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Experiences among firefighters and police officers of saving lives in out-of-hospital cardiac arrest in a dual dispatch programme

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Abstract

Objectives The objective of this study was to explore firefighters' and police officers' experiences of saving lives in out-of-hospital cardiac arrest.

Design A qualitative interview study using Critical Incident Technique (CIT), and inductive content analysis.

Setting The County of Stockholm, Sweden.

Participants Police officers (n=10), and firefighters (n=12) participating in a dual dispatch programme with Emergency Medical Services in case of suspected out–of–hospital cardiac arrest.

Results Analysis of 60 critical incidents was performed resulting in three consecutive time sequences (Preparedness, Managing the scene, and The aftermath) with related categories, where first responders described the complexity of the cardiac arrest situation. Detailed information about the case and the location was crucial for the preparedness, and information deficits created stress, frustration and incorrect perceptions about the victim. The technical challenges of performing cardiopulmonary resuscitation and managing the airway, was prominent and the need of regular team training and education in first aid was highlighted.

Conclusions Participating in dual dispatch in case of suspected out–of–hospital cardiac arrest was described as a complex technical and emotional process by first responders. Providing case discussions and opportunities to give, and receive feedback about the case is a main task for the leadership in the organizations to diminish stress among personnel and to improve future OHCA missions.

Article summary

- Few studies concerning first responders' experiences about participating in dual dispatch with Emergency Medical Services in out-of-hospital cardiac arrest have previously been published.
- To diminish stress reactions amongst first responders, case discussions after tough out-of-hospital cardiac arrest missions, should be provided within the participating organizations.
- Qualitative studies propose a deeper understanding of a phenomenon, but the results cannot be generalized to any other group of first responders or organizations. However new theories and fields of research can be developed from the results.

Keywords

Cardiopulmonary Resuscitation; Critical Incident Technique; Firefighters; First responders; Out–of–Hospital Cardiac Arrest; Police officers

Introduction

To improve outcome in out-of-hospital cardiac arrest (OHCA) several prehospital measures have been introduced worldwide, e.g. different types of public access defibrillation programs[1] and implementation of dual dispatch systems including emergency medical services (EMS), firefighters and/or police officers i.e. first responders (FRs), trained in Basic Life Support (BLS) dispatched in case of suspected OHCA.[2-5] In the County of Stockholm, Sweden, a dual dispatch system involving EMS and firefighters was introduced in 2005.[6] Police officers were fully integrated in the OHCA alarm system in 2012.[7] Experiences of performing cardiopulmonary resuscitation (CPR) outside hospital are mostly explored within the bystander population.[8-12] Previous research in regards to FRs experiences of participating in emergency call–outs has been described in the context of traffic accidents [13] and psychological consequences about performing CPR and using an automated external defibrillator (AED).[14]

The aim of this interview study was to explore firefighters' and police officers' experiences of saving lives in OHCA in a dual dispatch programme.

Methods

Design

This was an interview study where data was analysed by using Critical Incident Technique (CIT)[15] and inductive qualitative content analysis.[16] A "critical incident" (CI), in this study is a description of a cardiac arrest situation recalled as important by the participants.

Study setting and dispatch

The study was conducted in Stockholm County covering 6.5 km^2 with 2.3 milj. inhabitants living in densely populated urban areas, as well as in more rural parts. In case of an suspected OHCA the dispatchers at the Emergency Medical Communication Centre (EMCC) dispatches

two ambulances staffed with specialist nurses and emergency medical technicians.[17] FRs trained in BLS, and equipped with AEDs are also simultaneously dispatched.[18] Approximately 1200 confirmed OHCA occurs annually, and FRs are being dispatched in estimated 70% of these cases.

Participants

Eligible were firefighters and police officers with experiences of being dispatched as first responders in OHCA. The recommended sample size in CIT depends on what activity or behavior being studied. If the activity is relatively well-defined, a total number of 50 to 100 critical incidents (CIs) are needed for the analysis.[15 19] With an estimate of 2-4 CIs per interview, a sample size of approximately 20 interviews was considered sufficient.

Data collection

The strategy used was a purposeful sampling of key participants with knowledge from one or more cardiac arrest situations, with the main focus to collect as rich descriptions as possible.[20] To obtain a variety of workplaces, different ages and gender three approaches for recruitment were used; 1) An invitation letter from the researchers was presented to the main collaboration group for OHCA alarms in Stockholm County. 2) On the police report for cardiac arrest alarms there was a request to contact the researchers for a voluntary interview. 3) Fire stations were directly contacted for recruitment of respondents. All three approaches were used, and all voluntary participants who fulfilled the inclusion criteria were included.

The final study sample consisted of 22 participants; 12 firefighters representing four different fire brigades, and 10 police officers from eight police stations throughout the County. The participants received written information about the study and contact information to the researchers before the interviews took place. An interview guide with open–ended semi-structured questions was used (Table 1).

Table 1. Interview guide for collecting Critical Incidents

1. Can you describe a particular situation and the circumstances surrounding it when you have been dispatched to a person suffering from an out-of-hospital cardiac arrest? Please describe the circumstances and the time.
2. Can you describe how you acted in this situation?
3. Can you describe how other persons acted in this situation?
4. Can you describe how you reacted?
5. What was the result of the situation?
6. Do you want to add something more?

Data of demographic character was also collected. The participants could choose the place for the interview, and all except three took place at their regular workplaces. The interviews lasted between 9 to 38 minutes (22 minutes in median), and were all conducted by the first author (IHA). The interviews were recorded with a digital voice recorder (Olympus™ VN-7800PC), and transcribed verbatim by a secretary with knowledge of cardiac arrest research. A pilot interview to test the questions in the interview guide was performed in February 2015. No change of questions was needed. The pilot interview contained rich material with descriptions from three CIs, and were therefore included in the final analysis. The following interviews were carried out June 16th to December 13th 2016.

Data analysis

The analysis was performed as follows: 1) Identification of CIs as the unit of analysis in each interview.[16] The CIs were thereafter read repeatedly to gain a comprehensive view of the whole. 2) Condensation of each CI into meaning units with the purpose to reduce the text and preserve the core in the narrative. A meaning unit is close to the text and is not interpreted by the researchers at this stage. 3) Interpretation and coding the meaning units into sub-

categories by the authors. 4) The sub-categories were thereafter merged into categories from which time sequences were created (Table 2).

Table 2. Description of the analysis process

Critical Incident (CI)	Condensed meaning units	Sub-category	Category	Time sequence
There was some sort of crack house; a younger girl had a cardiac arrest. // And then you think before going in, there is a second type of threat scenario when entering…	Crack house Younger girl Cardiac arrest Think before going in Second threat	Safety	The environment	Managing the scene

Excerpt from Critical Incident #1, (Firefighter #1)

To ensure rigor and consistency of interpretation, the analysis was discussed by the researchers, and agreement was reached at every step to ensure that all analyses were supported by the data.

Ethical considerations

Written informed consent was obtained from the participants and information was given about the possibility to withdraw from the study without any reprisal. Participants were not entitled to financial remuneration or other benefits. The study was approved by the Regional Ethics Review Board in Stockholm, Sweden (registration number 2015/1091- 31/5).

Patient and Public Involvement

The patients and the public were not involved in planning or the design of this study.

Results

Baseline characteristics are presented in Table 3. Median age was 36 years and the working experience as firefighter and police officer were 6.5 years in median for both professions.

Firefighters were predominantly men, and they had longer experience of being dispatched to an OHCA than the participating police officers.

Table 3. Characteristics of respondents (n=22)

(F/P)	Age (y)	Sex	Prof exp. (y)	No of CA	Years in OHCA dispatch	Latest CPR course (y)	CPR level	Chest compr.	Vent.	Defibr.*	Health-care edu.†
F1	23	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	Yes
F2	47	M	9.5	>20	8-10	1	PLS	Yes	Yes	Yes	Yes
F3	26	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	No
F4	43	M	5	>20	4-7	1	PLS/ILS	Yes	Yes	Yes	Yes
F5	50	M	27	>20	8-10	1	BLS	Yes	Yes	Yes	No
F6	54	M	11	>20	8-10	1	BLS	Yes	Yes	Yes	Yes
F7	43	M	10	>20	8-10	1	BLS	Yes	Yes	Yes	No
F8	28	M	7	0-5	0-3	1	ILS	Yes	Yes	No	Yes
F9	35	M	2	11-20	0-3	1	ILS	Yes	Yes	Yes	No
F10	36	M	11	>20	8-10	1	PLS	Yes	Yes	Yes	No
F11	27	F	6	>20	4-7	1	ILS	Yes	Yes	Yes	No
F12	28	M	5	6-10	4-7	1	ILS	Yes	Yes	Yes	Yes
P1	40	M	7	>20	4-7	>2	ILS	Yes	No	Yes	No
P2	31	F	3	0-5	0-3	1	ILS	Yes	No	No	Yes
P3	30	M	2	6-10	0-3	1	BLS	Yes	Yes	Yes	No
P4	43	M	13	>20	4-7	1-2	ILS	Yes	No	No	Yes
P5	26	M	2	0-5	0-3	1-2	BLS	Yes	No	Yes	Yes
P6	38	F	10	6-10	8-10	1	ILS	Yes	Yes	Yes	No
P7	28	F	2.5	11-20	0-3	1-2	ILS	Yes	No	No	No
P8	33	M	6	0-5	4-7	1	BLS	Yes	Yes	Yes	No
P9	40	M	9	0-5	0-3	1	BLS	Yes	Yes	Yes	No
P10	41	F	9	6-10	0-3	>2	ILS	Yes	No	No	Yes

F/P:firefighter/police officer; M/F: male/female; CA:cardiac arrest; CPR:cardiopulmonary resuscitation; PLS/ILS/BLS: pediatric life support/immediate life support/basic life support; Chest kompr:chest compressions; Defibr:defibrillation

*Automated External Defibrillator applied and electric chock administered.

