A Paramedic Field Supervisor's Situational Awareness in Prehospital Emergency Care

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Abbreviations:
ALS: Advanced Life Support
BLS: Basic Life Support
EMS: Emergency Medical Services
ERC: Emergency Response Center
GIS: geographic information system
MCI: multi-casualty incidents
RFID: radio frequency identification
SA: situational awareness
WIISARD: Wireless Internet Information System for Medical Response in Disasters

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Abstract

Introduction: Situational awareness (SA), or being aware of what is going on and what might happen next, is essential for the successful management of prehospital emergency care. However, far too little attention has been paid to the flow of information. Having the right information is important when formulating plans and actions.

Problem: The aim of this study was to analyze and describe the type of information that is meaningful for SA in the work of paramedic field supervisors, and to create an information profile for them in the context of prehospital emergency care.

Methods: Data were collected from January through March 2012 from semi-structured interviews with ten paramedic field supervisors representing four rescue departments in Finland. The interviews were based on three different types of real-life scenarios in the context of prehospital emergency care, and deductive content analysis was employed according to the information exchange meta-model. Data management and analysis were performed using Atlas.ti 7.

Results: A paramedic field supervisor information interest profile was formulated. The most important information categories were Events, Means, Action Patterns, and Decisions. The profile showed that paramedic field supervisors had four roles – situation follower, analyzer, planner and decision maker – and they acted in all four roles at the same time in the planning and execution phases.

Conclusion: Paramedic field supervisors are multitasking persons, building SA by using the available data, combining it with extensive know-how from their working methods and competencies, and their tacit knowledge. The results can be used in developing work processes, training programs, and information systems.

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Introduction

Prehospital emergency medical care is organized and structured as a regional Emergency Medical Services (EMS) system aimed at starting emergency care onsite. It consists of multiple components, ranging from dispatch to different levels of EMS units, organized in a multi-tiered system. The effective and efficient leadership and supervision of multiple EMS units on a 24/7 basis is one key element in the successful delivery of emergency care.

The issue of operative field medical leadership was raised when the Finnish national legislation related to prehospital emergency care was up for renewal; as a result, it is now mandatory to have at least one paramedic field supervisor available at all times in each hospital district.[1] The task of the paramedic field supervisor is to maintain sufficient regional situational awareness (SA) of the district's EMS and their resources, and to intervene if necessary.

Situational Awareness

Having the right information to make the right decisions, and the ability to predict what will happen next, are the key elements of a paramedic field supervisor's daily work in prehospital emergency care. This phenomenon is called SA, ie, "knowing what is going on so you can figure out what to do."[2] It is also about being aware of what is not the case, being aware of what is not known and may be necessary to find out, and being aware of what others are aware of and unaware of.[3] Different aspects of SA are studied in many

disciplines (eg, psychology, education and cognition). Irrespective of the discipline or field in question, the definitions of SA relate to a person's awareness of their environment and potential changes to it.[4] Much of the research has been conducted in aviation and in the military where the importance of SA is widely accepted.

Recently, there has also been a great deal of interest in SA in health care, but only a few studies have been done related to prehospital emergency care. A recent study by Busby and Witucki-Brown[5] pointed out the growing need for SA in multi-casualty incidents (MCIs). They developed a theory that SA in MCIs is an ongoing and iterative process, with each piece of information influencing new actions. Most of the studies in prehospital emergency care focus on finding out how SA can be improved by using different technologies together with information systems. Technologies used are, for example, in: gathering field data with mobile devices and showing it in graphical format to improve data quality;[6] making a multi-view, role-based design to help team members analyze geospatial information (using geographic information systems, or GIS), share and integrate critical information, and monitor individual activities to aid decision making; group activity awareness;[7] and a combination of GIS network data and data on response resources.[8] A typical aim in these studies is how to better share the data and, in this way, improve SA (eg, by creating a methodology that makes the sharing of contextual information between systems more efficient and gives users full control).[9] One study showed that using radio frequency identification (RFID) in triage documentation improved SA; the data was available approximately one hour earlier in the care chain, compared with using traditional paper triage tags.[10] There are also several studies related to Wireless Internet Information System for Medical Response in Disasters (WIISARD) technology, focusing on generating a real-time common operational picture, enhancing information flow, and gaining efficient SA.[11,12]

