR, only one case completed the instruction, but was later discharged from hospital without any complications.

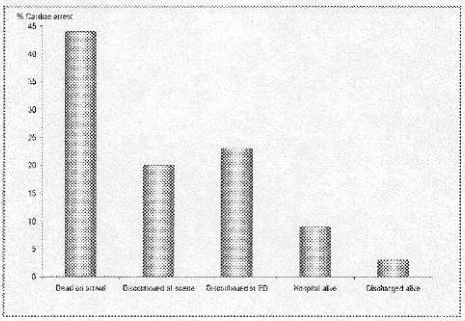
Four hundred and twenty-seven patients (90%) had cardiac arrest on ambulance arrival. In this group, the witnesses of 280 patients (66%) were offered dispatcher-assisted bystander CPR, of whom half (142 witnesses accepted the offer and 36% (102 witnesses) completed dispatcher-assisted bystander CPR.

Table 9

	Suspected CA *not* offered T-CPR (n=22*)	Suspected CA and offered T-CPR (n=23)
Syncope	6	8
Cerebrovascular disease	8	2
Unconsciousness (intoxication)	3	3
Seizures	3	2
Unconsciousness (alcohol)	1	4
Unconsciousness and respiratory arrest	0	2
Choking	1	2

For a high proportion, 191/427 patients (45%), no further attempt was made by the ambulance crew to resuscitate due to advanced signs of death (Fig. 4). The majority of these patients (164/191) belonged to dispatch group 5 and 6, which were cases where the witness had declined the offer of instruction or cases not being offered any instruction by the EMD. In 91/427 patients (21%), resuscitation efforts were terminated at the scene, 103/427 (24%) were terminated in the ED, 42 patients (10%) were hospitalised, and 19 (4%) could be discharged alive. After exclusion of the patients found to be dead on EMS responder's arrival, the survival rate amounts to 8%.

Figure 4

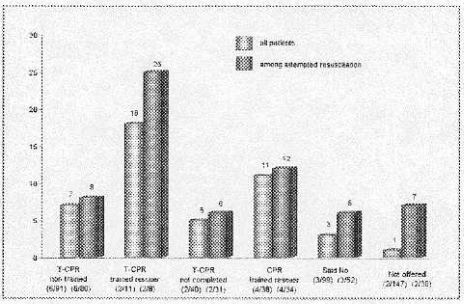


Among the 236 patients where EMS attempted ALS, nearly half (110/236), had asystole and 39% had ventricular fibrillation. The median time interval between collapse and first defibrillation was 10 minutes, ranging from 8-12 minutes. In group 1 and 2, where dispatcher-assisted bystander CPR was completed, the median time interval was 11 and 12 minutes respectively.

In all included cases of cardiac arrest (n=427), approximately 60% were judged as caused by coronary artery disease.

Fig. 5 illustrates patients who could be discharged from hospital in relation to dispatch group. The numbers are small, and no statistically significant differences between groups were found. However, the results seem to suggest that dispatch group 2, representing trained rescuers who received dispatcher-assisted bystander CPR, and dispatch group 4, representing trained rescuers who wanted to manage on their own, had the best outcome rates (Fig. 5).

Figure 5



The comparison of "resuscitative" patients in whom dispatcher-assisted bystander CPR was performed, groups 1 and 2, with "resuscitative" patients in whom dispatcher-assisted bystander CPR was not performed, groups 3, 5 and 6, an increase in survival is suggested from 6% (groups 3, 5 and 6) to 9% (groups 1 and 2).

Paper IV

In this paper an evaluation of 99 EMS dispatch tape recordings of consecutive patients, which had been admitted to the two city hospitals in Göteborg after out-of-hospital cardiac arrest, are presented.

Of the 99 interviews, 88% were regarded as optimal in terms of time and could not have been shortened. In only 6% of the cases was there an unnecessary delay of more than 60 sec.

Of the 97 interviews that could be effectively evaluated, 54% were judged to be impeccable, with short, distinct questions, quickly resulting in a decision on how to handle the case. Another 16% were of high quality resulting in only a few remarks, such as unnecessary questions

being asked (70% were close to optimal; 95% confidence interval, [CI] 61% - 80%).

In another 16 interviews, serious criticism could be levelled as the EMD exhibited very stressful behaviour, or asked several unnecessary questions, or omitted one or more important questions (95% CI, 9% - 25%). In 13 of the cases, the interviews were unacceptable or non-existent and the dispatch therefore occurred without the necessary background data (95% CI, 7% - 21%) (Table 10).

Table 10

Quality of interview	n=97 (*2) n	(%)
5 Very good	52	(54)
4	16	(16)
3	16	(16)
2	10	(10)
1 Very poor	3	(3)
Time delay of the interview		
Optimal	87	(88)
Too long delay 0-15 sec	1	(1)
16-30	2	(2)
31-45	3	(3)
45-60	0	(0)
>60	6	(6)

In each case, a recording was made of whether the EMD had asked about the patient's state of consciousness and breathing or whether this could be assessed indirectly. In 16 cases, the answer was received directly from the interview, without it being asked for. In 8 cases, there was uncertainty about the patient state of consciousness. In 37% (of the remaining 75 cases), this important question was never raised. Regarding whether the patient was breathing, this was obvious from the interview in 19 cases. In five cases there was an uncertainty about the patients breathing. Of the remaining 75 patients, the dispatcher asked whether the patient was breathing in 60%, whereas in 40% this question was never asked (Table 11)..

Table 11

	Was the patient unconscious?		Was the patient breathing?	
	n	%	*n*	%
Obvious from the interview	16		19	
Unclear despite asking about it	8		5	
To obtain information	75		75	
Dispatcher asked	47	63	45	60
Dispatcher did *not* ask	28	37	30	40

In eight cases, it was obvious from the interview that the patient was alive. In another 15 cases, the patient could possibly be alive. The caller's description in 12 (of 15) cases was that the patient was "breathing heavily", "wheezing" or "snoring" and, in three cases, the caller said that the patient was "not totally unconscious".

In all, there were 22 cases where the ALS-responders was not alerted, even though it was obvious in 15 of them that the ALS unit should have been alerted on the basis of information available to the EMD.

In 64 cases, it was evident from the interview that dispatcher-assisted bystander CPR was not possible. The reasons included the fact that the caller was not at the scene (20%), or that the patient was too far from the telephone (9%). In four cases, the circumstances were unclear. In 21 cases, it was technically possible to provide dispatcher-assisted bystander CPR, i.e. the caller was at the same place as the patient. Another 10 cases were assessed as being feasible for starting dispatcher-assisted bystander CPR, but there were negative factors such as the relative's emotional

reactions, so that they were not deemed receptive for interview (30% were considered suitable for dispatcher-assisted bystander CPR; 95% CI, 22% - 41%). In eight cases, the EMDs tried dispatcher-assisted bystander CPR.

Paper V

Dispatcher-assisted telephone-CPR: A qualitative study exploring how dispatchers perceive their experiences

In this paper EMDs perceptions of their experience of identifying suspected cardiac arrests, and offer and provide instructions in cardiopulmonary resuscitation via telephone are presented. A qualitative method inspired by phenomenographic design was applied where 10 EMDs were approached for semi-structured interviews.

In this analysis, twelve categories and 31 subcategories emerged.

The categories for perception in identifying CA were:

To trust the witness's account

This principal category describes the EMD's perceptions of, on the one hand using pre-existing criteria for identification and, on the other hand being dependent on the witness's descriptions and ability to comprehend the situation correctly.

To use pre-existing criteria

This subcategory describes the EMD's perception of using the criteria for suspected CA, which is built on obtaining a trustworthy answer from the witness. Among other dispatchers, intervention-based identification is used, where the witness checks breathing by starting mouth-to-mouth ventilation.

"...we work with symptoms what people say. If they say that they are having difficulty breathing, we have to believe them, until something else is proven."

To be dependent on comprehending descriptions of the patients breathing

This subcategory describes the dispatchers' demands on a clear statement for the absence of breathing in order to offer first aid. Thus, it is difficult to differentiate a wheezing breath among patients, it can range from conscious, unconscious and CA.

"The witness can say "he is breathing a little" or answer vaguely. I want them to say, "he is not breathing" to be able to start the instruction ".

"...really difficult to judge normal breathing, and this is often where I get stuck. If I have a person that is unconscious and has difficulty in breathing then it is really problematic. In which way are they having difficulty in breathing, that they are barely breathing or that they are breathing shallowly or that they are breathing sporadically?"

To be dependent on the witness's ability to comprehend the situation and then verbally express it

This subcategory describes the dispatcher's perception of diffuse descriptions and distraught witnesses who make the EMD uncertain and create a fear for hurting the patient.

"What I do when I suspect a CA depends on the witness's presence of mind and response to act"

To be open-minded

This main category describes the dispatcher's perceptions of being open-minded to the witness responses.

To be open-minded to the witnesses expressions

This subcategory describes the EMD's perception of their own capability in listening actively and interpreting both by using previous experience and by being open-minded to new situations.

"For 60-70% of the time the best I can do is to listen. One receives all the information

one needs just by listening. One must, however, ask certain questions. But one receives most of the information just by listening."