† Healthcare education besides regular professional training as firefighter/police officer.

The total number of CIs were 60, varying from one to five per participant. Police officers described in median three CIs, compared to two for the firefighters. During the analysis three time sequences emerged which reflects the temporal continuity of the OHCA situation: 1)

Preparedness, 2) Managing the scene, 3) The aftermath. (Figure 1). They are presented with suitable citations to highlight important aspects of each time sequence. The firefighters are referred to as "F" and the police officers as "P".

Preparedness

This time sequence comprises the response time, which is defined as from incoming emergency call received at the EMCC, to arrival of FRs at the scene.

Information

Information deficit about the case was described as a considerable problem and caused stress and frustration amongst FRs. Especially when not finding the address, entry code to the building, or when there was no bystanders present showing the way.

"We were trying to find the address; we were on the right street but we couldn't find the right number…..//…We started to feel frustration building up: Damn! We can't find it." (F10)

Expectations

Expectations were grounded in the participants' previous experiences and mental pictures of what was expected to happen. If the victim's characteristic was not communicated by the EMCC, both firefighters and police officers described that they had a preconceived perception of the victim as an older person. Valuable time for both technical and mental preparations could then be delayed if the victim proved to be a child or a young adult.

Managing the scene

The time sequence was defined as from when the FRs vehicle stops at the address, to departing from the location.

The environment

To be able to start CPR the FRs had to take control over the environment. Threats from bystanders and traffic caused anxiety, especially if there were few FRs in place from the beginning and they had to focus mainly on the victim, instead of prioritizing their own safety first.

"*So there we were in the middle of the motorway doing compressions, we were like, just right there, in the middle of the road, doing compressions*." (F10)

Obstacles had to be taken care of, i.e. extraction from vehicles, removing furniture, or placing the victim in supine position to be able to start resuscitation.

The victim

The victim could be described in both a technical and emotional way as heavy, still warm, or disgusting to take care of when regurgitation had occurred. Performing manual chest compressions was recounted by FRs as a repulsive task depending on flail chest caused by the resuscitation.

"*What I often think about is that when you do compressions, ribs get broken and I think that is so horrible. That's really the thing that affects me the most, whenever I do compressions or when I think about cardiac arrest alarms."* (F6)

When futile to resuscitate the victim, FRs often described the situation as sad or disappointing, especially when young people died in accidents or drug abuse. The mental strain could be considerable if the FRs children were at similar age as the deceased.

"*It was a young girl. It just feels so damned awful and you know when you've got two girls of your own as well, it just feels awful….//…they had taken cocaine, amphetamine…//* (F5)

Managing the airway was specified to be the most difficult technical skill, especially among the police officers. This is also shown in Table 3 were six (60%) of the police officers used compressions-only technique when resuscitating.

The bystanders

Comforting and taking care of bystanders was an extensive part of the assignment and many of the FRs expressed how laborious this task could be. Lack of education in handling emotional crisis after a cardiac arrest was emphasized. There were also no clear instructions where the FRs responsibility ended when the EMS had left. To leave an elderly person alone afterwards when the spouse had passed away was expressed as difficult.

"*I think we stayed there for almost an hour after the ambulance had left…//…She had some problems walking, this old lady. So we put lots of bottles of juice and stuff by the armchair where she used to sit so she wouldn't have to walk about and fetch things, because that was what her husband had done for her, before he had his cardiac arrest*. (F12)

Although protective towards the bystanders, FRs could also be critical. Especially personnel in elderly care facilities were described as passive and not knowing how to act in emergency situations.

Self-efficacy

The FRs were moving between confidence and doubt when talking about their own capacity in the OHCA situation. A circumstance mentioned was when the case was not a cardiac arrest but some other illness. To make medical decisions before arrival of EMS without appropriate training in first aid was described as extremely difficult and stressful, especially for the police officers.

"*I don't have any medical training; I could see that half of the brain was out, maybe it works anyway, I don't have enough knowledge to decide*." (P5)

The FRs could describe fear of doing more harm than good, but also satisfaction with their own work, knowing that they had played a significant role for the outcome.

The rescue team

Pronounced feelings of togetherness and dependence were noticeable, and the FRs trusted each other's ability to manage critical situations. Protocols for handling OHCA situations, especially among the firefighters, were expressed as "*our guiding star*" (F9), and they could also describe a clear structure for teamwork. This was not marked among the police officers who could feel loneliness and insufficiency if first in place, especially in more difficult OHCA cases.

The aftermath

The aftermath was when no more actions were taken by FRs in conjunction with the victim or bystanders, to as long memories were preserved, which could be years.

Caring for the rescuers

After tough assignments bodily symptoms, spinning thoughts and imprinted memories were reported in terms of "*never forgetting*" (P2), and "*stuck in my head*". (P5)

//..."*and I just have to pass by the place, I don't think there has ever been a time when I haven't thought about it, I mean, every time I walk past or drive past this place, I think about this.*"…// (P6)

Assessment and defusing afterwards occurred more often among equal colleagues rather than meetings initiated by superior officers. Inputs from others about the case and own performance were considered positive and could ease the pressure, but several FRs called for a more pronounced responsibility from the heads of the department. The participants expressed that occupational stress could be avoided if stress management took place regularly.

Repression was a strategy for coping by some FRs, others thought this could cause long term impairment of the ability to feel empathy. A positive experience afterwards was if the survivor came to visit the FRs at the fire- or police station. The survivors were seen as reminders of success.

Discussion

The aim of this interview study was to explore FRs experiences of participating in a dual dispatch programme in case of suspected OHCA. Our analysis of recounted critical incidents revealed three distinct time sequences regarding the cardiac arrest event described by the participants (Figure 1). Our main findings in each time sequence were: 1) Lack of information from EMCC about the victim caused frustration amongst FRs. 2) Perceived uncertainty in performing CPR, especially concerning rescue breaths. To handle psychological reactions amongst bystanders after an OHCA could be overwhelming. 3) FRs were missing discussion after mission with participating colleagues and superior officers, especially after tough cases.

Information deficit from EMCC was a main concern for the FRs. However, information could be missing for the dispatchers in time for call-out due to language barriers or difficulties detecting if it is a true cardiac arrest or not.[21 22] EMS personnel have previously described similar concerns regarding dispatch.[23]

Uncertainty could emerge if it was not an OHCA, but seizures or intoxication for example. Both firefighters and police officers therefore expressed a need of more thorough education in first aid. Regular training and education is also a matter of concern in EMS organizations taking care of OHCA victims.[24] Handling the airway appears to be a subject for improvement as reported earlier.[14] The ERC guidelines recommend that all rescuers trained and able to perform CPR should combine chest compressions and rescue breaths.[18] However, only five (50%) of the police officers had undergone annual training in CPR, and they expressed that

chest compression–only technique was preferred as an easier way of managing the situation (Table 3). The police force in Stockholm County joined the dual dispatch programme later compared to the firefighters, therefore the police officers have less experience in participating in cardiac arrest alarms.[25] In the interviews the police officers expressed more doubts about their self-efficacy[26] than the firefighters, especially concerning technical skills. To attach defibrillation pads and deliver countershocks was not much discussed by the police officers. This could be a consequence of the police being last summoned in OHCA alarms due to technicalities in the dispatch system. Other personnel prior to the police patrol have often already started treatment. In comparison, 686 firefighters in a survey, 24% had never applied an AED and 3% felt very uncomfortable doing so.[27] Application rates and retention could improve if FRs underwent frequent targeted hands-on AED training.[28 29] Stressful cardiac arrest situations were described in detail, despite a lapse of several months or years since the events. Adverse psychological effects after long–term exposure of traumatic events such as stress, anxiety, depression and posttraumatic stress disorder has been reported amongst FRs.[30-32] Several of the FRs discussed the need to ventilate the case among colleagues, and also the absence of organized case discussions after the mission.

A limitation of the study was that all participants worked in the most densely populated County in Sweden with high access to prehospital resources. Including FRs from other parts of the country would probably have generated other experiences, especially in low density populated areas where there are few rescuers available. Only one of the firefighters was female, which could have affected the results. The uneven gender distribution reflects the fact that only 5.5% of all firefighters in Sweden are women.[33] The police officers had a more even gender distribution,

In a qualitative study generalization is not possible; instead the concept of trustworthiness is highlighted. Credibility was obtained by peer debriefing of all steps in the analysis (EJA, PN).

The interviews were all conducted by the first author (IHA), which increased the likelihood they were performed in the same way. The participants were recruited through different approaches to reflect a representative sample of first responders in the County, thus increasing the transferability. Moreover, the researchers (IHA, PN, JH, LS) had a profound knowledge of the research field of OHCA and implementation of dual dispatch systems both local and national, which strengthens the results.