The importance of SA in acute care has come out in several studies. Situational awareness is a nontechnical skill in delivering safe anesthesia.[13,14] Mcllvaine[15] described fundamental concepts of SA and its application to anesthesiology with many examples, one being how to reduce medication errors with improved SA. There are also several studies investigating how to improve SA by designing displays for better information sharing and enhancing patient safety in the operating room and intensive care unit.[16-20] The positive effect on SA of a patient-tracking system in the emergency department has been studied, and a scoping review identified SA as one of the nine core, nontechnical emergency medical skills, specifically linked to safety and error in the emergency department.[21,22]

A good information flow is required when making decisions in situations with multiple casualties. These decisions depend on the SA of the person making them. To create a correct mental picture of what is going on, a person needs information from different sources. The quality and quantity of the information has an effect on the completeness and correctness of that mental picture. If decisions are based on low-grade information, it can lead to poor patient outcomes or risk to rescuers.[5] The information of interest also varies depending on the role of the actor (situation follower, information analyst, planner, or decision maker) and the phase of the activity (eg, planning or executing a mission).[23,24]

Information Exchange Meta-Model

In this article, the information exchange meta-model is used to find out what type of information is essential in prehospital emergency care from an SA point of view. The information exchange meta-model is a systemic model of the information used in planning and decision-making situations. The main assumption in constructing this model was that, from the information exploitation point of view, organizations are social systems that consist of individual human beings. Human beings make choices on the basis of the information available to them. Thus, to understand the overall information aspects of an organization, both social system and human information processing viewpoints must be considered. The model is based on theories from communication philosophy, sociology, cognition philosophy, organizational culture, knowledge management, and decision support systems.[23,24] This ontological model has been developed, iterated, and applied frequently over the past few years (2004-2008) in national and international, inter-organizational cooperation exercises. Individual results of those studies have been published in academic conferences and research reports.[23-26]

The approach in the model is the information itself. Information can be data, information, or knowledge. An actor's interest in information can be categorized in several ways: on a time axis or on the basis of information content, and the role of a particular actor or the phase of the activity in question. Information interests differ from one situation to another, and also from one actor to another, depending on the task or purpose of the actor in an organization. All these different viewpoints exist in situations where actors are involved. The information exchange meta-model has a unified and sufficiently abstract structure for describing information; this is necessary in order to determine the type of information various networking situations require, and subsequently, structure various knowledge discovery situations in an equal way. Figure 1 shows the combination of role- and activity-phase related information interest profiles. "Role" is here understood as SA, analyzing the meaning of the content, planning the operation, and decision making.[23] It is based on research findings from 2004-2008, showing the approximate and average abstraction of an actor's roles. It also gives an idea as to the type of information that, as a rule, could be meaningful to various actors in different situations.[24]

The information exchange meta-model contains categories of source information, information-refining steps, resultant information, and knowledge. Information facts are combined with other information existing on the right level of the system, and the refined abstraction about this combination is expressed as the output information on every level. Information is refined from bottom to top. On the first layer, the number of alternative data is immense. When information flows towards the ultimate decision, the abstraction level of the information increases and the amount of information decreases.

The model framework (Table 1) consists of columns and layers. The values and competence column on the left contains the cultural information described by Schein.[27,28] The values form the cultural basis for the social systems, and competence is the skill-knowledge base of individuals in the social system. The internal facts column describes actors' internal information and their way of acting. The conclusion column contains both conclusive information that is used in making final decisions, and the expressed conclusions drawn by the actor. The external facts column includes all facts concerning events in the world outside the entity itself, and the information related explicitly to the entity.