To interpret according to the witnesses preparedness to act
This subcategory describes the dispatcher's perception of difference between obviously dead with late signs of death and those recently having a CA and still being warm.
"A grey zone is: Is the patient already dead? If there is no rigidity or lividity and if they are prepared to start resuscitation, then one should encouraged commencement even if one feels it is nothing more than a formality. If they are prepared to even a preliminary try."

To be organised
This main category describes the perception of the dispatchers as to their own capabilities in having a structured idea as to how to direct the conversation and assess circumstances.

To be capable of analysing difficulties and possibilities, to have contact and guide the witness
This subcategory describes the dispatcher's perception of their ability to analyse the situation adequately and act accordingly.
"A step-wise guidance of the witness: With a suspicion of CA, I ask if they can perceive any breathing. If they do not know, I ask them to check. If I receive the answer that they can't feel anything, I say: I will help you and so on...Then step-wise continue - not to harass them, but listen and if or when it gets to be too much, be supportive at the same time. Offer one thing at a time."

To obtain information from the witness in the right order
This subcategory describes the EMD's perception of prioritisation, receiving information about location and descriptions of roads and landmarks to be able to guide the rescue units to the area before providing CPR instructions.

"The CPR instruction is secondary, the primary object is to comprehend what has happened and where the patient is located."

To have a suspicion of CA in certain circumstances
This subcategory describes the dispatcher's perception of situations whereby certain circumstances point to a suspected CA.

"One can be suspicious when it occurs in the home and there is a person who has collapsed who has a heart condition."

The categories for perception in offering t-CPR were:

To feel prepared to meet the witness by being organised, flexible and supportive
This category describes the dispatcher's perceptions of being prepared to be active and present for the witness, as well as regarding the needs of the situation in a structured way.

To be active and structured
This subcategory describes dispatcher's perceptions of experiences from situations where they had both to regard the time factor as well as influence the witness's ability to act.
"We talk about CPR all the time, but a 75-year old lady doesn't know what that is, but they do, however, know what mouth-to-mouth or artificial breathing is! We have to adjust to whom we are talking to."

To be a flexible guide
This subcategory describes the dispatcher's perception of influencing the witness to act, especially those who appear to be susceptible, cases in which the EMD is prepared to meet the witness's own intention to act.
"That one does something, this is important for the people on the other end that are willing. That they accomplish something whilst waiting for the ambulance. As this is what they want to do. What can I do? Many ask this question. Many are normally in a

state of shock when they call, thus not reacting normally."

To provide confidence and psychological support
This subcategory describes the dispatcher's perception of being present for the witness, to have confidence and give psychological support.
"...we can ask them to stay by the patient's side and I choose to stay in the phone as a security and ask them to check on the patient."

To obtain a basis for assessments
This main category describes the dispatcher's perception of the basis for the decision as to whether to offer t-CPR, ranging from using the CBD curriculum, to making totally subjective assessments independently of the CBD.

To make subjective assessments of witness's inability to act
This subcategory describes the dispatcher's perception of the witness's ability to act in relation to age. The subjective experience of the dispatcher determines when to make an offer.
"...if it is an elderly couple, 70-80 years old, I do not even ask the woman (if it concerns the man), nine times out of ten, whether they wants to help. They can' t manage - to pull him down to the floor, feel for pulse and breathing, to kneel down."

To use criteria-based offers
This subcategory describes the dispatcher's perception of demanding the criteria - non-responsive and non-breathing patient - and the difficulties in obtaining this confirmation from the witness.
"...one should offer instruction when the patient is not awake and not breathing, and that information can be difficult to get."

To decide whether he/she wants to act
This subcategory describes the EMD's perception of having the power not to act, without any obvious reason.
"We should use the instruction, but it is not compulsory. We do not have to use it."

To omit interview questions
This subcategory describes the dispatcher's perception of having lack of knowledge and therefore omitting to ask the right questions.
"...reasons for not making an offer when one should start, could be lack of knowledge of the dispatcher combined with poor interview questions."

To be observant of different obstacles in any given a situation
This category describes the dispatcher's perceptions of a situation in which both technically and personally related obstacles occur, as well as lack of response of the witness to their suggestions.

To recognise the problem of having a long distance between patient and telephone as the reason for not making an offer
This subcategory describes the dispatcher's perceptions of patients being physically out of reach of the telephone.
"...reasons for not making an offer are when patients are hard to reach, for instance in the bathroom or outdoors."

To recognise problems of third-party relay as reason for not making an offer
This subcategory describes the dispatcher's perception of the impossibility of making an offer when there is a third-party relay.
" cannot offer instruction when it is a report from a third party."

To have experience of witnesses unreachable due to severe stress as a psychological reason for not making an offer
This subcategory describes the dispatcher's perception of making an offer due to the inability of witnesses who show a strong reluctance to every suggestion of being active.

"...then there are cases: Do you want to help with CPR? "I don't have time! I cannot!"... he was already fleeing, he was already on his way, sort of."

To have experience of witnesses being physically disabled or having an infirmity as the reason for not being able to act
This subcategory describes the dispatchers perception of some witnesses either telling us that he/she is physically disabled/ infirmity or that problems occur following the offer due to this.
"...and he was working really well whilst we waited for the ambulance. Afterwards he very quietly said: I don't know if I can manage more as I had a heart attack myself not so long ago, and then I felt as if two people were going to die on me. Towards the end - prior to arrival of the ambulance - he was very affected, he was very tired. I mean it is really tiring to do CPR, so I said to him: you should naturally only do as much as you feel capable of, so much as you can manage. You must also take care of yourself."

To have experience of witnesses who do not want to act for unknown reasons
This subcategory describes the dispatcher's perception of experience with witnesses telling them straight that they do not want to help for unknown reasons.
"...it can be that they don't want to, they can't manage mentally."

To have experience of witnesses who have language difficulties *(interview 1)*
This subcategory describes the dispatcher's perception of experience with witnesses who have language difficulties.
"...it can be language difficulties. This is today a large group. We cannot understand each other."

The categories for perception for performance of t-CPR were:

To feel engaged, to be supportive for the witness
This category describes the dispatchers' perception of engagement in a situation with suspicion of CA, ranging from an interest and beliefs of being of help, to less engaged where the witness's poor knowledge impacts negatively.

To be dependent on the witness's susceptibility and flexibility
This subcategory describes the dispatchers' perception of CPR performance as highly dependent on the witness's ability to focus according to the EMD's guidance. There are feelings of satisfaction when the witness is receptive and prepared to act, which is described as improving the dispatcher's engagement. There are perceptions that most witnesses are reachable but the opposite can also apply, which points to the offer being accepted in the first place as the largest obstacle for provision of CPR instructions.
"There was a women – she was around 40 perhaps. She was really responsive. Then one approaches the call in a completely different way if one feels that there is a chance. One feels that there is a real possibility of doing something when the person is so receptive. Then I think this feels really good. "

To be able to act
This subcategory describes the dispatcher's perception of being given an opportunity to be of active help. There are feelings of making a difference, giving immediate help and be supportive until the ambulance arrives, to constitute a needed link.
"It is a unique opportunity. I would not want to be without it...if all the ingredients are present and if they fit and if the CPR is well done, one can help someone to come back to life, to get a second chance. That has happened. That I think is a unique feeling, which is worth working on."

To prioritise being a support to the witness for CPR performance
This subcategory describes the dispatcher's perception of how to prioritise these calls ranging from the EMD who focuses on the instruction while their colleagues offer

support by temporarily taking over the running routines for her/him, to the dispatcher for whom the motivation for providing t-CPR is influenced by the workload. Thus, having difficulties prioritising the time-consuming t-CPR before taking the incoming calls.

"When there is really a great deal to do I can imagine that some people can be stressed at having to start something like this that takes so much time and find themselves tied up, as there are many other calls waiting. It is important to know that - I can take instructions even if this person continues for 15 minutes and I will do this and everything else must wait during this period so that I can take the time required for this call, and if the emergency line is frantic I must just ignore it. This is about saving just this one person right now."

To feel less engaged by the witness's lack of knowledge

This subcategory describes the dispatcher's perception of the witness training in CPR, ranging from conceiving their role as a support for the relatives in their wish to help, to being guides in an efficient CPR. When the witness's previous knowledge of CPR is lacking, this impacts negatively on the EMD's desire to encourage the witness to continue.

"...then we should start with the heart massage and they must listen to what I say, go and do it and then come back to the call. Then comes the comment: "Nothings happening", then I feel somehow a hopelessness."

"When the whole Swedish nation has been on a CPR-training course, then I believe that we can fill a very important function, as it is then that we are their support system to their underlying knowledge. To those that have the basic training and that need support to remember. But those that have never done this before, then I believe that it is difficult to be good at it. In these cases, I believe that it is only a mental thing for the relative, to feel that he or she was able to do something."

To be ready for the witness's beliefs of an immediate return of vital signs after CPR initiation

This subcategory describes the dispatcher's perception of witnesses who show feelings of hopelessness and dejection after giving chest compressions with no immediate return of vital signs and how to handle this, as well as the fact that the dispatchers cannot ensure that the resuscitation effort lead to survival.

"...if there is no response, one asks if they can see the chest rising and falling, if the head is tilted back far enough. Then an apathy can arise..."