Conclusion

Participating in dual dispatch in case of a suspected OHCA was often described as a complex process by first responders. Detailed information about the case and the location was crucial for the preparedness, and information deficits caused stress and incorrect perceptions about the victim. Technical challenges of performing CPR and managing the airway was prominent. The need of regular team training and education in first aid was requested as well as knowledge about psychological reactions amongst bystanders after an OHCA. Providing case discussions and opportunities to give and receive feedback about the case is a main task for the leadership in the first responder organizations.

Conflicts of Interest

None.

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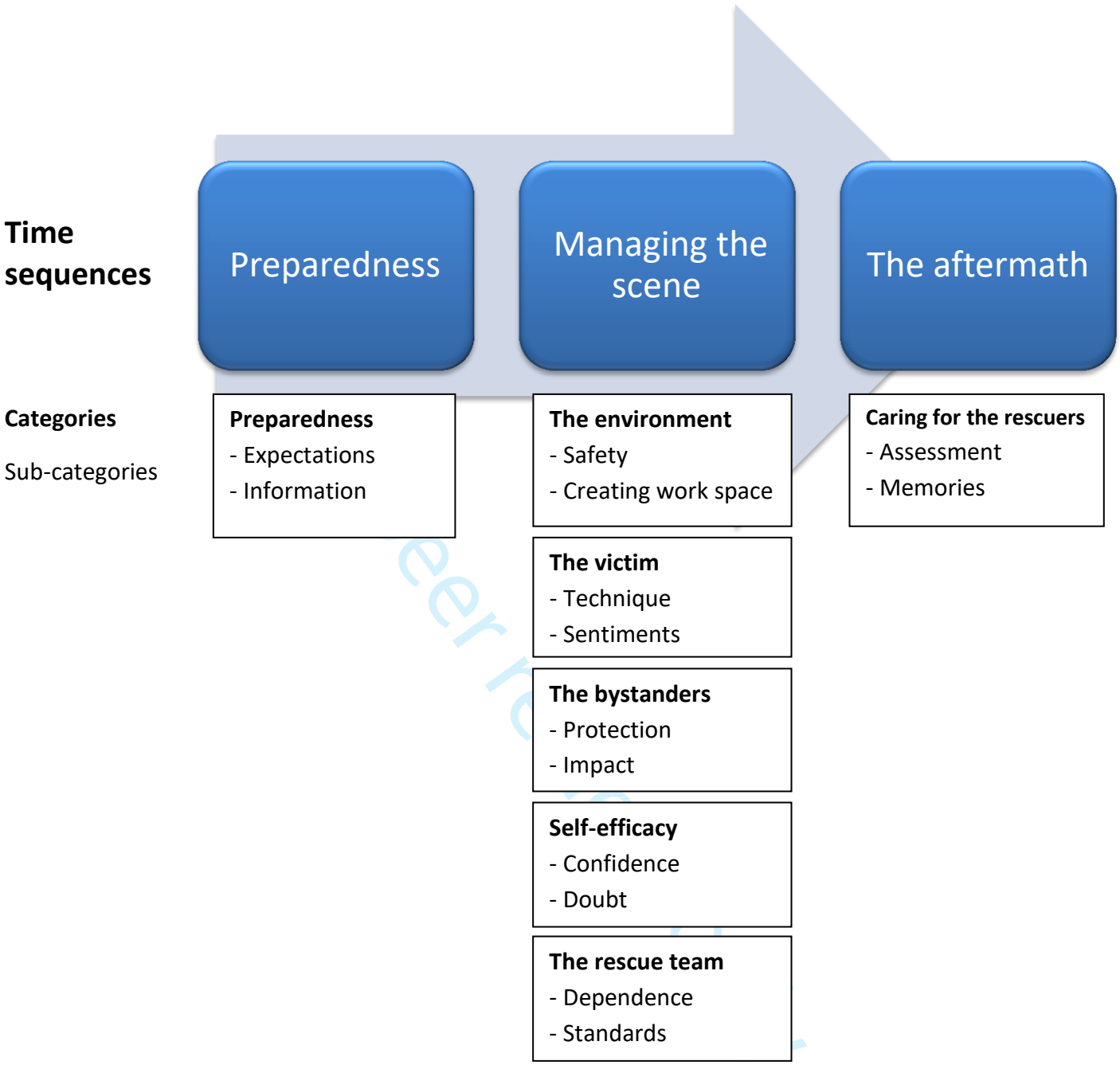
Time sequences
Preparedness
Managing the scene
The aftermath
Categories
Sub-categories
Preparedness
- Expectations
- Information
The environment
- Safety
- Creating work space
The victim
- Technique
- Sentiments
The bystanders
- Protection
- Impact
Self-efficacy
- Confidence
- Doubt
The rescue team
- Dependence
- Standards
Caring for the rescuers
- Assessment
- Memories

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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BMJ Open

Experiences among firefighters and police officers of responding to out-of-hospital cardiac arrest in a dual dispatch programme in Sweden: an interview study

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Experiences among firefighters and police officers of responding to out-of-hospital cardiac arrest in a dual dispatch programme in Sweden: an interview study

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Article: 3347

Abstract

Objectives The objective of this study was to explore firefighters' and police officers' experiences of responding to out-of-hospital cardiac arrest in a dual dispatch programme.

Design A qualitative interview study with semi-structured, open-ended questions where Critical Incident Technique (CIT) was used to collect recalled cardiac arrest situations from the participants' narratives. The interviews where transcribed verbatim and analyzed with inductive content analysis.

Setting The County of Stockholm, Sweden.

Participants Police officers (n=10), and firefighters (n=12) participating in a dual dispatch programme with Emergency Medical Services in case of suspected out–of–hospital cardiac arrest of cardiac or non-cardiac origin.

Results Analysis of 60 critical incidents was performed resulting in three consecutive time sequences (Preparedness, Managing the scene, and The aftermath) with related categories, where first responders described the complexity of the cardiac arrest situation. Detailed information about the case and the location was crucial for the preparedness, and information deficits created stress, frustration and incorrect perceptions about the victim. The technical challenges of performing cardiopulmonary resuscitation and managing the airway, was prominent and the need of regular team training and education in first aid was highlighted.

Conclusions Participating in dual dispatch in case of suspected out–of–hospital cardiac arrest was described as a complex technical and emotional process by first responders. Providing case discussions and opportunities to give, and receive feedback about the case is a main task for the leadership in the organizations to diminish stress among personnel and to improve future OHCA missions.

Strengths and limitations of this study

- Few other studies concerning first responders' experiences about participating in dual dispatch with Emergency Medical Services in out-of-hospital cardiac arrest have previously been published.
- The study provides new insights from first responders about the complex situation of out-of-hospital cardiac arrest.
- One limitation of the study is the risk of recall bias.
- Qualitative studies propose a deeper understanding of a phenomenon, but the results cannot be generalized to any other group of first responders or organizations. However new theories and fields of research can be developed from the results.

Keywords

Cardiopulmonary Resuscitation; Critical Incident Technique; Firefighters; First responders; Out–of–Hospital Cardiac Arrest; Police officers

Introduction

To improve outcome in out-of-hospital cardiac arrest (OHCA) several prehospital measures have been introduced worldwide, e.g. different types of public access defibrillation programs[1] and implementation of dual dispatch systems including emergency medical services (EMS), firefighters and/or police officers i.e. first responders (FRs), trained in Basic Life Support (BLS) dispatched in case of suspected OHCA.[2-5] In the County of Stockholm, Sweden, a dual dispatch system involving EMS and firefighters was introduced in 2005.[6] Police officers were fully integrated in the OHCA alarm system in 2012.[7] Experiences of performing cardiopulmonary resuscitation (CPR) outside hospital are mostly explored within the bystander population.[8-12] Previous research in regards to FRs experiences of participating in emergency call–outs has been described in the context of traffic accidents [13] and psychological consequences about performing CPR and using an automated external defibrillator (AED).[14]

The aim of this interview study was to explore firefighters' and police officers' experiences of saving lives in OHCA in a dual dispatch programme.

Methods

Design

This was an interview study where data were analyzed by using Critical Incident Technique (CIT)[15] and inductive qualitative content analysis.[16] A "critical incident" (CI), in this study is a description of a cardiac arrest situation recalled as important by the participants. OHCAs were included independent of etiology (medical or non-medical) and age of the victim.

Study setting and dispatch

The study was conducted in Stockholm County covering 6519 km^2 with 2.3 milj. inhabitants living in densely populated urban areas, as well as in more rural parts. In case of a suspected

OHCA the dispatchers at the Emergency Medical Communication Centre (EMCC) first dispatches two ambulances staffed with specialist nurses and emergency medical technicians performing advanced life support.[17] In special circumstances such as major trauma, drowning and pediatric cardiac arrests, a physician-staffed rapid response vehicle is alerted. FRs trained in BLS, and equipped with AEDs are also dispatched, primarily the fire fighters and thereafter the police[18] The EMS, police force, and fire department are alerted by the common emergency number (112). In Stockholm County there are 40 fire stations and 30 police stations. Depending on time of day and type of vehicles being dispatched, the number of attending staff varies between four and ten in average. The police are considered to be an extra resource in OHCA, and cannot always engage depending on other ongoing missions. Approximately 1200 confirmed OHCA occurs annually, and FRs are being dispatched in estimated 70% of these cases.