Each layer of the model has a specialized task in the overall process of forming situational understanding and using information

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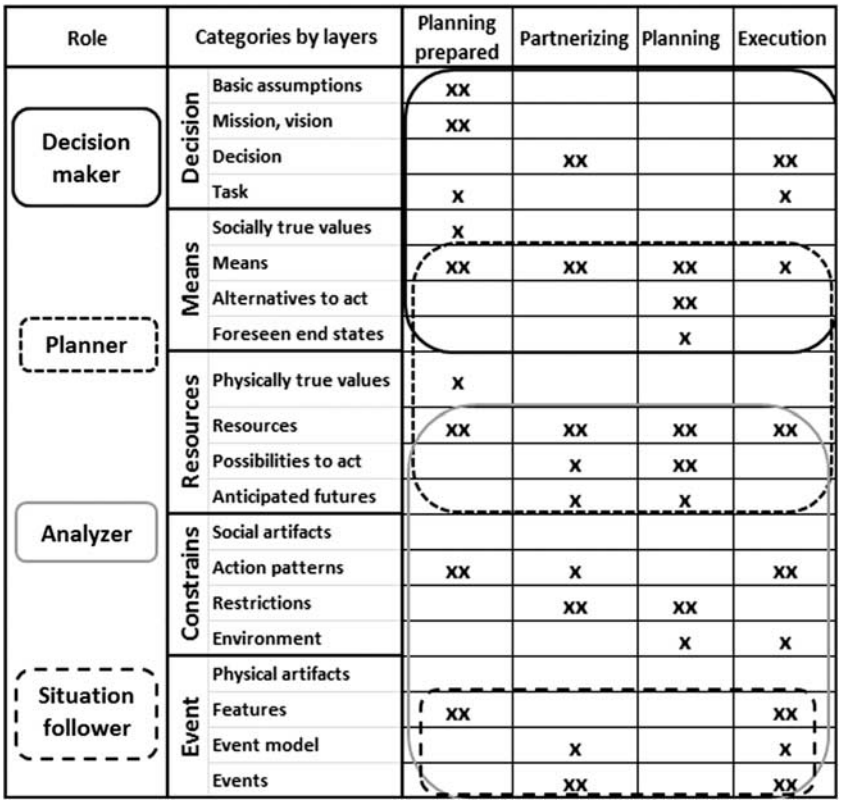

Figure 1. Combination of Role- and Activity-Phase Related Information Interest Profiles (modified)[24]

Values, Competence	Internal facts	Conclusions	External facts
Basic assumptions	Mission, vision	Decision	Task
Socially true values	Means	Alternatives to act	Foreseen end states
Physically true values	Resources	Possibilities to act	Anticipated futures
Social artifacts	Action patterns	Restrictions	Environment
Physical artifacts	Features	Event model	Events

Table 1. The High-Level Abstraction of the Information Exchange Meta-Model[23]

in the situation follow-up, planning, and decision-making processes. Layers describe the temporality and abstraction degree of information. Information at the upper layer is the most abstract and future oriented, and its effects are long lasting. The lowest level contains information that updates fast, is concrete, and is observable as immediate events.

The event information layer deals with situational information that produces the ever-updating picture (event model) of the situation. The explicitly expressed input information of the layer is the ongoing flow of information about the places and activities of all actors in the same situation. This information product makes an input to the tacit dimension, where it enriches the internal competence to understand the activity patterns of all actors.

On the next layer, the constraints are sorted out. This means the restrictions and possibilities that the environment has and the capabilities all actors have. Explicitly expressed information is the situation picture and the information about the environmental circumstances (eg, weather and conditions on the scene). Tacit knowledge of the action patterns of actors is required. The tacit dimension gets input information to develop an understanding of the ways the overall situation could develop.

The next two layers contain information about resources and means as internal facts. These facts, along with information on events and environment, and knowledge about the composition of and developments in the situation and possible end states, are used as a basis for drawing conclusions. Possibilities for action and information on alternate ways to operate are refined. Information on the situation and environment, knowledge about the composition and development of the situation, and the possible end states are used as a basis. On this level, the ability to understand how the future could develop is essential.

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The chain of deduction can be continued until the ultimate decision-making layer is reached. There, all output information from the lower layers has to be available in an explicitly expressed form, or in the tacit dimension. Conclusions of a neighbor layer are relatively more meaningful than information in the other layers. The whole spectrum of the tacit dimension must be available to the decision maker.