To feel secure by recognising response-feedback from the witness

This main category describes the dispatchers' perception of the witness reporting and giving feedback on the actions at the scene as "good cases" which also determines the EMD's feelings of hoping to succeed.

"I think it is useful to try to imagine how it looks at the scene and what they are doing. To have an understanding and to make a picture of it and be prepared to meet problems. And to try to listen for convincing answers to your questions."

To observe external conditions with regards to the localisation and technical complications

This main category describes the dispatchers' perceptions of favourable/ unfavourable external conditions.

To know the significance of the place of the CA

This subcategory describes the dispatchers perception of the "good case" being located in an urban area, and ranging from being most favourable if it is in home to that the place of the arrest is of no major importance.

" ...he snored and he is lying in front of me and he don't seem to be breathing anymore...There! And in the middle of Vänersborg or in the middle of Trollhättan, there we have the right conditions."

To know the significance of technical impediments

This subcategory describes the perception of the dispatchers of the witness's problem of moving the victim down onto the floor, as a major problem, which commonly obstructs CPR performance. The telephone being too far away, for example on another floor, make it difficult to complete instruction. There are also perceptions that some witnesses do not complete instruction due to repugnance.

"... there is a problem with heavy patients. They cannot get them down on the floor. They are afraid that they will be hurt and I cannot always persuade them to pull them down anyway. And then I have to convince them that it is more important to start CPR than that the patient is a little hurt."

To use other (medical) resources

This subcategory describes the dispatchers' perception of using the nearest medical resource by dispatching healthcare workers (from GPs offices) to ensure performance of CPR.

"... if it happens outside Göteborg, where we have totally different times for ambulance arrival, then you have to do everything to dispatch people. One can dispatch healthcare personal from the GPs office. Then you know it's trained personal at the scene, who can start CPR."

To be composed and adjust to the needs of the situation

This main category describes the dispatcher's perception of their ability to be a guide, being supportive by being determined, unpretentious and by showing empathy towards the witness.

To be an authority who guides the witness

This subcategory describes the dispatcher's perception of directing the witness and not letting them take over, both force them to pay more attention as well as to be an emotional support in influencing them to think that they can act. The aim is to create possibilities for first aid.

"Have good empathy, but at the same time be a little resolute when needed, as is necessary in these situations. They should not be indecisive and uncontrolled as then there will be no instructions followed. One should make them listen and maybe be a little firm sometimes. And suddenly they are functioning and feel that someone has now taken responsibility. Tell them also that you are there to help. But it is the combination of being gentle and having empathy and being very resolute – this is very important."

To keep calm and patient

This subcategory describes the dispatchers' perception of being calm and composed, where composure and patience can be projected and keep the witness from being distraught.

"It is probable that one gives a sense of composure or that they can come over the sense of panic thanks to the calmness one gives. It can feel like an unburdening. Instead of finding oneself in an adverse situation. Someone counsels you with something that sound very sensible - here at last I can in fact do something."

To feel competent

This category describes that the dispatcher's perception that being able to give CPR instructions is dependant on how often they work as a receiving party, and not only sending out the rescue units. This ranges between feeling experienced, which reduces the dispatcher's indecision to act, to omitting an offer of CPR instructions due to uncertainty.

"Some don't want to give this instruction, they cannot, they are a little insecure...every time a doctor comes (to the dispatch centre), the number of cases increase where telephone instruction are given."

" the more you are doing this, the surer you get, and to get over the threshold of starting something."

To feel despair

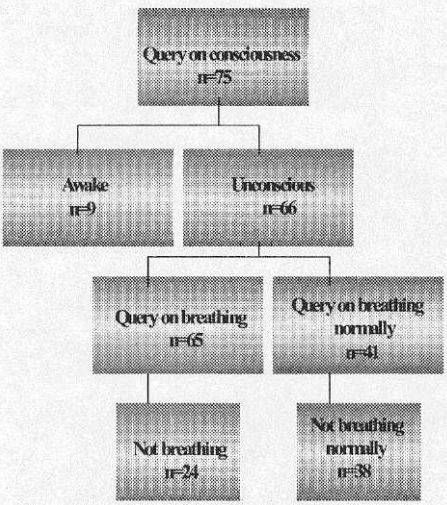
This category describes the dispatcher's perception of a futile situation when

confronted with a suspected CA and the efficacy of CPR instructions are questioned.
"I think it is too late already when they call. I don't know for sure if I believe in it. We don't get to the patients in time, I think. They are not witnessed, they are found, so it is already too late."
"I have heard so many cases where it hasn't worked. And not so many times where it has worked. They cannot inflate air or they have bent the arms (when they do the chest compressions). The ambulance personal witness many strange ways of performing CPR."

Paper VI
In this paper, by evaluating 100 tape recordings of EMD calls, the EMDs ability for the identification and prioritisation of cardiac arrest cases, offering and achievements of dispatcher-assisted bystander cardiopulmonary resuscitation is presented. The paper also give an account of the frequency of agonal respiration in cardiac arrest calls and the caller's descriptions of breathing.

The EMD raised questions of consciousness (n=100) in 75% and respiration in only 2/3 of all cases. The specific question: "Is he/she breathing normally?" was only raised in 41% of all cases (Fig. 6).

Figure 6



Among the 25 cases where no question of consciousness was raised, there were seven cases in which it was obvious from the call that the patients were awake, and in one case a nurse reported that CPR was ongoing. In the remaining 17 cases the caller reported a variety of signs and illnesses that would have led to inquires from the EMD about vital signs (Table 12).

Table 12

	n=17
Breathing difficulties	6
Chest pain	2
Collapsed	3
Seizure ongoing	1
Impaired consciousness	1
Syncope	1
Diabetes coma	1
Uncertain problems, nausea	1
One case where no information was available in the dispatch protocol	1

Based on the interrogations, 62 cases presented a clear opportunity for the EMD to identify the case as suspected cardiac arrest. These patients included the 24 cases of suspected unconsciousness and not breathing, and 38 cases of suspected unconsciousness and not breathing normally (Fig. 6).

Thirty-eight patients were reported as not breathing normally, and the descriptions were; difficulties in breathing (n=10), poorly (n=10), gasping (n=8), wheezing (n=5), impaired (n=4) and occasional breathing (n=1). According to the ambulance charts, 24 of these were in respiratory arrest on EMS arrival, four patients were awake, 2 patients were borderline conscious with wheezing breathing and for 8 patients information was missing. The incidence of suspected agonal breathing in this study was estimated to ~30%.

The ALS response was not dispatched in 17/100, of which 9 patients fulfilled the criteria for a suspected life-threatening condition.

Among the 100 cases, 24 were identified as suspected unconscious and in respiratory arrest. A further 38 cases were presented as unconscious with abnormal breathing. In only fourteen cases was dispatcher-assisted bystander CPR offered by the EMD, and in 11 of these it was attempted, of which 8 were completed.

By analysing the reasons for not offering dispatcher-assisted bystander CPR, we interpret that except for the 14 offered cases, an additional 32 cases (in all 46) would have been eligible to be approached with such an offer.

These were patients with gasping or abnormal breathing (n=16), cases not asked whether there was breathing or not (n=10), and cases in which it seems like the EMD has omitted the offer for no obvious reason (n=6).

The vast majority of callers were calm even in the beginning of the call (score 1 and 2; 69%) and as many as 90% were co-operative (score 1,2 and 3). Towards the end of the call, 83 were calm and 96 were co-operative. None of the callers scored 5, i.e. showed an uncontrollable, hysterical behaviour (Table 13).

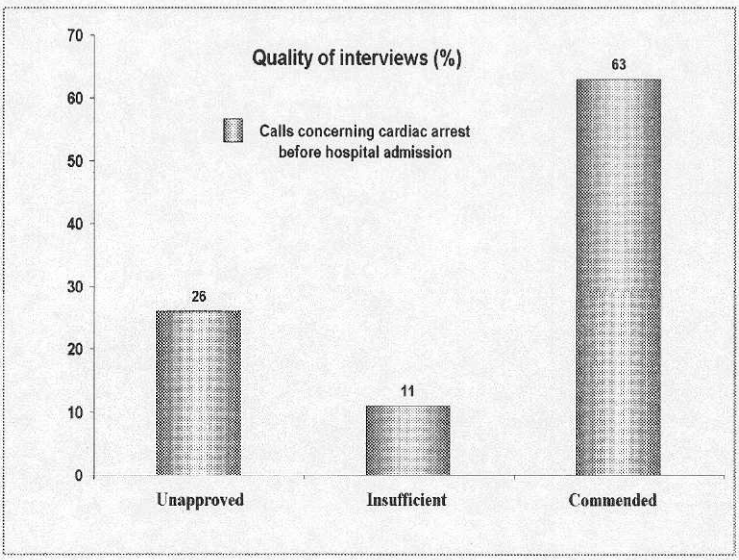
Table 13

	n=100, %
At the beginning of the call (%)	
(1) Normal conversational speech	31
(2) Anxious but co-operative	38
(3) Moderately upset but co-operative	21
(4) Uncooperative, not listening, hysterical	10
(5) Uncontrollable, hysterical	0
At the end of the call (%)	
(1) Normal conversational speech	39
(2) Anxious but co-operative	44
(3) Moderately upset but co-operative	13
(4) Uncooperative, not listening, hysterical	4
(5) Uncontrollable, hysterical	0

In two-thirds of all cases, the quality of interview-performance was highly commended since the EMD had raised relevant questions and interrogated according to the needs of the situation, as well as offering dispatcher-assisted bystander CPR in appropriate cases. Eleven percent of interviews was insufficient, where the EMD raise questions regarding either consciousness or breathing, but nor both, and did not offer dispatcher-assisted bystander CPR, o for any obvious reason,

The remaining 26% of cases were considered as unapproved since important questions were omitted and the EMD terminated the call with no further interrogation, despite reasons to suspect a serious condition (Fig. 7).