CPR training amongst FRs

Annual adult and pediatric BLS training is recommended for FRs by European guidelines in CPR[18] and the Swedish Resuscitation Council. However compliance to these recommendations could differ between participating organizations. It is mandatory for FRs to start CPR if first on scene unless obvious signs of death are present.

Participants

Eligible participants were firefighters and police officers with experiences of being dispatched as first responders in OHCA. The recommended sample size in CIT depends on what activity or behavior being studied. If the activity is relatively well-defined, a total number of 50 to 100 critical incidents (CIs) are needed for the analysis.[15 19] With an estimate of 2-4 CIs per interview, a sample size of approximately 20 interviews was considered sufficient.

Data collection

The strategy used was a purposive sampling of key participants with knowledge from one or more cardiac arrest situations, with the main focus to collect as rich descriptions as possible.[20] To obtain a variety of workplaces, different ages and gender three approaches for recruitment were used; 1) An invitation letter from the researchers was presented to the main collaboration group for OHCA alarms in Stockholm County. 2) On the police report for cardiac arrest alarms there was a request to contact the researchers for a voluntary interview. 3) Fire stations were directly contacted for recruitment of participants. All three approaches were used, and all voluntary participants who fulfilled the inclusion criteria were included.

The final study sample consisted of 22 participants; 12 firefighters representing four different fire brigades, and 10 police officers from eight police stations throughout the County. The participants received written information about the study and contact information to the researchers before the interviews took place. An interview guide with open–ended semi-structured questions was used (Table 1).

Table 1. Interview guide for collecting Critical Incidents

1. Can you describe a particular situation and the circumstances surrounding it when you have been dispatched to a person suffering from an out-of-hospital cardiac arrest? Please describe the circumstances and the time.
2. Can you describe how you acted in this situation?
3. Can you describe how other persons acted in this situation?
4. Can you describe how you reacted?
5. What was the result of the situation?
6. Do you want to add something more?

Data of demographic character were also collected. The participants could choose the place for the interview, and all except three took place at their regular workplaces. The interviews lasted between 9 to 38 minutes (22 minutes in median), and were all conducted by the first author (IHA), a nurse anesthetist and teacher with professional knowledge in OHCA research, especially CPR/defibrillation and dual dispatch. The interviews were recorded with a digital voice recorder (Olympus™ VN-7800PC), and transcribed verbatim by a secretary with knowledge of cardiac arrest research. A pilot interview to test the questions in the interview guide was performed in February 2015. No change of questions was needed. The pilot interview contained rich material with descriptions from three CIs, and were therefore included in the final analysis. The following interviews were carried out June 16th to December 13th 2016.

Data analysis

The analysis was performed as follows: 1) Identification of CIs as the unit of analysis in each interview. The CIs were thereafter read repeatedly to gain a comprehensive view of the whole. 2) Condensation of each CI into meaning units with the purpose to reduce the text and preserve the core in the narrative. A meaning unit is close to the text and is not interpreted by the researchers at this stage. 3) Interpretation and coding the meaning units into sub-categories by the authors. 4) The sub-categories were thereafter merged into categories from which time sequences were created (Table 2).

Table 2. Description of the analysis process

Critical Incident (CI)	Condensed meaning units	Sub-category	Category	Time sequence
There was some sort of crack house; a younger girl had a cardiac arrest. // And then you think before going in, there is a second type of threat scenario when entering…	Crack house Younger girl Cardiac arrest Think before going in Second threat	Safety	The environment	Managing the scene

Excerpt from Critical Incident #1, (Firefighter #1)

To ensure rigor and consistency of interpretation, the analysis was discussed by the researchers, and agreement was reached at every step after dialogue between the co-researchers, to ensure that all analyses were supported by the data. In the analysis, the participants were anonymized for the researchers.

Ethical considerations

Written informed consent was obtained from the participants and information was given about the possibility to withdraw from the study without any reprisal. Participants were not entitled to financial remuneration or other benefits. The study was approved by the Regional Ethics Review Board in Stockholm, Sweden (registration number 2015/1091- 31/5).

Patient and Public Involvement

The patients and the public were not involved in planning or the design of this study.

Results

Baseline characteristics are presented in Table 3. Median age was 36 years and the working experience as firefighter and police officer were 6.5 years in median for both professions.

Firefighters were predominantly men, and they had longer experience of being dispatched to an OHCA than the participating police officers.

Table 3. Characteristics of participants (N=22)

F/P 55/45 %	Age (y) Mean =36	Sex M/F 77/23 %	Prof exp. (y) Mean= 7.5	No of CA	Years in OHCA dispatch	Latest CPR course (y) Mean =1	CPR level	CC Yes/ No 100/0 %	Vent. Yes/ No 73/27 %	Defibr.* Yes/No 77/23 %	Health-care edu.† Yes/No 45/55 %
F1	23	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	Yes
F2	47	M	9.5	>20	8-10	1	PLS	Yes	Yes	Yes	Yes
F3	26	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	No
F4	43	M	5	>20	4-7	1	PLS/ILS	Yes	Yes	Yes	Yes
F5	50	M	27	>20	8-10	1	BLS	Yes	Yes	Yes	No
F6	54	M	11	>20	8-10	1	BLS	Yes	Yes	Yes	Yes
F7	43	M	10	>20	8-10	1	BLS	Yes	Yes	Yes	No
F8	28	M	7	0-5	0-3	1	ILS	Yes	Yes	No	Yes
F9	35	M	2	11-20	0-3	1	ILS	Yes	Yes	Yes	No
F10	36	M	11	>20	8-10	1	PLS	Yes	Yes	Yes	No
F11	27	F	6	>20	4-7	1	ILS	Yes	Yes	Yes	No
F12	28	M	5	6-10	4-7	1	ILS	Yes	Yes	Yes	Yes
P1	40	M	7	>20	4-7	>2	ILS	Yes	No	Yes	No
P2	31	F	3	0-5	0-3	1	ILS	Yes	No	No	Yes
P3	30	M	2	6-10	0-3	1	BLS	Yes	Yes	Yes	No
P4	43	M	13	>20	4-7	1-2	ILS	Yes	No	No	Yes
P5	26	M	2	0-5	0-3	1-2	BLS	Yes	No	Yes	Yes
P6	38	F	10	6-10	8-10	1	ILS	Yes	Yes	Yes	No
P7	28	F	2.5	11-20	0-3	1-2	ILS	Yes	No	No	No
P8	33	M	6	0-5	4-7	1	BLS	Yes	Yes	Yes	No
P9	40	M	9	0-5	0-3	1	BLS	Yes	Yes	Yes	No
P10	41	F	9	6-10	0-3	>2	ILS	Yes	No	No	Yes

F/P:firefighter/police officer; M/F:male/female; CA:cardiac arrest; CPR:cardiopulmonary resuscitation; PLS/ILS/BLS; pediatric life support/immediate life support/basic life support; CC:chest compressions; Defibr:defibrillation

*Automated External Defibrillator applied and electric chock administered.

† Healthcare education besides regular professional training as firefighter/police officer.

The total number of CIs were 60, varying from one to five per participant. Police officers described in median three CIs, compared to two for the firefighters. During the analysis seven categories and 14 sub-categories emerged which reflects three major time sequences describing the temporal continuity of the OHCA situation: 1) Preparedness, 2) Managing the scene, 3) The aftermath (Figure 1). They are presented with suitable citations to highlight

important aspects of each time sequence. The firefighters are referred to as "F" and the police officers as "P".

Preparedness

This time sequence comprises the response time, which is defined as from incoming emergency call received at the EMCC, to arrival of FRs at the scene.

Information

Information deficit about the case was described as a considerable problem and caused stress and frustration amongst FRs. Especially when not finding the address, entry code to the building, or when there was no bystanders present showing the way.

"We were trying to find the address; we were on the right street but we couldn't find the right number…..//…We started to feel frustration building up: Damn! We can't find it." (F10)

Expectations

Expectations were grounded in the participants' previous experiences and mental pictures of what was expected to happen. If the victim's characteristic was not communicated by the EMCC, both firefighters and police officers described that they had a preconceived perception of the victim as an older person. Valuable time for both technical and mental preparations could then be delayed if the victim proved to be a child or a young adult.

Managing the scene

The time sequence was defined as from when the FRs vehicle stops at the address, to departing from the location.

The environment

To be able to start CPR the FRs had to take control over the environment. Threats from bystanders and traffic caused anxiety, especially if there were few FRs in place from the

beginning and they had to focus mainly on the victim, instead of prioritizing their own safety first.

"*So there we were in the middle of the motorway doing compressions, we were like, just right there*, *in the middle of the road, doing compressions*." (F10)

Obstacles had to be taken care of, i.e. extraction from vehicles, removing furniture, or placing the victim in supine position to be able to start resuscitation.

The victim

The victim could be described in both a technical and emotional way as heavy, still warm, or disgusting to take care of when regurgitation had occurred. Performing manual chest compressions was recounted by FRs as a repulsive task depending on flail chest caused by the resuscitation.

"*What I often think about is that when you do compressions, ribs get broken and I think that is so horrible. That's really the thing that affects me the most, whenever I do compressions or when I think about cardiac arrest alarms."* (F6)

When futile to resuscitate the victim, FRs often described the situation as sad or disappointing, especially when young people died in accidents or drug abuse. The mental strain could be considerable if the FRs children were at similar age as the deceased.