The information exchange meta-model contains three main levels of thinking: (1) the decision level; (2) the planning level; and (3) the operating level. The model describes the human information handling process in the case of SA and situational understanding. It is about the ability to exchange information that is relevant to the situation being dealt with. This ontology of human information handling structure is used to analyze various and different information sharing and information exploitation situations.[23]

Purpose and Aim

The present work extends the use of the Kuusisto's[29] information exchange meta-model from the military to prehospital emergency care. Situational awareness is a complex, multifaceted phenomenon that plays a key role in information sharing, especially in predicting what will happen next. Situational awareness is about information and inference. It helps in determining the answers to the following questions: "What is happening? Why is it happening? What will happen next? What does it mean in terms of my objectives? What can I do about it?"[3]

To be able to answer these questions, a paramedic field supervisor needs the right type of information based on the role at the time and the phase of the activity in question. There have been several studies examining how to further a paramedic field supervisor's SA. However, these studies have centered mainly on different technologies rather than on the information itself.

The purpose of this study is both to analyze and to describe the type of information that is meaningful in paramedic field supervisors achieving SA in their work, and to create an information profile for them in the context of prehospital emergency care.

Methods

Design of the Study

Ten paramedic field supervisors from four Finnish rescue departments volunteered to participate in the study. The rescue departments represented different geographic areas of Finland and different organization sizes in order to obtain diversity of the sample. The data were collected using semistructured interviews from January through March 2012.

Three progressive real-life scenarios were used in the study. Scenarios were selected to represent different types of prehospital missions and the paramedic field supervisors' leadership role in these missions. The first scenario was a traffic accident with eight potential patients. It took place in the winter, approximately 30 km from the city center, and at a time when the paramedic field supervisor was in the city center leading a team in resuscitation. The second scenario described a situation on a Saturday night in the beginning of June, at the start of the school summer vacation. Many young adults in different locations, but all in one neighborhood, were not feeling well and later became unconscious; it was later found that there was a group of eight young adults who bought cheap alcohol containing poisonous methanol from an unknown person. The third scenario was a shooting threat outside of a shopping center ending in one person being wounded. The situation required the presence of an ambulance unit in a safe zone.

The scenarios were designed and pretested by prehospital emergency care professionals, and checked in informal pilot interviews conducted by an emergency response center (ERC) instructor and a police field commander, who vouched for the validity of the scenarios.

The scenarios proceeded as cases do in real life. The paramedic field supervisors received the information they would receive automatically from ambulance units or other authorities (eg, the ERC), the rescue department, and the police, based on the practice in their area. Some automatically-provided information was meant for them and some was not. During the interview, paramedic field supervisors asked for more information from other field authorities, as they would do normally in their daily work situations. They were given the information that was available in that particular step of the scenario. As the scenarios proceeded, they made decisions such as whether to join the call or not, and delivered information to other authorities. At the same time, they had to take care of their normal daily tasks, ensuring that there were enough free resources in their area. Some scenarios caused a situation where there were not enough ambulances for the mission or no free ambulances in the area. The interviewer simulated the different authorities during the interview. The interviews were audio-recorded and their mean duration was approximately 70 minutes.

Ethics

The University of Eastern Finland Committee on Research Ethics approved the study on December 15, 2011.

Analysis

Results were analyzed using deductive content analysis. Content analysis is a research technique for making replicable and valid inferences from texts in the context of their use.[30] Deductive content analysis is used when the structure of analysis is operationalized on the basis of previous knowledge, and is based on an earlier theory or model. A categorization matrix is used, and the data are coded based on categories.[31] In this study, the information exchange meta-model[29] was used to categorize the interview data. The interview data were transcribed verbatim. The only changes were to dialect words, which were changed to standard language to avoid the recognition of the area where the interview was conducted. Also, the names used to recognize the area were changed.

As a basis for analysis, the text was coded based on the 20 information categories from the information exchange meta-model (Table 2) by using the qualitative data software Atlas.ti Version 7.0.79. (Atlas.ti, GmbH, Berlin Germany). The coding was done one scenario at a time to increase the reliability. A code could have been either a meaningful whole sentence or a couple of words with a meaningful purpose.