Fig. 7



DISCUSSION (Papers I and II)

Is the handling of patients with chest pain at the EMS dispatch centre optimal, and what are the weaknesses?

Optimal handling with regard to the proportion of accurate prioritisation was one endpoint in the study. ALS response is shown to reduce the mortality in AMI in comparison with patient randomised to transportation with BLS-response (Wennerblom et al. 1982). In Göteborg there is a two-tiered EMS system and limited resources, where the EMD stratifies patients who call for an ambulance due to chest pain. In a prior study of patients transported by ambulance to the ED due to suspected AMI, only 43% of these patients, whom the physician suspected strongly of having AMI, were transported by ALS-response (Herlitz et al. 1992). Subsequently, the majority of patients assessed as suspected AMI in ED, were allocated a BLS response by EMDs. In the present study, however, the distribution of priority levels were totally different, where 81% of patients defined as having a potential life-threatening condition (including an acute coronary syndrome of 60%), received ALS response. Thus, the handling of patients with chest pain with regard to prioritisation, was close to optimal. This was also shown in the relatively strong relationship between the EMDs degree of suspicion of AMI, and development of AMI, where the EMDs accuracy was relatively high.

Explanations for the difference in priority between the two studies, could be that the prior study was performed five years before (1986-1987), another might be that the EMD's performance was influenced by the present study. The study protocol, filled in by the EMDs, probably constituted an extra support for the prioritisation's being more frequently in line with current criteria and also the interview becoming more standardised according to this.

However, in a recently performed study in Göteborg, where patients transported by ambulance were retrospectively evaluated from ambulance records with regard to symptoms raising suspicion of acute coronary syndrome (chest pain and other symptoms). In this report, patients with a final diagnosis of AMI and all patients having an acute coronary syndrome, 76% received ALS response (Herlitz et al. 2002). Still, 24% of patients with acute coronary syndrome and AMI, were not allocated an ALS response by the EMDs.

The weaknesses of the handling of chest pain calls are, by the studies presented in papers I and II, not revealed. A useful approach for evaluating the handling of calls (in this case chest pain or suspected AMI in the ED), is to assess tape recordings of calls for receiving answers of: Are there other crucial information in the calls that we did not ask for in the study protocol? What knowledge do the EMDs use? What basis do they have for their assessments? Are advice and instructions given when appropriate? Is the EMD able to be a support to the caller or patient, when there is need for it?

Are there reasons to estimate the intensity of patient chest pain?

In the present study, patients judged to have severe pain developed AMI during their hospital stay twice as often as patients judged to have vague pain. This difference between severe and vague chest pain and the subsequent development of AMI, was seen among younger patients and males, but was not found among older patients and women.

There are reasons, thus, for estimating the severity of chest pain. This may influence the assessment, especially in cases of strong intensity of pain. Additional information, however, is crucial, especially in cases of vague or no chest pain, where pain radiating to neck, jaw, arms and back and associated symptoms reflecting a worsening in vital functions (Grijseels et al. 1995). Overall relevant knowledge of how life-threatening

conditions can present and evolve is highly important for the EMDs.

Are there reasons to raise question about associated symptoms?
In the present study, the presence of cold sweat tended to be associated with a higher risk of AMI ($p=0.06$). None of the other symptoms showed a similar tendency. However, the sample size was small and the statistical power low. Other studies have, however, confirmed the association between associated symptoms and a life-threatening condition. Grijseels et al. (1995) found after triaging patients seen by a general practitioner, that chest pain as main symptom, male gender, radiation of chest pain, the presence of nausea and/or sweating, a history of cardiovascular disease and an abnormal ECG, was independent predictors for acute cardiac pathology (acute myocardial infarction and unstable angina). Associated symptoms such as nausea, vomiting and dyspnoea have been shown more frequently among female patients with AMI, and cold sweat has been shown to be occur more often in men with AMI (Mieschke et al. 1998, Goldberg et al. 1998)

Regarding the associated symptom of anxiety, AMI patients have described more intense sensory, affective and total pain, even though they had received more morphine than non-AMI patients (Gaston-Johansson et al. 1991). They have also been shown to use more often stronger word descriptors, reflecting the emotional component (Hofgren et al. 1994). The AMI patient's higher emotional component of pain was explained by anxiety and fear.

Thus, presence of associated symptoms is an important indicator of the patient condition, since it can be a sign of a possible severe condition and an hemodynamically unstable patient, needing prompt and advanced EMS response.

Further studies with larger sample sizes than ours, are needed to evaluate the predictive value of various associated symptoms in the emergency medical dispatch.

Should the EMD attempt to diagnose?
It should always be the description on the severity of symptoms, which form the basis for prioritisation. However, a sense of the whole is needed for being able to understand the severity of combinations of symptoms. The EMD might however report their suspicion of a diagnosis to the EMS responders.

Are there other questions than intensity of pain or associated symptoms that the EMD should raise?
The EMD should always raise questions about impaired consciousness and breathing difficulties, which, when present, points at a potentially life-threatening condition demanding highest priority. Furthermore, in cases of chest discomfort, description of the localisation (Everts et al. 1996) and radiation (Grijseels et al. 1995) of pain is valuable information for assessing the case.

Pain in the chest and the radiation to arms, shoulders, neck, jaw, back or higher abdomen are signs that should raise immediate suspicion of an acute coronary event (Lee et al. 1991, Goldberg et al. 1998).

Patients calling for an ambulance due to chest pain and having a previous history of cardiovascular disease, could be indicative of a worsening of the disease, which should favour a decision of ALS response (Lee et al. 1991, Grijseels et al. 1995, Herlitz et al. 2002).

The onset of symptoms in the acute coronary syndrome may be acute, gradual or intermittent. Ruston et al., (1998) who performed face-to face interviews with AMI patients, often found descriptions of an evolving experience rather than an acute event, which is also an important knowledge for an EMD. In AMI, compared to stable angina, the duration of pain is usually more

than 30 minutes, thus duration of pain should be asked for..
A serious condition may be present when symptoms (chest pain/chest discomfort with or without cold sweat, nausea, vomiting, fainting, anxiety) interrupts normal activity. Thus questions regarding patients activity before and after onset of symptoms are important.

A qualitative analysis of calls concerning AMI, would be beneficial to help explore what and how information being present in the calls, is valuable in the suspicion of AMI.

Can we define "life-threatening conditions" which are presenting with chest pain/discomfort?
Conditions presenting symptoms of chest pain/discomfort have been studied at emergency departments (Herlitz et al. 2000) and with general practitioners (Grijseels et al. 1995). There is no generally accepted definition of a life-threatening condition in this population. However, conditions that may be defined as life-threatening can be described as those, which may lead to death, and such information can be gathered from statistics over causes of death. The following diseases and conditions may present with chest pain/discomfort, and commonly do, and are also associated with an increased risk of death: cardiac arrest (VT, VF, asystole and PEA), AMI, myocardial ischemia, pulmonary embolism, aortic aneurysm, pneumothorax, myocarditis, pericarditis, cardiomyopathy, aortic disease (Herlitz et al. 2000, National Swedish Board of Health and Welfare 1999).

In a study of 930 ambulance transports of patients with chest pain or other symptoms raising suspicion of acute coronary syndrome, independent predictors for 30-day mortality were: age >70 years, symptoms of dyspnoea, a low oxygen saturation, hypotension and a decreased consciousness on ambulance arrival (Herlitz et al. 2002).

There are however difficulties to clearly define and differentiate what conditions should be classified as life-threatening or not.

Was the EMDs ability to suspect AMI optimal? If not, how could that improve in the future?
When EMDs had a strong suspicion of AMI, 29% developed an AMI. The EMDs ability to foresee AMI was thus relatively accurate, taking into account that they base their assessment only on the patient or callers description of symptoms and course of events. This accuracy can be compared to study where physicians at ED had the accuracy of 50% (Karlson et al. 1991), and physicians in the pre-hospital setting having an accuracy of 45% in predicting AMI (Herlitz et al. 1995).

However, it was also found that patients where the EMD had a vague or no suspicion of AMI, 18% respective 15% developed an AMI. Thus, as the EMDs failed to allocate these patients a rapid and ALS response, their ability to suspect AMI might therefore not be optimal.

Only the fact that the patient calls the EMS dispatch centre complaining of chest pain or chest discomfort, is a warnings sign of the possibility of a patient with a life-threatening condition.