"*It was a young girl. It just feels so damned awful and you know when you've got two girls of your own as well, it just feels awful…..//…they had taken cocaine, amphetamine…//* (F5)

Managing the airway was specified to be the most difficult technical skill, especially among the police officers. This is also shown in Table 3 were six (60%) of the police officers used compressions-only technique when resuscitating.

The bystanders

Comforting and taking care of bystanders was an extensive part of the assignment and many of the FRs expressed how laborious this task could be. Lack of education in handling emotional crisis after a cardiac arrest was emphasized. There were also no clear instructions where the FRs responsibility ended when the EMS had left. To leave an elderly person alone afterwards when the spouse had passed away was expressed as difficult.

"*I think we stayed there for almost an hour after the ambulance had left…//…She had some problems walking, this old lady. So we put lots of bottles of juice and stuff by the armchair where she used to sit so she wouldn't have to walk about and fetch things, because that was what her husband had done for her, before he had his cardiac arrest*. (F12)

Although protective towards the bystanders, FRs could also be critical. Especially personnel in elderly care facilities were described as passive and not knowing how to act in OHCA situations.

Self-efficacy

The FRs were moving between confidence and doubt when talking about their own capacity in the OHCA situation. A circumstance mentioned was when the case was not a cardiac arrest but some other illness. To make medical decisions before arrival of EMS without appropriate training in first aid was described as extremely difficult and stressful, especially for the police officers.

"*I don't have any medical training; I could see that half of the brain was out, maybe it works anyway, I don't have enough knowledge to decide*." (P5)

The FRs could describe fear of doing more harm than good, but also satisfaction with their own work, knowing that they had played a significant role for the outcome.

The rescue team

Pronounced feelings of togetherness and dependence were noticeable, and the FRs trusted each other's ability to manage critical situations. Protocols for handling OHCA situations, especially among the firefighters, were expressed as "*our guiding star*" (F9), and they could also describe a clear structure for teamwork. This was not marked among the police officers who could feel loneliness and insufficiency if first in place, especially in more difficult OHCA cases.

The aftermath

The aftermath was when no more actions were taken by FRs in conjunction with the victim or bystanders, to as long memories were preserved, which could be years.

Caring for the rescuers

After tough assignments bodily symptoms, spinning thoughts and imprinted memories were reported in terms of "*never forgetting*" (P2), and "*stuck in my head*". (P5)

//..."*and I just have to pass by the place, I don't think there has ever been a time when I haven't thought about it, I mean, every time I walk past or drive past this place, I think about this.*"…// (P6)

Assessment and defusing afterwards occurred more often among equal colleagues rather than meetings initiated by superior officers. Inputs from others about the case and own performance were considered positive and could ease the pressure, but several FRs called for a more pronounced responsibility from the heads of the department. The participants expressed that occupational stress could be avoided if stress management took place regularly. Repression was a strategy for coping by some FRs, others thought this could cause long term impairment of the ability to feel empathy. A positive experience afterwards was if the

survivor came to visit the FRs at the fire- or police station. The survivors were seen as reminders of success.

Discussion

The aim of this interview study was to explore FRs experiences of participating in a dual dispatch programme in case of suspected OHCA. Our analysis of recounted critical incidents revealed three distinct time sequences regarding the cardiac arrest event described by the participants (Figure 1). Our main findings in each time sequence were: 1) Lack of information from EMCC about the victim caused frustration amongst FRs. 2) Perceived uncertainty in performing CPR, especially concerning rescue breaths. To handle psychological reactions amongst bystanders after an OHCA could be overwhelming. 3) FRs were missing discussion after mission with participating colleagues and superior officers, especially after tough cases.

Information deficit from EMCC was a main concern for the FRs. However, information could be missing for the dispatchers in time for call-out due to language barriers or difficulties detecting if it is a true cardiac arrest or not.[21 22] EMS personnel have previously described similar concerns regarding dispatch.[23]

Uncertainty could emerge if it was not an OHCA, but seizures or intoxication for example. Both firefighters and police officers therefore expressed a need of more thorough education in first aid. Regular training and education is also a matter of concern in EMS organizations taking care of OHCA victims.[24] Handling the airway appears to be a subject for improvement as reported earlier.[14] The ERC guidelines recommend that all rescuers trained and able to perform CPR should combine chest compressions and rescue breaths.[18] However, only five (50%) of the police officers had undergone annual training in CPR, and they expressed that chest compression–only technique was preferred as an easier way of managing the situation (Table 3). The police force in Stockholm County joined the dual dispatch programme later

compared to the firefighters, therefore the police officers have less experience in participating in cardiac arrest alarms.[25] In the interviews the police officers expressed more doubts about their self-efficacy[26] than the firefighters, especially concerning technical skills. To attach defibrillation pads and deliver countershocks was not much discussed by the police officers. This could be a consequence of the police being last summoned in OHCA alarms due to technicalities in the dispatch system. Other personnel prior to the police patrol have often already started treatment. In comparison, 686 firefighters in a survey, 24% had never applied an AED and 3% felt very uncomfortable doing so.[27] Application rates and retention could improve if FRs underwent frequent targeted hands-on AED training.[28 29] Stressful cardiac arrest situations were described in detail, despite a lapse of several months or years since the events. Adverse psychological effects after long–term exposure of traumatic events such as stress, anxiety, depression and posttraumatic stress disorder has been reported amongst FRs.[30-32] Several of the FRs discussed the need to ventilate the case among colleagues, and also the absence of organized case discussions after the mission.

A limitation of the study was that all participants worked in the most densely populated County in Sweden with high access to prehospital resources. Including FRs from other parts of the country would probably have generated other experiences, especially in low density populated areas where there are few rescuers available. Only one of the firefighters was female, which could have affected the results. The uneven gender distribution reflects the fact that only 5.5% of all firefighters in Sweden are women.[33] The police officers had a more evenly gender distribution.

Selecting volunteers for interviews could have introduced bias in terms of a non-representative sample. Different fire- and police stations around the County were thus chosen, as well as gender and varying ages among participants to obtain as rich information as possible about the research subject. There is always a risk of recall bias in interview studies,

especially if the incident took place months or years ago. All participants had however very clear memories of the recounted OHCA situations, and could describe them in detail.

In a qualitative study generalization is not possible; instead the concept of trustworthiness is highlighted. Credibility was obtained by peer debriefing of all steps in the analysis (EJA, PN). The interviews were all conducted by the first author (IHA), which increased the likelihood they were performed in the same way. The participants were recruited through different approaches to reflect a representative sample of first responders in the County, thus increasing the transferability. Moreover, the research group has experiences in cardiology, out-of-hospital cardiac arrest, dual dispatch (PN, LS, JH), and other domains such as intensive care and qualitative studies (EJA). This strengthens the results, but also raises questions about reflexivity and bias, which were discussed during the whole process of collecting and interpreting data.

Conclusion

Participating in dual dispatch in case of a suspected OHCA was often described as a complex process by first responders. Detailed information about the case and the location was crucial for the preparedness, and information deficits caused stress and incorrect perceptions about the victim. Technical challenges of performing CPR and managing the airway was prominent. The need of regular team training and education in first aid was requested as well as knowledge about psychological reactions amongst bystanders after an OHCA. Providing case discussions and opportunities to give and receive feedback about the case is a main task for the leadership in the first responder organizations.

Contributors

The study was designed by IHA and EJA. IHA recruited the participants and collected the data under the supervision of EJA. IHA, EJA and PN made substantial contributions to the analysis and interpretation of data. IHA drafted the manuscript. EJA, PN, LS and JH critically reviewed and revised the manuscript. All authors approved the final version of the manuscript for publication.

Data availability

Data can be made available upon request to the corresponding author.

Conflicts of Interest

None.