After the text was coded, it was checked that every code included similar types of things; this was done to ensure the validity of the coding. The total number of codes was 1,144. The traffic accident scenario had 560 codes, the youth scenario had 390 codes, and the shooting scenario had 194 codes. The findings were changed to percentages to enable comparison with the relative share. The percentages were calculated per scenario; for example, in the traffic accident scenario, 560 findings represented 100%.

Values, Competence	Internal Facts	Conclusions	External Facts
Basic Assumptions Hidden assumptions that guide the behavior of an actor. The fundamental features of a culture.	**Mission, Vision** A subjective and expressed impression of the end state of the actor.	**Decision** A solution based on thinking and assessment.	**Task** Activities or work to be performed, activities originated by upper-level management, or by the development of a situation.
Socially True Values Assumptions that are mutually accepted in a certain group to be a basis of thinking and executing activities.	**Means** Activities or methods applied to reach an aim or fulfill a purpose.	**Alternatives to Act** Description of realistically executable acting solutions.	**Foreseen End States** Future situations most certainly reached when activities are finished.
Physically True Values Assumption about structures that can be accepted to be valid, eg, organization, division of labor, and competencies.	**Resources** Available tangible resources, such as people, financial resources, material, machinery, and office space.	**Possibilities to Act** Describes possible paths to the goal that the actor can choose and that provide something new to the actor, eg, strategy alternatives.	**Anticipated Futures** Describes a thing, event or development that can be taught or is expected.
Social Artifacts Structure of a social system, principles of interaction, description of nodes and their mutual positions, and observable behavior.	**Action Patterns** Describe how an actor can behave, eg, process descriptions and instructions.	**Restrictions** Things that have to be considered before planning the use of resources and means in the context of anticipated futures.	**Environment** Describes an area or a space that affects and actor, eg, media activities or market trends, national trends, and global trends.
Physical Artifacts Results of activity, like technical results of a group, written and spoken language, symbols, and art.	**Features** Describe the properties of objects such as organizations or equipment, eg, infrastructure descriptions and properties of equipment.	**Event Model** A description that enables the outlining of the pattern of a situation. For example, reports, documents, and analyzed conclusion, such as quality reports, statistics, pictures, and maps.	**Events** Describes time-limited events caused by actors. For example, meetings and sales reports on stock market prices.

Table 2. The Information Exchange Meta-Model[23]

A mean score was needed to evaluate the meaningfulness of each category of information in the work of paramedic field supervisor. According to the model, the mean score was five, which was 100% divided by 20 (20 categories). If the mean score was twice that (10), the data in that category was highly meaningful.

Results

The results are presented below by first defining the important categories of information and the differences between the scenarios and, second, explaining the findings by layers. The analysis describes the information profile for paramedic field supervisors, the kind of information they need, and the type of information they should provide to others.

Main Information Categories

The main categories of information with a highly meaningful value (≥10) in the work of paramedic field supervisors were: Events (19%), Means (13%), Action Patterns (12%), and Decisions (11%), as shown in Table 3. The highest value was in the Events category, under External Facts. This category included event-related information received from other actors, such as ERCs or ambulance units. Typical information was triage, mission code, or changes in mission code from A to B. The value varied from one scenario to another: 14% for the traffic accident scenario, 24% for the youths scenario and 26% for the shooting scenario. Under Internal Facts, the Means category (ie, activities or methods used to achieve an aim or fulfill a purpose) consisted of paramedic field supervisor actions (eg, sharing information, giving instructions and orders, checking, ensuring security, preliminary pre-arrival notification to hospital, asking for more resources, and discussing matters with other authorities). In the Means category, the traffic accident scenario had a higher value (16%) than the average (13%), and the shooting scenario had a lower value (10%).

Action Patterns (12%) described how an actor could have behaved (eg, giving process descriptions and instructions). There was dispersion between the scenarios: the traffic accident was 14%, the youths scenario was six percent and the shooting scenario was 18%. Paramedic field supervisors described these situations as follows:

> Scenario One: Traffic Accident
> In practice, if the care leader notices that, for example, the green patients are getting worse, then he informs me that green is changing to red. This triggers the action that I ask for more resources from the ERC. Then I inform the care leader that the unit will arrive in ten minutes.

> Scenario Two: Youths
> The caregiver from the first unit will take the responsibility for treatment until I arrive.