In patients admitted to the ED due to chest pain a comparison between patients transported by ambulance and those with self-transport showed that there was a final diagnosis of either confirmed or possible myocardial infarction/ischemia in 69% of the ambulance cases compared with 38% in self-transported cases (Herlitz et al. 2000). Furthermore, associated symptoms such as acute severe congestive heart failure, syncope and arrhythmias were more frequent among patients transported by ambulance and the proportion being hospitalised was 87% compared to 53% among those who were not (Herlitz et al.

2000). In a study from Ulm in 1991, of more than 35,000 alarm calls to the dispatch centre, half of patients suffering from chest pain were vitally endangered and needed immediate medical treatment (Rossi 1994).

For improvements in the future the focus should be to assess randomly the quality of the handling of all patients at the EMS dispatch centre, by a continues evaluation and feed-back to EMDs, both rapid (feed-back from the EMS for preliminary clinical assessment) and slow (review of tape recordings, follow-up of clinical courses for overall accuracy).

In the present study, it would be of interest to survey the calls where the EMD had no or vague suspicion, to find out what information was available, to develop the interview skills by giving feed-back to EMDs.

The ability to foresee AMI is based on the ability to realise what a description of symptoms or combination of symptoms may indicate. This might be improved by an increased clinical experience and theoretical knowledge of the characteristics and possible course of diseases.

Why was the relationship between the EMDs priority and presence of life-threatening conditions and prognosis regarding survival so poor?

No relationship was found between the EMD priority and the development of life-threatening conditions, or short-term survival. However, in patients retrospectively judged as not having a potential life-threatening condition, as many as 73% received the highest priority level, not differing that much to what patients classified as having a potential life-threatening condition received (81% receiving highest priority).

The lack of relationship between the EMDs priority and the presence of life-threatening condition was due to this overestimation of the non-life-threatening cases.

A certain overestimation for margins of security is inevitable in emergency medical dispatch, and could be the result of the dispatch criteria's for the main complaint "chest pain", which says that an ongoing severe or vague chest pain (the latter in combination with associated symptom) for more than 15 minutes are entitled of highest priority. However, an unnecessary use of limited resources, and a wearing out is detrimental to the EMS system (Zachariah et al. 1995).

In Sweden, the set up time limit from the start of the call until the EMS units should be dispatched, is 45 seconds. This is the EMDs time to decide level of priority. Due to the lack of time and all eventualities in an interview, it is likely that questions remains unanswered.

Regarding the similar mortality rate in the two groups, one explanation could be the relatively small sample in this study. However, there are reasons to be cautious in the interpretation of data since only 20% developed AMI. The prehospital mortality among AMI patients being alive on arrival of the ambulance, is low according to observations by others (Wennerblom et al. 1984).

How could priority by EMD improve ?

A qualitative analysis of emergency calls concerning chest discomfort and the clinical course, could be an evaluative approach to explore possibilities and obstacles of priority in all types of complaints. In our study, pain intensity and associated symptoms was used and the EMDs choose themselves the degree of AMI suspicion without necessary correlation to the above-written variables. No evaluation of the EMD reliability in filling in the study protocols in relation to information present in the calls was made. Analyses of a portion of calls to assess the correct recognition by the EMDs of the entry criteria, have been performed by others when evaluating the handling of potential cardiac emergency calls (Sramek

et al. 1994). A similar analysis would have been useful in the present study with regard to EMS registrations according to information available in calls.

EMDs need tools for supporting collection and documentation of symptoms and injuries in a correct and clear manner. This should constitute a base for priority, advice and instructions to the caller.

How our experiences of the relationship between the EMDs priority and outcome fit in with other studies?

In Göteborg it has previously been shown that EMDs fails to identify patients with AMI in 57% (Herlitz et al. 1992). In the present study (II), the accuracy in priority for AMI was 81% (including other causes also defined as life-threatening). However, due to the study protocol, the EMDs could have been influenced to make more accurate decisions. In a study of the EMS dispatch in Amsterdam and Enschede in Holland, the EMDs only failed in recognising medically urgent calls (including the main complaint chest discomfort) in 10%, i.e., 90% accuracy. However, only 40% of calls concerning chest discomfort were classified as urgent in retrospect, needing an emergency ambulance transportation (Sramek et al. 1994).

Paper III

Why do EMDs overestimate some cases as cardiac arrest ?

In the present study, 10% were mistakenly identified as suspected cardiac arrest, of which only one patient received completed dispatcher-assisted bystander CPR.

Similar results were found by Hallstrom et al., showing that EMDs initially identified 20% patients of non-cardiac arrest as suspected cardiac arrest cases. This was in most cases though reconsidered during the continuation of the instruction protocol, leaving only 7 patients of non-cardiac arrest receiving dispatcher-assisted bystander CPR (3%) (Hallstrom et al. 2000).

The final diagnoses and conditions in the present study of the mistakenly identified non-cardiac arrest cases were: syncope, seizures, stroke and unconsciousness due to intoxication, which all may present with unresponsiveness. Syncope, however, is a condition with a return of consciousness within a short period of time (<2 minutes), and should be discovered by the EMD during the call. The other conditions may be shown be unresponsiveness and abnormal breathing, and a differentiation to suspected cardiac arrest may not be possible. Lack of information to enable interpretation of the case has properly been reported frequently by EMDs as a reason for misdiagnosing. Another reason is failure in the interrogation by the EMD, which has been shown in 1/3 of calls concerning cardiac arrest (paper VI). Continuous evaluations of patients receiving dispatcher-assisted bystander CPR for bringing the EMDs feed-back is therefore essential in this intervention.

Why do EMDs underestimate some cases as cardiac arrests?

In the present paper, only 1/3 of patients with cardiac arrest outside hospital were identified as suspected cardiac arrests by the EMDs. There might be a row of reasons behind this result, including that some patient's arrest after the call to the EMS dispatch centre, or callers that report presence of breathing despite a respiratory arrest or abnormal breathing, and other insufficient information from the caller. There could also be an insecure handling by the EMD, as shown in paper VI, where some calls revealed insufficient interrogations, with too short interviews and neglecting of signs and symptoms, where the EMS was dispatched with no further interrogation (paper VI). The problem of agonal respirations was also shown as being a large obstacle for identification by the EMDs. Kuisma and Määttä reported that a quarter of cardiac arrest cases remained unrecognised by the EMDs, mostly due to the caller not knowing what had happened as he/she had only been asked to call or that

the dispatch protocol was not being followed (Kuisma & Määttä 1996).

How can we improve EMDs accuracy?
Accurate interrogation by the EMD may decrease the number of cases which are mistakenly identified as suspected cardiac arrest as well as being able to detect patients in cardiac arrest to a larger extent. There are recommendations for development of EMD accuracy (National Heart Attack Alert Program, 1995). The first recommendation is to review and give feed-back on calls to EMDs for them to be able to correct possible mistakes and increase protocol compliance, including the important basic questions being raised. The second recommendation should be to study calls where patients have been reported unresponsive, and the type of breathing, in relation to the subsequent state of patient on ambulance arrival and cause of unconsciousness. In such evaluations, both detection of agonal breathing and other possibly important information could be identified.

Are there reasons to accept some inaccuracy in the identification of cardiac arrest?
A certain inaccuracy is probably unavoidable due to the similarities of symptoms in other causes. By using a reference from a system with a high frequency of suspected cardiac arrest, (Seattle) (Hallstrom et al. 2000), an acceptance of 5% of cases being wrongly categorised by EMDs may be considered acceptable.

Was our material representative? If not, what type of selection was made?
A source for erroneous selection was the large proportion of included cases that were obviously dead on EMS arrival. Some of these were initially suspected to be obviously dead, but the inclusion criteria of unresponsiveness and respiratory arrest fitted for this group of patients too. There is also often a problem for the EMD to receive information about the time of collapse, definitely in unwitnessed cases.
Another selection bias was that the included cases were non-consecutive and constituted a small sample size of only one-third of all cardiac arrests during this time period. The distribution of patients in the different dispatch groups (1-6) was thus probably not representative for all patients who fulfilled the inclusion criteria. Whether this will change in the future or not depends on the willingness to provide EMDs with support, feed-back and a strong medical leadership for their difficult task

How often did EMDs offer and perform dispatcher-assisted bystander CPR?
When the EMD had suspected cardiac arrest (in all, approx. 25%), witnesses to patients later being treated by ALS for cardiac arrest, were offered dispatcher-assisted bystander CPR in 66%, half of these witnesses accepted the offer and one-third performed the instruction. This is a highly commended result, where the EMDs made an accomplishment by frequently offering dispatcher-assisted bystander CPR, which resulted in a fairly frequent performance. Others have reported an offering of dispatcher-assisted bystander CPR in 31% among all cardiac arrest cases (57/185), and in 84% of those considered appropriate and possible to deliver dispatcher-assisted bystander CPR and of these, a subsequent performance in 38% of a completed instruction (Clark et al. 1994).

Why was the survival rate so low?
The overall survival rate for all included cases were 4%. This is, however, misleading due to inclusion of patients who were obviously dead when the EMS arrived. The correct rate of survival is 7%, based on ALS-treated cardiac arrest patients, which is in concordance with results from population-based studies from the same area (Herlitz et al. 2000, Engdahl 1997).

Does our data support that dispatcher-assisted CPR increases survival in cardiac arrest?