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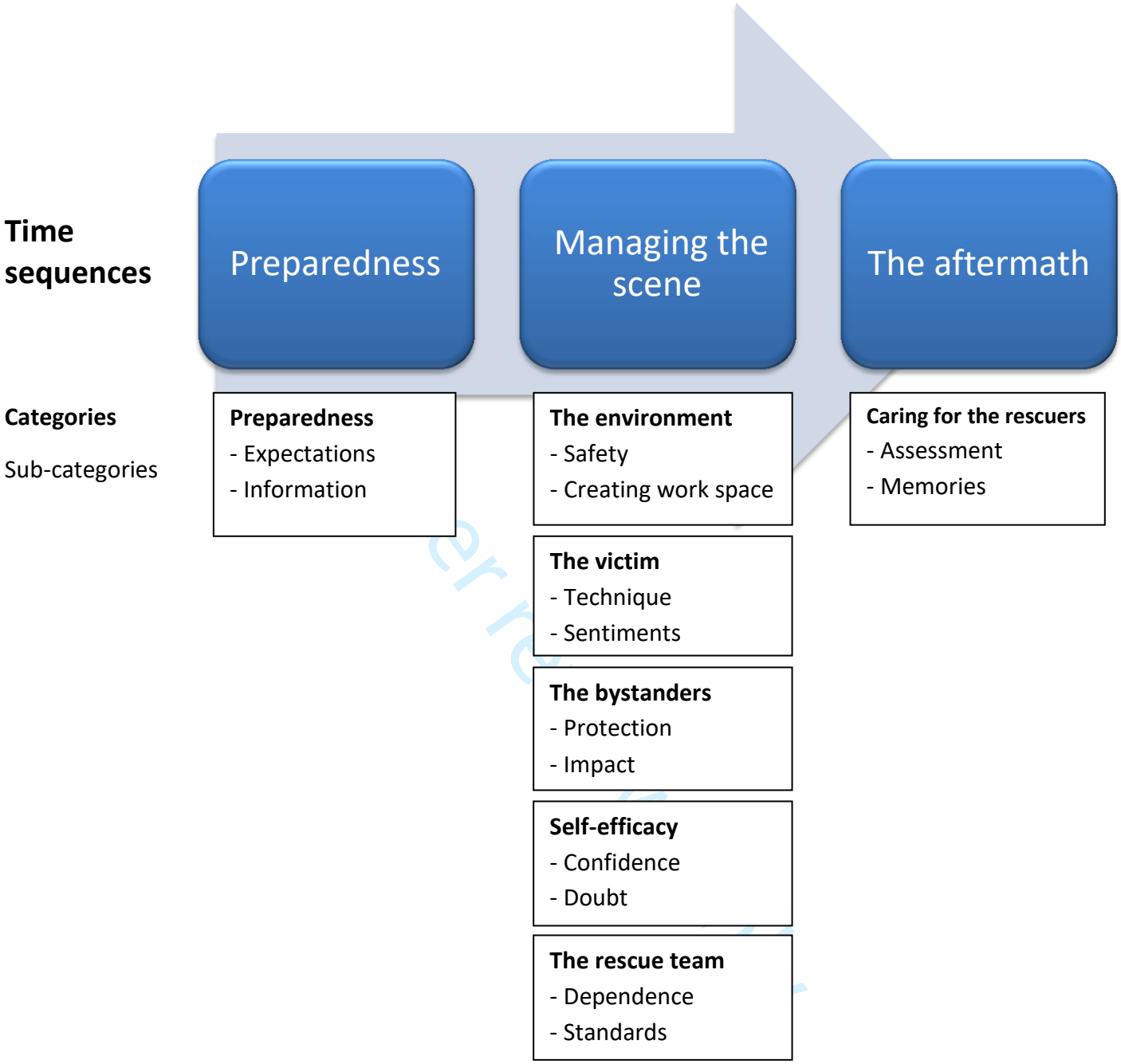
Figure 1. Time sequences, Categories and Sub-categories



COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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Experiences among firefighters and police officers of responding to out-of-hospital cardiac arrest in a dual dispatch programme in Sweden: an interview study

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Article: 3347

Abstract

Objectives The objective of this study was to explore firefighters' and police officers' experiences of responding to out-of-hospital cardiac arrest in a dual dispatch programme.

Design A qualitative interview study with semi-structured, open-ended questions where Critical Incident Technique (CIT) was used to collect recalled cardiac arrest situations from the participants' narratives. The interviews where transcribed verbatim and analyzed with inductive content analysis.

Setting The County of Stockholm, Sweden.

Participants Police officers (n=10), and firefighters (n=12) participating in a dual dispatch programme with Emergency Medical Services in case of suspected out–of–hospital cardiac arrest of cardiac or non-cardiac origin.

Results Analysis of 60 critical incidents was performed resulting in three consecutive time sequences (Preparedness, Managing the scene, and The aftermath) with related categories, where first responders described the complexity of the cardiac arrest situation. Detailed information about the case and the location was crucial for the preparedness, and information deficits created stress, frustration and incorrect perceptions about the victim. The technical challenges of performing cardiopulmonary resuscitation and managing the airway, was prominent and the need of regular team training and education in first aid was highlighted.

Conclusions Participating in dual dispatch in case of suspected out–of–hospital cardiac arrest was described as a complex technical and emotional process by first responders. Providing case discussions and opportunities to give, and receive feedback about the case is a main task for the leadership in the organizations to diminish stress among personnel and to improve future OHCA missions.

Strengths and limitations of this study

- Few other studies concerning first responders' experiences about participating in dual dispatch with Emergency Medical Services in out-of-hospital cardiac arrest have previously been published.
- The study provides new insights from first responders about the complex situation of out-of-hospital cardiac arrest.
- One limitation of the study is the risk of recall bias.
- Qualitative studies propose a deeper understanding of a phenomenon, but the results cannot be generalized to any other group of first responders or organizations. However new theories and fields of research can be developed from the results.

Keywords

Cardiopulmonary Resuscitation; Critical Incident Technique; Firefighters; First responders; Out–of–Hospital Cardiac Arrest; Police officers

Introduction

To improve outcome in out-of-hospital cardiac arrest (OHCA) several prehospital measures have been introduced worldwide, e.g. different types of public access defibrillation programs[1] and implementation of dual dispatch systems including emergency medical services (EMS), firefighters and/or police officers i.e. first responders (FRs), trained in Basic Life Support (BLS) dispatched in case of suspected OHCA.[2-5] In the County of Stockholm, Sweden, a dual dispatch system involving EMS and firefighters was introduced in 2005.[6] Police officers were fully integrated in the OHCA alarm system in 2012.[7] Experiences of performing cardiopulmonary resuscitation (CPR) outside hospital are mostly explored within the bystander population.[8-12] Previous research in regards to FRs experiences of participating in emergency call–outs has been described in the context of traffic accidents [13] and psychological consequences about performing CPR and using an automated external defibrillator (AED).[14]

The aim of this interview study was to explore firefighters' and police officers' experiences of saving lives in OHCA in a dual dispatch programme.

Methods

Design

This was an interview study where data were analyzed by using Critical Incident Technique (CIT)[15] and inductive qualitative content analysis.[16] A "critical incident" (CI), in this study is a description of a cardiac arrest situation recalled as important by the participants. OHCAs were included independent of etiology (medical or non-medical) and age of the victim.

Study setting and dispatch

The study was conducted in Stockholm County covering 6519 km^2 with 2.3 milj. inhabitants living in densely populated urban areas, as well as in more rural parts. In case of a suspected

OHCA the dispatchers at the Emergency Medical Communication Centre (EMCC) first dispatches two ambulances staffed with specialist nurses and emergency medical technicians performing advanced life support.[17] In special circumstances such as major trauma, drowning and pediatric cardiac arrests, a physician-staffed rapid response vehicle is alerted. FRs trained in BLS, and equipped with AEDs are also dispatched, primarily the fire fighters and thereafter the police[18] The EMS, police force, and fire department are alerted by the common emergency number (112). In Stockholm County there are 40 fire stations and 30 police stations. Depending on time of day and type of vehicles being dispatched, the number of attending staff varies between four and ten in average. The police are considered to be an extra resource in OHCA, and cannot always engage depending on other ongoing missions. Approximately 1200 confirmed OHCA occurs annually, and FRs are being dispatched in estimated 70% of these cases.

CPR training amongst FRs

Annual adult and pediatric BLS training is recommended for FRs by European guidelines in CPR[18] and the Swedish Resuscitation Council. However compliance to these recommendations could differ between participating organizations. It is mandatory for FRs to start CPR if first on scene unless obvious signs of death are present.

Participants

Eligible participants were firefighters and police officers with experiences of being dispatched as first responders in OHCA. The recommended sample size in CIT depends on what activity or behavior being studied. If the activity is relatively well-defined, a total number of 50 to 100 critical incidents (CIs) are needed for the analysis.[15 19] With an estimate of 2-4 CIs per interview, a sample size of approximately 20 interviews was considered sufficient.

Data collection

The strategy used was a purposive sampling of key participants with knowledge from one or more cardiac arrest situations, with the main focus to collect as rich descriptions as possible.[20] To obtain a variety of workplaces, different ages and gender three approaches for recruitment were used; 1) An invitation letter from the researchers was presented to the main collaboration group for OHCA alarms in Stockholm County. 2) On the police report for cardiac arrest alarms there was a request to contact the researchers for a voluntary interview. 3) Fire stations were directly contacted for recruitment of participants. All three approaches were used, and all voluntary participants who fulfilled the inclusion criteria were included.

The final study sample consisted of 22 participants; 12 firefighters representing four different fire brigades, and 10 police officers from eight police stations throughout the County. The participants received written information about the study and contact information to the researchers before the interviews took place. An interview guide with open–ended semi-structured questions was used (Table 1).

Table 1. Interview guide for collecting Critical Incidents

1. Can you describe a particular situation and the circumstances surrounding it when you have been dispatched to a person suffering from an out-of-hospital cardiac arrest? Please describe the circumstances and the time.
2. Can you describe how you acted in this situation?
3. Can you describe how other persons acted in this situation?
4. Can you describe how you reacted?
5. What was the result of the situation?
6. Do you want to add something more?

Data of demographic character were also collected. The participants could choose the place for the interview, and all except three took place at their regular workplaces. The interviews lasted between 9 to 38 minutes (22 minutes in median), and were all conducted by the first author (IHA), a nurse anesthetist and teacher with professional knowledge in OHCA research, especially CPR/defibrillation and dual dispatch. The interviews were recorded with a digital voice recorder (Olympus™ VN-7800PC), and transcribed verbatim by a secretary with knowledge of cardiac arrest research. A pilot interview to test the questions in the interview guide was performed in February 2015. No change of questions was needed. The pilot interview contained rich material with descriptions from three CIs, and were therefore included in the final analysis. The following interviews were carried out June 16th to December 13th 2016.