> Scenario Three: Shooting
> I would call the police incident commander and ask the questions, and then of course be told that there is someone

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Layer	Category	Traffic Accident	Youth	Shooting Case	All Findings
Decision Making	Basic assumptions	1	2	2	2
	Mission, vision	0	0	0	0.2
	Decision	11[a]	10[a]	10[a]	11[a]
	Task	0	0	0	0
Means	Socially true values	5[b]	5[b]	4	5[b]
	Means	16[a]	12[a]	10[a]	13[a]
	Alternatives to act	6	4	3	5
	Foreseen end states	0	1	0	0.2
Resources	Physically true values	2	0	0	1
	Resources	4	6[b]	2	4
	Possibilities to act	1	0	0	1
	Anticipated future	0	0	0	0.2
Constraint	Social artifact	1	6[b]	5[b]	4
	Action patterns	14[a]	6[b]	18[a]	12[a]
	Restrictions	5[b]	8[b]	8[b]	6[b]
	Environment	4	4	2	4
Event Information	Physical artifacts	1	1	5[b]	1
	Features	8[b]	2	1	5[b]
	Event model	7[b]	10[a]	7	8[b]
	Events	14[a]	24[a]	26[a]	19[a]

Table 3. Relative Share of Data in a Paramedic Field Supervisor's Work and the Meaningfulness of the Data, Relative Share Compared to 100%
[a]Highly Meaningful (≥10).
[b]Meaningful (5-9).

> who is firing a shotgun into the air. I would definitely ask whether there are any wounded. Then I would tell them that our driving time to the scene is about 15-20 minutes. When we arrive at the point of entry to the safe zone, I will ask whether I should meet the police incident commander there or should I wait for him to contact me. When I have all this information, I call by mobile phone to the ambulance unit that is dispatched to the incident.

The Decision category under Conclusions had very similar values (11%, 10%, and 10%) regardless of the scenario. Decisions were related to actions (eg, no actions, join the operation, every patient needs own unit, or in this case "load and go") or they were related to resources (eg, holding non-urgent missions, establishing new EMS units, or the Advanced Life Support (ALS) unit will be split up to help Basic Life Support (BLS) units). Further in the Event Model category, the youths scenario, with several patients at different locations in the same neighborhood, had a highly meaningful value (10%).

As shown in Table 3, the meaningful information categories were Event Model (eight percent), Restrictions (six percent), Action Alternatives (five percent), Socially True Values (five percent), and Features (five percent). Restrictions, meaning things that had to be considered before planning the use of resources and means, was the only category with a meaningful value in all scenarios. Many findings in the Restriction category related to resources (eg, location and status of resources, lack of resources, or ambulance units from another organization) or the availability of information (eg, not available yet, not possible to focus on radio communication while driving the car, too much information, or the information system did not show all the units). Paramedic field supervisors also mentioned the duration of the operation, the distance to scene or to hospital, and the fact that the scene was not secure. In the Features category, the traffic accident scenario had a higher value (eight percent) than the other scenarios (two percent and one percent). The Features category included the types of units (ALS, BLS or helicopter EMS), the competencies of the personnel, the management and allocation of tasks, the use of care protocols, the dispatch protocol, and the paramedic field supervisor's current status. There were also categories which, in some scenarios, had a meaningful value: Recourses in the youths scenario (six percent),

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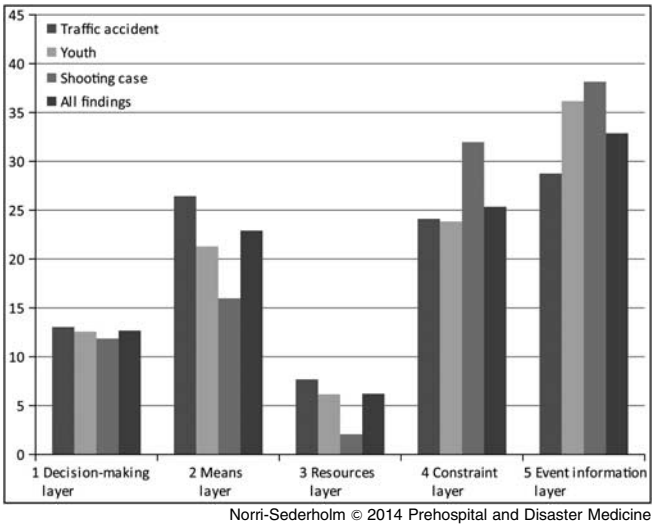