Our data could not provide significant support for an increased survival in cardiac arrest due to dispatcher-assisted bystander CPR. However, a tendency was shown suggesting an increase in survival from 6% (groups 3, 5 and 6) to 9% (groups 1 and 2).

Specifically, the combination of prior CPR training plus dispatcher-assisted bystander CPR tenders to have the best survival rate. Our data did not provide obvious support, but this combination may be optimal due to the problem of BLS skill retention (Brennan et al. 1995).

Papers IV and VI.

Was our definition of agonal respiration optimal?

There is no precise medical definition for agonal respirations. In medical dictionaries it is defined as: "pertaining to or occurring at the time just before death" (Dorland's 2000) or " relating to the process of dying, or the moment of death, so called because of the erroneous notion that dying is a painful process" (Stedman, 2000). Thus, they do not define agonal in conjunction with respirations.

Braunwald's textbook of cardiovascular medicine (2001) defines the diagnostics of cardiac arrest: "Absence of respiratory efforts, or the presence of only agonal respiratory efforts, in conjunction with an absent pulse, is diagnostic of cardiac arrest; however, respiratory efforts can persist for a minute or more after the onset of the arrest."

We chose in this study to count any descriptions of abnormal respiratory efforts described by the callers and when the patient was reported unresponsive, as agonal respirations. This "definition" was adopted from an empirical study describing the incidence of agonal respirations in cases of cardiac arrest (Clark et al. 1991).

Clark et al. pointed out in limitations of their study, that the data relied on lay descriptions of a critical medical phenomenon, where lay people have no reference point for describing it. Also, questions asked by EMDs were not consistent to be able to identify the phenomenon.

In our study, the included patients were ALS-treated by the EMS for cardiac arrest out-of-hospital. Whether or not they had the cardiac arrest prior ambulance arrival was not known while analysing the calls and filling in the study protocol.

The results showed that 38 patients were reported as unconscious, not breathing normally. In the subsequent evaluation of ambulance charts, the majority were in respiratory arrest on EMS arrival, while four patients were awake and 2 patients had an impaired consciousness with wheezing breathing.

This emphasises the importance of a thorough initial inquiry regarding the state of consciousness, to be able to assess the type of breathing and the suspicion of cardiac arrest.

Since a pulse check is omitted in the early protocol of dispatcher-assisted bystander CPR (necessary withdrawal), it is not possible to assess the descriptions of abnormal breathing in conjunction with an absent pulse. Thus, due to these results where difficulty occurred in interpreting the cases, mainly in only 2 cases, our definition seems accurate.

How often does agonal breathing occur in cardiac arrest?

In paper VI, the incidence of suspected agonal breathing was estimated to ≈30% among all patients regardless of aetiology of arrest. Paper IV also evaluated tape recordings of patients subsequently treated for cardiac arrest by the EMS. In this study no follow-up of ambulance charts were made in patients reported not breathing normally. Thus, agonal activity was not

specifically evaluated, but there was a suspicion among at least 12 patients, described as breathing heavily, wheezing and snoring (12%).

A paper specifically evaluating the incidence of agonal respirations in cardiac arrest (Clark et al. 1991), showed a high incidence. Agonal activity occurred in 40% in all patients (n=445), 55% in the witness's cases (20% in unwitnessed), 46% in cases of cardiac aetiology (32% in non-cardiac aetiology), 56% among patients with VF (34% among non-VF). Others have reported gasping (agonal respiration) in patients with cardiac arrest in 17% outside hospital, and 46% in-hospital cardiac arrests (Mullie et al. 1989).

Experimental studies of animals have also shown a high incidence of agonal respirations in cardiac arrest (Menegazzi et al. 1995, Berg et al. 1997). (See chapter: Cardiac arrest).

Agonal respirations seem to occur in more than half of all patients with a cardiac arrest according to results of witnessed cases (Clark et al. 1991, Mullie et al. 1989). Most importantly, the presence of agonal activity is associated with increased survival, i.e. having an even better chance of survival than those without (Clark et al. 1991, Mullie et al. 1989, Martens et al. 1995). EMDs must be made aware of this phenomenon and its frequency, which otherwise can prevent them from identifying cardiac arrest, since also the bystanders may omit to initiate CPR.

Why was the quality of the EMDs interview insufficient in so many cases?
The results from our study represent a dispatch centre where there are no medical operational leaders having more than assistant nurse medical competence levels. There are neither any regular and organised feed-back from the EMS organisation on the accuracy in the EMD apprehension and reporting of symptoms and priority in emergency calls. There are no evaluations and continuous reviews of emergency calls, and no time reserved for organised discussions, for ventilating thoughts and questions and to reflect on medical calls. And the majority of EMDs have no formal medical education and no clinical experience. A minority of the EMDs (35%) has previously worked as assistant nurses or EMTs, and five years ago there were only 5% of the EMDs having such formal medical training.

The Index for emergency medical dispatching, a system built to support the EMD in making assessments, prioritise, give advise and instructions in medical acute conditions, was implemented in Göteborg in 1997. Since then there has not been any reviews of calls, nor has any evaluation of Index compliance been performed.

To achieve a high and approved standard of interview quality, there are several conditions that have to be present:
the professional: appropriateness in EMD knowledge, awareness and attitudes towards the problem through specialisation of the EMD as medical dispatcher, focused on the medical area of dispatching.
a timely manageable assignment: where the EMD is not scattered in many different assignments simultaneously, such as by being responsible for dispatch and directing the EMS responders and, at the same time answer to incoming EMS calls;
the work tools: the use of tested protocols and instructions as a support for the EMD;
the organisation: the dispatch centres organisation as integrated with the EMS and hospital emergency care clinics for feed-back, evaluations, and rotate duty for competence maintenance among medical dispatchers.

How does our experience of EMD interview-quality relate to prior studies?
Studies have shown EMD-caused delay in identification of cardiac arrest calls pending on unnecessary questions in 57%, omission of the important question: "Does the patient breath normally?" in 21%, and deviations

from protocol (22%) (Culley et al. 1991). Calle et al. studied cardiac arrest cases to assess the effects of an educational program for EMDs in the handling of cardiac arrest calls (Calle et al. 1997). A total of 112 cardiac arrest cases were studied; 64 before and 48 after the training course. Before the course, all relevant information was obtained in 36% of cases, only partial information in 56% and no useful medical information in 8% of cases. The dispatchers were judged to be the main reason for failure to obtain all relevant information in 34%, by not asking questions, not asking all relevant questions, or by asking the wrong questions. After the training course, the dispatcher-caused lack of information decreased to 18% of cases where this occurred. The training program started with a theoretical course of three x 8 hours, including psychological aspects of handling emergency calls, pathophysiology and therapy in cardiac arrest, stroke, seizures, asthma, drug abuse etc. The main subject dealt with protocols for caller interrogation using key questions and main complaints for prioritisation. 100h of practical training followed. Trends towards an increase in the percentages of cases in which ALS response was sent immediately from 58% before the course to 75% after the course.

How can we improve EMD interview quality in the future?

The primary approach to encounter the needs of quality in interview-performance, is to review medical calls. To use the true situations in a portion of calls processed by each EMD for interpretation and assessment of performance quality together with the EMD. Only then do the dispatchers have the chance of receiving feed-back, not only corrections but encouragement and support for their coming cases.

Another obvious possibility is that the EMS contributes with feedback in accordance with symptoms and accuracy in priority level after assignments. A registration of such feedback into the patients dispatch protocol makes also a base for statistics of overall performance of the dispatch centre, and for each dispatcher and each main complaint.

In paper IV and VI, where we evaluated tape recordings on cardiac arrest calls, the time span between time for data collection is 14 years, but the proportion of cases in which quality of interviews is insufficient or unapproved, approx. 1/3, is unchanged. In a comparison of the two periods there are two changes, firstly the Index for emergency medical dispatch was implemented before the later study (1997), secondly in the recruitment of new staff, assistant nurses and EMTs have been employed (35% of EMDs), during the latter years. These efforts have not in an obvious way had effect on the interview quality. As mentioned before, feedback and medical, operational leadership is missing.

In the issue of what formal competence level is needed for assessing medical cases, and communicating medical advice and instructions, one has to look at the needs of the assignment. For EMDs being knowledgeable enough and maintain motivation over time in a non-visual, stressful medical assignment, my perception is that a registered nurse trained and still working in hospital emergency care or EMS care would be a suitable level of competence.

Are our experiences of the caller's emotional state and co-operation in accordance with previous studies?

In paper VI, we found that the vast majority of callers were calm and able to interact with the EMDs. It is surprising that there were, to a larger extent, no problems with the content and co-operation with the caller. This finding is supported by others, ranging from 65% to 80% of callers in cardiac arrest calls being calm (Eisenberg et al. 1986, Culley et al. 1991, Meron et al. 1996).

What percentages of cardiac arrest cases are accessible for T-CPR?
Both paper IV and VI evaluated the appropriateness and possibility of dispatcher -assisted bystander CPR among cardiac arrest cases. There are 14 years between the two studies, and they are showing a feasibility of between 30-40% of all cases. In a study from King County, studying 185 non-traumatic cardiac arrests, it was also found to be feasible to deliver dispatcher-assisted bystander CPR in 37% (Clark et al. 1994).