Data analysis

The analysis was performed as follows: 1) Identification of CIs as the unit of analysis in each interview. The CIs were thereafter read repeatedly to gain a comprehensive view of the whole. 2) Condensation of each CI into meaning units with the purpose to reduce the text and preserve the core in the narrative. A meaning unit is close to the text and is not interpreted by the researchers at this stage. 3) Interpretation and coding the meaning units into sub-categories by the authors. 4) The sub-categories were thereafter merged into categories from which time sequences were created (Table 2).

Table 2. Description of the analysis process

Critical Incident (CI)	Condensed meaning units	Sub-category	Category	Time sequence
There was some sort of crack house; a younger girl had a cardiac arrest. // And then you think before going in, there is a second type of threat scenario when entering…	Crack house Younger girl Cardiac arrest Think before going in Second threat	Safety	The environment	Managing the scene

Excerpt from Critical Incident #1, (Firefighter #1)

To ensure rigor and consistency of interpretation, the analysis was discussed by the researchers, and agreement was reached at every step after dialogue between the co-researchers, to ensure that all analyses were supported by the data. In the analysis, the participants were anonymized for the researchers.

Ethical considerations

Written informed consent was obtained from the participants and information was given about the possibility to withdraw from the study without any reprisal. Participants were not entitled to financial remuneration or other benefits. The study was approved by the Regional Ethics Review Board in Stockholm, Sweden (registration number 2015/1091- 31/5).

Patient and Public Involvement

The patients and the public were not involved in planning or the design of this study.

Results

Baseline characteristics are presented in Table 3. Median age was 36 years and the working experience as firefighter and police officer were 6.5 years in median for both professions.

Firefighters were predominantly men, and they had longer experience of being dispatched to an OHCA than the participating police officers.

Table 3. Characteristics of participants (N=22)

F/P 55/45 %	Age (y) Mean =36	Sex M/F 77/23 %	Prof exp. (y) Mean= 7.5	No of CA	Years in OHCA dispatch	Latest CPR course (y) Mean =1	CPR level	CC Yes/ No 100/0 %	Vent. Yes/ No 73/27 %	Defibr.* Yes/No 77/23 %	Health-care edu.† Yes/No 45/55 %
F1	23	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	Yes
F2	47	M	9.5	>20	8-10	1	PLS	Yes	Yes	Yes	Yes
F3	26	M	3.5	11-20	0-3	1	PLS/ILS	Yes	Yes	Yes	No
F4	43	M	5	>20	4-7	1	PLS/ILS	Yes	Yes	Yes	Yes
F5	50	M	27	>20	8-10	1	BLS	Yes	Yes	Yes	No
F6	54	M	11	>20	8-10	1	BLS	Yes	Yes	Yes	Yes
F7	43	M	10	>20	8-10	1	BLS	Yes	Yes	Yes	No
F8	28	M	7	0-5	0-3	1	ILS	Yes	Yes	No	Yes
F9	35	M	2	11-20	0-3	1	ILS	Yes	Yes	Yes	No
F10	36	M	11	>20	8-10	1	PLS	Yes	Yes	Yes	No
F11	27	F	6	>20	4-7	1	ILS	Yes	Yes	Yes	No
F12	28	M	5	6-10	4-7	1	ILS	Yes	Yes	Yes	Yes
P1	40	M	7	>20	4-7	>2	ILS	Yes	No	Yes	No
P2	31	F	3	0-5	0-3	1	ILS	Yes	No	No	Yes
P3	30	M	2	6-10	0-3	1	BLS	Yes	Yes	Yes	No
P4	43	M	13	>20	4-7	1-2	ILS	Yes	No	No	Yes
P5	26	M	2	0-5	0-3	1-2	BLS	Yes	No	Yes	Yes
P6	38	F	10	6-10	8-10	1	ILS	Yes	Yes	Yes	No
P7	28	F	2.5	11-20	0-3	1-2	ILS	Yes	No	No	No
P8	33	M	6	0-5	4-7	1	BLS	Yes	Yes	Yes	No
P9	40	M	9	0-5	0-3	1	BLS	Yes	Yes	Yes	No
P10	41	F	9	6-10	0-3	>2	ILS	Yes	No	No	Yes

F/P:firefighter/police officer; M/F:male/female; CA:cardiac arrest; CPR:cardiopulmonary resuscitation; PLS/ILS/BLS; pediatric life support/immediate life support/basic life support; CC:chest compressions; Defibr:defibrillation

*Automated External Defibrillator applied and electric chock administered.

† Healthcare education besides regular professional training as firefighter/police officer.

The total number of CIs were 60, varying from one to five per participant. Police officers described in median three CIs, compared to two for the firefighters. During the analysis seven categories and 14 sub-categories emerged which reflects three major time sequences describing the temporal continuity of the OHCA situation: 1) Preparedness, 2) Managing the scene, 3) The aftermath (Figure 1). They are presented with suitable citations to highlight

important aspects of each time sequence. The firefighters are referred to as "F" and the police officers as "P".

Preparedness

This time sequence comprises the response time, which is defined as from incoming emergency call received at the EMCC, to arrival of FRs at the scene.

Information

Information deficit about the case was described as a considerable problem and caused stress and frustration amongst FRs. Especially when not finding the address, entry code to the building, or when there was no bystanders present showing the way.

"We were trying to find the address; we were on the right street but we couldn't find the right number…..//…We started to feel frustration building up: Damn! We can't find it." (F10)

Expectations

Expectations were grounded in the participants' previous experiences and mental pictures of what was expected to happen. If the victim's characteristic was not communicated by the EMCC, both firefighters and police officers described that they had a preconceived perception of the victim as an older person. Valuable time for both technical and mental preparations could then be delayed if the victim proved to be a child or a young adult.

Managing the scene

The time sequence was defined as from when the FRs vehicle stops at the address, to departing from the location.

The environment

To be able to start CPR the FRs had to take control over the environment. Threats from bystanders and traffic caused anxiety, especially if there were few FRs in place from the

beginning and they had to focus mainly on the victim, instead of prioritizing their own safety first.

"*So there we were in the middle of the motorway doing compressions, we were like, just right there*, *in the middle of the road, doing compressions*." (F10)

Obstacles had to be taken care of, i.e. extraction from vehicles, removing furniture, or placing the victim in supine position to be able to start resuscitation.

The victim

The victim could be described in both a technical and emotional way as heavy, still warm, or disgusting to take care of when regurgitation had occurred. Performing manual chest compressions was recounted by FRs as a repulsive task depending on flail chest caused by the resuscitation.

"*What I often think about is that when you do compressions, ribs get broken and I think that is so horrible. That's really the thing that affects me the most, whenever I do compressions or when I think about cardiac arrest alarms."* (F6)

When futile to resuscitate the victim, FRs often described the situation as sad or disappointing, especially when young people died in accidents or drug abuse. The mental strain could be considerable if the FRs children were at similar age as the deceased.

"*It was a young girl. It just feels so damned awful and you know when you've got two girls of your own as well, it just feels awful…..//…they had taken cocaine, amphetamine…//* (F5)

Managing the airway was specified to be the most difficult technical skill, especially among the police officers. This is also shown in Table 3 where six (60%) of the police officers used compressions-only technique when resuscitating.

The bystanders

Comforting and taking care of bystanders was an extensive part of the assignment and many of the FRs expressed how laborious this task could be. Lack of education in handling emotional crisis after a cardiac arrest was emphasized. There were also no clear instructions where the FRs responsibility ended when the EMS had left. To leave an elderly person alone afterwards when the spouse had passed away was expressed as difficult.

"*I think we stayed there for almost an hour after the ambulance had left…//…She had some problems walking, this old lady. So we put lots of bottles of juice and stuff by the armchair where she used to sit so she wouldn't have to walk about and fetch things, because that was what her husband had done for her, before he had his cardiac arrest*. (F12)

Although protective towards the bystanders, FRs could also be critical. Especially personnel in elderly care facilities were described as passive and not knowing how to act in OHCA situations.

Self-efficacy

The FRs were moving between confidence and doubt when talking about their own capacity in the OHCA situation. A circumstance mentioned was when the case was not a cardiac arrest but some other illness. To make medical decisions before arrival of EMS without appropriate training in first aid was described as extremely difficult and stressful, especially for the police officers.

"*I don't have any medical training; I could see that half of the brain was out, maybe it works anyway, I don't have enough knowledge to decide*." (P5)

The FRs could describe fear of doing more harm than good, but also satisfaction with their own work, knowing that they had played a significant role for the outcome.

The rescue team

Pronounced feelings of togetherness and dependence were noticeable, and the FRs trusted each other's ability to manage critical situations. Protocols for handling OHCA situations, especially among the firefighters, were expressed as "*our guiding star*" (F9), and they could also describe a clear structure for teamwork. This was not marked among the police officers who could feel loneliness and insufficiency if first in place, especially in more difficult OHCA cases.

The aftermath

The aftermath was the time period from when the FRs left the scene, and as long as vivid memories of the cardiac arrest were recalled and could be recounted by the participants.