Figure 2. Relative Share of Findings by Layers

Social Artifact in the youths (six percent) and shooting scenarios (four percent), and Physical Artifact in the shooting scenario (five percent). Social Artifacts included subjects, such as commonly agreed methods or principles of interaction with other authorities, whereas Physical Artifacts were mainly official instructions and care protocols.

Results by Layers

The results by layers are shown in Figure 2. In this data, there were differences among the scenarios in all layers, except the Decision layer, which was the same in all scenarios. When comparing the data by scenarios, the youths scenario was quite close to the average of all findings, whereas the shooting scenario had meaningful deviation.

Paramedic Field Supervisor's Information Interest Profile

An average of the paramedic field supervisor information interest profile with the role, activity phase, and the associated scenario-specific deviations is presented in Figure 3.

Paramedic field supervisors acted in all four roles. As situation followers, they collected event information. In the analyzing role, in addition to Event Information, they also focused on Constraints, especially the Action Patterns. Also, the Restrictions and Social Artifacts needed to be considered. The Resources layer was not meaningful in this study. In the Planner role, paramedic field supervisors focused on Means and Alternatives to Act, which were also part of the decision maker role. In addition, the Decisions themselves formed an important part of this role. In the paramedic field supervisor's profile, Socially True Values had an important meaning in making decisions.

There were some differences among the scenarios. The shooting scenario had a deviation in categories. Alternatives to Act, Socially True Values, and Features were not meaningful. However, Physical Artifacts, a different kind of instructions, had a meaningful value as part of an Analyzer role in the shooting scenario.

While comparing the profile to the model profile, it was found that a paramedic field supervisor was actually acting at the same time in the planning and execution phases. In regards to information categories, some were not meaningful in the paramedic field supervisor's profile: Task, Foreseen End States, Anticipated Future, and Environment. On the other hand, Socially True Values and Social Artifacts were meaningful.

Discussion

This aim of this study was to analyze and describe the type of information that is meaningful in the SA of paramedic field supervisors, and to create an information profile for them in the context of prehospital emergency care. This was done by using the information exchange meta-model.

The results of this study indicated that paramedic field supervisors operated simultaneously in the planning and execution phases. They also acted simultaneously in all four roles, mainly in that they obtained event information, both analyzed and planned, and made decisions. This finding describes quite well the nature of a paramedic field supervisor acting in all four roles simultaneously.

From an SA point of view, paramedic field supervisors seem to make the most of all the available information, from collecting data items to using their tacit knowledge, despite the restrictions they face during an operation. They receive a varying amount of information relating to the event itself. This situational information produces the ever-updating picture of the situation. In the analyzer role, they develop an understanding of the possibilities on how the overall situation could develop. They also need to know how the various organizations work, not only the EMS, but also the basic operations model of rescue and police teams, to be able to know and understand all the patterns of action. Also, they need to have a good understanding of the care protocols and the competencies of the ambulance personnel in order to know what types of actions the available personnel can do by themselves, or what type of help they might need. Receiving or noting information from all the restrictions, such as the status of resources or the distance to the scene, is necessary while planning. The planning requires the ability to understand potential future developments: "What will or could happen next?"[3] In order to understand all this, paramedic field supervisors need to receive and analyze a sufficient amount of information. Finally, in the decision maker role, they should have and use a situational understanding. For paramedic field supervisors, the Means and Decisions categories were the most meaningful. This result probably stems from the role. They are supposed to make decisions and use different means to achieve their goal as fast and efficiently as possible, while constantly receiving information from, and supplying information to, other actors. Working at this level, they have knowledge about how to deal with different situations and, as mentioned in the literature review,[23] the whole spectrum of the tacit dimension is available to the decision maker.