What is the main reason for the low number of cases in our study that were accessible for T-CPR?
A major obstacle for the identification of cardiac arrest by EMDs was the presence of suspected agonal breathing, as is described above. Another is, shown both in paper IV and VI, too short and incomplete interviews to assess the case. There are several organisational issues that could support a more accurate performance in EMS dispatch calls (feedback, medical guidance, motivation and demands from medical supervisors).

What place has T-CPR in the treatment of cardiac arrest in the future?
Dispatcher-assisted bystander CPR is a part of the patient's possibility of receiving early life-supporting measures, regardless of whether the bystander is a trained rescuer or not. According to a study asking 1,012 recently trained rescuers whether they thought guidance from an EMD would make it easier to start CPR, 75% answered "yes" (Axelsson et al. 2000).

Especially when considering the problem with skill retention (Brennan et al. 1995), the EMD and the dispatcher-assisted bystander CPR plays an important role in suggesting and encouraging the witness to start first aid.

How should dispatcher-assisted bystander CPR be given – as chest compressions alone or as a combination of mouth-to-mouth ventilation and chest compressions?
One randomised-controlled study compared two procedures of dispatcher-assisted bystander CPR and survival. Among the cases in the intervention arm, receiving instructions for chest compressions only, 14.6% survived compared to the control arm receiving instructions for traditional CPR, i.e. mouth-to-mouth ventilation's and chest compressions, where 10.4% survived (Hallstrom et al. 2000).

However, this study was performed in an EMS system with rapid response times (mean 4 minutes). Whether the study results are relevant for other settings with longer response times has not been explored and more research is needed to support this result in other areas and EMS systems.

The advantages of providing instructions for chest compressions alone, are several. Firstly, for the EMD, as the shorter and simpler message makes their assignment more manageable, secondly for the bystander to accomplish only one technique, and thirdly for the patient to receive help early, and maybe more effective chest compressions for the chance of survival.

The disadvantages are that a portion of patients needs early oxygenation and all patients maybe need a patent airway during chest compressions alone (Becker et al. 1997).

There are recently presented guidelines that say that in an adult patient where the witnesses on scene are inexperienced in CPR, an instruction in chest compressions alone is recommended (International Guidelines, 2000).

In our country, most bystanders are untrained in CPR and would therefore only receive instructions in chest compressions accordingly the ERC guideline. For to be able to scientifically study survival in relation to instructions in traditional bystander CPR and chest compressions only

CPR, would take many years. So for now, the ERC guideline only should be implemented at our EMS dispatch centres.

Paper V

DISCUSSION (Paper V)

Why does the attitude vary toward dispatcher-assisted bystander CPR among EMDs?

In the description of the EMD's perceptions, many with a long experience of emergency calls, their work has been determined in terms of having a caring and ethical attitude in their communication to the caller. This includes intention to meet the witness mentally by being flexible, adapting to the witness and the situation and to convey confidence and support.

The EMDs have also described perceptions of applied listening and being sensitive of witness responses, to function as an authority, retaining self-control and project calmness. However, perceptions of lack of knowledge which most probably influence the meaning and motivation for a medical intervention, as well as feelings of despair, were also expressed by the EMDs.

This difference in perception probably shows in the EMDs personal interpretations and experiences of the phenomenon. However, a mutual goal, time for joint reflections, and a strong leadership, are crucial components in this special assignment and also for maintaining a positive attitude and approach towards this patient group.

What are the weak links in dispatcher-assisted bystander CPR, and what can be done to improve them?

The EMDs have described insecurity in the use of the dispatch protocol. There are perceptions of needing a clear statement on the absence of breathing to be able to continue with an offer of dispatcher-assisted bystander CPR, i.e. not following the instructions regarding the questions of "breathing normally". This has to be looked into further since patients with suspected agonal respirations are a large group (>40%) among cardiac arrests (Clark et al. 1991), and are definitely requiring an early CPR intervention.

The EMDs have expressed that they are afraid of initiating dispatcher-assisted bystander CPR on patients with a pulse. There is a chain of conditions resembling cardiac arrest, which could mistakenly be assessed by the EMD as suspected cardiac arrest.

The true cause for most of the patient's initially misdiagnosed as cardiac arrests have been shown to be attributed to stroke or transient ischemic attack, seizures, syncope (Hallstrom et al. 2000), also described in paper III, with the additional causes of unconsciousness due to intoxication or alcohol abuse.

The research design for this problem would be to evaluate unconscious patients reported to the EMS dispatch centre, and the descriptions of these patient's breathing, in relation to the subsequent status on ambulance arrival and in-hospital diagnosis.

The EMDs have also described an overall lack of protocol compliance, using personal preferences instead. Others have reported that by providing the EMDs with appropriate performance feedback, compliance to protocol improves (Clawson et al. 1998).

A crucial weakness in the approach drawn from the results, is that it seems as if the attitude of the caller, to a large extent, influences the EMD in the further handling of the case, i.e. that it lies with the caller in many cases whether or not there will be an offer and initiation of dispatcher-assisted bystander CPR. The EMD's perception of being so dependent of the caller's ability "to focus" could be an exaggeration, since many evaluations have revealed that the majority of callers are calm and co-operative

(Eisenberg et al. 1986, Culley 1991, Meron et al. 1996, Clawson et al. 2001).

The methods to change this might be by strengthening the EMDs perceptions in their work, by knowing what to do and recognising when to do it, by feedback, tutoring and debriefing. This may lead to the EMD having the initiative or intention to act, and to rely not only on the initiative of the caller.

Is our data representative for EMDs in Sweden?

The data produced regarding the phenomenon in this study represents a part of all possible perceptions. Some of the results represents the perceptions of many EMDs and some of only a few. We consider it likely that the results are representative among other EMDs in Sweden due to the similar training profile and due to the EMDs working in the same organisation having the same company policies.

Are all aspects covered in EMDs perceptions of T-CPR?

We consider it likely that the majority of aspects have been covered since many reasonable categories were identified. However, the vast majority of the results were of "positive" character, compared to the results in the quantitative studies (papers III, IV and VI), which showed many problems in the identification and offering of dispatcher-assisted bystander CPR.

This could be that the "positive" perceptions of the phenomenon (such as feeling engaged, supportive, secure and using the dispatch protocol, etc.), were expressed in the interviews and the reason for the fewer "negative" perceptions (including feeling a lack of knowledge, insecurity, despair, etc.) might have been hidden.

What are the crucial factors for the EMDs perception of dispatcher-assisted bystander CPR?

Educational levels most probably influence the understanding of the importance of early treatment for these patients. That is, having a basis for motivation, to have a firm intention while confronted with a suspected cardiac arrest.

There were perceptions of having an interest and belief in being of help, to a lesser engagement - having a lack of faith in the witness' ability to perform lay-person bystander CPR.

This was shown despite the fact that bystander CPR by lay-people has shown a three-fold increase in the chance of survival (Herlitz et al. 1994). In addition, a recently published study shows very favourable results for dispatcher-assisted bystander CPR, with a 50% increase in the chance of survival as compared to "no CPR" before EMS arrival (Rea et al. 2001).

Prior negative and positive experiences have also an impact, as well as the circumstances in the working situation. If the EMD is responsible for both dispatch, directing the EMS responders and answers the incoming calls, this will put the EMD in a situation requiring selection, which we consider a negative factor for the initiation of dispatcher-assisted bystander CPR.

Besides being knowledgeable, the EMDs have perceptions for the need to be empathic, supportive, authoritative, and that he/she needs to maintain calm and patience. To be all of this for the callers in various difficult situations, it is most desirable to receive an input of tutoring and debriefing, the EMDs being in the front line in emergency medical care (Linton et al. 1993).

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CONCLUSIONS

- Among patients reported to the EMS dispatch centre having chest pain, patients judged as having severe chest pain, developed AMI twice as often as patients judged to have vague pain.
- There was a strong relationship between the EMDs initial suspicion of AMI and subsequent diagnosis. However, one-third developed AMI among chest pain patients, where the EMD had had a moderate, vague or no suspicion if AMI.
- No relationship was found between the EMDs level of priority and the degree of suspicion of AMI or risk of early death.
- No relationship was found between associated symptoms and AMI or early death.
- The study sample size was too small to evaluate the predictive value of various associated symptoms accompanying chest pain.
- Regarding patients reported to the EMS dispatch centre due to cardiac arrest, the EMDs should pay more attention to the detection of these patients; due to only a fraction could be identified by the EMDs.
- When the EMDs suspected a cardiac arrest, their accuracy was high.
- Half of the witnesses accepted the offer of dispatcher-assisted bystander CPR, and one-third completed dispatcher-assisted bystander CPR.
- The comparison between no performance and performance of dispatcher-assisted bystander CPR, suggests an increase in survival from 6% (groups 3, 5 and 6) to 9% (groups 1 and 2).
- The sample size was too small to evaluate the impact of callers previous training in CPR on survival.
- In the vast majority of interviews (70%), the quality was very high, while in one-third serious criticism could be voiced.
- Only in 8% of the 99 cases was dispatcher-assisted bystander CPR accomplished, while
- one-third (95% CI, 22-41) of cardiac arrest cases were considered suitable for dispatcher-assisted bystander CPR.