Caring for the rescuers

After tough assignments bodily symptoms, spinning thoughts and imprinted memories were reported in terms of "*never forgetting*" (P2), and "*stuck in my head*". (P5)

//..."*and I just have to pass by the place, I don't think there has ever been a time when I haven't thought about it, I mean, every time I walk past or drive past this place, I think about this.*"…// (P6)

Assessment and defusing afterwards occurred more often among equal colleagues rather than meetings initiated by superior officers. Inputs from others about the case and own performance were considered positive and could ease the pressure, but several FRs called for a more pronounced responsibility from the heads of the department. The participants expressed that occupational stress could be avoided if stress management took place regularly. Repression was a strategy for coping by some FRs, others thought this could cause long term impairment of the ability to feel empathy. A positive experience afterwards was if the

survivor came to visit the FRs at the fire- or police station. The survivors were seen as reminders of success.

Discussion

The aim of this interview study was to explore FRs experiences of participating in a dual dispatch programme in case of suspected OHCA. Our analysis of recounted critical incidents revealed three distinct time sequences regarding the cardiac arrest event described by the participants (Figure 1). Our main findings in each time sequence were: 1) Lack of information from EMCC about the victim caused frustration amongst FRs. 2) Perceived uncertainty in performing CPR, especially concerning rescue breaths. To handle psychological reactions amongst bystanders after an OHCA could be overwhelming. 3) FRs were missing discussion after mission with participating colleagues and superior officers, especially after tough cases.

Information deficit from EMCC was a main concern for the FRs. However, information could be missing for the dispatchers in time for call-out due to language barriers or difficulties detecting if it is a true cardiac arrest or not.[21 22] EMS personnel have previously described similar concerns regarding dispatch.[23]

Uncertainty could emerge if it was not an OHCA, but seizures or intoxication for example. Both firefighters and police officers therefore expressed a need of more thorough education in first aid. Regular training and education is also a matter of concern in EMS organizations taking care of OHCA victims.[24] Handling the airway appears to be a subject for improvement as reported earlier.[14] The ERC guidelines recommend that all rescuers trained and able to perform CPR should combine chest compressions and rescue breaths.[18] However, only five (50%) of the police officers had undergone annual training in CPR, and they expressed that chest compression–only technique was preferred as an easier way of managing the situation (Table 3). The police force in Stockholm County joined the dual dispatch programme later

compared to the firefighters, therefore the police officers have less experience in participating in cardiac arrest alarms.[25] In the interviews the police officers expressed more doubts about their self-efficacy[26] than the firefighters, especially concerning technical skills. To attach defibrillation pads and deliver countershocks was not much discussed by the police officers. This could be a consequence of the police being last summoned in OHCA alarms due to technicalities in the dispatch system. Other personnel prior to the police patrol have often already started treatment. In comparison, 686 firefighters in a survey, 24% had never applied an AED and 3% felt very uncomfortable doing so.[27] Application rates and retention could improve if FRs underwent frequent targeted hands-on AED training.[28 29] Stressful cardiac arrest situations were described in detail, despite a lapse of several months or years since the events. Adverse psychological effects after long–term exposure of traumatic events such as stress, anxiety, depression and posttraumatic stress disorder has been reported amongst FRs.[30-32] Several of the FRs discussed the need to ventilate the case among colleagues, and also the absence of organized case discussions after the mission.

A limitation of the study was that all participants worked in the most densely populated County in Sweden with high access to prehospital resources. Including FRs from other parts of the country would probably have generated other experiences, especially in low density populated areas where there are few rescuers available. Only one of the firefighters was female, which could have affected the results. The uneven gender distribution reflects the fact that only 5.5% of all firefighters in Sweden are women.[33] The police officers had a more evenly gender distribution.

Selecting volunteers for interviews could have introduced bias in terms of a non-representative sample. Different fire- and police stations around the County were thus chosen, as well as gender and varying ages among participants to obtain as rich information as possible about the research subject. There is always a risk of recall bias in interview studies,

especially if the incident took place months or years ago. All participants had however very clear memories of the recounted OHCA situations, and could describe them in detail.

In a qualitative study generalization is not possible; instead the concept of trustworthiness is highlighted. Credibility was obtained by peer debriefing of all steps in the analysis (EJA, PN). The interviews were all conducted by the first author (IHA), which increased the likelihood they were performed in the same way. The participants were recruited through different approaches to reflect a representative sample of first responders in the County, thus increasing the transferability. Moreover, the research group has experiences in cardiology, out-of-hospital cardiac arrest, dual dispatch (PN, LS, JH), and other domains such as intensive care and qualitative studies (EJA). This strengthens the results, but also raises questions about reflexivity and bias, which were discussed during the whole process of collecting and interpreting data.

Conclusion

Participating in dual dispatch in case of a suspected OHCA was often described as a complex process by first responders. Detailed information about the case and the location was crucial for the preparedness, and information deficits caused stress and incorrect perceptions about the victim. Technical challenges of performing CPR and managing the airway was prominent. The need of regular team training and education in first aid was requested as well as knowledge about psychological reactions amongst bystanders after an OHCA. Providing case discussions and opportunities to give and receive feedback about the case is a main task for the leadership in the first responder organizations.

Contributors

The study was designed by IHA and EJA. IHA recruited the participants and collected the data under the supervision of EJA. IHA, EJA and PN made substantial contributions to the analysis and interpretation of data. IHA drafted the manuscript. EJA, PN, LS and JH critically reviewed and revised the manuscript. All authors approved the final version of the manuscript for publication.

Data availability

Data can be made available upon request to the corresponding author.

Conflicts of Interest

None.

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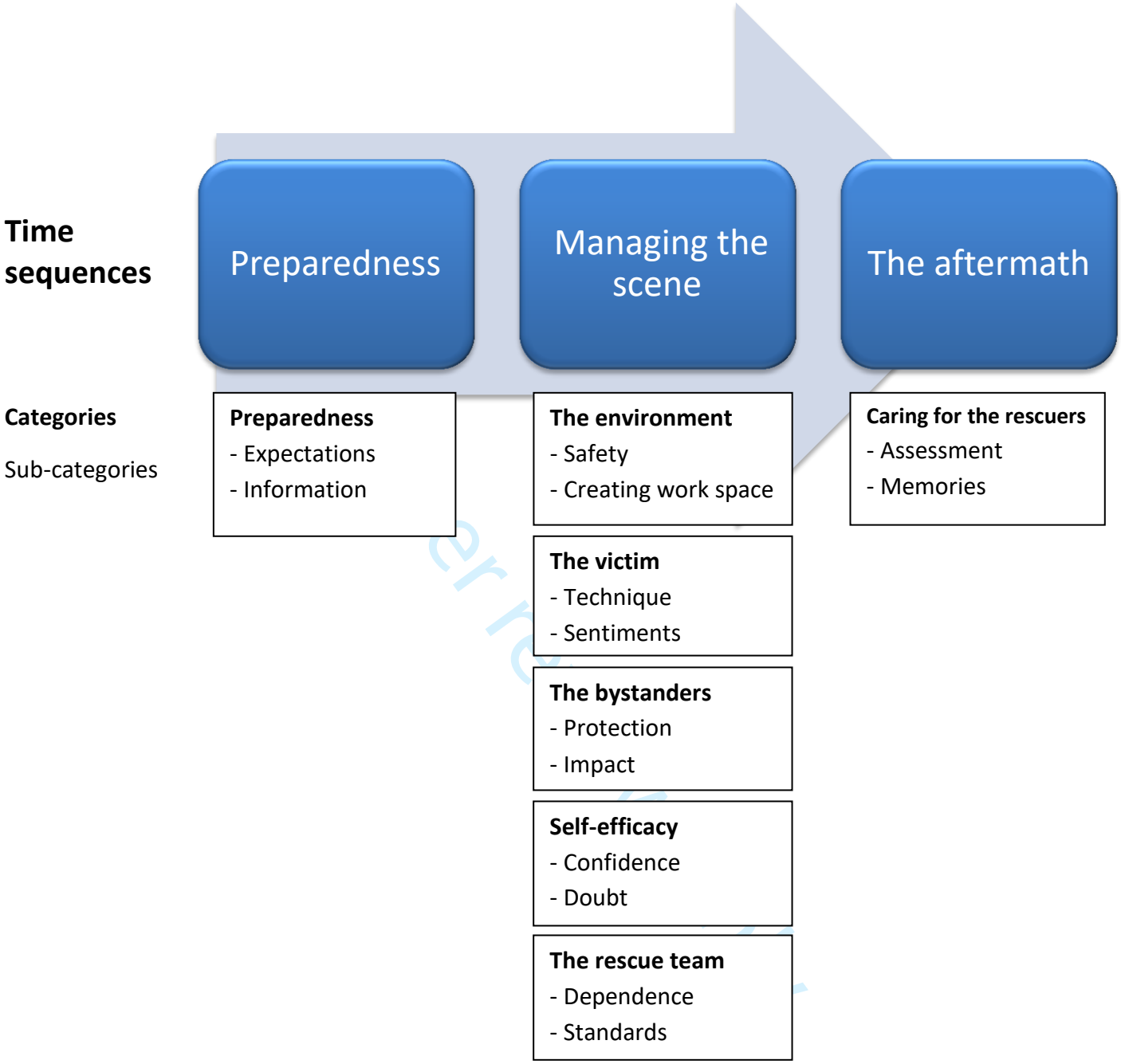
Figure 1. Time sequences, Categories and Sub-categories



COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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