In all scenarios of this study, the findings in the Decision layer were equal. It can therefore be assumed that, despite differences in the mission, the amount of decisions is similar. However, with a small sample size, caution must be applied as the findings might not be transferable to every case. Another interesting finding was that these three scenarios confirmed that it was not possible to manage all situations with the same type of information. Different types of information were needed for different situations. However, the findings of the present study are different from the previous research.[32] A possible explanation for this could be that the participants in the previous research were Finnish national administration workers, and the target of the study was to identify the information requirements of top decision makers during a situation of sudden crisis. Some of the most important information

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Role	Categories by layers		Model		Paramedic field supervisor			
			Planning-phase	Execution-phase	All	Traffic accident	Youths	Shooting
Decision maker	Decision	Basic assumptions						
		Mission, vision						
		Decision		XX	OO	OO	OO	OO
		Task		x				
Planner	Means	Socially true values			o	o	o	
		Means	XX	x	OO	OO	OO	OO
		Alternatives to act	XX		o	o		
		Foreseen end states	x					
	Resources	Physically true values						
		Resources	XX	XX			o	
		Possibilities to act	XX					
		Anticipated futures	x					
Analyzer	Constrains	Social artifacts			o		o	o
		Action patterns		XX	OO	OO	OO	OO
		Restrictions	XX		o	o	o	o
		Environment	x	x				
Situation follower	Event	Physical artifacts						o
		Features		XX	o	o		
		Event model		x	o	o	OO	o
		Events		XX	OO	OO	OO	OO

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Figure 3. Comparison of Role- and Activity-Phase Related Information Interest Profiles (XX, OO = Highly Meaningful Information Category, x, o = Meaningful Information Category)

categories in the earlier research had a very low value in this study, like Mission and Vision, Foreseen End States, Anticipated Futures, and Tasks. This might originate from the nature of the job. The fact that there were no Tasks stands to reason that the paramedic field supervisors made the decisions not to accept the new given tasks. Instead, they made a new decision about who should take the charge of the new task, or simply ignored it.

Overall, the paramedic field supervisors in prehospital emergency care are multitasking persons, acting in several roles and phases from an information point of view, at the same time. They need extensive knowledge of the working methods and competencies of the organization and their partners. This should be considered when planning training, education, and on-the-job-training. When it comes to sharing the data within the organization(s), knowing what kind of information is needed and should be delivered enables a focus on meaningful information flow in communication between ambulance units and with other authorities. However, more research is needed to deepen the understanding of information flow in prehospital emergency care to improve SA.

Limitations

The main limitation in this study was that it was impossible to generate and collect data from real-life situations without the risk of affecting the quality of the paramedic field supervisors' daily work. However, the focus was on the flow of information and not on the actions performed during a mission. An instrument to conduct the study was needed, and the progressive scenarios were chosen to represent situations paramedic field supervisors might actually meet. A multidisciplinary team created the scenarios, and their validity was checked by the research group and external experts. Scenarios were also tested before the interviews took place. The overall feedback from interviewees was that scenarios were realistic and that they could happen, and have actually happened, in daily work. Despite the fact that it was impossible to recreate the stress and the amount of information coming from the communications equipment, the scenarios functioned quite well as a data collection tool.

One question that should have been asked was whether the sample, ten paramedic field supervisors, was sufficient and representative. The interviews were both from geographically different parts of Finland, and from different-sized organizations. They also had a great deal of working experience as paramedic field supervisors.

The study was conducted in one country: Finland. From a research point of view, the intention was not to generalize the results; rather, it was more to test the model to determine its suitability in prehospital emergency care. Situational awareness, as a concept, is global, and many EMS organizations are looking at how to improve it. Regardless of differences in organizations and working methods, the need for information at the scene is likely the same.

Conclusions

Based on the results, a paramedic field supervisor's information profile for SA was formed. This study provided evidence that the role of paramedic field supervisors is extremely demanding; from an information point of view, they operate simultaneously in several roles and phases. They receive event information, analyze and plan, and deliver decisions. Paramedic field supervisors build SA by using available data and combining it with an extensive, tacit knowledge of the working methods and competencies of the organization. These results could be used in developing the work processes, education, and information systems.

Supplementary Materials

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S1049023X14000132

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