- By listening in an open-minded way, the EMD can collect the vast amount of the information.
- The EMDs have a belief that they are being an empathic authority that relieves the witness of the burden of responsibility, and by meeting the witness mentally, this may enable the witness to act at the scene.
- There are EMDs who feel competent and experienced to encounter these cases, and other EMDs who feel insecure and despair towards the possibility of t-CPR.
- The choice between initiating t-CPR and answering incoming calls is prioritised differently among EMDs.
- There is also a broad subjective assessment among EMDs of offering t-CPR, especially to persons over 70 years old that they consider incapable of performing CPR.
- The EMDs competence in t-CPR is dependent on re-training and feedback on the welfare of the patients.
- Witnesses who are negative towards being active, constitute a common problem. There are witnesses with physical impediments and also witnesses who psychologically are not susceptible to suggestions.
- The EMD is dependent on the witness's knowledge and trustworthiness, and convincing answers from witnesses prompt a more secure feeling in the EMDs, just as witness's lack of knowledge having a negative effect on the EMDs efforts.

- Based on the interrogations, 62 cases presented a clear opportunity for the EMD to identify the case as suspected cardiac arrest. These patients included the 24 cases of suspected unconsciousness and not breathing, and 38 cases of suspected unconsciousness and not breathing normally.

- Among suspected cardiac arrest cases, EMDs offer CPR instruction to only a small fraction of callers (n=14).

- A major obstacle was the presentation of suspected agonal breathing, which was estimated to occur in about 30%, and was described as: difficulties breathing, poorly, gasping, wheezing, impaired and occasional breathing.

- The quality of EMD-performed interviews was highly commended in 63 % of cases, but insufficient or unapproved in the remaining 37%.

- The caller's state of mind was not a major problem for co-operation.

- Witnesses of patients with a combination of unconsciousness and agonal breathing should be offered dispatcher-assisted CPR instruction. This might improve survival in out-of hospital cardiac arrest.

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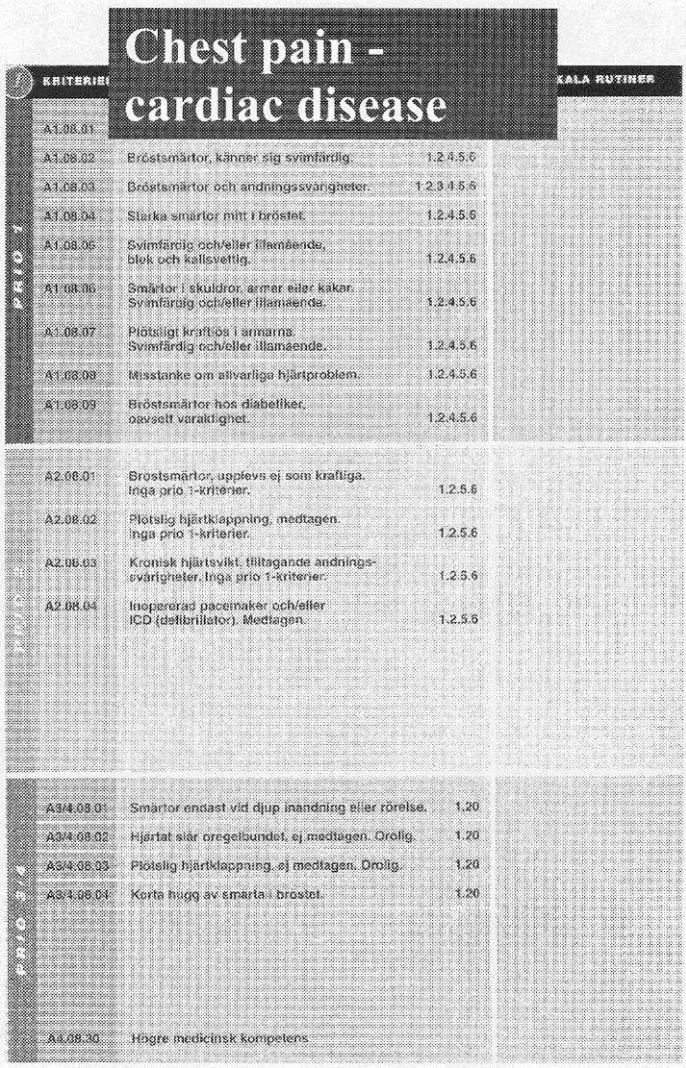
APPENDIX



Chest pain - cardiac disease

PRIO 1		
A1.08.01		
A1.08.02	Bröstsmärtor, känner sig svimfärdig.	1.2.4.5.6
A1.08.03	Bröstsmärtor och andningssvårigheter.	1.2.3.4.5.6
A1.08.04	Starka smärtor mitt i bröstet.	1.2.4.5.6
A1.08.05	Svimfärdig och/eller illamående, blek och kallsvettig.	1.2.4.5.6
A1.08.06	Smärtor i skuldror, armar eller käkar. Svimfärdig och/eller illamående.	1.2.4.5.6
A1.08.07	Plötsligt kraftlös i armarna. Svimfärdig och/eller illamående.	1.2.4.5.6
A1.08.08	Misstanke om allvarliga hjärtproblem.	1.2.4.5.6
A1.08.09	Bröstsmärtor hos diabetiker, oavsett varaktighet.	1.2.4.5.6
PRIO 2		
A2.08.01	Bröstsmärtor, upplevs ej som kraftiga. Inga prio 1-kriterier.	1.2.5.6
A2.08.02	Plötslig hjärtklappning, medtagen. Inga prio 1-kriterier.	1.2.5.6
A2.08.03	Kronisk hjärtsvikt, tilltagande andnings-svårigheter. Inga prio 1-kriterier.	1.2.5.6
A2.08.04	Inopererad pacemaker och/eller ICD (defibrillator). Medtagen.	1.2.5.6
PRIO 3/4		
A3/4.08.01	Smärtor endast vid djup inandning eller rörelse.	1.20
A3/4.08.02	Hjärtat slår oregelbundet, ej medtagen. Orolig.	1.20
A3/4.08.03	Plötslig hjärtklappning, ej medtagen. Orolig.	1.20
A3/4.08.04	Korta hugg av smärta i bröstet.	1.20
A4.08.30	Högre medicinsk kompetens	

Unconscious - adult

CPR

An
Jag
Är

Flytta telefonen så nära patienten som möjligt.

Accessera om ingen av de närvarande kan eller vill hjälpa till.
Behåll telefonkontakten till ambulansen är framme.

Kriterium A1.23.01

Lyssna om han/hon andas som vanligt.
Gör det nu och kom genast tillbaka till telefonen.

Andas som vanligt

Andas inte som vanligt

Fri luftväg och ny kontroll av andningen

Du måste du öppna luftvägarna.
Lägg honom/henne på rygg om du kan.
Ställ dig på knä vid sidan av hans/hennes bröst korg.

Var försiktig om han/hon har varit utsatt för olycka

Lägg en hand på pannan och en hand under hakan och böj huvudet försiktigt långt bakåt.
Lägg öra och kind mot hans/hennes ansikte
Känn efter andedräkt och lyssna efter andetag. Titta samtidigt på bröstkorgen om den höjer sig. Gör det nu och kom genast tillbaka till telefonen.

Kriterium A1.23.02

Om den hjälpande inte lyckas med detta.
Ta en instruktionen: noggrant en gång till från början.

Andas som vanligt nu

Andas fortfarande inte som vanligt

Inblåsning Kriterium A1.23.03

Nu ska du blåsa ner luft i hans/hennes lungor.
Lägg din ena hand på hans/hennes panna och böj huvudet försiktigt långt bakåt. Klämm ihop hans/hennes näsborrar med två fingrar.
Lyft upp hakan ordentligt med den andra handen.

Ta ett djupt andetag och lägg dina läppar över hela hans/hennes mun.
Blås ner 2 djupa andetag. Tag själv ett andetag mellan inblåsningarna.
Gör det nu. Kom tillbaks till telefonen och säg om bröstkorgen höjer sig när du blåser ner luft.

Bröstkorgen höjer sig inte

Brösttryckningar Kriterium A1.23.04

Försök att få ner patienten på golvet. (fortsätt nedan)

Bra! Nu ska du göra brösttryckningar.
Ställ dig på knä intill hans/hennes ena sida av bröstkorgen.
Lägg dina händer ovanpå varandra på hans/hennes bröstkorg, mitt emellan bröstvårtorna.
Öppna klämmarna över bröstkorgen.
Tryck kraftigt ner hans/hennes bröstkorg med raka armar och släpp upp igen.
Tryck 15 gånger i följ med takten:
ETT-o-TVÅ-o-TRE-o-FYR-o-FEM osv. Räkna högt! Kom sedan tillbaka till telefonen.

HLR 2:18

Bra! Nu ska du göra 2 nerblåsningar och 15 brösttryckningar om och om igen tills ambulansen kommer.
Kom tillbaka till telefonen om det inte fungerar. Jag lyssnar hela tiden.

Du gör ett bra jobb! Kom tillbaka till telefonen om du blir trött. Ambulansen är på väg. Jag lyssnar hela tiden.

Kriterium A1.23.05

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